CLINICAL PRACTICE GUIDELINES

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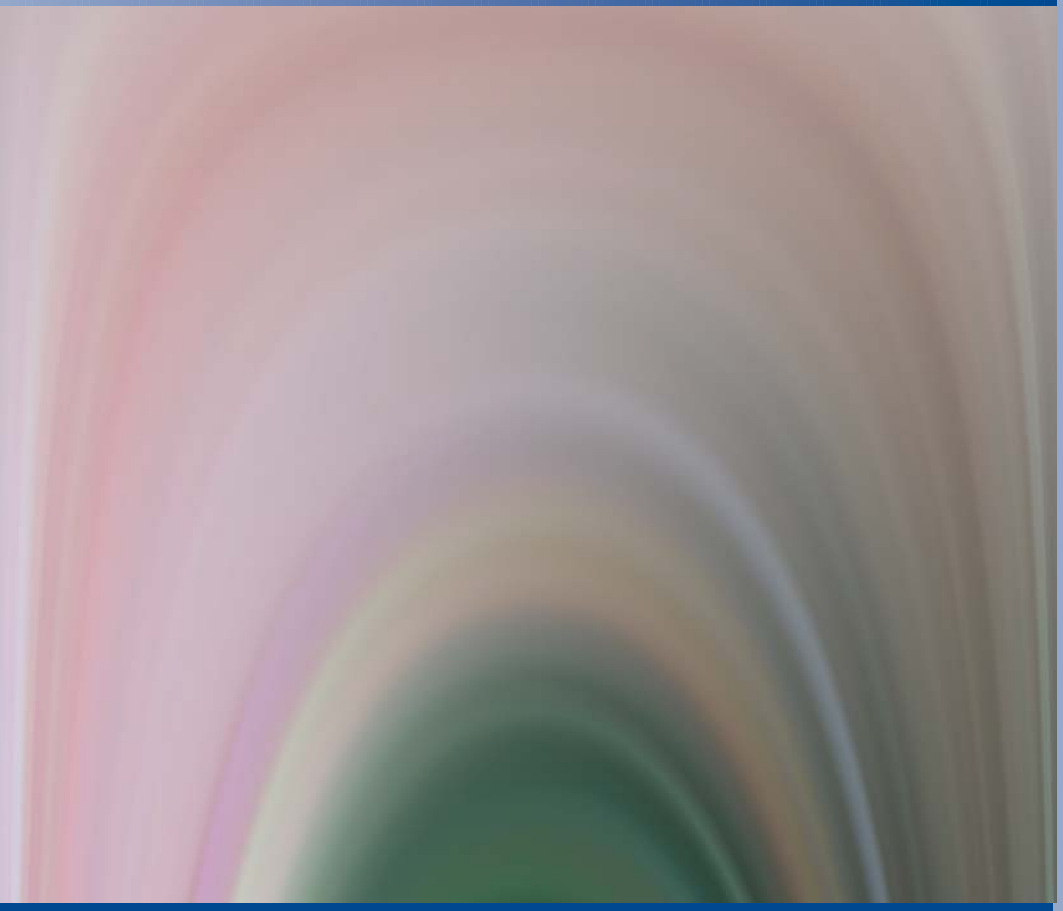

Perioperative fasting in adults and children

An RCN guideline for the multidisciplinary team

FULL VERSION
November 2005

Clinical practice guidelines

Perioperative fasting in adults and children

An RCN guideline for the multidisciplinary team
(full version)

This guideline has been endorsed by the professional groups represented by the Guideline Development Group and other key organisations:

- Royal College of Anaesthetists
- Association of Paediatric Anaesthetists of Great Britain and Ireland
- Royal College of Midwives
- Preoperative Association
- British Association of Day Surgery

We are grateful to the Association of Anaesthetists of Great Britain and Ireland who provided helpful comments on this guideline.

RCN Institute project team:
Dr Maggie Westby (Project Lead) Research and Development Fellow
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Introduction

The Royal College of Nursing (RCN) Quality Improvement Programme has worked collaboratively with key organisations in the development of this clinical guideline on perioperative fasting[1] for use in the NHS and the independent sector in England, Northern Ireland, Scotland and Wales. This follows referral of the topic by the RCN membership following a 'clinical topic priorities survey'.

The RCN Institute, through its Quality Improvement Programme, has a long standing and well respected national guideline development and implementation work programme. It has established strong links with key organisations in the field of evidence-based information nationally - for example, the National Institute for Clinical Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (SIGN) - and internationally - the Guidelines International Network, The Cochrane Collaboration and the Joanna Briggs Institute.

This national guideline provides recommendations for good practice based on the best available evidence of clinical effectiveness. It is intended to be the source material for developing local guidelines.

This document is the full version of the guideline, which contains the guideline methodology, evidence summaries and recommendations. It is intended to be a reference document for interested readers. Other guideline documents are: the short version - a 30-page summary, for use in wards and clinical departments; a quick reference guide for health professionals - as an A2 poster; and an 'information for the public' leaflet - for patients (available in 2006).

[1] Perioperative fasting is the time during which a patient is nil by mouth before planned or emergency surgery, and continues until the patient regains consciousness and is able to take fluids orally.

Clinical imperative for the guideline

Until relatively recently, surgical patients were fasted routinely from food and drink for periods of eight to 12 hours before anaesthesia to reduce the risk of aspiration pneumonitis at induction of anaesthesia. Despite evidence that shortened preoperative fasts do not increase the risk of a harmful event for the patient, contemporary practice still has wide variations across the United Kingdom (Hebballi et al., 2002). The benefits of reduced preoperative fasting, increased patient comfort and hydration, coupled with an unchanged risk of adverse events, provide a persuasive argument for variations in contemporary practice to be addressed. It is hoped that the guideline development process will not just afford an opportunity to review the available evidence, canvass expert opinion and generate recommendations, but will also promote a change in the climate of the care provision, thereby facilitating change in clinical practice.

Since the 1970s, randomised trials in adults and children have been carried out to investigate the effects of a shortened preoperative fast. Following on from these, several countries produced national guidelines (ASA, 1999; CAS, 2002; Ljungquist and Soreide, 2003; Fasting et al., 1998; Malaysia, 1998). In the UK, the Association of Anaesthetists of Great Britain and Ireland (AAGBI) adopted the American Society of Anesthesiologists' (ASA) recommendations and published a brief chapter on fasting policies (AAGBI, 2001), together with the recommendation that each hospital and trust should develop their own written policies. However, uptake of the AAGBI guidance has been slow, and patients are still faced with the prospect of excessively long periods without drink, with resulting negative effects on their wellbeing.

In contrast to preoperative fasting, the optimal time for fasting after surgery has not been extensively studied, including its impact on postoperative nausea and vomiting - outcomes that are unpleasant for patients and increase the costs of health care. Restriction of liquid and solid food has been a commonly accepted practice after surgery involving the gastrointestinal tract (Hoshi et al., 1999). However, there is a lack of evidence and guidance in

terms of the resumption of oral intake in otherwise healthy patients undergoing elective surgery not involving the gastrointestinal tract, under general anaesthesia.

This guideline seeks to address and resolve inconsistencies in preoperative fasting policies and to provide guidance in the postoperative field. As a guideline requested by members of the RCN and produced by an interdisciplinary team, it is expected to make an impact on clinical practice to the ultimate benefit of patients undergoing operations.

Disclaimer

Clinical guidelines have been defined as ‘systematically’ developed statements that are designed to assist clinicians, patients and carers in making decisions about appropriate treatments for specific conditions and aspects of care.

As with all clinical guidelines, recommendations may not be appropriate for use in all circumstances. Decisions to adopt any particular recommendations must be made by practitioners in the light of:

- available resources
- local services, policies and protocols
- the patient’s circumstances and wishes
- the clinical experience of the practitioner
- knowledge of more recent research findings.

It is important for all health care professionals that, when implementing evidence-based guidance, they understand the local context in which they work and existing quality improvement structures.

Guideline Development Group (GDG) members

Claire Allen	**Deputy administrator, The Cochrane Collaboration Secretariat, Oxford, and Cochrane Consumer Network**
Lindsay Beverley	**Senior pharmacist, Falkirk and District Royal Infirmary**
Jane Bovey	**Anaesthetics and recovery nurse, Salisbury District Hospital bank contract, and NHS Professionals, Portsmouth Health Trust, and RCN Perioperative & Surgical Nursing Forum**
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Endorsements

This guideline has been endorsed by the professional groups represented by the Guideline Development Group and other key organisations: The Royal College of Anaesthetists, The Association of Paediatric Anaesthetists of Great Britain and Ireland, The Royal College of Midwives, The Preoperative Association and the British Association of Day Surgery. We are also grateful to the Association of Anaesthetists of Great Britain and Ireland who provided helpful comments on this guideline.

Acknowledgements

We are grateful to the panel of peer reviewers for their critical appraisal of this guideline. Their names and organisations are listed in Section 12.

We would like to thank Dr Marian Brady, as lead author of the two Cochrane Reviews for her assistance with this guideline. We thank both Marian Brady and the Cochrane Wounds Group for providing original data and for allowing the GDG to use the review in children prior to its publication.

We also thank Dr Sybille Jürgens for supplying further data from her survey (Hebballi et al., 2002), and Linda Watterson for helpful discussions on the audit section.

Abbreviations

Technical terms

ARR	absolute risk reduction
ASU	ambulatory surgical unit
BMI	body mass index
CI	confidence interval
DSU	day surgery unit
GDG	Guideline Development Group
GI	gastrointestinal
GOR	gastro-oesophageal reflux
GPP	good practice point
H_2RA	Histamine-2 receptor antagonist
HTA	health technology assessment
IPD	individual patient data
LAS	linear analogue scale
NNH	number needed to harm
NNT	number needed to treat
NPO	nil (nulla) per os; nil by mouth
NS	not significant
OR	odds ratio
OR	operating room
PACU	post anaesthetic care unit
PONV	postoperative nausea and vomiting
PPI	proton pump inhibitor
QALY	quality-adjusted life year
RCT	randomised (controlled) trial

RR	risk ratio (relative risk)
RD	risk difference
SEM	standard error of the mean
SD	standard deviation
SMD	standardised mean difference
VAS	visual analogue scale
WMD	weighted mean difference

Where a patient is being fasted and receiving nothing orally, the globally accepted abbreviation, NPO, is used.

Organisations

AAGBI	Association of Anaesthetists of Great Britain and Ireland
APAGBI	Association of Paediatric Anaesthetists of Great Britain and Ireland
CC	The Cochrane Collaboration
CREST	Clinical Resource Efficiency Support Team (Northern Ireland)
DH	Department of Health
GIN	Guidelines International Network
JBI	Joanna Briggs Institute
MHRA	Medicines and Healthcare products Regulatory Agency
NCC-NSC	National Collaborating Centre for Nursing and Supportive Care
NICE	National Institute for Clinical Excellence (England and Wales)
QIS	Quality Improvement Scotland
RCN	Royal College of Nursing
RCoA	Royal College of Anaesthetists
SIGN	Scottish Intercollegiate Guidelines Network

General glossary

Absolute risk reduction The difference between the observed event rates (proportions of individuals with the outcome of interest) in the two groups.

Allocation concealment The process used to prevent foreknowledge of group assignment in an RCT (c.f. **double blinding**). The allocation process should be impervious to any influence by the individual making the allocation – this can be achieved by having the allocation process carried out by someone who is not responsible for recruiting participants, for example, a hospital pharmacy; or by hiding the allocation, for example, in serially numbered, opaque, sealed envelopes.

Bias Influences on a study that can lead to invalid conclusions about a treatment or intervention. This may result from flaws in the design of a study or in the analysis of results, and may result in either an underestimate or an overestimate of the effect size. Bias can occur at different stages in the research process, for example, in the collection, analysis, interpretation or publication of the research.

Case-control study A study in which the effects of an exposure in a group of patients (cases) who have a particular condition is compared with the effects of the

	exposure in a similar group of people who do not have the clinical condition (the latter is called the control group).
Case report	A detailed report on one patient (case), usually covering the course of that person's disease and response to treatment.
Case series	A description of several cases of a given disease or condition, usually covering the course of that disease and response to treatment. There is no comparison (control) group of patients.
Carer	An individual who provides unpaid care as opposed to paid carers (for example, care workers).
Clear fluid	A fluid through which it is possible to read newsprint.
Clinical effectiveness	The extent to which an intervention (for example, a drug or treatment) produces health benefits (i.e. more good than harm).
Cochrane Collaboration (The)	An international organisation that aims to help people make well informed decisions about health by preparing, maintaining and ensuring the accessibility of systematic reviews of the benefits and risks of health care interventions. The *Cochrane database of systematic reviews* contains regularly updated systematic reviews on a variety of issues. *The Cochrane library* contains the central register of controlled trials (CENTRAL) and a number of

	other databases that are regularly updated. It is available as CD-Rom or on the internet – **www.thecochranelibrary.com**
Cohort	A group of people sharing some common characteristics (for example, patients with the same disease or condition), followed up in a research study for a specified period of time.
Cohort study	An observational study that takes a group (cohort) of patients and follows their progress over time in order to measure outcomes, such as disease or mortality rates, and makes comparisons according to the treatments or interventions that patients receive. Thus within the study group, sub-groups of patients are identified and these are compared with respect to outcome – for example, comparing mortality between groups that did or did not receive treatment. Cohorts can be assembled in the present and followed into the future (a concurrent or prospective cohort study) or identified from past records and followed forward from that time up to the present (a historical or retrospective cohort study). Patients are not randomly allocated to sub-groups, and these may be quite different in their characteristics. Therefore adjustments must be made when analysing the results to ensure that the comparison between groups is as fair as possible.
Co-morbidity	Co-existence of a disease or diseases in a study population, in addition to the condition that is the subject of study.

Confidence interval	The range of possible effects (of a treatment or intervention) within which the 'true' value is expected to lie with a given degree of certainty (for example, 95 per cent or 99 per cent). A wide confidence interval indicates a lack of certainty (or precision) about the true size of the clinical effect and is often seen in studies with too few patients. Where confidence intervals are narrow, this indicates precision and this is often found in studies with larger patient samples. If the (95 per cent) confidence interval does not contain the null point (for example, 1 for an odds ratio, 0 for a mean difference), the effect is said to be '**statistically significant**'.
Confounding	A situation in which a measure of the effect of an intervention (or exposure) is distorted because of the association of the intervention with other factor(s) that influence the outcome under investigation.
Double blind study	A study in which neither the participant (patient) nor the observer (investigator or clinician) is aware of which treatment or intervention the participant is receiving. The purpose of blinding is to protect against bias. Blinding of the outcome assessor is considered especially important.
Economic evaluation	A comparative analysis of alternative courses of action, in terms of both their costs and consequences.
Effectiveness	The extent to which interventions achieve health improvements in real practice settings.

Efficacy	The extent to which interventions achieve health improvements under ideal circumstances.
Epidemiological study	A study that looks at the incidence, distribution, and control of disease in a population.
Evidence-based	The process of systematically finding, appraising and using research findings as the basis for clinical decisions.
Evidence-based clinical practice	Evidence-based clinical practice involves making decisions about the care of individual patients based on the best available research evidence, rather than on personal opinion or common practice (that may not always be evidence-based). Evidence-based clinical practice involves integrating individual clinical expertise and patient preferences with the best available evidence from research.
Evidence table	A table with information extracted from research papers, usually summarising the results of a collection of studies. Together, this information represents the supporting evidence for a recommendation in a guideline.
Experimental study	A research study designed to test whether a treatment or intervention has an effect on the course or outcome of a condition or disease, where the conditions of testing are to some extent under the control of the investigator. A randomised trial is an example of an experimental study.

Extrinsic	Factors which are external to the individual.
Follow-up	Observation over a period of time of an individual, group or population whose relevant characteristics have been assessed in order to observe changes in health status or health-related variables.
Forest plot	A graphical representation of the individual results of each study included in a **meta-analysis**, together with the combined meta-analysis result. The plot also allows readers to see the **heterogeneity** among the results of the studies. The results of individual studies are shown as squares centred on each study's point estimate. A horizontal line runs through each square to show each study's **confidence interval**. The overall estimate from the meta-analysis and its confidence interval are shown at the bottom, represented as a diamond. The centre of the diamond represents the pooled point estimate, and its horizontal tips represent the confidence interval.
Gold standard	A method, procedure or measurement that is widely accepted as being the best available.
Health professional	Includes nurses, allied health professionals, doctors.
Health technology assessment	The process by which evidence is systematically evaluated on the clinical effectiveness and the costs and benefits of using a technology in clinical practice.

Heterogeneity	Or lack of homogeneity. The term is used in **meta-analysis** and **systematic review**, when the results or estimates of effects of treatment from separate studies seem to be very different in terms of size of treatment effects or adverse treatment effects. Such results may occur because of differences between studies in terms of the patient population, outcome measures, definitions of variables or duration of follow-up.
Homogeneity	This means that the results of the studies in a **systematic review** or **meta-analysis** are similar. Results are usually regarded as homogenous when the differences between studies are those that are reasonable to expect between studies.
Incidence	The number of new cases of illness commencing, or of persons falling ill, during a specified time period in a given population.
Intention to treat analysis	A strategy for analysing data from a **randomised trial.** All participants are included in the arm to which they were allocated, whether or not they received (or completed) the intervention given to that arm, c.f. per protocol analysis.
Intervention	A health care action intended to benefit the patient, for example, drug treatment, psychological therapy.
Intrinsic	Factors which present within the individual.
Meta-analysis	A statistical method of summarising the results from a group of similar studies.

Non-carbonated drink	Carbonation occurs when carbon dioxide is dissolved in water or an aqueous solution. Carbonated drinks often contain refined sugars, are generally acidic and increase the risk of gastro-oesophageal reflux.
Number needed to treat	The number of patients who need to be treated to prevent one event.
Number needed to harm	The number of patients who when treated have a non-favourable outcome.
Observational study (non-experimental study)	A study in which nature is allowed to take its course. Changes or differences in one characteristic are studied in relation to changes or differences in other(s) (for example, whether or not they died), without action by the investigator.
Odds	The odds are the ratio of the number of people in a group *with* an event to the number *without* an event.
Odds ratio	The odds of an event occurring in the experimental group, divided by the odds of an event occurring in the control group.
Per protocol analysis	An analysis of the subset of participants from a **randomised trial** who complied with their original allocation (protocol), c.f. **intention to treat analysis**.
pH	Negative logarithm to base 10 of the hydrogen ion concentration. As pH increases the acidity decreases. pH ranges from 0 (most acidic) to 14.

Premedication	Drug therapy given to prepare the patient for anaesthesia and operation. The main aim of prescribing premedication is to prevent stress-induced physiological reactions.
Prevalence	The proportion of persons with a particular disease within a given population at a given time.
Pseudo-values	Mean and standard deviation calculated from median and range statistics.
Quasi-randomised study	A clinical trial in which the treatments are allocated to the participants by a systematic method such as alternation, date of birth, etc.
Randomisation	Method used to generate a random allocation sequence, such as using tables of random numbers or computer-generated random sequences.
Randomised (controlled) trial	A clinical trial in which the treatments are randomly assigned to participants. The random allocation eliminates bias in the assignment of treatment to patients and establishes the basis for statistical analyses.
Risk	The risk of an event is the ratio of the number of people in a group with an event to the total number in the group.
Risk ratio (relative risk)	The ratio of the risk of an event occurring in the experimental group, divided by the corresponding risk in the control group.

Standard fast	Fasting from food and drink from midnight for a morning operating session or 6 a.m. for an afternoon session. In infants, the standard fast may mean the normal feed is allowed up to four hours preoperatively.
Statistical power	The ability of a study to demonstrate an association or causal relationship between two variables, given that an association exists. For example, 80 per cent power in a clinical trial means that the study has 80 per cent chance of having a p-value of less than 5 per cent in a statistical test (statistically significant).
Statistical significance	The level of significance (or **p-value**) is the probability of having observed the data in a study (or more extreme data) when the null hypothesis is true. (Usually in intervention studies the null hypothesis is that there is no difference in effect between the two interventions). A statistically significant result is often taken to be one with a p-value less than 0.05 (and leads to the rejection of the null hypothesis) – see also **confidence interval**.
Systematic review	A review of a clearly formulated question that uses systematic and explicit methods to identify, select and critically appraise relevant research, and to collect and analyse data from the studies that are included.
User	Anyone using the guideline.

Validity	The extent to which a variable or intervention measures what it is supposed to measure or accomplish, or the degree to which a result (of a measurement or study) is likely to be true and free from bias (systematic errors). *Internal validity:* the extent to which the observed effects are true for the people in a study. *External validity or generalisability:* of a study refers to the appropriateness by which its results can be applied to non-study patients or populations.

Partially based on *Clinical epidemiology glossary* by the Evidence-based Medicine Working Group, www.ed.ualberta.ca/ebm; the glossary from the *Cochrane handbook for systematic reviews of interventions*, www.cochrane.org ; *Information for national collaborating centres and guideline development groups, (NICE 2005)* and the glossary from the Patient Involvement Unit at NICE, www.nice.org.uk

1. Executive summary

The RCN has collaborated with key professional groups to develop this clinical guideline on *Perioperative fasting in adults and children*. The topic emerged from a consultation process with RCN members in 2002, with an invitation to support this research and development work to key organisations that are represented in the GDG. This document describes the methods used for developing the guideline and presents evidence-based recommendations. It is the source document for an abbreviated version for health professionals and for the *Information for patients and carers* version. These are available as web-based documents (PDF download) and RCN publications.

The guideline was produced by an interdisciplinary GDG, with project management undertaken by the RCN. The main areas examined by the guideline are:

- preoperative fasting in healthy adults
- preoperative fasting in healthy paediatric patients
- preoperative fasting in higher-risk groups
- postoperative fasting in healthy adults
- postoperative fasting in healthy paediatric patients

Recommendations for good practice based on the best available evidence of clinical effectiveness are presented. Literature searching details, including cut-off dates, are reported in the methods section for each topic area. Update searches were performed for each area not less than six months before publication. Recommendations contained in this document are those considered to be central to perioperative fasting care. This is a guide to that management, not a textbook of care.

Health care professionals should use their clinical judgement in support of these evidence-based recommendations.

2. Principles of practice and summary of the guideline recommendations

2.1 Principles of practice

The principles, outlined on the following pages, describe the ideal context in which to implement the recommendations contained in this guideline. They reflect original research and development work previously produced by the RCN, and enable clinicians using evidence-based guidance to contextualise and understand the importance of preparation and planning prior to using this evidence-based tool.

Person-centred care

- Patients and carers should be made aware of the guideline and its recommendations and be referred to the version, *Information for patients and carers.*
- Patients and carers should understand decisions made about the management of perioperative fasting, and have the opportunity to ask questions.
- Patients and carers should be informed about any potential risks and/or complications of perioperative fasting.

A collaborative interdisciplinary approach to care

- All members of the interdisciplinary team should be aware of the guidelines and all care should be documented in the patient's health care records.
- The approach to care should be an interdisciplinary one involving all appropriate people in the management of perioperative fasting.

Organisational issues

- There should be an integrated approach to the management of perioperative fasting, with a clear strategy and policy supported by management.
- Care should be delivered in a context of continuous quality improvement, where improvements to care following guideline implementation are the subject of regular feedback and audit.
- Commitment to, and availability of, education and training are needed to ensure that all staff, regardless of profession, are

given the opportunity to update their knowledge and are able to implement the guideline recommendations.

- The health care team should undergo appropriate training and be able to demonstrate competence in perioperative care.
- Staffing levels and skill mix should reflect the needs of patients, and are paramount to providing high quality services for people who are being fasted before and after operations.

2.2 Summary of the guideline recommendations and algorithm

The summary recommendations are given separately for adult and paediatric patients, so that each section can stand alone. Colour coding is used to help distinguish the two. The recommendations are also summarised in an algorithm.

Although the term ‘children and young people’ applies within the National Service Framework (NSF, 2004), the term ‘paediatric’ has been used in this document to denote the whole ‘child’ population 0 to 18 years. This terminology was adopted to enable different patient groups to be distinguished. The following other terms apply: ‘infant’ – under one year - and ‘child’ - one to 18 years.

Reference is also made to ‘healthy’ and ‘higher-risk’ patients. The former category is defined as patients who are ASA I-II (Appendix 2) without gastrointestinal disease or disorders; these are the types of patients specified in the trials in healthy patients. ‘Higher-risk’ refers to groups of patients who are expected to be at increased risk of regurgitation and aspiration, such as patients who have gastro-oesophageal reflux, obesity and diabetes. The anaesthetic team should decide the most appropriate risk category for each patient.

Some of the recommendations state that the patients may have fluids ’*up to* two hours before induction of anaesthesia‘. This means that two hours is the

recommended *minimum* time before induction of anaesthesia for that patient, but the patient should also be encouraged to take fluids as close as possible to two hours preoperatively.

The levels of evidence and grades of recommendations referred to in the summary are defined in Tables 1 and 2.

The D grading encompasses consensus decisions made on the basis of expert opinion, which, in many cases, is underpinned by evidence that is indirect or only partially applicable (for example, a randomised trial that provides evidence for what *should not* be done, but cannot be used to say what *should* be done).

Postoperative resumption of oral intake in patients undergoing non-routine surgery is outside the scope of this guideline. Readers are referred to guidance from NICE and SIGN.

TABLE 1[Ø]: LEVELS OF EVIDENCE

Level of evidence	Type of evidence
1^{++}	High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias.
1^{+}	Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias.
1^{-}	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias[*].
2^{++}	High quality systematic reviews of case–control or cohort studies. High-quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal.
2^{+}	Well-conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal.
2^{-}	Case-control or cohort studies with a high risk of confounding bias, or chance and a significant risk that the relationship is not causal*.
3	Non-analytic studies (for example, case reports, case series).
4	Expert opinion, formal consensus.

[Ø] Source: NICE *Guideline development methods* (NICE 2005), based on SIGN 50. *A guideline developer's handbook* (SIGN 2004)

* Studies with a level of evidence '-' should not be used as a basis for making a recommendation.

TABLE 2[Ø] GRADES OF RECOMMENDATIONS

Grade	Evidence
A	At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population, or A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results. Evidence drawn from a NICE technology appraisal.
B	A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results, or Extrapolated evidence from studies rated as 1++ or 1+.
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results, or Extrapolated evidence from studies rated as 2++.
D	Evidence level 3 or 4, or Extrapolated evidence from studies rated as 2+, or Formal consensus.
D(GPP)	A good practice point (GPP) is a recommendation for best practice based on the experience of the GDG.

[Ø] Source: NICE *Guideline development methods* (NICE, 2005), based on SIGN 50. *A guideline developer's handbook* (SIGN, 2004)

Adult patients

Preoperative fasting in healthy[†] adults

A) The Intake of Oral Fluids during a Restricted Fasting Period

Grade	Recommendation
A	Intake of water up to two hours before induction of anaesthesia for elective surgery is safe in healthy adults, and improves patient well-being.
A	Other clear fluid*, clear tea and black coffee (without milk) can be taken up to two hours before induction of anaesthesia in healthy adults.
B	Tea and coffee with milk are acceptable up to six hours before induction of anaesthesia.
A	The volume of administered fluids does not appear to have an impact on patients' residual gastric volume and gastric pH, when compared to a standard fasting regimen. Therefore, patients may have unlimited amounts of water and other clear fluid up to two hours before induction of anaesthesia.

[†] 'Healthy' defined as ASA I-II (Appendix 2) without gastrointestinal disease or disorders.

* In practice, a clear fluid is one through which newsprint can be read.

B) The Intake of Solid Foods during a Restricted Fasting Period

Grade	Recommendation
D	A minimum preoperative fasting time of six hours is recommended for food (solids and milk).

C) Chewing Gum and Sweets during a Restricted Fasting Period

Grade	Recommendation
B	Chewing gum should not be permitted on the day of surgery.
D	Sweets are solid food. A minimum preoperative fasting time of six hours is recommended.

D) Pharmacological Interventions

1. Concurrent medications

Grade	Recommendation
D(GPP)	Regular medication taken orally should be continued preoperatively unless there is advice to the contrary.
D(GPP)	Up to 30 ml water may be given orally to help patients take their medication.

2. Premedication

Grade	Recommendation
A	Administration of premedication as currently practised - for example, benzodiazepines - does not appear to affect the fasting recommendations for water and other clear fluid.

3. Histamine-2 Receptor Antagonists (H_2RAs)

Grade	Recommendation
D	The routine use of H_2 receptor antagonists is not recommended for healthy adults.

E) Delayed Operations

Grade	Recommendation
D(GPP)	If an elective operation is delayed, consideration should be given to giving the patient a drink of water to prevent excessive thirst and dehydration.

Preoperative fasting in higher-risk[‡] adult groups

Grade	Recommendation
D	Higher-risk patients should follow the same preoperative fasting regime as healthy adults, unless contraindicated. In addition, the anaesthetic team should consider further interventions, as appropriate to the overall clinical situation[#].
D	Adults undergoing emergency surgery should be treated as if they have a full stomach. If possible, the patient should follow normal fasting guidance to allow gastric emptying.

Postoperative resumption of oral intake in healthy adults

Grade	Recommendation
A	When ready to drink, patients should be encouraged to do so, providing there are no medical, surgical or nursing contraindications.

[‡] Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes.

[#] Such as H_2 receptor antagonists, sodium citrate, gastrokinetic agents and proton pump inhibitors, together with rapid sequence induction, tracheal intubation and nasogastric tube.

Paediatric patients

Preoperative fasting in healthy[†] infants and children

A) The Intake of Oral Fluids during a Restricted Fasting Period

Grade	Recommendation
A (children[§]) D (infants)	Intake of water and other clear fluid* up to two hours before induction of anaesthesia for elective surgery is safe in healthy infants and children, and improves patient well-being.
A (children) D (infants)	The volume of administered fluids does not appear to have an impact on patients' residual gastric volume and gastric pH when compared to a standard fasting regimen. Therefore, patients may have unlimited amounts of water and other clear fluid up to two hours before induction of anaesthesia.

B) The Intake of Milk during a Restricted Fasting Period

Grade	Recommendation
D	Breast milk may be given up to four hours before induction of anaesthesia.
D	Formula milk or cows' milk may be given up to six hours before induction of anaesthesia.

[†] 'Healthy' defined as ASA I-II (Appendix 2) without gastrointestinal disease or disorders.
[§] Children – age one year and above; infants – less than one year old.

* In practice, a clear fluid is one through which newsprint can be read.

C) The Intake of Solid Foods during a Restricted Fasting Period

Grade	Recommendation
D	A minimum preoperative fasting time of six hours is recommended for food.

D) Chewing Gum and Sweets during a Restricted Fasting Period

Grade	Recommendation
D(GPP)	Chewing gum should not be permitted on the day of surgery.
D	Sweets (including lollipops) are solid food. A minimum preoperative fasting time of six hours is recommended.

E) Pharmacological Interventions

1. Concurrent medications

Grade	Recommendation
D(GPP)	Regular medication taken orally should be continued preoperatively unless there is advice to the contrary.
D(GPP)	Up to 0.5 ml/kg (up to 30 ml) of water may be given orally to help children take their medication.

2. Premedication

Grade	Recommendation
A	Administration of premedication as currently practised - for example benzodiazepines - does not appear to affect the fasting recommendations for water and other clear fluid.

3. Histamine 2 Receptor Antagonists (H_2RAs)

Grade	Recommendation
D	The routine use of H_2 receptor antagonists is not recommended for healthy children.

F) DELAYED OPERATIONS

Grade	Recommendation
D(GPP)	If an elective operation is delayed, consideration should be given to giving the patient a drink of water or other clear fluid to prevent excessive thirst and dehydration. If it is confirmed by the anaesthetist and/or surgeon that a delay is likely to be longer than two hours, water or other clear fluid should be given.

G) EXCESSIVE FASTING

Grade	Recommendation
D(GPP)	If a child admitted for surgery has undergone excessive fasting, consideration should be given to offering them a drink and scheduling their operation slightly later in the operating list.

Preoperative fasting in higher-risk[‡] groups

Grade	Recommendation
D	Higher-risk patients should follow the same preoperative fasting regime as healthy infants and children, unless contraindicated. In addition, the anaesthetic team should consider further interventions, as appropriate to the overall clinical situation[#].
D	Patients undergoing emergency surgery should be treated as if they have a full stomach. If possible, the patient should follow normal fasting guidance to allow for gastric emptying.

[‡] Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes.

[#] Such as H_2 receptor antagonists, gastrokinetic agents and proton pump inhibitors, together with rapid sequence induction, tracheal intubation and nasogastric tube.

Postoperative resumption of oral intake in healthy infants and children.

Grade	Recommendation
A	Oral fluids can be *offered* to healthy infants and children when they are fully awake following anaesthesia, providing there are no medical, surgical or nursing contraindications.
D(GPP)	Clinicians should consider giving clear fluids or breast milk before introducing other oral intake.
A	Infants and children undergoing day surgery should *not be required* to drink as part of the discharge criteria.

ALGORITHM

Patient presents for planned or emergency surgery

For patients undergoing emergency surgery:

Treat as though the patient has a full stomach. If possible, follow normal fasting guidance to allow gastric emptying.

Information provided on fasting regime

given by a health care professional with suitable training.

Clear signage for each patient, indicating fasting regime

recorded in the multidisciplinary notes and clearly visible in the patient's bed space.

For healthy patients without GI disorders

For higher risk patients

Adults

Water up to two hours before induction.

Clear fluids*, including clear tea and black coffee also permitted up to two hours before induction of anaesthesia.

Food / milk / sweets / tea or coffee with milk, can be taken six hours (minimum**)** before induction.

Chewing gum not permitted on day of surgery

* Clear fluids – those through which newsprint can be read

Children (0 to 18 years)

Clear fluids* and water up to two hours before induction of anaesthesia.

Breast milk up to four hours before induction.

Formula/cows' milk up to six hours before induction.

Food, including sweets, can be taken six hours (minimum) before induction of anaesthesia.

Chewing gum not permitted on day of surgery

All higher risk patients

Includes those with obesity, diabetes and gastro-oesophageal reflux.

Follow same fasting regime as healthy patients, unless contraindicated.

The anaesthetic team should consider further interventions, as appropriate.

Regular medication continued, unless contraindicated; premedication (benzodiazepines) acceptable; taken with up to 30 ml fluid (children 0.5 ml/kg)

Postoperative recovery

Adults routine surgery

Encourage the patient to drink when they are ready, providing there are no complications.

Children (0 to 18 years) routine surgery

Oral fluids can be offered when the patient is fully awake following anaesthesia, providing there are no complications.

Consider clear fluids or breast milk first.

Not required to drink before discharge.

GI tract/major abdominal surgery (including Caesarean section)

Consult surgical team for postoperative recovery regimes.

See NICE and SIGN guidance.

3. Background

The practice of fasting patients for a period of time preoperatively is based on the premise that fasting allows time for gastric emptying to occur, thereby reducing the risk of aspiration pneumonitis at induction of anaesthesia. Traditionally, patients were fasted from midnight for a morning list and from 6 a.m. for an afternoon list, with a light breakfast of tea and toast commonly being allowed for the latter (Ljungqvist and Soreide, 2003; Corbett and Mortimer, 1997; Pandit et al., 2000). However, in recent years, several authors have questioned the usefulness of a long preoperative fast from fluids, both in terms of its effectiveness in preventing pulmonary aspiration and its influence on patient comfort and morbidity. This is particularly true in babies and elderly people, who may become dehydrated, hypoglycaemic, hypotensive or experience other adverse metabolic consequences of prolonged fasting (Cammon and Hackshaw, 2000; Corbett and Mortimer, 1997; Strunin, 1993; Ljungqvist, 2004; Ljungqvist and Soreide, 2003).

Factors affecting aspiration

Fasting became common following publication of Mendelson's 1946 observational study on women receiving general anaesthesia for vaginal delivery - which identified a link between aspiration and feeding during labour - and his experimental animal studies (Mendelson, 1946). These studies suggested that if the gastric contents are aspirated into the lungs, there is a greater risk of pneumonitis and death if there is particulate matter present; if the contents are highly acidic; or if the volume of gastric contents in the lungs is relatively high, with particulate matter representing the greatest risk and a high volume the least. Mendelson found an incidence of aspiration of 66 in 44,016 pregnant women undergoing obstetric anaesthesia, over the period 1932 to 1945 (i.e. 15 in 10,000). He proposed that a reduction in aspiration under general anaesthesia would be achieved by: no oral feeding in labour; wider use of local anaesthesia; alkalinisation and emptying of the stomach before general anaesthesia; and adequate equipment (a tilting table, transparent anaesthetic masks, suction and equipment for tracheal intubation). Later, these preventative measures were extended to other forms of surgery, and the number of

aspirations in all patients having a range of surgical procedures under general anaesthesia reduced to 1 to 10 in 10,000, i.e., 0.01 to 0.1% (Mellin-Olsen et al., 1996; Søreide et al., 1996; Flick et al., 2002). Less than 5 per cent of these aspirations resulted in death, and the mortality rate following aspiration perioperatively was between 0 and 2 in 10,000 (Ng and Smith, 2002; Flick et al., 2002). Clearly this represents a small percentage risk, but in absolute terms this could be a large number of people, given that an estimated six million people in the UK undergo surgery under general anaesthetic each year (DH, 2005).

Patients 'at risk'

In 1974, Roberts and Shirley defined the patient at risk of developing pulmonary aspiration syndrome as having a residual gastric volume greater than 0.4 ml/kg and a pH less than 2.5 units (Roberts and Shirley, 1974; Teabeaut, 1952). The volume threshold in particular was based on experiments carried out on one rhesus monkey. Nevertheless these criteria were adopted for many years by clinicians and researchers as a means of assessing patients 'at risk'.

In practice, the ranges of gastric volume and pH vary considerably in normal healthy people, and the Roberts and Shirley criteria give highly inflated estimates of the numbers of patients at risk. For example, studies have shown that 30 to 75 per cent of children fall into the Roberts and Shirley 'at risk' category (Schreiner, 1998; Hardy et al., 1990), whereas the incidence of aspiration lies in the range 0.01 to 0.1%. The discrepancy lies in the fact that other factors are involved. In healthy people not undergoing operations, the contents of the stomach are retained by the lower oesophageal sphincter (LOS), and the LOS pressure exceeds the intragastric pressure. In addition, normal reflexes - such as the cough reflex - prevent regurgitation and aspiration. During surgery, the pressure difference ('barrier pressure') is affected by several factors, including the body position of the patient, the duration of the procedure, and some anaesthetic drugs and techniques. Under general anaesthesia, the protective reflexes are less effective and therefore even healthy patients are at increased risk of aspiration perioperatively. In some patient groups, the LOS does not work as effectively as in healthy people, placing these patients at even greater risk because regurgitation is more likely to occur (Ng and Smith, 2001).

Current views are that, although the Roberts and Shirley criteria may be inaccurate or unreliable in predicting patients at risk of aspiration, there is still a risk that aspiration of the stomach contents will occur under general anaesthesia, even in healthy patients. Minimising the risk of aspiration and its associated morbidity and mortality involves control of the gastric contents, reduction in gastro-oesophageal reflux, prevention of pulmonary aspiration, and attenuation of the effects of aspiration (Ng and Smith, 2001). Preoperative fasting affects the first two of these, and an increased gastric volume, a reduced gastric pH and the presence of particulate matter in the aspirate still present a risk to the patient. Any alteration in fasting regimes should ensure that these quantities do not change adversely.

Gastric emptying

Physiological evidence suggests that the fasting times required to ensure the minimal volume of gastric contents at induction of anaesthesia will vary for different types of oral intake - but even a fasted stomach is not empty: it can secrete up to 50 ml gastric juice in an hour (Dowling, 1995; Love, 2002). Solids and fluids are emptied by different mechanisms. The rate of emptying of clear fluids is rapid and decreases exponentially; for example, water has an emptying half-life of 12 minutes. This means that 95 per cent of the contents are emptied within one hour (Meakin and Murat, 1999). The rate of emptying of fluids is inversely related to the osmolarity of ingested fluids, and calorie-containing solutions tend to empty more slowly than water (Petring and Blake, 1993; Splinter and Schreiner, 1999). Solids empty from the stomach with a constant rate and, depending on the food's composition and amount, 10 to 30 per cent may remain after six hours (Ljungqvist and Soreide, 2003; Phillips et al., 1994; Moore et al., 1981). Milk lies between solids and liquids – it is a complex colloidal dispersion, which becomes destabilised in the acid environment of the stomach, forming curds. The rate of gastric emptying is also affected by pharmacological interventions, for example, delayed emptying occurs with opiates, nicotine, anticholinergics, beta agonists, L-dopa and tricyclic antidepressants (Kallar and Everett, 1993; Petring and Blake, 1993; Ng and Smith, 2002).

Clinical trials and surveys

In view of these relatively fast emptying rates, especially for water and clear fluids, there has been increasing pressure to reduce the preoperative fasting times, but in a differential way, according to the type of food or drink consumed. To this end, several randomised trials were carried out in the 1980s and 1990s, and much of this work was summarised in the 1999 guideline produced by the ASA (ASA, 1999). In 2001, the AAGBI recommended the following minimum fasting periods for elective operations based on the ASA guidelines: two hours fast for clear, non-particulate and non-carbonated fluids; four hours for breast milk; and six hours for solid food, infant formula or other milk. They also recommended that each UK hospital and trust should have agreed written policies (AAGBI, 2001). In the paediatric perioperative field, in the absence of much evidence, clinicians have been largely influenced by the results of a 1996 survey by Emerson et al., amongst 110 members of the Association of Paediatric Anaesthetists (APA) in the UK (Emerson et al., 1998). This led to what is popularly known as the '2-4-6 rule': in infants (less than one year old), two hours fast for clear fluids, four hours for breast milk and six hours for formula milk and solids. In neonates (less than 44 weeks post-conceptional age), this was revised to four hours for both breast and formula milks. Some authors have applied the latter rule to infants up to three months (Meakin 1999).

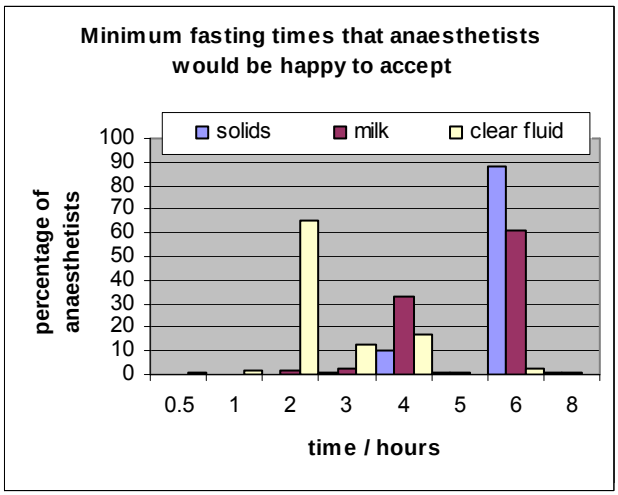


Figure 1. Results of fasting survey (Heballi et al. 2002)

A survey of UK anaesthetists (Heballi et al., 2002; Jürgens, 2004) showed that the uptake of the AAGBI (2001) guidance was variable for adult patients: 151/167 (90 per cent) anaesthesia departments responding had local guidelines, but 62 per cent of these anaesthesia departments followed traditional fasting rules. Anaesthetists reported that they also had options within

the departmental policy to implement shortened fasting times for fluids: four hours (26 per cent of respondents), three hours (21 per cent) or two hours (47 per cent). However, many anaesthetists said they would be 'happy to accept' shorter fasting times, despite departmental practice, although the 'acceptable' times varied widely (see Figure 1).

In the paediatric field, a more recent survey by Bliss (2002) of 149 delegates at the 28th Annual Scientific Meeting of the APA, revealed that 90 per cent of respondents agreed on a fast of two hours for clear fluids and 80 per cent on six hours for solids, but practice was mixed on both breast and formula milks – about one-third of respondents advocated a three hour fast for breast milk (and the rest favoured four hours); and opinion was split on whether four or six hours was most appropriate for formula milk.

There is clearly still a need to standardise practice in the UK in healthy patients, although the surveys suggest positive attitudes to change. This RCN guideline both extends the ASA guideline to include additional evidence, and puts in place the development process to facilitate the uptake of the guideline throughout the UK.

Patients at increased risk of regurgitation and aspiration

This background section has dealt largely with preoperative fasting in healthy patients. However, there any many patients who have co-morbidities that place them at increased risk of regurgitation and aspiration. Increasingly, perioperative clinicians have specified the need to identify patients at higher risk of regurgitation and aspiration by virtue of their condition or disease, rather than the volume and pH of their stomach contents. The assessment of preoperative risk factors for aspiration is outside the scope of this guideline. However, a broad division can reasonably be made, based on ASA categories, into patients who are ASA I-II *without* a gastrointestinal disease and disorders, and all others (Appendix 2).

Generally, a patient's risk of surgery under general anaesthesia is well represented by the ASA classification, which describes the number and severity of pre-existing conditions. Approximately 40 per cent of patients undergoing

general anaesthesia are ASA III-V. However, the ASA classification does not necessarily relate to the risk of aspiration (Flick et al., 2002). The following groups of people are amongst those identified as potentially being at increased risk of aspiration: obese patients (i.e. a body mass index of more than 30, especially those with gastro-oesophageal reflux); women in the later stages of pregnancy (including the postpartum period); patients with diabetes (especially those with autonomic neuropathies); and patients undergoing emergency operations (especially those with trauma). For some of these groups the evidence is mixed and opinion is divided (Watson, 2002; Mellin-Olsen et al., 1996).

Postoperative fasting

Postoperatively, the risks that accompany the intake of food or drink are much less severe than those preoperatively, and complications are usually rare and minor (Villeret et al., 2002). Nevertheless, postoperative nausea and vomiting (PONV) is a common and distressing occurrence – 20 to 30 per cent of patients undergoing procedures under general anaesthesia are affected (Nelson, 2002). This amounts to about two million people in the UK every year. About 1 per cent of patients undergoing ambulatory surgery are admitted overnight because of uncontrolled PONV (Tramer, 2003). In addition to the often considerable distress to the patient, PONV can increase the costs of health care – for example, costs of antiemetics and nursing care, and loss of operating theatre time because of patients remaining longer in the post anaesthetic care unit (Gan et al., 2003; Jones et al., 2001).

Many factors have been associated with an increased risk of postoperative nausea and vomiting, including female gender, age, opioid premedication, type of anaesthetic, the use of opioids for pain relief and the type of operation (Tramer, 2003; Ouellete and Ouellete, 1998; Nelson, 2002; Jones et al., 2001). General anaesthesia is at higher risk than regional, although spinal and epidural blocks can be associated with an increased risk. Operations at higher risk of PONV include strabismus (squint correction) and ENT surgery, especially tonsillectomy and adenoidectomy. In adults, gynaecological procedures, head and neck surgery, knee arthroscopy and operations on the stomach, duodenum

and gall bladder are also high risk for PONV (Ouellette and Ouellette, 1998). Overall, children have twice the incidence of vomiting as adults, however younger children (less than two years) vomit less often than older ones (Schreiner et al., 1992).

Some observational studies have reported that preoperative fasting increases the incidence of postoperative nausea and vomiting (Smith et al., 1997; Keeton, 1999). These observations were supported indirectly by a randomised trial in adults (Trepanier and Isabel, 1993) of gastric aspiration immediately before extubation, for which the aspirated group had significantly more nausea and vomiting one day after discharge, although there were no significant differences in recovery or the day surgery unit. A similar quasi-randomised trial in children (Jones et al., 2001) showed no significant reduction in the incidence of postoperative vomiting. More generally, though, the effect of oral fluids and food on PONV has received only limited attention. An ASA guideline on post-anaesthetic care as a whole was produced in 2002 (ASA, 2002). It concluded that the requirement of drinking clear fluids should not be part of the discharge protocol. There do not appear to be any literature reports on current UK practice with respect to postoperative fasting. Recent years have marked the development of more effective anti-emetics and changes in anaesthesia (Tramer, 2003; Jones et al., 2001), and it is likely that future postoperative care will consider a concerted approach to the prevention and management of PONV.

3.1 Clinical need for evidence-based guidance in perioperative fasting

Many of the recommendations included in this guideline have affirmed recommendations made by the ASA in their 1999 guideline in this area. The present guideline seeks not only to update the ASA guideline, but also to address the poor uptake of the ASA guideline in the UK, an issue of considerable importance. The commissioning of this RCN guideline by nurse members, together with representation on the GDG from all relevant

professional bodies is seen as a major advantage in the implementation of the guideline.

4. Aim of the guideline

The aim of this clinical guideline is to improve the care of patients undergoing surgery through careful implementation of the recommendations.

This aim has been supported by a rigorous evidence-based process. As the most up-to-date evidence resource, this guideline is able to inform the development of local policies and guidance in both NHS trusts and the independent sector. Successful implementation of recommendations and local adaptation will address the wide variations that currently exist, ensuring contemporary practice is shaped around best evidence.

4.1 Who is this guideline for?

This guideline is of relevance to health professionals who have direct contact with, and make decisions concerning, the treatment of patients undergoing surgery under general anaesthesia, who will have a period of planned fasting. It will also benefit patients (and their family members or significant others) who have a planned period of fasting as part of their care.

4.2 Groups covered by the guideline

The guideline recommendations apply to all patient groups (adults, older people, infants, children and young people) undergoing operations under general anaesthesia.

4.3 Groups not covered

There are no restrictions regarding preoperative fasting. However, it is clear that the research evidence in some areas and for some groups (for example pregnant women) is very limited. This guideline does not cover patients undergoing procedures under sedation. For postoperative fasting, patients

undergoing surgery involving the gastrointestinal tract or major abdominal surgery are not covered by this guideline.

4.4 Health care setting

This guideline makes recommendations for care given by health professionals who have direct contact with, and make decisions concerning, the treatment of patients undergoing surgery who will have a period of planned fasting. The guideline will also help to guide, inform and educate patients and their relatives or significant others by increasing awareness related to evidence-based perioperative fasting practice.

This is a guideline prepared for the NHS and the independent sector by the collaborative professional bodies represented on the GDG. For the purpose of clarity, the evidence review is separated into two parts, covering adult and paediatric patients, for ease of reading and implementation of findings.

4.5 Clinical questions covered by the guideline

i) What is the optimal duration of perioperative fasting required for adults and children in relation to intake of water, clear fluids, other fluids and solids?

ii) What is the optimal fasting regimen required in relation to the type of intake that may be permitted perioperatively?

iii) What is the optimal volume of permitted intake perioperatively?

iv) To what extent does the evidence base support the need for different fasting regimes for sub-groups such as pregnant, obese, elderly and diabetic patients?

Other issues

Should patients be permitted to chew gum/sweets during a restricted fasting period?

Does the intake of medication impact on patient safety or the risk of aspiration / regurgitation?

- premedication?
- antacids?

5. Methods used to develop the guideline

In the rest of this guideline, the term ‘review’ refers to the evidence reviews carried out by the guideline authors, as distinguished from ‘Cochrane Reviews’.

5.1 Summary of development process

The GDG was recruited by inviting representatives from relevant national bodies, covering the fields of anaesthesia, nursing, midwifery, surgery, dietetics and pharmacy. Members were selected because of their experience with both adult and paediatric patient groups. The GDG also had a patient representative, Claire Allen, who is employed by the Cochrane Collaboration within the UK and is actively involved in supporting the consumer group within that organisation. As a recent patient who has undergone planned surgery, with the potential for further surgery, she was an ideal patient representative to support the development of the guideline. The GDG members are listed at the beginning of the document (GDG).

The GDG met nine times between November 2002 and June 2005. The scope, once established (see Appendix 1), created the framework for the content of the guideline. Evidence reviews were presented and recommendations were made based on available evidence. The GDG worked well together to appraise critically the evidence and to consider its clinical applicability. Discussions reflected expert opinion ranging across the multidisciplinary team, and once consensus was reached, recommendations for practice were generated. The main questions asked in the guideline were addressed by high quality evidence.

Health economics work was not undertaken.

The guideline has been extensively peer reviewed by the main external professional bodies and relevant organisations. Peer reviewers are listed in section 12. The peer review was favourable, and where appropriate, further changes were discussed by the GDG and recommendations modified.

Five evidence reviews are presented. These are:

- preoperative fasting in healthy adults
- postoperative fasting in healthy adults
- preoperative fasting in healthy paediatric patients
- postoperative fasting in healthy paediatric patients
- preoperative fasting in higher-risk groups.

For convenience, the results for the adult and paediatric reviews are presented separately in sections 6 and 7 respectively. The application to higher-risk patients is included at the end of each section. Recommendations about pharmacological interventions, chewing gum and sweets are also included in each of the sections. This method of reporting may mean there is some duplication. All of the material in the rest of Section 5 is common to each type of patient group, unless otherwise stated. The guideline has been written in this way so that readers can, if desired, select the results and recommendations for the adult or paediatric sections only.

The results and recommendations sections (6 and 7) are presented in the following format. Recommendations first, followed by evidence tables and then more detailed results, which summarise the full analyses presented in the appendices.

5.2 Clinical effectiveness review methods – preoperative fasting

A Cochrane Review of randomised trials entitled *Preoperative fasting for adults to prevent perioperative complications* was first published in *The Cochrane Library* in 2003 (Brady et al., 2003) and a second Cochrane Review in children, *Preoperative fasting for children to prevent perioperative complications*, first published in 2005 (Brady et al., 2005). These Cochrane Reviews formed the

basis of many of the analyses presented for the purposes of this guideline, as described in the methods sections below. We are grateful to the authors of the Cochrane Reviews for supplying the original data, so that additional analyses could be carried out for guideline purposes.

5.2.1 Objectives

The preoperative reviews sought to answer the following questions:

- How long should patients be nil by mouth (nulla per os; NPO) before general anaesthesia?
- What type of food/fluids should be permitted during a restricted fasting period?
- What amount of food/fluids should be permitted during a restricted fasting period?

5.2.2 Selection criteria

The following selection criteria were applied to studies to determine their suitability for inclusion in the reviews:

Types of studies

Randomised trials (RCTs) or quasi-randomised trials comparing different fasting regimens in terms of duration or type or volume of oral intake before general anaesthesia.

We did not consider less robust study designs where randomised and quasi-randomised trials were available. However, where there were no randomised trials, we included other designs as appropriate, mainly to inform GDG discussions before consensus.

We included studies investigating gastric emptying in volunteers and patients not having general anaesthesia, but only as additional information.

Types of participants

For the healthy patients' reviews: healthy ASA I-II patients (Appendix 2) without gastrointestinal disease and disorders, who were undergoing elective surgery under general anaesthesia.

For the higher-risk groups' review: patients undergoing elective surgery under general anaesthesia, who fitted the description of 'higher-risk' for regurgitation and aspiration. This group included, but was not restricted to, pregnant women and patients with: diabetes, gastro-intestinal conditions that affect gastric emptying and/or a history of gastro-oesophageal reflux, dyspsnoea, neuromuscular disease, renal impairment, intra-abdominal tumours and ascites (Phillips et al., 1994; Watson, 2002).

We stratified studies by age into groups where the patients were (i) adults or (ii) children (defined as aged one to 18 years) or (iii) infants (aged less than one year).

Types of intervention

We included studies that evaluated the following interventions:

- shortened fluid fast versus standard fast
- shortened solid fast versus standard fast
- shortened solid fast versus shortened fluid fast
- fluid 1 (for example, water, fruit juice) versus fluid 2
- fluid volume 1 versus fluid volume 2 (same fluid).

For the purposes of the adult review, we defined a standard fast as nil by mouth (NPO) from midnight before morning surgery, and a light breakfast - such as tea and toast - early in the morning (6 a.m.) before afternoon surgery. We used the same definition for the paediatric review, but for infants the 'standard fast' also permitted breast milk up to four hours and formula milk up to six hours before surgery. The range of standard fasts in the paediatric review was a complication when analysing available evidence.

Within a standard fast, patients may have small amounts of fluid at any time to help them take oral medication. The GDG decided that this did not constitute a break in the fast provided the fluid volume did not exceed 30 ml for adults and 0.5 ml/kg (up to 30 ml) for children.

We analysed separately studies having co-administration of pharmacological interventions such as H_2RAs, prokinetic agents and antacid agents. These studies were included, provided both the control and experimental groups had the same pharmacological intervention, and provided the study evaluated one of the five interventions listed above.

We also included studies if they investigated the effect of co-administration of pharmacological interventions in the following randomised comparisons:

- pharmacological intervention versus no pharmacological intervention, both groups having a shortened fluid or solid fast
- pharmacological intervention 1 versus pharmacological intervention 2, both groups having a shortened fluid or solid fast.

For the investigation of premedication, we analysed head-to-head randomised trials as above, and also carried out sub-group analyses in the set of H_2RA-free studies, according to the type of premedication. Sub-groups were opioid-based, non-opioid-based (usually benzodiazepines), or no premedication. For some studies the proportion of patients receiving premedication was not clear.
For the head-to-head comparisons, we included studies with the following:

- premedication versus no premedication in the presence of a shortened fluid or solid fast
- premedication 1 versus premedication 2 in the presence of a shortened fluid or solid fast.

Types of outcome

PRIMARY:

- Rates of adverse events (for example, aspiration or regurgitation) or events following aspiration, including related morbidity (for example, aspiration pneumonitis) and death related to aspiration and/or pneumonia.

- pH and/or volume of gastric contents (at induction of anaesthesia).

- For studies with a solids or milk intake, the proportion of patients with particulate matter in their aspirate.

The second primary outcomes – examining the difference in gastric volume and pH – are recognised as **surrogate measures** of regurgitation with aspiration. Surrogate measures are used when it is impossible or impractical to measure the true outcome. For validity there is a need to have independent evidence of correlations between the surrogate and desired outcome measures. There are no studies that report direct correlations in humans between these surrogate and clinically meaningful outcomes. However, there is some evidence that the risks of pneumonitis and death are reduced, should the patient aspirate the stomach contents, if the gastric residual volume is less, the pH is higher and there are no particles in the aspirate (Splinter and Schreiner, 1999; Mendelson, 1946). On this basis, the GDG decided that these surrogate outcomes, which monitor the effect of changes in fasting regimen on the stomach contents, are directly applicable, and can be used with confidence to indicate changes in the risk of regurgitation and aspiration.

SECONDARY:

- Thirst
- Hunger
- Pre- and postoperative nausea
- Pre- and postoperative vomiting
- Anxiety

- Irritability
- Comfort.

5.2.3 Search strategy for the identification of studies

Search strategies for the identification of relevant studies were adapted from the Cochrane Reviews to suit the guideline purposes. Details are given in Appendix 3.

We searched the following electronic databases:

- MEDLINE (from 1966 to 2005, January; Ovid version)
- EMBASE (from 1980 to 2005, February; SilverPlatter version)
- CINAHL (from 1987 to 2005, February; SilverPlatter version)
- *The Cochrane Library* (2005, Issue 1)
- Meta-register (*mRCT*) and links were searched for ongoing studies.

A combination of subject headings (MESH) and free text terms (including alternative spellings) were used. No language restrictions were imposed.

We did not undertake handsearching for the update of the Cochrane Review, following NICE advice that exhaustive searching on every guideline review topic is not practical or efficient (Mason et al., 2002; Hopewell et al., 2002). We searched the reference lists of the relevant papers for further studies.

5.2.4 Inclusion of studies

For the Cochrane Reviews (Brady et al., 2003; Brady et al., 2005), three independent reviewers evaluated studies identified through searches for their eligibility to meet the inclusion criteria. One of the guideline authors ran update searches and identified additional studies. Where uncertainties about study eligibility occurred, a second reviewer was consulted.

5.2.5 Data extraction

All extracted data and evidence summary statistics were entered into a Microsoft Access database developed specifically for this guideline by one of its authors. The database was used to sort and group information and to produce much of the data reported in the appendices.

Data from the eligible studies included in the Cochrane Reviews (Brady et al., 2003; Brady et al., 2005), which had been independently extracted by two reviewers, were entered into the database. The additional studies identified in the process of guideline development were included in the update of the Cochrane Review and the data were extracted by two reviewers.

We extracted the following data from each study:

- patients' characteristics (age, sex, weight, ASA physical status)
- patient inclusion and exclusion criteria
- type of surgery
- premedication
- duration of fast
- intake permitted (fluid or solid, type and volume)
- concurrent interventions
- timing of data collections
- outcomes (including the method of gastric content collection),

We recorded the duration of fast in two main ways: the duration randomised (as reported by the authors), and the observed summary statistics for the duration (mean, standard deviation, median, range). We then grouped studies according to the shortest duration randomised, and described the category as 'up to' shortest time. For example, 'up to two hours' included studies in which the patients were randomised to 'two hours', 'two to three hours', 'up to two hours', 'a minimum of two hours', etc (it did not include randomisation to a wider range of durations, for example, 'two to four hours'). We noted if the mean differed by more than an hour from the shortest time randomised (and carried out sensitivity analyses in meta-analysis, if it did).

Where studies were published more than once, all sources were used for data extraction to retrieve the maximum amount of data relating to the study. In three studies (Crawford et al., 1990; and Goresky et al., 1992 [paediatric]; Lam et al., 1993 [higher-risk]), two reviewers extracted individual patient data from a graph. This may have led to some inaccuracies through poor reproduction and/or measurement errors, but we regarded this as more useful than omitting the study.

5.2.6 Appraisal of methodological quality

The methodological quality of each study was assessed by two reviewers.

The vast majority of the studies were **randomised trials** and for these, we used the following quality criteria:

- *a priori* sample size calculation
- method of generation of the randomisation schedule
- allocation concealment at randomisation
- baseline comparability of treatment groups
- outcome assessor blinded
- analysis of all randomised patients (intention to treat).

We considered the other included studies to be prospective **non-randomised comparative** studies (for example, some of the milk studies, Section 7). For these, the following criteria were considered:

- prospective study
- all eligible patients selected
- baseline characteristics comparable across groups
- outcome assessors blinded
- analysis of all included patients (intention to treat).

Studies were not excluded from the review on the basis of quality, but poorer quality studies were generally not combined with those of higher quality in meta-analysis (section 5.4).

5.2.7 Data synthesis

Although the majority of studies were included in the Cochrane Reviews, some updating was necessary for the adult review. We also conducted additional or modified meta-analyses and extra sub-group analyses in order to adapt the Cochrane Reviews to answer the specific clinical questions posed by the guideline.

We carried out two types of analysis: meta-analysis and regression. In the former case, the effects of different variables (for example, duration of fast) on the summary statistics were investigated separately in sub-group analyses. In the latter, all the variables were examined simultaneously.

Much of the continuous outcome data (for example, residual gastric volume and pH values) had skewed distributions and were often described by the median and range or interquartile range. However, meta-analysis requires mean and standard deviation summary statistics for the outcome measures (gastric pH and volume). Where the study authors gave only the median and range, the Cochrane Review authors calculated 'pseudo-values' for the mean and standard deviation, by making use of mean-variance relationships between the normal distribution and the median-range distribution (Brady et al., 2003; O'Rourke, 2002). Our view was that this approach was a reasonable approximation, provided the study size is greater than 20 participants, and consequently we also used the pseudo-values in the guideline analyses. Use of this method of calculating pseudo-values increased the number of studies included in the meta-analysis (at the present time) by about two-thirds in the adult review and by about one-third in the paediatric review, and therefore substantially increased the evidence base.

Where the evidence comprised a single study, we still considered the summary statistics of mean and standard deviation, but also took into account the median and range values.

Meta-analysis

Meta-analysis of similar trials, where appropriate, was carried out using *The Cochrane Collaboration's* analysis software, Review Manager (Version 4.2). Trials were pooled using a random effects model.

The primary continuous outcome variables in relation to gastric content (pH and volume) were summarised using weighted mean differences. The outcome measure of the proportion of patients with particulate matter in their aspirate was summarised using the relative risk. Where it was possible to combine studies, secondary outcomes were summarised using relative risks or odds ratios for dichotomous data and weighted mean differences for continuous data. In some cases we had to use the standardised mean difference to combine studies with different scales, and in two studies the 0 to10 scale was inverted before analysis (by subtracting the score from 10), whilst keeping the same standard deviation.

For the guideline analyses, we did not combine truly randomised trials and quasi-randomised trials (for example, sequence generation by alternate allocation or by operation list) in a meta-analysis. Where both types of design were present, we excluded the quasi-randomised studies from the analysis, as they represented a potentially higher risk of bias. Other studies that were potentially biased were those with large numbers (more than 20 per cent) of withdrawals or protocol deviations in any group (that were eliminated from the study's analyses). Small studies (n<20) also represented a potential for bias because of the approximations about skewed distributions. Where quasi-randomised studies represented the only evidence, they were analysed separately and graded accordingly.

We assessed heterogeneity between trials by visual inspection of forest plots, noting where there was poor overlap of horizontal lines, and by using statistical measures: the χ^2 test for heterogeneity and the level of inconsistency, I^2 ($I^2 = [(\chi^2 - df)/ \chi^2] \times 100\%$, where df is the degrees of freedom). We considered that there was heterogeneity if $p<0.1$ and/or $I^2>50\%$. Any heterogeneity was explored further and unexplained heterogeneous results were not used as the basis for recommendations.

Post hoc we stratified studies according to the presence or absence of H_2RAs. We then carried out sub-group analyses based on the pre-specified variables of duration, type and volume of intake, and the *post hoc* variable, type of premedication, both to investigate the effects of these variables and to explore heterogeneity. In some cases, we carried out sub-group analyses for a particular group of studies (for example, the effect of premedication in the studies with water only) – 'sub-sub-group analyses'. Sub-group analyses are observational, rather than randomised comparisons, and should be carried out cautiously. This is particularly so for the sub-sub-group analyses – increased subdivisions mean that differences are more likely to be found by chance.

Secondary outcome measures (thirst, hunger, nausea, vomiting, irritability and anxiety) were measured in the studies in a variety of ways and could not always be pooled in a quantitative fashion. For example, thirst was measured as: the number of patients with no thirst at induction, the number of patients with a decrease in thirst between an initial time and induction, and mean visual analogue scale readings.

Regression analysis

An alternative approach to meta-analysis is to look at all the variables simultaneously in a univariate stepwise regression analysis of the change in mean pH or the change in mean gastric volume.
We used the method to produce an initial model, for example,

$$\Delta pH = a + b[duration] + c[fluid\ vol] + F(water)$$

where a, b and c are coefficients and F is a factor representing the presence or absence of water, in this case.
Then we altered this model by including and excluding different terms in order to get the best fit to the data. We used SPSS (version 12) to analyse the data. Covariates used were: mean volume of intake and duration of fast preoperatively. Factors were +/- premedication, +/- fruit juice, +/- water, +/- clear fluids. For the premedication factor, studies were given a rating of 1 regardless of the type of premedication or the proportion of patients receiving it. An additional analysis based on +/- opiate premedication was also carried out.

Regression analysis of studies becomes inaccurate if the number of studies is small. It can also be confounded by features not known, and the comparison of mean values for patient characteristics in each study may not be representative of the comparison of individuals. Therefore interpretation should be carried out carefully.

5.2.8 Interpretation of meta-analysis results

Several meta-analyses gave pooled summary statistics close to the null value. Where the confidence interval was narrow, we considered this to be 'evidence for little difference' between shortened and standard fasts and the approach became similar to that of an equivalence trial (Alderson, 2004). Under these circumstances, 'evidence for little difference' suggests that a shortened fast can be used equally as safely as the standard fast.

This approach requires some definition of what constitutes a narrow confidence interval, and the use of the surrogate outcome measures gastric volume and pH pose certain problems in this respect. There are no studies in humans that investigate correlations between gastric volume or pH and the risk of aspiration. The only evidence is in animal studies and the observations of Mendelson in pregnant women.

The GDG was unable to suggest what minimum change in gastric volume or pH might be important, but agreed to describe the confidence interval as 'wide' if the difference between upper and lower confidence limits was more than 2 units for pH and more than 30 ml (adults) or 0.5 ml/kg (children) for gastric volume. For the secondary outcomes using visual analogue scales of 0-10 or 1-10 cm, we took a confidence interval of more than 2 units as an indication of uncertainty. Where the difference in upper and lower confidence limits was less than these values, we considered there to be 'evidence for little difference' between the two interventions.

We adopted the following broad principles as bases for interpretation of the analyses:

1) A statistically significant increase in pH or decrease in gastric volume for a shortened fast with fluids, compared with the standard fast, was interpreted as evidence that the shortened fast was perceived to decrease risk.

2) A statistically significant decrease in pH or increase in gastric volume was regarded with caution and perceived to increase risk.

3) Interpretation of a non-significant change was dictated by the width of the confidence interval. If the confidence interval was wide, we decided that the evidence was insufficient to draw conclusions. If the confidence interval was not wide, we regarded this as sufficient evidence to show little difference between the shortened and standard fasts. If this were the case, we concluded that the shortened and standard fasts presented similar risks.

5.3 Clinical effectiveness review methods – postoperative resumption of oral intake

5.3.1 Objectives

The postoperative reviews sought to answer the following questions:

- When can patients be offered oral fluids or food after general anaesthesia for elective non-gastrointestinal surgery?
- What type and amount of food/fluids should be permitted after elective non-gastrointestinal surgery?

5.3.2 Selection criteria

Types of studies

Randomised trials (RCTs) or quasi-randomised trials comparing different regimens of oral intake resumption in terms of timing, or type or volume of fluid

or food permitted after general anaesthesia. We did not consider less robust study designs where randomised and quasi-randomised trials were available. However, where there were no randomised trials, we included other designs as appropriate.

Types of participants

Healthy ASA I-II patients (Appendix 2), without gastrointestinal disorders, undergoing elective surgery under general anaesthesia.

We excluded studies of postoperative oral feeding of patients who have had surgery involving the gastrointestinal tract or major abdominal surgery (including Caesarean section): the decision to permit the resumption of postoperative oral intake is not only made on the basis of nutrition and hydration, but is heavily reliant on input from the surgical team. Such surgical based decisions were not within this guideline's remit. The GDG therefore agreed to restrict the guideline to healthy patients undergoing routine, uncomplicated surgery.

Types of intervention

We included studies that evaluated the following interventions:

- early oral intake of fluids or food versus NPO after general anaesthesia
- early oral intake of fluids or food versus late intake
- type of intake 1 versus type of intake 2
- fluid volume 1 versus fluid volume 2
- food amount 1 versus amount 2.

Types of outcome

- Rates of nausea and vomiting (primary outcome).
- Rates of other postoperative complications.
- Patients' subjective feelings (for example, satisfaction, thirst, hunger).

5.3.3 Search strategy for the identification of studies

We identified studies through systematic searches of electronic databases using the search strategy for the preoperative fasting review, as well as an additional search strategy covering terms specific to post-anaesthetic care. Details of both search strategies are given in Appendix 3. The following electronic databases were searched:

- MEDLINE (from 1966 to 2005, January; Ovid version)
- EMBASE (from 1980 to 2005, February; SilverPlatter version)
- CINAHL (from 1987 to 2005, February; SilverPlatter version)
- *The Cochrane Library* (2005, Issue 1)
- Meta-register (*mRCT*) and links were searched for ongoing studies.

A combination of subject headings (MESH) and free text terms (including alternative spellings) were used for all areas. No language restrictions were imposed.

We did not undertake handsearching, following advice from NICE that exhaustive searching on every guideline review topic is not practical or efficient (Mason, 2002; Hopewell et al., 2002).

We searched the reference lists of the relevant papers for further studies.

5.3.4 Inclusion of studies

One reviewer ran the searches and identified studies. Where uncertainties about study eligibility occurred, a second reviewer was consulted.

5.3.5 Data extraction

Data were extracted by two reviewers and entered into a Microsoft Access database.

The following data were extracted from each study:

- patients' characteristics (age, sex, weight, ASA physical status)
- patient inclusion and exclusion criteria
- type of surgery (including day or inpatient surgery)
- type of anaesthesia
- duration of postoperative fast; timing of first oral intake
- intake permitted (fluid or solid type and quantity)
- concurrent interventions (including opioids for pain relief)
- timing of data collections
- outcomes.

5.3.6 Appraisal of methodological quality

The methodological quality of each study was assessed by two reviewers. The quality criteria used are given in section 5.2.6:

5.3.7 Data synthesis

The primary dichotomous outcome variables (rates of nausea and vomiting) were summarised using relative risks. Numbers needed to treat or harm were calculated. Continuous variables were summarised using weighted mean differences.

Meta-analysis of similar trials, where appropriate, was carried out using *The Cochrane Collaboration's* analysis software, Review Manager (Version 4.2). Trials were pooled using a random effects model.

We assessed heterogeneity in the same way as section 5.2.7. Any heterogeneity was explored further and unexplained heterogeneous results were not used as the basis for recommendations. Sub-group analyses based on the pre-specified variables of duration of fast and type of intake were proposed to explore heterogeneity.

5.4 Evidence synthesis and grading

The remainder of Section 5 applies to both pre- and postoperative reviews.

1. A level of evidence was assigned to each study or meta-analysis (or systematic review) according to the hierarchy given in Table 1. This hierarchy is recommended for intervention studies by NICE and SIGN at the time of writing (NICE, 2005; SIGN, 2004).

Studies or meta-analyses with a minus rating were not used as a basis for recommendations.

We found it necessary to interpret the NICE/SIGN ratings for bias, and included the following general approaches:

1. Studies that had a quasi-randomised method of allocation were regarded as potentially biased, but were rated as 2+ (rather than 1-). We gave this assignment to studies in this guideline, because we believed that such studies were comparable with good cohort studies. However, these quasi-randomised studies were not combined with randomised trials in meta-analyses.

2. We regarded randomised trials with at least 20 per cent of data missing from any group as potentially biased, and gave these trials an evidence level of 1- . They were also not combined with higher quality randomised trials in meta-analyses.

3. In some studies it was not possible to obtain a reasonable volume of aspirate for all the patients, and so the number of patients with a pH measurement was necessarily reduced. We had some reservations about how much reliance should be placed on mean pH values calculated for only a relatively small proportion of the patients. After some discussion, the GDG agreed that, pragmatically, the patients with insufficient aspirate were unlikely to be at risk of aspiration. Therefore we included these studies in the meta-analysis, but noted when missing aspirate was present. For most of these studies, the study authors calculated the mean gastric volume by setting the values for the missing

aspirates to zero. Where the study authors had not carried out this procedure, we calculated a revised mean gastric volume using the same assumption.

4. Single studies or meta-analyses that had wide confidence intervals or heterogeneity were also regarded as potentially biased, this time giving a type II error (representing the uncertainty about measuring the true effect). We gave these studies or meta-analyses an evidence rating of 1-.

5. We gave a level of 1+ to meta-analyses of a small number (three or less) of randomised trials (unless there was heterogeneity). Meta-analyses of more than three trials were rated 1++.

6. Where the evidence was contained in a single randomised study, we assigned a level of 1+ unless the trial was large (n>200) and of high quality (in which case the level was 1++), and we were cautious if the study size was less than 20.

7. Where the evidence was from sub-group analyses, we gave an evidence level of 1++, provided the sub-groupings were carried out appropriately. Sometimes sub-group analyses of a stratified group were carried out for clarification (for example, trials where water was the intake and different types of premedication were given) – these were regarded cautiously, and given a level of 1+.

8. Single studies or meta-analyses including studies for which the data were extracted from a graph were given a level of 1+, reflecting the uncertainty which may arise from this method of data extraction.

9. Sub-group analyses involving parents' (proxy) assessments of secondary effects were given a level of 1+, reflecting the uncertainty introduced by indirect methods.

10. Sometimes studies in (1) and (2) were used to advise group consensus, as were other indirect measurements, such as gastric emptying studies

in participants not awaiting an operation. The evidence tables then contained the words ’studies used to inform consensus‘.

The evidence tables and reviews were distributed to GDG members for comment on the interpretation of the evidence and grading. Factors taken into consideration when grading the evidence were the study design, quality assessment and the uncertainty in the effect estimate (confidence interval).

5.5 Formulating and grading recommendations

The GDG discussed the evidence and its interpretation, and the wording of recommendations was considered carefully until there was agreement. Recommendations were graded according to the scheme in Table 2.

The following factors were considered by GDG members when formulating clinically useful recommendations:

- The best available evidence with preference given to empirical evidence over expert judgement.
- The balance of benefits against risks - including, where reported, all patient-relevant endpoints (including adverse effects and patients’ well-being).
- The applicability of the evidence to groups defined in the scope of the guideline, having considered the profile of patients recruited to the studies.

Integral to the GDG discussion was whether evidence obtained from surrogate outcomes (together with the use of skewed data) was sufficiently reliable for an A’ grade award. The GDG decided that changes in the gastric volume and pH can be used directly to reflect changes in the risk of aspiration and regurgitation, especially since the studies were in appropriate patient groups (for example, those undergoing operations). Thus an ‘A’ grade was the considered recommendation.

6. Results and recommendations for adult patients

The GDG agreed that during initial assessment, the anaesthetic team should decide if the patient is categorised as 'higher-risk' or should follow recommendations for healthy patients.

6.1 Preoperative fasting in healthy patients

The majority of the evidence contained in this review is based on the Cochrane Review of Brady et al. (2003). This is a well-conducted systematic review with much detail that informs the guideline.

Results in this section should be taken in conjunction with the appendices for the adult studies (A1 to A17) at the back of the document.

6.1.1 Results of clinical effectiveness evidence retrieval and appraisal

A) Characteristics of studies included in the review

For the update of the Cochrane Review (Brady et al., 2003) five additional randomised trials (Brocks et al., 1987; Henriksen et al., 2003; Holmes et al., 1988; Naguib et al., 2001; Nygren et al., 1995) were included. All studies but one were already included in the Cochrane Review's 'studies awaiting assessment' section.

The studies were divided into those that did and did not give the patients H_2RAs. The GDG considered that the latter represented the true clinical picture for healthy patients in the UK, who do not routinely receive H_2RAs.

All included studies for the preoperative review of healthy adult patients are summarised in Appendix A1. This also includes studies that gave the patients H_2RAs. Excluded studies are reported in Appendix A2.

Healthy patients not given H_2RAs

1738 patients were randomised in 18 studies included in the review. Six studies were conducted in the UK (Miller et al., 1983; McGrady and MacDonald, 1988; Samaan et al., 1989; Goodwin et al., 1991; Read and Vaughan, 1991; Phillips et al., 1993). One study (Splinter and Schaefer, 1991) included in the Cochrane Review was excluded from the adult review because the patients were adolescents (13 to 19 years), and the GDG considered the study should be included in the paediatric review only. All patients underwent elective surgery, with most described as ASA I-II; four studies did not report ASA status (Miller et al., 1983; Henriksen et al., 2003; Maltby et al., 1986; McGrady and MacDonald, 1988). All studies took measures to exclude gastrointestinal disease, disorders and/or drugs that affected gastric secretion or motility.

Eight studies included in the review had three or more relevant comparison arms (Agarwal et al., 1989; Hausel et al., 2001; Henriksen et al., 2003; Holmes, 1988; Hutchinson et al., 1988; Miller et al., 1983; Naguib et al., 2001; Søreide et al., 1993). This resulted in a total of 40 comparisons. Where studies required one control group to be compared with two or more interventions in the same meta-analysis, we followed standard practice and split the control group between the comparisons. In this way all experimental arms could be included, whilst avoiding the inclusion of the control patients twice in the meta-analysis. Divisions were as equal as possible but in whole numbers (i.e. without splitting a patient). For dichotomous outcomes we divided the number of events and the number of patients each by the number of comparisons, but for continuous outcomes only the number of patients was modified - the standard deviation remained the same because this is not dependent on sample size.

Details of the different comparisons are given in Appendix A1. The key to the study references (for example, Naguib et al., 2001j) is also reported.

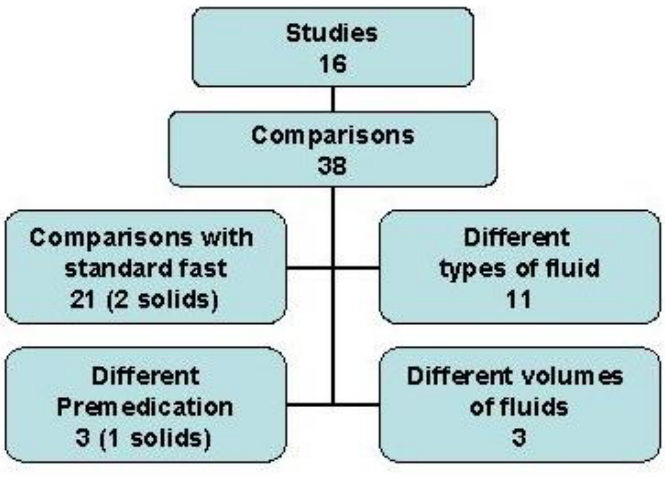
In all studies, at least one group of patients was randomised to a shortened fast. The most frequently investigated duration of shortened fluid fast was two hours, represented by the intervention, ‘fluids allowed up to two hours preoperatively’. The shortest investigated fast was one hour (‘fluids up to one hour’, Holmes et

al., 1988), although the mean and standard deviation were not available for this study. Most of the studies in the sub-group 'up to two hours', had a mean fasting duration (where given) of around 2.5 hours, (with the exception of Hausel et al., 2001 which was 3.6 hours), but examination of the distributions (mean +/- 2 SD, or range) showed that all studies had some patients with a fast less than two hours. We carried out sensitivity analyses for the Hausel study.

Five studies reported that they monitored the patients for evidence of regurgitation and aspiration. No incidence was found. This was not unexpected, but meant that the surrogate outcome measures of gastric pH and volume had to be used for the evidence summary.

In 16 studies (38 comparisons) gastric content samples were collected. A variety of tools were used to measure pH values. Details of these comparisons are given in Figure 2.

Figure 2: Adult review – types of comparison



Eleven studies (29 comparisons) reported the patients' experience of the fasting process, i.e. the secondary outcomes of this review (Agarwal et al., 1989; Goodwin et al., 1991; Hausel et al., 2001; Henriksen et al., 2003; Hutchinson et al., 1988; Maltby et al., 1986; Naguib et al., 2001; Nygren et al., 1995; Phillips et al., 1993; Read and Vaughan, 1991; Søreide et al., 1993). Nine of these 11 studies (15 comparisons) compared a shortened fast with the standard fast; the

remaining comparisons were mainly of different types of fluids. The 15 comparisons with the standard fast recorded patient outcomes for thirst (14), hunger (11), anxiety (five), preoperative nausea (two) and postoperative nausea (three); one study recorded outcomes only for the intervention group (Maltby et al., 1986). Various measures were used for these outcomes: six (of 15) comparisons used visual analogue scales (but four gave the median and p values). The scales used were mainly 0 to 10 cm (five comparisons), but one comparison (median measured) had a 1 to10 cm scale. In all studies 10 was the worst rating.

Five comparisons (two studies) recorded the number of patients who graded their thirst (or hunger) in absolute terms, as none/mild/moderate/severe immediately before induction. Three (two studies) asked the patients to grade their thirst (hunger) on two occasions (two to three hours preoperatively and in the operating room just before induction), and recorded the number of patients with no change or more or less thirst/hunger. The two types of outcome measure, the number of patients with no thirst (hunger) and the number with less thirst (hunger), were analysed separately. Within these groups, where appropriate, the studies were combined in meta-analyses.

Solids, chewing gum and sweets

The studies were stratified into those that gave the patients fluids and those that gave solids. Only one study (Miller et al., 1983, two comparisons) compared a shortened fast of solids with the standard fast. The patients in the solids arm were allowed breakfast (one slice of buttered toast) and tea or coffee with milk two to four hours preoperatively.

Two additional studies (Søreide et al., 1995; Dubin et al., 1994) randomly compared sugar-free gum up to the time of transport to the operating room, with a standard fast. One of these (Søreide et al., 1995) also randomised smokers to Nicorette gum and a standard fast. Another study (Macaluso et al., 1996) was looked at the effect of sweets: as part of the study, 60 adults were randomised to receive a lollipop 10 to 70 minutes preoperatively, or nothing.

Premedication

Three studies (Agarwal et al., 1989; Holmes, 1988; Miller et al., 1983) also included randomised comparisons of different types of premedication or premedication versus none, under the conditions of a shortened fast. The Miller study, although randomising all patients to a fast of two to four hours, had a significant difference in mean duration for the two interventions (4.2 versus 3.3 h; $p<0.001$), which may have led to confounding.

Healthy patients given H_2RAs

The additional studies included in this section are described in Appendix A1. They were studies found using the search strategy for preoperative fasting, and all except one (Suzuki et al.,1996) were included in the Cochrane Review. Specific searches were not carried out for studies that compared groups of patients who were or were not given H_2RAs in the presence of preoperative fluids.

Eleven randomised studies (23 comparisons) either had an H_2RA in both comparison arms (14 comparisons), or were randomised comparisons of H_2RA versus no H_2RA (eight) or different H_2RAs (one) in the presence of fluids in both arms. Ten of the 14 H_2RA comparisons compared shortened and standard fasts, and four compared different types of intake (including one comparison of solids with fluids; (Tanabe et al., 1997). One study (Vincent et al., 1991) gave the patients metoclopramide as a gastrokinetic agent in addition to the H_2RA, and this study was treated separately.

Most comparisons used ranitidine as the H_2RA; but four (Tanabe et al., 1996; Yatsu et al., 1996 - three) employed roxatidine; two comparisons (Samaan et al., 1989; Suzuki et al., 1996) gave the patients famotidine; and one (Tanabe et al., 1997) used roxatidine and famotidine. The Samaan study also included a randomised comparison of ranitidine and famotidine.

All studies except one (Vincent et al., 1991; up to three hours) allowed fluids up to two hours, and thus the effect of duration was not investigated. The mean

fasting durations (where given) for most of these studies was around 2.5 hours, and examination of the distributions (mean +/- 2 SD, or range) showed that all studies had some patients with a fast of, or less than two hours.

B) Methodological quality of included studies

A summary of the methodological quality of each of the studies is shown in Appendix A3. It should be noted that although the authors of some studies provided additional information to the authors of the Cochrane Reviews, for many studies the data on quality was not well reported.

Healthy patients without H_2RAs

The 18 studies included in the review were generally small or moderate in size, with groups consisting of fewer than 100 patients (range 10 to 84). The method of generating the randomisation sequence was evaluated as adequate in eight studies, partially adequate in one study, inadequate in one study (Holmes, 1988) and unclear for the remaining eight studies.

No study was assessed to have adequate allocation concealment, although four reported the concealment partially (Hausel et al., 2001; McGrady and MacDonald, 1988; Read and Vaughan, 1991; Samaan et al., 1989). The Holmes (1988) study had inadequate allocation concealment (alternation) and it was unclear for the remaining studies.

In evaluating fasting regimens patients cannot be blinded as to whether or not they have had something to eat or drink, and even blinding the volume of intake is difficult. Blinding assessment in this review refers only to the blinding of assessors who collected and measured the gastric content outcomes, not to the blinding of patients, or individuals involved in administering the interventions. Fourteen of the studies reported adequate blinding of the outcome assessors, one study (Holmes, 1988) had inadequate blinding and three (Naguib et al., 2001; Nygren et al., 1995; Hausel et al., 2001) were unclearly reported. One study reported an *a priori* sample size calculation (Naguib et al., 2001).

Eleven studies reported an intention to treat analysis for at least one outcome; five studies (Goodwin et al., 1991; Hausel et al., 2001; Henriksen et al., 2003; Maltby et al., 1988; McGrady and MacDonald, 1988) had some withdrawals, but less than 20 per cent in any group and it was unclear in two studies. Nine studies reported the omission of some data from the analysis (especially for the measurement of pH), mainly because insufficient aspirate could be obtained (the proportion with missing aspirate was more than 50 per cent in one arm in the Miller 1983 study). The pH measurement was also not reported for about 50 per cent of patients in each group in the Hausel study.

Baseline characteristics were comparable across groups in all studies except Read and Vaughan (1991) (type of operation significantly dissimilar), McGrady and MacDonald (1988) (patients in water group significantly heavier) and Holmes (1988) (not reported).

Pseudo-values were calculated for five studies (Maltby et al., 1988; Miller et al., 1983; Phillips et al., 1993; Read and Vaughan, 1991; Samaan et al., 1989) and are still awaited for four (Brocks et al., 1987; Henriksen et al., 2003; Holmes, 1988; Naguib et al., 2001).

In evaluating the methodological quality of these studies, some studies had a potentially higher level of bias (for example, they were quasi-randomised or had more than 20 per cent protocol deviations or withdrawals), and we decided that they should not be combined in a meta-analysis with higher quality randomised trials. Where these studies were the only evidence, the quasi-randomised studies were included as level 2+ evidence and the protocol deviations were assigned level 1-. Holmes (1988) (quasi-randomised) fell into this category.

The two studies (Dubin et al., 1994; Søreide et al., 1995) comparing chewing gum with a standard fast had unclear allocation concealment and sequence generation, both had the outcome assessors blinded, one (Søreide et al., 1995) carried out a power calculation and both had intention to treat analyses. The two sugar-free gum comparisons each had some mismatch between groups in the baseline characteristics: the Søreide gum group was significantly lighter weight and the Dubin gum group was significantly older than their no-gum counterparts.

The Macaluso study (lollipops) had adequate sequence generation, unclear allocation concealment and the outcome assessors were not blinded. The study had an intention to treat analysis, and the baseline characteristics were similar across groups.

Healthy patients with H_2RAs

A summary of the methodological quality of each of the studies is given in Appendix A3.

The eleven studies included in the H_2RA review were generally small or moderate in size, with groups consisting of fewer than 100 patients (range 15 to 50). The method of generating the randomisation sequence was evaluated as adequate in five studies (Hutchinson et al., 1988; Maltby et al., 1986; Maltby et al., 1988; Sutherland et al., 1987; Vincent et al., 1991) and unclear for the remaining six.

All studies except one (Samaan et al., 1989) had unclear allocation concealment; this was evaluated as having partial allocation concealment.

Five of the studies reported adequate blinding of the outcome assessors (Hutchinson et al., 1988; Maltby et al., 1986; Maltby et al., 1988; Sutherland et al., 1987; Vincent et al., 1991) and the rest were unclearly reported.

No studies reported an *a priori* sample size calculation.

Five studies reported an intention to treat analysis for at least one outcome (Hutchinson et al., 1988; Maltby et al., 1986; Sutherland et al., 1987; Tanabe et al., 1997; Yatsu et al., 1996). Two studies had some withdrawals (but less than 20 per cent in any group), two had more than 20 per cent withdrawals (Vincent et al., 1991: 27 per cent of patients in the fluids group with protocol violations, and Suzuki et al., 1996: 22 per cent of patients in the famotidine group who were not analysed), and it was unclear in two studies. Six studies reported the omission of some data from the analysis (especially for the measurement of pH), mainly because insufficient aspirate could be obtained (the proportion with missing aspirate was 41 per cent in one arm in the Vincent study).

Baseline characteristics were comparable across groups in all studies except Yatsu et al.,1996 (differences in age, gender and height). Details are given in Appendix A3. Pseudo-values were calculated for two studies (Maltby et al., 1988; and Samaan et al., 1989).

In view of the numbers of withdrawals in the Vincent and Suzuki studies, these were not combined in meta-analyses with the higher quality studies, and were given a rating of 1-.

6.1.2 Guideline recommendations with supporting evidence reviews

Sections A to D (2) below concern studies of healthy patients not given H_2RAs.

A) The intake of fluids during a restricted fasting period

For the purpose of this review, a clear fluid is defined as fluid through which it is possible to read newsprint (Phillips et al., 1994). Fluids investigated included 'clear fluids', apple juice, and some specifically designed carbohydrate-rich drinks.

RECOMMENDATIONS

Grade	Recommendation
A	Intake of water up to two hours before induction of anaesthesia for elective surgery is safe in healthy† adults and improves patient well-being.
A	Other clear fluid* and clear tea and black coffee (without milk) can be taken up to two hours before induction of anaesthesia in healthy adults.

† 'Healthy' defined as ASA I-II (Appendix 2) without gastrointestinal disease or disorders.

* In practice, a clear fluid is one through which newsprint can be read.

B	Tea and coffee with milk are acceptable up to six hours before induction of anaesthesia.
A	The volume of administered fluids does not appear to have an impact on patients' residual gastric volume and gastric pH when compared to a standard fasting regimen. Therefore, patients may have unlimited amounts of water and other clear fluid up to two hours before induction of anaesthesia.
D(GPP)	If an elective operation is delayed, consideration should be given to giving the patient a drink of water to prevent excessive thirst and dehydration.

EVIDENCE

Level of evidence	**Evidence statement**
1++	5/18 studies reported that they looked for evidence of aspiration or regurgitation. None was found in these (or any other) studies.
1-	One study (n=75) compared fluids given up to 1.5 h preoperatively with the standard fast. There was insufficient evidence to support a recommendation of up to 1.5 h as the minimum duration.
1++	Ingestion of water, up to two hours preoperatively, in comparison with the standard fast, had no significant effect on gastric pH at induction of anaesthesia, and resulted in a modest, but statistically significant reduction in the residual gastric volume (mean 6 ml).
1++	Drinking water significantly decreased thirst in 2/5 studies and also improved patients' well-being.

1++	Ingestion of clear fluids up to two hours preoperatively showed little difference between shortened and standard fasts for pH, but resulted in a small *increase* in gastric volume (mean 3 ml) - this is not clinically important. The effect of clear fluids on thirst and patients' well-being was uncertain.
1++	In randomised comparisons between water and other fluids, the patients given water had less thirst and less hunger. No primary outcome data were available.
1++ 4	Non-clear fluids (such as coffee and orange juice) showed little difference in gastric volume or pH between shortened and standard fasts, but decreases in both thirst and hunger were found. The GDG's view was that non-clear fluids are likely to contain small particles that could put the patient at increased risk. They preferred to restrict their recommendation to clear fluids.
1+ 1+ 4	One study (n=100) compared coffee (with milk in some cases) up to two hours, with the standard fast, and found little difference between fasts for gastric volume or pH. Another study (n=57) allowed the patients to choose tea or coffee without milk as one of a set of clear fluids, up to two hours preoperatively. There was little difference between the shortened and standard fasts for gastric volume, but the pH result was uncertain. GDG consensus was that they could not recommend two hours as a reasonable fasting time for tea or coffee because of difficulties in controlling the amount of milk. Therefore their recommendation was that tea and coffee with milk are acceptable up to six hours, and that tea and coffee without milk could be taken up to two hours preoperatively.

1++	Sub-group analyses found that low volumes of fluids gave heterogeneous results, but low volumes of *water* gave a statistically significant decrease in gastric volume (mean 7 ml) for a shortened fast, compared with a standard fast. High or unlimited volumes of fluids (or water) showed little difference in gastric volume or pH.
1+	One study (n=50) randomised patients to low and high volumes of water. Little difference was found between groups for gastric volume, but the pH was statistically significantly in favour of the lower volume (pH change 0.5 units), and anxiety was significantly less for patients who drank a lower volume.
4	GDG consensus was that if an operation was to be delayed, the patient should be offered a drink of water to prevent excessive thirst and dehydration.

CLINICAL EVIDENCE

Fourteen studies (20 comparisons) compared a standard fast with a fast that permitted some *fluid* intake. Five studies (12 comparisons) compared different types of fluid, and three studies (three comparisons) compared different volumes of fluid. Some studies had more than one type of comparison.

No event of aspiration or regurgitation was reported in the 18 studies. Despite being the most directly relevant outcome measure, only one study that compared a shortened fluid fast to a standard fast reported the incidence of adverse events and associated morbidity (Hausel et al., 2001) and four reported that they specifically looked for regurgitation and aspiration (Goodwin et al., 1991, Phillips et al., 1993, Søreide et al., 1993 and Hausel et al., 2001), but did not observe any incidence of these (although Goodwin confined his report to the intervention group).

In the absence of aspiration data, the surrogate outcome measures of gastric pH and volume were used. One study (Goodwin et al., 1991) did not measure gastric contents. Six studies (Phillips et al., 1993; Holmes, 1988; Maltby et al.,

1988; Naguib et al., 2001; Read and Vaughan, 1991; Samaan et al., 1989) did not report both the mean and the standard deviation for the gastric volume and pH, and pseudo-values for these quantities were required. To date, pseudo-values have been calculated for all but two of these studies (Naguib et al., 2001; and Holmes, 1988). This meant that only eleven studies (15 comparisons), comparing a shortened fluid fast with the standard, could be included in a meta-analysis for these outcomes.

The evidence was assessed to find the impact, on the gastric pH and volume, of the duration of fast, and the type and volume of intake. These variables were examined separately in sub-group analyses and together in a regression analysis.

Sub-group analyses for fluids

The sub-group analyses undertaken were by duration of fluid fast, type of intake and volume of intake.

Duration of fluid fast (Appendix A4):

Meta-analysis was carried out in two duration sub-groups: ‘up to 1.5 hours’ (two comparisons in one study; Søreide et al., 1993; n=75) and ‘up to two hours’ (12 comparisons, n=921). For the sub-group ‘up to 1.5 hours’, the confidence interval (upper minus lower limits = 26 ml) was fairly wide for the gastric volume, and, in view of the comparisons being in the same study, we considered there to be insufficient evidence at this duration to draw conclusions. For the sub-group ‘up to two hours’, there was little difference between the shortened and standard fluid fasts in terms of gastric pH, but the gastric volume showed heterogeneity ($p=0.01$, $I^2=55\%$). Sensitivity analyses in the absence of the Hausel study (with the longer fast time), made little difference either to the gastric volume or the pH.

The secondary outcomes for the sub-group ‘up to two hours’ also showed some heterogeneity.

No studies compared directly different durations of fast for the same intake.

The source of the heterogeneity in the sub-group ‘up to two hours’ was investigated (see next section) and was attributed to the type of fluid. Both water and other clear fluid could be given up to two hours preoperatively, without a prohibitive increase in gastric volume or acidity. Therefore, the GDG recommended that water and other clear fluid may be given up to two hours preoperatively.

Type of fluid intake (Appendix A5)

Fluids administered as part of a preoperative fasting intervention ranged from water and coffee to a carbohydrate drink. The comparisons were split into sub-groups, pre-specified by the GDG, of water, clear fluids and non-clear fluids. Clear fluids (other than water) included a carbohydrate drink, fruit juice, coffee (without milk) and clear tea. Non-clear fluids were coffee (in some cases with milk on request) and orange juice.

Water

Nine comparisons (eight studies, 611 patients) were included in the meta-analyses for gastric contents. There was clear evidence that intake of water during the preoperative period resulted in a statistically significantly lower gastric volume on induction of anaesthesia than when no fluids were taken. This difference was modest (6 ml), however, and is likely to be clinically insignificant. The analysis of pH change showed little difference between interventions. Six comparisons (including a study not included in the above analyses, Naguib et al., 2001) recorded secondary outcomes. Often the outcomes measured were different and could not be combined in a statistical synthesis (Appendix A5): overall, patients in two of six comparisons had statistically significantly less thirst when given water and the others showed little difference compared with the standard fast; patients in one of four studies had significantly less anxiety when given water; there was little difference in hunger (three comparisons) or postoperative nausea between the standard and shortened fasts (although for postoperative nausea, meta-analysis of three comparisons showed the results favoured water, non-significantly).

Other clear fluid

For clear fluids other than water, three comparisons (three studies; 318 patients) were included in the meta-analyses for gastric contents. The analysis showed a statistically significant *increase* in gastric volume (3 ml) for clear fluids compared with the standard fast. However, this difference is clinically unimportant, and the GDG concluded that clear fluids could still be given without putting the patient at increased risk. The pH outcome showed little difference between shortened and standard fasts. Secondary outcomes were measured in six comparisons (with the addition of comparisons in Naguib et al. (2001) (very low volumes (60 ml) of honey, apple juice, water and mixed sugars) and Goodwin et al. (1991) (water or orange drink)). Meta-analysis of four comparisons (three from one study) showed much heterogeneity ($p<0.0001$) for the outcome, number of patients with no thirst at induction; two other studies reported significantly less thirst (VAS) for the patients given fluids. Heterogeneity was also found for the hunger outcome; only one study (n=150) examined patient anxiety (VAS), which was found to be significantly reduced by clear fluids ($p<0.05$); and one study reported no significant difference for postoperative nausea (VAS). The cause of the heterogeneity is unclear, but it may be that the particular type of clear fluid makes a difference for the secondary, more subjective outcomes.

Non-clear fluids

There were two comparisons in one study (Hutchinson et al., 1988 - 150 patients). Analysis showed little difference between shortened and standard fasts for both gastric volume and pH. Both thirst and hunger were significantly less for patients given non-clear fluids compared to the standard fast. The GDG's view, however, was that non-clear fluids were likely to contain small particles which could put the patient at increased risk. They preferred to restrict their recommendation to clear fluids.

Head-to-head comparisons of water and clear fluids

There were five comparisons (two studies, Naguib et al., 2001 and Henriksen et al., 2003) in which water and clear fluids were compared in a randomised trial (Appendix A6). At present, no summary statistics are available for gastric volume and pH outcomes in either study, but the secondary outcomes are presented in Appendix A6. Meta-analysis of the Naguib comparisons showed

statistically significantly more patients had thirst and hunger with clear fluids compared to water. The Henriksen comparisons found no significant differences between water and other fluids for nausea (pre- and postoperatively), anxiety or wellbeing.

Effect of type of intake

The sub-group analysis according to type of fluid revealed differences and explained the heterogeneity found in the overall meta-analysis for gastric volume (see duration, above). Division into water and 'all other fluids' sub-groups showed the same effect. Sensitivity analyses in the absence of the Hausel comparisons showed few differences. Although sub-group analyses have limitations and are not randomised comparisons of different types of fluid, they lend support to recommending water (in adults) up to two hours preoperatively. The preference for water in the head-to-head comparison adds weight to this recommendation. The GDG concluded that both water and other clear fluid can be given up to two hours preoperatively without increase in risk.

Tea and coffee

For this adult review, there was interest in whether tea or coffee might be drunk preoperatively, and the evidence was examined accordingly. One study (Hutchinson et al., 1988; n=100) randomised patients to coffee (with a little milk on request) up to two hours preoperatively. The results showed little difference in the gastric volume or pH compared to the standard fast; patients were significantly less thirsty when they had coffee. However, the number of patients taking milk and the amount added was not stated.

A further study in healthy adult patients (Maltby et al., 1988; n=57) randomised a group to 'clear fluids'; the patients could choose from a list that included tea and coffee without milk. The number opting for tea or coffee was not stated. There was little difference between the shortened and standard fasts for gastric volume, but the pH outcome had a wide confidence interval.

The GDG's view was that the amount of milk in tea and coffee could not be controlled in practice, and there was a risk that the milk would form curds that would not clear quickly from the stomach. They agreed that tea or coffee with

milk should be treated in the same way as solids (i.e. a minimum of six hours preoperatively), and that tea and coffee without milk should be treated as clear fluids (and permitted up to two hours preoperatively). They also agreed that more research was needed for tea and coffee intake.

Volume of fluid intake (Appendix A7)

Several different volumes of intake were compared either to a standard fast, or to a different volume of intake. The volume of fluids investigated varied from a controlled intake of 60 to 450 ml to unlimited amounts; with the most common volume being 150 ml. After Brady et al. (2003), the various volumes permitted preoperatively were categorised into three types: low volume (less than or equal to 150 ml – which corresponds to approximately one glass of liquid), high volume (more than 150 ml) and unlimited volumes (where no restriction was placed on the volume of patients' preoperative fluid intake). Sub-group analysis was then carried out for the comparisons with the standard fast.

Low volume

For the meta-analyses for gastric content, nine comparisons (eight studies; n=572) allowed the patients a low volume of fluid (range 100 to150 ml). The gastric volume results were heterogeneous, but there was little difference between fasts for the pH outcome. Secondary outcomes (range 60 to 150 ml), similarly, gave varying conclusions, but the majority of analyses concluded that a low volume of fluid produced significantly less thirst. Other secondary outcomes gave conflicting results.

High volume

Three comparisons (n=295; two in one study - Hausel et al., 2001) had a high volume (range 300 to 450 ml). There was little difference between shortened and standard fasts for either gastric volume or pH (although it is noted that the two Hausel comparisons had ~50% missing pH data). Two of three comparisons (both from the same study) reported significantly less thirst, hunger and anxiety when fluids were given; the other study showed little difference between shortened and standard fasts.

Unlimited amounts of fluid

Two studies (n=154; only one for the gastric volume outcome) allowed the patients unlimited amounts of fluid up to two hours before surgery. The mean volumes taken for these studies were 388 ml (Phillips et al., 1993) and 500 ml (Read and Vaughan, 1991). There was little difference between shortened and standard fasts for either outcome measure. The two studies used different methods of recording the secondary outcomes and found significantly less or unchanged thirst, significantly less hunger and anxiety (one study each).

Sub-group analyses for studies with an intake of water

We hypothesised that the heterogeneity found in the low volume studies could be caused by differences in the type of fluid. When we repeated the analysis for the studies giving the patients water (Appendix A8), meta-analysis of six low volume studies showed a statistically significant reduction in gastric volume of 7 ml and no evidence of heterogeneity, whereas the high volume (two studies) and unlimited fluids (one study; pH outcome only) analyses showed little difference between shortened and standard fasts. There was little difference in the pooled summary statistics amongst the sub-groups for pH, although the low volume group still had heterogeneity, attributed to the McGrady and MacDonald (1988) study. This procedure of sub-sub-group analysis has been used cautiously – increased subdivisions mean that differences are more likely to be found by chance – but we felt it was worth doing in order to explore the heterogeneity for the low volume studies. The secondary outcomes of thirst, hunger and anxiety did not appear to depend on the volume of water consumed, although the evidence consists of a number of different outcome measures recorded by single studies.

Randomised comparisons of different volumes (Appendix A7)

Although three studies randomly compared two different volumes, only one study reported standard deviations for gastric contents. This study (Søreide et al., 1993; n=50) also reported secondary outcomes. Patients were randomised to low (150 ml) and high (300 to 450 ml) volumes of water up to 1.5 hours preoperatively. Little difference was found between groups for gastric volume, but the pH was statistically significantly in favour of the lower volume (pH change 0.5 units). The study also found significantly less anxiety for the patients

receiving the lower volume – indeed the patients given 450 ml water were reported to be unhappy about having to drink more than they were used to, and the surgical staff complained about the need for intra-operative catheterisation.

The GDG concluded that both low and high volumes of fluid could be given up to two hours preoperatively.

REGRESSION ANALYSIS FOR FLUIDS

The regression analysis included more intervention-control comparisons (N=18) than used in the meta-analyses (N=14) because only the difference in means between intervention and control was required for the regression analysis, but for the meta-analysis some studies were still awaiting calculation of pseudo-values for the standard deviation.

For the gastric volume mean difference, one factor was found to be significantly important – whether or not the intake was water (p=0.001); water was predicted to decrease significantly the gastric volume. For the pH mean difference there were no significant factors. The same conclusions were reached when the regression analysis was restricted to the studies used in the meta-analysis.

Delayed operations

If an operation was to be delayed, the GDG agreed that consideration should be given to giving the patient a drink of water (or clear fluid) to prevent excessive thirst and dehydration.

B) The intake of solid foods during a restricted fasting period

RECOMMENDATIONS

Grade	Recommendation
D	A minimum preoperative fasting time of six hours is recommended for food (solids and milk).

EVIDENCE

Level of evidence	Evidence statement
1-	Evidence was insufficient in a small, randomised study (n=45) comparing a light breakfast two to four hours preoperatively with the standard fast.
4	There was insufficient evidence to allow recommendations to be made about the nature of food consumed. GDG consensus was that there should be a minimum fasting time of six hours for solid food and milk in line with current clinical guidance (ASA, 1999; AAGBI, 2001).

CLINICAL EVIDENCE (Appendix A9)

There is limited evidence in relation to the intake of solids by patients before surgery. Only two small comparisons (n=21 and n=24) within a single study (Miller et al., 1983) compared a shortened solid fasting regimen with a standard fast. For this study pseudo-values were calculated for the pH means and standard deviations. Two randomised groups received a shortened fast two to four hours preoperatively, with the intake consisting of one slice of buttered toast plus a cup of tea or coffee with milk. One group received non-opioid premedication and the other had opioids. In practice, there was a statistically significant difference in the mean fasting duration of 4.2 and 3.3.hours respectively, which may lead to confounding.

Meta-analysis of the two comparisons showed little difference in the residual gastric volume between the shortened and standard fasts, but there was heterogeneity for the pH outcome. The non-opioid comparison, on its own, gave a large statistically significant decrease in pH (mean 2.88) in favour of the standard fast, but for the opioid comparison, the mean difference was small and the confidence interval was too wide to draw conclusions. The study also

recorded the number of patients having particulate matter in the aspirate (which occurred for one patient in the opioid group) but the confidence interval was very wide and this event could have occurred as easily by chance. Secondary outcomes were not addressed and the GDG felt that there was too little information in this study to draw reliable conclusions. The study was used to inform GDG discussions.

The evidence relating to solids was discussed by the GDG. Discussion was aided by the following additional background information.

1. The ASA recommendation: 'It is appropriate to fast from intake of light meal (toast and clear liquid) or non-human milk for six or more hours before the elective surgical procedure requiring anaesthesia. Fried or fatty food or meat may prolong gastric emptying time. Both the amount and type of food and non-human milk ingested must be considered when determining an appropriate fasting period'(ASA, 1999).
2. Gastro-physiological studies on healthy volunteers or non-surgical patients (Petring and Blake. 1993; Maltby, 2000) have shown that, generally, fluids leave the stomach more rapidly than solids. Factors determining the emptying rate of fluids include the gastric volume, the osmolarity and caloric content. The digestive process for solid food is slower. Solids can pass through the stomach as slowly as twelve or more hours depending on the volume, content and a variety of other factors such as anxiety, medication and gastrointestinal disorders (Dowling, 1995).

Taking these factors into consideration, the GDG's consensus view was to err on the side of caution and recommend a minimum fasting time of six hours from solid food. They felt there was insufficient evidence to allow recommendations to be made about the nature of food consumed, and that staff had no control over the intake prior to the patient's arrival in hospital. For (non-human) milk, the GDG's view was that it forms curds in the stomach, and should therefore be treated as a solid.

Current clinical guidance (ASA, 1999; AAGBI, 2001) recommends a minimum fasting time of six hours for solid food and milk, which was supported by the

GDG. The GDG also suggested that any food consumed should be light and easily digestible, to avoid patients eating fatty and fried foods. It would, however, be useful to carry out further research to determine the time preoperatively at which a light snack can be given.

C) Chewing gum and sweets during a restricted fasting period

RECOMMENDATIONS

Grade	Recommendation
B	Chewing gum should not be permitted on the day of surgery.
D	Sweets are solid food. A minimum preoperative fasting time of six hours is recommended.

EVIDENCE

Level of evidence	Evidence statement
1+	For sugar-free gum, there was a significant increase in gastric volume (11 ml) when patients were allowed chewing gum. There was little difference in the pH. Patients were allowed gum up to the time of transport to the operating room.
1+	For smokers, there was little difference in either gastric volume or pH between patients allowed and not allowed Nicorette gum.
4	The GDG decided that chewing gum should not be allowed before surgery. Evidence was extrapolated from the very short duration meta-analysis (which has a level of evidence 1+)
1+	For lollipops administered 10 to 70 minutes before the operation, one study (n=60) found a small, but statistically significant decrease in pH (0.3 units) when the patients had a lollipop, but there was little difference in the gastric volume.

4	The GDG decided that sweets were solid food and should have the same recommendations as solids.

CLINICAL EVIDENCE (Appendix A9)

Two randomised studies in adults (Søreide et al., 1995; Dubin et al., 1994) addressed the question of chewing gum. The Søreide study separately randomised 46 smokers and 60 non-smokers to nicotine gum or no gum, and a sugar-free gum or no gum respectively. The Dubin study randomised 31 patients to sugar-free gum or no gum. Patients were allowed to chew gum up to the time of transport to the operating room (up to 20 minutes pre-induction for Dubin). This study also gave chewing gum to 46 other patients, but they were not randomised and therefore not included in the analysis.

Meta-analysis for sugar-free gum (two trials, n=91) showed a statistically significant increase in gastric volume (11 ml) between shortened and standard fasts, in favour of no gum; the pH showed little difference. For the Nicorette gum for smokers, the single comparison (n=44) revealed little difference between gum and no gum for either outcome.

The evidence suggests that sugar-free chewing gum should not be given up to the time of transport to the operating room, but there is no evidence for longer times. After some deliberation, the GDG decided that chewing gum should not be permitted on the day of surgery. This was consistent with the recommendation for children. Therefore extrapolated evidence (from the short duration studies) was used to make the recommendation.

Only one study examined the effect of sweets on gastric volume and pH (Macaluso et al., 1996): the patients were given a lollipop containing either fentanyl citrate or placebo. A third group received no lollipop. The relevant comparison was placebo lollipop given 10 to 70 minutes preoperatively versus no lollipop (n=60). Results showed little difference in the gastric volume (but there was a fairly wide confidence interval), and the pH showed a small, statistically significant difference (mean 0.30) in favour of no lollipop (standard

fast). No patient had nausea or vomiting, and there was insufficient evidence on anxiety to draw conclusions (wide confidence interval).
The GDG's view was that sweets are a type of solid food and should not therefore be given less than six hours preoperatively.

D) Pharmacological interventions

1. Concurrent medications

RECOMMENDATIONS

Grade	Recommendation
D(GPP)	Regular medication taken orally should be continued preoperatively unless there is advice to the contrary.
D(GPP)	Up to 30 ml water may be given orally to help patients take their medication.

EVIDENCE

Level of evidence	Evidence statement
4	The GDG agreed that most oral medications for concurrent conditions are tolerated well throughout surgery and do not interfere with anaesthesia, and that withdrawal of oral medication can put the patient at risk of complications.
4	The GDG recommended that up to 30 ml could be taken at any time preoperatively to help patients take their medication.

CLINICAL EVIDENCE

The GDG agreed that most oral medications for concurrent conditions are tolerated well throughout surgery and do not interfere with anaesthesia, and that withdrawal of oral medication can put the patient at risk of complications. Some drugs (for example, ACE inhibitors) may need special care and the anaesthetic

team should decide the course of action for each patient. Further discussion is outside the scope of the guideline.

The GDG considered the need for patients to have a drink to help them take medication during the fasting period, and whether this constituted a break in the fast. They decided this was acceptable provided the volume did not exceed 30 ml.

2. Premedication in healthy adults

RECOMMENDATIONS

Grade	Recommendation
A	Administration of premedication as currently practised - for example benzodiazepines - does not appear to affect the fasting recommendations for water and other clear fluid.

EVIDENCE

Level of evidence	Evidence statement
1-	A small study (n=23) that randomly compared opioid and non-opioid premedication had insufficient evidence to draw conclusions.
1+	Another study (n=100) compared patients given opioid and no premedication in the presence of water to two hours. There was little difference between the two groups for either gastric volume or pH.
1+	A further study (n=60) compared patients given fentanyl citrate or placebo lollipops 10 to 70 minutes before arrival in the operating room. There was little difference in gastric volume and the pH showed a small statistically significant increase in pH (0.2) with the premedication. Patients had eight times more dizziness with the fentanyl lollipop than the placebo.

1++ 1+	Sub-group analysis showed that, in the absence of premedication, there was a significant decrease in gastric volume (mean 7 ml) for an intake of fluids up to two hours, compared with a standard fast. In the presence of both opioid and non-opioid premedication there was little difference between shortened and standard fasts for gastric volume and pH.
1+	Analysis of the subset of studies in which the patients had water suggested that the improvement found for water up to two hours preoperatively is not affected by non-opioid premedication. Even in the presence of opioid premedication there was little difference between shortened and standard fasts.

CLINICAL EVIDENCE (Appendix A10)

Premedication may influence the rate of gastric emptying. Drugs that inhibit gastric emptying include opioids, anticholinergics (such as atropine) and beta-agonists. Airway reflexes are impaired by premedication with diazepam (Ng and Smith, 2002).

The effect of premedication was studied **in the context of a shortened fast that permitted some fluid or solid**. Two approaches were taken:

- Randomised head-to-head comparisons of different premedication (or none) for patients who all had a shortened fast.
- Sub-group analyses within the main review, splitting the comparisons of shortened and standard fasts according to the type of premedication.

No studies were included that examined head-to-head comparisons of different pharmacological interventions under standard fasting conditions.

Premedication was classified into opioid-based, non-opioid based (usually benzodiazepines) and none. For some studies the number of patients receiving premedication was not clear.

Head-to-head randomised comparisons

Three studies compared different types of premedication, or premedication versus no premedication, in the presence of a shortened fast in adults (Agarwal et al., 1989; Holmes, 1988; and Miller et al., 1983). The Holmes study awaited pseudo-value calculations.

Only one small study looked at premedication type head-to-head (Miller et al., 1983, n=23). This study compared opioid and non-opioid premedication in the presence of a solid food intake – the two arms also differed significantly in the mean duration of fasting, which is a limitation of the study. There was insufficient evidence to draw conclusions (wide confidence interval for pH and small sample size).

Another study (Agarwal et al., 1989, n=100) compared patients given opioid or no premedication in the presence of water up to two hours preoperatively. There was little difference between the two groups for either gastric content outcome.

A further study looked at premedication versus placebo (Macaluso et al., 1996, n=60). The study used a lollipop with added fentanyl citrate to investigate premedication effects on gastric volume and pH. The study found a small, statistically significant increase in pH (0.2 units) favouring the fentanyl lollipop, and little difference for the gastric volume. The patients had statistically significantly more dizziness (eight times) when the premedication was given, but the results were inconclusive for both anxiety and nausea.

Sub-group analyses

No premedication

In the absence of premedication there were four comparisons (n=271) of shortened and standard fasts. Meta-analysis for gastric volume showed a statistically significant decrease (7 ml), in favour of fluids; there was little difference between the groups for pH. The secondary outcomes had mixed conclusions for hunger and thirst; a single study (n=100) showed no significant differences in postoperative nausea.

Opioid premedication

Three studies (4 comparisons; n=346) had opioid premedication. This sub-group of comparisons of shortened and standard fasts showed little difference between interventions for either gastric volume or pH. Two comparisons within one study reported significantly less thirst and one of these comparisons found less anxiety and hunger for the shortened fast; the other was non-significant.

Non-opioid premedication

Four studies (six comparisons, n=378) in the non-opioid sub-group gave the patients benzodiazepines as premedication, but in three comparisons (Hutchinson et al., 1988 (two comparisons) and Phillips et al., 1993) premedication was given to some, not all, of the patients. There was little difference between shortened and standard fasts for gastric volume or pH. Secondary outcomes for six comparisons in this sub-group showed significantly less thirst and hunger for the shortened fast, and one study showed significantly less anxiety for this intervention.

Any premedication

Combining the two premedication groups, meta-analysis of eight comparisons (three of which had premedication for some, not all of the patients; n=630) showed little difference between groups for either gastric volume or pH. The secondary outcomes largely favoured the shortened fast, with significantly less thirst, hunger and anxiety.

Sub-groups in studies with an intake of water

We thought that the apparent effect of premedication on gastric volume could have been confounded by the type of fluid, so examined the studies with an intake of water (Appendix A10). Four, two and three comparisons were included in the no premedication, opioid and non-opioid sub-groups respectively. For the gastric volume outcome, there was a statistically significant decrease in volume (mean 7 ml) for the premed-free sub-group, and the non-opioid group favoured water, non-significantly (mean decrease 8 ml), but the opioid sub-group showed little difference between groups. There was no effect on pH for any sub-group. We have reservations about sub-sub-group analyses, particularly when the

number of studies is small. However, tentative conclusions are that that water and other clear fluid may be given up to two hours preoperatively and the type of premedication used is not critical, non-opioid premedication may be preferred.

3. Histamine-2 receptor antagonists

RECOMMENDATIONS

Grade	Recommendation
D	The routine use of H_2RAs is not recommended for healthy adults.

EVIDENCE

Level of evidence	Evidence statement
4	GDG consensus was that H_2RAs are not effective in all patients, they are relatively expensive and relatively slow acting, and they should not be used in healthy patients.
1++	In healthy adults (n=397), addition of an H_2RA in the presence of a shortened fast gave a statistically significant decrease in volume (mean 10 ml), together with a large, statistically and clinically significant increase in pH (mean 3.9).
1+ 1- 1+ 1+	Sub-group analysis by type of intake in healthy adults, in the presence of H_2RAs, showed that: • There is little difference between shortened and standard fasts for water for volume and pH. • There is insufficient evidence to draw conclusions about an intake of clear fluids. • For non-clear fluids, there were statistically significant increases in gastric volume (mean 4.8 ml) and acidity (pH mean decrease 0.68) for the shortened fast compared with the standard. • For fruit juice, the pH change was of borderline significance (p=0.06) in favour of the standard fast.

1+ 1+ 1+	Three studies (separately) compared different types of fluid: One study (n=100) found little difference between orange juice and coffee. The second (n=40), compared black Assam tea and apple juice, and found statistically significant improvements when tea was taken for both gastric volume and pH (mean decrease in volume 10.7 ml; mean increase in pH 1.6). Another study (n=30) found little difference in gastric volume between water and an isotonic drink, but the pH was uncertain.
1+	Sub-group analyses of different types of H_2RA suggested that type had little effect on the difference in gastric volume and pH between shortened and standard fasts. A head-to-head comparison of ranitidine and famotidine (in a shortened fast) in a single study showed little difference in gastric volume, but there was insufficient evidence for the pH outcome.

CLINICAL EVIDENCE

The function of H_2RAs is to reduce the secretion of gastric acid and pepsin, which in turn reduces both the gastric volume and the acidity. H_2RAs are not widely used except for higher risk patients because they are not effective in all patients; they are relatively expensive and relatively slow acting. This lack of effectiveness was demonstrated by one study in the paediatric review which provided individual patient data (H_2RA_children), but this type of information is not given in any of the adult studies. GDG consensus was that healthy patients should not be given H_2RAs.

The review identified several studies in healthy patients in which H_2RAs were given. However, the GDG's view was that these studies were only useful in that their results might be extrapolated to higher-risk patients. The analyses are included in this section, partly because the studies are in healthy adults and

partly in order to keep the pharmacological intervention data together, but their application is to higher-risk patient groups (Section 6.2).

Type of H_2RA (Appendix A11)

Sub-group analysis by type of H_2RA was carried out and one study randomly compared different H_2RAs.

This study (Samaan et al., 1989; n=46) compared ranitidine and famotidine. There was little difference in the gastric volume, but the confidence interval for pH was too wide to draw conclusions.

Sub-group analyses by type of H_2RA (Appendix A11)

These were based on 10 comparisons of shortened fluid and standard fasts, in which all patients were given H_2RAs. One of these comparisons (Gilbert et al., 1995) did not measure gastric content outcomes.

Five comparisons (n=304) had ranitidine as the H_2RA; two comparisons in the same study (Yatsu et al., 1996, n=45) had roxatidine; and one study (Samaan et al., 1989, n=45) gave the patients famotidine. All sub-groups showed little difference between shortened and standard fasts for gastric volume, but conclusions could not be drawn for the pH outcome in the latter two groups because of wide confidence intervals.

We decided that studies with the different H_2RAs used here should be combined in future analyses.

Head-to-head comparisons with versus without H_2RAs (Appendix A12)

Seven comparisons (Hutchinson et al., 1988(2), Maltby et al., 1986, Maltby et al., 1988, Samaan et al., 1989 (two) and Sutherland et al., 1987) in healthy adults randomised patients to groups with and without an H_2RA, in addition to receiving fluids up to two hours preoperatively. Pseudo-values were calculated for three comparisons (Maltby et al., 1986 and two in Samaan et al., 1989), and

are awaited for one (Maltby et al., 1988). Meta-analysis (six comparisons; n=397) showed a statistically significant decrease in gastric volume (mean 10 ml) and a large, statistically significant increase in pH (mean 3.9), favouring the H_2RA.

Sub-group analyses by type of fluid (Appendix A12)

The comparisons of shortened and standard fasts, in the presence of H_2RAs in both arms, were included in this section. All these studies allowed fluids up to two hours, thus the effect of duration was not investigated. Sub-group analyses by type of intake were carried out, divided into water, clear fluids and non-clear fluids.

For **water**, meta-analysis of five H_2RA trials (n=276) showed little difference between shortened and standard fasts for gastric volume and pH (c.f. the studies without H_2RAs, for which the gastric volume was statistically significantly in favour of the shortened fast).

For **clear fluids**, one small study (n=22) showed little difference in the gastric volume and was inconclusive for pH.

For **non-clear fluids**, meta-analysis of two comparisons within the same study (Hutchinson et al., 1988; n=150) showed statistically significant increases in both gastric volume and acidity: the mean volume increase was 4.8 ml and the mean pH decrease was 0.68 (c.f. the studies without H_2RAs, for which there was little difference between shortened and standard fasts).

One study gave the patients **fruit juice** (Hutchinson et al., 1988; n=100). This showed borderline significance (p=0.06) in favour of the standard fast for pH, but little difference in volume.

Three studies randomly compared **different types of fluid**: one (Hutchinson et al., 1988; n=100) found little difference between orange juice and coffee, but another study (Tanabe, 1996; n=40), comparing black Assam tea and apple juice, found a statistically significant difference in favour of the tea for both gastric volume and pH outcomes (mean decrease in volume 11 ml; mean increase in pH 1.6). The third study (Yatsu et al., 1996; n=30) found little

difference in gastric volume between water and an isotonic drink, but the pH had a wide confidence interval.

Although the adverse effect of non-clear fluids and fruit juice is smaller than the positive effect of the H_2RA, it should be recalled that the effect of H_2RA varies among patients. This suggests that the safest approach is to avoid non-clear fluids and fruit juice in the presence of H_2RA.

6.2 Preoperative fasting in higher-risk groups

Higher-risk groups consist of patients with conditions or diseases likely to cause an increased risk of regurgitation and aspiration, such as (untreated) gastro-oesophageal reflux and diabetes. In this guideline, and in clinical practice, the expression 'higher-risk' does not**,** as in some publications, refer to patients having a gastric volume above, and/or a pH below, a given threshold.

6.2.1 Results of clinical effectiveness evidence retrieval and appraisal

A) Characteristics of studies included in the review

Three randomised studies described in the Cochrane Review, one additional randomised study (Ozkan et al., 2000) and one controlled study (Lewis and Crawford, 1987) were included in the higher-risk category. Two studies (Lam et al., 1993; Somwanshi et al., 1995) were in *postpartum* women undergoing elective sterilisation, one to five days *postpartum*. Two studies (Ozkan et al., 2000; Lewis and Crawford, 1987) were in pregnant women undergoing elective Caesarean section, and the other (Maltby et al., 2004, n=138) was in obese patients.

Four studies did not give the patients H_2RAs, and the Ozkan study compared the effect of the addition of different types of IV gastric emptying medications: ranitidine (an H_2RA), metoclopramide (a gastric motility enhancer) and omeprazole (a proton pump inhibitor; PPI).

One study (Lewis and Crawford, 1987) examined the effect of a light breakfast two to four hours preoperatively and the other studies gave the patients fluids.

All included studies for the preoperative review of higher-risk adult patients are summarised in Appendix A1. Excluded studies are listed in Appendix A2.

428 patients participated in the randomised trials included in the review. No study was conducted in the UK. Patients in all these studies had ASA status I-II. Most of the studies took measures to exclude gastrointestinal disease or disorders, and/or drugs that affected gastric secretion or motility. The Lewis and Crawford controlled study had 40 patients and was carried out in the UK. The ASA status of the patients was unclear and exclusions were not stated.

Only one study (Somwanshi et al., 1995) reported that the patients were monitored for evidence of regurgitation and aspiration. No incidence was found, so the surrogate outcome measures of gastric pH and volume were used for the evidence summary.

B) Methodological quality of included studies

A summary of the methodological quality of each of the studies is given in Appendix A3.

The four randomised studies included in the review were generally small or moderate in size, with groups consisting of fewer than 100 patients (range 20 to 65). The method of generating the randomisation sequence was evaluated as adequate in one study (Maltby et al., 2004), partially adequate in one (Lam et al., 1993) and unclear for the other two (Ozkan et al., 2000; Somwanshi et al., 1995).

No study was assessed to have adequate allocation concealment, although one reported some attempts at concealment (Lam et al., 1993). Two of the studies reported adequate blinding of the outcome assessors (Lam et al., 1993; Somwanshi et al., 1995), and in the rest, blinding was not clearly reported. Two studies reported an *a priori* sample size calculation (Lam et al., 1993; and Maltby et al., 2004).

Three studies reported an intention to treat analysis for at least one outcome, and one study (Maltby et al., 2004) had some withdrawals, but less than 20 per cent in any group. Baseline characteristics were comparable across groups in these studies.

The mean and standard deviation were calculated from individual patient data on a graph for the Lam study.

The Lewis and Crawford study stated that the patients were 'divided' into groups, and reported an intention to treat analysis. No details were given of baseline characteristics.

RECOMMENDATIONS

Grade	Recommendation
D	Higher-risk patients[‡] should follow the same preoperative fasting regime as healthy adults, unless contraindicated. In addition, the anaesthetic team should consider further interventions, as appropriate to the overall clinical situation[#].
D	Adults undergoing emergency surgery should be treated as if they have a full stomach. If possible, the patient should follow normal fasting guidance to allow gastric emptying.

[‡] Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes.

[#] Such as H_2RAs, sodium citrate, gastrokinetic agents and proton pump inhibitors, together with rapid sequence induction, tracheal intubation and nasogastric tube.

EVIDENCE

Level of evidence	Evidence statement
1+	In obese patients without gastro-oesophageal reflux, a single randomised trial showed a statistically significant increase in mean gastric volume (19 ml) for the patient group receiving clear fluids up to two hours preoperatively, compared with a standard fast. There was little difference in pH. This is in contrast to the median gastric volume (as used by the study authors) that showed no significant differences.
4	For obese patients without reflux, GDG consensus was that they should be treated in the same way as non-obese patients (i.e. be allowed water and other clear fluid up to two hours preoperatively).
4	For patients with gastro-oesophageal reflux, GDG consensus was that, in the absence of evidence, unless there are contraindications, these patients should follow the same preoperative fasting regime as healthy patients. Regular medication should be continued.
1+ 4	Four of the trials in the healthy adults review included patients older than 65 years, and one had patients of mean age 64 years. For each trial there was little difference between the shortened and standard fasts. GDG consensus for older people was that, if healthy, they should be treated the same as other healthy patients.
4	GDG consensus for patients with diabetes was that preoperative management should be tailored to individual needs, and patients with autonomic neuropathies in diabetes should be treated as a separate group.

4	In the absence of evidence, the GDG was concerned that patients undergoing bowel preparations were at risk of dehydration because of prolonged fasting.
1+ 1+ 2+	For pregnant women undergoing elective Caesarean section, one study (n=50) showed little difference between a regimen of 200 ml water up to two hours preoperatively and the standard fast. Both H_2RAs and PPIs statistically significantly decreased the gastric volume and acidity in the presence of water up to two hours (mean volume decreased by 6 ml and 10 ml respectively, and pH increased by 2.2 and 3.4). In a controlled prospective study (n=40), patients given toast and tea, two to four hours preoperatively, had statistically significant increases in gastric volume and acidity (mean volume increased by 36 ml, and pH decreased by 0.6), compared to patients having a standard fast. Two patients had particles of toast in their aspirate.
4	For pregnant women undergoing emergency Caesarean section, the GDG supported the recommendation of the NICE guideline on Caesarean section: that women should be offered antacids and drugs (such as H_2RAs and PPIs) to reduce gastric volumes and acidity before Caesarean section.
1+	In *postpartum* women (one to five days *postpartum*), meta-analysis (n=139) showed little difference in gastric volume or pH between women allowed water up to two hours and those given a standard fast.
4	Overall, for higher-risk groups undergoing elective surgery, GDG consensus was that the anaesthetic team should consider using H_2RAs, sodium citrate, gastrokinetic agents and PPIs before elective surgery.

4	For patients undergoing emergency surgery, GDG consensus was that, if possible, they should follow normal fasting guidance to allow gastric emptying, and should be treated as if they have a full stomach.

CLINICAL EVIDENCE (Appendix A13)

This section is concerned with a range of patient groups considered to be at higher-risk of aspiration and/or regurgitation. The GDG considered the evidence for each separately, but also discussed higher-risk groups as a whole.

Higher-risk groups in general

The GDG's consensus was that, for all higher-risk groups, normal fasting regimes should be followed unless contraindicated and the anaesthetic team should consider the use of H_2RAs, sodium citrate, drugs that increase the gastric motility (for example, metoclopramide) and proton pump inhibitors (such as omeprazole).

The GDG considered it acceptable to extrapolate the conclusions from the review of studies using H_2RAs in healthy patients to the higher-risk adult groups. These conclusions (Section 6.1) were that H_2RAs gave a statistically significant decrease in the mean gastric volume and a large statistically significant increase in pH in the presence of fluids up to 2 h. For patients given H_2RAs, there was little difference between shortened and standard fasts for water and other clear fluid, but non-clear fluids and fruit juice were less favoured.

Obese patients - defined as those with a body mass index of more than 30

Obese patients are included in the higher-risk group because their stomachs are compressed by the abdominal mass, there may be difficulties in airway management and they often have a hiatus hernia. The potential for aspiration problems may depend on whether the patients have gastro-oesophageal reflux (Harter et al., 1998).

One randomised study (Maltby et al., 2004, n=130) compared the intake of 300 ml clear fluids (water, apple juice, black coffee, clear tea, carbonated beverage) up to two hours with a standard fast, without any additional pharmacological interventions. The mean difference showed a statistically significant increase in the gastric volume, for a fluids fast compared with the standard fast (19 ml), but little difference between groups for pH. The authors of the study compared the median values for the gastric volume (using a least absolute value model) and found the difference between shortened and standard fasts was not significant.

GDG consensus was to move away from the mean gastric volume evidence, preferring to use the median, and to support widely recognised best practice (two hours for water and other clear fluid and six hours for solids). The group agreed that obese patients (without reflux) should be treated in the same way as non-obese patients.

Patients with gastro-oesophageal reflux

No evidence was found for this patient group – patients with gastro-oesophageal reflux were excluded from the majority of randomised trials studied in the healthy patient reviews.

The GDG noted that patients with gastro-oesophageal reflux form a heterogeneous group, which also includes patients receiving treatment (i.e. symptom free). The consensus of the GDG, in the absence of evidence, was that, unless there are contraindications, these patients should follow the same preoperative fasting regime as healthy patients. Regular medication should be continued.

Older patients

The GDG discussed what was meant by older patients and noted that, although, traditionally, ‘older people’ are those over 65 years, there are differences in physiology between people aged 65 and 85. Older people often have decreased airway reflexes (Ng and Smith, 2002) and delayed gastric emptying, but the gastric pH increases making any aspirate potentially less harmful. Aspiration

pneumonia is an important cause of mortality and morbidity for people over 60 both in nursing homes and living independently (Terpenning et al., 2001).

No randomised trials were found on preoperative fasting in this patient group. However, four of the adult studies comparing fluids in a shortened fast with the standard fast (Hausel et al., 2001; Maltby et al., 1988; Phillips et al., 1993; Samaan et al., 1989) included patients over 65, with patients in the Phillips study having a mean age of 64 years. These individual randomised studies showed little difference between the shortened and standard fasts. GDG consensus was that, if they are healthy, older people should be treated the same as other healthy patients.

Patients with diabetes

Gastric emptying in diabetic patients varies and may be affected by other factors such as obesity. About 20 to 40 per cent of patients with diabetes develop autonomic neuropathies, which results in delayed gastric emptying.

No randomised evidence was found for preoperative fasting in patients with diabetes. GDG consensus was that diabetes is a complex condition and that preoperative management should be tailored to individual needs. Patients with autonomic neuropathies in diabetes should be treated as a separate group.

Bowel preparation

No studies or information were found. The GDG was concerned that patients were at risk of dehydration because of prolonged fasting and suggested that this should be a topic for research or audit.

Pregnant women undergoing elective Caesarean sections

Pregnant women are included in the higher-risk group because their lower oesophageal sphincter is compromised by raised progesterone levels, and there is an increase in intra-abdominal pressure as a result of the increased uterine size. However, evidence from a small gastric emptying study (Wong et al.,

2002), suggests that pregnant women at term had similar gastric emptying behaviour to non-pregnant women.

One randomised study in women undergoing elective Caesarean sections (Ozkan et al., 2000; n=50) compared a shortened fast (200 ml water up to two hours preoperatively) with the standard fast. There was little difference between groups for either gastric volume or pH.

The same study also randomly allocated pregnant women undergoing an elective Caesarean section to various pharmacological interventions: ranitidine (H_2RA), metoclopramide (gastrokinetic agent), omeprazole (PPI) or none (25 in each group); all patients were given 200 ml water up to two hours preoperatively. Ranitidine and omeprazole both gave statistically significant decreases in gastric volume (6 and 10 ml respectively) and statistically significant increases in pH (2.2 and 3.4 units). Metoclopramide made little difference to the volume or pH.

Another study (Lewis and Crawford, 1987) 'divided' (i.e. not necessarily randomised) 40 women into two groups, offering one group a light breakfast of tea and toast two to four hours before an elective Caesarean section. Some patients (9/20) only had tea, and gastric content measurements were reported for the tea and tea-and-toast sub-groups separately; standard deviations for the entire breakfast group were not given. The study did, however, report p-values for the comparison of breakfast and control groups. The mean gastric volume increased by 36.2 ml ($p<0.02$) and the pH decreased by 0.60 ($p<0.05$) for the patients given breakfast. Additionally two patients had particles of toast in their aspirate.

The published NICE guideline (CGB; **www.nice.org.uk**) on Caesarean section recommends that women should be offered antacids and drugs (such as H_2RAs and PPIs) to reduce gastric volumes and acidity before Caesarean section. The GDG agreed to support this guidance.

Pregnant women undergoing emergency Caesarean section

Both labour itself, and opioids used in labour, cause a decrease in gastric emptying and an increase in gastric volume. For emergency Caesarean sections, oral intake during labour becomes important, but there does not appear to be a consensus between anaesthetists, and midwives and obstetricians as to the advisability of allowing solid intake during labour.

There were no randomised studies investigating a shortened fast preoperatively for this patient group, but two randomised trials (Scrutton et al., 1999; Kubli et al., 2002) investigated gastric emptying during early labour by measuring the area of the gastric antrum. One (Scrutton et al., 1999) compared a light diet (toast, cereal, crackers, low fat cheese and a range of drinks) throughout labour, with water in 94 women and found a significantly larger gastric antral cross-sectional area for the light diet within one hour of delivery (p=0.001). The second RCT (Kubli et al., 2002) compared an isotonic sports drink with water in 60 women, and found little difference in gastric antral cross-sectional areas within 45 minutes of delivery.

Although the GDG members discussed this evidence, they concluded that fasting during labour was outside their remit. They noted that a new NICE guideline on *intrapartum* care (**www.nice.org.uk**), which is expected to report in 2006, includes eating and drinking during labour.

Meanwhile, the GDG supported the recommendation of the NICE guideline on Caesarean section: 'to reduce the risk of aspiration pneumonitis women should be offered antacids and drugs (such as H_2RAs and PPIs) to reduce gastric volumes and acidity before Caesarean section'.

Postpartum patients undergoing elective surgery

It might be expected that an increased risk of aspiration would persist in the hours *postpartum*, but an observational study (Sandhar et al., 1992) comparing gastric emptying in two *postpartum* periods (two to three days and six weeks) showed no significant differences in half emptying time.

In *postpartum* women (one to five days) undergoing tubal ligation, two randomised studies (Somwanshi et al., 1995; Lam et al., 1993; n=139) compared patients given a standard fast with patients allowed water ‘up to two hours’, or ‘up to 2.5 hours’ respectively. No pharmacological interventions were given. The two studies had similar mean fasting durations. Meta-analysis showed little difference between the shortened and standard fasts.

The GDG also agreed that it was important to define the *postpartum* period (normally it is 42 days).

Patients undergoing emergency surgery

In acute trauma patients, a prospective study by Lockey (et al., 1999) found that 34 per cent of patients experienced aspiration before intubation. Lacerations larger than 2.5 cm, forearm fractures and other trauma have been reportedly associated with increased gastric volumes. Spinal cord injuries and, to a lesser extent, head injuries are also associated with delayed gastric emptying (Schuster-Bruce, 2000). In addition, alcohol or drug intoxication is often associated with trauma, and may also lead to delayed gastric emptying. Furthermore, distress may cause the patient to swallow air (aerophagia), which can put pressure on the lower gastro-oesophageal sphincter.

The GDG discussed emergency surgery and noted that it was often not possible to predict when an emergency operation was likely to take place. GDG consensus was that patients should follow normal fasting guidance to allow gastric emptying to occur, and should be treated as if they have a full stomach.

6.3 Postoperative resumption of oral intake after elective surgery in healthy patients

6.3.1 Results of clinical effectiveness evidence retrieval and appraisal

A) Characteristics of studies included in the review

All included studies for the postoperative review of healthy adult patients are summarised in Appendix A14. Four studies were identified.

The studies varied widely in the types of patients, types of surgery, types of anaesthesia and the interventions. The gender mix ranged from mainly men (van den Berg et al., 1987) to all women (Hann and Ross, 1987); most studies were adults only, but one (van den Berg et al., 1987) had a mixture of infants, children and adults. Surgery included ophthalmic (two) and minor gynaecological (two). Three studies (Jin et al., 1998; Van den Berg et al., 1987; and Hann and Ross, 1987) were exclusively concerned with patients undergoing general anaesthesia; and in the other study (Martinez Claret and Sanchez-Coll, 2001), the patients had different types of anaesthesia, approximately equally divided into general, regional and sedation.

Two studies reported their patients to be 'healthy' or ASA I-II (Hann and Ross, 1987 and Jin et al., 1998). Two studies (Jin et al., 1998; Martinez Claret and Sanchez Coll, 2001) stated that they took measures to exclude gastrointestinal disease, gastric disorders and/or drugs that affected gastric secretion or motility.

The interventions and comparisons in the studies also varied: one randomised study (Jin et al., 1998) compared mandatory early intake of fluids with no intake. One randomised study (Martinez Claret and Sanchez Coll, 2001) compared an early intake of fluids (less than two hours) with a later intake (two to six hours postoperatively). One non-randomised study (van den Berg et al., 1987) compared small amounts of early fluids (as soon as the patient was awake) with later fluids (more than two or four hours depending on the patient age) and the

other non-randomised study (Hann and Ross, 1987) compared four different durations of fast.

None of the studies investigated differences between types of fluids offered to patients postoperatively or different fluid volumes. Fluids offered included tea, coffee, apple juice and orange juice. Different volumes were administered – from 30 ml offered hourly to unlimited intake. No study offered the patients food.

The incidence of nausea and vomiting were common outcome measures across the studies; other outcomes, specific for individual studies, included other postoperative complications, time to the first fluid ingestion, time to first gas emission, patients' satisfaction, and appetite immediately before first oral intake.

Excluded studies are reported in Appendix A15.

B) Methodological quality of included studies

A summary of the methodological quality of each of the studies is shown in Appendix A16.

Two studies were randomised (Jin et al., 1998; Martinez Claret and Sanchez Coll, 2001), one was a prospective cohort study in infants, children and adults (Van den Berg et al., 1987), and the other (Hann and Ross, 1987) was a prospective non-randomised study. Study size ranged from small to large (range 40 to 371 per group).

For both randomised studies, the method of generating the randomisation sequence was evaluated as adequate and the allocation concealment was judged to be unclear. Both studies were unclear in their reporting of blinding of the outcome assessors. Both studies reported an *a priori* sample size calculation, and each reported an intention to treat analysis for at least one outcome. Baseline characteristics were comparable across groups in both studies.

For the non-randomised studies, there were significant differences in both age and type of procedure for the Hann study, and patients were assigned to groups

on the basis of the type of procedure they received. Therefore we decided to exclude this study from the analysis, as we believed that its conclusions would be misleading. The other study (van den Berg et al., 1987) was assessed to be of good quality – the first 100 patients were allocated to the early fluids group and the second 100 to the later fluids group.

6.3.2 Guideline recommendations, with supporting evidence reviews

Postoperative fasting in healthy patients undergoing routine surgery

RECOMMENDATIONS

Grade	Recommendation
A	When ready to drink, patients should be encouraged to do so, providing there are no medical, surgical or nursing contraindications.

EVIDENCE

Level of evidence	Evidence statement
1++	Evidence from one large randomised trial (n=726) showed little difference in the incidence of either nausea or vomiting between patients given mandatory fluid, compared with those not allowed to drink in the day surgery unit (DSU).
1-	A smaller randomised trial (n=80) gave insufficient evidence to compare early (less than two hours) with later (two hours and above) intake of fluid in patients having general or regional anaesthesia or sedation; the study authors reported no significant differences for general anaesthesia alone.

2+	A large prospective cohort study (n=200) in infants, children and adults showed no significant differences in the incidence of vomiting following hourly sips of water (30 ml) at one to two hours postoperatively, compared with no oral intake up to two hours for infants and children and four hours for adults, following general anaesthesia.
4	GDG consensus was that fluids could be offered to patients as soon as they were fully awake from anaesthesia and able to communicate, unless there were medical, surgical or nursing contraindications. It was preferable to treat each patient individually, with the input of an interdisciplinary team including surgical opinion.

CLINICAL EVIDENCE (Appendix A17)

As described above, the postoperative studies represent a heterogeneous group, which precluded their combination in a meta-analysis. The GDG decided that the Hann non-randomised study was too unreliable to be discussed further.

The large randomised trial (Jin et al., 1998; n=726) compared mandatory fluids (mean volume 150 ml) during the patient's stay in the day surgery unit (DSU), with no drinking. The majority of patients had gynaecological surgery (80 to 84 per cent). Outcome measures included, separately, vomiting and nausea in both the DSU and 24 hours post-discharge; and patient dissatisfaction (number of patients with neutral or dissatisfied ratings). The groups were similar in the proportion of patients treated with anti-emetics (about 10 per cent) and the proportion receiving morphine (about 10 per cent).

For each of the nausea and vomiting outcomes, there was little difference between the groups. The outcome of patient dissatisfaction had a wide confidence interval. Although there were several protocol violations, including 22 per cent in the no drinkers group, a sensitivity analysis excluding these protocol violators gave similar results.

A smaller randomised trial (Martinez Claret and Sanchez Coll, 2001; n=80) compared an early (less than two hours) with a later (two hours or more) intake of fluids in patients undergoing a range of surgeries. The type of anaesthesia was approximately equally divided between general, regional and sedation; separate results for these anaesthesia sub-groups were not given, but the study authors reported that there was no significant difference in vomiting for the patients who received general anaesthesia.

One prospective non-randomised study was identified (van den Berg et al., 1987, n=200), a prospective cohort study in infants, children and adults that also compared an early intake with a later one: in one group hourly sips of water (total 30 ml) were offered at one to two hours postoperatively, while the other group had no oral intake for at least two hours for infants and children and four hours for adults following general anaesthesia. There was no significant difference in the incidence of vomiting, although early fluids were favoured.

None of the studies investigated differences in the type or volume of fluid offered to patients postoperatively or fluid volumes. Thus there is insufficient evidence to make recommendations on the type or volume of intake. No evidence was found on the advisability of offering solid food to patients postoperatively. These areas are subjects for further research.

GDG discussions considered the evidence, and agreed that fluids could be offered to patients as soon as they were fully awake from anaesthesia and able to communicate, unless there were medical, surgical or nursing contraindications. It was preferable to treat each patient individually, with the input of an interdisciplinary team including surgical opinion. The GDG did not see a need to specify either drinking or no drinking as part of the discharge requirements, because the evidence showed that having a drink made little difference to PONV (c.f. paediatric review).

Postoperative fasting following other types of surgery

The postoperative sections of the guideline are restricted to healthy patients undergoing routine, uncomplicated surgery.

Studies investigating oral feeding after gastrointestinal or major abdominal surgery were not included in this guideline, as this was considered to be the responsibility of the surgical team. The reader is referred to other guidance:

Gastro-intestinal surgery

This area has been covered by SIGN guideline No 77 (**www.sign.ac.uk**), *Postoperative management in adults*. This guideline concluded that: "Oral intake should be commenced as soon as possible after surgery."

Caesarean section

This area has been covered by NICE guideline CG13 (**www.nice.org.uk**), *Caesarean section*, which recommends that: 'Women who are feeling well and have no complications can eat or drink when they feel hungry or thirsty."

Major abdominal gynaecology operations (mainly in cancer patients)

The search identified five randomised and quasi-randomised trials, which are listed in the excluded studies table (Appendix A15).

7. Results and recommendations for paediatric patients

The GDG agreed that during initial assessment, the anaesthetic team should decide if the patient is categorised as ‘higher-risk’ or should follow recommendations for healthy patients.

7.1 Preoperative fasting in healthy infants and children

The majority of the evidence contained in this review is based on the Cochrane Review of Brady (et al., 2005). This is a well-conducted systematic review with much detail that supplements the guideline. Some additional analyses were carried out in order to answer specific clinical questions relevant to the development of the guideline.

Results in this section should be taken in conjunction with the appendices for the paediatric studies (B1 to B19).

7.1.1 Results of clinical effectiveness evidence retrieval and appraisal

A) Characteristics of studies included in the review

The studies were divided into those that did and did not give the patients H_2RAs. The GDG considered that the latter represented the true clinical picture for healthy patients in the UK, who would not routinely receive H_2RAs.

All included studies for the preoperative review of healthy paediatric patients are summarised in Appendix B1. This Appendix also includes studies that gave the patients H_2RAs. Excluded studies are reported in Appendix B2.

Healthy patients not given H_2RAs

2,224 patients were randomised in 24 included studies. Only two studies (Meakin et al., 1985; Fry and Ibrahim, 1976) were conducted in the UK. All patients underwent elective surgery with most described as ASA I-II. Seven studies did not report the patients' ASA status (Fry and Ibrahim, 1976; Kushikata et al., 1996; Splinter and Schaefer, 1990_1a and 1b; van der Walt and Carter, 1986; Sarti et al., 1991; Welborn et al., 1993), but the first five described the patients as 'healthy'. A further study (Nicolson et al., 1992) had patients undergoing elective cardiac surgery classed as ASA II-IV, and, following discussion with the GDG, this study was not included in the healthy patients' review. Most studies took measures to exclude gastrointestinal disease or disorders, and/or drugs that affected gastric secretion or motility, with only five failing to indicate these as exclusion criteria (Aun and Panesar, 1990; Fry and Ibrahim, 1976; Kushikata et al., 1996; Sarti et al., 1991; Welborn et al., 1993).

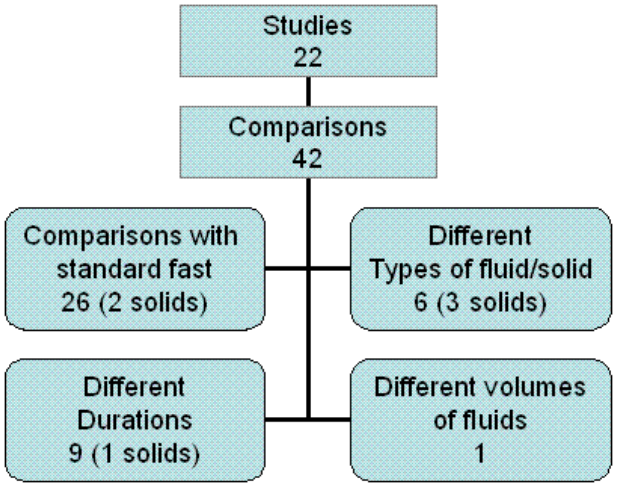
Six of the studies included in the review had three or more comparison arms (Crawford et al., 1990; Maekawa et al., 1993; Meakin et al., 1985; Splinter et al., 1990; Splinter and Schafer, 1990_3; van der Walt and Carter, 1986). This resulted in a total of 44 comparisons. Where studies required one control group to be compared with two or more interventions in the same meta-analysis, we followed standard practice and split the control group between the comparisons. In this way all experimental arms could be included, whilst avoiding the inclusion of the control patients twice in the meta-analysis. Divisions were as equal as possible but in whole numbers (i.e. without splitting a patient). For dichotomous outcomes the number of events and the number of patients were divided by the number of comparisons, but for continuous outcomes only the number of patients was modified - the standard deviation remained the same because this property is not dependent on sample size.

Details of the nature of the different comparisons are shown in Appendix B1. The key to the study references (for example, Meakin et al., 1985g) is also reported.

Seventeen of these 24 studies reported that they monitored patients for evidence of regurgitation and/or aspiration (some evidence was from the Cochrane Review authors' correspondence with the study authors). Only one incident of aspiration/regurgitation was reported (Goresky et al., 1992), which could as well have occurred by chance. The evidence is therefore insufficient to draw conclusions. This absence of aspiration data was not unexpected, but it meant that the surrogate outcome measures of gastric pH and volume had to be used for the evidence summary.

In 22 studies (42 comparisons) gastric content samples were collected (figure 3). Generally a syringe was used to aspirate the stomach contents following insertion of a tube. Two other studies used a nasogastric tube (Aun and Panesar, 1990; Gombar et al., 1997), while the Moyao Garcia study reported the collection of gastric contents during an endoscopic examination. A variety of tools were used to measure pH values.

Fig 3: Children's review – types of comparison



Nine studies (Aun and Panesar, 1990; Cook-Sather et al., 2003 (infants); Fry and Ibrahim, 1976; Gombar et al., 1997; Kushikata et al., 1996; Schreiner et al., 1990; Splinter et al., 1989; Splinter et al., 1990; Splinter and Schaefer, 1991; 11 comparisons) reported the patient's experience of the fasting process with reference to the secondary outcomes addressed by this review. All but two of these comparisons compared a shortened fast with the standard fast; the remaining comparisons were of different volumes of fluids (Splinter et al., 1990c)

and different types of fluid (Fry and Ibrahim, 1976). The nine comparisons with the standard fast recorded outcomes for thirst (six), hunger (seven), irritability (six) and postoperative vomiting (one). In four studies (Cook Sather et al., 2003 (infants); Gombar et al., 1997; Kushikata et al., 1996; Schreiner et al., 1990) the assessments were made by the parents alone; in the adolescents' study (Splinter and Schaefer, 1991) the secondary outcomes were reported by the patients themselves; and in the remaining studies assessments were made by both children and parents. Some uncertainty exists for the studies with outcomes assessed by parents rather than the child.

Various measures were used for these secondary outcomes: nine comparisons used visual analogue scales (but one, Splinter and Schaefer, 1991, gave the median and p values). Scales used varied: four comparisons used a scale of 1 to 10 cm and four used 0 to 10 cm; one study (Kushikata et al., 1996) had a scale of 1 to 3. For two comparisons (Schreiner et al., 1990; Gombar et al., 1997), the 0 to 10 scale was inverted to allow combination of studies – thus in all studies 10 became the worst rating. Where possible, the studies were combined in meta-analyses, sometimes using the standardised mean difference, and they were also summarised narratively.

The studies in the paediatric review were classified according to age – the guideline scope specified a split into six groups (preterm, neonates (0 to 28 days), infants (29 days up to one year), children one to two years, children three to five years and children six years and older). In practice, only one study lay wholly within one of the six age bands: Splinter et al., 1991 was a study in children in the six years and older group (ages 13 to 19 years).

The GDG decided (*post hoc*) that infants and neonates were sufficiently different (both physiologically and in the type of food consumed) from the other age groups, and should therefore be treated as a completely separate group for the whole review. For the rest of the review they will be referred to as 'infants', and patients in the other age groups as 'children'.

Two studies recruited only infants (Van der Walt and Carter, 1986; Cook Sather et al., 2003; seven comparisons); two recruited both infants and children

(Splinter and Schaefer 1990_3, three comparisons, and Miller et al., 1990); and the remainder recruited children only. In the absence of sub-group information in the study reports, the two mixed age studies were classified as studies on children.

A further complication of the paediatric review was that the 26 comparisons of an intake of fluid or solids with the 'standard fast' had different definitions of 'standard fast'. To a large extent, this depended on patient age, and in one study (Schreiner et al., 1990) the standard fast varied according to age.
In the children's studies, four (Crawford et al., 1990; Meakin et al., 1985; Schreiner et al., 1990; Welborn et al., 1993; 8 comparisons) had a standard fast of six hours; nine (nine comparisons) had patients NPO from midnight (nominally, eight hours); two (Miller et al., 1990; and Goresky et al., 1992) had children fasted for ten hours and one study (Maekawa et al., 1993; two comparisons) had a 12 hour fast. In both of the infant studies, the standard fast group was allowed to have their normal feeds (i.e. milk) up to four hours preoperatively.

The studies also varied in the durations randomised for the shortened fast, with fluids being allowed 'up to two hours', 'up to 2.5 hours', 'up to three hours' and 'up to four hours'. For most studies the distribution of fast durations included this time limit, although the Cook Sather study in infants had a mean fast time of 3.8 hours (SD 0.8; range two to 16 hours) for the group allowed clear fluids up to two hours.

Solids, sweets and chewing gum

The studies were stratified into those that gave the patients fluids and those that gave solids. Only one study (Meakin et al., 1985; two comparisons) compared a shortened fast of solids with the standard fast. The children in the solids arm were allowed biscuits with orange squash. A further study (Kushikata et al., 1996) investigated the effect of adding soup-like rice porridge at 5.5 hours to clear fluids given at five hours.

One study (Stanley et al., 1989) was found that looked at the effect of sweets: as part of the study 32 children were randomly allocated to receive a lollipop 30

to 60 minutes preoperatively or nothing. No study in children investigated the effect of chewing gum preoperatively.

Milk

One randomised study (van der Walt and Carter, 1986) and one controlled clinical trial (Thomas, 1974) were identified that compared milk given preoperatively with a standard fast or with another fluid. The van der Walt and Carter (1986) study investigated giving cows' milk to infants up to three hours' preoperatively. The Thomas study gave the children milk up to four hours preoperatively.

An indirect study in infants and young children (Sethi et al., 1999) investigated gastric emptying in patients scheduled for an operation, but who did not have one at the time of the measurements. The study assigned patients to four groups, the first two randomly: formula milk, glucose, breast milk and standard fast (NPO from midnight). Gastric emptying as a function of time was investigated by measuring the area of the gastric antrum ultrasonically. The gastric contents were aspirated when the value of the gastric antral area returned to that of the baseline; the mean time for this to occur was between 1.5 and 2.5 hours.

No randomised studies compared a shortened fast allowing formula milk or breast milk with a standard fast. To find evidence on breastfeeding preoperatively, other study designs were considered for inclusion (Appendix B3). Two prospective non-randomised studies were identified (Litman et al., 1994; van der Walt et al., 1990). One compared breast milk and clear fluids up to two hours preoperatively (Litman et al., 1994) and the other compared breast and formula milks up to three hours preoperatively (van der Walt et al., 1990). The indirect study (Sethi et al., 1999; non-randomised component) also compared breast and formula milks with each other and with a standard fast.

Two milk studies mainly recruited children (Sethi et al., 1999 had patients up to five years old; and Thomas, 1974 had children aged 19 months to 14 years). The other milk studies were in infants and those in the van der Walt 1990 study were all less than three months old.

Premedication

Only one study (Stanley et al., 1989) compared premedication versus none under the conditions of a shortened fast.

Healthy patients given H_2RAs or PPIs

The additional studies included in this section are described in Appendix B1. All were in children. The studies were found using the search strategy for preoperative fasting, but specific searches were not carried out for studies that compared groups that were or were not given H_2RAs or PPIs in the presence of preoperative fluids.

Three randomised studies (Gombar et al., 1997; Goresky et al., 1992; Sandhar et al., 1989; four comparisons) either had an H_2RA in both comparison arms (two comparisons), or were comparisons of an H_2RA versus no H_2RA (three), with both randomised groups receiving fluids. All comparisons used ranitidine as the H_2RA. Two comparisons (Gombar et al., 1997; Goresky et al., 1992) examined a shortened fast versus the standard fast in the presence of an H_2RA.

Two randomised studies (Mikawa et al., 1995; Nishina et al., 1994) compared a PPI versus no PPI, with both randomised groups receiving fluids.

B) Methodological quality of included studies

Healthy patients not given H_2RAs

A summary of the methodological quality of each of the studies is given in Appendix B4. It is noted that although study authors provided additional information for some studies, for many the data on quality was not well reported.

The 24 studies included in the review were generally small or moderate in size, with groups consisting of fewer than 100 patients (range nine to 76). The method of generating the randomisation sequence was evaluated as adequate in 16 studies, inadequate in three studies (Meakin et al., 1985; Kushikata et al., 1996; Welborn et al., 1993) and unclear for the remaining five studies (Goresky

et al., 1992; Jensen et al., 1982; Maekawa et al., 1993; Sarti et al., 1991; Splinter and Schaefer, 1990_3).

One study (Aun and Panesar, 1990) was assessed to have adequate allocation concealment, and two reported the concealment partially (Cook Sather et al., 2003 (infants); and Schreiner et al., 1990). Three studies (Meakin et al., 1985; Kushikata et al., 1996; Welborn et al., 1993) had inadequate allocation concealment (alternation) and for the remaining studies the allocation concealment was unclear.

In evaluating fasting regimens, children cannot be blinded as to whether or not they have had something to eat or drink, and even blinding the volume of intake is difficult. Blinding assessment in this review refers only to the blinding of assessors who collected and measured gastric content values, not to blinding of the children or the individuals involved in administering the interventions. Seventeen of the studies reported adequate blinding of the outcome assessors and for seven, blinding was unclearly reported (Fry and Ibrahim, 1976; Gombar et al., 1997, Jensen et al., 1982; Kushikata et al., 1996; Sandhar et al., 1989; Sarti et al., 1991; Welborn et al., 1993).

Seven studies reported an *a priori* sample size calculation (Cook Sather et al., 2003 (infants); all four 1990 Splinter and Schaefer studies, Splinter et al., 1990 and Splinter et al., 1991).

Seventeen studies reported an intention to treat analysis for at least one outcome; three studies (Crawford et al., 1990; Goresky et al., 1992; Welborn et al., 1993) had some withdrawals, but less than 20 per cent in any group, and two studies (Cook Sather et al., 2003 (infants); and Sandhar et al., 1989) had more than 20 per cent of withdrawals. For each of these studies, 38 per cent of the patients in one group had protocol deviations and their results were not included in the study's analysis. Ten studies reported the omission of some data from the analysis (especially for the measurement of pH), mainly because insufficient aspirate could be obtained – in four studies the proportion missing was around 50 per cent or more (Cook Sather et al., 2003 (infants); Miller et al., 1990; van der Walt and Carter, 1986 (infants); and Welborn et al., 1993). For

most studies with missing aspirate, the study authors calculated the mean gastric volume by setting the values for the missing aspirates to zero. In one study (Miller et al., 1990) where this procedure had not been carried out, a revised mean gastric volume was calculated by one of the guideline authors.

Baseline characteristics were comparable across groups in all studies except Splinter et al., 1990; (children in the higher volume group weighed less), and Sarti et al., 1991 and Fry and Ibrahim, 1976 (not reported).

Pseudo-values for the mean and standard deviation of the gastric volume and pH were calculated for five studies (Aun and Panesar, 1990; Meakin et al., 1985; Sandhar et al., 1989; van der Walt and Carter, 1986 (infants); and Welborn et al., 1993); none is outstanding.

In evaluating the methodological quality of these studies, some studies had a potentially higher level of bias (for example, they were quasi-randomised or had more than 20 per cent protocol deviations or withdrawals), and we decided that they should not be combined in a meta-analysis with higher quality randomised trials. Where these studies were the only evidence, the quasi-randomised studies were included as level 2+ evidence and those with protocol deviations were assigned level 1-. In these categories were Welborn et al., 1993; Kushikata et al., 1996 and Meakin et al., 1985 (all quasi-randomised), and Cook Sather et al., 2003 (infants) and Sandhar et al., 1989 (protocol deviations).

One study (Crawford et al., 1990) did not give summary statistics for gastric volume and pH, but reported individual patient data in a graphical form. The study authors did not report how many children were randomised to each arm, but the graph showed gastric volume data for 46, 26 and 25 children suggesting a 2:1:1 ratio, with little loss of patients; nine of the two hour group did not appear to record a pH value. Although this estimation of group numbers from a graph may have led to some errors, we decided that it would be better to include this study in the meta-analyses than to omit the results entirely. The gastric volume for the Goresky study was also calculated from an individual patient data graph, for which there were difficulties in extracting data because some of the points overlapped.

Solids, sweets and chewing gum

The two studies that allowed the patients a shortened solid fast (Meakin et al., 1985; and Kushikata et al., 1996) were both quasi-randomised; the outcome assessors were adequately blinded in the Meakin study, but blinding was unclear for the Kushikata study. An intention to treat analysis was carried out for both studies, but the Meakin study reported several patients with insufficient gastric aspirate (29 per cent in the combined control and four to six hours groups). The baseline characteristics were comparable across groups for both studies.

The Stanley study comparing a lollipop with no intervention was unclear in its reporting of allocation concealment, sequence generation and outcome assessor blinding. Nine of 64 children (14 per cent) were not evaluated because of protocol deviations, but the baseline characteristics were comparable across groups. This study also compared groups receiving lollipops with or without fentanyl citrate, and found the time taken to consume the lollipop was statistically significantly longer when the active drug was present.

Milk

The methodological quality of the milk studies is reported above for the randomised study (van der Walt and Carter, 1986) and in Appendix B5 for the other studies.

In the Thomas study the patients were ‘divided into two groups’, it is unclear if this was in a randomised way. The baseline age and weight of the groups were comparable. The volume per kilogram was calculated for this study using the mean weights for each group.

The two non-randomised studies (Litman et al., 1994; van der Walt et al., 1990) were of reasonable quality, although there were significant differences in age in the van der Walt (et al., 1990) study (72 versus 48 days). This difference may not be clinically important, however.

For the indirect study (Sethi et al., 1999), there were significant differences between the breast milk group and the other groups in terms of age (0.81 versus

2.43 to 3.20 years) and weight. We decided to exclude any comparisons involving breast milk in this study. There were also differences in the ingestion to aspiration times between the glucose (mean 1.5 hours) and formula milk (mean 2.3 hours) groups, but this randomised comparison was included to inform consensus discussions, as was the non-randomised comparison of a shortened fast allowing formula milk with the standard fast. The latter comparison was of reasonable quality.

In all the milk studies except for Thomas, there was missing aspirate for more than 30 per cent of the patients, and in two studies (Litman et al., 1994 and van der Walt et al., 1990) the missing proportion was between 67 and 90 per cent. The absence of aspirate may, in part, have been caused by difficulties in aspirating very small absolute volumes from the stomachs of infants. The use of the approximation 0 ml/kg for a large proportion of the patients may represent an underestimate in the mean, leading to errors. Caution is expressed regarding the use of these data.

Healthy patients given H_2RAs or PPIs

A summary of the methodological quality of each of the studies is given in Appendix B4.

The three studies included in the H_2RA review were generally small or moderate in size, with groups consisting of fewer than 100 patients (range 15 to 60). The two PPI studies each had groups of about 25 patients. The method of generating the randomisation sequence was evaluated as adequate in two studies (Gombar et al., 1997; Sandhar et al., 1989) and unclear for the other three (Goresky et al., 1992; Mikawa et al., 1995; Nishina et al., 1994). One study reported allocation concealment partially (Mikawa et al., 1995, ‘envelope method’) and the other studies had unclear allocation concealment. Three studies (Goresky et al., 1992; Mikawa et al., 1995; Nishina et al., 1994) reported adequate blinding of the outcome assessors. No studies reported an *a priori* sample size calculation. The gastric volume for the Goresky study was calculated from individual patient data extracted from a graph.

Three studies reported intention to treat analyses for at least one outcome (Gombar et al., 1997; Mikawa et al., 1995; Nishina et al., 1994), one had withdrawals of less than 20 per cent in any group (Goresky et al., 1992) and one had more than 20 per cent withdrawals in the orange juice H_2RA-free group (Sandhar et al., 1989). The other groups had fewer than 20 per cent withdrawals.

Three studies (Mikawa et al., 1995; Nishina et al., 1994; Sandhar et al., 1989) also reported the omission of some data from the analysis (especially for the measurement of pH), because insufficient aspirate could be obtained, but the proportion with missing aspirate was less than 20 per cent in any one group.

Baseline characteristics were comparable across groups in all studies. Details are given in Appendix B4. Pseudo-values for the mean and standard deviation of the gastric volume and pH were calculated for one study (Sandhar et al., 1989).

In evaluating the methodological quality of these studies, one (Sandhar et al., 1989) was found to have a potentially higher level of bias (more than 20 per cent protocol deviations or withdrawals) for one of the comparisons, and we decided that this should not be analysed with higher quality randomised trials. This was the head-to-head comparison of H_2RA versus none.

7.1.2 Guideline recommendations, with supporting evidence reviews

Sections A to E(2) below concern studies of healthy patients not given H_2RAs or PPIs.

A) The intake of fluids during a restricted fasting period

For the purpose of this review, a clear fluid is defined as one through which it is possible to read newsprint (Phillips et al., 1994). Clear fluids given to healthy patients were dextrose, non-particulate (pulp-free) apple juice, jelly, lemonade, ice lollipops, a non-carbonated sugared soft drink and an isosmolar solution of electrolytes.

RECOMMENDATIONS

Grade	**Recommendation**
A (children[§]) D (infants)	Intake of water and other clear fluid[*] up to two hours before induction of anaesthesia for elective surgery is safe in healthy[‡] infants and children and improves patient well-being.
A (children) D (infants)	The volume of administered fluids does not appear to have an impact on patients' residual gastric volume and gastric pH when compared to a standard fasting regimen. Therefore, patients may have unlimited amounts of water and other clear fluid up to two hours before induction of anaesthesia.
D(GPP)	If an elective operation is delayed, consideration must be given to giving the patient a drink of water or other clear fluid to prevent excessive thirst and dehydration. If it is confirmed by the anaesthetist and/or surgeon that a delay is likely to be longer than two hours, water or other clear fluid should be given.
D(GPP)	If a child admitted for surgery has undergone excessive fasting, consideration should be given to offering them a drink and scheduling their operation slightly later in the operating list.

§ Children – age one year and above; infants – less than one year old.

* In practice, a clear fluid is one through which newsprint can be read.

‡ 'Healthy' defined as ASA I-II (Appendix 2) without gastrointestinal disease or disorders.

EVIDENCE

Level of evidence	Evidence statement
1++	16/23 randomised studies reported that they looked for evidence of aspiration or regurgitation. None was found in these (or any other) studies, apart from one incident that could have occurred by chance.
1+	In children, sub-group analysis showed, for any duration, little difference in gastric volume or pH between shortened and standard fasting regimes. The shortest duration studied was up to two hours.
1+	Randomised comparisons of different durations of fast showed little difference in gastric volume and pH.
1++	Ingestion of clear fluids, up to two hours preoperatively, in comparison with the standard fast, had little effect on residual gastric volume at induction of anaesthesia and resulted in a highly heterogeneous distribution of results for the gastric pH. Sensitivity analysis revealed an anomalous study responsible for the heterogeneity; meta-analysis of the remaining 12 comparisons (n=891) gave a small but statistically significant improvement (0.11 units) in the gastric pH for clear fluids.
1+	Administration of clear fluids decreased thirst and improved children's well-being.
1+	In children, ingestion of water up to two hours preoperatively (n=147) showed little difference between shortened and standard fasts for the residual gastric volume or the pH.
1+	Administration of water decreased thirst and irritability.

2+	Ingestion of non-clear fluids (orange squash) showed little difference between the shortened and standard fasts. The two comparisons were quasi-randomised.
1++ 1+	In children, sub-group analyses showed that, for all volumes of fluid ingested, there was little difference in gastric volume or pH for the shortened fast compared with the standard fast. Low and unlimited volumes of fluids decreased thirst and irritability, but the effect on these outcomes was uncertain when higher volumes were given.
1+	In infants (two comparisons, n=92), ingestion of clear fluids, up to three hours preoperatively, in comparison with the standard fast, resulted in a significant improvement (0.38 ml/kg) in the residual gastric volume at induction of anaesthesia, but the evidence for the gastric pH was uncertain (wide confidence interval).
1- 4	Only one study in infants (n=97) compared clear fluids up to two hours with the standard fast. There was little difference between interventions, but the study had protocol violations, and so was simply used to inform consensus. GDG consensus favoured continuing the rule of clear fluids up to two hours for the infants group.
1+	In infants, evidence from two comparisons in one study suggested that high volumes of clear fluids may be consumed up to three hours without a resulting increase in gastric volume or a reduction in pH, compared with the standard fast.

4	GDG consensus was that if an operation were to be delayed, consideration should be given to giving the patient a drink of water or clear fluids to prevent excessive thirst and dehydration. If the anaesthetist and/or surgeon confirmed a delay of at least two hours, then clear fluids should be given.
4	GDG consensus was that if a child admitted for surgery has undergone excessive fasting, consideration should be given to offering them a drink and scheduling their operation slightly later in the operating list.

CLINICAL EVIDENCE

There were 23 studies in healthy infants and children not given H_2RAs or PPIs. Of these, 16 studies reported that they looked for evidence of aspiration or regurgitation. Only one incident was reported (Goresky et al., 1992), which could as well have occurred by chance. Some patients in this study also vomited or spat out the intervention fluid, but it was unclear to which groups the patients belonged.

The rest of the paediatric review is separated into studies in children and in infants.

Children

There were 22 studies (40 comparisons) in children. Seventeen studies (23 comparisons) compared a standard fast with a fast that permitted some fluid intake; six studies (nine comparisons) compared different durations, three studies (four comparisons) compared different types of intake and one study (Splinter et al., 1990) compared different volumes of fluid. Some studies had more than one type of comparison.

In the absence of aspiration data, the surrogate outcomes of gastric pH and volume were used. One study (Aun and Panesar, 1990) did not record the

gastric pH. Four studies (Aun and Panesar, 1990; Meakin et al., 1985; Sandhar et al., 1989; Welborn et al., 1993) did not report both the mean and the standard deviation for the outcomes of gastric volume and pH, and pseudo-values for these quantities were calculated.

The evidence was assessed to find the impact on the gastric pH and volume of the duration of fast, and the type and volume of intake. These variables were examined separately in sub-group analyses and together in regression analysis.

Sub-group analyses for fluids

The sub-group analyses undertaken were by duration of fluid fast, type of intake and volume of intake. Four comparisons were not included in the meta-analyses because they were judged to be of poorer quality.

Duration of fluid fast (for meta-analyses details, see Appendix B6)

Meta-analysis was carried out in four duration sub-groups: 'up to two hours', 'up to 2.5 hours', 'up to three hours' and 'up to four hours' (three; n=141).

'Up to two hours'

Five comparisons were included in the 'up to two hours' sub-group. For these, the mean fasting durations ranged from 2.1 to 2.8 hours, but examination of the distributions (where given; mean +/- 2 SD, or range) showed that all studies had some patients with a fast of two hours or less. Meta-analysis (n=417) found little difference between the shortened and standard fasts for either gastric volume or pH. Parents rated their children as statistically significantly less irritable when given the shortened fast compared to the standard fast (one study: Schreiner et al., 1990; n=121).

'Up to 2.5 hours'

Three comparisons were included in this sub-group. The mean fasting durations ranged from 2.5 to 2.7 hours, and all studies had some patients with a fast of 2.5 hours or less. Meta-analysis (n=173) found heterogeneity (p=0.01, I^2=78%) for the gastric volume (and little difference for pH) so the results are inconclusive. Children were rated as statistically significantly less hungry by both parents and

children. Parents in one comparison rated their children as significantly less thirsty, but a meta-analysis of two comparisons recording children's ratings of thirst gave a wide confidence interval. Meta-analysis of two comparisons found that parent rated irritability was also inconclusive.

'Up to three hours'

Five comparisons were included in this sub-group. The mean fasting durations ranged from 2.5 to 3.6 hours, and we found that all studies had some patients with a fast of three hours or less. Meta-analysis (n=407) showed considerable heterogeneity for the pH outcome ($p<0.00001$, $I^2=93\%$) and there was also heterogeneity for the gastric volume ($p=0.09$). The heterogeneity for both outcomes was attributed to one study (Moyao Garcia et al., 2001). When this study was omitted in a sensitivity analysis, there was a small, but statistically significant increase in pH (0.16 units), i.e., in favour of the shortened fast, and the heterogeneity was eliminated ($p=0.85$, $I^2=0\%$). This increase in pH is unlikely to be important clinically. There was little difference between the shortened and standard fasts for the gastric volume, and no heterogeneity remained ($p=0.93$, $I^2=0\%$). Secondary outcome results from single studies showed that the children allowed a shortened fast were significantly less thirsty (both parent and child rated) and significantly less irritable; there was no significant difference reported in the hunger rating.

'Up to four hours'

Three comparisons were included in this sub-group. The mean fasting durations ranged from 4 to 4.5 hours, and examination of the distributions (where given) showed that the studies had some patients with a fast of four hours or less. Meta-analysis (n=141) found little difference between the shortened and standard fasts for either gastric volume or pH. There was no secondary outcome evidence in this sub-group.

There were eight randomised comparisons of different durations of fast for the same type of intake: 'up to two hours' versus 'up to 2.5 hours' (one comparison; n=100), 'up to two hours' versus 'up to three hours' (two; n=248), 'up to two hours' versus 'up to four hours' (two; n=120) and 'up to 2.5 hours' versus 'up to three hours' (two; n=180). In all comparisons there was little difference in either

the pH or the gastric volume between the two durations. There were no secondary outcomes reported for these comparisons.

On the basis of this evidence, the GDG recommended that children may have fluids up to two hours preoperatively. All durations were combined in the remaining sub-group analyses.

Type of fluid intake (Appendix B7)

Fluids administered as part of a preoperative fasting intervention ranged from water to orange juice to an isosmolar solution of electrolytes (Moyao Garcia et al., 2001). The comparisons were split into sub-groups, pre-specified by the GDG, of water, 'clear fluids' (other than water) and non-clear fluids. Clear fluids included clear apple juice, dextrose (two), jelly, lemonade, ice lollipops or Kool Aid - a non-carbonated sugared soft drink. The fluids in the non-clear fluids sub-group were orange juice and orange squash.

Water

Three comparisons (two studies, 147 children) were included in the meta-analyses for gastric contents. There was little difference between the shortened and standard fasts for either gastric volume or pH. Only one study (Gombar et al., 1997, n=50) recorded secondary outcomes. There was found to be significantly less thirst and irritability (as rated by the parents) for the shortened fast allowing water.

Clear fluids (other than water)

For clear fluids, 13 comparisons (11 studies; 931 children) were included in the meta-analyses for gastric contents. There was found to be heterogeneity for both the pH ($p<0.00001$, $I^2=84\%$) and volume ($p=0.03$, $I^2=47\%$) outcomes. Much of this heterogeneity was explained by the Moyao Garcia study, which had anomalous, large decreases in both gastric volume and acidity for the shortened fast compared with the standard fast. When this study was omitted in a sensitivity analysis, there was a small but statistically significant increase in pH (0.11 units), i.e. in favour of the clear fluids shortened fast, and the heterogeneity was eliminated ($p=0.85$, $I^2=0\%$). This increase in pH is unlikely to be important clinically. Without the anomalous study, there was little difference

between the shortened and standard fasts for the gastric volume, and the heterogeneity that remained was not statistically significant (p=0.23, I^2=22%). There is insufficient information to say if the isosmolar properties of the fluid in the Moyao Garcia study account for the anomalous behaviour, or if some other characteristic may be important (such as the different method of gastric sampling used), but it could be a subject for further research.

Secondary outcomes were measured in six comparisons. Meta-analysis of three comparisons monitoring thirst (child rating on a visual analogue scale; VAS) showed a wide confidence interval; another child rating showed statistically significantly less thirst for the shortened fast, and the study reporting parent ratings of thirst also significantly favoured the shortened fast. Meta-analysis of three comparisons found that the children given clear fluids rated their hunger as significantly less than those having the standard fast; a fourth study (in adolescents) measuring median VAS scores found no significant differences in hunger rating. The parent rating of hunger was also found to be statistically significantly less when the children were given clear fluids. Meta-analysis of three comparisons revealed that the parents rated their children as being significantly less irritable when they were given clear fluids.

Non-clear fluids

Three comparisons (two studies, 102 children) were included in this sub-group. However, both studies had methodological limitations: Meakin et al., 1985 (two comparisons) had alternate allocation by list to groups and compared orange squash with the standard fast. Sandhar et al., 1989 had 38 per cent protocol violations in the orange juice group. We decided to include only the Meakin study in the meta-analysis (two comparisons, n=70), which showed little difference between shortened and standard fasts for both gastric volume and pH. Secondary outcomes were not reported.

Examination of seven (clear) **fruit juice** comparisons (439 patients) revealed little difference between shortened and standard fasts.

There were no studies that randomly compared different types of fluid.

Volume of fluid intake (Appendix B8)

Several volumes of intake were compared to a standard fast, or to a different volume of intake. The volume of clear fluids investigated in studies varied from controlled intake of 2 to 10 ml/kg to unlimited amounts; with the most common volume being 10 ml/kg. After Brady, the various volumes permitted preoperatively were categorised into three types of intake; low volume (less than or equal to 5 ml/kg), high volume (more than 5 ml/kg) and unlimited volumes (where no restriction was placed on the volume of children's preoperative fluid intake) (Brady et al., 2005). Sub-group analyses were then carried out for the comparisons with the standard fast.

Low volume

Six comparisons (5 studies; n=366) gave the children a low volume of fluid (range 2 to 5 ml/kg). Meta-analysis showed heterogeneity for both gastric volume ($p=0.03$, $I^2=59\%$) and pH ($p<0.00001$, $I^2=89\%$). Secondary outcomes showed that the parents' ratings of thirst (two comparisons), hunger (one comparison) and irritability (one comparison) were all statistically significantly less for the shortened fast compared to the standard. The child rating of thirst (one comparison) had a wide confidence interval.

The heterogeneity is largely attributed to the Moyao Garcia study. A sensitivity analysis without this study, found there was little difference between the shortened and standard fasts and very little heterogeneity.

High volume

Six comparisons (five studies, n=262, only five comparisons for pH) gave the children a high volume of fluid (range 6 to 10 ml/kg). There was little difference between shortened and standard fasts for either gastric volume or pH. The secondary outcomes were largely inconclusive for thirst and irritability, but children in two comparisons in one study rated their hunger as statistically significantly less when fluids were given.

Unlimited amounts of fluid

Four studies (n=450) allowed the children unlimited amounts of fluid. The mean volumes actually given in these studies ranged from 4.8 ml/kg (Splinter and

Shaefer, 1991) to 10.4 ml/kg (Splinter and Schaefer, 1990_2). There was little difference between shortened and standard fasts for either gastric outcome measure. Only two studies (one in adolescents) measured the secondary outcomes. The results from one study (Splinter et al., 1991) revealed that adolescents given fluids rated their thirst significantly lower than those having the standard fast, but found no significant difference in hunger. In the other study, the parents rated the irritability of the children as significantly less when they were given fluids.

Randomised comparisons of different volumes (Appendix B8)

Only one study (Splinter et al., 1990; n=62) randomly compared two different volumes of fluid, 6 ml/kg versus 10 ml/kg, but both were in the same high volume category, so conclusions were not drawn from this comparison.

The GDG concluded that the volume of fluid given is unimportant.

Regression analysis for fluids

The regression analysis excluded those studies that were judged to be of lower quality (quasi-randomised or with high numbers of patient withdrawals).
No factor was found to be significantly important for either the gastric volume or pH. These conclusions were not affected when the analysis was repeated excluding the anomalous Moyao Garcia study.

Infants

There are two studies (van der Walt and Carter, 1986; and Cook Sather et al., 2003; seven comparisons) in infants. Two studies (four comparisons) compared a fast that permitted some fluid intake with a standard fast. Three comparisons in the van der Walt study also randomly compared different types of fluid. The fluids permitted during a shortened fast were cows' milk, dextrose and polyjoule (a water soluble glucose polymer with an average of six glucose units), up to three hours preoperatively (van der Walt and Carter, 1986); and 'clear fluids' (Cook Sather et al., 2003), up to two hours. The comparisons with cows' milk are considered in the section on milk (Type of milk intake), which leaves three

comparisons of clear fluids with the standard fast and one comparison of different types of clear fluid.

Both infants' studies reported that they specifically looked for regurgitation and aspiration, but did not observe any incidence of these. In the absence of aspiration data, the surrogate outcomes of gastric pH and volume were used.

The Cook Sather study had 38 per cent protocol violations in one of the randomised groups, and these infants were excluded from the study's analysis. The mean fasting time for this study was 3.8 h (SD 0.8), and the range of durations included by the study authors in their per protocol analysis (see methodological quality) was two to 5.5 hours. We decided to treat the study as potentially biased (level 1-) and it was not analysed with the van der Walt and Carter (1986) study; however, its conclusions were reported, in order to aid GDG consensus discussions.

Duration of fast (Appendix B9)

Meta-analysis of the two comparisons (n=92; 1 study) giving clear fluids up to three hours revealed a large, statistically significant decrease in gastric volume (mean 0.38 ml/kg) compared with the standard fast, but the results for pH were inconclusive (wide confidence interval). The Cook Sather study (which is potentially biased evidence, n=67) showed little difference between unlimited amounts of clear fluids up to two hours preoperatively and a standard fast (of formula milk up to four hours) for gastric volume, but favoured clear fluids for pH (not significantly). Secondary outcome measures all had wide confidence intervals.

Thus the evidence is very limited for this age group, but it suggests that clear fluids may be given safely up to three hours. Further research is needed for this patient group.

In the absence of more definitive evidence, the GDG chose to draw on the results of a 1996 survey (Emerson et al., 1998), which has helped to shape practice. In this survey 77 per cent and 66 per cent of respondents allowed clear fluids up to two hours preoperatively for neonates (less than 44 weeks post-

conceptual age) and infants (less than 1 year) respectively. GDG consensus favoured continuing the rule of clear fluids to two hours.

Type of fluid intake

A head-to-head comparison of polyjoule and dextrose up to three hours (van der Walt and Carter, 1986; 59 patients) showed little difference between interventions for gastric volume and favoured polyjoule for pH (non-significantly).

Volume of fluid intake

There is insufficient evidence for sub-group analysis of different volumes of fluids, but it is noted that high volumes (10 ml/kg) were given in the van der Walt and Carter (1986) study.

Delayed operations

If an operation were to be delayed, the GDG agreed that consideration should be given to giving the patient a drink of water or clear fluids to prevent excessive thirst and dehydration. This applies especially to infants and children, who have a greater fluid metabolism than adults and are more likely to become dehydrated. If it were confirmed by the anaesthetist and/or surgeon that the delay would be longer than two hours, then water or other clear fluid should be given. The GDG also agreed that a recommendation should be made to cover the possibility that a child might arrive for surgery having undergone excessive fasting. They agreed that, if this were the case, consideration should be given to offering the child a drink and scheduling their operation slightly later in the operating list.

B) The intake of milk during a restricted fasting period

RECOMMENDATIONS

Grade	Recommendation
D	Breast milk may be given up to four hours before induction of anaesthesia.

D	Formula milk or cows' milk may be given up to six hours before induction of anaesthesia.

EVIDENCE

Level of evidence	Evidence statement
1-	In infants, there was insufficient information to draw conclusions about a cows' milk feed up to three hours in comparison with the standard fast.
2+	In a single study (n=62) in children, the intake of milk up to four hours resulted in a higher volume of gastric contents on induction of anaesthesia than for a standard fast. The small difference in volume of 0.08 ml/kg was of borderline significance.
1+	Intake of cows' milk up to three hours in infants resulted in a statistically significantly higher volume of gastric contents on induction of anaesthesia than when clear fluids were taken (mean increase 0.45 ml/kg), but the pH outcome statistically significantly favoured milk (mean increase 1.4 units).
2-	In two prospective non-randomised comparative studies in infants, there was insufficient evidence to draw conclusions about the relative effects of breast milk and clear fluids up to two hours preoperatively, or of breast and formula milks up to three hours.
4	Gastric emptying studies and the above evidence were used to aid GDG consensus, which found that there was insufficient evidence to change contemporary best practice (i.e. breast milk up to four hours and formula and cows' milk up to six hours).

CLINICAL EVIDENCE (Appendix B10)

In all the milk studies except two (Thomas, 1974 and Sethi et al., 1999) there were a high proportion of patients with insufficient aspirate to record the pH. The Litman study authors calculated an adjusted mean and standard deviation for the residual gastric volume in order to include all infants, by assigning the patients with insufficient aspirate a value of zero. We also did this for the Sethi study. The van der Walt 1990 study reported few results: only the numbers of infants with a gastric volume greater than 0.4 ml/kg and with no aspirate were reported, therefore we calculated an approximate mean volume by assuming a value of 0.4 ml/kg for those with measured volumes greater than 0.4, and 0.2 ml/kg for the infants with observed values between 0 and 0.4.

Duration of milk fast

There was only one randomised trial that compared milk with a standard fast (van der Walt and Carter, 1986; n=84. One group of infants were given cows' milk up to three hours preoperatively and the others had a standard fast ('normal feeding to four hours - mean 5.5 hours'). This study had insufficient information to draw conclusions (very wide confidence interval).

Another study (Sethi et al., 1999), in infants and children, non-randomly compared the gastric contents of patients given formula milk at a mean of 2.3 hours prior to sampling, with those of patients who had a standard fast (NPO from midnight). Although scheduled for various surgical procedures, the patients had gastric content measurements taken at a different time to their operations – so this evidence is regarded as indirect, and was used to inform GDG consensus discussions. The study found a statistically significant, but clinically unimportant, decrease in gastric volume (mean 0.08 ml/kg) for the milk group. The pH was non-significantly in favour of a shortened milk fast.

The comparison of breast milk with the standard fast in the same study was regarded as confounded because of the large disparity in baseline characteristics and is not reported here.

Type of milk intake (compared to other fluids)

For two randomised comparisons within the same study (van der Walt and Carter, 1986, n=90), intake of cows' milk up to three hours preoperatively resulted in a statistically significantly higher gastric volume than when clear fluids (dextrose and polyjoule) were taken (mean increase 0.45 ml/kg), but the pH outcome was statistically significantly in favour of milk (mean increase 1.4 units).

The indirect trial (Sethi et al., 1999; n=45) randomly compared the effect of consuming glucose solution and low fat formula milk on the gastric contents. However, the time between ingestion and aspiration for the two groups differed (mean of 1.5 and 2.3 hours respectively). There was a statistically significant increase in both gastric volume (mean 0.22 ml/kg, favouring glucose) and pH (mean 0.37, favouring milk). However, as the fasting times for the two feeds were different and there were no operations, this study was used only to inform GDG consensus discussions.

One non-randomised study (Litman et al., 1994; n=18) in infants two to six months, compared breast milk and clear fluids up to two hours preoperatively. The results were inconclusive for both gastric volume and pH (wide confidence intervals).

The other non-randomised study (van der Walt et al., 1990; n=62) in infants one to three months, compared breast and formula milks up to three hours preoperatively. There was little difference between breast and formula milks up to three hours, but it should be noted that this comparison involved approximations and assumptions in calculating the summary statistics.

In children, one controlled study (Thomas, 1974; n=62) found that the gastric volume was larger for a group allowed milk four hours preoperatively than for the group receiving the standard fast (borderline significance, p=0.05). However, the mean difference of 0.08 ml/kg (2 ml) was clinically insignificant.

GDG discussions also took into account gastric emptying information: four prospective non-randomised studies (Cavell, 1981; Tomomosa, 1987; Billeaud,

1990; van den Driessche et al., 1999) compared gastric emptying of breast and formula milks in infants up to one year. Cavell showed that breast and formula milks emptied from the stomach with half-emptying times of 48 and 78 minutes respectively ($p<0.01$), but no information was given about the baseline comparability of the groups. Van den Driessche reported half-emptying times of 47 and 65 minutes respectively ($p<0.05$) in preterm infants (although there were differences in baseline characteristics). Tomomosa showed that, in the three hours after feeding, significantly more digestive activity took place for the breast-fed infants compared to those given cows' milk formula – the two groups were comparable at baseline. Billeaud showed that human milk was evacuated very rapidly from the stomach with 18 per cent residual activity remaining after two hours, a whey-predominant formula had 26 per cent; a casein-predominant formula 39 per cent; follow-up formula was 46 per cent and cows' milk 55 per cent. They found the results for the whey-predominant formula were not affected by the age of the infant.

The Sethi study also reported the variation of the gastric antral area with time. The study authors determined that the mean times taken post-intake to return to the fasting levels were 1.53 (SD 0.25) hours, 2.43 (0.27) and 2.32 (0.31) hours and for glucose, breast milk (younger patients) and low-fat milk respectively.

All the evidence was discussed at length by the GDG and consensus was reached that there was insufficient evidence to recommend changing the current practice of two hours for clear fluids, four hours for breast milk and six hours for formula or cows' milk. Further research is welcomed in this area.

C) The intake of solid foods during a restricted fasting period

RECOMMENDATIONS

Grade	Recommendation
D	A minimum preoperative fasting time of six hours is recommended for food.

EVIDENCE

Level of evidence	Evidence statement
2+	Ingestion of solids (biscuits), two to four hours preoperatively, in comparison with a standard fast, resulted in statistically significant increases in both the residual gastric volume (0.25 ml/kg) and the risk of obtaining particulate matter in the aspirate (17 times the risk). There was no significant effect on gastric pH.
2+	At four to six hours preoperatively there was little difference between fasts for volume or pH and the evidence on particulate matter was inconclusive.
2+	Comparison of a shortened solid fast with a shortened fluid fast gave little difference in gastric volume or pH, and less hunger for the solids group, but evidence was limited.
4	GDG consensus was to err on the side of caution and recommended a minimum fasting time of six hours for solids. There was insufficient evidence to allow recommendations to be made about the nature of food consumed, and the GDG felt that staff had no control over the intake prior to the child's arrival in hospital.

CLINICAL EVIDENCE

There is limited evidence in relation to the intake of solids by children before surgery. One study (Meakin et al., 1985; two comparisons) compared a standard fast with a fast from solid food of a shorter duration, and two studies (three comparisons; Meakin et al., 1985 and Kushikata et al., 1996) compared a shortened solids fast with a shortened fluid fast. Children in both studies were assigned to groups by a quasi-randomised method (by operating list) and the evidence is regarded as comparable with a cohort study.

Duration of solid fast (Appendix B10)

Meakin's study compared an intake of biscuits and orange squash at two to four hours, or four to six hours preoperatively, with a standard fast (up to six hours preoperatively).

One comparison (n=52) of a group allowed solids **two to four hours preoperatively**, with a group receiving the standard fast showed a statistically significant increase in gastric volume (0.25 ml/kg) for the solids group and a statistically significant increase in the risk (17 times) of the children having particulate matter in their aspirate (the number needed to harm was three). The effect on pH was not significant.

The comparison for the group given solids at **four to six hours preoperatively** (n=34) showed little difference between the shortened and standard fasts for both gastric volume and pH, and the outcome, number of children with particles in their aspirate, had insufficient information (very wide confidence interval).

The **direct comparison of the two to four and four to six hour fasts** (n=46) showed a non-significant increase in gastric volume for the shorter fast, little difference in pH and a wide confidence interval for the number of children with particles in their aspirate.

Thus, although there was evidence that a two to four hour fast should not be considered for solids such as biscuits, the results at four to six hours in the same quasi-randomised study were too uncertain to support a recommendation of four hours preoperatively.

Type of intake of solid food (Appendix B11)

Two studies (Meakin et al., 1985; two comparisons; and Kushikata et al., 1996) compared a shortened solid fast with a shortened fluid fast. The Kushikata study (n=20) compared a group taking soup-like rice porridge (made with water and some salt) at 5.5 hours preoperatively together with clear fluids up to five hours, versus a group taking clear fluids up to five hours preoperatively. The Meakin

study compared groups taking two biscuits and squash with groups taking squash alone, at both two to four and four to six hours preoperatively.

Meta-analysis of the three comparisons (n=116) found little difference in gastric volume between the solid-plus-fluids and the fluids alone shortened fasts. The pH was non-significantly in favour of the shortened solid fast.

For **biscuits** (two comparisons; n=96), there was little difference between the shortened and standard fasts for either gastric volume or pH. For the **rice porridge (n=20)**, the pH outcome results non-significantly favoured the solids fast, but the results were inconclusive for the gastric volume. Children receiving solid food were less hungry than those receiving fluids only, but the result was not significant.

The GDG concluded there was insufficient evidence from these studies to draw conclusions about the type of solid preferred.

The limited evidence relating to solids was discussed by the GDG. Discussion was also aided by the following additional background information.
1) The ASA recommendation: “It is appropriate to fast from intake of light meal (toast and clear liquid) or non-human milk for six or more hours before the elective surgical procedure requiring anaesthesia. Fried or fatty food or meat may prolong gastric emptying time. Both the amount and type of food/non-human milk ingested must be considered when determining an appropriate fasting period.” (ASA, 1999; AAGBI, 2001)

2. Gastro-physiological studies on healthy volunteers or non-surgical patients (Petring and Blake, 1993; Maltby, 2000) have shown that, generally, fluids leave the stomach more rapidly than solids. Factors determining the emptying rate of fluids include the gastric volume, the osmolarity and caloric content. The digestive process for solid food is slower. Solids can pass through the stomach as slowly as 12 or more hours depending on the volume, content and a variety of other factors such as anxiety, medication and gastrointestinal disorders (Dowling, 1995).

Taking all these factors into consideration, the GDG's consensus view was to err on the side of caution and recommend a minimum fasting time of six hours from solid food. They felt there was insufficient evidence to allow recommendations to be made about the nature of food consumed, and that staff had no control over the intake prior to the patient's arrival in hospital.

Current clinical guidelines (ASA, 1999; AAGBI, 2001) recommend a minimum fasting time of six hours for solid food, which is supported by the GDG.

D) Chewing gum and sweets during a restricted fasting period

RECOMMENDATIONS

Grade	Recommendation
D(GPP)	Chewing gum should not be permitted on the day of surgery.
D	Sweets (including lollipops) are solid food. A minimum preoperative fasting time of six hours is recommended.

EVIDENCE

Level of evidence	Evidence statement
4	Following discussion, the GDG decided that children should not be allowed to have chewing gum because of the risk of swallowing it.
1+	For the intake of sweets: a lollipop given 30 to 60 minutes preoperatively resulted in a statistically significant increase in gastric volume (0.24 ml/kg) and little difference in pH compared with no lollipop.
4	Following discussion, the GDG decided that sweets were solid food and should have the same recommendations.

CLINICAL EVIDENCE

a) Chewing gum

There was no evidence found on the effects of chewing gum preoperatively in children. The GDG's consensus view was that the evidence for adults should not be extrapolated to children and that there was a risk of swallowing gum in children. They therefore agreed to recommend that children should not be allowed chewing gum on the day of surgery.

b) Sweets (Appendix B12)

One study (Stanley et al., 1989) gave evidence on the effect of sweets on gastric volume and pH. Children were given a lollipop containing either fentanyl citrate or no drug. A third group received no lollipop. The relevant comparison was lollipop (without fentanyl) given 30 to 60 minutes preoperatively versus no lollipop (n=37). Results showed a statistically significant increase in the gastric volume (mean 0.24 ml/kg) in favour of the standard fast. The pH outcome showed little difference between interventions. The secondary outcome measures of postoperative nausea and postoperative vomiting had inconclusive results (wide confidence intervals), but the number of children with little or no anxiety was of borderline significance (p=0.09) in favour of the lollipop.

The GDG concluded that lollipops should not be given to administer premedication, and agreed that sweets in general were a type of solid food and therefore should not be given less than six hours preoperatively.

E) Pharmacological interventions

1. Concurrent medications

RECOMMENDATIONS

Grade	Recommendation
D(GPP)	Regular medication taken orally should be continued preoperatively unless there is advice to the contrary.

D(GPP)	Up to 0.5 ml/kg (up to 30 ml) of water may be given orally to help children take their medication.

EVIDENCE

Level of evidence	Evidence statement
4	Following discussion, the GDG decided that most oral medications for concurrent conditions are tolerated well throughout surgery and do not interfere with anaesthesia, and that withdrawal of oral medication can put the patient at risk of complications.

CLINICAL EVIDENCE

The GDG agreed that most oral medications for concurrent conditions are tolerated well throughout surgery and do not interfere with anaesthesia, and that withdrawal of oral medication can put the patient at risk of complications. Some drugs (for example, ACE inhibitors) may need special care and the anaesthetic team should decide the course of action for each patient. Further discussion is outside the scope of the guideline.

The GDG considered the need for children to have a drink to help them take medication during the fasting period, and whether this constituted a break in the fast. They decided this was acceptable provided the volume did not exceed 0.5 ml/kg, up to a maximum of 30 ml.

2. Premedication in healthy patients

RECOMMENDATIONS

Grade	Recommendation
A	Administration of premedication as currently practised, for example benzodiazepines, does not appear to affect the fasting recommendations for water and other clear fluid.

EVIDENCE

Level of evidence	Evidence statement
1++	Sub-group analysis showed that, in the absence of premedication, there was little difference in gastric volume and a small statistically significant increase in the pH (0.12) for an intake of water and other clear fluid up to two hours, compared with a standard fast.
1+	In the presence of both opioid and non-opioid premedication there was little difference between shortened and standard fasts for the pH, and for the gastric volume for the non-opioid sub-group. There was uncertainty in the volume for the opioid group.
1-	There is insufficient evidence to draw conclusions about the importance of the type of premedication.
1+	One small study in healthy patients (n=37) showed little difference in gastric pH between groups having a lollipop with and without added fentanyl citrate, but the effect on gastric volume was uncertain.

CLINICAL EVIDENCE (Appendix B14)

Premedication may influence the rate of gastric emptying. Drugs that inhibit gastric emptying include opioids, anticholinergics (such as atropine) and beta-agonists. Airway reflexes are impaired by premedication with diazepam (Ng and Smith, 2002).

The effect of premedication was studied **in the context of a shortened fast that permitted some fluid or solid**. Two approaches were taken:

- Randomised head-to-head comparisons of different premedications (or none) for patients who all had a shortened fast.
- Sub-group analyses within the main review, splitting the comparisons of shortened and standard fasts according to the type of premedication.

No studies were included that looked at head-to-head comparisons of different pharmacological interventions under standard fasting conditions.

Premedication was classified into opioid-based, non-opioid based (usually benzodiazepines) and none. For some studies the number of patients receiving premedication was not clear.

Head-to-head randomised comparisons

Only one small study compared premedication with none in the presence of a shortened fast (Stanley et al., 1989, n=37). This study gave children a lollipop with added fentanyl citrate to investigate the effects of premedication on gastric volume and pH, and secondary outcomes. There was little difference for pH between groups having a lollipop with and without fentanyl citrate, but the confidence interval for the gastric volume was too wide to draw conclusions. The children were statistically significantly less anxious (1.6 times less risk) when premedication was given, but the effect on nausea and vomiting was uncertain.

Sub-group analyses within the main review were carried out, splitting the comparisons of shortened and standard fasts according to the type of premedication. The review was initially divided into sub-groups of opioid-based, non-opioid based (usually benzodiazepines) and none. Only the studies in children, without H_2RAs were analysed.

No premedication

In the absence of premedication, there were 13 comparisons (n=844) of shortened and standard fasts. Meta-analysis showed heterogeneity for both gastric volume and pH. This was largely caused by one study (Moyao Garcia et al., 2001) – sensitivity analysis without this study removed the heterogeneity and showed a statistically significant, but clinically small increase in pH (0.12 units) and little difference for the gastric volume.

Two studies (Aun and Panesar, 1990; Schreiner et al., 1990, n=135) had opioid **premedication**. There was little difference between shortened and standard fasts for gastric volume or pH.

One study (Goresky et al., 1992, n=99) in the **non-opioid** sub-group gave the children benzodiazepines as premedication. There was little difference between shortened and standard fasts for the pH, but the confidence interval was wide for the gastric volume.

Combining the two premedication groups, meta-analysis of three comparisons (n=234) showed little difference between groups for either gastric volume or pH.

The limited evidence suggests that premedication does not affect the gastric volume or pH when water and other clear fluid are given in a shortened fast up to two hours preoperatively. However, there are too few studies giving premedication to draw reliable conclusions about the effect of different types.

3. Histamine-2 receptor antagonists

This section is concerned with studies of healthy patients given H_2RAs.

RECOMMENDATIONS

Grade	Recommendation
D	The routine use of H_2RAs is not recommended for healthy children.

EVIDENCE

Level of evidence	Evidence statement
1+	Individual patient data in one study showed that some children receiving an H2RA had increased pH values, but for others the H_2RA was ineffective or had only a small effect.

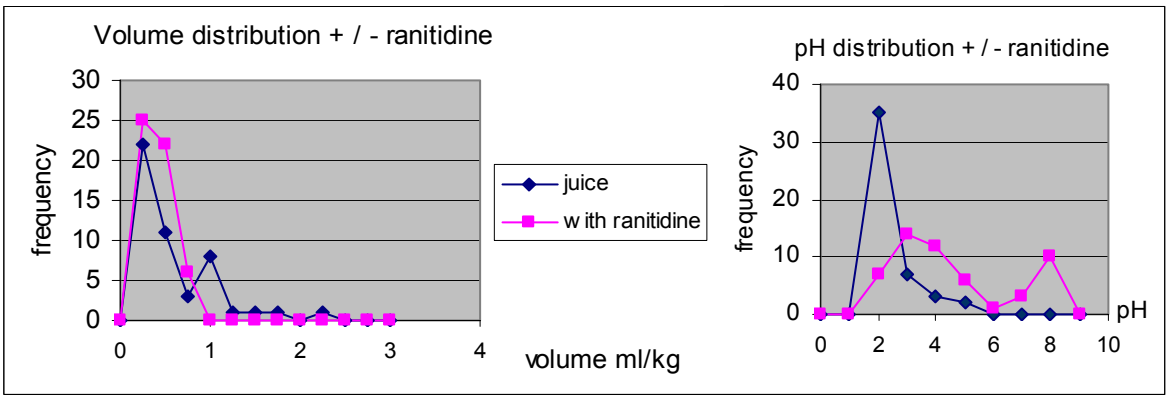
1++	In healthy children, addition of an H_2RA in the presence of a shortened fast gave statistically significant decreases in volume (mean 0.13 ml/kg) and acidity (mean increase in pH 2.3).
1+	In healthy children given H_2RAs, there was little difference in gastric volume or pH between the standard fast and fluids given up to two hours preoperatively.
1+	In healthy children, addition of a PPI the previous night and three hours preoperatively, in the presence of a shortened fast, gave statistically significant decreases in volume (mean 0.44 ml/kg) and acidity (mean increase in pH 3.0).
4	GDG conclusions were that H_2RAs are not effective in all patients, they are relatively expensive and relatively slow acting, and they should not be used in healthy patients.

CLINICAL EVIDENCE

The function of H_2RAs is to reduce the secretion of gastric acid and pepsin, which in turn reduces both the gastric volume and the acidity (and increases the pH). H_2RAs are not widely used except for higher risk patients because they are not effective in all patients; they are relatively expensive and relatively slow acting.

This lack of effectiveness was demonstrated by one study (Goresky et al., 1992), which provided individual patient data. Figure 4 shows the distribution of gastric volumes and pH for a set of 100 patients, who were given apple juice with or without ranitidine up to two hours preoperatively. The pH distribution shows a clear double peak for the ranitidine group, indicating that while some patients had increased pH values, for many the ranitidine was ineffective or had only a small effect. The GDG agreed to recommend that healthy children should not be given H_2RAs.

Fig 4. Individual patient data for Goresky study



The review identified three studies in healthy children in which H_2RAs were given (Gombar et al., 1997; Goresky et al., 1992; and Sandhar et al., 1989) and two studies in which PPIs were taken (Mikawa et al., 1995; and Nishina et al., 1994). The GDG's view was that these studies were really only useful in that their results might be extrapolated to higher-risk patients. The analyses are included in this section, however, partly because the studies are in healthy children and partly in order to keep the pharmacological intervention data together, but their application is to higher-risk patient groups (section 7.2).

Comparison of shortened and standard fasts in the presence of H_2RAs for healthy patients (Appendix B15)

Two studies (Goresky et al., 1992; and Sandhar et al., 1989) compared shortened and standard fasts in which all patients were given H_2RAs. Patients in these studies received fruit juice (apple and orange respectively) up to two hours preoperatively. Meta-analysis (n=133) showed little difference between shortened and standard fasts for both volume and pH.

Head-to-head comparisons with versus without H_2RAs (Appendix B15)

Two comparisons (Goresky et al., 1992; and Gombar et al., 1997) randomly allocated healthy children to groups receiving or not receiving an H_2RA, in addition to having fluids up to two or three hours preoperatively. Meta-analysis (n=151) showed large, statistically significant decreases in gastric volume and acidity for the group receiving H_2RAs – the mean decrease in volume was 0.13 ml/kg and the mean increase in pH was 2.3 units.

The GDG agreed that the Goresky data supported their view that H_2RAs should not be widely used, except for higher-risk patients because they are not effective in all patients. In addition, they noted that H_2RAs are relatively expensive and slow-acting pharmokinetically. On this basis, the GDG recommended that healthy children should not be given H_2RAs, but agreed that the evidence for healthy children could be extrapolated for application in higher-risk patients.

Head-to-head comparison with versus without PPIs (Appendix B15)

Two studies (Mikawa et al., 1995 and Nishina et al., 1994) randomly allocated healthy children to groups receiving a PPI or a placebo, in addition to taking apple juice up to three hours preoperatively. Three groups in each study received a PPI: at 9 pm the previous night, at 5 am (three hours preoperatively) or at both times; the other group received a placebo at both times. Meta-analysis of the two studies, for the different comparisons with placebo, showed large, statistically significant decreases in gastric volume and acidity for the groups receiving PPI, except for the pH in the groups receiving PPI at 5 am only: this analysis showed heterogeneity. We concluded that the most effective approach was to give PPIs at both times and for this comparison with placebo (n=102), the mean decrease in volume was 0.44 ml/kg and the mean increase in pH was 3.0 units.

7.2 Preoperative fasting in higher-risk groups

Higher-risk groups consist of patients with conditions or diseases likely to cause an increased risk of regurgitation and aspiration, such as (untreated) gastro-oesophageal reflux and diabetes. In this guideline, and in clinical practice, the expression ‘higher-risk’ does not, as in some publications, refer to patients having a gastric volume above, or a pH below, a given threshold.

7.2.1 Results of clinical effectiveness evidence retrieval and appraisal

A) Characteristics of studies included in the review

One randomised study (Nicolson et al.,1992; n=100) described in the Cochrane Review was included in the higher-risk category. The study was in patients aged less than six months to five years who were undergoing heart surgery (ASA categories II-IV). Patients were excluded if they had a history of gastrointestinal disease, or were taking medication known to affect gastric contents. The study investigated the incidence of regurgitation or aspiration, but found none.

B) Methodological quality of included studies

A summary of the methodological quality is shown in Appendix B3.

The Nicolson study was moderate in size, with groups of fewer than 50 patients. The method of generating the randomisation sequence was evaluated as unclear and the allocation concealment as partially adequate. The assessor blinding was considered to be adequate, and the study had some withdrawals, but less than 20 per cent in any group. There was insufficient aspirate to measure the pH in at least 50 per cent in each group. Baseline characteristics were comparable across groups.

7.2.2 Guideline recommendations with supporting evidence reviews

RECOMMENDATIONS

Grade	Recommendation
D	Higher-risk patients‡ should follow the same preoperative fasting regime as healthy infants and children. In addition, the anaesthetic team should consider further interventions, as appropriate to the overall clinical situation#.
D	Patients undergoing emergency surgery should be treated as if they have a full stomach. If possible, the patient should follow normal fasting guidance to allow for gastric emptying.

EVIDENCE

Level of evidence	Evidence statement
1+	One randomised trial (n=100) in infants and children undergoing cardiac operations found little difference in pH between a group given clear fluids up to two hours and one having a standard fast; there was a wide confidence interval for gastric volume.
4	For obese children without reflux, GDG consensus was that they should be treated in the same way as non-obese children (i.e. be allowed water and other clear fluid up to two hours preoperatively).

‡ Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes.

Such as H_2RAs, gastrokinetic agents and proton pump inhibitors, together with rapid sequence induction, tracheal intubation and nasogastric tube.

4	For patients with gastro-oesophageal reflux, GDG consensus was that, in the absence of evidence, unless there are contraindications, these patients should follow the same preoperative fasting regime as healthy patients. Regular medication should be continued.
4	For patients with diabetes, GDG consensus was that preoperative management should be tailored to individual needs, and patients with autonomic neuropathies in diabetes should be treated separately.
4	In the absence of evidence, the GDG was concerned that paediatric patients undergoing bowel preparations were at risk of dehydration.
4	Overall, for higher-risk groups undergoing elective surgery, GDG consensus was that the anaesthetic team should consider using H_2RAs, gastrokinetic agents and PPIs in higher-risk patients before elective surgery.
4	For infants and children undergoing emergency surgery, GDG consensus was that, if possible, patients should follow normal fasting guidance to allow gastric emptying, and should be treated as if they have a full stomach.

CLINICAL EVIDENCE (Appendix B12)

This section is concerned with a range of patient groups considered to be at higher-risk of aspiration and/or regurgitation. The GDG considered the evidence for each separately, but also discussed higher-risk groups as a whole.

Higher-risk groups in general

One randomised study in infants and children (Nicolson et al., 1992, n=100) undergoing cardiac operations found little difference for pH between a group given clear fluids up to two hours preoperatively and a standard fast, but there was a wide confidence interval for the gastric volume.

The GDG's overall consensus was that, for all higher risk groups, the anaesthetic team should consider the use of H_2RAs, drugs that would increase the gastric motility (for example, metoclopramide) and PPIs (such as omeprazole). The GDG considered it acceptable to extrapolate to the higher-risk paediatric groups the conclusions from the review of studies using H_2RAs and PPIs in healthy patients (Section 7.1). These were that both H_2RAs and PPIs gave statistically significant decreases in gastric volume and large, statistically significant increases in pH in the presence of a shortened fluid fast. For patients given H_2RAs, there was little difference between shortened and standard fasts for fluids.

Obese children (defined as a body mass index of more than 30)

Obese children are included in the higher-risk group because their stomachs are compressed by the abdominal mass. The potential for aspiration problems may depend on whether the children have gastro-oesophageal reflux (Harter et al., 1998).

No randomised evidence was found for preoperative fasting in obese children. GDG consensus was to support widely recognised best practice (two hours for water and other clear fluid, four hours for breast milk and six hours for solids and other milk). The group agreed that obese patients (without reflux) should be treated in the same way as non-obese patients.

Patients with gastro-oesophageal reflux

No evidence was found for this patient group: patients with gastro-oesophageal reflux were excluded from the majority of randomised trials studied in the above reviews.

The GDG noted that patients with gastro-oesophageal reflux form a heterogeneous group and also include those receiving treatment (i.e. symptom free). In the absence of evidence, the consensus of the GDG was that, unless there are contraindications, these patients should follow the same preoperative fasting regime as healthy infants and children. Regular medication should be continued.

Patients with diabetes

Gastric emptying in diabetic patients varies and may be affected by other factors such as obesity. Some diabetic paediatric patients develop autonomic neuropathies, which results in delayed gastric emptying.

GDG consensus was that diabetes is a complex condition and that preoperative management should be tailored to individual needs. Patients with autonomic neuropathies in diabetes should be treated separately.

Bowel preparation

No studies or information were found. The GDG was concerned that paediatric patients were at risk of dehydration because of prolonged fasting and suggested that this should be a topic for research or audit.

Infants and children undergoing emergency surgery

Lacerations larger than 2.5cm, forearm fractures and other trauma have been reportedly associated with increased gastric volumes. Spinal cord injuries and, to a lesser extent, head injuries are also associated with delayed gastric emptying (Schuster-Bruce, 2000). In addition, alcohol or drug intoxication is often associated with trauma, and may also lead to delayed gastric emptying. In addition, distress may cause the patient to swallow air (aerophagia), which can put pressure on the lower gastro-oesophageal sphincter.

One prospective observational study in children aged one to 14 (n=110), who had sustained injuries requiring operations (Bricker et al., 1989), showed that the median volume of gastric contents was significantly larger when the interval

between eating and induction was four to six hours compared with six to eight hours.

The GDG discussed emergency surgery and noted that it was often not possible to predict when an emergency operation was likely to take place, with the exception of immediate operations, such as those dealing with compound fractures and brain haemorrhage. The GDG noted that gastric emptying usually stops when trauma occurs. Their consensus was that, if possible, patients should follow normal fasting guidance to allow gastric emptying to occur, and should be treated as if they have a full stomach.

7.3 Postoperative resumption of oral intake after elective surgery

7.3.1 Results of clinical effectiveness evidence retrieval and appraisal

A) Characteristics of studies included in the review

All included studies for the postoperative review of healthy paediatric patients are summarised in Appendix B16. Two large randomised studies in infants and children (Schreiner et al., 1992; and Kearney et al., 1998), and one non-randomised study in infants, children and adults (van den Berg et al., 1987) were identified.

All three studies were exclusively concerned with patients undergoing general anaesthesia, but none stated exclusion criteria. Both randomised studies reported that the children were ASA I-II. These studies had a range of types of day surgery all requiring an IV catheter. The non-randomised study had patients undergoing ophthalmic surgery.

The interventions and comparisons in the studies also varied: one (Kearney et al., 1998) compared a group in which oral fluids had to be tolerated before

discharge (i.e. mandatory), with a group that had oral fluids withheld for four hours (age under two years) or six hours (age two to16 years). The other study (Schreiner et al., 1992) compared a group receiving mandatory clear fluids (minimum 60 ml) prior to discharge, with a group allowed (but not required) to have fluids before discharge from the day surgery unit (DSU). The outcome measures included vomiting in the DSU and in the 24 hours post-discharge, and total vomiting. The non-randomised study compared a group offered small amounts of early fluids (as soon as the patient was awake) with one receiving later fluids (more than two or four hours depending on the patient's age).

None of the studies investigated differences between types of fluids offered postoperatively or different fluid volumes. Fluids offered were not specified. Different volumes were administered – from 30 ml given hourly to unlimited intake. No study investigated the effect of food.

The incidence of nausea and vomiting was a common outcome across the studies.

Excluded studies are reported in Appendix B17.

B) Methodological quality of included studies

A summary of the methodological quality of each of the studies is shown in Appendix B18.

The two randomised studies were large (range 128 to 525 per group); the non-randomised study was a prospective cohort study in infants, children and adults (Van den Berg et al., 1987), with 100 per group.

For the two randomised studies, the method of generating the randomisation sequence was evaluated as unclear – in both cases cohorts of infants and children were randomised to the interventions. Both studies were assessed to have unclear allocation concealment and unclear blinding of the outcome assessors. One study (Kearney et al., 1998) reported an *a priori* sample size calculation.

Neither study reported an intention to treat analysis – the Kearney study reported reassigning up to 7 per cent of non-compliant patients to the alternative group, and the Schreiner study had a small number of patients excluded.

Baseline characteristics were comparable across groups in both studies for several features. However, there were some important differences: the Kearney study reported significant differences in the type of surgery (the mandatory group had a significantly higher proportion of patients at higher risk of PONV because of the type of operation), and they also received a significantly lower volume of IV fluids. In the Schreiner study fewer of the mandatory group received anti-emetics and they were older and heavier.

The non-randomised study (van den Berg et al., 1987) was assessed to be of good quality – the first 100 patients were allocated to the early fluids group and the second 100 to the later fluids group.

7.3.2 Guideline recommendations, with supporting evidence reviews

RECOMMENDATIONS

Grade	Recommendation
A	Oral fluids can be offered to healthy infants and children when they are fully awake following anaesthesia, providing there are no medical, surgical or nursing contraindications.
D(GPP)	Clinicians should consider giving clear fluids or breast milk before introducing other oral intake.
A	Children and infants undergoing day surgery should not be required to drink as part of the discharge criteria.

EVIDENCE

Level of evidence	Evidence statement
1+	Evidence from two large randomised trials showed that significant increases in postoperative vomiting occurred if paediatric patients were required to drink fluids before discharge from hospital compared either with a fast for at least four hours or with elective drinking in the day surgery unit. There were some limitations to the studies. The GDG therefore recommended that fluids could be **offered** to infants and children as soon as they were fully awake from anaesthesia and able to communicate, unless there were medical, surgical or nursing contraindications.
4	The GDG's consensus view was that clear fluids and breast milk should be given before other forms of oral intake.

CLINICAL EVIDENCE (Appendix B19)

As described above, the postoperative studies have some methodological limitations, mainly because of imbalance in the patient characteristics. Both sets of study authors did carry out sensitivity analyses and sub-group analyses to investigate the effects of these, and concluded that these imbalances did not account for the differences between groups. The evidence is summarised in Appendix B19.

One large randomised trial (Kearney et al., 1998; n=317) compared unrestricted amounts of mandatory fluids before discharge from hospital, with fluids withheld for four to six hours in the day surgery unit (DSU). Outcome measures included vomiting in the DSU and vomiting 24 hours post-discharge. The groups were similar in the proportion of patients treated with anti-emetics (about 35 per cent) and the proportion receiving morphine (about 70 per cent), but there were

significant differences in the proportion undergoing surgery with a higher risk of PONV (40 per cent for mandatory and 28 per cent for withheld).

There was a statistically significantly larger risk (twice) of vomiting in the DSU when the patients were required to have oral fluids before discharge (this corresponded to a number needed to harm (NNH) of 6). Twenty-four hours after the operation, the risk was no longer significant, but still favoured the withholding of fluids. Overall, the risk of vomiting postoperatively was increased by 1.5 times when mandatory fluids were given (NNH was 6). For the large sub-group of patients not receiving higher risk surgery there was still a statistically significant increase in vomiting in the DSU for the mandatory group (RR 1.95; 95%CI 1.19, 3.19) and the incidence after 24 hours favoured withholding fluids.

A second large randomised study (Schreiner et al., 1992, n=1002) compared mandatory fluids (minimum 60 ml) before discharge from hospital, with elective fluids (infants and children were allowed, but not required, to drink before discharge) in the DSU. Outcome measures included vomiting in the DSU and vomiting 24 hours post-discharge. The groups were similar in the proportion of patients receiving opioid analgesia (about 10 per cent), but there were significant differences in the age and weight of the patients, and in the proportion treated with prophylactic anti-emetics (5 per cent for mandatory and 9 per cent for withheld).

There was a statistically significantly larger risk (1.6 times) of vomiting in the DSU when the patients were required to take oral fluids before discharge (this corresponded to a number needed to harm of 11). Twenty-four hours after the operation there was little difference between the groups. The total risk of vomiting postoperatively was increased by 1.2 times when mandatory fluids were given (NNH was 14). Sensitivity analyses without the patients receiving prophylactic anti-emetics were reported not to change the outcome of the analyses.

Both studies considered the effect of opioids, age and operation type on postoperative vomiting, but there was insufficient evidence to draw conclusions because the data were divided too much.

Although the studies compared different interventions, we considered it reasonable to combine them in a meta-analysis to give a comparison of mandatory fluids versus withheld or elective fluids. The meta-analysis (two studies, n=1306) showed statistically significantly more (1.7 times the risk) vomiting in the DSU when patients were required to drink before discharge from hospital (NNH 9); there was no heterogeneity found. There were no significant differences after 24 hours. Overall, vomiting was significantly more likely (1.3 times risk; NNH 9) when mandatory fluids were given.

One prospective non-randomised study was identified (van den Berg et al., 1987, n=200), a prospective cohort study in infants, children and adults that compared an early intake with a later one. The proportions of infants and children, and adults in this study were not stated. In one group, up to 30 ml fluid were offered hourly at one to two hours postoperatively, while the other group had no oral intake for at least two hours for paediatric patients and four hours for adults following general anaesthesia. There was no significant difference in the incidence of vomiting.

None of the studies investigated differences between the type or volume of fluids offered to patients postoperatively. Thus there is insufficient evidence to make recommendations on the type or volume of intake. ASA guidelines (2002) on post-anaesthetic care recommend that the requirement of drinking clear fluids should not be part of a discharge protocol for healthy paediatric patients.

The GDG considered the evidence, and agreed that fluids could be offered to patients as soon as they were fully awake from anaesthesia and able to communicate, unless there were medical, surgical or nursing contraindications. It was preferable to treat each patient individually, with the input of an interdisciplinary team including surgical opinion. Drinking fluids should not be required as part of the discharge criteria. The GDG recommended that clinicians should consider giving clear fluids or breast milk before introducing other oral intake.

Postoperative fasting following other types of surgery

The postoperative sections of the guideline are restricted to healthy patients undergoing routine, uncomplicated surgery. Studies investigating oral feeding after gastrointestinal or major abdominal surgery were not included as this was considered to be the responsibility of the surgical team.

8. Comparison between the adult and paediatric reviews

The majority of the studies in the adult preoperative review gave the patients water and few studies looked at the effect of other clear fluids. This is in contrast to the paediatric review, where the reverse was found. Many children are reluctant to drink plain water and prefer fruit drinks, whereas adults are willing to drink water; thus, the types of fluid given in the studies reflect patients' preferences. It is notable that the meta-analysis of three RCTs in the adult review for clear fluids found a small, statistically significant difference in gastric volume (3 ml) in favour of the standard fast – this was not found for the 13 paediatric studies, which showed little difference in the gastric volume. The statistically significant decrease in gastric volume found for the adult review for water was not found for the three comparisons in the paediatric review, but this may be due to insufficient numbers of studies in the latter, or a faster rate of gastric emptying of clear fluids in children.

The rapid turnover of body fluids in paediatric patients (two to three times greater in the smallest infants compared with adults) is associated with a much increased risk of dehydration if they are allowed to fast for a prolonged period of time (Bissonett, 1996). Therefore, if an operation is likely to be delayed beyond two hours it is advisable to give oral fluids.

In the adult postoperative review, a large randomised trial showed that the number of patients vomiting was not affected by how soon the adults received fluids, but, for paediatric patients, there was a statistically significant increase in vomiting if they had mandatory fluids before discharge. Therefore the GDG recommended that infants and children should not be required to drink before discharge, but saw no reason to specify this for adults.

In terms of the recommendations, the adult and paediatric reviews differ in the following ways:

- Chewing gum is not recommended for children, but is allowed up to two hours preoperatively in adults.

- It is recommended that infants and children undergoing day surgery should not be **required** to take oral fluids before discharge, but this recommendation is not needed for adults. Both patient groups should be **offered** fluids.

- The risk of dehydration and excessive thirst is critical in paediatric patients (especially infants) if operations are delayed and this is reflected in the more explicit recommendation in the paediatric review that drinks should continue to be given up to two hours preoperatively.

9. Recommendations for research

On the basis of its review of the evidence, the GDG has made the following recommendations for research. Research in these areas is important to enable improvements to be made in guidance and patient care.

- Is the type of clear fluid important? For example, what is the effect of osmolarity? And how useful are isosmolar solutions?
- Is there a significant difference between clear fluids and carbonated drinks?
- When should the last feed of breast or formula milk be given preoperatively to infants?
- At what time preoperatively is it safe to give patients a light snack?
- When can tea and coffee (with milk) be given safely preoperatively?
- Does preoperative fasting alter the incidence of postoperative nausea and vomiting?
- What are the fasting recommendations for patients undergoing bowel preparations?
- What type and quantity of oral fluid or food can be given postoperatively?
- Are there other important factors that limit the intake of oral fluids or foods postoperatively? For example, operation type, patient age, effect of opioids?

10. Audit criteria

Clinical audit criteria are defined as 'systematically developed statements that can be used to assess the appropriateness of specific health care decisions, services and outcomes' (Field and Lohr, 1992). Audit criteria are explicit statements, based on research evidence (where possible), that define what is being measured and represent elements of care that can be measured objectively.

In keeping with NICE methodology, we have not set standards for audit against which compliance should be measured (for example, 100 per cent of patients referred to the specialist immediately). Instead, the GDG and RCN Institute staff have used key recommendations from the guideline as a broad basis for audit criteria that can be developed for national or local audits. These general audit criteria have also taken into account the RCoA's publication, *Raising the Standard. A compendium of audit recipes* (RCoA, 2000), and should be read alongside the *Perioperative fasting algorithm*.

Plans for a national web based audit tool are in place, creating emphasis on the importance of implementation of this guidance. This builds on the innovative work currently being tested by the Quality Improvement Programme, RCN Institute in the area of venous leg ulcers, supported by the Healthcare Commission.

Possible objectives for an audit

- To ensure that the management of perioperative fasting follows evidence based guideline recommendations.

People that could be included in an audit:

- All patients undergoing elective surgery.
- All staff and carers who work or have close associations with patients undergoing planned elective surgery.

Measures that could be used as a basis for an audit

Criterion	Exception	Definition of terms
• Water (clear fluid) is taken up to two hours before induction of anaesthesia.	The higher-risk patient that the anaesthetic team treats differently. Contraindications.	Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes. 'Up to two hours': two hours is the recommended minimum time before induction of anaesthesia for that patient, but the patient should also be encouraged to take fluids as close as possible to two hours preoperatively.
• Breast milk is taken up to four hours preoperatively.	The higher-risk patient that the anaesthetic team treats differently. Contraindications.	Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes. 'Up to four hours': four hours is the recommended minimum time before induction of anaesthesia for that patient, but the patient should also be encouraged to take breast milk as close as possible to four hours preoperatively.

Criterion	Exception	Definition of terms
• The patient fasts from solids, formula milk, cows' milk and milk-containing drinks for at least six hours preoperatively.	The higher-risk patient that the anaesthetic team treats differently. Contraindications.	Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes. Fast for '**at least** six hours': six hours is the recommended minimum time solids can be taken before induction.
• The anaesthetic team gives the higher-risk patient further interventions.	Healthy patients.	Higher risk of regurgitation and aspiration; patients include those with obesity, gastro-oesophageal reflux and diabetes. Further interventions such as H_2 receptor antagonists, sodium citrate, gastrokinetic agents and proton pump inhibitors, together with rapid sequence induction, tracheal intubation and nasogastric tube.
• a) Postoperatively, oral fluids are *offered* to healthy patients when they are fully awake. b) The infant or child is not *required* to drink as part of the discharge criteria.	Non-routine, complicated surgery. Gastrointestinal or major abdominal surgery. Contraindications.	5b) is not a criterion for adults.

11. Dissemination of the guideline

The aim of the present guideline is to improve the care of patients undergoing surgery through implementation of perioperative fasting recommendations that are supported by an evidence-based process. It follows that failure to get these recommendations into practice would ultimately be failure of the guideline itself.

The survey of anaesthetists in the UK (Hebballi et al., 2002) showed that uptake of the ASA 1999 guideline was incomplete. Whilst incorporating additional evidence, the current guideline reaches very similar conclusions to the ASA guideline, so it might be thought that uptake of the new guideline would be

similarly incomplete. However, the current guideline is expected to have more impact because it was prepared by an interdisciplinary group commissioned by the RCN and targets the multidisciplinary team. These factors should help acceptance of the guideline, but significant improvements will only be achieved with good dissemination and implementation strategies.

A recent systematic review of guideline dissemination and implementation identified a number of different approaches that may be helpful to the process. (Grimshaw et al., 2004). These included educational strategies, feedback on performance, mass media campaigns and facilitative approaches (for example, educational outreach and opinion leadership). A research team of members from the RCN and the RCoA are funded to conduct a randomised trial that measures the effectiveness of two such strategies, in comparison with standard dissemination methods, using the current perioperative fasting guideline. The research team will report their findings in 2008.

In addition to this research, the following implementation tools will be produced to complement the technical report and focus on implementation of the guideline. These are:

- Short version of the guideline. This has an executive summary; key recommendations for implementation; all other recommendations; audit criteria; and research recommendations.
- Quick reference guide. Presented as an A2 poster, with the perioperative fasting algorithm, supplemented by key recommendations and strap lines.
- Patient information leaflet. Written for patients by a patient, using the guideline's key messages and encouraging patients to be directly involved in their perioperative fasting care.
- Web-based resource, enabling practitioners and patients to use web-based media to look at key messages in an interactive way. This is expected to incorporate innovative tools such as an algorithm wallpaper as a desktop background, and a screen saver reminding clinicians of key recommendations.

In terms of the practicalities of implementing the guideline, the GDG recognises that there may be difficulties introducing individual patient fasting regimens. In order to do this it is necessary to know the time when each patient will have their operation. This is frequently difficult to establish at the time of booking the operation due to unexpected changes in the starting times or changes in the order of operating lists, last minute cancellations etc. The Royal College of Anaesthetists has referred to some of these difficulties in their *Raising the standard* document (see www.rcoa.ac.uk).

The GDG has made the following suggestions for implementing the current guideline in healthy patients:

Solid food, milk and milk-containing drinks

All patients should be advised to stop taking solid food, milk and milk containing drinks six hours before the scheduled start of the operating list. In practice, the recommendation of a six-hour *minimum* fasting time leaves little or no room for variation after the start of the operating list.

Clear fluids

The GDG suggests the following two-stage procedure. All patients should be advised to stop clear fluids two hours before the start of the operating list. When the time of each patient's operation is known, the anaesthetist should decide the time of last fluid intake (usually two hours before the operation). Easily seen dry-wipe boards could be provided within the patient's bed space indicating the time of last fluid intake.

We also recognise that there is a substantial element of patient responsibility involved in fasting, especially for day surgery, when the patient takes charge of their own intake of food and drink before arrival at the hospital. For children, this responsibility is likely to fall on the parents and carers, who need to be vigilant about their child's oral intake. Other groups of patients (for example, those with eating disorders and people with mental impairment) may also have difficulties complying with fasting recommendations.

12. Validation

The guideline has been peer reviewed by the main external professional bodies and relevant organisations. The members of the Peer Review Group were as follows.

- Association of Paediatric Anaesthetists of Great Britain and Ireland: Council members: Dr Robert Bingham, anaesthetic consultant, Great Ormond Street Hospital, London; Dr Neil Morton, consultant in paediatric anaesthesia, Royal Hospital for Sick Children, Glasgow; Dr Monica Stokes, consultant anaesthetist, Birmingham Children's Hospital; Dr Kathy Wilkinson, consultant anaesthetist, Norfolk and Norwich University Hospital and Honorary Secretary APAGBI.

- Dr Robin Correa: consultant anaesthetist, University Hospital Coventry and Warwickshire.

- Liz McInnes: senior research and development fellow, NICE Collaborating Centre - Nursing and Supportive Care, Oxford.

- National Association of Theatre Nurses: C Allen, theatre services manager, Murrayfield Hospital, Edinburgh, and Chairman Anaesthetic and Recovery Forum.

- Preoperative Association: Dr John Carlisle (Chairman) and consultant anaesthetist, South Devon Healthcare NHS Trust, and members: Dr Paul Knight, consultant anaesthetist, Calderdale Royal Hospital; Dr John Watt, research and development lead clinician, Southport and Formby District General Hospital; Dr Nelson Richard, consultant in anaesthesia, Countess of Chester Hospital; Dr Chris Earlam, consultant anaesthetist, Hope Hospital, Salford.

- Royal College of Anaesthetists: Council members.

- Dr Eileen Scott: research and development co-ordinator, North Tees and Hartlepool NHS Trust, and Chair RCN Perioperative and Surgical Nursing Forum.

- Joanna Smith: lecturer child health nursing, University of Leeds, and RCN Children's Surgical Nursing Forum.

13. Scheduled review of the guideline

The guideline is scheduled to be reviewed in 2009.

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Appendix 1: Guideline scope

The guideline development process adheres to the methodologies adapted by national guideline development programmes, such as the Royal College of Nursing (RCN), the National Institute for Clinical Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (SIGN). Information about their processes can be found on the relevant web sites:

- **www.nice.org.uk**
- **www.rcn.org.uk**
- **www.sign.org.uk**

This document is the scope. It defines exactly what this guideline will (and will not) examine. It also defines what the guideline developers will consider.

Questions to be addressed in the guideline are:

1. What is the optimal duration of perioperative fasting for adults and children in relation to intake of water, chewing gum, clear fluids, other fluids and solids?
2. What is the optimal fasting regimen in terms of type?
3. What is the optimal fasting regimen in terms of amount that may be permitted perioperatively?
4. To what extent does the evidence base support the need for different fasting regimes for higher-risk patient sub-groups such as those who are pregnant, older people, those who are obese, those with diabetes and patients who have sustained some form of trauma?

The specific areas that will be addressed by the guideline are described in the following sections:

A) Population

Groups that will be covered

The guideline recommendations will apply to all patient groups.

Age of paediatric patients will be categorised within the following headings:

- Preterm infants — below 38 weeks (age adjusted for gestation).
- Neonates — 0 to 28 days (age adjusted for gestation).
- Infants — 29 days up to 1 year (age adjusted for gestation).
- Children — one to two years; three to five years; and six years and older.

Sub-groups of the guideline population that will be considered include:

- those in pain
- diabetics
- children and older people
- pregnant women
- those with a history of gastrointestinal disease
- those who are obese
- trauma patients.

Note that this is not an exhaustive list.

Groups that will not be covered

None.

B) Health care setting

1. The guideline may be of relevance to staff preparing day case or in-patients for surgery that will include the administration of general anaesthesia.
2. The guideline will be of relevance to patients (and carers of patients) about to undergo surgical interventions that will lead to the administration of a general anaesthetic and will also help guide and inform patients and carers about perioperative fasting practices.
3. The evidence considered will be based on fasting prior to general anaesthesia. The guidelines will not directly consider fasting prior to other types of anaesthesia - for example, regional - but may be of

relevance where it is likely that an intervention may be extended to the administration of a general anaesthetic.

4.3 Clinical management

The guideline will include information on:

a) The duration of total (nil-by-mouth) fast preoperatively.

b) The type(s) of fluid/food permitted during a restricted preoperative fasting period.

c) The duration of this restricted fasting.

d) The amount of fluid/food that may be permitted during this restricted intake period.

e) The use of perioperative medication including premedication.

CLINICAL APPLICATION

May include the following:

- surgical lists
- patient compliance
- patient information (patient version of the guideline).

Appendix 2: American Society of Anesthesiologists (ASA) physical status classification system

Class I	A normal healthy patient.
Class II	A patient with mild systemic disease.
Class III	A patient with severe systemic disease.
Class IV	A patient with severe systemic disease that is a constant threat to life.
Class V	A moribund patient who is not expected to survive without the operation.
Class VI	A declared brain-dead patient whose organs are being removed for donor purposes.

Source: **www.asahq.org**

Appendix 3: Search strategies

A) MEDLINE search strategy 1 for preoperative and postoperative fasting

MEDLINE(R) 1966 – 2005/January (SilverPlatter ASCII 3.0)

1	an?esth*
2	explode "Anesthesia"/ all subheadings
3	#1 or #2
4	fasting* or fasted* or starv* or feed*
5	pre?oper* or pre?proced* or pre?surg* or pre?anesth* or pre?anaesth*
6	post?oper* or post?proced* or post?surg* or post?anesth* or post?anaesth*
7	explode "Fasting"/ all subheadings
8	explode "Preoperative-Care"/ all subheadings
9	explode "Post-operative-Care"/ all subheadings
10	#4 or #7
11	#5 or #8
12	#6 or #9
13	#10 and #11
14	#10 and #12
15	human in TG
16	#13 and #15
17	#14 and #15
18	#3 and #16
19	#3 and #17
20	fluid* or drink* or water*
21	#20 and #3
22	#21 and #15
23	#22 and #11
24	"nil by mouth" or NPO or "nulla per os" or "nothing by mouth"
25	#24 and #15
26	anti?aspiration*
27	aspiration
28	pneumonia
29	aspiration pneumonia
30	pneumonitis
31	regurgitation*

32	#26 or #27 or #28 or #29 or #30 or #31
33	intra?operative complication* or post?operative complication*
34	complication* and #3
35	explode "Intraoperative-Complications"/ all subheadings
36	explode "Post-operative-Complications"/ all subheadings
37	explode "Pneumonia-Aspiration"/ all subheadings
38	#32 or #37
39	#38 and #15
40	#39 and #3
41	#33 or #34 or #35 or #36 or #38
42	#41 and #15
43	#42 and #3
44	#43 and #15
45	gastric
46	volume or content*
47	gastric next volume
48	gastric next content*
49	#47 or #48
50	#40 and #49
51	#50 and #15
52	#23 and #15
53	#40 and #15

This part of the search strategy, which contained both free text terms (including alternative spellings) and MeSH terms, was also combined with **highly sensitive search strategy for RCTs** as described in the Cochrane *Handbook for Systematic Reviews of Interventions* Available from **www.cochrane.org**

B) MEDLINE search strategy 2 for postoperative fasting and resumption of oral intake

MEDLINE(R) 1966 - 2005/February (SilverPlatterASCII 3.0)

1	explode "Postanesthesia-Nursing"/ all subheadings
2	liquid* or fluid* or drink* or water*
3	food* or feed* or nutrition* or solid*
4	post?anaesthe* or post?anesthe*
5	"after an?esthesia"
6	#1 and #2
7	#1 and #3
8	#1 or #4 or #5
9	#8 and #2
10	#8 and #3
11	human in TG
12	#6 and #11
13	#7 and #11
14	#8 and #11
15	#9 and #11
16	#10 and #11
17	#1 and #11
18	oral fluid*
19	anaesthe* or an?esthe*
20	#18 and #19 and #11
21	surg*
22	recovery
23	after surgery
24	#21 near #22
25	#24 or #23
26	#25 and #2 and #11
27	#26 in TI, AB
28	#26 in TI
29	#26 in AB
30	post?operative

31	#30 and #2 and #11
32	oral*
33	#31 and #32
34	#30 and #3 and #32 and #11
35	random*
36	#33 and #35

C) EMBASE search strategy for preoperative and postoperative fasting

SilverPlatterASCII 3.0WINNEMBASE (R) 2005/February

1	an?esth*
2	explode "anesthesia"/ all subheadings
3	#1 or #2
4	(human* in DEM) or (human* in DER) or (human* in DRR) or (human* in EC)
5	#3 and #4
6	pre?oper* or pre?proced* or pre?surg* or pre?anaesth* or pre?anesth*
7	post?oper* or post?proced* or post?surg* or post?anaesth* or post?anesth*
8	explode "preoperative-care"/ all subheadings
9	explode "preoperative-period"/ all subheadings
10	explode "post-operative-care"/ all subheadings
11	explode "post-operative-period"/ all subheadings
12	#6 or #8 or #9
13	#7 or #10 or #11
14	fasting* or fasted* or starv* or feed* or depriv*
15	explode "diet-restriction"/ all subheadings
16	#14 or #15
17	#12 and #16 and #5
18	#17 and #4
19	#13 and #16 and #5
20	#19 and #4
21	fluid* or drink* or water* or hydrat*
22	food* or eat* or nutrition*

23	#21 or #22
24	#23 and #5 and #12
25	#24 and #4
26	#23 and #5 and #13
27	#26 and #4
28	"nil by mouth" or NPO* or "nulla per os" or "nothing by mouth"
29	#28 and #5
30	#29 and #4
31	anti?aspiration* or aspiration* or pneumonia* or pneumonitis or regurgitation*
32	intra?operative complication* or post?operative complication*
33	explode "post-operative-complication"/ all subheadings
34	explode "peroperative-complication"/ all subheadings
35	"aspiration-pneumonia"/ all subheadings
36	#31 or #32 or #33 or #34 or #35
37	5
38	#36 and #5
39	#38 and #16
40	#39 and #4
41	gastric
42	volume* or content* or pH
43	#41 and #42
44	#43 and #5
45	#44 and #4

D) CINAHL search strategy for preoperative and postoperative fasting

SilverPlatter ASCII 3.0WINNCINAHL (R) Database 2005/February

1	an?esth*
2	explode "Anesthesia"/ all topical subheadings / all age subheadings
3	#1 or #2
4	pre?oper* or pre?proced* or pre?surg* or pre?anesth* or pre?anaesth*
5	post?oper* or post?proced* or post?surg* or post?anesth* oe post?anaesth*
6	explode "Preoperative-Care"/ all topical subheadings / all age subheadings
7	explode "Preoperative-Period"/ all topical subheadings / all age subheadings
8	explode "Post-operative-Care"/ all topical subheadings / all age subheadings
9	explode "Post-operative-Period"/ all topical subheadings / all age subheadings
10	#4 or #6 or #7
11	#5 or #8 or #9
12	fasting* or fasted* or starv* or feed* or depriv*
13	explode "Fasting"/ all topical subheadings / all age subheadings
14	#12 or #13
15	#3 and #10 and #14
16	#3 and #11 and #14
17	fluid* or drink* or water* or hydrat*
18	food* or eat* or nutrition*
19	#17 or #18
20	#19 and #3 and #10
21	#19 and #3 and #11
22	"nil by mouth" or NPO* or "nulla per os" or "nothing by mouth"
23	#22 and #3
24	anti?aspiration* or aspiration* or pneumonia* or pneumonitis or regurgitation*
25	intra?operative complication* or post?operative complication*
26	explode "Post-operative-Complications"/ all topical subheadings / all age subheadings

27 explode "Intraoperative-Complications"/ all topical subheadings / all age subheadings

28 explode "Pneumonia-Aspiration"/ all topical subheadings / all age subheadings

29 #24 or #25 or #26 or #27 or #28

30 #29 and #3

31 #30 and #14

32 gastric

33 volume* or content* or pH

34 #32 and #33

35 #34 and #3

E) Cochrane library search strategy for preoperative and postoperative fasting (2005, Issue 1)

1	fasting
2	preoperative
3	pre-operative
4	#2 or #3
5	anaesthesia
6	anesthesia
7	ANESTHESIA explode all trees (MeSH)
8	#5 or #6 or #7
9	fluid* or drink* or water* or food*
10	restrict* or start* or fasting or fasted
11	#9 and #10
12	#4 and #1 and #8
13	#4 and #1 and #8
14	aspiration*
15	#14 and #8
16	#14 and #12
17	nil next by next mouth
18	nulla next per next os
19	npo
20	nothing next by next mouth
21	#17 or #18 or #19 or #20
22	#21 and #8
23	gastric
24	volume* or content*
25	#23 and #24 and #14 and #8
26	#25 and #1
27	#25 and #11

Appendix A1: Included studies – preoperative fasting in adults

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, No H_2RAs							
Agarwal et al., 1989	150	I-II	Elective surgery. Exclusions: pregnant; emergency cases; outpatients; those taking drugs known to affect gastric secretion/motility.	1. Water 150 ml 2 h preop (n=50) 2. Water 150 ml + im morphine & promethazine 2 h preop (n=50) 3. Standard fast (NPO from 10pm) (n=50).	A: 1 vs. 3 b: 2 vs. 1	n	Mean fast duration: 1) 2.5 h (SD 0.4) 2) 2.6 h (SD 0.4).
Brocks et al., 1987	40	'Healthy'	Elective sterilisation surgery. Exclusions: not listed.	1. Water 50 ml; 2 h preop (n=20) 2. Water 100 ml; 2 h preoperatively (n=20).		Y	Premedication – diazepam; median fast duration 2.7(1) 2.3 h (2).
Goodwin et al., 1991	100	I-II	Elective day surgery – first trimester abortion. Exclusions: history of gastrointestinal disease; migraine; cluster headaches.	1. Clear fluids (water or orange drink); 150 ml; 1.5 to 2 h preoperatively (n=50) 2. Standard fast (NPO midnight) (n=49).		N	Patients requiring premedication were excluded. Mean fast duration 1.5 h.
Hausel et al., 2001	252	I-II	Elective, abdominal surgery (174 cholecystectomy; 78 major colorectal). Exclusions: conditions and drugs that impair GI motility, pregnancy, diabetes.	1. Water 400ml up to 2 h (+ 800ml evening before surgery) (n=86) 2. Carbohydrate drink 400 ml up to 2 h before premed (+ 800 ml evening before surgery) (n=80) 3. Standard fast (NPO from midnight) (n=86).	A: 1 vs. 3 b: 2 vs. 3 c: 1 vs. 2	y	Colorectal. Premedication – morphine hydrochloride 10 mg or ketobemidine 5 mg > 2 h after drink. Fast time pre-induction; Mean: 1) 3.6 h (SD 1.3) 2) 3.6 h (SD 1.2).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, No H_2RAs							
Henriksen et al., 2003	48	Unclear	Elective bowel resections. Exclusions: inflammatory bowel disease, disseminated malignant disease, previous treatment for intra-abdominal cancer, cv disease; NYHA angina class III-IV; diabetes, mental disease, alcohol/drug abuse.	1. Water unlimited amount up to 3h (n=16) 2. Carbohydrate drink 400 ml up to 3 h (+ 400ml evening before surgery) (n=16) 3. Carbohydrate-peptide drink 400 ml up to 3 h (+ 400 ml evening before surgery) (n=16).	a: 1 vs. 2 b: 1 vs. 3 c: 2 vs. 3	ns	Probably more severe than ASA I-II. Premedication - unclear. Mean fast duration: 1) 5.4 h (3.0 to 7.4) 2) 5.2 h (3.8 to 6.9) 3) 5.7 h (4.3 to 8.3).
Hutchinson et al., 1988	150	I-II	Elective surgery. Exclusions: pregnant; ambulatory; those taking drugs which affect gastric secretion/motility (including opiate or belladonna alkaloid premedication).	1. Coffee (+milk) 150 ml 2 to 3 h preoperatively 2. Orange juice 150 ml 2 to 3 h preoperatively 5.Standard fast (All n=50).	a: 1 vs. 5 b: 2 vs. 5 e: 2 vs. 1	some	Premedication - as prescribed - Diazepam 5 to 15 mg permitted 1 to 1.5h preoperatively. Mean fast durations: 1) 2.5 h (SD 0.7) 2) 2.7 h (SD 0.5).
Holmes, 1988	60	Healthy	Elective surgery. Exclusions: not listed.	1. Water 150 ml up to 1 h (n=15) 2. Water 50 ml + diazepam (10mg) up to 1 h (n=15) 3. Standard fast (n=15) 4. Water 150 ml + diazepam 10mg up to 1 h (n=15).	a: 1 vs. 3 b: 2 vs. 4 c: 4 vs. 1	n	Mean duration not stated.
McGrady and MacDonald, 1988	50	ns	Elective, gynaecological and general. Exclusions: disorder affecting gastric emptying.	1. Water; 100 ml; ~ 2 h preoperatively (n=23); 2. Standard fast (NPO midnight) (n=21).		y	Premedication - pethidine + promethazine by weight 1h preoperatively. Mean duration 1) 2.2 h (SD 0.4)

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, No H_2RAs							
Maltby et al., 1986	70	Not stated 'ambulatory'	First trimester abortion. Exclusions: those taking medication known to affect gastric secretion.	1. Water 150 ml 2 to 3 h preoperatively (n=35) 3. Standard fast (at least 10 h from midnight) (n=35).	a: 1 vs. 3	n	Premedication – none Mean fast durations: 1) 2.4 h (SD 0.3)
Maltby et al., 1988	57	I-II	In-patients, elective surgery. Exclusions: pregnant; emergency; those taking medication known to affect gastric secretion/motility.	1. Clear fluids (patient's choice of water, fruit juice, coffee, tea) 150ml 2 to 3 h preoperatively (n=29) 3. Standard fast (n=29).	a: 1 vs. 3	y	Premedication – morphine + atropine 1 h preoperatively Mean fast durations: 1) 2.7 h (SD 0.8) 2) 2.6 h (SD 0.6).
Naguib et al., 2001	375	I	First case on elective surgery list, peripheral orthopaedics, gynaecological procedures. Exclusions: pregnancy, obesity, diabetes, GI disease, emergency care, anticipated difficulty with airway management.	1. Honey 60 ml (n=75) 2. Glucose-fructose-sucrose-maltose 60 ml (n=75) 3. Apple juice 60 ml (n=75) 4. Water 60 ml (n=75) All given 2h before start of list 5. Standard fast (NPO midnight) (n=75) Key continued: i: 4 v 2; j: 4 v 3.	a: 1 vs. 5 b: 2 vs. 5 c: 3 vs. 5 d: 4 vs. 5 e: 2 vs. 1 f: 3 vs. 1 g: 4 vs. 1 h: 3 vs. 2	n	Also excluded: ingestion of alcohol, opioids, anticholinergics, H_2RAs or metoclopramide preoperatively. Duration is 2 h before start of operating list.
Nygren et al., 1995	12	I-II	Elective laparoscopic cholecystectomy or parathyroid surgery. Exclusions: history of diabetes mellitus, earlier gastric surgery or medication known to affect gastric emptying.	1. Carbohydrate rich drink; 400 ml; 4 h preoperatively (n=6) 2. Water 4 h preoperatively 400 ml (n=6).		ns	Small study. Mean duration not stated

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, No H_2RAs							
Phillips et al., 1993	100	I-III (4% III)	Variety: cholecystectomy, prostate resection, bowel resection, hernia, varicose vein. Exclusions: pregnancy, gastrointestinal disease, opioids, H_2RAs, anticholinergics, metoclopramide within 24 h.	1. Clear fluids; unlimited amount; up to 2 h; range 1 to 4 h (n=50) 2. Standard fast (NPO midnight) (n=50).		some	Some had colorectal surgery. 35/50 (intervention group) & 22/50 control had temezepam 10-20 mg 2h preoperatively.
Read and Vaughan, 1991	53	I-II	Elective, general surgery. Exclusions:pregnant, gastro-intestinal abnormality, taking any drugs known to affect gastric emptying.	1. Water; unlimited amount; up to 2 h; mean fast duration 2.23h (SD 0.44) (n=25) 2. Standard fast (NPO midnight). (n=29).		y	Premedication - temazepam 20 mg.
Samaan et al., 1989	51	I-III	Elective minor surgery. Exclusions: known gastrointestinal disease, obesity (weight > 100 kg).	1. Water 150 ml 2 h preoperatively (n=27) 4. Standard fast (n=24).	a: 1 vs. 4	n	Premedication – none Mean duration for all interventions 2.25 h and comparable amongst groups.
Søreide et al., 1993	75	I-II	Day-case gynaecological laparoscopy. Exclusions: diseases known to affect gastric secretion and motility.	1. Water 150 ml 1 to 2 h preoperatively (n=25) 2. Water 300-450 ml 1 to 2 h preoperatively (n=25) 3. Standard fast (overnight) (n=25).	a: 1 vs. 3 b: 2 vs. 3 c: 1 vs. 2	y	Premedication - diazepam 10 mg at 1.5h Mean fast duration: 1) 1.5 h (SD 0.3) 2) 1.5 h (SD 0.5).
Sutherland et al., 1987	50	I-II	Elective surgery. Exclusions: medications known to delay gastric secretion.	1. Water 150 ml 2 to 3 h preoperatively (n=25) 3. Standard fast (NPO midnight)(n=25).	a: 1 vs. 3	n	Premedication - stated to be not narcotic; number with premed not stated. Mean duration: 1) 2.4 h (SD 0.4)

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, solids, no H_2RAs							
Miller et al., 1983	45	ns	Gynaecological surgery including hysterectomy before 10:30am. Exclusions: gastrointestinal disease.	1. Breakfast [1 slice buttered toast + 1 cup tea/coffee + milk] 2 to 4 h preoperatively + opioid premed + anticholinergic (n=13) 2. Breakfast 2 to 4 h preoperatively + lorazepam (n=10) 3. Standard fast from 10pm + opioid premed + anticholinergic (n=11 4. Standard fast + lorazepam (n=11).	a: 1 vs. 3 b: 2 vs. 4 c: 2 vs. 1	y	Premedication 1 to 2 h preoperatively: papaveretum 10mg/hyoscine 0.4 mg (14), pethidine 50mg/promethazine 50mg/hyoscine 0.4 mg (10). Both groups had anticholinergics. Mean fast durations; 1) 4.2 h (SD 1.0) 2) 3.3 h (SD 1.1) significantly different ($p<0.001$)
Adults, gum and sweets							
Dubin et al., 1994	31	I-II	Elective outpatient or day surgery. Exclusions: patients with gastrointestinal disorders or taking medications affecting gastric emptying.	1. Sugarless gum (1 piece implied); up to 20 min pre-induction; (n=15) 2. Standard fast (at least 8 h) (n=16).		Un-clear	Gum removed upon call to operating room. Only randomised patients included (group 3 in paper excluded).
Søreide et al., 1995a	60	I-II	Gynaecological laparoscopy/laparotomy. Exclusions: obesity, history of GI disease needing medication, use of tranquillisers.	1. Sugar free gum; not more than 1 piece per hour; up to time of transport to operating room (n=30) 2. Standard fast (probably NPO from midnight) (n=30).		n	Non-smokers; could chew up to time of transport to operating room. Not sure what food/fluid restrictions. Premedication - none. No trace of chewing gum in aspirate.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, gum and sweets							
Søreide et al., 1995b	46	I-II smokers	Gynaecological laparoscopy/laparotomy. Exclusions: obesity, history of GI disease needing medication, use of tranquillisers.	1. Nicorette gum; not more than one piece per hour; up to time of transport to operating room (n=23) 2. Standard fast (probably NPO from midnight) (n=23).		n	Smokers; could chew up to time of transport to operating room. Instructed to chew/suck slowly. Not sure what food/fluid restrictions. No trace of gum in aspirate.
Macaluso et al., 1996	90	I-II	Same day admission surgery. Exclusions: pregnancy.	1. Transmucosal fentanyl citrate 300 to 400 µg in lollipop (n=30) 2. Placebo lollipop (n=30) 3. No lollipop.		Head	Patients given lollipop 10 to 70 min before entering operation room.
Adults, with H_2RAs							
Gilbert et al.,1995	100	I-II	Elective minor surgery (orthopaedic, d&c, cystoscopy). Exclusions: history of gastrointestinal disease; pregnant; mental handicap.	1. Water + ranitidine [150 mg]; 500 to 1000 ml; given over period of 2 h before a 3 h fast (n=46) 2. Standard fast (NPO midnight or toast and tea) (n=49).		y	Premedication - temazepam 20 mg, 2 h preoperatively. Mean fast duration: 3.1 h (SD 0.3).
Hutchinson et al., 1988 (see above also)	150	I-II	Elective surgery. Exclusions: pregnant; ambulatory; those taking drugs which affect gastric secretion /motility (including opiate or belladonna alkaloid premed).	3. Coffee + ranitidine [150 mg] 150 ml 2 to 3 h preop 4.Orange juice + ranitidine 150 ml 2 to 3 h preop 6.Standard fast + ranitidine (All n=50).	c: 3 vs. 6 d: 4 vs. 6 f: 4 vs. 3	Some	Premedication - as prescribed - diazepam 5 to 15 mg permitted 1 to 1.5h preoperatively. Mean fast durations: 3) 2.7 h (SD 0.6) 4) 2.4 h (SD 0.6).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, with H_2RAs							
Maltby et al., 1986 (see above also)	70	Not stated 'ambulatory'.	First trimester abortion. Exclusions: those taking medication known to affect gastric secretion.	2. Water + ranitidine [150 mg] 150 ml 2 to 3 h preoperatively (n=35) 4. Standard fast (at least 10 h from midnight) + ranitidine (n=35).	b: 2 vs. 4	n	Premedication – none. Mean fast durations: 2) 2.4 h (SD 0.3).
Samaan et al., 1989 (see also above)	51	I-III	Elective minor surgery. Exclusions: known gastrointestinal disease, obesity (weight > 100 kg).	2. Water + ranitidine [150 mg] 150 ml 2 h preoperatively (n=25) 3. Water + famotidine [20 mg] 150 ml 2 h preoperatively (n=24) 5. Standard fast + ranitidine (n=26) 6. Standard fast + famotidine (n=21).	b: 2 vs. 5 c: 3 vs. 6	n	Premedication – none. Mean duration for all interventions 2.25 h and comparable amongst groups.
Sutherland et al., 1987 (see also above)	50	I-II	Elective surgery. Exclusions: medications known to delay gastric secretion.	2. Water + ranitidine [150 mg] 150 ml 2 to 3 h preoperatively (n=25) 4. Standard fast + ranitidine (n=25).	b: 2 vs. 4	n	Premedication - stated to be not narcotic; number with premed not stated. Mean duration: 2) 2.4 h (SD 0.4).
Tanabe et al., 1996	40	I-II	Exclusions: obese, brain disease, digestive system damage or confused.	1. Assam tea [no milk or sugar] + 75 mg roxatidine; 150 ml; 2h preoperatively (n=20) 2. Apple juice + roxatidine 75 mg 2 h preoperatively 150 ml (n=20).		y	Premedication - diazepam 5 to 10 mg 2 h preoperatively. Mean fast duration unclear.
Tanabe et al., 1997	40	I-II	Gynaecological, orthopaedic, ear/nose or dental surgery. Exclusions: obese (BMI ≥27); disease of digestive system; unconscious; confused.	1. 2 slices of bread and jam + isotonic drink or apple juice + roxatidine 75 mg + famotidine 20mg; 250 ml; 4.5 to 7.5h (n=20) ; mean fast 5.5 h (SD 0.6) 2. Isotonic drink or apple juice + [rox 75 mg + fam 20 mg] 4.5 to 7.5 h. 250 ml (n=20); mean fast 6.1 h (SD 0.8).		y	Premedication - morning of surgery; diazepam 5 to 10 mg 1 h preoperatively. Patients chose apple juice or isotonic drink; bits in aspirate (all chose apple juice).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, with H_2RAs							
Vincent et al., 1991	60	I-II	Elective, general surgery. Exclusions: ASA III or IV; hiatal hernia; peptic ulcer disease; pregnant; preoperative pain; opioids, antacids.	1. Clear apple juice + ranitidine [150 mg x 2] + metoclopramide; 360 ml; 3 h preoperatively (n=26) 2. Standard fast + ranitidine [150 mg x 2]+ metoclopramide (n=34).		y + metocl	Premedication - diazepam; metoclo-pramide also given (3h). Mean fast duration: 2.6 h (SD 0.8).
Yatsu et al., 1996	45	I-II	Elective surgery. Exclusions: diabetes, pregnant, gastrointestinal disorder or disease, those taking antiemetic drug (metoclopramide).	1. Water + roxatidine [75 mg] 150 ml 2 h preoperatively (n=15) 2. Isotonic sports drink + roxatidine [75 mg] 150ml 2 h preoperatively (n=15) 3. Standard fast (from 9pm) + roxatidine [75 mg] at 2 h (n=15). Mean durations not stated.	a: 1 vs. 3 b: 2 vs. 3 c: 1 vs. 2	y	Translation from Japanese. H_2RA also given night before surgery (roxatidine 75mg). Premed: night before surgery triazolam 0.125 to 0.25mg; morning of surgery: diazepam 5 to 10 mg 2h preoperatively.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, with versus without H_2RAs							
Hutchinson et al., 1988 (see above also)	150	I-II	Elective surgery. Exclusions: pregnant; ambulatory; those taking drugs which affect gastric secretion/motility (including opiate or belladonna alkaloid premedication).	1. Coffee (+milk) 150 ml 2 to 3 h preoperatively 2. Orange juice 150 ml 2 to 3 h preop 3. Coffee + ranitidine [150 mg] 150 ml 2 to 3 h preoperatively 4.Orange juice + ranitidine 150 ml 2 to 3 h preoperatively.	g: 4 vs. 2 h: 3 vs. 1	some	Premedication - as prescribed - diazepam 5 to 15 mg permitted 1 to 1.5h preoperatively. Mean fast durations: 1) 2.5 h (SD 0.7) 2) 2.7 h (SD 0.5) 3) 2.7 h (SD 0.6) 4) 2.4 h (SD 0.6).
Maltby et al., 1986 (see above also)	70	Not stated 'ambulatory'	First trimester abortion. Exclusions: those taking medication known to affect gastric secretion.	1. Water 150 ml 2 to 3 h preoperatively (n=35) 2. Water + ranitidine [150 mg] 150 ml 2 to 3 h preoperatively (n=35).	c: 2 vs. 1	n	Premedication – none. Mean fast durations: 1) 2.4 h (SD 0.3) 2) 2.4 h (SD 0.3).
Maltby et al., 1988	57	I-II	In-patients, elective surgery. Exclusions: pregnant; emergency; those taking medication known to affect gastric secretion/motility.	1. Clear fluids (water, fruit juice, coffee, tea (patient choice)) 150ml 2 to 3 h preoperatively (n=29) 2. Clear fluids + ranitidine 150ml 2 to 3 h preoperatively (n=31).	b: 2 vs. 1	y	Premedication – morphine+ atropine 1 h preoperatively. Mean fast durations: 1) 2.7 h (SD 0.8) 2) 2.6 h (SD 0.6).
Samaan et al., 1989	51	I-III	Elective minor surgery. Exclusions: known gastrointestinal disease, obesity (weight > 100 kg).	1. Water 150 ml 2 h preoperatively (n=27) 2. Water + ranitidine [150 mg] 150 ml 2 h preoperatively (n=25) 3. Water + famotidine [20 mg] 150 ml 2 h preoperatively (n=24).	d: 2 vs. 1 e: 3 vs. 1 f: 2 vs. 3	n	Premedication – none. Mean duration for all interventions 2.25 h and comparable amongst groups.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adults, with versus without H_2RAs							
Sutherland et al., 1987 (see also above)	50	I-II	Elective surgery. Exclusions: medications known to delay gastric secretion.	1. Water 150 ml 2 to 3 h preoperatively (n=25) 2. Water + ranitidine [150 mg] 150 ml 2 to 3 h preoperatively (n=25).	c: 2 vs. 1	n	Premedication - stated to be not narcotic; number with premed not stated. Mean duration: 1) 2.4 h (SD 0.4); 2) 2.4 h (0.4).
Suzuki et al., 1996	43	I-II	Elective surgery. Exclusions: operations on GI tract, digestive system disorders, pregnancy, diabetes, endocrine disorder.	1. Clear fluids (water, green tea, sports drink) unlimited amounts (318 ml) up to 2 h (n=20) 2. Clear fluids unlimited amounts (522 ml) up to 2 h + famotidine 20mg,(n=23).		y	Premedication – diazepam + atropine. Mean duration not stated.
Adults, with versus without sodium citrate							
Schmidt et al., 1984	40	'Healthy'	Gynaecologic laparotomy or laparoscopy. Exclusions: history of gastrointestinal disease.	1. Water 50 ml at 6.30am (n=20) 2. Water 50 ml at 6.30am + sodium citrate 50 ml immediately before admission to operating theatre, 15 to 50 min before aspiration (n=20).		y	Premedication – diazepam. Water given at 6.30 am for all patients on list so that duration mean (range) was 1) 3.6 h (1.3 to 6.2 h) 2) 30 min (15 to 50 min).
Adult higher-risk groups							
Lam et al., 1993	100	I	Tubal ligation. Exclusions: previous gastric surgery; nausea or vomiting on morning of surgery; opioid drugs or other medications known to affect gastric motility or secretion in 24 h before surgery.	1. Water; 150 ml; 2 to 3 h preoperatively (n=50) 2. Standard fast (NPO from midnight) (n=50).		n	Post partum - up to 5 days postpartum. Premedication - none. Median fast duration: 2.5 h (range 1.5 to 3.5).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Pre-med	Study comments
Adult higher-risk groups							
Maltby et al., 2004 ('Maltby Pytka 2004')	138	I-II	Elective. Exclusions: diabetes; gastroesophageal reflux; those known to have taken medication that affects gastric secretion/motility in 24 h preoperatively; pregnant.	1. Clear fluids (water, apple juice, black coffee, clear tea, carbonated beverage); 300 ml; up to 2h (n=65) 2. Standard fast (NPO midnight). (n=65).		n (main)	Obese patients. Premedication - none unless anxiolytic agent by patient request. Mean fast duration: 2.4 h (SD 0.6).
Somwanshi et al., 1995	40	I-II	Elective sterilisation, 1 to 4 days post partum. Exclusions: drugs or disease known to increase risk of abnormal gastric contents; acute injury	1. Water; 50 ml; 2.5 h preoperatively (n=20) 2. Standard fast (NPO from 10pm) (n=20).		n	Post partum. Premedication - none. Mean fast duration: 2.8 h (SD 0.2).
Ozkan et al., 2000	150	I	Elective Caesarean section.	1. Water 200 ml, 2h preop (n=25) 2. Water 200 ml + ranitidine (iv), 2 h preoperatively (n=25) 3. Water 200ml + metoclopramide (iv) 2 h preoperatively (n=25) 4. Water + omeprazole (iv) 200ml, 2 h preoperatively (n=25) 5. Standard fast (n=25).	a: 1 vs. 5 b: 2 vs. 1 c: 3 vs. 1 d: 4 vs. 1	ns	Pregnant patients. Mean fast duration not stated.
Lewis and Crawford, 1987	40	Not stated	Elective Caesarean section. Exclusions: none stated.	1. Breakfast of tea and toast offered (11/20 had toast) within 4h of surgery (n=20). Mean: tea 3.6 h (0.4); tea+toast 2.7 h (0.9) 2. Standard fast (n=20).		n	Pregnant patients; all given magnesium trisilicate; 'divided' into groups.

Appendix A2: Excluded studies – adult review

Study	Reason for exclusion	Study	Reason for exclusion
Andrews et al., 1982	Comparison of H_2RAs, but no group had a shortened fast.	Hett et al., 1995	Comparison of PPIs, but no group had a shortened fast.
Bennett et al., 1999	Intravenous interventions.	Levack et al., 1996	Comparison of H_2RAs and PPIs, but no group had a shortened fast.
Bouly et al., 1993	Comparison of H_2RA and PPIs, but no group had a shortened fast.	Maltby et al., 1991	Not randomised.
Callander et al., 1987	Comparison of H_2RAs, but no group had a shortened fast.	Manchikanti et al., 1984	Comparison of H_2RAs, but no group had a shortened fast.
Cruickshank et al., 1989	Comparison of PPIs, but no group had a shortened fast.	Memiş et al., 2003	Comparison of H_2RAs and PPIs, but no group deliberately given fluids to shorten fast (fluid fast was 4 h).
Escolano et al., 1992	Comparison of H_2RAs and PPIs, but no group had a shortened fast.	Murphy et al., 2000	Not randomised.
Gallagher et al., 1988	Comparison of H_2RAs, but no group had a shortened fast.	Nishina et al., 2000	Comparison of PPIs, but no group had a shortened fast.
Gombar et al., 1994	Comparison of H_2RAs and PPIs, but no group had a shortened fast.	Pandit et al., 1986	Comparison of H_2RAs, but no group had a shortened fast.
Greenfield et al., 1996	Not general anaesthesia.	Popat et al., 1991	Comparison of H_2RAs, but no group had a shortened fast.

Study	Reason for exclusion	Study	Reason for exclusion
Rao et al., 1984	Comparison of H_2RAs, but no group had a shortened fast.	**Higher risk patients continued**	
Roberts and Shirey, 1974	Not randomised; no group had shortened fast.	Juvin et al., 2001	Obese patients; case control.
Scarr et al., 1989	Not randomised.	Lam et al., 1986	Obese patients; comparison of H_2RAs, but no group had a shortened fast.
Søreide et al., 1995b	Comparison of premedication, but only one group given fluids.	Laws et al., 1986	Obese patients; comparison of H_2RAs, but no group had a shortened fast.
Sutherland et al., 1986	Observational study.	Lewis et al., 1990	Not randomised.
Tutuncu et al., 1996	Not said to be randomised.	Moote and Manninen, 1989	Obese patients; comparison of H_2RAs, but no group had a shortened fast.
Higher risk patients		Stull et al., 1983	Obese patients; comparison of H_2RAs, but no group had a shortened fast.
Brock-Utne et al., 1989	Emergency Caesarean section; comparison of H_2RAs, but fasting not recorded.	Vila et al., 1991	Obese patients; comparison of H_2RAs, but no group had a shortened fast.
Harter et al., 1998	Obese patients; not randomised, all patients fasted.		

Appendix A3: Quality of included studies – adult review

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Agarwal et al., 1989	Adequate (table of random sampling numbers).	Unclear	Yes	Yes, but missing aspirate.		Not stated	Yes	Age, weight, smoking status, incidence of heartburn, dyspepsia - all comparable.	No	No gastric pH value for 4/50 (8%) in water group, 5/50 (10%) in water+morphine group and 2/50 (4%) in control group.
Brocks et al., 1987	Unclear	Unclear	Yes	Yes		Not stated	Yes	Age, weight, time from premedication to aspiration - all comparable.	Awaiting calculation	
Gilbert et al., 1995	Unclear	Unclear	Unclear	No (≤ 20% dropouts)	4/50 (8%) excluded from water group and 1/50 (2%) from control - mainly because of iv fluids.	Not stated	Yes	Age, gender, duration and type of operation - all comparable.	----	
Goodwin et al., 1991	Unclear	Unclear	Yes	No (≤ 20% dropouts)	1/50 (2%) withdrawn from fasted group.	Not stated	Yes	Age, weight, parity, duration of anaesthesia and surgery - all comparable.	----	
Hausel et al., 2001	Adequate (tickets drawn from lottery box).	Partial (sealed tickets).	Unclear	No (≤ 20% dropouts)	2/86 (2%) water, 2/80 (3%) carbohydrate and 3/86 (3%) control did not receive nasogastric tube.	Not stated	Yes	Age, gender, BMI - all comparable.	No	3/245 patients had no gastric aspirate. pH not measured for 41/86 (48%) of water group, 40/80 (50%) carbohydrate group and 44/86 (51%) in control group.

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Henriksen et al., 2003	Partial (block randomisation with varying block sizes).	Unclear (randomisation by one author using closed envelope method. Another knew the allocations).	Yes	no (≤ 20% dropouts)	10/58 (17%) were not analysed for various reasons.	Not stated	Yes	Age, gender, height, weight - all comparable.	Awaiting calculation	Gastric volume was measured in a sample of 29 patients.
Holmes et al., 1988	Inadequate (alternation: unpublished data).	Inadequate (alternation: unpublished data).	No (volume inadequate; pH adequate; unpublished data).	Yes	Implied no withdrawals.	Not stated.	Not stated.		Awaiting calculation.	Very little information.
Hutchinson et al., 1988	Adequate (table of random sampling numbers).	Unclear	Yes	Yes, but missing aspirate.		Not stated.	Yes	Age and weight comparable.	No	Missing aspirate: coffee 1/50, orange juice 4/50, ctrl 1/50; coffee + H_2RA 8/50 (16%), orange juice + H_2RA 13/50 (26%), Ctrl + H_2RA 10/50 (20%).
McGrady and MacDonald, 1988	Unclear	Partial (sealed opaque envelopes: unpublished data).	Yes	No (≤ 20% dropouts).	6/50 (12%) excluded from analysis.	Not stated.	Yes mainly.	Comparable for age, but patients in water group significantly heavier.	No	IPD given; 1/21 patients in fasting group had no aspirate.
Maltby et al., 1986	Adequate (table of random sampling numbers; unpublished data).	Unclear	Yes (unpublished data).	Yes, but missing aspirate.		Not stated.	Yes	Age, weight, gestation, smoking history, heartburn or dyspepsia - all comparable.	No	Missing aspirate: 2/35 (6%) in water group, 2/35 in control group, 7/35 (20%) in water + ranitidine group, 4/35 (12%) in control + ranitidine group.

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Maltby et al., 1988	Adequate (table of random numbers).	Unclear	Yes	No (≤ 20% dropouts).	5/122 excluded (interval between dye ingestion and sampling >4h).	Not stated.	Yes	Age and weight comparable.	Yes calculated, but awaited for one group.	Missing aspirate: fluids group 6/29 (21%), control 4/28 (14%).
Miller et al., 1983	Unclear	Unclear	Yes	Yes, but missing aspirate.		Not stated.	Yes	Age and duration of surgery comparable.	Yes calculated.	Missing aspirate: 4/13 (31%) breakfast+narcotic, 3/11 (27%) narcotic + std fast, 2/10 (20%) breakfast+non-narcotic, 6/11(55%) non-narcotic + std fast. Pseudo-values for pH.
Naguib et al., 2001	Adequate (computer generated randomisation list unpublished data).	Unclear	Unclear (blinded for secondary outcomes; primary unclear).	Yes		Yes	Yes	Age, gender, weight and smoking habit - all comparable.	Awaiting calculation	
Nygren et al., 1995	Unclear	Unclear	Unclear	Unclear		Not stated.	Yes, but limited data.	Similar for age, gender, weight and height.	No	Secondary outcomes only; small study (n=12).
Phillips et al., 1993	Unclear ("allocated randomly on alternate weeks").	Unclear ("allocated randomly on alternate weeks").	Yes	Yes		Not stated.	Yes	Age, gender, ASA level, smoking history and surgical procedure - all comparable.	Yes calculated.	

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Read and Vaughan 1991	Unclear	Partial (envelopes on ward: unpublished).	Yes	Yes	Two VAS completed incorrectly, but gastric contents ITT.	Not stated.	Yes mainly	Age and gender - comparable; type of operation dissimilar.	Yes calculated.	
Samaan et al., 1989	Unclear	Partial (sealed envelopes; unpublished data).	Yes (unpublished data).	Unclear		Not stated.	Yes	Age and weight comparable>	Yes calculated	Some gastric samples missing (number per group unclear) because of difficulties obtaining sample.
Søreide et al., 1993	Adequate (table of random numbers; unpublished data).	Unclear	Yes	Yes		Not stated.	Yes	Age, weight, height - all comparable.	No	
Sutherland et al., 1987	Adequate (table of random numbers unpublished data).	Unclear	Yes	Yes, but missing aspirate.		Not stated.	Yes	Age, gender, weight, incidence of smoking, heartburn and dyspepsia - all comparable.	No	Missing aspirate: 3/25 (12%) in water+placebo group, 0/25 control, 6/25 (24%) in water+H_2RA group, 4/25 (H_2RA+plac).
Suzuki et al., 1996	Unclear	Unclear	Unclear	No (> 20% dropouts).	5/23 (22%) excluded from famotidine group.	Not stated.	Yes	Age, gender, weight, amount of fluid - all comparable.		
Tanabe et al., 1996	Unclear	Unclear	Unclear	Unclear		Not stated.	Yes	Age, gender, height, weight - all comparable.	No	
Tanabe et al., 1997	Unclear	Unclear	Unclear	Yes		Not stated.	Yes mainly	Age, gender, height, weight - all comparable; fasting time significantly different for groups.	No	

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Vincent et al., 1991	Adequate (rolling dice - two phases of randomisation due to protocol violation by patients in group 2).	Unclear	Unclear	No (>20% dropouts)	7/26 (27%) in fluids group excluded because of protocol violations.	Not stated.	Yes	Age, gender, BMI, smoking status, height and weight - all comparable.	No	6/19 (32%) in apple juice group and 14/34 (41%) control had no gastric aspirate.
Yatsu et al., 1996	Unclear	Unclear	No (doctor collecting gastric juice knew groups).	Yes		Not stated.	No mainly	Some differences in groups - water group older, and refreshing drink more males and taller; weight similar.	No	
Adults, gum and sweets										
Dubin et al., 1994	Unclear	Unclear	Yes	Yes		Not stated.	Yes mainly	Gender, height, weight comparable. Gum group significantly older ($p<0.05$).	No	
Søreide et al., 1995a	Unclear (block randomisation procedure).	Unclear	Yes	Yes		Yes	Yes mainly	Age, height, type of surgery all comparable; weight significantly greater for no gum group ($p=0.0006$).	Yes calculated.	
Søreide et al., 1995b	Unclear (block randomisation procedure).	Unclear	Yes	Yes						

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Adults, gum and sweets										
Macaluso et al., 1996	Adequate (computer programme).	Unclear	Partly (blinding for lollipop groups).	Yes		Not stated.	Yes	Age and weight distributions similar.	No	
Adult higher-risk patients										
Lam et al., 1993	Partial (drawing envelopes; unpublished data).	Partial (drawing unsealed, opaque envelopes; unpublished data).	Yes (unpublished information).	Yes		Yes	Yes	Age, weight, time after delivery all comparable.	No	Retrospective power calculation. Mean and SD for Volume and pH calculated from IPD on a graph.
Maltby, Pytka et al., 2004	Adequate (computer-generated table of random numbers).	Unclear	Unclear ("Investigator aspirated gastric contents blindly").	No (≤ 20% dropouts).	Eight patients had surgery delayed	Yes	Yes	Age, gender, weight, BMI all comparable.	No	
Somwanshi et al., 1995	Unclear	Unclear	Yes (independent assessor not aware of patients' groups).	Yes		Not stated.	Yes	Age, weight and time since delivery all comparable.	No	
Ozkan et al., 2000	Unclear	Unclear	Unclear	Yes		Not stated.	Yes	Age and weight comparable.	No	
Adults, solids, higher-risk group										
Lewis and Crawford, 1987	Not said to be randomised.	Not said to be randomised.	No (different sized tubes used for two groups).	Yes		Not stated.	Not stated.		No	

Appendix A4: Adult studies by duration

Primary outcomes

Duration: up to 1.5h

Comments Two comparisons in one trial (Søreide et al., 1993); additional trial (Goodwin et al., 1991) for secondary outcomes

Number of comparisons 2 **Number of patients** 75

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	-8.00 (-21.00 5.00)	0.00	1	1.00	0	in favour of water, but not significant; two comparisons in one trial
Gastric pH (WMD)	-0.20 (-0.68 0.28)	1.18	1	0.28	15	little difference

Duration: up to 2h

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001 and Read and Vaughan 1991.

Number of comparisons 12 **Number of patients** 921

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	-1.86 (-5.24 1.52)	22.18	10	0.01	55	heterogeneous
Gastric pH (WMD)	0.14 (-0.04 0.32)	8.88	11	0.63	0	little difference

Secondary outcomes

Duration: up to 1.5h

Comments Two comparisons in one trial (Søreide et al., 1993); additional trial (Goodwin et al., 1991) for secondary outcomes

Number of comparisons 3 **Number of patients** 175

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - VAS (WMD)	-1.07 (-2.19 0.05)	0.14	1	0.71	0	Two comparisons in one trial; favours reduced fast, borderline significance (p=0.06)
Thirst - descriptive						One study (Goodwin, n=100) - visual analogue scale, median, significantly less thirst for shortened fast (p<0.001)
Hunger - descriptive						One study (n=100) - visual analogue scale, median, no significant difference
Anxiety - VAS (WMD)	-0.13 (-2.38 2.12)	2.34	1	0.13	57	Wide confidence interval => results uncertain; some heterogeneity
Postop nausea - no of pts (RR)	0.74 (0.13 4.18)	0.12	1	0.73	0	Wide confidence interval & not significant => results uncertain
Postop nausea - descriptive						One study (n=100) - visual analogue scale, median, no significant difference

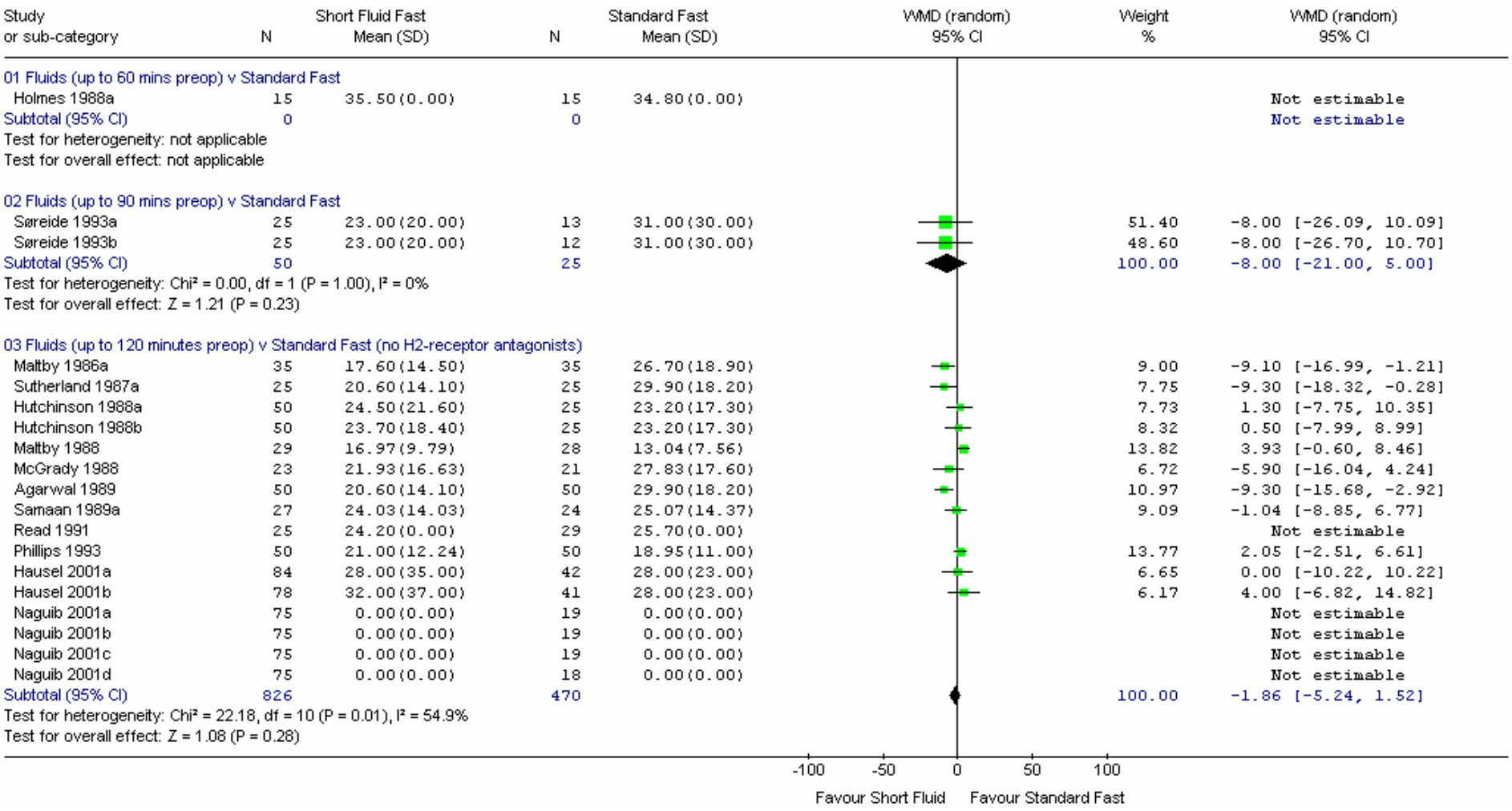
Duration: up to 2h

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001 and Read and Vaughan 1991.

Number of comparisons 12 **Number of patients** 1100

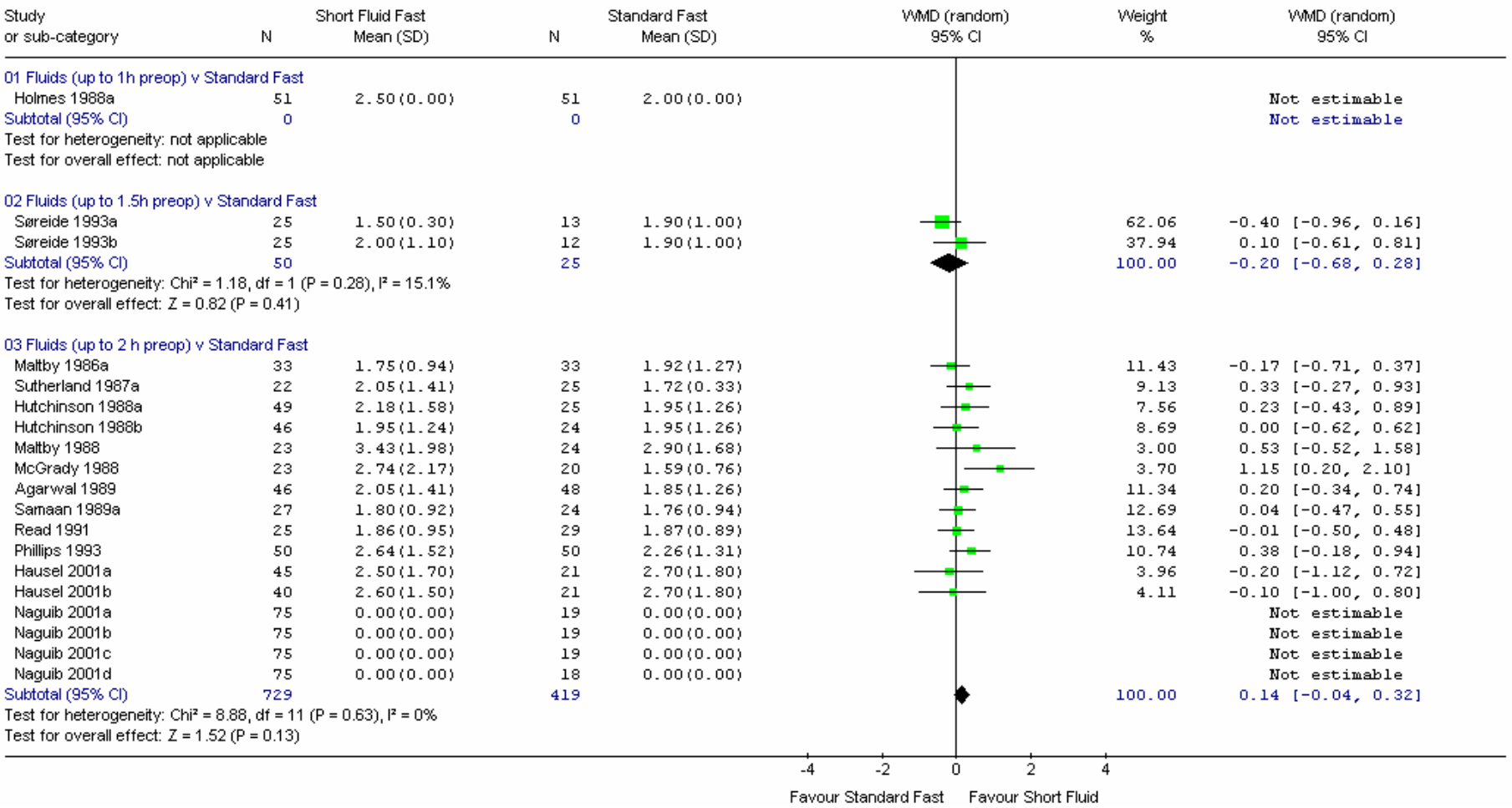
Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with none (RR)	1.05	(0.61	1.80)	34.37	4	<0.00001	88	Highly heterogeneous
Thirst - no. of pts with less (RR)	8.69	(3.68	20.55)	1.68	2	0.43	0	Operating room vs. 2 to 3h preoperatively; statistically significantly less thirst for shorter fast (1/9 risk)
Thirst - descriptive								Three comparisons (two within one study, n=298) - VAS median; two had significantly less thirst for fluids (p<0.0001); other was NS
Hunger - no. of pts with none	0.86	(0.65	1.16)	12.39	4	0.01	68	Heterogeneous
Hunger - no. of pts with less (RR)	3.38	(1.63	6.98)	0.58	2	0.75	0	Operating room vs. 2 to 3h preoperatively; statistically significantly less hunger for shorter fast (1/3 risk)
Hunger - descriptive								Two comparisons within one study - VAS median; one showed significantly less hunger for fluids (p<0.05); the other was NS
Anxiety - descriptive								Three comparisons (two within one study, n=298) - VAS median; two had significantly less anxiety for fluids (p<0.03); other was NS
Postop vomiting - no of pts (RR)	0.47	(0.16	1.42)			1 trial		Wide confidence interval => results uncertain
Postop nausea - no of pts (RR)	0.52	(0.25	1.12)			1 trial		One small study (n=36); borderline significantly less nausea for fluids (p=0.09)

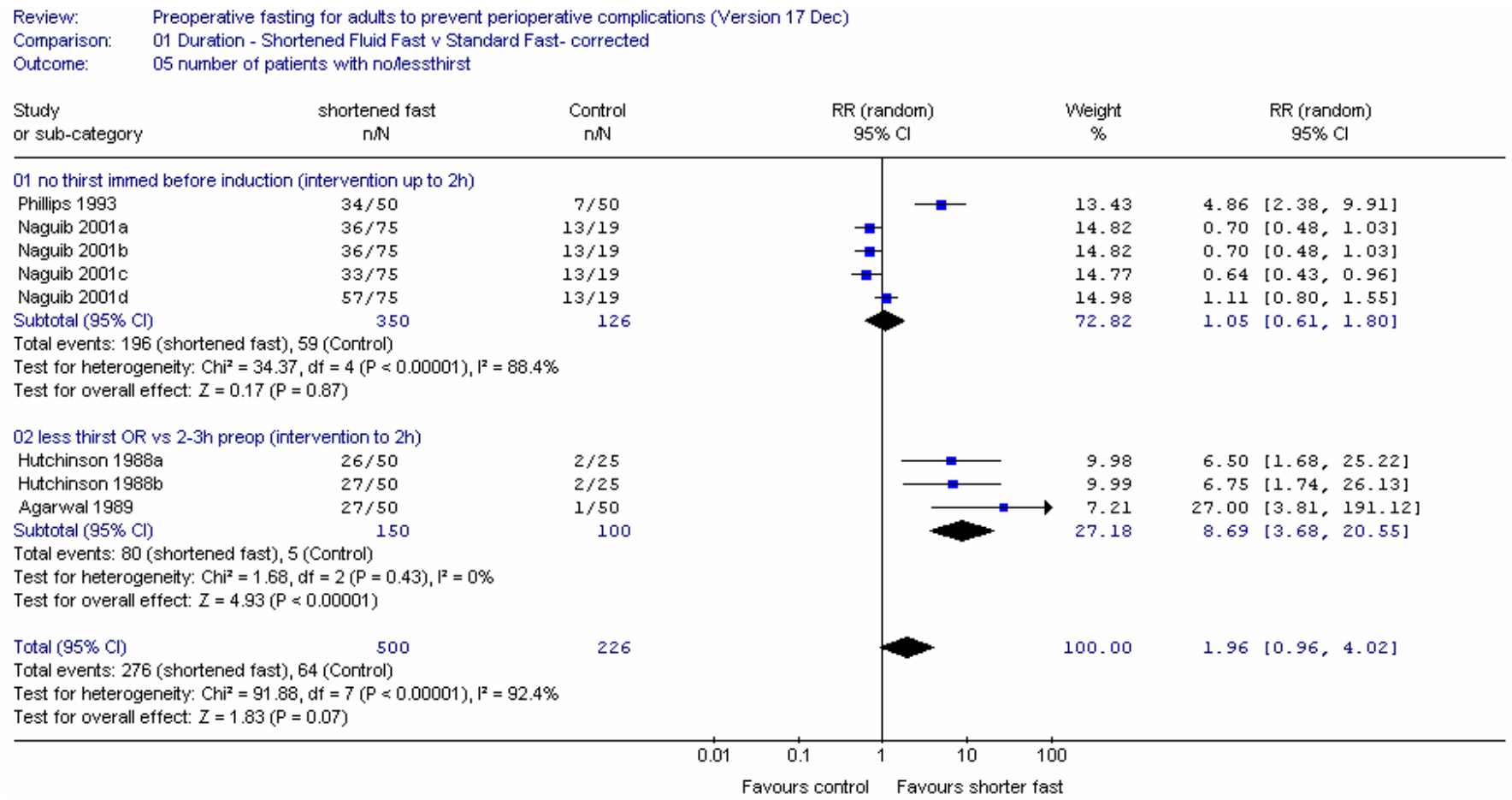
Review: Preoperative fasting for adults to prevent perioperative complications (Version 29 Nov)
Comparison: 01 Duration - Shortened Fluid Fast v Standard Fast- corrected
Outcome: 01 Gastric Contents - Volume (ml)



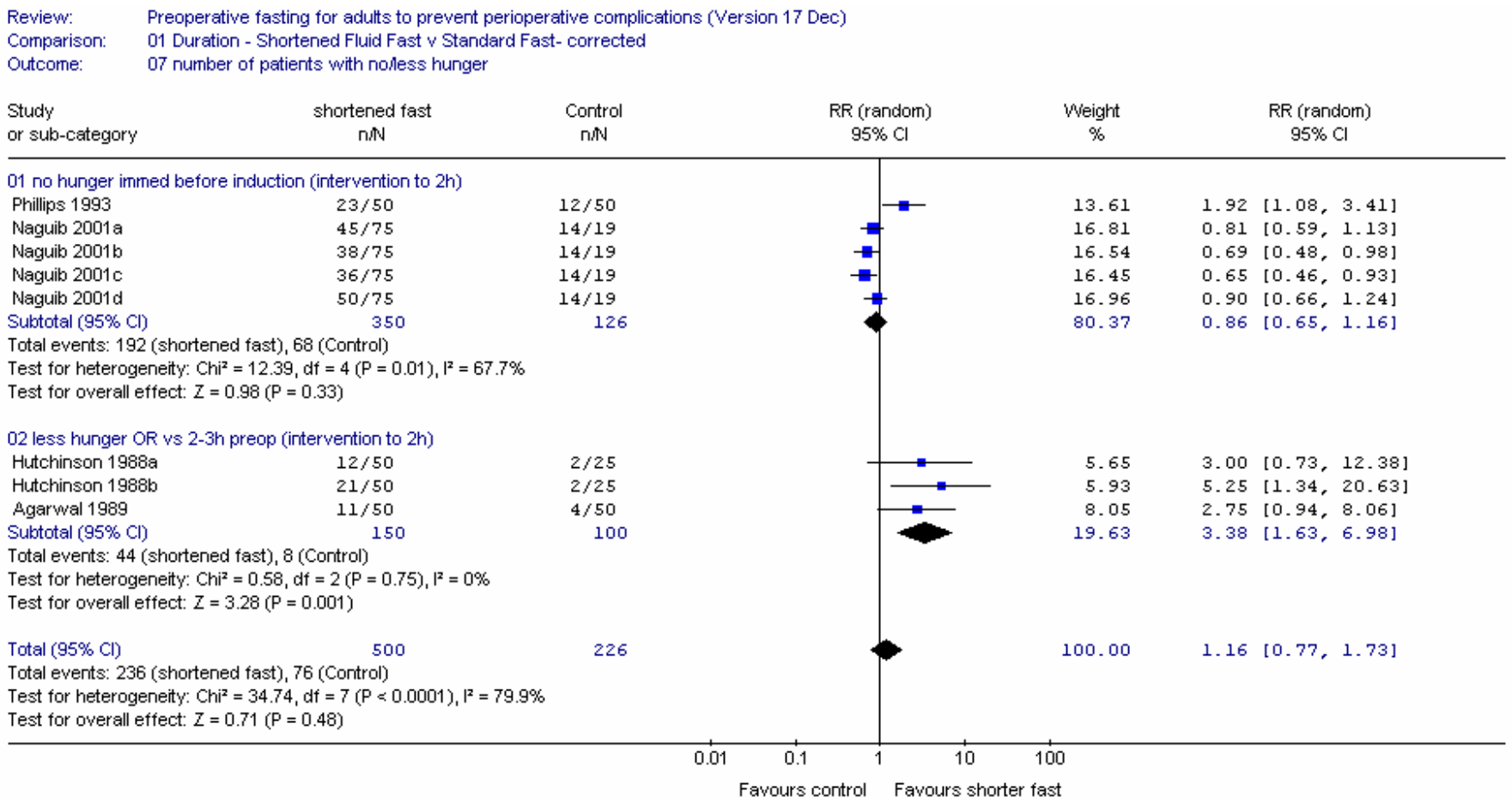
Adults studies by duration

Review: Preoperative fasting for adults to prevent perioperative complications (Version 29 Nov)
Comparison: 01 Duration - Shortened Fluid Fast v Standard Fast- corrected
Outcome: 02 Gastric Contents - pH




Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 01 Duration - Shortened Fluid Fast v Standard Fast- corrected
Outcome: 05 number of patients with no/lessthirst
Study or sub-category
shortened fast n/N
Control n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 no thirst immed before induction (intervention up to 2h)
Phillips 1993 34/50 7/50 13.43 4.86 [2.38, 9.91]
Naguib 2001a 36/75 13/19 14.82 0.70 [0.48, 1.03]
Naguib 2001b 36/75 13/19 14.82 0.70 [0.48, 1.03]
Naguib 2001c 33/75 13/19 14.77 0.64 [0.43, 0.96]
Naguib 2001d 57/75 13/19 14.98 1.11 [0.80, 1.55]
Subtotal (95% CI) 350 126 72.82 1.05 [0.61, 1.80]
Total events: 196 (shortened fast), 59 (Control)
Test for heterogeneity: Chi² = 34.37, df = 4 (P < 0.00001), I² = 88.4%
Test for overall effect: Z = 0.17 (P = 0.87)
02 less thirst OR vs 2-3h preop (intervention to 2h)
Hutchinson 1988a 26/50 2/25 9.98 6.50 [1.68, 25.22]
Hutchinson 1988b 27/50 2/25 9.99 6.75 [1.74, 26.13]
Agarwal 1989 27/50 1/50 7.21 27.00 [3.81, 191.12]
Subtotal (95% CI) 150 100 27.18 8.69 [3.68, 20.55]
Total events: 80 (shortened fast), 5 (Control)
Test for heterogeneity: Chi² = 1.68, df = 2 (P = 0.43), I² = 0%
Test for overall effect: Z = 4.93 (P < 0.00001)
Total (95% CI) 500 226 100.00 1.96 [0.96, 4.02]
Total events: 276 (shortened fast), 64 (Control)
Test for heterogeneity: Chi² = 91.88, df = 7 (P < 0.00001), I² = 92.4%
Test for overall effect: Z = 1.83 (P = 0.07)
0.01
0.1
1
10
100
Favours control
Favours shorter fast

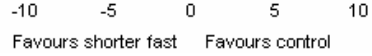
Adults studies by duration



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 01 Duration - Shortened Fluid Fast v Standard Fast- corrected
Outcome: 10 mean VAS for thirst (intervention to 1.5h)

Study or sub-category	Shortened fast N	Shortened fast Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Søreide 1993a	25	1.62(2.16)	13	2.89(2.34)		53.89	-1.27 [-2.80, 0.26]
Søreide 1993b	25	2.05(2.52)	12	2.89(2.34)		46.11	-0.84 [-2.49, 0.81]
Total (95% CI)	50		25			100.00	-1.07 [-2.19, 0.05]

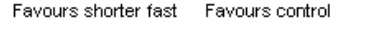
Test for heterogeneity: Chi² = 0.14, df = 1 (P = 0.71), I² = 0%
Test for overall effect: Z = 1.87 (P = 0.06)



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 01 Duration - Shortened Fluid Fast v Standard Fast- corrected
Outcome: 11 mean VAS for anxiety (intervention to 1.5h)

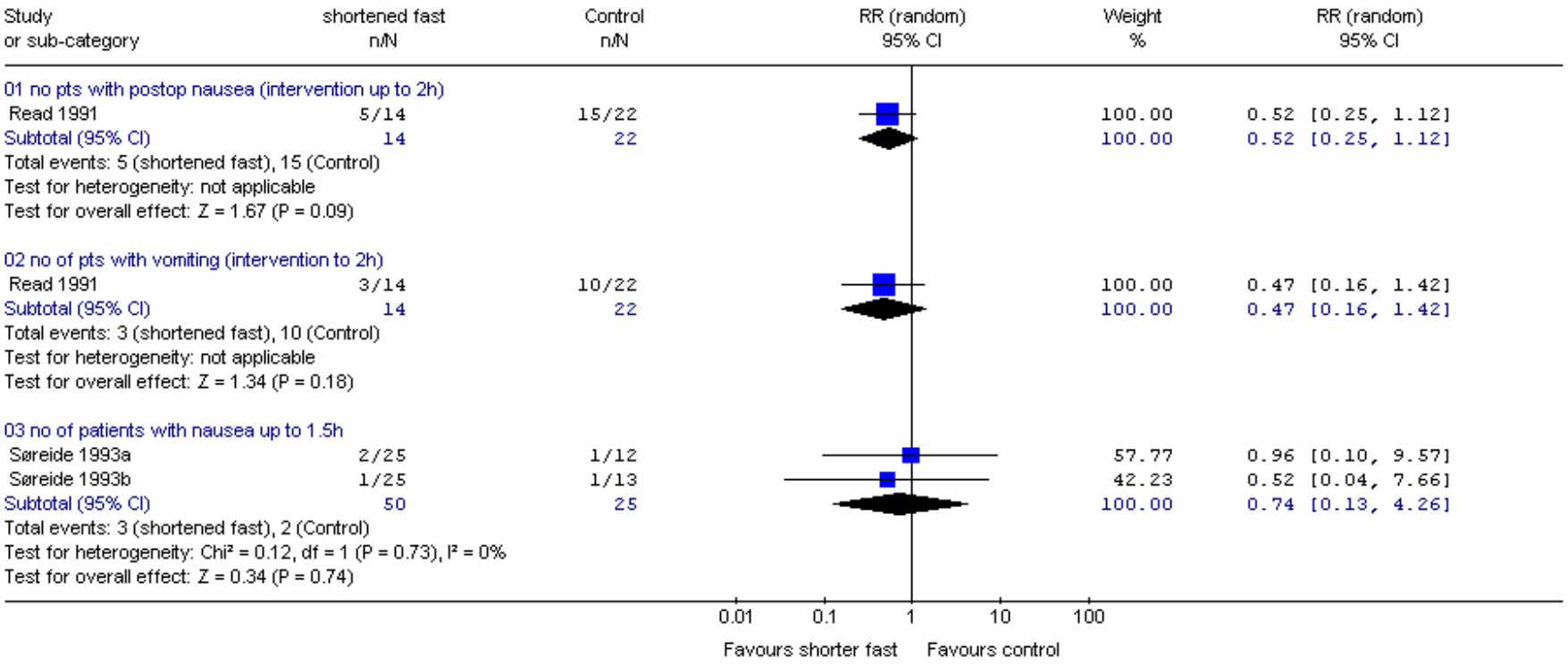
Study or sub-category	Shortened fast N	Shortened fast Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Søreide 1993a	25	1.50(1.60)	13	2.70(3.30)		53.56	-1.20 [-3.10, 0.70]
Søreide 1993b	25	3.80(3.20)	12	2.70(3.30)		46.44	1.10 [-1.15, 3.35]
Total (95% CI)	50		25			100.00	-0.13 [-2.38, 2.12]

Test for heterogeneity: Chi² = 2.34, df = 1 (P = 0.13), I² = 57.3%
Test for overall effect: Z = 0.12 (P = 0.91)



Adults studies by duration

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 01 Duration - Shortened Fluid Fast v Standard Fast- corrected
Outcome: 09 number of patients PONV



Appendix A5: Adult studies by type

Primary outcomes

Type of fluid or solid: water

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001

Number of comparisons 9 **Number of patients** 611

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	-6.27 (-9.48 -3.07)	5.46	7	0.60	0	Statistically significantly in favour of water; mean decrease 6.3ml
Gastric pH (WMD)	0.04 (-0.18 0.27)	9.96	8	0.27	20	Little difference

Type of fluid or solid: clear fluids

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001 and Goodwin et al., 1991

Number of comparisons 3 **Number of patients** 318

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	3.10 (0.05 6.15)	0.37	2	0.83	0	Statistically significantly in favour of standard fast; mean difference clinically small (3 ml)
Gastric pH (WMD)	0.25 (-0.16 0.65)	1.40	2	0.50	0	Little difference; one study (Hausel) had ~50% pH measurements missing - without this, WMD = 0.41 (95%CI -0.08, 0.90)

Type of fluid or solid: non-clear fluids

Comments Two trials in same report (Hutchinson et al., 1988)

Number of comparisons 2 **Number of patients** 150

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	0.87 (-5.31 7.06)	0.02	1	0.90	0	Little difference; two comparisons in one trial
Gastric pH (WMD)	0.11 (-0.35 0.56)	0.25	1	0.62	0	Little difference; two comparisons in one trial

Type of fluid or solid: all fluids except water

Comments All clear and non-clear fluids (except water alone)

Number of comparisons 5 **Number of patients** 468

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	2.66 (-0.07 5.40)	0.78	4	0.94	0	Little difference
Gastric pH (WMD)	0.19 (-0.12 0.49)	1.86	4	0.76	0	Little difference

Type of fluid or solid: fruit juice

Comments Single trial (Hutchinson et al) and an additional comparison with secondary outcomes in Naguib et al., 2001

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	0.50 (-6.50 7.50)			1 trial		Little difference
Gastric pH (WMD)	0.00 (-0.50 0.50)			1 trial		Very little difference; single trial (n=100)

Type of fluid or solid: coffee

Comments Single study (Hutchinson et al); coffee + milk on request

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	1.30 (-6.37 8.97)			1 trial		Little difference; 1 study (n=100)
Gastric pH (WMD)	0.23 (-0.34 0.80)			1 trial		Favours coffee, not significant

Secondary outcomes

Type of fluid or solid: water

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001

Number of comparisons 5 **Number of patients** 546

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with none	1.12	(0.91	1.37)			1 trial		Little difference between groups; one comparison (Naguib, n=150)
Thirst - no. of pts with less	27.00	(3.81	191.12)			1 trial		Operating room vs. 2 to 3h preoperatively; statistically significantly less thirst for shorter fast (1/27 risk); wide confidence interval; 1 comparison (Agarwal, n=100)
Thirst - VAS (WMD)	-1.07	(-2.19	0.05)	0.14	1	0.71	0	Two comparisons in one trial (Søreide); favours reduced fast, borderline significance (p=0.06)
Thirst - descriptive								Two comparisons - VAS median; one1 had significantly less thirst for water (p<0.0001); other was NS
Hunger - no. of pts with none	0.91	(0.74	1.12)			1 trial		Little difference
Hunger - no. of pts with less	2.75	(0.94	8.06)			1 trial		Fairly wide confidence interval; less hunger for water, borderline significance (p=0.07) Operating room vs. 2 to 3h preoperatively
Hunger - descriptive								One study (Hausel, n=172), no significant differences between groups
Anxiety - VAS (WMD)	-0.13	(-2.38	2.12)	2.34	1	0.13	57	Wide confidence interval => results uncertain; some heterogeneity
Anxiety - descriptive								Two studies, one had no significant difference, one had significantly less anxiety for patients having water
Postop vomiting - no of pts	0.47	(0.16	1.42)			1 trial		Wide confidence interval => results uncertain
Postop nausea - no of pts	0.55	(0.28	1.11)	0.25	2	0.88	0	Non-significantly less nausea for fluids; fairly wide confidence interval

Type of fluid or solid: clear fluids

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001 and Goodwin et al., 1991

Number of comparisons 6 **Number of patients** 666

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with none	1.05 (0.52 2.09)	33.08	3	<0.00001	91	Highly heterogeneous
Thirst - descriptive						Two studies - VAS median; both had significantly less thirst for fluids (p<0.001)
Hunger - no. of pts with none	0.84 (0.58 1.22)	13.30	3	0.004	77	Highly heterogeneous
Hunger - descriptive						Two studies - VAS median; one had significantly less hunger for fluids (p<0.05); other was NS
Anxiety - descriptive						One study (n=151) - VAS median; significantly less anxiety for fluids (p<0.05)
Postop nausea - descriptive						One study (n=100) - VAS median; no significant difference

Type of fluid or solid: non-clear fluids

Comments Two trials in same report (Hutchinson et al)

Number of comparisons 2 **Number of patients** 150

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with less	6.62 (2.54 17.26)	0.00	1	0.97	0	Two comparisons in one trial; statistically significantly less thirst for shortened fast (1/7 times risk); operating room vs. 2 to 3h preoperatively
Hunger - no. of pts with less	4.01 (1.50 10.73)	0.31	1	0.58	0	Operating room vs. 2 to 3h preoperatively; statistically significantly less hunger for shorter fast (1/4 risk); 2 comparisons in one trial

Type of fluid or solid: fruit juice

Comments Single trial (Hutchinson et al., 1988) and an additional comparison with secondary outcomes in Naguib et al., 2001

Number of comparisons 2 **Number of patients** 250

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with none	0.65 (0.48 0.87)			1 trial		Apple juice; statistically significantly more thirst for fruit juice (1.5 times risk)
Thirst - no. of pts with less	9.00 (2.92 27.76)			1 trial		Orange juice; operating room vs. 2 to 3h preoperatively; statistically significantly less thirst for fruit juice (1/9 risk); wide confidence interval; one trial
Hunger - no. of pts with none	0.63 (0.48 0.83)			1 trial		Apple juice; statistically significantly more hunger for shorter fast (1.5 times risk)
Hunger - no. of pts with less	5.25 (1.94 14.20)			1 trial		Orange juice; operating room vs. 2 to 3h preoperatively; statistically significantly less hunger for fruit juice (1/5 risk); wide confidence interval; 1 trial (n=100)

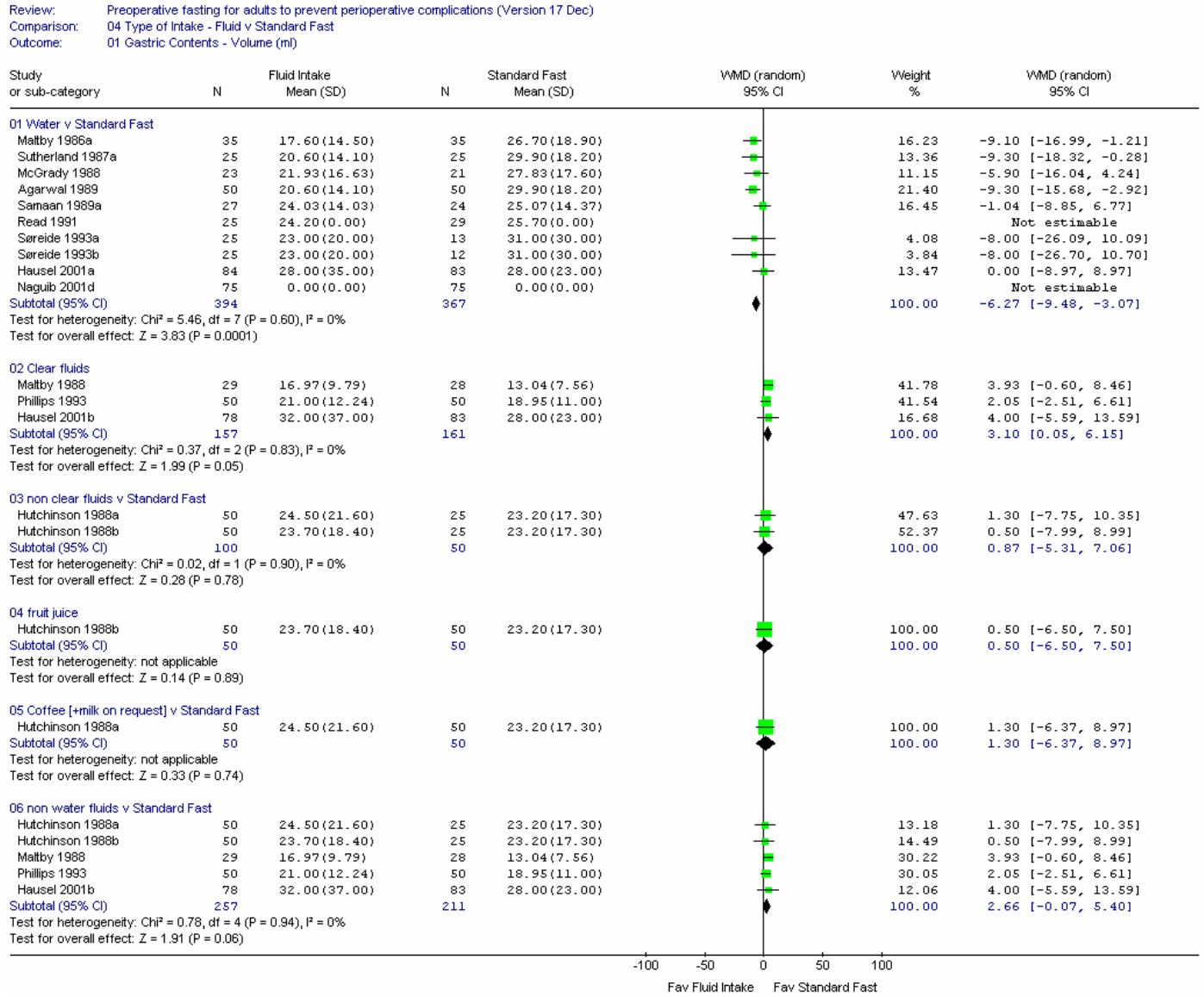
Type of fluid or solid: coffee

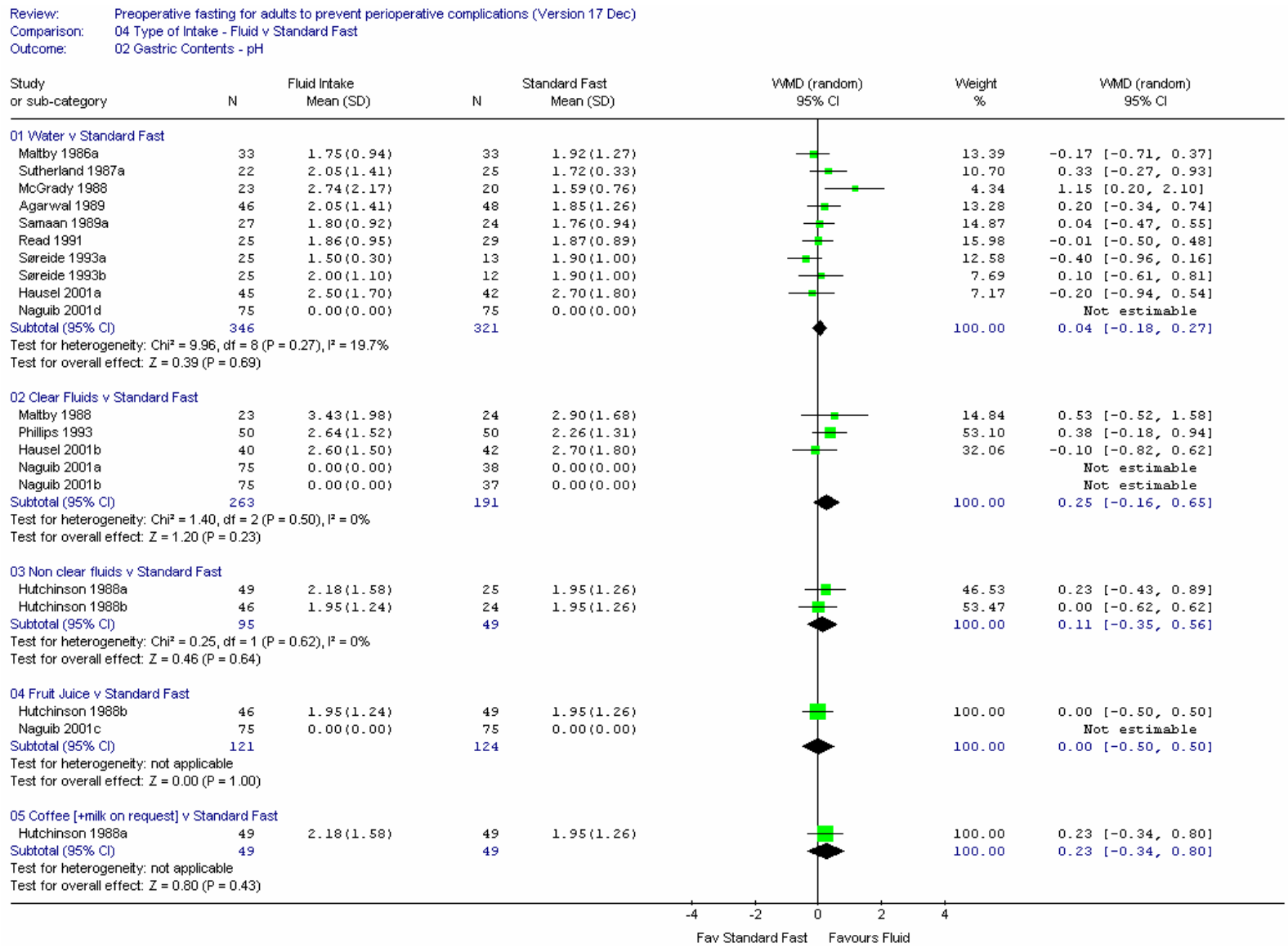
Comments Single study (Hutchinson et al., 1988); coffee + milk on request

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with less	8.67 (2.80 26.80)			1 trial		Statistically significantly less thirst for coffee group (1/9 risk); one study; operating room vs. 2 to 3h preoperatively
Hunger - no. of pts with less	3.00 (1.04 8.67)			1 trial		Statistically significantly less hunger for coffee group (1/3 risk); one study; operating room vs. 2 to 3h preoperatively

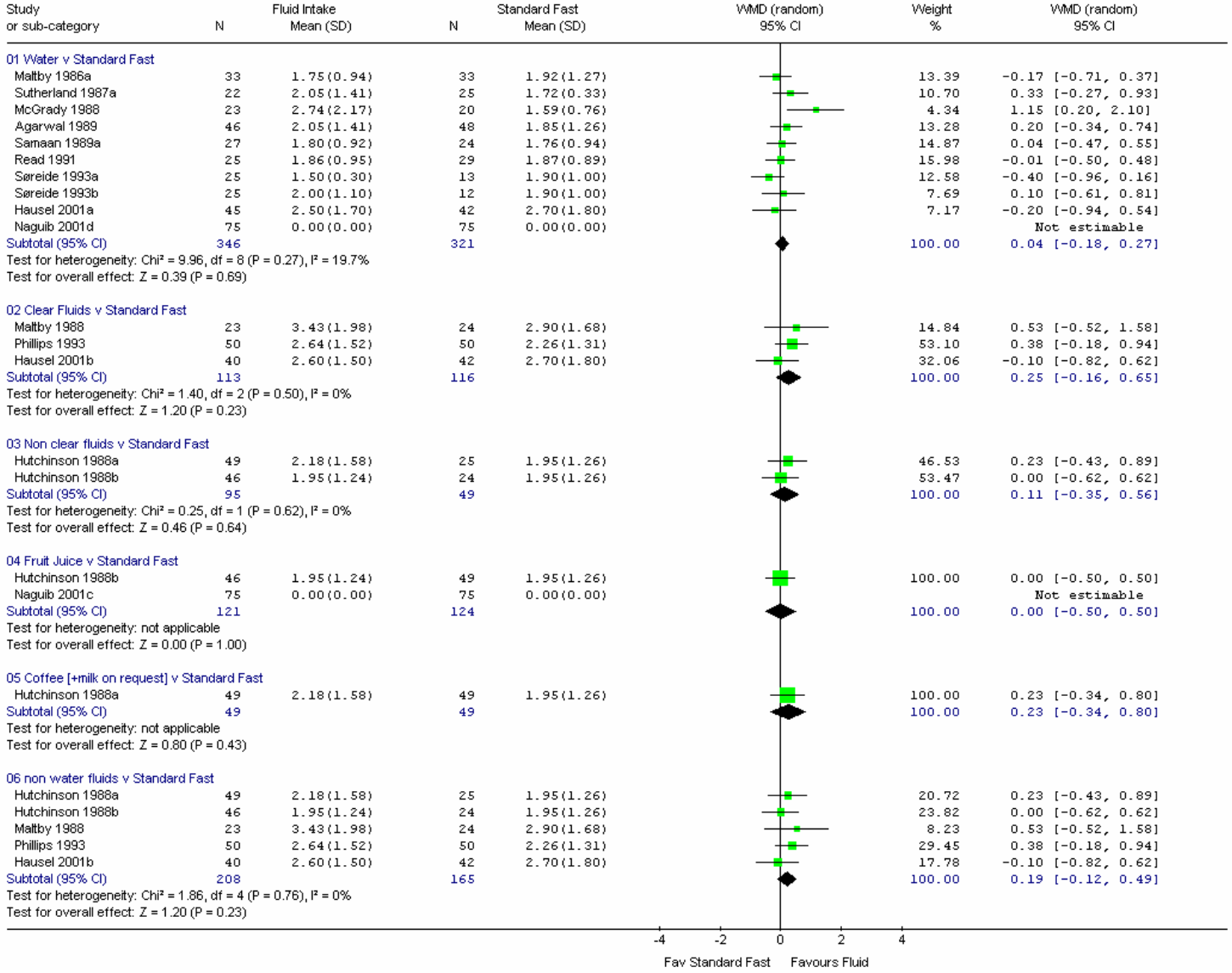
Adult studies by type



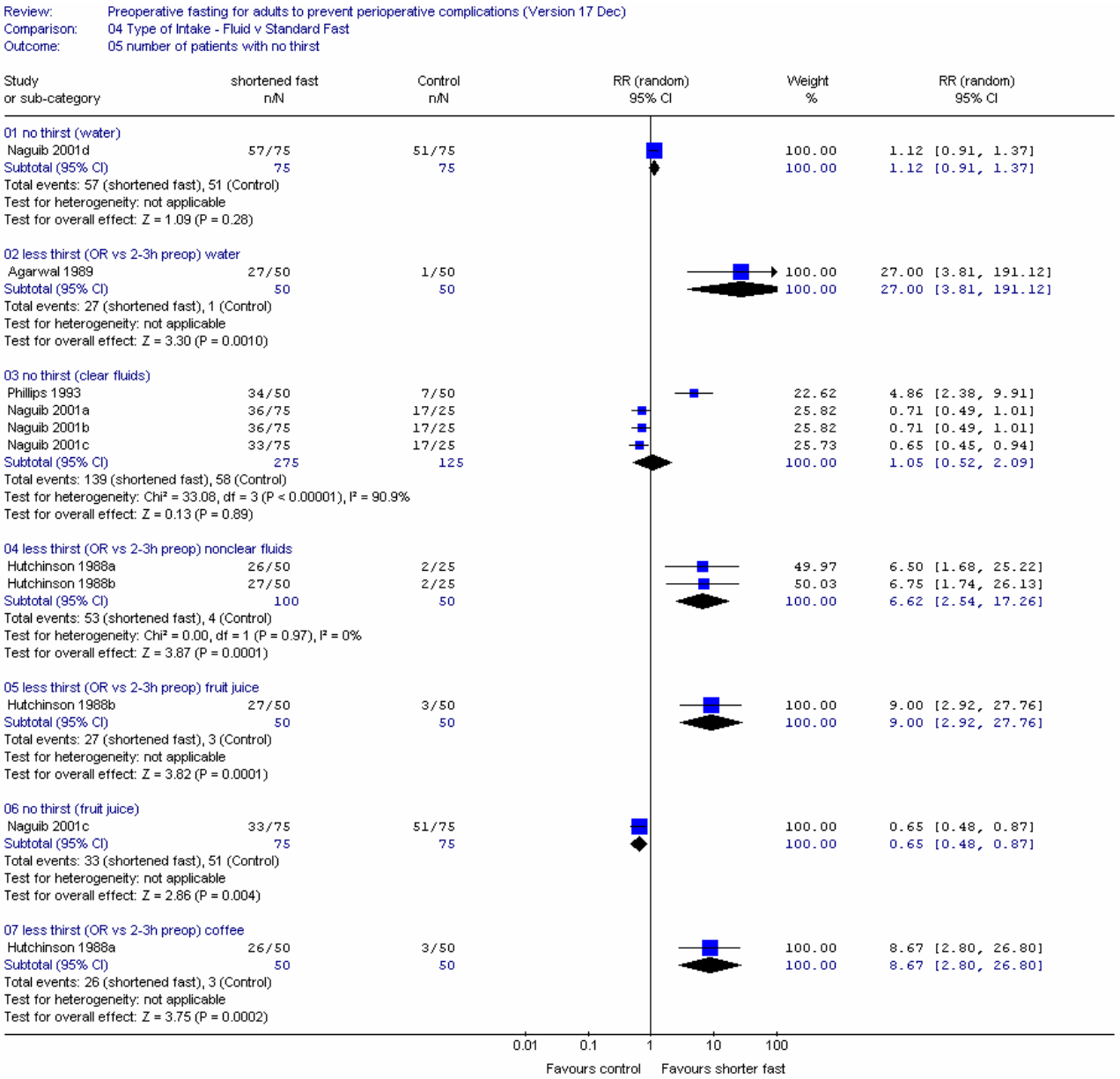

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 04 Type of Intake - Fluid v Standard Fast
Outcome: 02 Gastric Contents - pH
Study or sub-category
Fluid Intake N Mean (SD)
Standard Fast N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
01 Water v Standard Fast
Maltby 1986a 33 1.75(0.94) 33 1.92(1.27) 13.39 -0.17 [-0.71, 0.37]
Sutherland 1987a 22 2.05(1.41) 25 1.72(0.33) 10.70 0.33 [-0.27, 0.93]
McGrady 1988 23 2.74(2.17) 20 1.59(0.76) 4.34 1.15 [0.20, 2.10]
Agarwal 1989 46 2.05(1.41) 48 1.85(1.26) 13.28 0.20 [-0.34, 0.74]
Samaan 1989a 27 1.80(0.92) 24 1.76(0.94) 14.87 0.04 [-0.47, 0.55]
Read 1991 25 1.86(0.95) 29 1.87(0.89) 15.98 -0.01 [-0.50, 0.48]
Søreide 1993a 25 1.50(0.30) 13 1.90(1.00) 12.58 -0.40 [-0.96, 0.16]
Søreide 1993b 25 2.00(1.10) 12 1.90(1.00) 7.69 0.10 [-0.61, 0.81]
Hausel 2001a 45 2.50(1.70) 42 2.70(1.80) 7.17 -0.20 [-0.94, 0.54]
Naguib 2001d 75 0.00(0.00) 75 0.00(0.00) Not estimable
Subtotal (95% CI) 346 321 100.00 0.04 [-0.18, 0.27]
Test for heterogeneity: Chi² = 9.96, df = 8 (P = 0.27), I² = 19.7%
Test for overall effect: Z = 0.39 (P = 0.69)
02 Clear Fluids v Standard Fast
Maltby 1988 23 3.43(1.98) 24 2.90(1.68) 14.84 0.53 [-0.52, 1.58]
Phillips 1993 50 2.64(1.52) 50 2.26(1.31) 53.10 0.38 [-0.18, 0.94]
Hausel 2001b 40 2.60(1.50) 42 2.70(1.80) 32.06 -0.10 [-0.82, 0.62]
Naguib 2001a 75 0.00(0.00) 38 0.00(0.00) Not estimable
Naguib 2001b 75 0.00(0.00) 37 0.00(0.00) Not estimable
Subtotal (95% CI) 263 191 100.00 0.25 [-0.16, 0.65]
Test for heterogeneity: Chi² = 1.40, df = 2 (P = 0.50), I² = 0%
Test for overall effect: Z = 1.20 (P = 0.23)
03 Non clear fluids v Standard Fast
Hutchinson 1988a 49 2.18(1.58) 25 1.95(1.26) 46.53 0.23 [-0.43, 0.89]
Hutchinson 1988b 46 1.95(1.24) 24 1.95(1.26) 53.47 0.00 [-0.62, 0.62]
Subtotal (95% CI) 95 49 100.00 0.11 [-0.35, 0.56]
Test for heterogeneity: Chi² = 0.25, df = 1 (P = 0.62), I² = 0%
Test for overall effect: Z = 0.46 (P = 0.64)
04 Fruit Juice v Standard Fast
Hutchinson 1988b 46 1.95(1.24) 49 1.95(1.26) 100.00 0.00 [-0.50, 0.50]
Naguib 2001c 75 0.00(0.00) 75 0.00(0.00) Not estimable
Subtotal (95% CI) 121 124 100.00 0.00 [-0.50, 0.50]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.00 (P = 1.00)
05 Coffee [+milk on request] v Standard Fast
Hutchinson 1988a 49 2.18(1.58) 49 1.95(1.26) 100.00 0.23 [-0.34, 0.80]
Subtotal (95% CI) 49 49 100.00 0.23 [-0.34, 0.80]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.80 (P = 0.43)
-4
-2
0
2
4
Fav Standard Fast
Favours Fluid

Adults studies by type

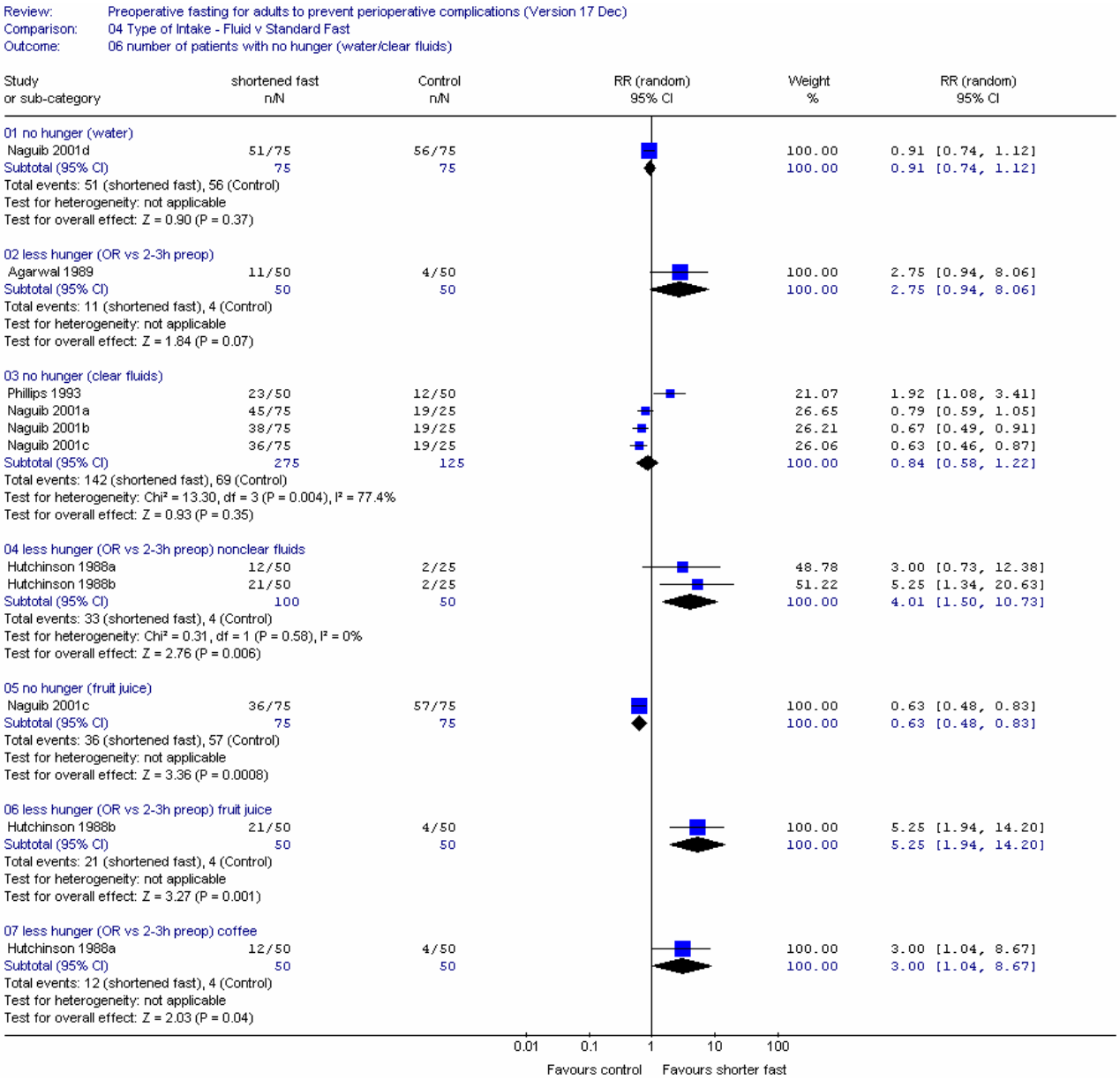
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 04 Type of Intake - Fluid v Standard Fast
Outcome: 02 Gastric Contents - pH



Adults studies by type



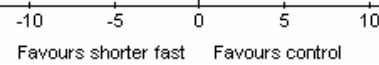
Adults studies by type



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 04 Type of Intake - Fluid v Standard Fast
Outcome: 07 mean VAS for thirst (water) to 1.5h

Study or sub-category	Shortened fast N	Shortened fast Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Søreide 1993a	25	1.62(2.16)	13	2.89(2.34)		53.89	-1.27 [-2.80, 0.26]
Søreide 1993b	25	2.05(2.52)	12	2.89(2.34)		46.11	-0.84 [-2.49, 0.81]
Total (95% CI)	50		25			100.00	-1.07 [-2.19, 0.05]

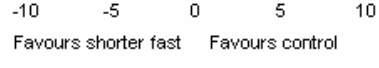
Test for heterogeneity: Chi² = 0.14, df = 1 (P = 0.71), I² = 0%
Test for overall effect: Z = 1.87 (P = 0.06)



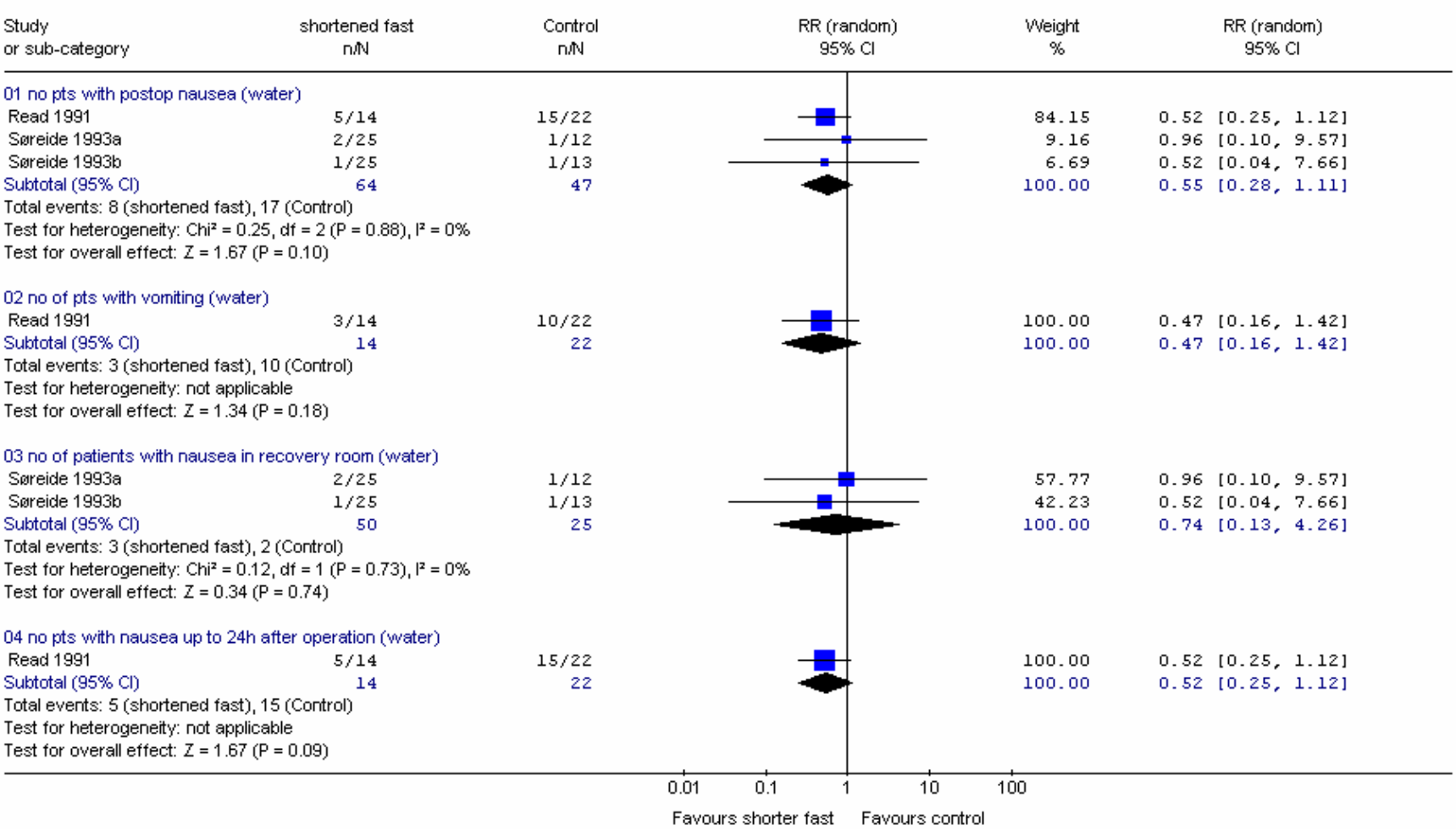
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 04 Type of Intake - Fluid v Standard Fast
Outcome: 08 mean VAS for anxiety (water) to 1.5h

Study or sub-category	Shortened fast N	Shortened fast Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Søreide 1993a	25	1.50(1.60)	13	2.70(3.30)		53.56	-1.20 [-3.10, 0.70]
Søreide 1993b	25	3.80(3.20)	12	2.70(3.30)		46.44	1.10 [-1.15, 3.35]
Total (95% CI)	50		25			100.00	-0.13 [-2.38, 2.12]

Test for heterogeneity: Chi² = 2.34, df = 1 (P = 0.13), I² = 57.3%
Test for overall effect: Z = 0.12 (P = 0.91)



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 04 Type of Intake - Fluid v Standard Fast
Outcome: 09 number of patients PONV



Appendix A6: Adult studies, water vs. clear fluids

Secondary outcomes

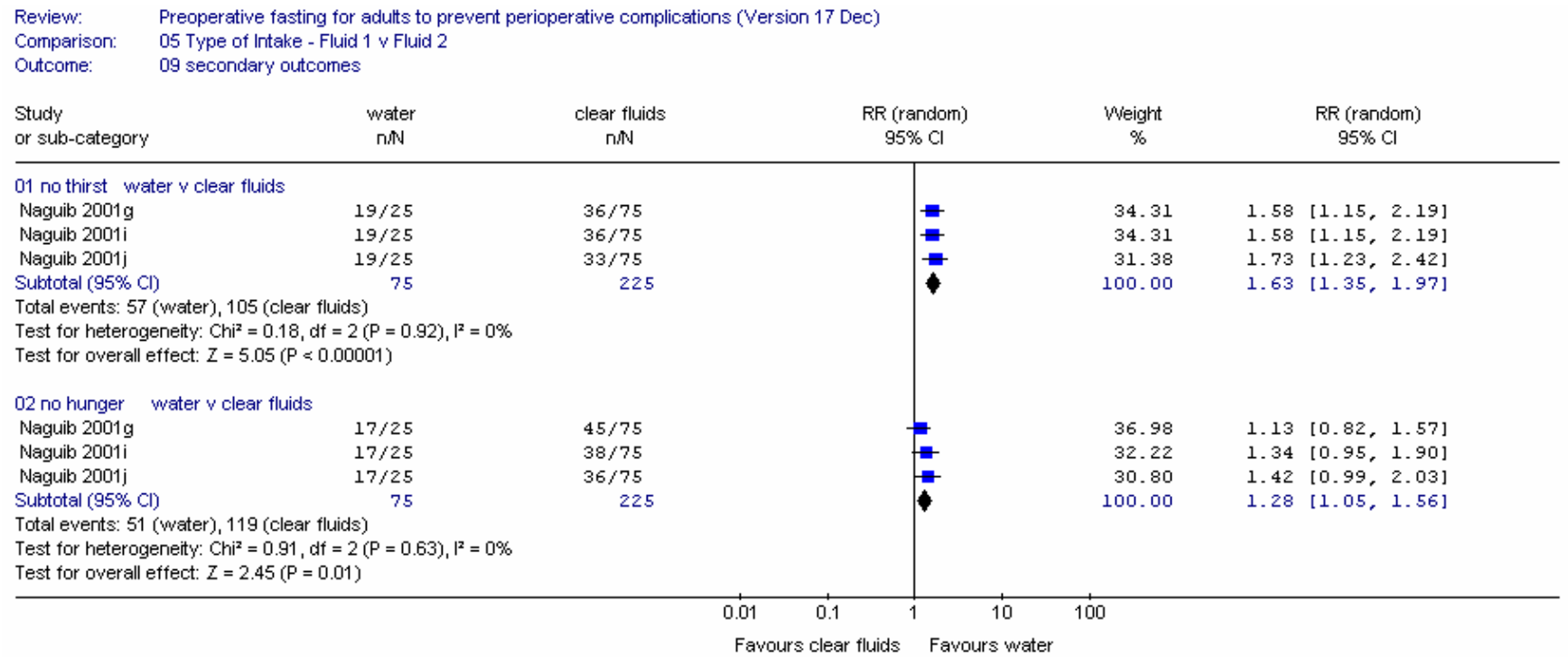
Type of fluid or solid: head-to-head water vs. clear fluids

Comments Three studies (Naguib, Nygren and Henriksen); Nygren narrative pre-post quantitative data and too small a study (n=12)

Number of comparisons 5 **Number of patients** 348

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with none (RR)	1.63 (1.35 1.97)	0.18	2	0.92	0	Three comparisons in one study; statistically significantly more thirst for clear fluids (1.6 times risk)
Hunger - no. of pts with none (RR)	1.28 (1.05 1.56)	0.91	2	0.63	0	Three comparisons in one study; statistically significantly more hunger for clear fluids (1.3 times risk)
All secondary						No significant differences for nausea, anxiety or well-being; two comparisons in one study (n=48)

Adult studies, water vs. clear fluids



Appendix A7: Adult studies by volume of fluid

Sub-group analyses of shortened versus standard fasts

Primary outcomes

Volume: low volume

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001

Number of comparisons 8 **Number of patients** 572

Outcome	WMD / RR / OR (95%CI)	Chi²	df	p (hetero)	I² (%)	Comments
Gastric volume (WMD)	-3.60 (-7.74 0.54)	19.27	8	0.01	59	Heterogeneous
Gastric pH (WMD)	0.09 (-0.16 0.35)	12.69	8	0.12	37	Little difference

Volume: high volume

Comments Two comparisons in one study (Hausel et al., 2001) had ~50% pH values missing

Number of comparisons 3 **Number of patients** 295

Outcome	WMD / RR / OR (95%CI)	Chi²	df	p (hetero)	I² (%)	Comments
Gastric volume (WMD)	-0.25 (-6.83 6.32)	1.75	2	0.42	0	Little difference
Gastric pH (WMD)	-0.01 (-0.44 0.42)	0.34	2	0.84	0	Little difference; two comparisons had ~50% pH values missing; without these,WMD = 0.10 (95%CI -0.48, 0.68)

Volume: unlimited

Comments Additional comparison with secondary outcomes in Read and Vaughan 1991.

Number of comparisons 2 **Number of patients** 154

Outcome	WMD / RR / OR (95%CI)	Chi²	df	p (hetero)	I² (%)	Comments
Gastric volume (WMD)	2.05 (-2.51 6.61)			1 trial		Little difference; one trial
Gastric pH (WMD)	0.16 (-0.22 0.54)	1.06	2	0.30	5	Little difference

Secondary outcomes

Volume: **low volume**

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001

Number of comparisons 10 **Number of patients** 845

Outcome	WMD / RR / OR (95%CI)	Chi²	df	p (hetero)	I² (%)	Comments
Thirst - no. of pts with none (RR)	0.78 (0.60 1.02)	5.83	3	0.12	49	More thirst for shorter fast, borderline significance (p=0.06); four comparisons from one study (Naguib et al)
Thirst - no. of pts with less (RR)	8.69 (3.68 20.55)	1.68	2	0.43	0	Statistically significantly less thirst for shortened fast (1/9 risk); operating room vs. 2 to 3h preoperatively
Thirst - VAS (WMD)	-1.27 (-2.52 -0.02)			1 trial		Statistically significantly less thirst for shortened fast; one comparison (Søreide 1993a)
Thirst - descriptive						One study (Goodwin, n=100) - VAS median; significantly less thirst for fluids (p<0.001)
Hunger - no. of pts with none (RR)	0.77 (0.65 0.91)	2.38	3	0.50	0	Statistically significantly more hunger for shorter fast (1.3 times risk); four comparisons from one study
Hunger - no. of pts with less (RR)	3.38 (1.63 6.98)	0.58	2	0.75	0	Operating room vs. 2 to 3h preoperatively; statistically significantly less hunger for shortened fast (1/3 times risk)
Hunger - descriptive						One study (Goodwin, n=100) - VAS median; no significant difference
Anxiety - VAS (WMD)	-1.20 (-2.64 0.24)			1 trial		Non-significantly less anxiety with water (p=0.10); 1 comparison (Søreide et al., 1993a)
Postop nausea - no of pts (RR)	2.00 (0.19 20.67)			1 trial		Wide confidence interval => results uncertain; 1 comparison (Søreide et al., 1993a)
Postop nausea - descriptive						One study (Goodwin, n=100) - VAS median; no significant difference

Volume: high volume

Comments Two comparisons in one study (Hausel et al., 2001) had ~50% pH values missing

Number of comparisons 3 **Number of patients** 302

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - VAS (WMD)	-0.84 (-2.19 0.51)			1 trial		One comparison (Søreide 1993b); little difference
Thirst - descriptive	Two comparisons within one study - VAS median; significantly less thirst for fluids (p<0.0001)					
Hunger - descriptive						Two comparisons within one study - VAS median; one had significantly less hunger for fluids (p<0.05); other was NS
Anxiety - VAS (WMD)	1.10 (-0.70 2.90)			1 trial		Wide confidence interval => results uncertain; 1 comparison (Søreide 1993b)
Anxiety - descriptive						Two comparisons within one study - VAS median; one had significantly less anxiety for fluids (p<0.05); other was NS
Postop nausea - no of pts (RR)	1.00 (0.07 15.12)			1 trial		Wide confidence interval => results uncertain; 1 comparison (Søreide 1993b)

Volume: unlimited

Comments Additional comparison with secondary outcomes in Read and Vaughan 1991.

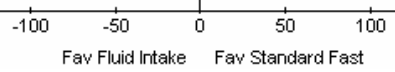
Number of comparisons 2 **Number of patients** 153

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Thirst - no. of pts with none (RR)	4.86 (2.38 9.91)			1 trial		Statistically significantly less thirst for shortened fast (1/5 times risk); single trial (Phillips et al., 1993)
Thirst - descriptive						One study (Reid, n=51); VAS, median; no significant difference
Hunger - no. of pts with none (RR)	1.92 (1.08 3.41)			1 trial		Statistically significantly less hunger for shortened fast (1/2 risk); single trial
Anxiety - descriptive						One study (Reid, n=51); VAS, median; significantly less anxiety for fluids group (p=0.03)
Postop vomiting - no of pts (RR)	0.47 (0.16 1.42)			1 trial		Wide confidence interval => results uncertain; 1 study (Reid; n=36 for this outcome)
Postop nausea - no of pts (RR)	0.52 (0.25 1.12)			1 trial		1 small study (n=36); Non- significantly less nausea for fluids (p=0.09)

Adults studies by volume of fluid

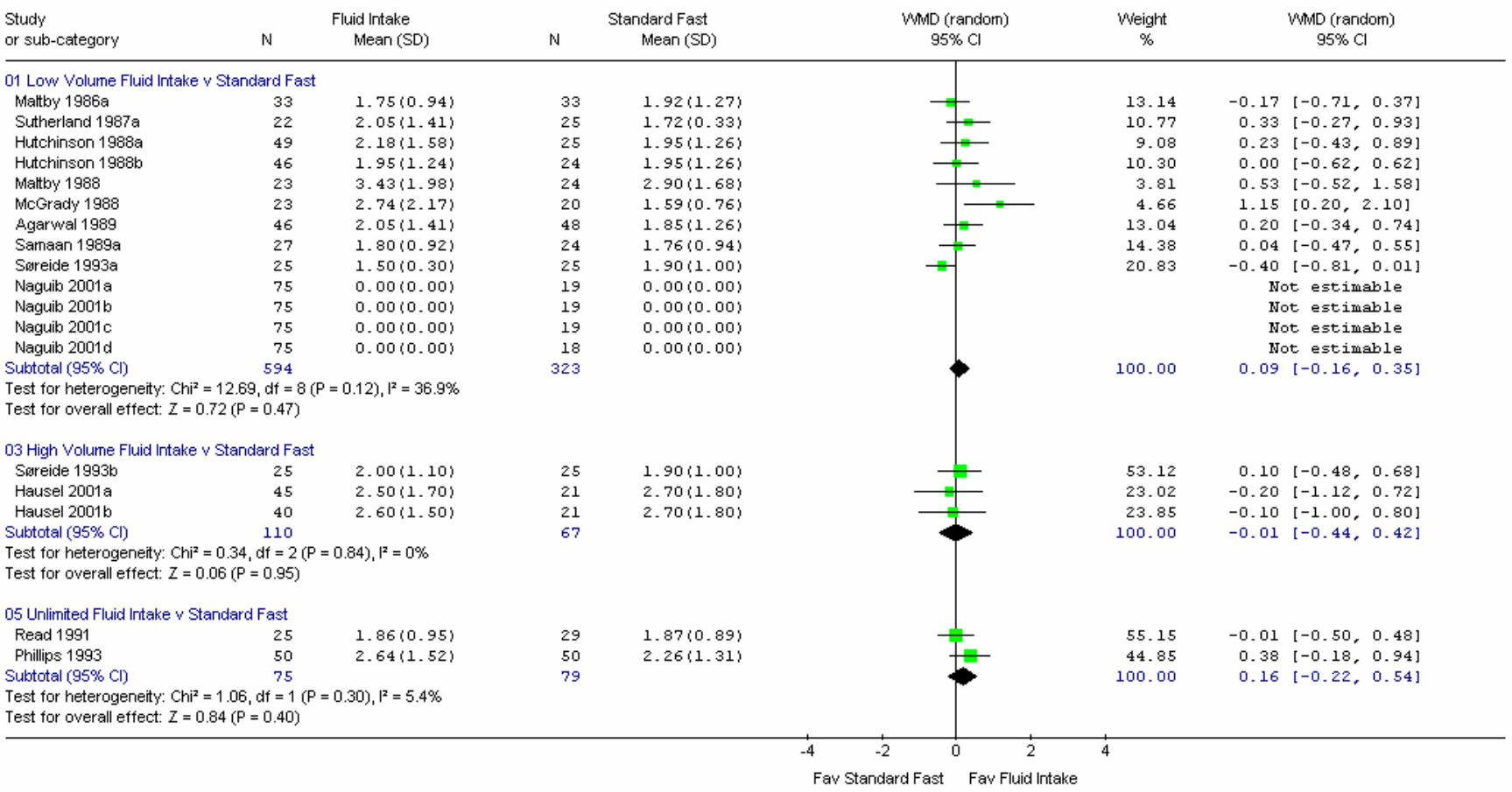
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast - corrected
Outcome: 01 Gastric Contents - Volume (ml)

Study or sub-category	Fluid Intake N	Fluid Intake Mean (SD)	Standard Fast N	Standard Fast Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 Low Volume Fluid Intake v Standard Fast							
Maltby 1986a	35	17.60(14.50)	35	26.70(18.90)		11.60	-9.10 [-16.99, -1.21]
Sutherland 1987a	25	20.60(14.10)	25	29.90(18.20)		10.03	-9.30 [-18.32, -0.28]
Hutchinson 1988a	50	24.50(21.60)	25	23.20(17.30)		10.00	1.30 [-7.75, 10.35]
Hutchinson 1988b	50	23.70(18.40)	25	23.20(17.30)		10.75	0.50 [-7.99, 8.99]
Maltby 1988	29	16.97(9.79)	28	13.04(7.56)		17.65	3.93 [-0.60, 8.46]
McGrady 1988	23	21.93(16.63)	21	27.83(17.60)		8.71	-5.90 [-16.04, 4.24]
Agarwal 1989	50	20.60(14.10)	50	29.90(18.20)		14.10	-9.30 [-15.68, -2.92]
Samaan 1989a	27	24.03(14.03)	24	25.07(14.37)		11.72	-1.04 [-8.85, 6.77]
Søreide 1993a	25	23.00(20.00)	25	31.00(30.00)		5.45	-8.00 [-22.13, 6.13]
Naguib 2001a	75	0.00(0.00)	19	0.00(0.00)			Not estimable
Naguib 2001b	75	0.00(0.00)	19	0.00(0.00)			Not estimable
Naguib 2001c	75	0.00(0.00)	19	0.00(0.00)			Not estimable
Naguib 2001d	75	0.00(0.00)	18	0.00(0.00)			Not estimable
Subtotal (95% CI)	614		333			100.00	-3.60 [-7.74, 0.54]
Test for heterogeneity: Chi² = 19.27, df = 8 (P = 0.01), I² = 58.5%							
Test for overall effect: Z = 1.71 (P = 0.09)							
03 High Volume Fluid Intake v Standard Fast							
Søreide 1993b	25	23.00(20.00)	25	31.00(30.00)		24.69	-8.00 [-22.13, 6.13]
Hausel 2001a	84	28.00(35.00)	42	28.00(23.00)		39.05	0.00 [-10.22, 10.22]
Hausel 2001b	78	32.00(37.00)	41	28.00(23.00)		36.26	4.00 [-6.82, 14.82]
Subtotal (95% CI)	187		108			100.00	-0.25 [-6.83, 6.32]
Test for heterogeneity: Chi² = 1.75, df = 2 (P = 0.42), I² = 0%							
Test for overall effect: Z = 0.08 (P = 0.94)							
05 Unlimited Fluid Intake v Standard Fast							
Read 1991	25	24.20(0.00)	29	25.70(0.00)			Not estimable
Phillips 1993	50	21.00(12.24)	50	18.95(11.00)		100.00	2.05 [-2.51, 6.61]
Subtotal (95% CI)	75		79			100.00	2.05 [-2.51, 6.61]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 0.88 (P = 0.38)							

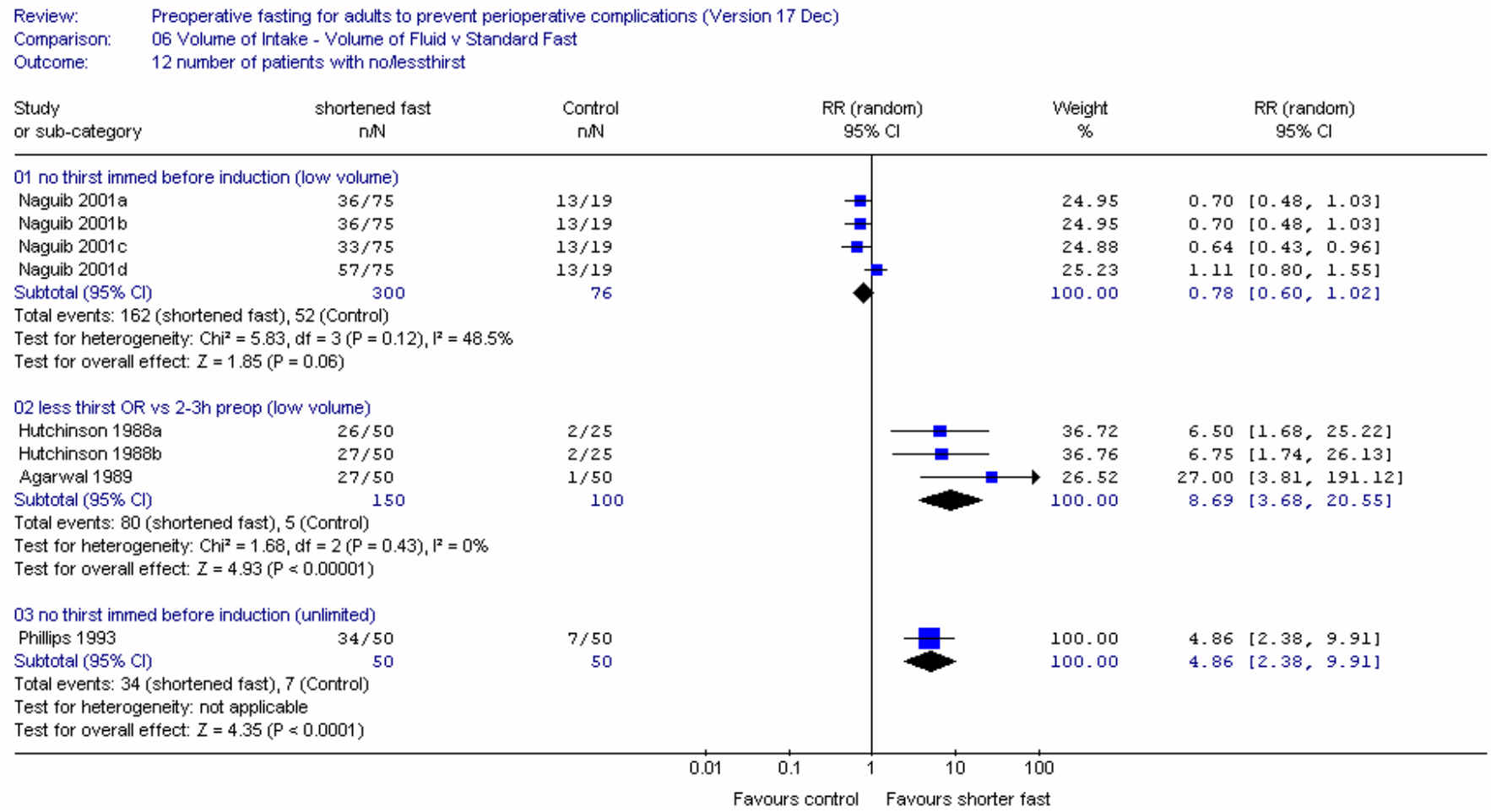


Adults studies by volume of fluid

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast - corrected
Outcome: 02 Gastric Contents - pH



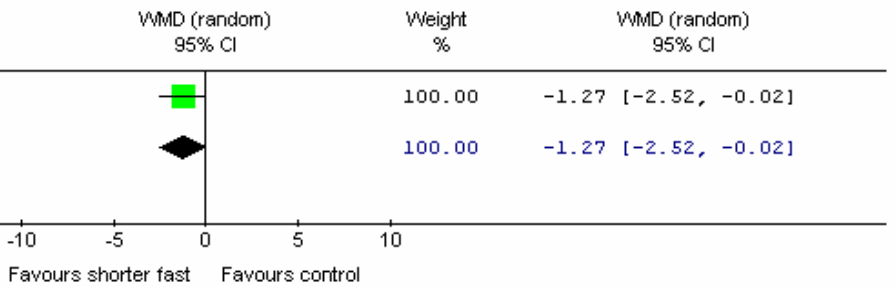
Adults studies by volume of fluid



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast
Outcome: 08 mean VAS for thirst low volume

Study or sub-category	N	Shortened fast Mean (SD)	N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Søreide 1993a	25	1.62(2.16)	25	2.89(2.34)		100.00	-1.27 [-2.52, -0.02]
Total (95% CI)	25		25			100.00	-1.27 [-2.52, -0.02]

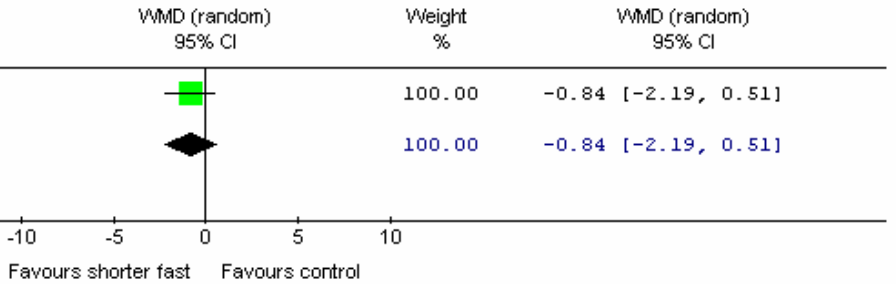
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.99 (P = 0.05)



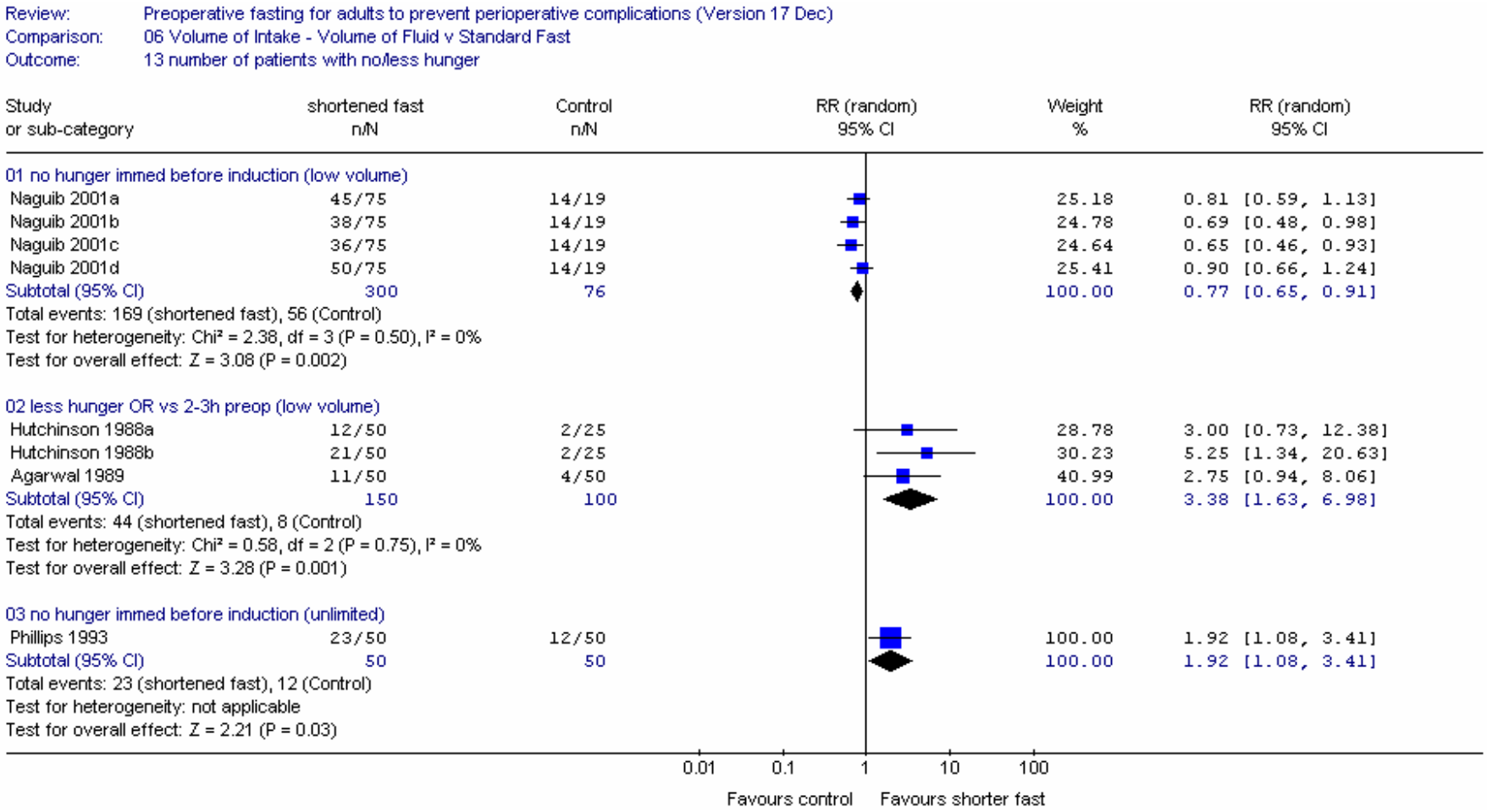
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast
Outcome: 09 mean VAS for thirst high volume

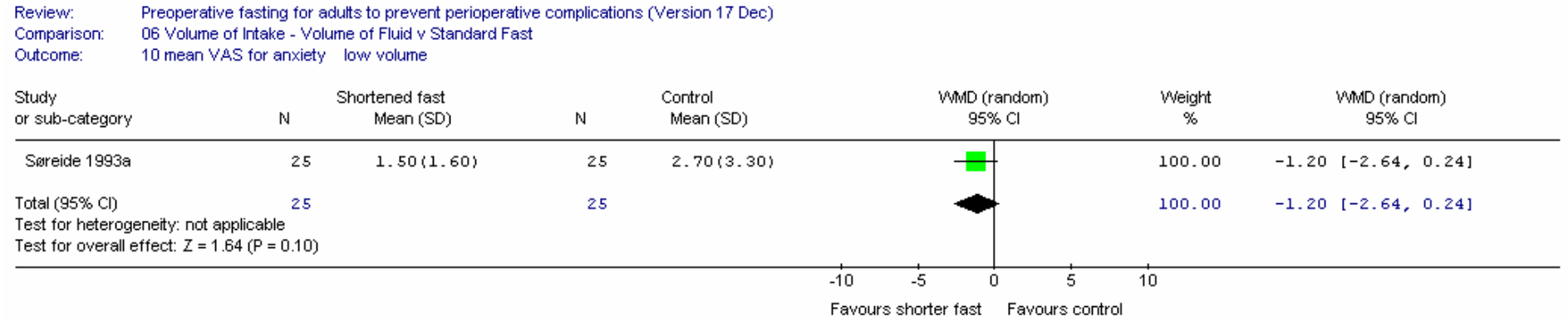
Study or sub-category	N	Shortened fast Mean (SD)	N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Søreide 1993b	25	2.05(2.52)	25	2.89(2.34)		100.00	-0.84 [-2.19, 0.51]
Total (95% CI)	25		25			100.00	-0.84 [-2.19, 0.51]

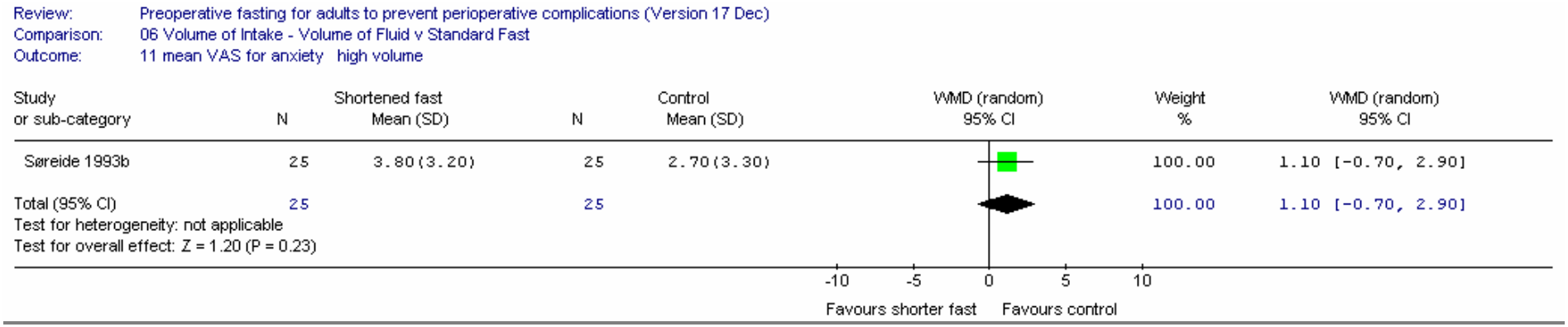
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.22 (P = 0.22)



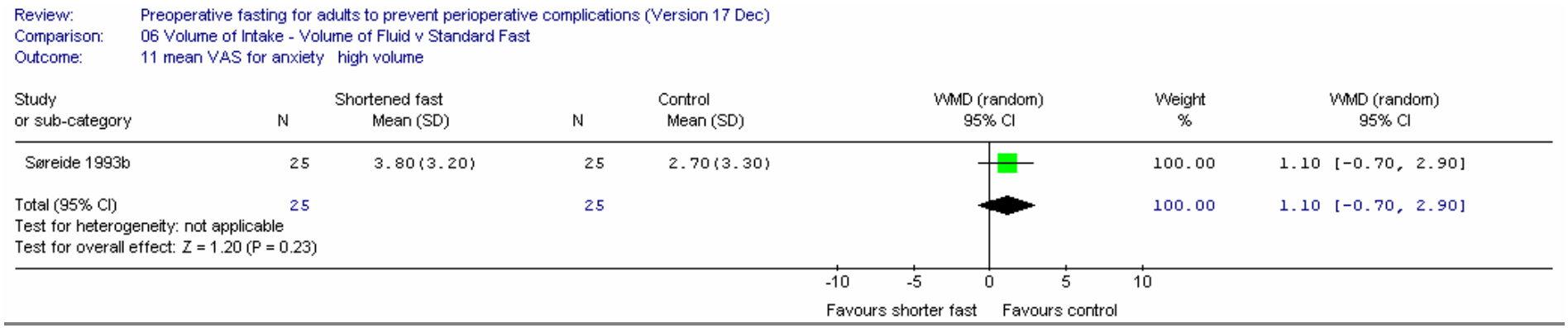
Adults studies by volume of fluid

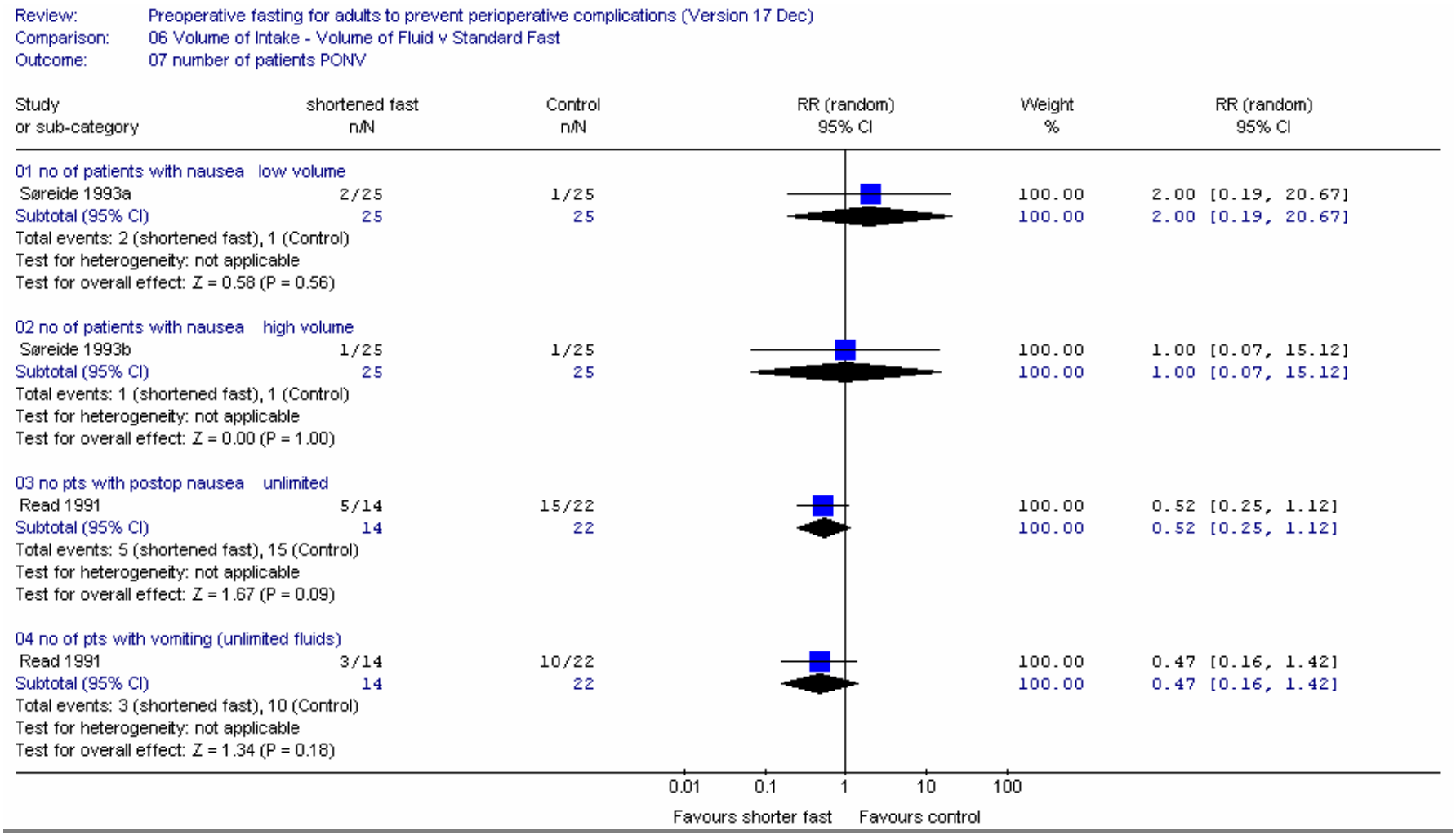



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast
Outcome: 10 mean VAS for anxiety low volume
Study or sub-category
Shortened fast N Mean (SD)
Control N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
Søreide 1993a 25 1.50(1.60) 25 2.70(3.30) 100.00 -1.20 [-2.64, 0.24]
Total (95% CI) 25 25 100.00 -1.20 [-2.64, 0.24]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.64 (P = 0.10)
-10 -5 0 5 10
Favours shorter fast Favours control


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast
Outcome: 11 mean VAS for anxiety high volume
Study or sub-category
Shortened fast N Mean (SD)
Control N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
Søreide 1993b 25 3.80(3.20) 25 2.70(3.30) 100.00 1.10 [-0.70, 2.90]
Total (95% CI) 25 25 100.00 1.10 [-0.70, 2.90]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.20 (P = 0.23)
-10 -5 0 5 10
Favours shorter fast Favours control

Adults studies by volume of fluid



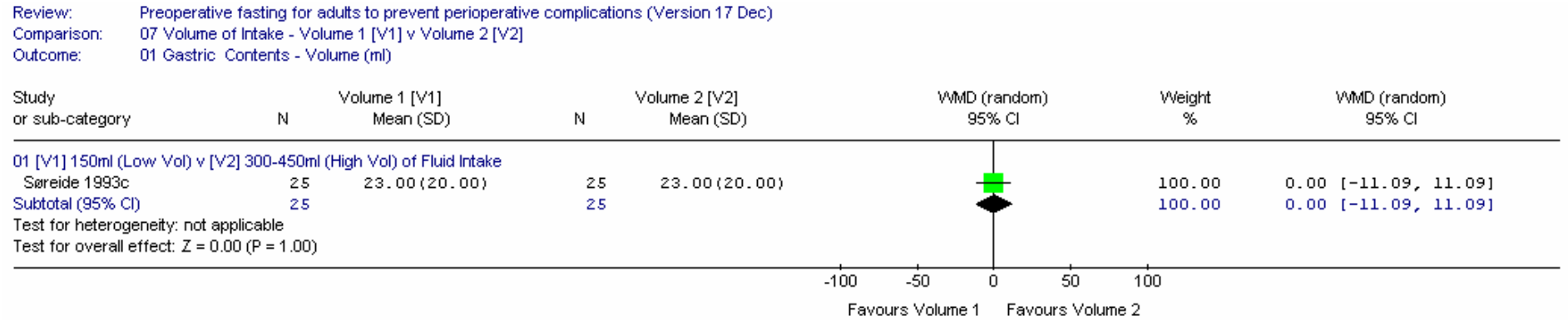

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast
Outcome: 07 number of patients PONV
Study or sub-category
shortened fast n/N
Control n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 no of patients with nausea low volume
Søreide 1993a 2/25 1/25 100.00 2.00 [0.19, 20.67]
Subtotal (95% CI) 25 25 100.00 2.00 [0.19, 20.67]
Total events: 2 (shortened fast), 1 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.58 (P = 0.56)
02 no of patients with nausea high volume
Søreide 1993b 1/25 1/25 100.00 1.00 [0.07, 15.12]
Subtotal (95% CI) 25 25 100.00 1.00 [0.07, 15.12]
Total events: 1 (shortened fast), 1 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.00 (P = 1.00)
03 no pts with postop nausea unlimited
Read 1991 5/14 15/22 100.00 0.52 [0.25, 1.12]
Subtotal (95% CI) 14 22 100.00 0.52 [0.25, 1.12]
Total events: 5 (shortened fast), 15 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.67 (P = 0.09)
04 no of pts with vomiting (unlimited fluids)
Read 1991 3/14 10/22 100.00 0.47 [0.16, 1.42]
Subtotal (95% CI) 14 22 100.00 0.47 [0.16, 1.42]
Total events: 3 (shortened fast), 10 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.34 (P = 0.18)
0.01
0.1
1
10
100
Favours shorter fast
Favours control

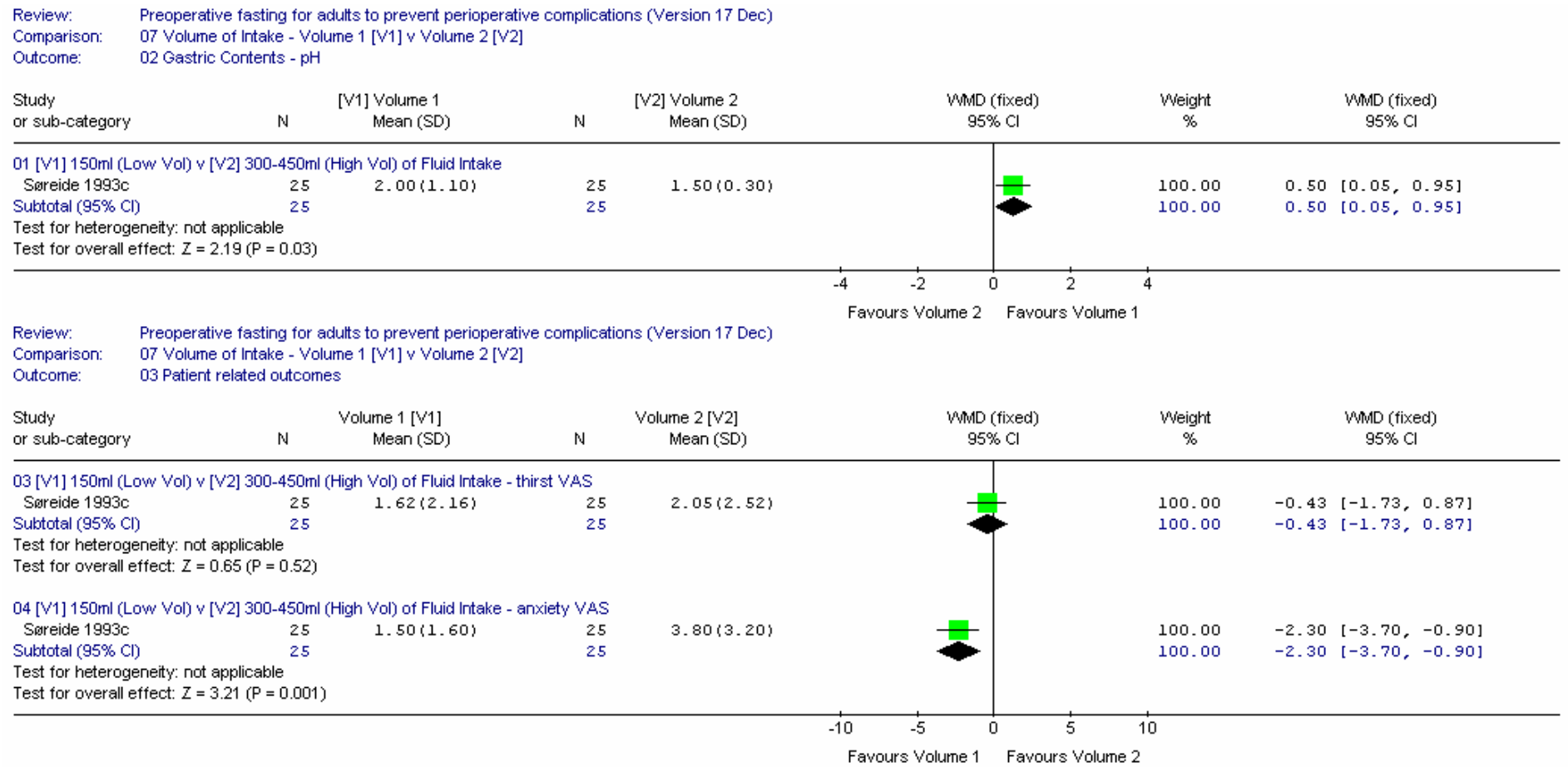
Head-to-head comparison of volume 1 with volume 2

Comments One study (Søreide et al., 1993); 150 ml vs. 300-450 ml water

Number of comparisons 1 **Number of patients** 50

Outcome	WMD / RR / OR (95% CI)	Chi^2	df	p (hetero)	I^2 (%)	Comments
Gastric volume (WMD)	0.00 (-11.09, 11.09)			1 trial		Little difference
Gastric pH (WMD)	0.50 (0.05 0.95)			1 trial		Statistically significantly in favour of lower volume; mean pH increase 0.50
Thirst - VAS (WMD)	-0.43 (-1.73 0.87)			1 trial		Wide confidence interval => results uncertain
Anxiety - VAS (WMD)	-2.30 (-3.70 -0.90)			1 trial		Statistically significantly in favour of lower volume




Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 07 Volume of Intake - Volume 1 [V1] v Volume 2 [V2]
Outcome: 02 Gastric Contents - pH
Study or sub-category
N
[V1] Volume 1 Mean (SD)
N
[V2] Volume 2 Mean (SD)
WMD (fixed) 95% CI
Weight %
WMD (fixed) 95% CI
01 [V1] 150ml (Low Vol) v [V2] 300-450ml (High Vol) of Fluid Intake
Søreide 1993c 25 2.00(1.10) 25 1.50(0.30) 100.00 0.50 [0.05, 0.95]
Subtotal (95% CI) 25 25 100.00 0.50 [0.05, 0.95]
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.19 (P = 0.03)
-4 -2 0 2 4
Favours Volume 2 Favours Volume 1
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 07 Volume of Intake - Volume 1 [V1] v Volume 2 [V2]
Outcome: 03 Patient related outcomes
Study or sub-category
N
Volume 1 [V1] Mean (SD)
N
Volume 2 [V2] Mean (SD)
WMD (fixed) 95% CI
Weight %
WMD (fixed) 95% CI
03 [V1] 150ml (Low Vol) v [V2] 300-450ml (High Vol) of Fluid Intake - thirst VAS
Søreide 1993c 25 1.62(2.16) 25 2.05(2.52) 100.00 -0.43 [-1.73, 0.87]
Subtotal (95% CI) 25 25 100.00 -0.43 [-1.73, 0.87]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.65 (P = 0.52)
04 [V1] 150ml (Low Vol) v [V2] 300-450ml (High Vol) of Fluid Intake - anxiety VAS
Søreide 1993c 25 1.50(1.60) 25 3.80(3.20) 100.00 -2.30 [-3.70, -0.90]
Subtotal (95% CI) 25 25 100.00 -2.30 [-3.70, -0.90]
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.21 (P = 0.001)
-10 -5 0 5 10
Favours Volume 1 Favours Volume 2

Appendix A8: Adult studies by volume - water sub-group

Primary outcomes

Volume: low volume

Comments Additional comparison with secondary outcomes in Naguib et al., 2001

Number of comparisons 6 **Number of patients** 365

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-7.18 (-10.63 -3.73)	3.31	5	0.65	0	Statistically significantly in favour of water; mean decrease 7ml
Gastric pH (WMD)	0.09 (-0.26 0.43)	11.41	5	0.04	56	Heterogeneous; without McGrady WMD -0.04 (95%CI -0.31, 0.22) and p(heterogeneity)=0.24, I^2=27%; i.e., little difference between groups

Volume: high volume

Comments

Number of comparisons 2 **Number of patients** 204

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-2.30 (-9.87 5.28)	0.88	1	0.35	0	Little difference
Gastric pH (WMD)	-0.02 (-0.47 0.44)	0.39	1	0.53	0	Little difference

Volume: unlimited

Comments One study (Read and Vaughan 1991)

Number of comparisons 1 **Number of patients** 53

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)						No evidence (no standard deviations calculated)
Gastric pH (WMD)	-0.01 (-0.50 0.48)			1 trial		Little difference

Secondary outcomes

Volume: low volume

Comments Additional comparison with secondary outcomes in Naguib et al., 2001

Number of comparisons 3 **Number of patients** 300

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - no. of pts with none (RR)	1.12 (0.91 1.37)		1 trial			Little difference; one trial (Naguib et al)
Thirst - no. of pts with less (RR)	27.00 (3.81 191.1)		1 trial			Operating room vs. 2 to 3h preoperatively; statistically significantly less thirst for shorter fast (1/27 risk); wide confidence interval; one trial
Thirst - VAS (WMD)	-1.27 (-2.52 -0.02)		1 trial			Statistically significantly less thirst for shortened fast; one comparison (Søreide et al., 1993a)
Hunger - no. of pts with none (RR)	0.89 (0.73 1.10)		1 trial			Little difference; one trial (Naguib et al)
Hunger - no. of pts with less (RR)	2.75 (0.94 8.06)		1 trial			Fairly wide confidence interval; less hunger for water, borderline significance (p=0.07); operating room vs. 2 to 3h preoperatively
Anxiety - VAS (WMD)	-1.20 (-2.64 0.24)		1 trial			Non-significantly less anxiety with water; one comparison (Søreide 1993a)
Postop nausea - no of pts (RR)	2.00 (0.19 20.67)		1 trial			Wide confidence interval => results uncertain; one comparison (Søreide et al., 1993a)

Volume: high volume

Comments

Number of comparisons 2 **Number of patients** 222

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - VAS (WMD)	-0.84 (-2.19 0.51)			1 trial		One comparison (Søreide et al., 1993b); little difference
Thirst - descriptive						One study (n=151) - VAS median; significantly less thirst for water (p<0.0001)
Hunger - descriptive						One study (n=151) - VAS median; no significant difference
Anxiety - VAS (WMD)	1.10 (-0.70 2.90)			1 trial		Wide confidence interval => results uncertain; one comparison (Søreide et al., 1993b)
Anxiety - descriptive						One study (n=151) - VAS median; no significant difference
Postop nausea - no of pts (RR)	1.00 (0.07 15.12)			1 trial		Wide confidence interval => results uncertain; one comparison (Søreide et al., 1993b)

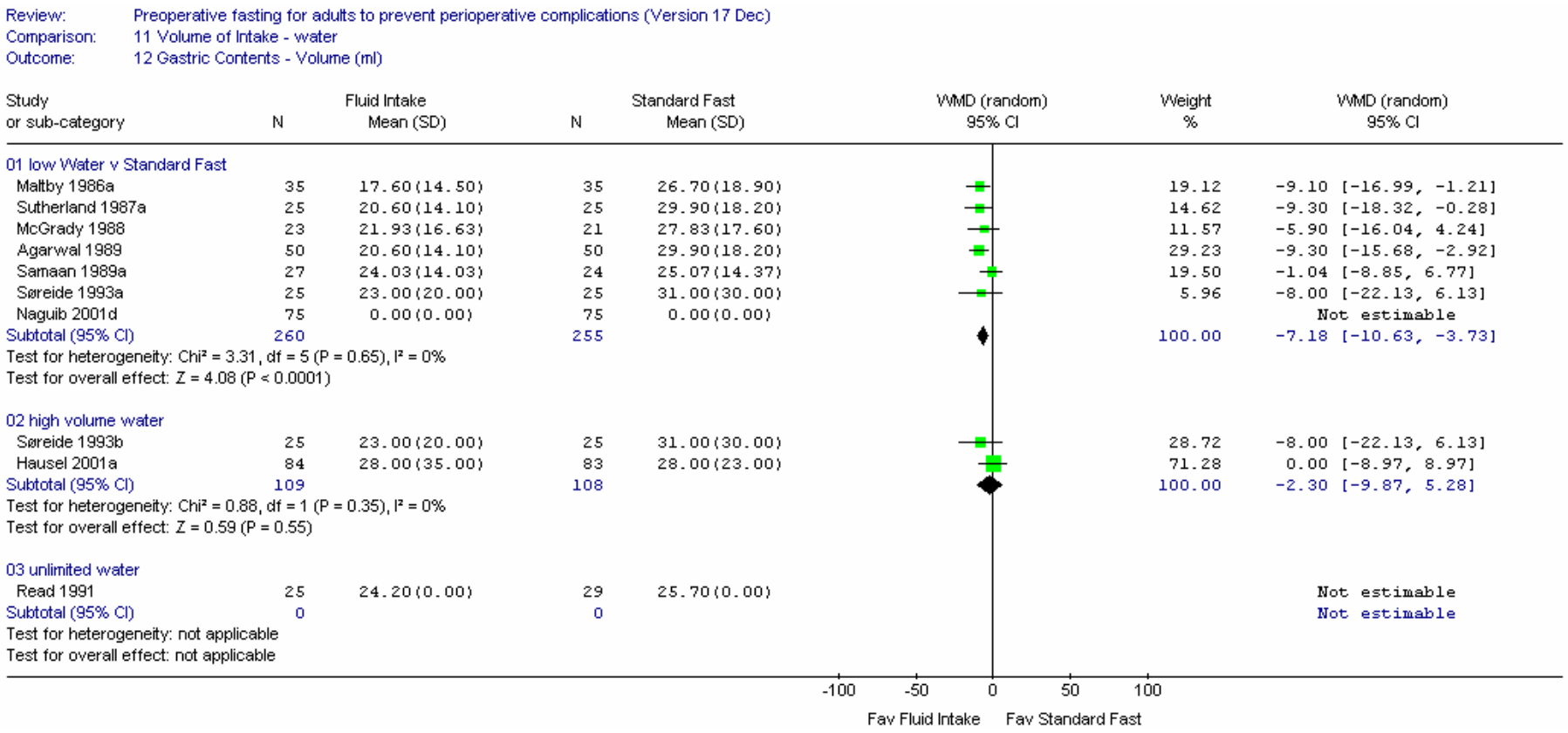
Volume: unlimited

Comments One study (Read and Vaughan 1991)

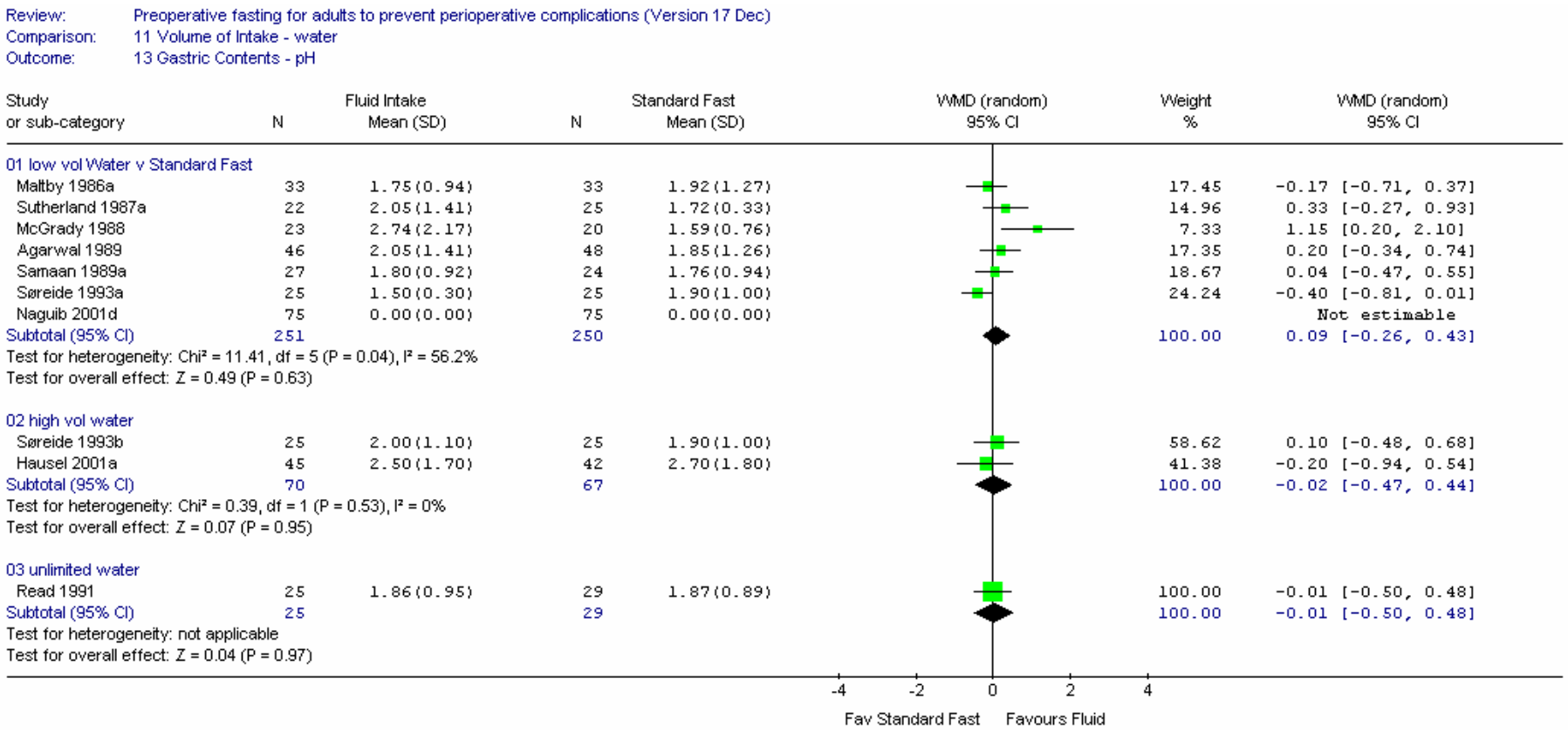
Number of comparisons 1 **Number of patients** 53

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - descriptive						One study - VAS median; no significant difference
Anxiety - descriptive						One study; VAS, median; significantly less anxiety for water group (p=0.03)
Postop vomiting - no of pts (RR)	0.47 (0.16 1.42)			1 trial		Wide confidence interval => results uncertain
Postop nausea - no of pts (RR)	0.52 (0.25 1.12)			1 trial		Non-significantly less nausea for fluids (p=0.09); but loss to follow up errors

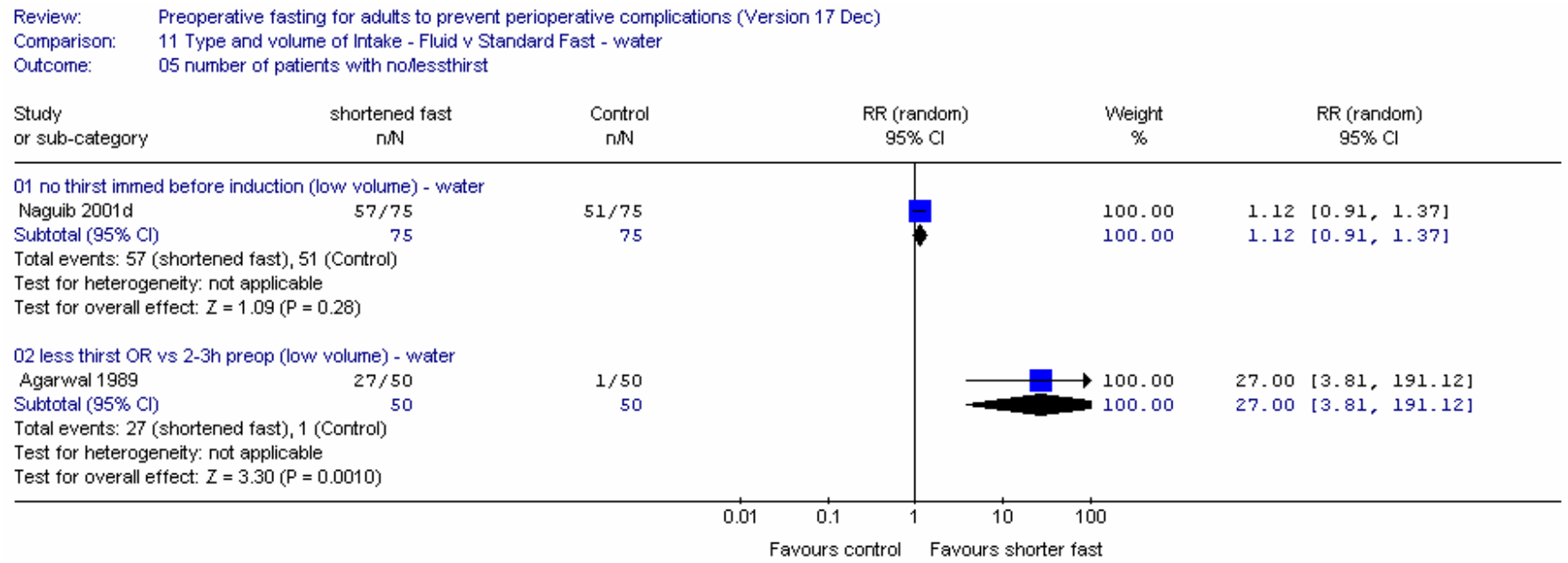
Adult studies by volume – water sub-group



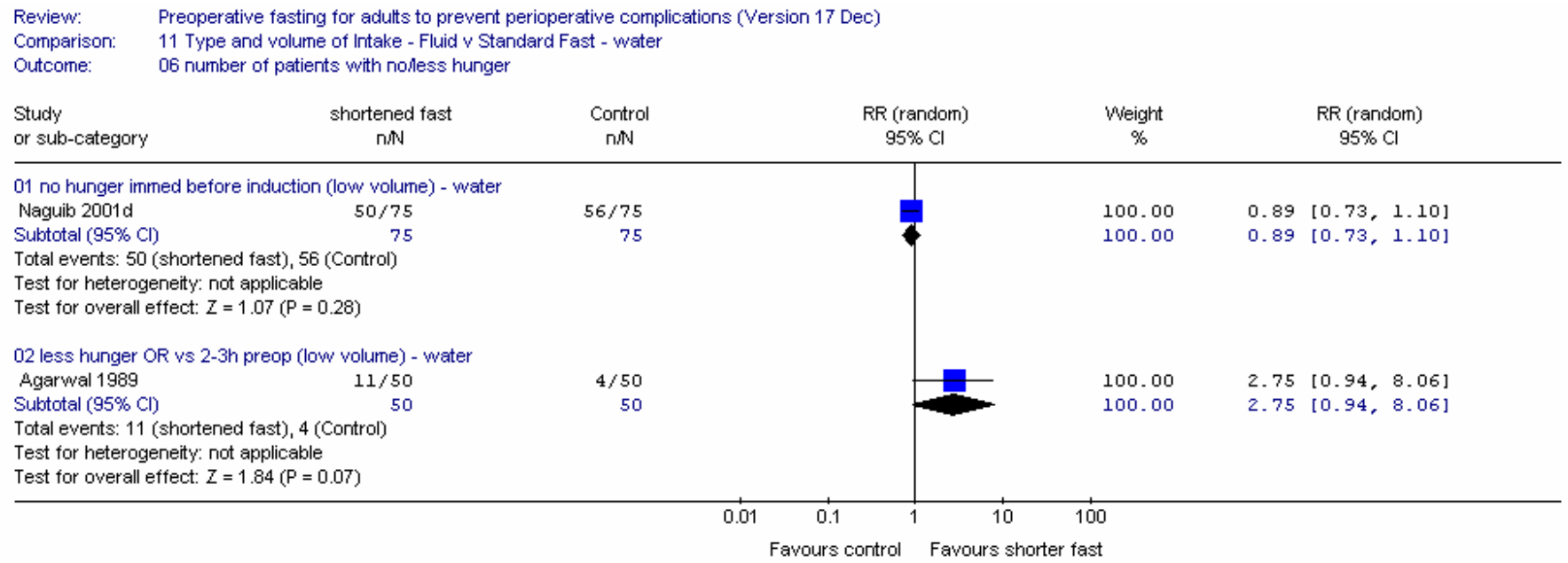
Adult studies by volume – water sub-group



Adult studies by volume – water sub-group



Adult studies by volume – water sub-group



Other secondary outcome forest plots were same as those for all fluids (Appendix A7)

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Appendix A9: Adult trials by duration – solids, chewing gum and sweets

Type of solid: breakfast+fluid

Duration: 2 to 4 h (mean 4.2 h)

Comments One small study (Miller et al., 1983, n=21); non-narcotic premed

Number of comparisons 1 **Number of patients** 21

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	2.10 (-9.15 13.35)			1trial		Little difference; one small study (n=21)
Gastric pH (WMD)	-2.88 (-5.56 -0.20)			1 trial		Large change, statistically significantly in favour of standard fast

Duration: 2 to 4 h (mean 3.3 h)

Comments One small study (Miller et al., 1983, n=24); opioid premed

Number of comparisons 1 **Number of patients** 24

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.80 (-13.99 12.39)			1 trial		Little difference
Gastric pH (WMD)	0.15 (-1.32 1.62)			1 trial		Wide confidence interval => results uncertain
No. of pts with particles in aspirate (RR)	2.88 (0.12 67.03)			1 trial		Wide confidence interval => results uncertain

Duration: all shortened fasts

Comments Two comparisons in one small trial (Miller et al); much missing aspirate for pH measurement

Number of comparisons 2 **Number of patients** 45

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.88 (-7.68 9.44)	0.11	1	0.74	0	Little difference
Gastric pH (WMD)	-1.15 (-4.09 1.79)	3.77	1	0.05	74	Heterogeneous
No. of pts with particles in aspirate (RR)	2.88 (0.12 67.03)			1 trial		Wide confidence interval => uncertain results

Type of solid: sweets (lollipops)

Duration: up to 30m

Comments One comparison in Macaluso et al., 1996. Lollipops.

Number of comparisons 1 **Number of patients** 90

Outcome	WMD / RR / OR (95%CI)	Chi2	df	p (hetero)	I2 (%)	Comments
Gastric volume (WMD)	2.00 (-12.74 16.74)			1 trial		Little difference, but fairly wide confidence interval => results not very reliable
Gastric pH (WMD)	-0.30 (-0.46 -0.14)			1 trial		Statistically significantly in favour of no lollipop, small mean decrease of 0.30 units
Anxiety - VAS (WMD)	1.41 (-0.35 3.17)			1 trial		Scale -9 (most anxious) to +9; wide confidence interval => results uncertain
All secondary						No patient in either group had nausea or vomiting. No significant differences in other side effects.

Type of solid: chewing gum (sugar free) – in non-smokers

Duration: up to 30m

Number of comparisons 2 **Number of patients** 91

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	10.85 (3.17 18.54)	0.17	1	0.68	0	Statistically significantly in favour of no gum. Mean increase 11 ml.
Gastric pH (WMD)	-0.15 (-0.55 0.24)	0.18	1	0.67	0	Little difference

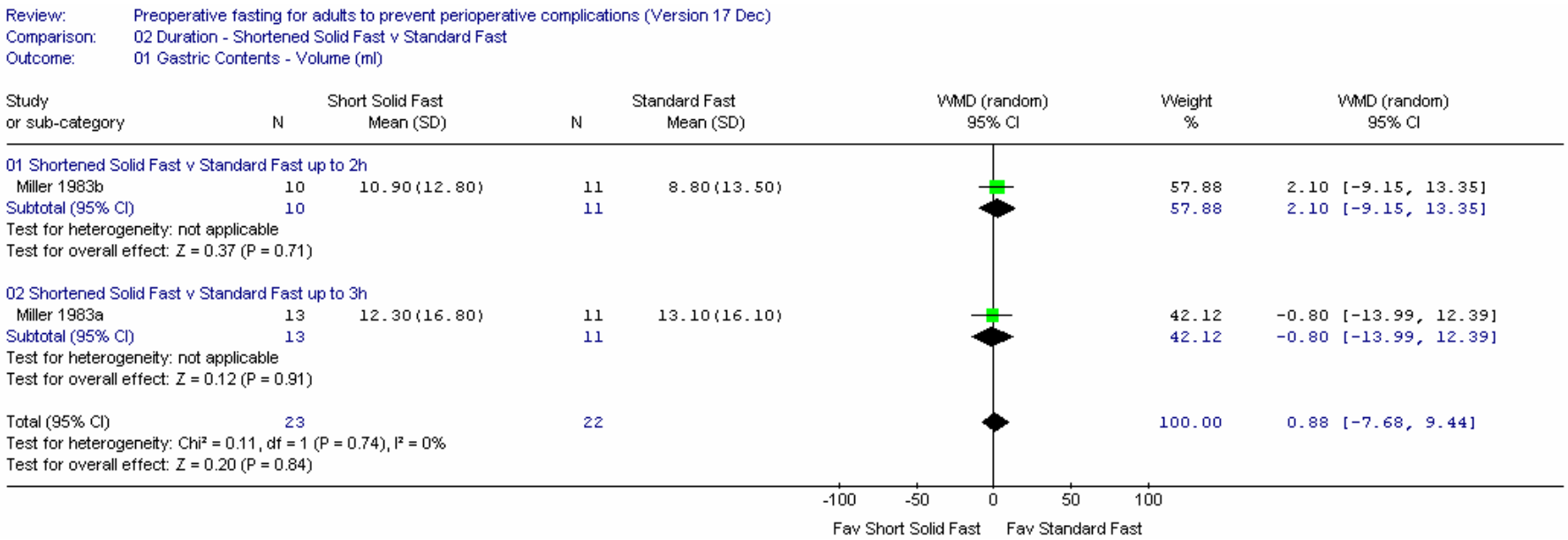
Type of solid: chewing gum (Nicorette) – in smokers

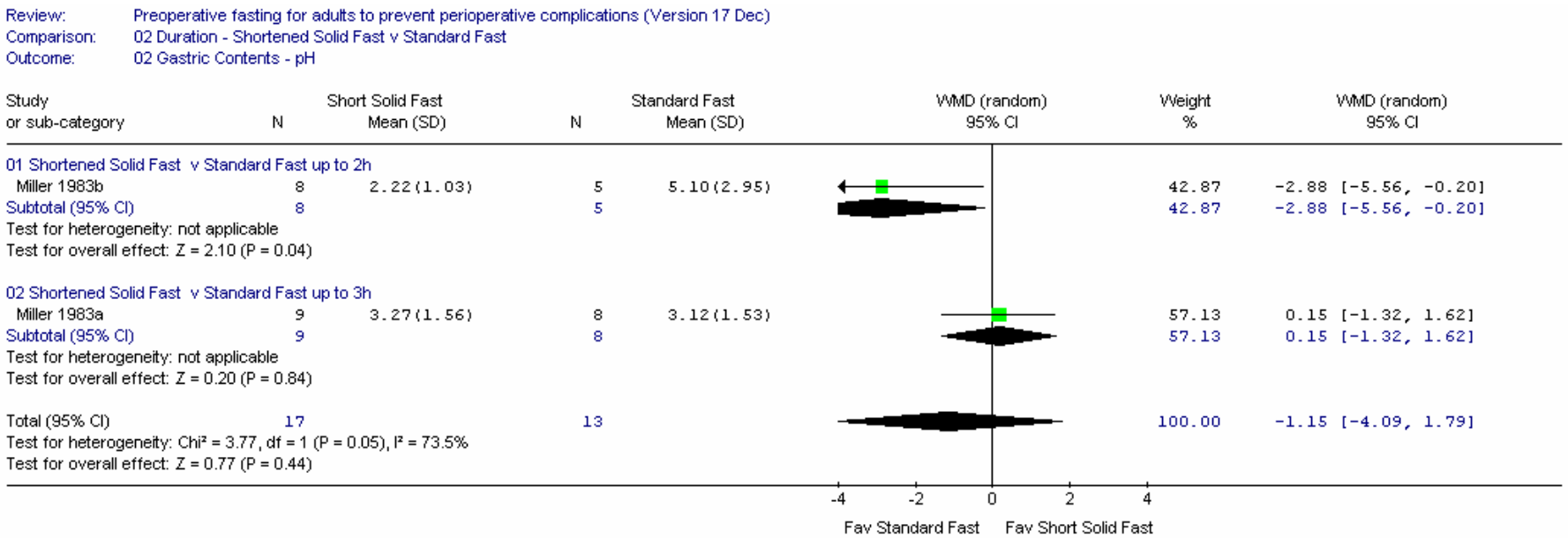
Duration: up to 30m

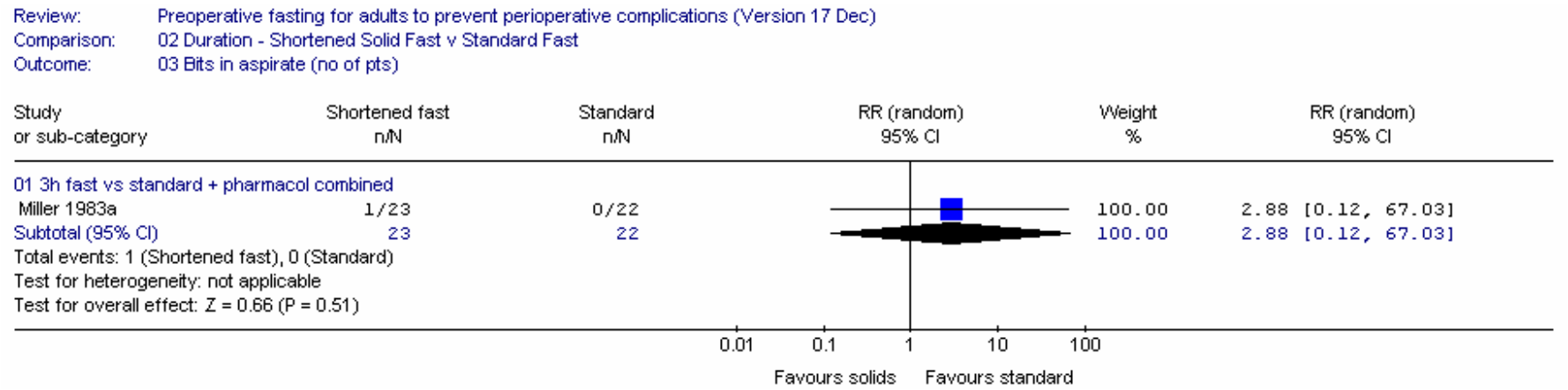
Number of comparisons 1 **Number of patients** 44

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	2.00 (-9.61 13.61)			1 trial		Little difference between groups
Gastric pH (WMD)	-0.20 (-0.66 0.26)			1 trial		Little difference

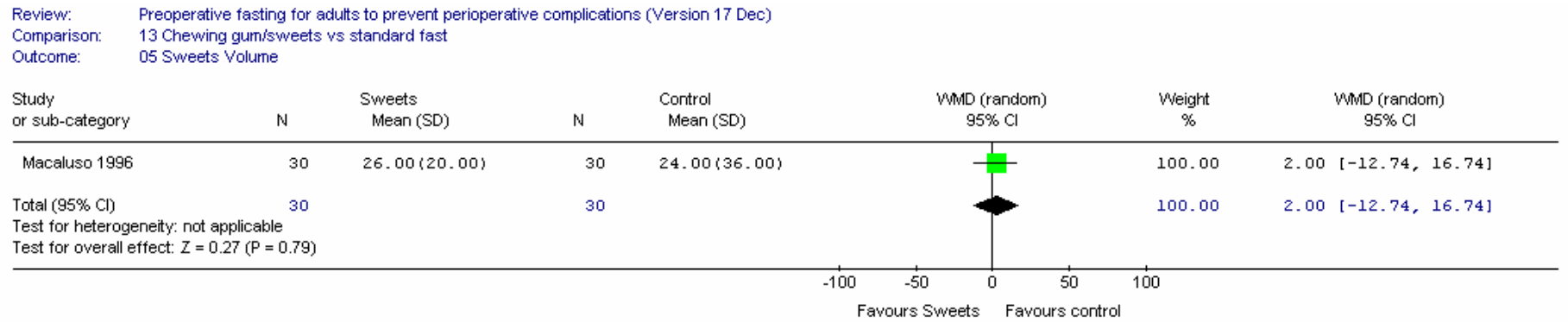
Adult trials by duration – solids, chewing gum and sweets

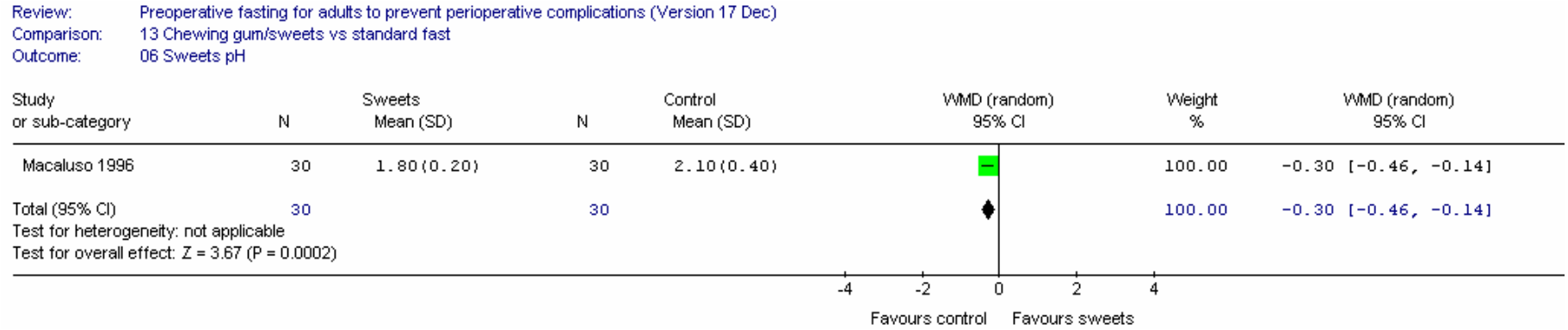


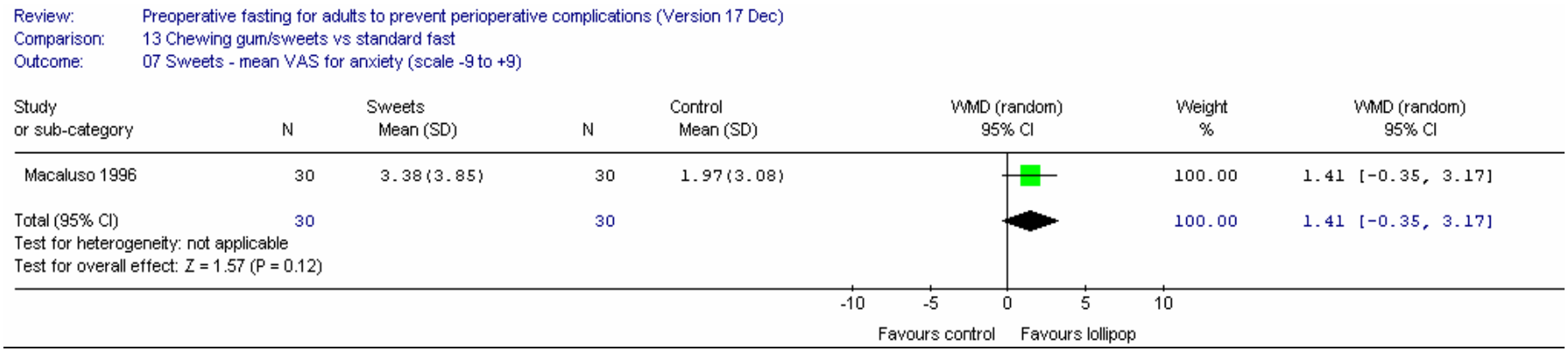

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 02 Duration - Shortened Solid Fast v Standard Fast
Outcome: 02 Gastric Contents - pH
Study or sub-category
Short Solid Fast N Mean (SD)
Standard Fast N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
01 Shortened Solid Fast v Standard Fast up to 2h
Miller 1983b 8 2.22(1.03) 5 5.10(2.95) 42.87 -2.88 [-5.56, -0.20]
Subtotal (95% CI) 8 5 42.87 -2.88 [-5.56, -0.20]
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.10 (P = 0.04)
02 Shortened Solid Fast v Standard Fast up to 3h
Miller 1983a 9 3.27(1.56) 8 3.12(1.53) 57.13 0.15 [-1.32, 1.62]
Subtotal (95% CI) 9 8 57.13 0.15 [-1.32, 1.62]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.20 (P = 0.84)
Total (95% CI) 17 13 100.00 -1.15 [-4.09, 1.79]
Test for heterogeneity: Chi² = 3.77, df = 1 (P = 0.05), I² = 73.5%
Test for overall effect: Z = 0.77 (P = 0.44)
-4 -2 0 2 4
Fav Standard Fast
Fav Short Solid Fast


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 02 Duration - Shortened Solid Fast v Standard Fast
Outcome: 03 Bits in aspirate (no of pts)
Study or sub-category
Shortened fast n/N
Standard n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 3h fast vs standard + pharmacol combined
Miller 1983a 1/23 0/22 100.00 2.88 [0.12, 67.03]
Subtotal (95% CI) 23 22 100.00 2.88 [0.12, 67.03]
Total events: 1 (Shortened fast), 0 (Standard)
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.66 (P = 0.51)
0.01 0.1 1 10 100
Favours solids
Favours standard

Sweets (lollipops)





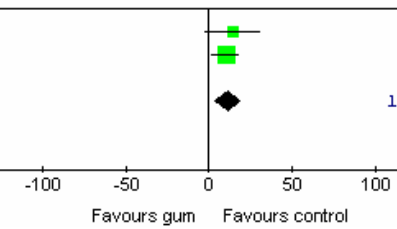

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 13 Chewing gum/sweets vs standard fast
Outcome: 07 Sweets - mean VAS for anxiety (scale -9 to +9)
Study or sub-category
Sweets N Mean (SD)
Control N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
Macaluso 1996 30 3.38(3.85) 30 1.97(3.08) 100.00 1.41 [-0.35, 3.17]
Total (95% CI) 30 30 100.00 1.41 [-0.35, 3.17]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.57 (P = 0.12)
-10 -5 0 5 10
Favours control
Favours lollipop

Chewing gum – sugar-free, non-smokers

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 13 Chewing gum/sweets vs standard fast
Outcome: 01 Chewing gum Volume - non-smokers

Study or sub-category	Chewing gum N	Chewing gum Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Dubin 1994	15	40.00(30.00)	16	26.00(14.00)		21.28	14.00 [-2.66, 30.66]
Soreide 1995a	30	30.00(19.00)	30	20.00(15.00)		78.72	10.00 [1.34, 18.66]
Total (95% CI)	45		46			100.00	10.85 [3.17, 18.54]

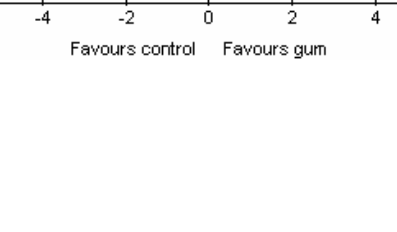
Test for heterogeneity: Chi² = 0.17, df = 1 (P = 0.68), I² = 0%
Test for overall effect: Z = 2.77 (P = 0.006)



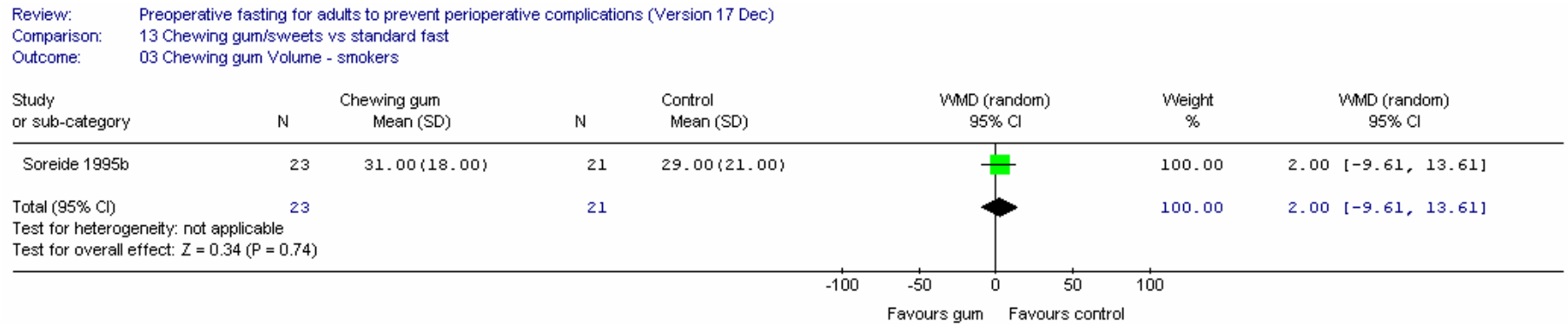
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 13 Chewing gum/sweets vs standard fast
Outcome: 02 Chewing gum non-smokers pH

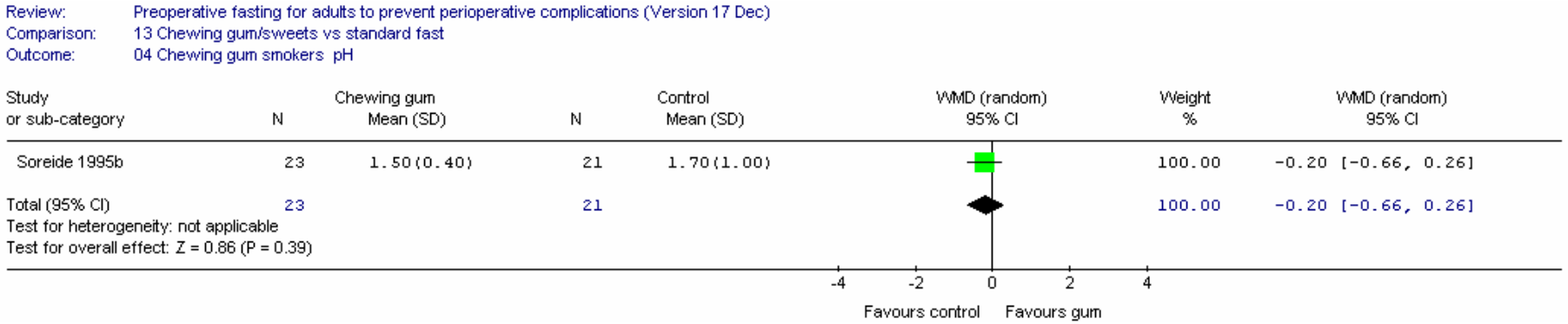
Study or sub-category	Chewing gum N	Chewing gum Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Dubin 1994	15	1.60(0.20)	16	1.80(0.90)		76.20	-0.20 [-0.65, 0.25]
Soreide 1995a	30	2.20(1.60)	30	2.20(1.60)		23.80	0.00 [-0.81, 0.81]
Total (95% CI)	45		46			100.00	-0.15 [-0.55, 0.24]

Test for heterogeneity: Chi² = 0.18, df = 1 (P = 0.67), I² = 0%
Test for overall effect: Z = 0.76 (P = 0.45)



Chewing gum - Nicorette





Appendix A10: Adult trials by premedication and fluid type

Head-to-head premedication comparisons

Type of premedication: head-to-head premed vs. none

Comments Premedication (opioid) vs. none in presence of 150 ml water 2 h preoperatively. One study (Agarwal et al., 1989)

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	1.70 (-3.17 6.57)			1 trial		Little difference; one study
Gastric pH (WMD)	0.01 (-0.53 0.58)			1 trial		Little difference

Type of premedication: head-to-head premed vs. placebo

Comments Premedication fentanyl lollipop vs. placebo lollipop 30 min preoperatively. One study (Macaluso et al., 1996)

Number of comparisons 1 **Number of patients** 100

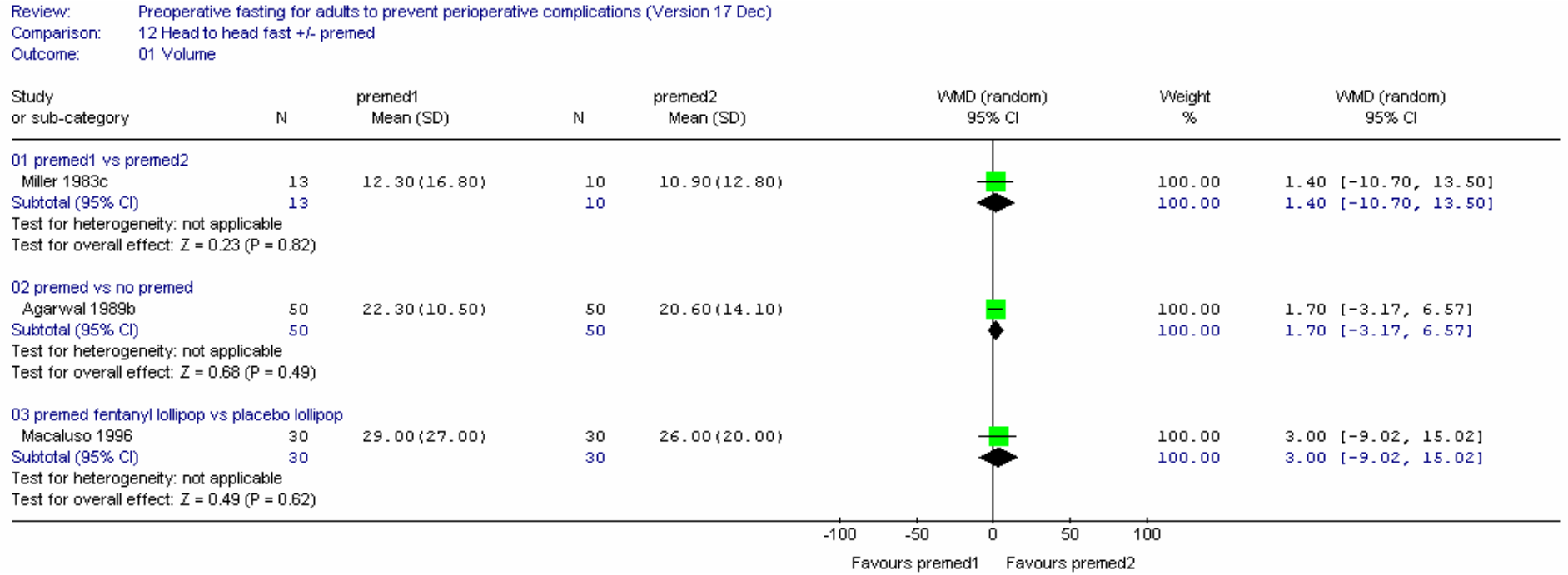
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	3.00 (-9.02 15.02)			1 trial		Little difference
Gastric pH (WMD)	0.20 (0.07 0.33)			1 trial		Statistically significantly higher pH with premed; mean increase 0.2 units (small)
Anxiety VAS (WMD)	1.12 (-0.83 3.07)			1 trial		Wide confidence interval => results uncertain; VAS scale -9 to +9
No. of patients with dizziness (RR)	7.67 (2.57 22.84)			1 trial		Statistically significantly more dizziness with premed (8 times)
No. of patients with nausea (RR)	15.00 (0.89 251.42)			1 trial		Very wide confidence interval => results uncertain

Type of premedication: head-to-head premed 1 vs. premed 2

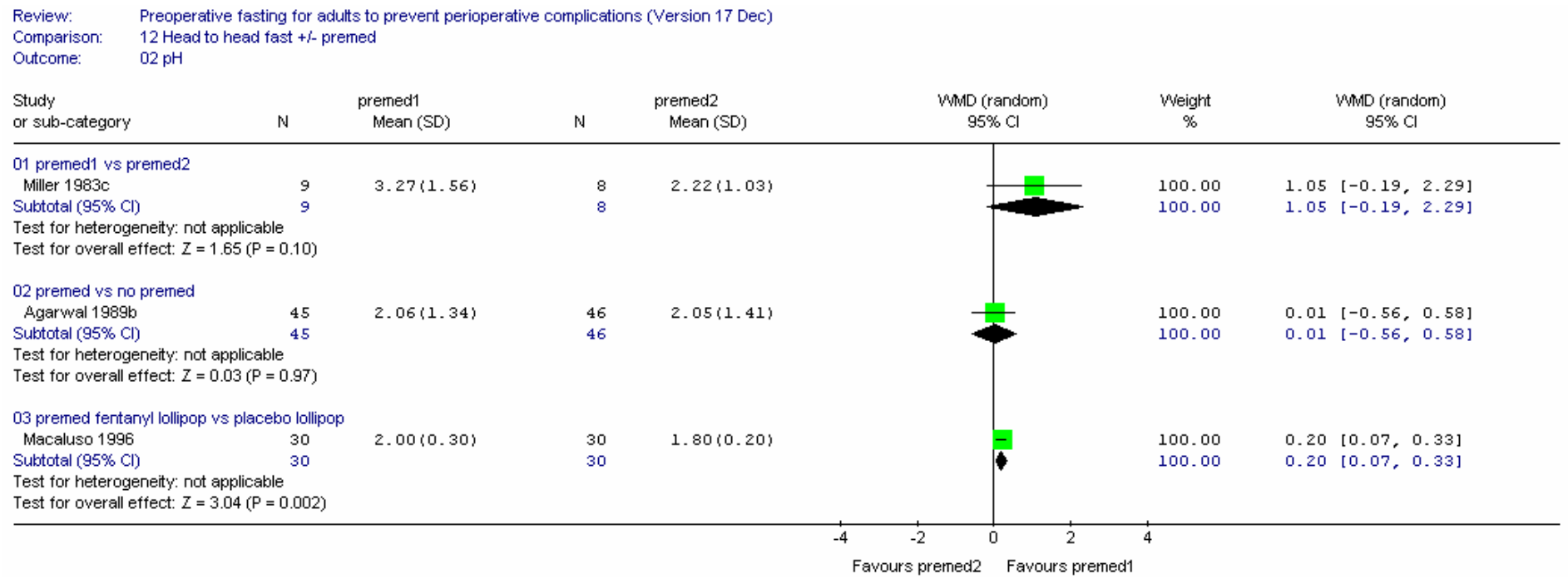
Comments Single trial (Miller et al., 1983) - breakfast+drink for both arms; non-opioid vs. opioid+anticholinergic; much missing aspirate for pH

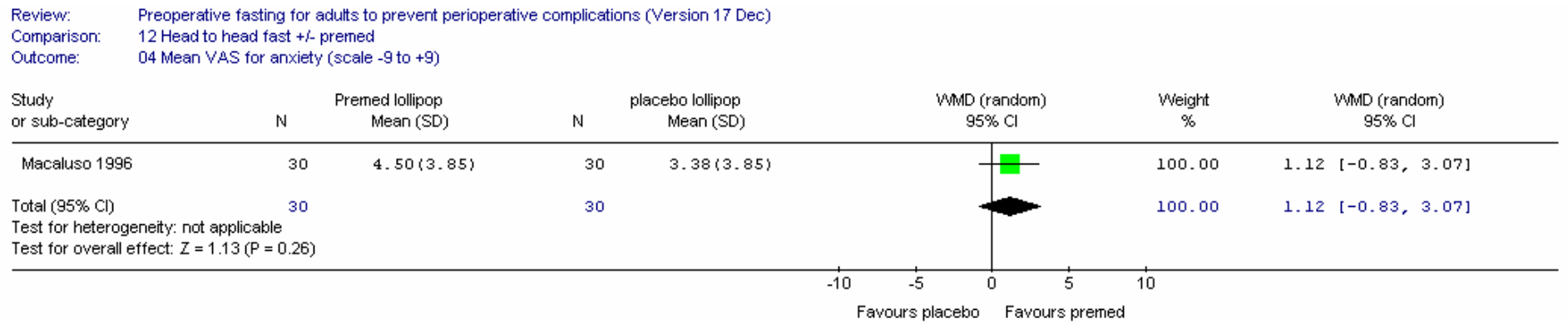
Number of comparisons 1 **Number of patients** 23

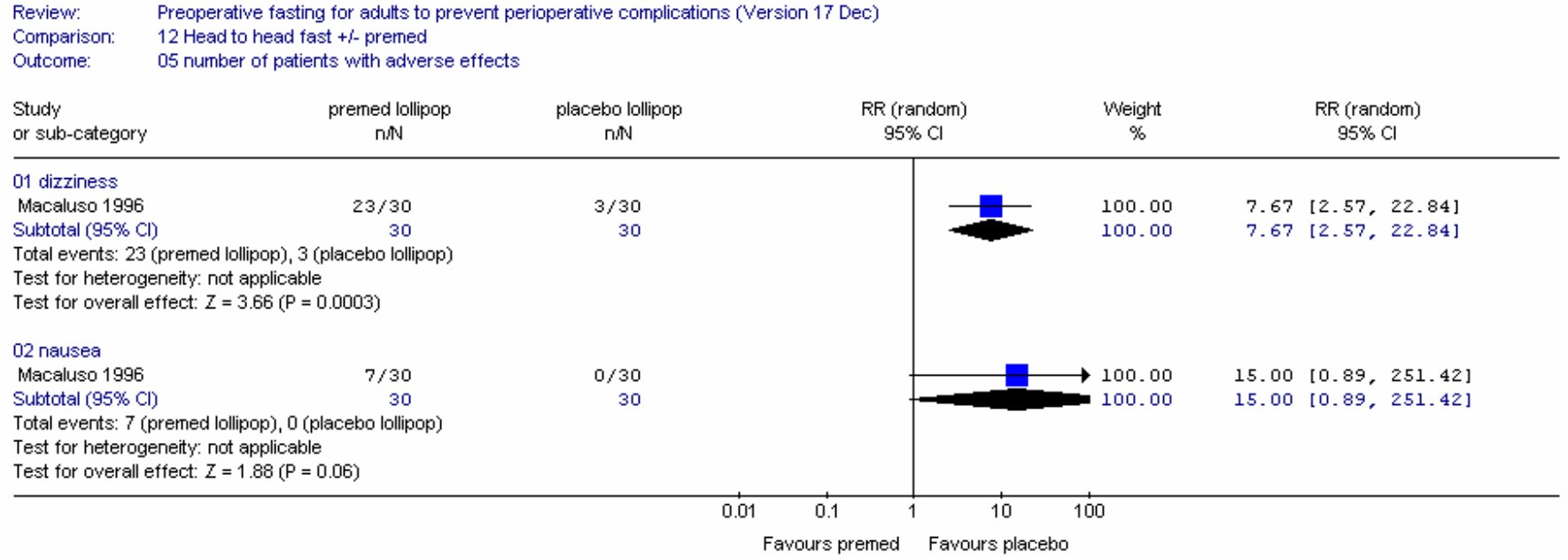
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	1.40 (-10.70 13.50)			1 trial		Little difference; one small trial (n=23)
Gastric pH (WMD)	1.05 (-0.19 2.29)			1 trial		Wide confidence interval => results uncertain; much aspirate missing (31% in one group)



Adult trials by premedication and fluid type




Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 12 Head to head fast +/- premed
Outcome: 04 Mean VAS for anxiety (scale -9 to +9)
Study or sub-category
Premed lollipop N Mean (SD)
placebo lollipop N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
Macaluso 1996 30 4.50(3.85) 30 3.38(3.85) 100.00 1.12 [-0.83, 3.07]
Total (95% CI) 30 30 100.00 1.12 [-0.83, 3.07]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.13 (P = 0.26)
-10 -5 0 5 10
Favours placebo
Favours premed


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 12 Head to head fast +/- premed
Outcome: 05 number of patients with adverse effects
Study or sub-category
premed lollipop n/N
placebo lollipop n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 dizziness
Macaluso 1996 23/30 3/30 100.00 7.67 [2.57, 22.84]
Subtotal (95% CI) 30 30 100.00 7.67 [2.57, 22.84]
Total events: 23 (premed lollipop), 3 (placebo lollipop)
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.66 (P = 0.0003)
02 nausea
Macaluso 1996 7/30 0/30 100.00 15.00 [0.89, 251.42]
Subtotal (95% CI) 30 30 100.00 15.00 [0.89, 251.42]
Total events: 7 (premed lollipop), 0 (placebo lollipop)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.88 (P = 0.06)
0.01 0.1 1 10 100
Favours premed
Favours placebo

Premedication sub-group analyses

Type of fluid: all fluids

Primary outcomes

Type of premedication: none

Comments Additional comparisons for secondary outcomes in Naguib et al., 2001 and Goodwin et al., 1991

Number of comparisons 4 **Number of patients** 271

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-7.28 (-11.24 -3.33)	3.23	3	0.36	7	Statistically significantly in favour of fluids; mean decrease 7ml
Gastric pH (WMD)	0.09 (-0.19 0.36)	1.70	3	0.64	0	Little difference

Type of premedication: all types of premed

Comments

Number of comparisons 10 **Number of patients** 725

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	1.55 (-0.98 4.07)	5.60	8	0.69	0	Little difference
Gastric pH (WMD)	0.11 (-0.13 0.35)	10.23	9	0.33	12	Little difference

Type of fluid: all fluids

Type of premedication: opioid

Number of comparisons 4 **Number of patients** 346

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	1.94 (-2.06 5.94)	3.29	3	0.35	9	Little difference
Gastric pH (WMD)	0.33 (-0.30 0.95)	5.18	3	0.16	42	Little difference

Type of premedication: non-opioid

Comments Benzodiazepines; four studies had premedication for some, not all, of the patients (exception Søreide et al., 1993)

Number of comparisons 6 **Number of patients** 379

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.92 (-2.61 4.46)	2.06	4	0.72	0	Little difference
Gastric pH (WMD)	0.04 (-0.20 0.27)	4.24	5	0.52	0	Little difference

Type of fluid: all fluids

Secondary outcomes

Type of premedication: none

Comments Additional comparisons for secondary outcomes in Naguib et al., 2001 and Goodwin et al., 1991

Number of comparisons 6 **Number of patients** 575

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Thirst - no. of pts with none (RR)	0.78	(0.60	1.02)	5.83	3	0.12	49	More thirst for shortened fast, borderline significance (p=0.06); four comparisons from one study (Naguib et al)
Thirst - no. of pts with less (RR)	27.00	(3.81	191.12)			1 trial		Operating room vs. 2 to 3h preoperatively; statistically significantly less thirst for shorter fast (1/27 risk); wide confidence interval; one study
Thirst - descriptive								One study (n=100) - VAS median; significantly less thirst for fluids (p<0.001)
Hunger - no. of pts with none	0.77	(0.65	0.91)	2.38	3	0.50	0	Statistically significantly more hunger for shortened fast (1.3 times risk); four comparisons from one study
Hunger - no. of pts with less	2.75	(0.94	8.06)			1 trial		Fairly wide confidence interval; Less hunger for shorter fast, borderline significance (p=0.07); operating room vs. 2 to 3h preoperatively
Hunger - descriptive								One study (n=100) - VAS median; no significant difference
Postoperative nausea - descriptive								One study (n=100) - VAS median; no significant difference

Type of premedication: all types of premed

Number of comparisons 8 **Number of patients** 630

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - no. of pts with none (RR)	4.86 (2.38 9.91)			1 trial		Statistically significantly less thirst for shortened fast (1/5 risk); one trial
Thirst - no. of pts with less (RR)	6.62 (2.54 17.26)	0.00	1	0.97	0	Two comparisons in one study; statistically significantly less thirst for shortened fast (1/7 risk); operating room vs. 2 to 3h preoperatively.
Thirst - VAS (WMD)	-1.07 (-2.19 0.05)	0.14	1	0.71	0	Two comparisons in one study; favours reduced fast, borderline significance (p=0.06)
Thirst - descriptive						Three comparisons (two within one study; n=298) - VAS median; two had significantly less thirst for fluids (p<0.0001); other was NS
Hunger - no. of pts with none	1.92 (1.08 3.41)			1 trial		Statistically significantly less hunger for shortened fast (1/2 risk); one trial
Hunger - no. of pts with less	4.01 (1.50 10.73)	0.31	1	0.58	0	Two comparisons in same study; statistically significantly less hunger for shortened fast (1/4 risk); operating room vs. 2 to 3h preoperatively.
Hunger - descriptive						Two comparisons within one study - VAS median; one showed significantly less hunger for fluids (p<0.05); the other was NS
Anxiety - VAS (WMD)	-0.24 (-1.69 1.21)	2.34	1	0.13	57	Wide confidence interval => results uncertain; some heterogeneity
Anxiety - descriptive						Three comparisons (two within one study, n=298) - VAS median; two had significantly less anxiety for fluids (p<0.03); other was NS
Postop vomiting - no of pts	0.47 (0.16 1.42)			1 trial		Wide confidence interval => results uncertain
Postop nausea - no of pts (RR)	0.55 (0.28 1.11)	0.25	2	0.88	0	Non-significantly less nausea for fluids; fairly wide confidence interval

Type of fluid: all fluids

Type of premedication: opioid

Comments

Number of comparisons 2 **Number of patients** 252

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - descriptive						Two comparisons within one study (Hausel) - VAS median; significantly less thirst for fluids (p<0.0001)
Hunger - descriptive						Two comparisons within one study - VAS median; one had significantly less hunger for fluids (p<0.05); other was NS
Anxiety - descriptive						Two comparisons within one study - VAS median; one had significantly less anxiety for fluids (p<0.05); other was NS

Type of premedication: non-opioid

Comments Benzodiazepines; four studies had premedication for some, not all, of the patients (exception Søreide et al., 1993)

Number of comparisons 6 **Number of patients** 378

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - no. of pts with none (RR)	4.86 (2.38 9.91)			1 trial		Statistically significantly less thirst for shortened fast (1/5 risk); one trial
Thirst - no. of pts with less (RR)	6.62 (2.54 17.26)	0.00	1	0.97	0	Two comparisons in one study; statistically significantly less thirst for shortened fast (1/7 risk); operating room vs. 2 to 3h preoperatively.
Thirst - VAS (WMD)	-1.07 (-2.19 0.05)	0.14	1	0.71	0	Two comparisons in one study; favours reduced fast, almost significant
Thirst - descriptive						One study(n=53) - VAS median; no significant difference

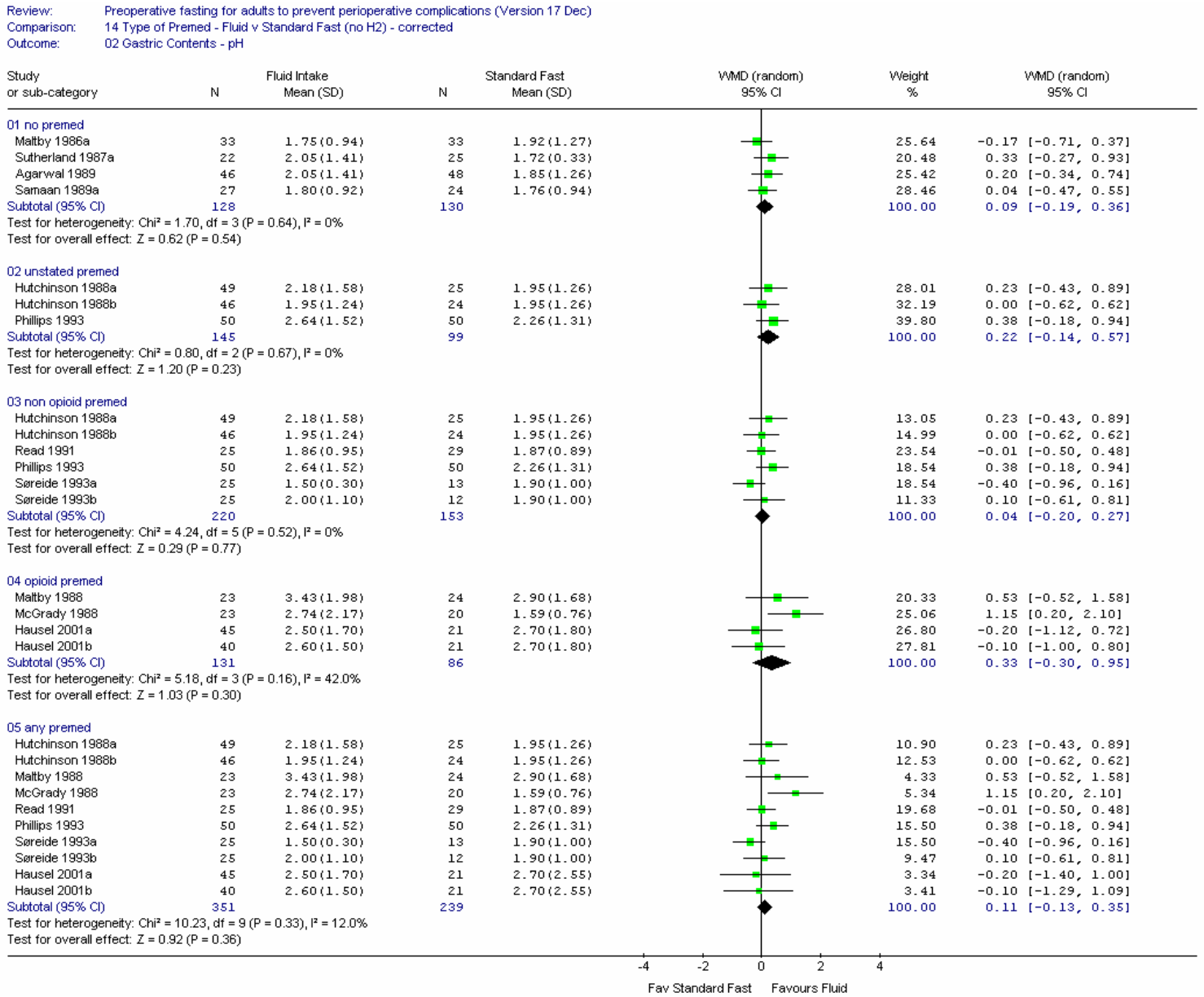
Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Hunger - no. of pts with none	1.92	(1.08	3.41)			1 trial		Statistically significantly less hunger for shortened fast (1/2 risk); 1 trial
Hunger - no. of pts with less	4.01	(1.50	10.73)	0.31	1	0.58	0	2 comparisons in same study; statistically significantly less hunger for shortened fast (1/4 risk); operating room vs. 2 to 3h preoperatively.
Anxiety - VAS (WMD)	-0.13	(-2.38	2.12)	2.34	1	0.13	57	Wide confidence interval => results uncertain; some heterogeneity
Anxiety - descriptive								One study (n=53); VAS, median; significantly less anxiety for fluids group (p=0.03)
Postop vomiting - no of pts	0.47	(0.16	1.42)			1 trial		Wide confidence interval => results uncertain
Postop nausea - no of pts (RR)	0.55	(0.28	1.11)	0.25	2	0.88	0	Almost significantly less nausea for fluids; fairly wide confidence interval

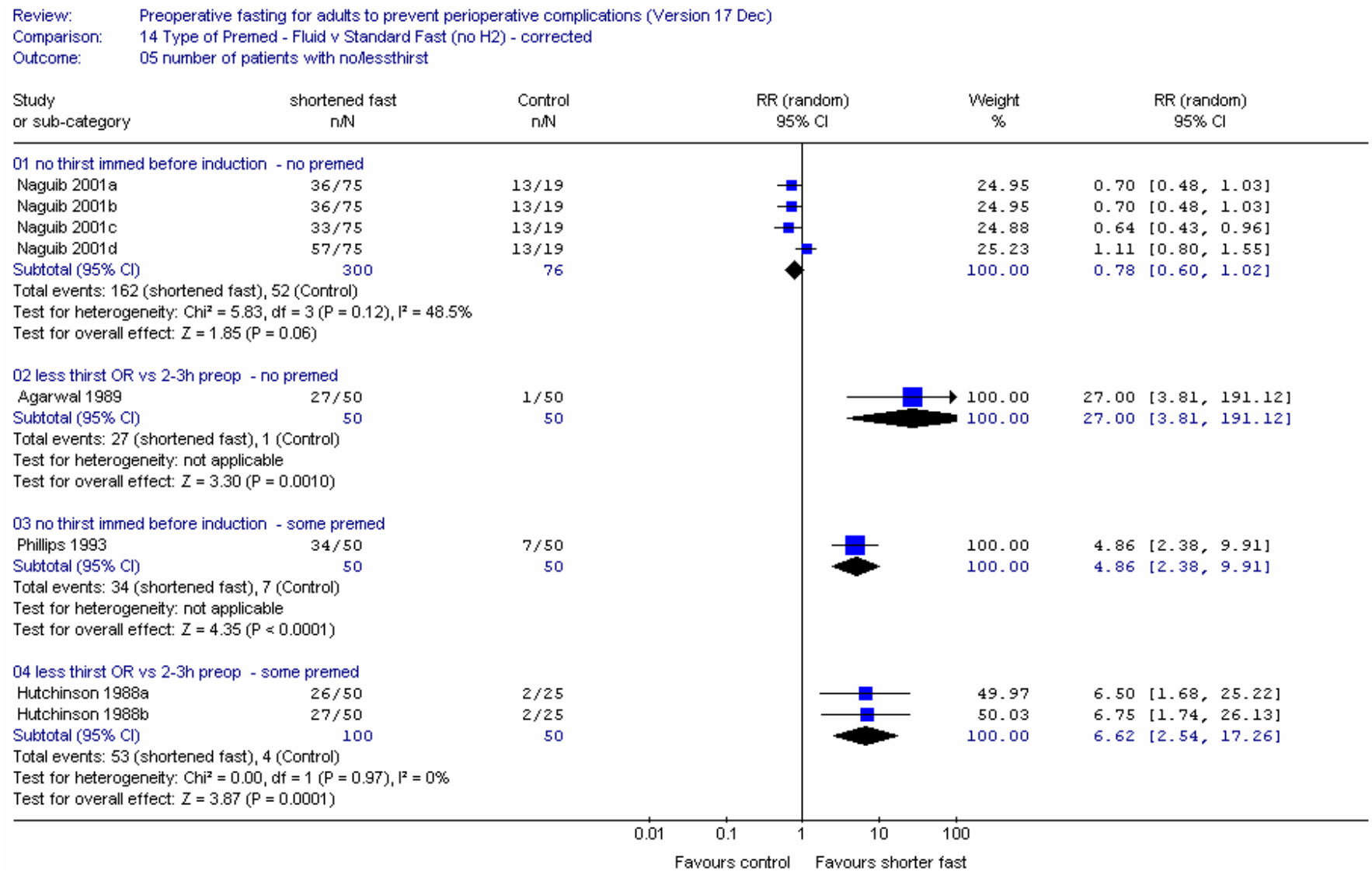
Adult trials by premedication and fluid type

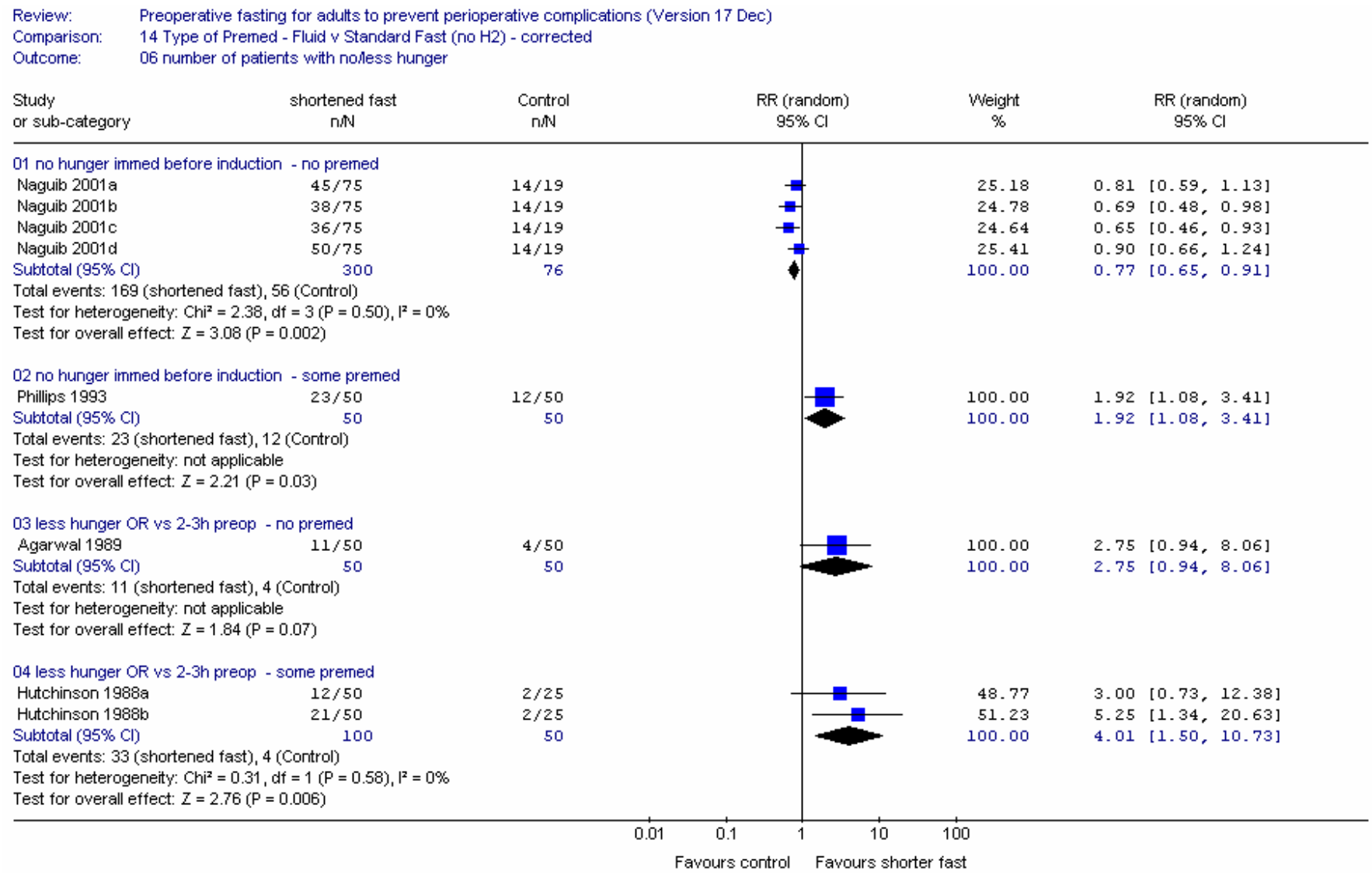
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 14 Type of Premed - Fluid v Standard Fast (no H2) - corrected
Outcome: 01 Gastric Contents - Volume (ml)

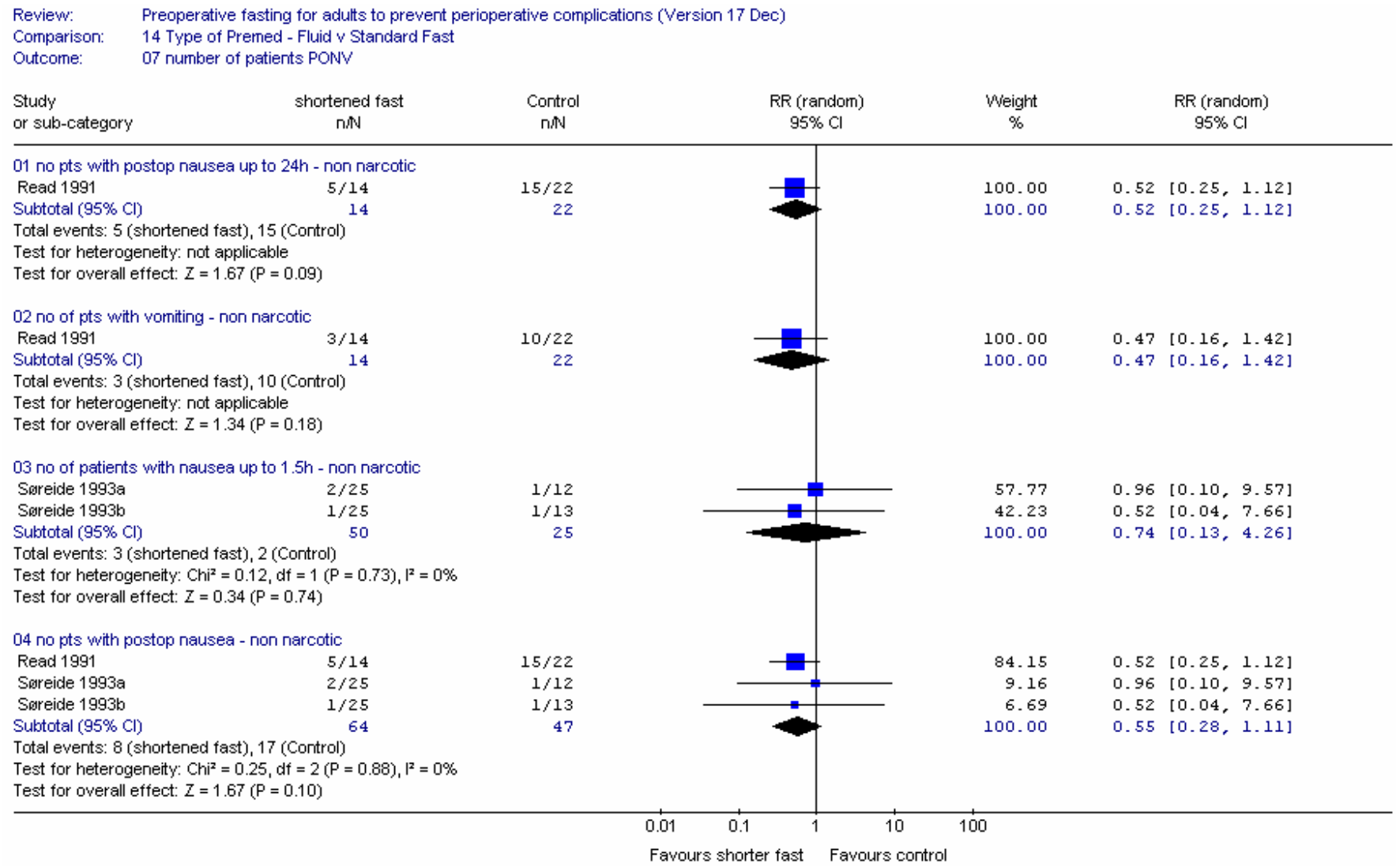
Study or sub-category	Fluid Intake N	Fluid Intake Mean (SD)	Standard Fast N	Standard Fast Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 No premed							
Maltby 1986a	35	17.60(14.50)	35	26.70(18.90)		23.90	-9.10 [-16.99, -1.21]
Sutherland 1987a	25	20.60(14.10)	25	29.90(18.20)		19.36	-9.30 [-18.32, -0.28]
Agarwal 1989	50	20.60(14.10)	50	29.90(18.20)		32.46	-9.30 [-15.68, -2.92]
Samaan 1989a	27	24.03(14.03)	24	25.07(14.37)		24.27	-1.04 [-8.85, 6.77]
Subtotal (95% CI)	137		134			100.00	-7.28 [-11.24, -3.33]
Test for heterogeneity: Chi² = 3.23, df = 3 (P = 0.36), I² = 7.2%							
Test for overall effect: Z = 3.61 (P = 0.0003)							
02 not stated premed							
Hutchinson 1988a	50	24.50(21.60)	25	23.20(17.30)		21.63	1.30 [-7.75, 10.35]
Hutchinson 1988b	50	23.70(18.40)	25	23.20(17.30)		23.96	0.50 [-7.99, 8.99]
Phillips 1993	50	21.00(12.24)	50	18.95(11.00)		54.41	2.05 [-2.51, 6.61]
Subtotal (95% CI)	150		100			100.00	1.64 [-2.04, 5.31]
Test for heterogeneity: Chi² = 0.11, df = 2 (P = 0.95), I² = 0%							
Test for overall effect: Z = 0.87 (P = 0.38)							
03 non opioid premed							
Hutchinson 1988a	50	24.50(21.60)	25	23.20(17.30)		19.27	1.30 [-7.75, 10.35]
Hutchinson 1988b	50	23.70(18.40)	25	23.20(17.30)		21.34	0.50 [-7.99, 8.99]
Read 1991	25	24.20(0.00)	29	25.70(0.00)			Not estimable
Phillips 1993	50	21.00(12.24)	50	18.95(11.00)		48.47	2.05 [-2.51, 6.61]
Søreide 1993a	25	23.00(20.00)	13	31.00(30.00)		5.63	-8.00 [-26.09, 10.09]
Søreide 1993b	25	23.00(20.00)	12	31.00(30.00)		5.29	-8.00 [-26.70, 10.70]
Subtotal (95% CI)	225		154			100.00	0.92 [-2.61, 4.46]
Test for heterogeneity: Chi² = 2.06, df = 4 (P = 0.72), I² = 0%							
Test for overall effect: Z = 0.51 (P = 0.61)							
04 opioid premed							
Maltby 1988	29	16.97(9.79)	28	13.04(7.56)		51.46	3.93 [-0.60, 8.46]
McGrady 1988	23	21.93(16.63)	21	27.83(17.60)		16.83	-5.90 [-16.04, 4.24]
Hausel 2001a	84	28.00(35.00)	42	28.00(23.00)		16.62	0.00 [-10.22, 10.22]
Hausel 2001b	78	32.00(37.00)	41	28.00(23.00)		15.09	4.00 [-6.82, 14.82]
Subtotal (95% CI)	214		132			100.00	1.94 [-2.06, 5.94]
Test for heterogeneity: Chi² = 3.29, df = 3 (P = 0.35), I² = 8.9%							
Test for overall effect: Z = 0.95 (P = 0.34)							
05 all types of premed							
Hutchinson 1988a	50	24.50(21.60)	25	23.20(17.30)		9.89	1.30 [-7.75, 10.35]
Hutchinson 1988b	50	23.70(18.40)	25	23.20(17.30)		10.95	0.50 [-7.99, 8.99]
Maltby 1988	29	16.97(9.79)	28	13.04(7.56)		25.05	3.93 [-0.60, 8.46]
McGrady 1988	23	21.93(16.63)	21	27.83(17.60)		8.19	-5.90 [-16.04, 4.24]
Read 1991	25	24.20(0.00)	29	25.70(0.00)			Not estimable
Phillips 1993	50	21.00(12.24)	50	18.95(11.00)		24.88	2.05 [-2.51, 6.61]
Søreide 1993a	25	23.00(20.00)	13	31.00(30.00)		2.89	-8.00 [-26.09, 10.09]
Søreide 1993b	25	23.00(20.00)	12	31.00(30.00)		2.72	-8.00 [-26.70, 10.70]
Hausel 2001a	84	28.00(35.00)	42	28.00(23.00)		8.09	0.00 [-10.22, 10.22]
Hausel 2001b	78	32.00(37.00)	41	28.00(23.00)		7.34	4.00 [-6.82, 14.82]
Subtotal (95% CI)	439		286			100.00	1.55 [-0.98, 4.07]
Test for heterogeneity: Chi² = 5.60, df = 8 (P = 0.69), I² = 0%							
Test for overall effect: Z = 1.20 (P = 0.23)							

Adult trials by premedication and fluid type




Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 14 Type of Premed - Fluid v Standard Fast (no H2) - corrected
Outcome: 05 number of patients with no/lessthirst
Study or sub-category
shortened fast n/N
Control n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 no thirst immed before induction - no premed
Naguib 2001a 36/75 13/19 24.95 0.70 [0.48, 1.03]
Naguib 2001b 36/75 13/19 24.95 0.70 [0.48, 1.03]
Naguib 2001c 33/75 13/19 24.88 0.64 [0.43, 0.96]
Naguib 2001d 57/75 13/19 25.23 1.11 [0.80, 1.55]
Subtotal (95% CI) 300 76 100.00 0.78 [0.60, 1.02]
Total events: 162 (shortened fast), 52 (Control)
Test for heterogeneity: Chi² = 5.83, df = 3 (P = 0.12), I² = 48.5%
Test for overall effect: Z = 1.85 (P = 0.06)
02 less thirst OR vs 2-3h preop - no premed
Agarwal 1989 27/50 1/50 100.00 27.00 [3.81, 191.12]
Subtotal (95% CI) 50 50 100.00 27.00 [3.81, 191.12]
Total events: 27 (shortened fast), 1 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.30 (P = 0.0010)
03 no thirst immed before induction - some premed
Phillips 1993 34/50 7/50 100.00 4.86 [2.38, 9.91]
Subtotal (95% CI) 50 50 100.00 4.86 [2.38, 9.91]
Total events: 34 (shortened fast), 7 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 4.35 (P < 0.0001)
04 less thirst OR vs 2-3h preop - some premed
Hutchinson 1988a 26/50 2/25 49.97 6.50 [1.68, 25.22]
Hutchinson 1988b 27/50 2/25 50.03 6.75 [1.74, 26.13]
Subtotal (95% CI) 100 50 100.00 6.62 [2.54, 17.26]
Total events: 53 (shortened fast), 4 (Control)
Test for heterogeneity: Chi² = 0.00, df = 1 (P = 0.97), I² = 0%
Test for overall effect: Z = 3.87 (P = 0.0001)
0.01
0.1
1
10
100
Favours control
Favours shorter fast


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 14 Type of Premed - Fluid v Standard Fast (no H2) - corrected
Outcome: 06 number of patients with no/less hunger
Study or sub-category
shortened fast n/N
Control n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 no hunger immed before induction - no premed
Naguib 2001a 45/75 14/19 25.18 0.81 [0.59, 1.13]
Naguib 2001b 38/75 14/19 24.78 0.69 [0.48, 0.98]
Naguib 2001c 36/75 14/19 24.64 0.65 [0.46, 0.93]
Naguib 2001d 50/75 14/19 25.41 0.90 [0.66, 1.24]
Subtotal (95% CI) 300 76 100.00 0.77 [0.65, 0.91]
Total events: 169 (shortened fast), 56 (Control)
Test for heterogeneity: Chi² = 2.38, df = 3 (P = 0.50), I² = 0%
Test for overall effect: Z = 3.08 (P = 0.002)
02 no hunger immed before induction - some premed
Phillips 1993 23/50 12/50 100.00 1.92 [1.08, 3.41]
Subtotal (95% CI) 50 50 100.00 1.92 [1.08, 3.41]
Total events: 23 (shortened fast), 12 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.21 (P = 0.03)
03 less hunger OR vs 2-3h preop - no premed
Agarwal 1989 11/50 4/50 100.00 2.75 [0.94, 8.06]
Subtotal (95% CI) 50 50 100.00 2.75 [0.94, 8.06]
Total events: 11 (shortened fast), 4 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.84 (P = 0.07)
04 less hunger OR vs 2-3h preop - some premed
Hutchinson 1988a 12/50 2/25 48.77 3.00 [0.73, 12.38]
Hutchinson 1988b 21/50 2/25 51.23 5.25 [1.34, 20.63]
Subtotal (95% CI) 100 50 100.00 4.01 [1.50, 10.73]
Total events: 33 (shortened fast), 4 (Control)
Test for heterogeneity: Chi² = 0.31, df = 1 (P = 0.58), I² = 0%
Test for overall effect: Z = 2.76 (P = 0.006)
0.01
0.1
1
10
100
Favours control
Favours shorter fast


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 14 Type of Premed - Fluid v Standard Fast
Outcome: 07 number of patients PONV
Study or sub-category
shortened fast n/N
Control n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 no pts with postop nausea up to 24h - non narcotic
Read 1991 5/14 15/22 100.00 0.52 [0.25, 1.12]
Subtotal (95% CI) 14 22 100.00 0.52 [0.25, 1.12]
Total events: 5 (shortened fast), 15 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.67 (P = 0.09)
02 no of pts with vomiting - non narcotic
Read 1991 3/14 10/22 100.00 0.47 [0.16, 1.42]
Subtotal (95% CI) 14 22 100.00 0.47 [0.16, 1.42]
Total events: 3 (shortened fast), 10 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.34 (P = 0.18)
03 no of patients with nausea up to 1.5h - non narcotic
Søreide 1993a 2/25 1/12 57.77 0.96 [0.10, 9.57]
Søreide 1993b 1/25 1/13 42.23 0.52 [0.04, 7.66]
Subtotal (95% CI) 50 25 100.00 0.74 [0.13, 4.26]
Total events: 3 (shortened fast), 2 (Control)
Test for heterogeneity: Chi² = 0.12, df = 1 (P = 0.73), I² = 0%
Test for overall effect: Z = 0.34 (P = 0.74)
04 no pts with postop nausea - non narcotic
Read 1991 5/14 15/22 84.15 0.52 [0.25, 1.12]
Søreide 1993a 2/25 1/12 9.16 0.96 [0.10, 9.57]
Søreide 1993b 1/25 1/13 6.69 0.52 [0.04, 7.66]
Subtotal (95% CI) 64 47 100.00 0.55 [0.28, 1.11]
Total events: 8 (shortened fast), 17 (Control)
Test for heterogeneity: Chi² = 0.25, df = 2 (P = 0.88), I² = 0%
Test for overall effect: Z = 1.67 (P = 0.10)
0.01
0.1
1
10
100
Favours shorter fast
Favours control

Type of fluid: water

Type of premedication: none

Comments Additional comparisons with secondary outcomes in Naguib et al., 2001

Number of comparisons 4 **Number of patients** 271

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-7.28 (-1124 -3.33)	3.23	3	0.36	7	Statistically significantly in favour of water; mean decrease 7 ml
Gastric pH (WMD)	0.09 (-0.19 0.36)	1.70	3	0.64	0	Little difference

Type of premedication: all types of premed

Number of comparisons 5 **Number of patients** 340

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-3.73 (-9.70 2.24)	1.25	3	0.74	0	Favours water, not significantly
Gastric pH (WMD)	0.04 (-038 0.46)	7.99	4	0.09	50	Some heterogeneity

Type of premedication: opioid

Comments One study (Hausel et al., 2001) had ~50% patients without pH values

Number of comparisons 2 **Number of patients** 211

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-2.59 (-9.31 4.13)	0.73	1	0.39	0	Little difference
Gastric pH (WMD)	0.44 (-0.88 1.76)	4.86	1	0.03	79	Heterogeneous

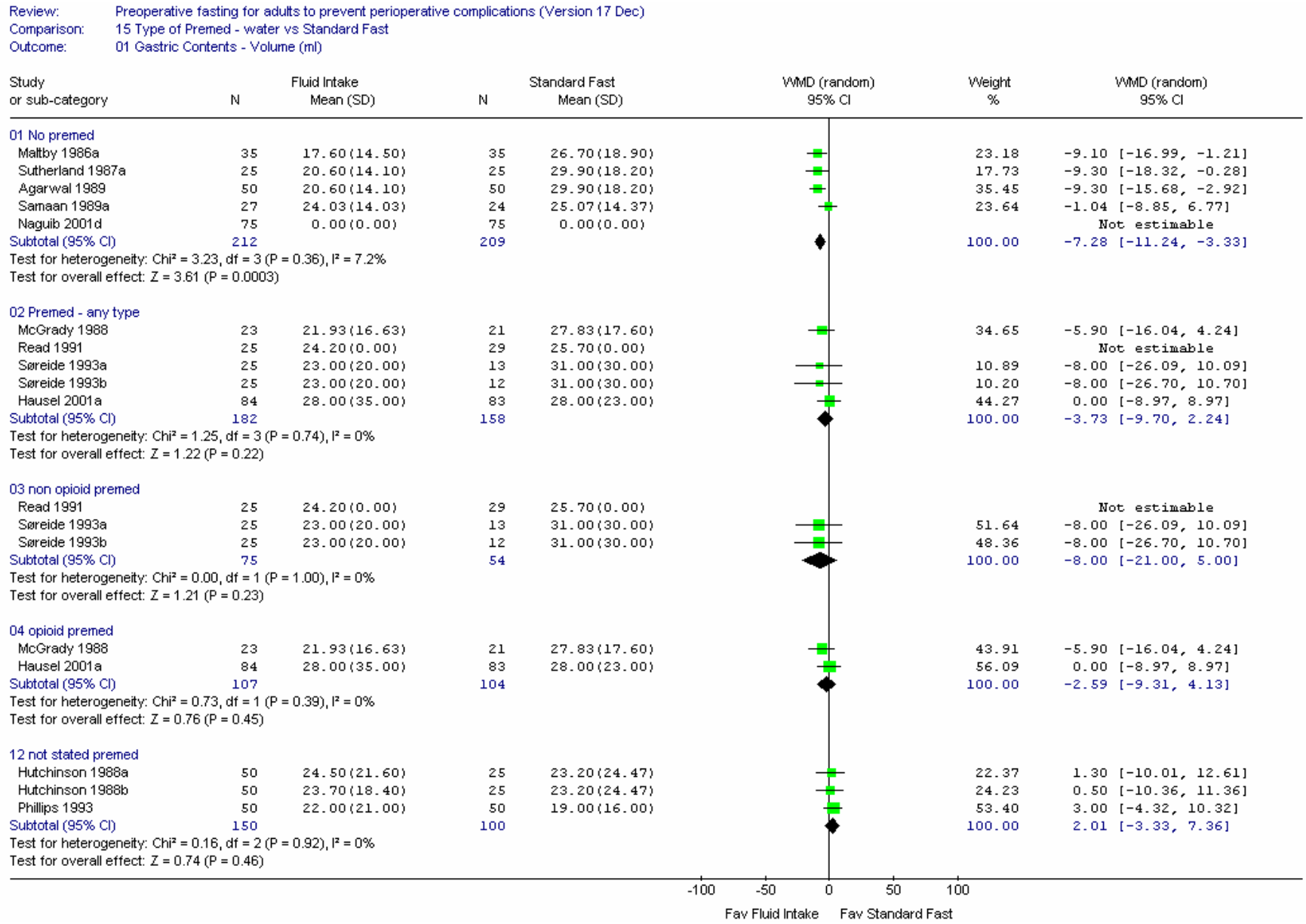
Type of premedication: non-opioid

Comments Benzodiazepines

Number of comparisons 3 **Number of patients** 129

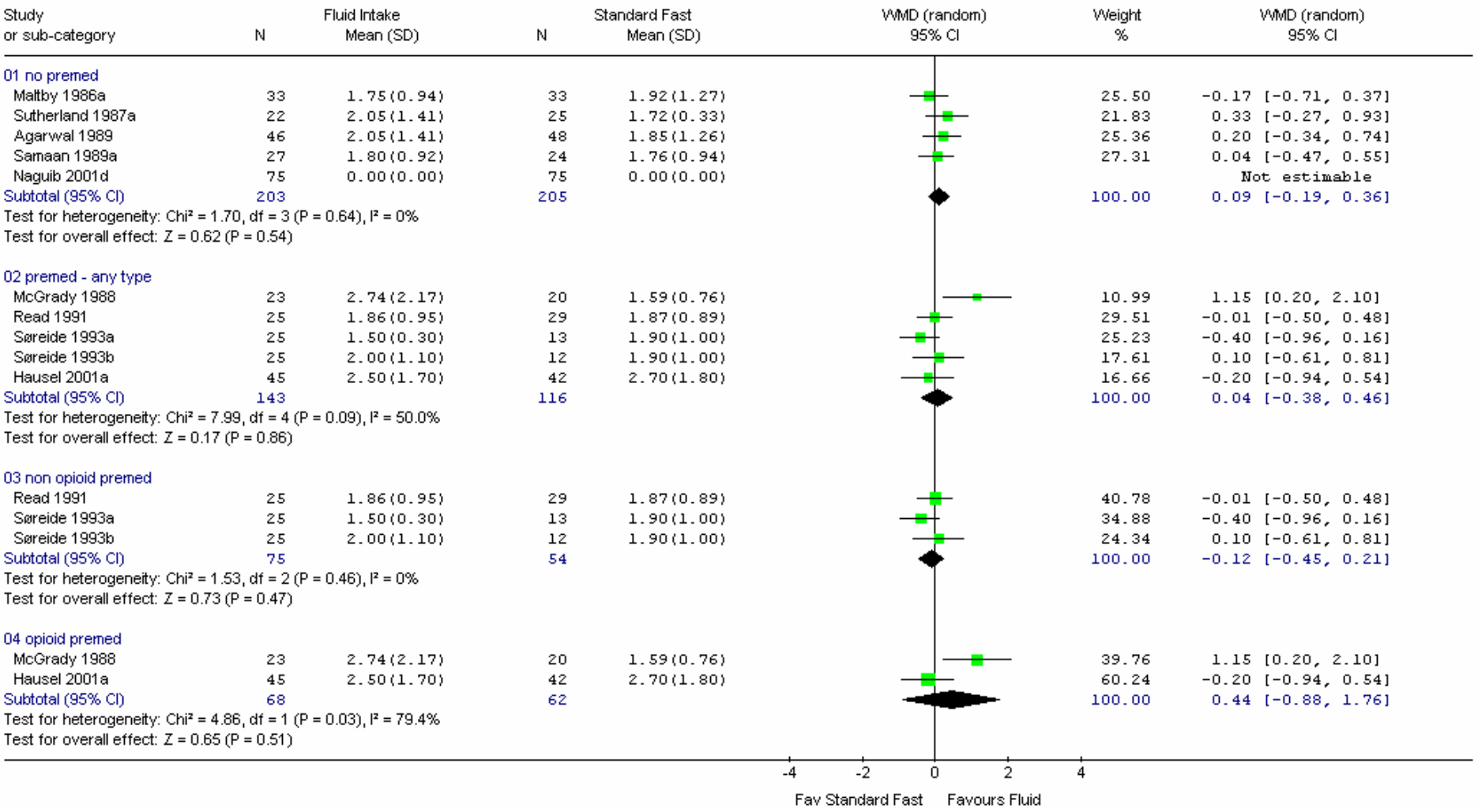
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-8.00 (-21.00 5.00)	0.00	1	1.00	0	Favours water, not statistically significant
Gastric pH (WMD)	-0.12 (-0.45 0.21)	1.53	2	0.46	0	Little difference

Adult trials by premedication and fluid type



Adult trials by premedication and fluid type

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 15 Type of Premed - water vs Standard Fast
Outcome: 02 Gastric Contents - pH



Appendix A11: Adult studies by type of H_2RA

Type of H_2RA sub-group analyses – shortened fluid fast versus standard fast

H_2 RA **Ranitidine**

Number of comparisons 5 **Number of patients** 304

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	1.50 (-0.73 3.72)	3.72	4	0.45	0	Little difference
Gastric pH (WMD)	-0.12 (-0.67 0.42)	5.82	4	0.21	31	Little difference

H_2 RA **Roxatidine**

Comments Two comparisons in one study (Yatsu et al., 1996)

Number of comparisons 2 **Number of patients** 45

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-3.79 (-8.33 0.75)	0.13	1	0.71	0	Little difference
Gastric pH (WMD)	0.41 (-0.95 1.78)	0.41	1	0.52	0	Wide confidence interval => results uncertain

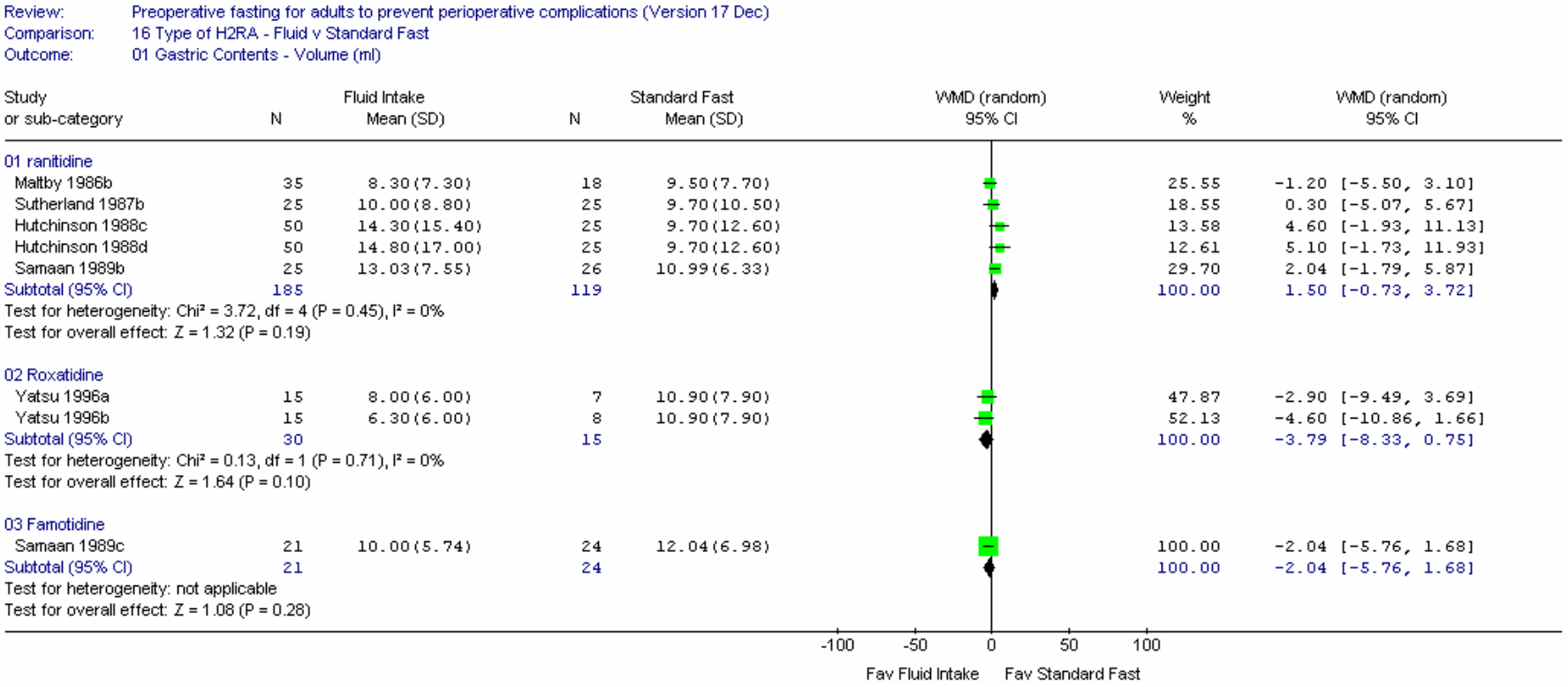
H_2RA **Famotidine**

Comments One study (Samaan et al., 1989)

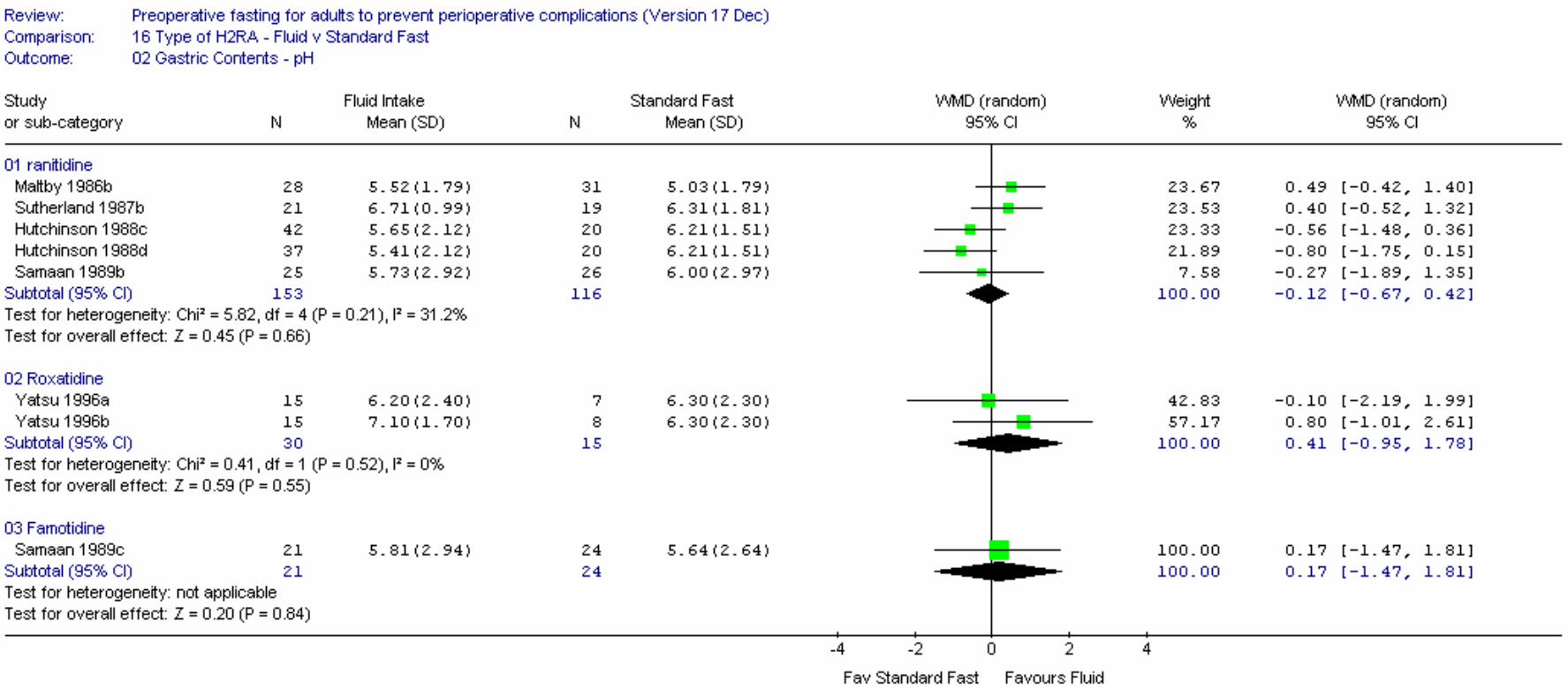
Number of comparisons 1 **Number of patients** 45

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-2.04 (-5.76 1.68)			1 trial		Little difference; one small trial (n=45)
Gastric pH (WMD)	0.17 (-1.47 1.81)			1 trial		Wide confidence interval => results uncertain

Adult studies by type of H_2RA



Adult studies by type of H_2RA



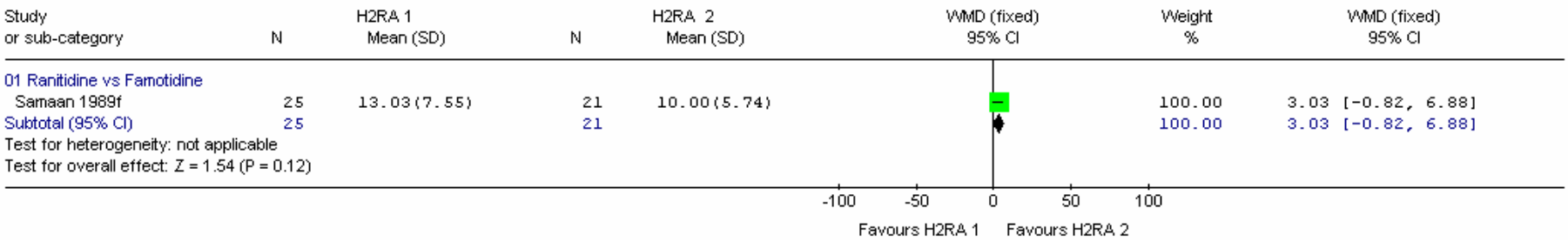
H_2RA head-to-head H_2RA 1 vs. H_2RA 2 (in presence of shortened fluid fast)

Comments One study (Samaan et al., 1989) - ranitidine versus famotidine

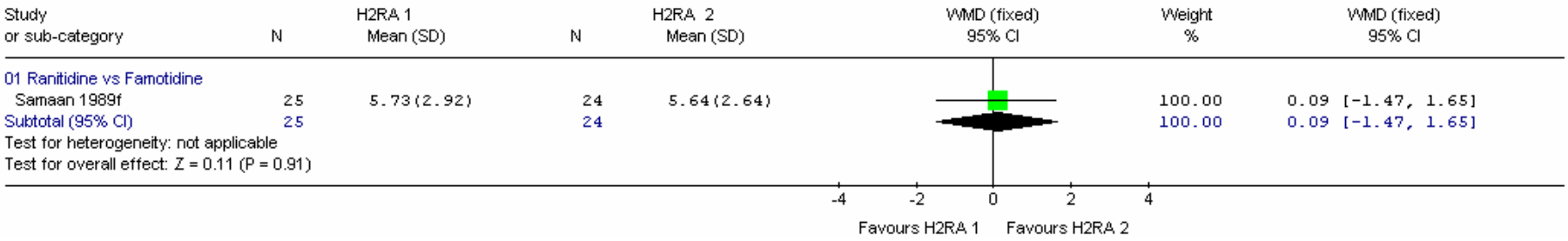
Number of comparisons 1 **Number of patients** 46

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	3.03 (-0.82 6.88)			1 trial		Little difference, favours famotidine, not significant
Gastric pH (WMD)	0.09 (-1.47 1.65)			1 trial		Wide confidence interval => results uncertain

Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 12 Head to head fast +/- premed
Outcome: 06 H2RA 1 vs H2RA 2 - volume



Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 12 Head to head fast +/- premed
Outcome: 07 H2RA 1 vs H2RA 2 - pH



Appendix A12: Adult studies with H_2RAs

Effect of H_2RA: head-to-head H_2RA versus no H_2RA in presence of shortened fluid fast

Type of fluid: all fluids

Comments

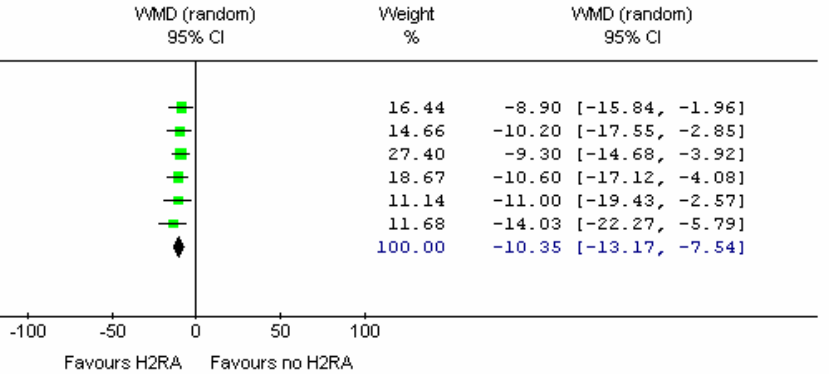
Number of comparisons 6 **Number of patients** 397

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-10.35 (-13.17 -7.54)	1.11	5	0.95	0	Statistically significantly in favour of H_2RA; mean volume decrease 10ml
Gastric pH (WMD)	3.88 (3.47 4.29)	6.78	5	0.24	26	Statistically significantly in favour of H_2RA; mean pH increase 3.9 units;

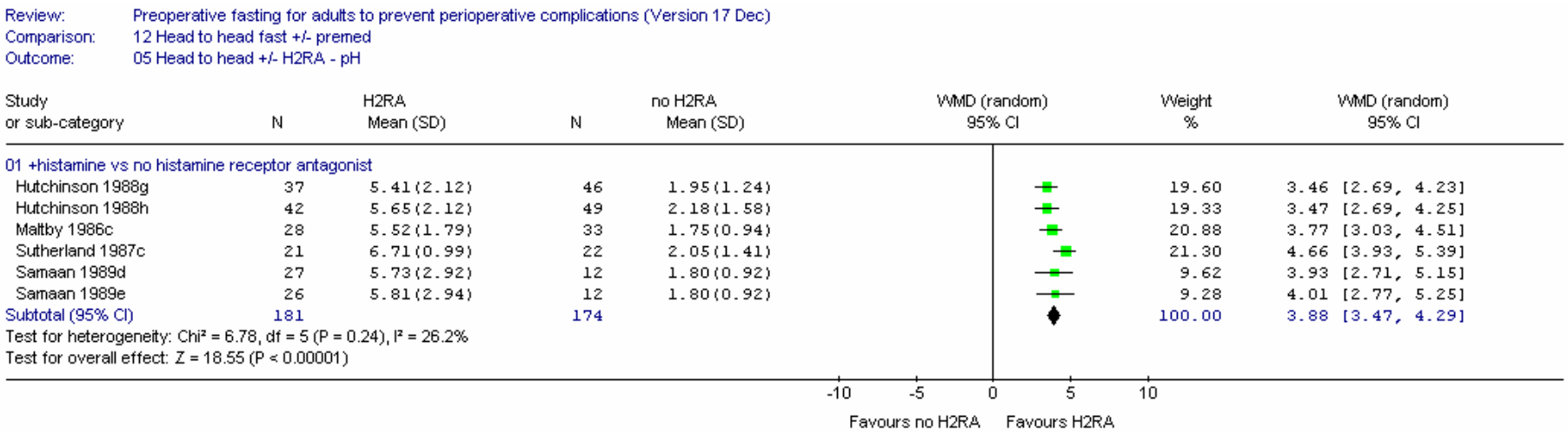
Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 12 Head to head fast +/- premed
Outcome: 04 Head to head +/- H2 receptor antagonists - volume

Study or sub-category	Treatment N	Treatment Mean (SD)	Control N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 +histamine vs no histamine							
Hutchinson 1988g	50	14.80(17.00)	50	23.70(18.40)		16.44	-8.90 [-15.84, -1.96]
Hutchinson 1988h	50	14.30(15.40)	50	24.50(21.60)		14.66	-10.20 [-17.55, -2.85]
Maltby 1986c	35	8.30(7.30)	35	17.60(14.50)		27.40	-9.30 [-14.68, -3.92]
Sutherland 1987c	25	10.00(8.80)	25	20.60(14.10)		18.67	-10.60 [-17.12, -4.08]
Samaan 1989d	27	13.03(7.55)	12	24.03(14.03)		11.14	-11.00 [-19.43, -2.57]
Samaan 1989e	26	10.00(5.74)	12	24.03(14.03)		11.68	-14.03 [-22.27, -5.79]
Subtotal (95% CI)	213		184			100.00	-10.35 [-13.17, -7.54]

Test for heterogeneity: Chi^2 = 1.11, df = 5 (P = 0.95), I^2 = 0%
Test for overall effect: Z = 7.21 (P < 0.00001)



Adult studies with H_2RAs



Effect of fluid type in the presence of H_2RAs

Type of fluid: water

Comments

Number of comparisons 5 **Number of patients** 246

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.71	(-2.55	1.13)	3.41	4	0.49	0	Little difference
Gastric pH (WMD)	0.30	(-0.25	0.84)	0.85	4	0.93	0	Favours water, not significant

Type of fluid: clear fluids

Comments One small study (Yatsu et al., 1996); Vincent et al., 1991 not included

Number of comparisons 1 **Number of patients** 22

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-4.60	(-10.86	1.66)			1 trial		Little difference, single trial
Gastric pH (WMD)	0.80	(-1.01	2.61)			1 trial		Wide confidence interval => results uncertain

Type of fluid: non-clear fluids

Comments Two comparisons from same trial (Hutchinson et al., 1988)

Number of comparisons 2 **Number of patients** 150

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	4.84	(0.12	9.56)	0.01	1	0.92	0	Statistically significantly in favour of standard fast; mean volume increase 5 ml
Gastric pH (WMD)	-0.68	(-1.34	-0.01)	0.13	1	0.72	0	Statistically significantly in favour of standard fast; mean pH decrease 0.7

Type of fluid: fruit juice

Comments One comparison (Hutchinson et al., 1988); Vincent et al., 1991 not included

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	5.10 (-0.77 10.97)			1 trial		Little difference
Gastric pH (WMD)	-0.80 (-1.63 0.03)			1 trial		Borderline significance (p=0.06) in favour of standard fast

Type of fluid: head-to-head orange juice versus coffee

Comments One study (Hutchinson et al., 1988)

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.50 (-5.86 6.86)			1 trial		Little difference
Gastric pH (WMD)	-0.24 (-1.18 0.70)			1 trial		Little difference; fairly wide confidence interval

Type of fluid: head-to-head apple juice versus tea

Comments One study (Tanabe et al., 1996)

Number of comparisons 1 **Number of patients** 40

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comment:
Gastric volume (WMD)	10.70 (1.82 19.58)			1 trial		Statistically significantly in favour of tea; mean decrease 11 ml
Gastric pH (WMD)	−1.60 (−3.09 -0.11)			1 trial		Statistically significantly in favour of tea; mean increase 1.6 units

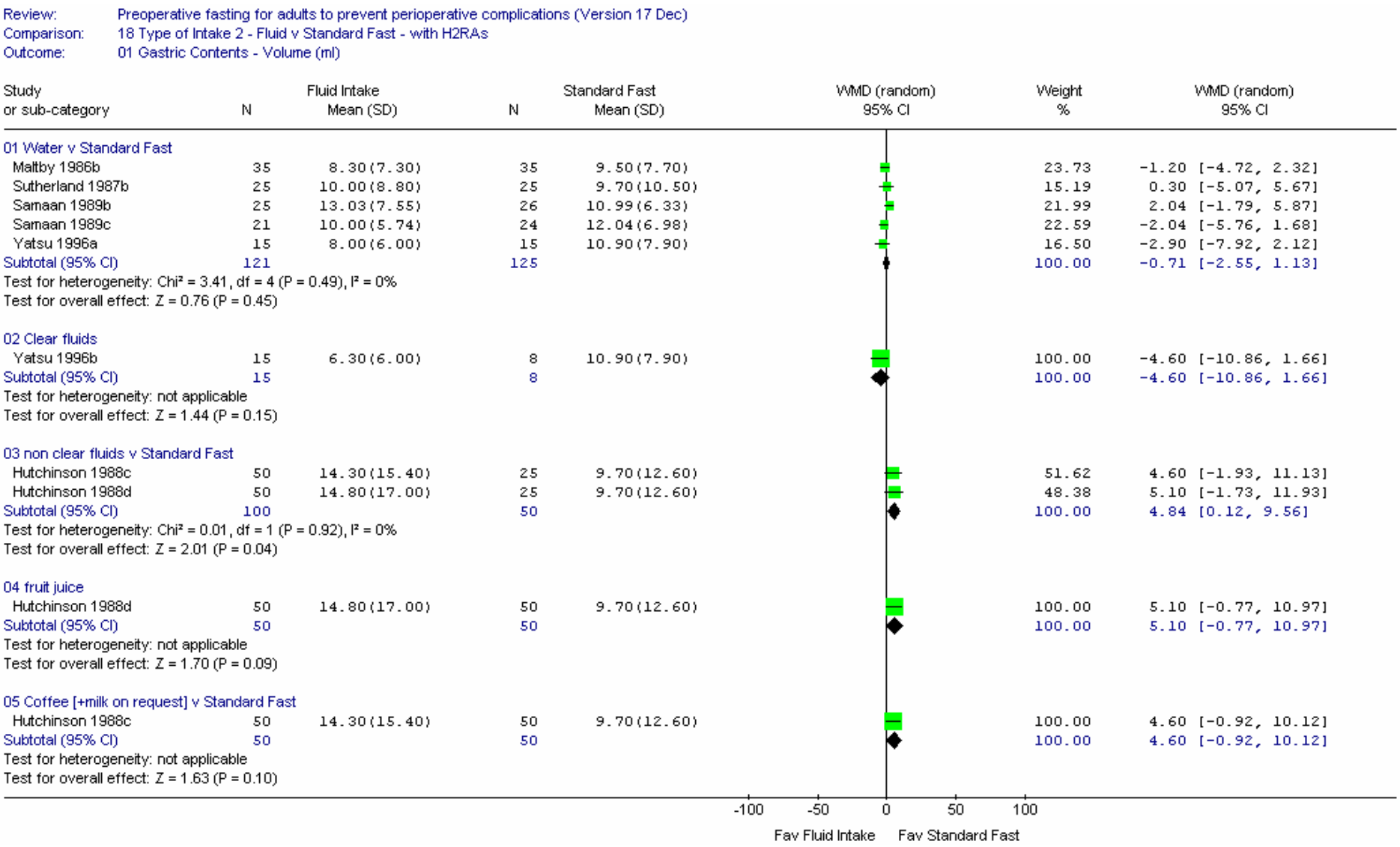
Type of fluid: head-to-head water versus isotonic drink

Comments One trial (Yatsu et al., 1996)

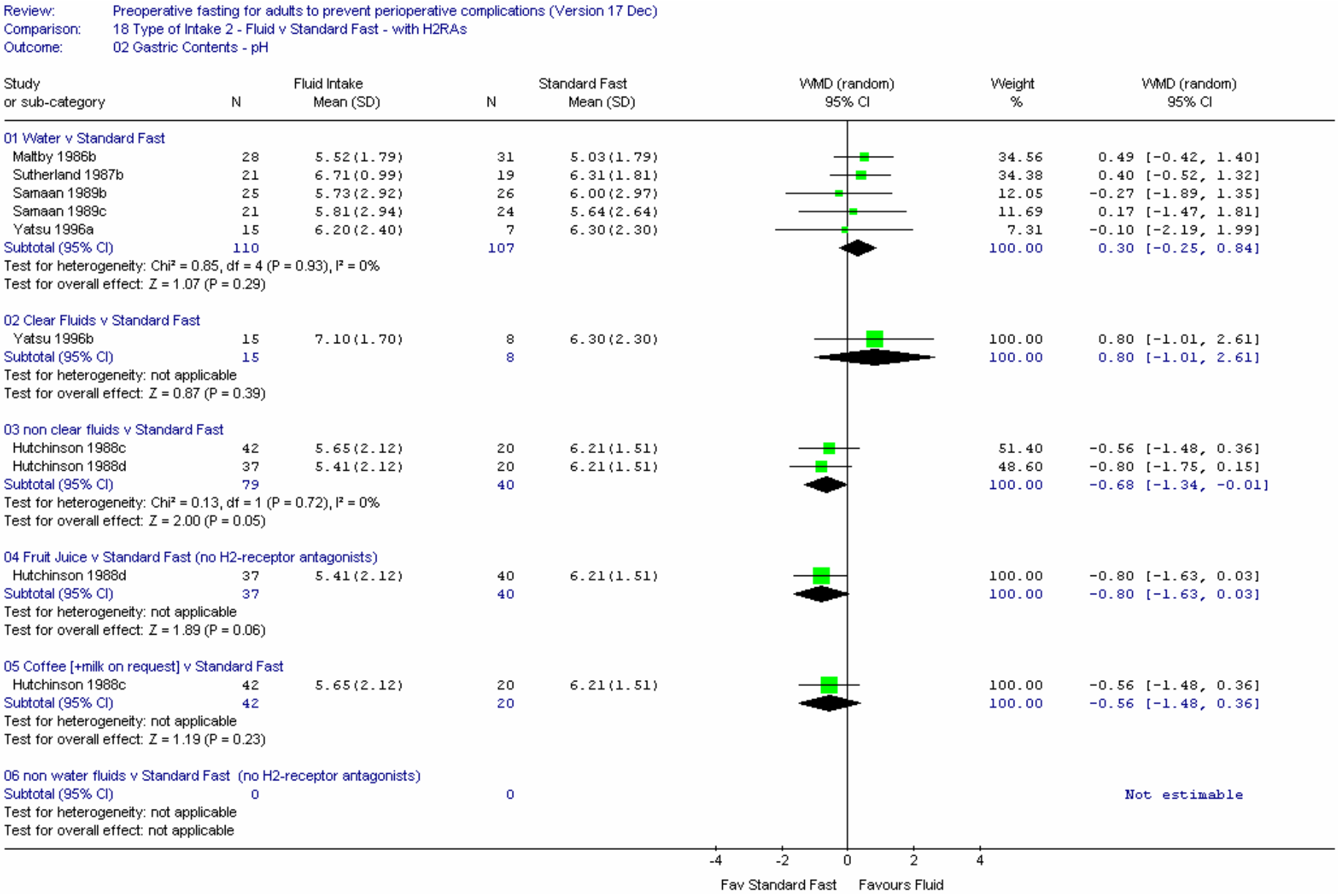
Number of comparisons 1 **Number of patients** 30

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	1.70 (-2.59 5.99)			1 trial		Little difference
Gastric pH (WMD)	-0.90 (-2.39 0.59)			1 trial		Wide confidence interval => results uncertain

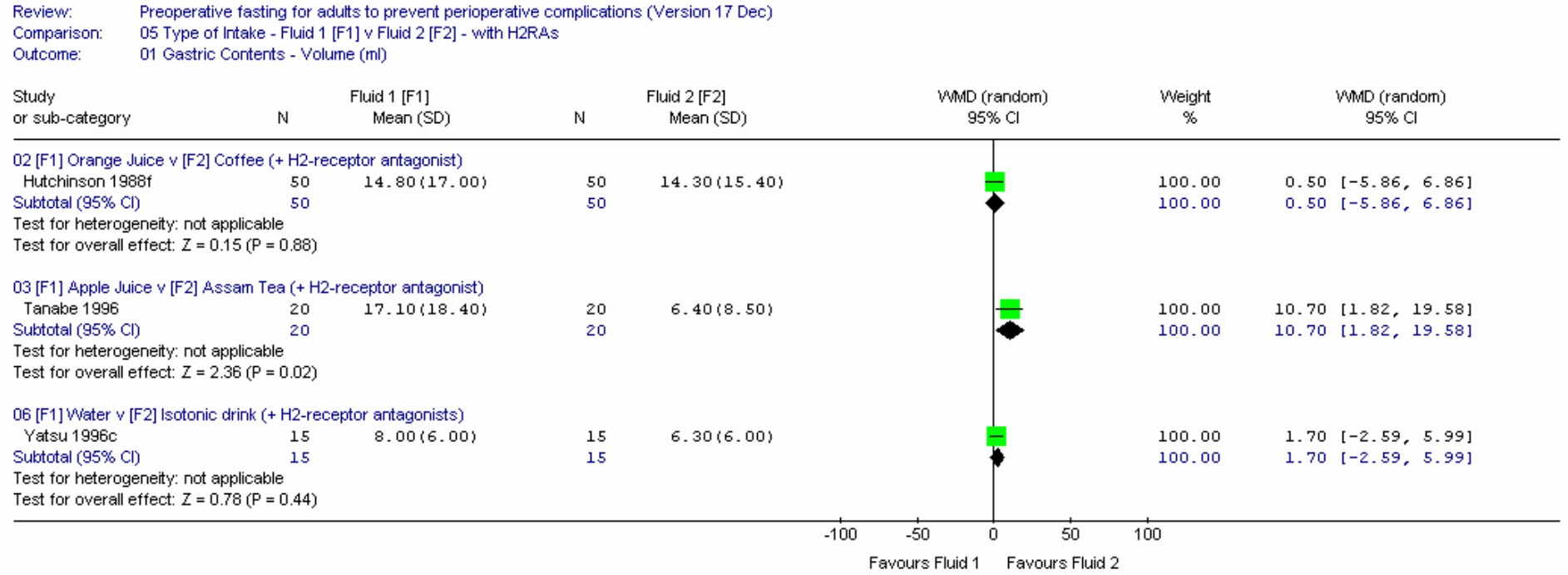
Adult studies with H_2RAs

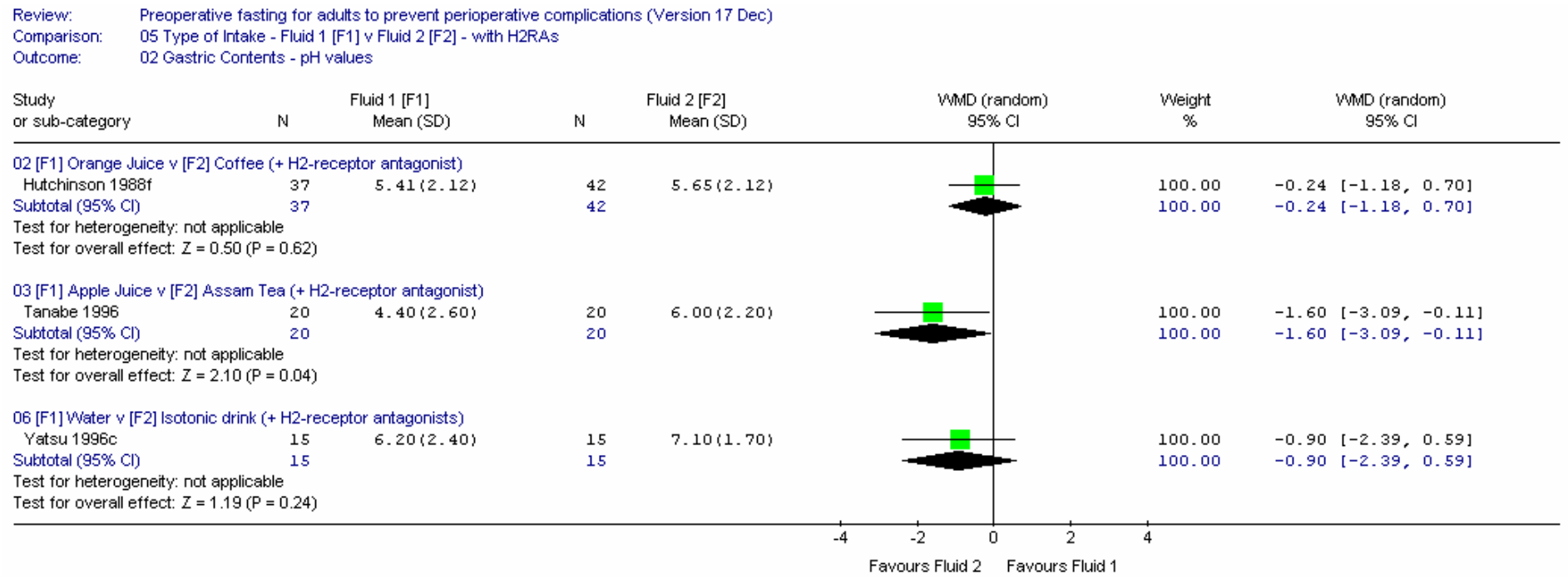


Adult studies with H_2RAs



Adult studies with H_2RAs




Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 05 Type of Intake - Fluid 1 [F1] v Fluid 2 [F2] - with H2RAs
Outcome: 02 Gastric Contents - pH values
Study or sub-category
N
Fluid 1 [F1] Mean (SD)
N
Fluid 2 [F2] Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
02 [F1] Orange Juice v [F2] Coffee (+ H2-receptor antagonist)
Hutchinson 1988f 37 5.41(2.12) 42 5.65(2.12) 100.00 -0.24 [-1.18, 0.70]
Subtotal (95% CI) 37 42 100.00 -0.24 [-1.18, 0.70]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.50 (P = 0.62)
03 [F1] Apple Juice v [F2] Assam Tea (+ H2-receptor antagonist)
Tanabe 1996 20 4.40(2.60) 20 6.00(2.20) 100.00 -1.60 [-3.09, -0.11]
Subtotal (95% CI) 20 20 100.00 -1.60 [-3.09, -0.11]
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.10 (P = 0.04)
06 [F1] Water v [F2] Isotonic drink (+ H2-receptor antagonists)
Yatsu 1996c 15 6.20(2.40) 15 7.10(1.70) 100.00 -0.90 [-2.39, 0.59]
Subtotal (95% CI) 15 15 100.00 -0.90 [-2.39, 0.59]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.19 (P = 0.24)
-4
-2
0
2
4
Favours Fluid 2
Favours Fluid 1

Appendix A13: Adult studies in higher-risk patients

Patient group: pregnant

Comments One trial (Ozkan et al., 2000); elective Caesarean section. Water up to two hours preoperatively.

Number of comparisons 1 **Number of patients** 50

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Shortened vs. standard fast						
Gastric volume (WMD)	-4.00 (-9.96 1.96)			1 trial		Little difference
Gastric pH (WMD)	0.32 (0.14 0.50)			1 trial		Statistically significantly in favour of shortened fast; mean increase 0.32
H_2RA (ranitidine) vs. no drug (in presence of a shortened fast)						
Gastric volume (WMD)	-5.90 (-11.75 -0.05)			1 trial		Statistically significantly in favour of H_2RA; mean decrease 6 ml
Gastric pH (WMD)	2.19 (1.87 2.51)			1 trial		Statistically significantly in favour of H_2RA; mean increase 2.2
PPI (omeprazole) vs. no drug (in presence of a shortened fast)						
Gastric volume (WMD)	-9.90 (-15.18 -4.62)			1 trial		Statistically significantly in favour of omeprazole; mean decrease 10 ml
Gastric pH (WMD)	3.44 (3.15 3.73)			1 trial		Statistically significantly in favour of omeprazole; mean increase 3.4
Gastrokinetic agent (metoclopramide) vs. no drug (in presence of a shortened fast)						
Gastric volume (WMD)	-0.30 (-5.91 5.31)			1 trial		Little difference
Gastric pH (WMD)	-0.06 (-0.16 0.28)			1 trial		Little difference

Patient group: obese

Comments One study (Maltby Pytka). Study authors found median not significantly different for gastric volume. Clear fluids up to two hours.

Number of comparisons 1 **Number of patients** 40

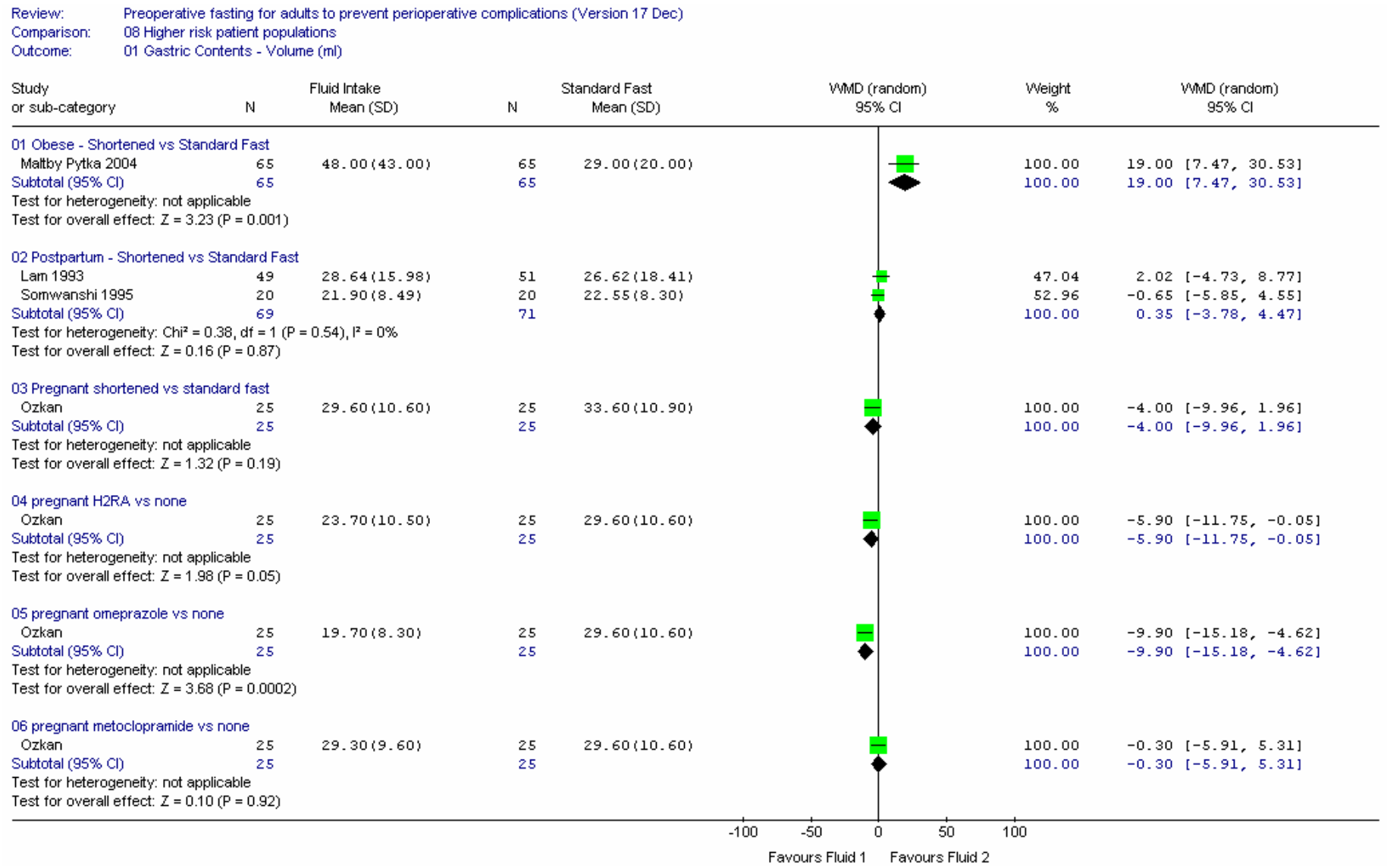
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Shortened vs. standard fast						
Gastric volume (WMD)	19.00 (7.47 30.53)			1 trial		Statistically significantly in favour of standard fast; mean increase 19 ml
Gastric pH (WMD)	0.02 (-0.40 0.44)			1 trial		Little difference

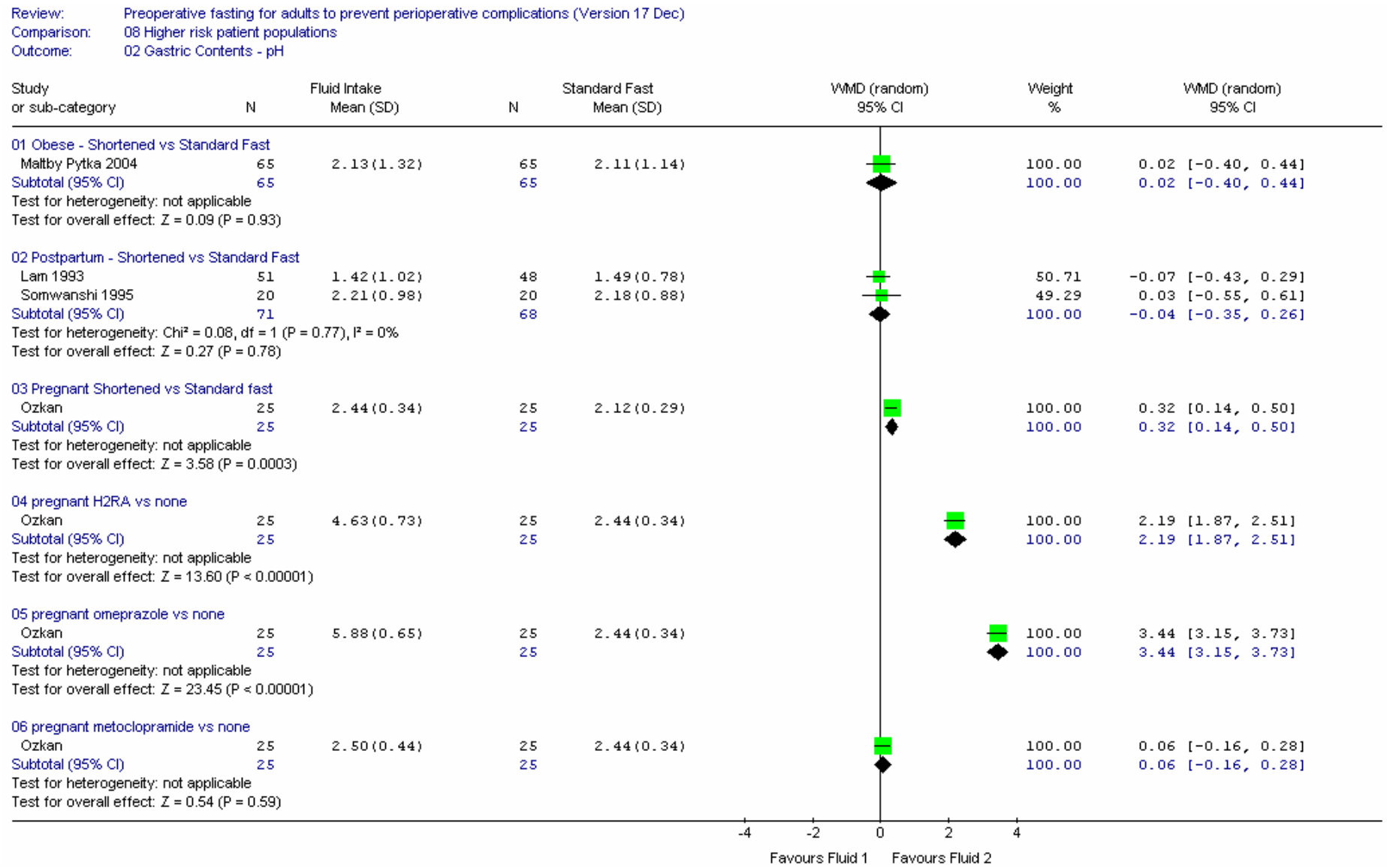
Patient group: postpartum

Comments Patient related outcomes only for one study (Lam et al., 1993). Water up to 2.5 hours.

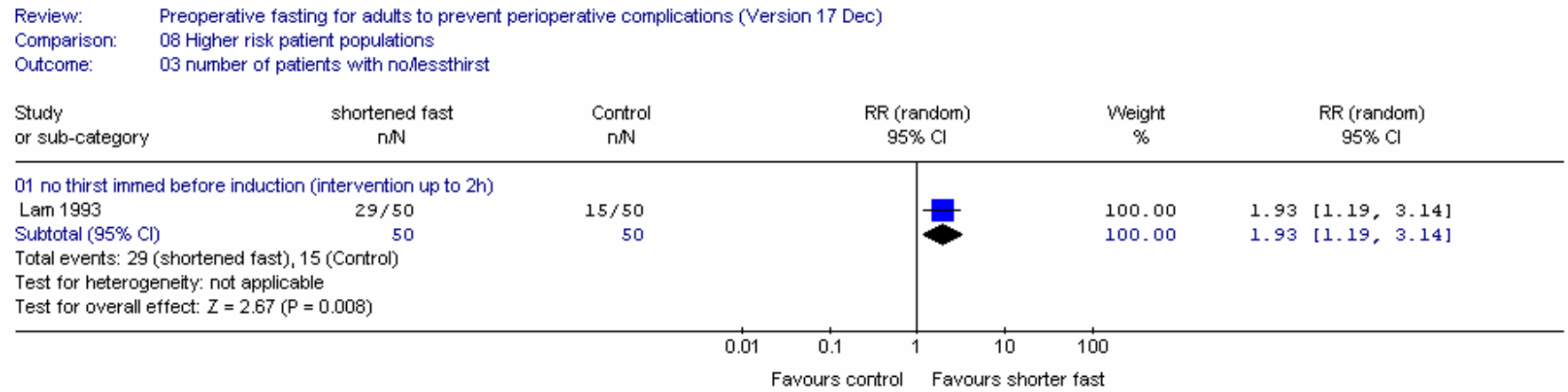
Number of comparisons 2 **Number of patients** 139

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Shortened vs. standard fast						
Gastric volume (WMD)	0.35 (-3.78 4.47)	0.38	1	0.54	0	Little difference
Gastric pH (WMD)	-0.04 (-0.35 0.26)	0.08	1	0.77	0	Little difference
Thirst - no. of pts with none (RR)	1.93 (1.19 3.14)			1 trial		Statistically significantly less thirst for shortened fast (1/2 risk)
Hunger - descriptive				1 trial		No differences in hunger


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 08 Higher risk patient populations
Outcome: 01 Gastric Contents - Volume (ml)
Study or sub-category | N | Fluid Intake Mean (SD) | N | Standard Fast Mean (SD) | WMD (random) 95% CI | Weight % | WMD (random) 95% CI
01 Obese - Shortened vs Standard Fast
Maltby Pytka 2004 65 48.00(43.00) 65 29.00(20.00) 100.00 19.00 [7.47, 30.53]
Subtotal (95% CI) 65 65 100.00 19.00 [7.47, 30.53]
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.23 (P = 0.001)
02 Postpartum - Shortened vs Standard Fast
Lam 1993 49 28.64(15.98) 51 26.62(18.41) 47.04 2.02 [-4.73, 8.77]
Somwanshi 1995 20 21.90(8.49) 20 22.55(8.30) 52.96 -0.65 [-5.85, 4.55]
Subtotal (95% CI) 69 71 100.00 0.35 [-3.78, 4.47]
Test for heterogeneity: Chi² = 0.38, df = 1 (P = 0.54), I² = 0%
Test for overall effect: Z = 0.16 (P = 0.87)
03 Pregnant shortened vs standard fast
Ozkan 25 29.60(10.60) 25 33.60(10.90) 100.00 -4.00 [-9.96, 1.96]
Subtotal (95% CI) 25 25 100.00 -4.00 [-9.96, 1.96]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.32 (P = 0.19)
04 pregnant H2RA vs none
Ozkan 25 23.70(10.50) 25 29.60(10.60) 100.00 -5.90 [-11.75, -0.05]
Subtotal (95% CI) 25 25 100.00 -5.90 [-11.75, -0.05]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.98 (P = 0.05)
05 pregnant omeprazole vs none
Ozkan 25 19.70(8.30) 25 29.60(10.60) 100.00 -9.90 [-15.18, -4.62]
Subtotal (95% CI) 25 25 100.00 -9.90 [-15.18, -4.62]
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.68 (P = 0.0002)
06 pregnant metoclopramide vs none
Ozkan 25 29.30(9.60) 25 29.60(10.60) 100.00 -0.30 [-5.91, 5.31]
Subtotal (95% CI) 25 25 100.00 -0.30 [-5.91, 5.31]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.10 (P = 0.92)
-100 -50 0 50 100
Favours Fluid 1 Favours Fluid 2


Review: Preoperative fasting for adults to prevent perioperative complications (Version 17 Dec)
Comparison: 08 Higher risk patient populations
Outcome: 02 Gastric Contents - pH
Study or sub-category | N | Fluid Intake Mean (SD) | N | Standard Fast Mean (SD) | WMD (random) 95% CI | Weight % | WMD (random) 95% CI
01 Obese - Shortened vs Standard Fast
Maltby Pytka 2004 65 2.13(1.32) 65 2.11(1.14) 100.00 0.02 [-0.40, 0.44]
Subtotal (95% CI) 65 65 100.00 0.02 [-0.40, 0.44]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.09 (P = 0.93)
02 Postpartum - Shortened vs Standard Fast
Lam 1993 51 1.42(1.02) 48 1.49(0.78) 50.71 -0.07 [-0.43, 0.29]
Somwanshi 1995 20 2.21(0.98) 20 2.18(0.88) 49.29 0.03 [-0.55, 0.61]
Subtotal (95% CI) 71 68 100.00 -0.04 [-0.35, 0.26]
Test for heterogeneity: Chi² = 0.08, df = 1 (P = 0.77), I² = 0%
Test for overall effect: Z = 0.27 (P = 0.78)
03 Pregnant Shortened vs Standard fast
Ozkan 25 2.44(0.34) 25 2.12(0.29) 100.00 0.32 [0.14, 0.50]
Subtotal (95% CI) 25 25 100.00 0.32 [0.14, 0.50]
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.58 (P = 0.0003)
04 pregnant H2RA vs none
Ozkan 25 4.63(0.73) 25 2.44(0.34) 100.00 2.19 [1.87, 2.51]
Subtotal (95% CI) 25 25 100.00 2.19 [1.87, 2.51]
Test for heterogeneity: not applicable
Test for overall effect: Z = 13.60 (P < 0.00001)
05 pregnant omeprazole vs none
Ozkan 25 5.88(0.65) 25 2.44(0.34) 100.00 3.44 [3.15, 3.73]
Subtotal (95% CI) 25 25 100.00 3.44 [3.15, 3.73]
Test for heterogeneity: not applicable
Test for overall effect: Z = 23.45 (P < 0.00001)
06 pregnant metoclopramide vs none
Ozkan 25 2.50(0.44) 25 2.44(0.34) 100.00 0.06 [-0.16, 0.28]
Subtotal (95% CI) 25 25 100.00 0.06 [-0.16, 0.28]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.54 (P = 0.59)
-4 -2 0 2 4
Favours Fluid 1 Favours Fluid 2

Adult studies in higher-risk patients



Appendix A14: Included studies – postoperative fasting in healthy adults

Study	Number of patients	ASA group	Study design	Operation type	Interventions	Preop fast	Pre-med	Study comments
Adults only								
Jin et al., 1998	726	I-II	RCT	General day surgery: D&C and diagnostic laparoscopy of the uterus, arthroscopic procedures, minor superficial procedures; general anaesthesia. Exclusions: diabetes, dyspepsia/reflux, obesity, motion sickness, previous PONV.	1. Mandatory 200 ml fluids during time in DSU (apple juice, tea, coffee) + 100 ml on request (n=355). 2. Nothing orally during hospital stay (n=371).	13 h NPO	n	Mean fluid intake (150 ml); no premedication reported; analgesia as required including morphine; anti-emetics given on request; gender (M:F): 52:674.
Martinez Claret and Sanchez Coll, 2001	80	ns	RCT	Minor non-digestive surgery: ophthalmology, rectal, gynaecology; anaesthesia: general, regional, sedation, <2 h anaesthesia duration. Exclusions: previous history of emesis, anti-emetics, pregnancy, nasogastric tube, fever >38 deg C, digestive disorders.	1. Early fluids (0 to 2 h) (n=40). 2. Late fluids (2 to 6 h) (n=40).	Not sure.	ns	Results for patients receiving different types of anaesthesia not reported separately; similar numbers for each type of anaesthesia; ~20% patients had opioid analgesia; anti-emetics not clear; gender (M:F): 39:41.
Hann and Ross, 1987	408	'Fit'	Prospective non-randomised study.	Short stay gynaecology procedures (D & C diagnostic, laparoscopy, termination of pregnancy); general anaesthesia. Exclusions: not stated.	Fluids (tea, coffee or orange juice) postoperatively: 1. at 0-1h (n=96) 2. at 1-2h (n=111) 3. at 2 to 3h (n=103) 4. at 3 to 4h (n=98).	ns	yes	Range of premedication from none to opioids; four intervention groups; gender - all women.

Study	Number of patients	ASA group	Study design	Operation type	Interventions	Preop fast	Pre-med	Study comments
Infants, children and adults								
Van den Berg et al., 1987	200	Unclear	Prospective non-randomised study.	Ophthalmic surgery; 20 to 190 min duration of anaesthesia; patients randomised to anti-emetics; general anaesthesia. Exclusions not stated.	1.30 ml fluids (sips) offered hourly when patients awake (n=100). 2. No oral fluids in first two hours in patients or four hours in adults (n=100).	ns	y	Morphine and atropine premedication in all patients; iv fluids continued postoperatively until oral fluids tolerated; anti-emetics given for PONV; opioid drugs for analgesia; gender (M:F): 124:76; adult/child numbers not stated; age range less than one to 83 years.

Appendix A15: Excluded studies – adult postoperative review

Study	Reason for exclusion	Study	Reason for exclusion
Abd Rabbo et al., 1995	Caesarean section – outside scope; although randomised trial.	Guedj et al., 1991	Caesarean section – outside scope; although randomised trial.
Burrows et al., 1995	Caesarean section – outside scope; although randomised trial.	Han-Geurts et al., 2001	Abdominal operations – outside scope; although randomised trial.
Cutillo et al., 1999	Gynaecological malignancy - outside scope; although randomised trial.	Hoshi et al., 1999	Healthy patients, randomised trial, but spinal anaesthesia only.
Daly et al., 1990	Gastrointestinal surgery – outside scope; not oral feeding.	Lewis et al., 2001	Gastrointestinal surgery – outside scope; although systematic review.
de Aguilar-Nascimento 2002	Gastrointestinal surgery – outside scope; although randomised trial.	MacMillan et al., 2000	Major gynaecological surgery – outside scope; although randomised trial.
de Lédinghen et al.,1997	Gastrointestinal surgery – outside scope; although randomised trial.	Mangesi and Hofmeyr, 2002	Caesarean section – outside scope; although systematic review.
Feo et al., 2004	Gastrointestinal surgery – outside scope; although randomised trial.	Patolia et al., 2001	Caesarean section and not general anaesthesia; although randomised trial.
Göçmen et al., 2002	Caesarean section – outside scope; although randomised trial.	Pearl et al., 1998	Gynaecological malignancy - outside scope; although randomised trial.

Study	Reason for exclusion	Study	Reason for exclusion
Reissman et al., 1995	Gastrointestinal surgery – outside scope; although randomised trial.	Steed et al., 2002	Major gynaecological surgery – outside scope; although randomised trial.
Schilder et al., 1997	Gynaecological malignancy - outside scope; although quasi randomised trial.	Weinstein et al., 1993	Caesarean section – outside scope; although randomised trial.
Seven et al., 2003	Oral feeding versus feeding via trans-oesophageal puncture for laryngectomy – outside scope, although randomised trial.		

Appendix A16: Quality of included studies, postoperative adults

Randomised studies

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Overall comments
Jin et al., 1998	Adequate (random number table).	Unclear	Unclear (anesthesio-logists blinded).	Yes	ITT, despite protocol deviations. But 12.5% loss to follow up for 24 h outcomes.	Yes	Yes	Age, gender, preoperative fasting, postoperative iv fluids, type of surgery and airway management, postoperative medication all comparable.	Sensitivity analysis also carried out, excluding those who had protocol deviations.
Martinez Claret and Sanchez Coll, 2001	Adequate (random number table).	Unclear	Unclear	Yes		Yes	Yes	Age, gender, type of surgery, duration of surgery, duration of recovery, type of analgesia all comparable.	

Non-randomised studies

Study	**Prospective**	**All eligible selected**	**Outcome blinding**	**ITT code**	**ITT details**	**Baseline OK?**	**Baseline comments**	**Overall comments**
Hann and Ross, 1987	Yes	Yes	No	Yes		No	Significant difference in age and type of surgery.	Patients assigned to oral intake regime according to ward (that all had different types of surgery).
Van den Berg 1987	Yes	Yes	No (nursing staff knew groups).	Yes		Yes	Age, gender, weight, duration of anaesthesia, recovery time all comparable. Type of antiemetic assumed comparable.	First 100 patients assigned to early fluids, second 100 to NPO group.

Appendix A17: Adult postoperative studies by comparison

Type of fluid or solid: mandatory fluids vs. NPO

Comments One study (Jin et al., 1998); mean stay in DSU 85 and 81 minutes. General anaesthesia.

Number of comparisons 1 **Number of patients** 726

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
No. patients with nausea in DSU (RR)	0.98 (0.60 1.59)			1 trial		Little difference
No. patients with vomiting in DSU (RR)	0.78 (0.27 2.24)			1 trial		Wide confidence interval => results uncertain
No. patients with nausea after 24 h (RR)	0.97 (0.74 1.27)			1 trial		Little difference
No. patients with vomiting after 24 h (RR)	1.45 (0.81 2.61)			1 trial		Difference not significant
No. patients with nausea overall (RR)	0.94 (0.79 1.13)			1 trial		Little difference
No. patients with vomiting overall (RR)	1.25 (0.79 1.97)			1 trial		Little difference
No. dissatisfied patients (RR)	0.83 (0.19 3.69)			1 trial		Wide confidence interval => results uncertain

Type of fluid or solid: early fluids vs. late fluids

Comments Single study (Martinez Claret and Sanchez Coll, 2001). Mixed anaesthesia.

Number of comparisons 1 **Number of patients** 80

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Postoperative vomiting - descriptive				1 trial		No significant difference for patients having general anaesthesia
No. patients with vomiting overall (RR)	1.50 (0.26 8.50)			1 trial		Wide confidence interval => results uncertain (mixed anaesthesia)

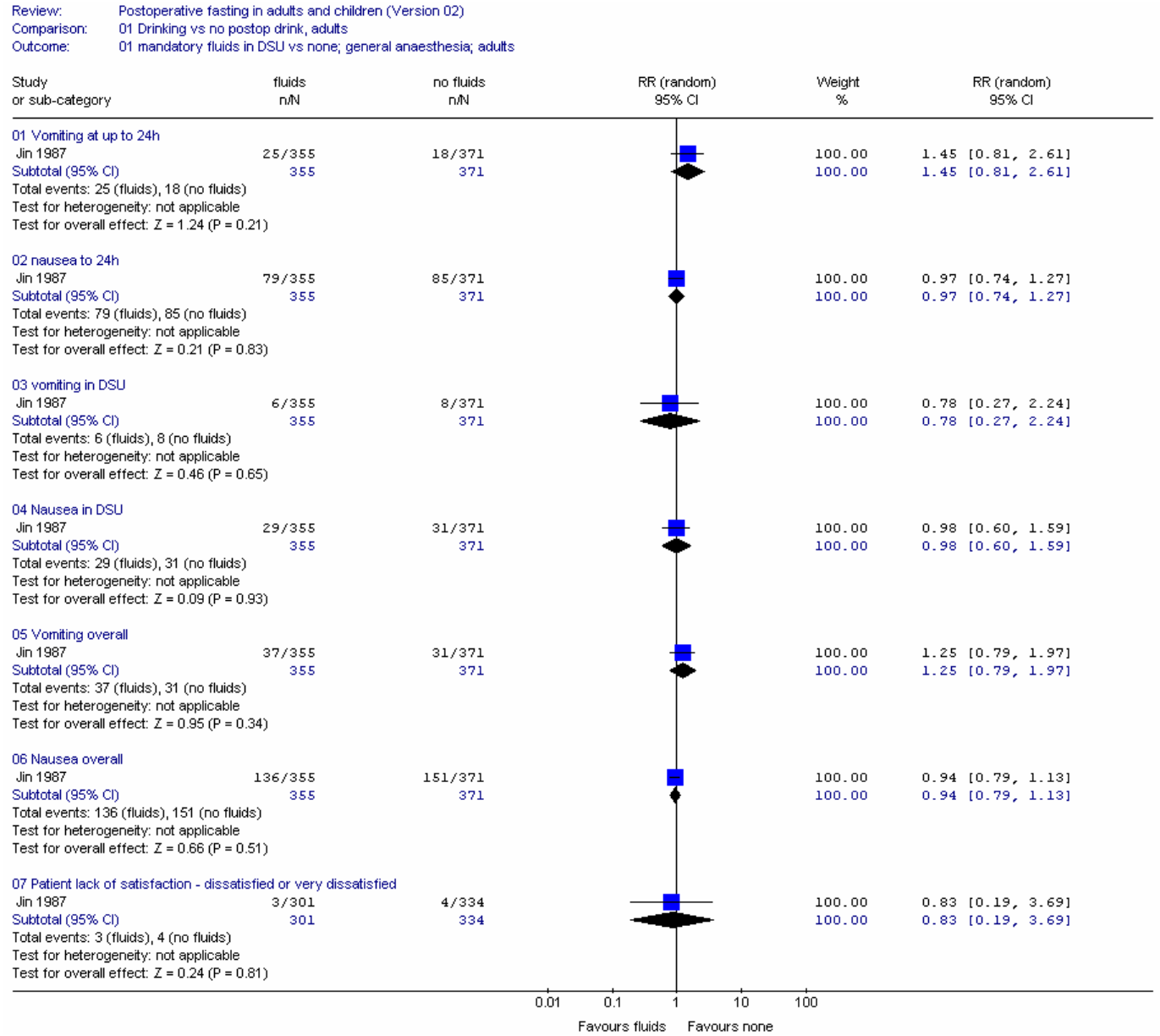
Type of fluid or solid: early fluids (sips) vs. later fluids (sips)

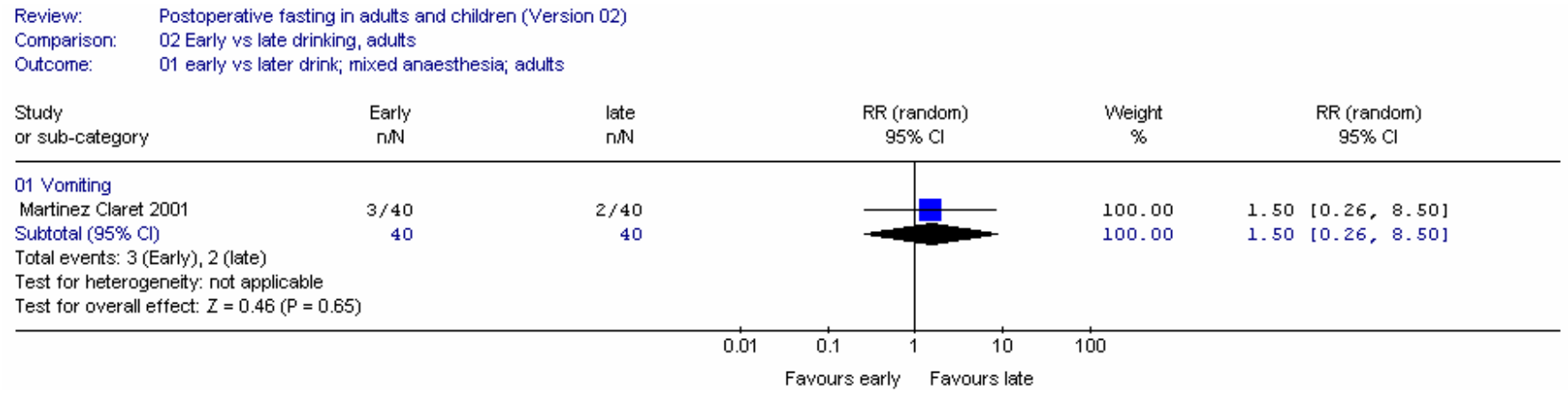
Comments Prospective non-randomised study; infants, children and adults; general anaesthesia

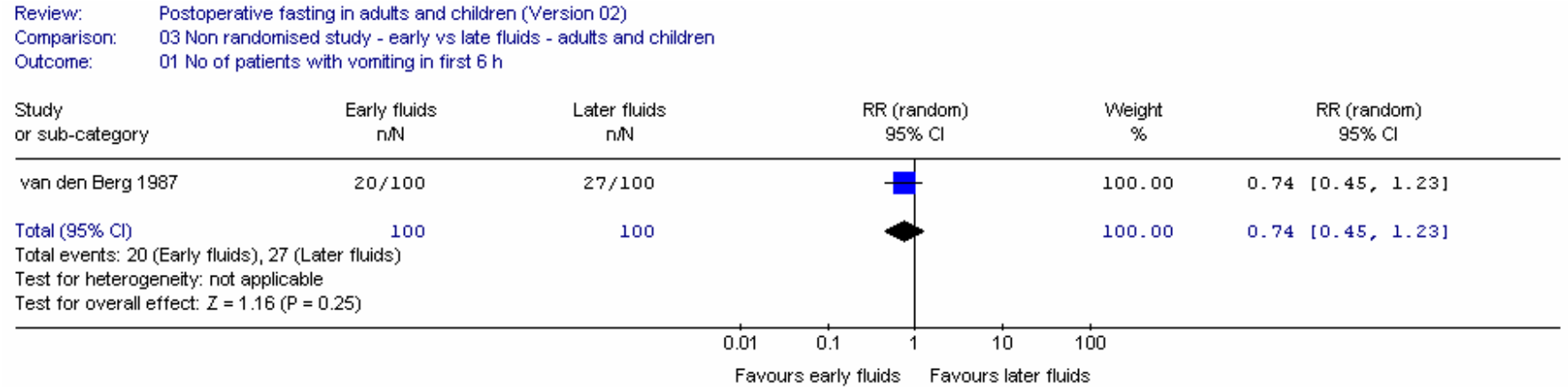
Number of comparisons 1 **Number of patients** 200

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
No. patients with vomiting overall (RR)	0.74 (0.45 1.23)			1 trial		Favours early fluids, not significantly

Adult postoperative studies by comparison




Review: Postoperative fasting in adults and children (Version 02)
Comparison: 02 Early vs late drinking, adults
Outcome: 01 early vs later drink; mixed anaesthesia; adults
Study or sub-category
Early n/N
late n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 Vomiting
Martinez Claret 2001 3/40 2/40 100.00 1.50 [0.26, 8.50]
Subtotal (95% CI) 40 40 100.00 1.50 [0.26, 8.50]
Total events: 3 (Early), 2 (late)
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.46 (P = 0.65)
0.01
0.1
1
10
100
Favours early
Favours late


Review: Postoperative fasting in adults and children (Version 02)
Comparison: 03 Non randomised study - early vs late fluids - adults and children
Outcome: 01 No of patients with vomiting in first 6 h
Study or sub-category
Early fluids n/N
Later fluids n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
van den Berg 1987 20/100 27/100 100.00 0.74 [0.45, 1.23]
Total (95% CI) 100 100 100.00 0.74 [0.45, 1.23]
Total events: 20 (Early fluids), 27 (Later fluids)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.16 (P = 0.25)
0.01
0.1
1
10
100
Favours early fluids
Favours later fluids

Appendix B1: Included studies – preoperative fasting in paediatric patients

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Aun and Panesar, 1990	20	I-II	Herniotomy, repair of hydrocele, circumcision. Exclusions: ASA III and above, difficult venous access, lack of parental consent.	1. Dextrose solution (5%); 10 ml/kg; ~ 4 h preoperatively (n=10); mean fast duration not stated. 2. Standard fast (milk feed to midnight then NPO) (n=10).		3 y (1 to 5)	y	Premedication: trimeprazine (plus morphine & atropine 1h preoperatively. No pH values reported.
Cook Sather et al., 2003 (infants)	97	I-II	Cleft lip and palate repair, hernia/hydrocele surgery, circumcision. Exclusions: wholly breast-fed infants, gastrointestinal disease that impedes emptying/diminishes motility/results in reflux.	1. Clear fluids (no formula at < 8 h); unlimited amount; 2 h preoperatively (n=36). 2. Standard fast (formula milk 4 to 6 h preoperatively; no solids or cows' milk to 8 h) unlimited amount (n=31).		6 (0 to 9) months at recruit-ment	y	Premedication – atropine. Mean fast duration; 3.8 h (SD 0.8); range 2 to16 h.
Crawford et al., 1990	100	I-II	Elective surgery. Exclusions: gastrointestinal disease, obese (>20% ideal body weight), those taking drugs known to affect gastric fluid composition and emptying.	1. Water 2 ml/kg 2 h preoperatively (n=46); range 1.9 to 3.7 h. 2. Water 2 ml/kg 4 h preoperatively (n=26); range 4.1 to 5.7 h. 3. Water 2 ml/kg 6 h preoperatively (n=25); range 6.2 to 9 h.	a: 1 vs. 3 b: 2 vs. 3 c: 1 vs. 2	1 to 14 y	n	Number of patients in each arm not stated – but worked out from IPD graph. Premedication - none.
Fry and Ibrahim 1976	50	'Healthy'	Elective superficial general or orthopaedic surgery. Exclusions not stated.	1. Water with orange extract; under 2 years 125 ml, over 2 years 250 ml; ~2 h preoperatively (n=22). 2. As (1) but 20% maltose added; ~2 h preoperatively (n=28).		Under 8 y	n	Premedication – none. Metoclopramide given. Mean fast duration not stated.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Gombar et al., 1997	50	I-II	Elective surgery (for example, herniotomy, orchiopexy, tonsillectomy, myringoplasty, hypospadias correction, circumcision, cystolithotomy, strabismus repair). Exclusions: active gastrointestinal disease, medication affecting gastric contents or motility.	1. Water 5 ml/kg 3 h preoperatively (n=25). 3. Standard fast (NPO midnight) (n=25).	a: 1 vs. 3	7 y (2 to 12)	n	Premedication - none. IV fluids administered as required. Mean duration of fast: 1) 2.7 h (SD 0.5) range 2.1 to 4.0 h. 3) Not stated.
Goresky et al., 1992	120	I-II	Elective minor surgery. Exclusions: known gastrointestinal disease, those taking medications including premedication (except benzodiazepines).	1. Apple juice 5 ml/kg + placebo at least 2 h preoperatively (n=60). 3. Standard fast + placebo (n=60).	a: 1 vs. 3	1 to 6 y	some	Premedication - only benzodiazepines. Duration of fast – mean of 2.77 h for all groups.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Jensen et al., 1982	88	'Healthy'	Elective minor surgery such as tonsillectomy, adenoidectomy and myringotomy. Exclusions: not stated.	1. Fruit syrup + water, containing invertose 20 g/dl 7.5ml/kg 6h preoperatively (n=42). 2. Standard fast from bedtime (n=46).		6 mo to 9 y	y	Premedication – nicomorphine and atropine. Mean fast duration not stated.
Maekawa et al., 1993	105	I	Elective surgery. Exclusions: metabolic disorders, gastrointestinal disease, obese (> 20% over ideal body weight), taking drugs affecting gastric fluid or emptying.	1. (Clear) apple juice 10 ml/kg 2h preoperatively (n=35) 2. (Clear) apple juice 10 ml/kg 4h preoperatively (n=35) 3. Apple juice then NPO (standard fast) milk/solids 12 h preoperatively (n=35).	a: 1 vs. 3 b: 2 vs. 3 c: 1 vs. 2	4.5 y (1 to 14)	n	Premedication - none. Mean fast duration: 1) 2.1 h (SD 0.3); range 1.5 to 2.5. 2) 4.0 h (SD 0.2); range 3.5 to 4.5.
Meakin et al., 1985 and 1987			See solids (below)					
Miller et al., 1990	44	I-II	Elective surgery. Exclusions: active cardiac, pulmonary, gastrointestinal disease.	1. Dextrose solution (5%); 4 oz = 118 ml (US oz) ~10 ml/kg; 3h preoperatively (n=19). 2. Standard fast (NPO for 10 h) (n=25).		2 y (1 mo to 5 y)	n	Premedication - none. Mean fast duration: 3.0 h (SD 0.4)
Moyao Garcia et al., 2001	40	I	Ophthalmology, otorhino-laryngology, plastic surgery. Exclusions: any medical condition affecting gastric or intestinal motility.	1. Isosmolar solution of electrolytes; 4 ml/kg; 3 h preoperatively (n=20); 2. Standard fast (no solids, milk or formula overnight, for at least 8 h). (n=20).		5.6 y (3 to12)	n	Premedication - none; aspiration by endoscopic technique. Visual inspection for bits in aspirate but results not reported. Mean fast not stated.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Sandhar et al., 1989	44	I-II	ENT, urology or minor general surgical procedures. Exclusions: history of gastrointestinal disorder.	1. Orange juice + placebo (glucose water 0.2 ml/kg) 2 to 3 h preop(n=21). 3. Standard fast + placebo 2 h (n=19).	a: 1 vs. 3	5.5 y (1 to 14)	n	Premedication – none. Mean duration of fast: 1) 2.6 h (SD 0.2) 3) 8.6 h (SD 0.6).
Sarti et al., 1991	62	Not stated	Urological surgery. Exclusions: premedicated patients, prior surgery.	1. Water or apple juice; unlimited amount; up to 2 h (n=32). 2. Standard fast (NPO from midnight). (n=30).		Median 5.2 y (1 to 12)	n	Premedication - none. Said to be ongoing study. Mean fast not stated.
Schreiner et al., 1990	121	I-II	Outpatients (or admitted on day of) elective surgery. Exclusions: medications or disease known to delay gastric emptying or increase acid production.	1. Clear fluids (29 apple juice, 13 water, 10 jelly, lemonade); unlimited fluids mean 8.2+/- 6.5 ml/kg; up to 2h (n=53). 2. Standard fast - depends on age: clear fluids up to 6 h (< 5 y) or up to 8 h (> 5 y); unlimited amount (n=68).		6.6 y (1 to 18)	y most	Premedication - meperidine, diazepam and atropine given to 85% of study patients and 87% of controls. Mean fast duration: 1) 2.6 h (SD 0.7); range 2 to 4 h.
Splinter et al., 1989	80	I-II	Elective surgery. Exclusions: history of gastrointestinal disease, taking medication known to affect gastric contents.	1. (Clear) apple juice; 3 ml/kg; 2.5 h preoperatively (n=40). 2. Standard fast (NPO from midnight) (n=40).		7.5 y (5 to 10)	n	Premedication - none Mean fast duration: 1) 2.6 h (SD 0.4).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Splinter et al., 1990	93	I-II	Elective surgery. Exclusions: history of gastrointestinal disease or medication known to affect gastric contents.	1. Clear apple juice 6 ml/kg 2.5h preop (n=30). 2. apple juice 10 ml/kg 2.5 h preop (n=32). 3. Standard Fast (NPO from midnight) (n=31).	a: 1 vs 3 b: 2 vs 3 c: 1 vs 2	7 y (5 to 10)	ns	Premedication - unclear; bits in aspirate found. Mean fast duration: 1) 2.5 h (SD 0.4) 2) 2.7 h (SD 0.5).
Splinter et al., 1991	152	I-II	Elective surgery. Exclusions: history of gastrointestinal disease, medication affected gastric contents.	1. Clear fluids (apple juice, water, lemonade, jelly); unlimited fluids (mean 260+/-170 ml = 4.8 ml/kg; up to 3 h (n=76). 2. Standard fast (NPO from midnight) (n=76).		15 y (13 to 19)	ns	Premedication unclear; adolescents. Mean duration of fast: 1) 3.6 h (SD 0.8); range 2 to 6; mode 3.5h.
Splinter and Schaefer , 1990 (‘Splinter Schaefer 1a’)	80	'Healthy'	Elective in- and outpatients. Exclusions: history of gastrointestinal disease or medication (including premedications) affecting gastric contents.	1. Clear fluids (clear fruit juice, water, lemonade, Kool aid, jelly); unlimited amount; up to 2.5 h (n=40). 2. Clear fluids to 3 h, unlimited amount (n=40).		6 y (2 to 12) y	n	Premedication - none Mean duration of fast: 1) 2.9 h (SD 0.8) 2) 3.5 h (SD 0.9).
Splinter and Schaefer, 1990 (‘Splinter Schaefer 1b’)	148	'Healthy'	Elective in- and outpatients. Exclusions: history of gastrointestinal disease or medication (including premedications) affecting gastric contents.	1. Clear fluids; unlimited amount; up to 2 h (n=74). 2. Clear fluids up to 3 h, unlimited amount (n=74).		6 y (2 to 12)	n	Premedication - none; second study in report. Mean duration of fast: 1) 2.5 h (SD 0.9) 2) 3.5 h (SD 0.7).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Splinter, Schaefer and Zunder 1990 ('Splinter Schaefer 2')	121	I-II	Elective (mainly ENT). Exclusions: history of gastrointestinal disease or medication known to affect gastric contents.	1. Clear fluids: unlimited amount; up to 3 h (n=57). 2. Standard fast (NPO from midnight) (n=64).		5.7 y (2 to 12)	n	Premedication – none. Mean duration of fast: 1) 3.3 h (SD 0.9) 2) 13.9 (SD 2.5).
Splinter, Schaefer and Bonn 1990 ('Splinter Schaefer 3')	150	I-II	Elective surgery. Exclusions: history of gastrointestinal disease, receiving medication known to affect gastric contents.	1. Clear fluids unlimited amount up to 2h (n=50). Mean 2.2 h (SD 0.7); range 1.0 to 5.0 h. 2. Clear fluids unlimited amount up to 2.5 h (n=50). Mean 2.7 h (SD 0.6); range 1.4 to 4.5 h. 3. Clear fluids unlimited amount up to 3h (n=50). Mean 3.4 h (SD 0.7); range 1.3 to 6.0 h.	a: 1 vs. 3 b: 2 vs. 3 c: 2 vs. 1	0 to 24 mo	ns	Participants allowed bottled milk/formula up to 6 h preop. Breast milk up to 4 h preop. Premedication - not reported; bits in aspirate for 5/36 pts who had formula or cows' milk - groups not stated.
van der Walt and Carter, 1986 (infants)	123	'Healthy'	'Routine' surgery. Exclusions: feeding problems, gastrointestinal disorders; iv fluids.	1. Poly-joule (20%) 10ml/kg 3 to 4 h preoperatively (+normal feed to 6 h) (n=30) 2.Dextrose solution (5%) 10 ml/kg 3 to 4 h preoperatively +normal feed to 6 h (n=29). 3. Cows' milk 10ml/kg 3 to 4 h preop+normal feed to 6h (n=31). 4. Standard fast (normal feed to 4h (n=33).	a: 1 vs. 4 b: 2 vs. 4 c: 3 vs. 4 d: 2 vs. 1 e: 2 vs. 3 f: 1 vs. 3	5 mo (5 d to 12 mo)	n	Premedication – none Mean fast durations: 1) 4.0 h (SD 0.8) range 2.4 to 5.3 h 2) 3.8 h (SD 0.8) range 2.5 to 5.8 h 3) 3.9 h (SD 0.9) range 1.8 to 6.2 h 4) 5.6 h (SD 1.1) range 2.3 to 14.8 h

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – no H_2RAs								
Welborn et al., 1993	200	Not stated.	Hernia repair, circumcision, orchidopexy, eye muscle surgery. Exclusions: not listed.	1. Apple juice; 10 ml/kg; 2 to 4h preoperatively (n=87). 2. Standard fast (clear fluids to 6 h) (n=113).		4 y (1 to 10)	n	Premed – none. Iv fluids – all patients; no solids from 12a.m. Mean duration of fast: 1) 2.9 h, range 1.6 to 4.0 h.
Healthy paediatric patients – studies with H_2RAs								
Goresky et al., 1992 (see also above)	120	I-II	Elective minor surgery. Exclusions: known gastrointestinal disease, those taking medications including premedication (except benzodiazepines).	2. Apple juice 5 ml/kg + ranitidine (2 mg/kg) at least 2 h preop (n=60). 4. Standard fast + ranitidine (n=60).	b: 2 vs. 4	1 to 6 y	Some	Premedication - only benzodiazepines. Duration of fast – mean of 2.77 h for all groups
Sandhar et al., 1989 (see also above)	44	I-II	ENT, urology or minor general surgical procedures. Exclusions: history of gastrointestinal disorder.	2. Orange juice 5 ml/kg + ranitidine (2 ml/kg) 2 to 3 h preop (n=18). 4. Standard fast+ranitidine 2h (n=15).	b: 2 vs. 4	5.5 y (1 to 14)	n	Premedication – none. Mean duration of fast: 2) 2.3 h (SD 0.1) 4) 8.2 h (SD 0.7).
Healthy paediatric patients – studies with versus without H_2RAs								
Gombar et al., 1997 (see also above)	50	I-II	Elective surgery (e.g. herniotomy, orchiopexy, tonsillectomy, myringoplasty, hypospadias correction, circumcision, cystolithotomy, strabismus repair). Exclusions: active gastrointestinal disease, medication affecting gastric contents or motility.	1. Water 5 ml/kg 3 h preoperatively (n=25). 2. Water + ranitidine 5 ml/kg 3 h preoperatively (n=25).	b: 2 vs. 1	7 y (2 to 12)	n	Premedication - none. IV fluids administered as required. Mean duration of fast: 1) 2.7 h (SD 0.5) range 2.1 to 4.0 h 2) 2.60 h (0.6) range 1.9 to 4.0 h

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – studies with versus without H_2RAs								
Goresky et al., 1992 (see also above)	120	I-II	Elective minor surgery. Exclusions: known gastrointestinal disease, those taking medications including premedication (except benzodiazepines).	1. Apple juice 5 ml/kg + placebo at least 2 h preoperatively (n=60). 2. Apple juice 5 ml/kg + ranitidine (2 mg/kg) at least 2 h preop (n=60).	c: 2 vs. 1	1 to 6 y	Some	Premedication - only benzodiazepines. Duration of fast – mean of 2.77 h for all groups
Sandhar et al., 1989 (see also above)	44	I-II	ENT, urology or minor general surgical procedures. Exclusions: history of gastrointestinal disorder.	1. Orange juice + placebo (glucose water 0.2 ml/kg) 2 to 3 h preop(n=21). 2. Orange juice 5 ml/kg + ranitidine (2 ml/kg) 2 to 3 h preop (n=18).	c: 2 vs. 1	5.5 y (1 to 14)	n	Premedication – none. Mean duration of fast: 1) 2.6 h (SD 0.2) 2) 2.3 h (SD 0.1).

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – studies with versus without PPIs								
Mikawa et al., 1995	100	I	Elective surgery (ophthalmological, otological, orthopaedic or urological). Exclusions: GI disease, obese patients, medication known to affect gastric emptying.	All arms had apple juice 10 ml/kg at 5.30am (3 h before induction), plus: 1. Lanzoprazole (30 mg oral) at 9pm + lanzoprazole at 5.30am (n=25). 2. Lanzoprazole (30 mg oral) at 9pm + placebo at 5.30am (n=25). 3. Placebo (30 mg oral) at 9pm + lanzoprazole at 5.30am (n=25). 4. Placebo (30 mg oral) at 9pm + placebo at 5.30am (n=25).	a: 1 vs. 4 b: 2 vs. 4 c: 3 vs. 4	~6.8 y (3 to 11)	n	Premedication – none. Mean duration of fast not stated. Induction of anaesthesia was started at 8.30am in all cases.
Nishina et al., 1994	104	I	Elective surgery. Exclusions: GI disease, obese patients, medication known to affect gastric emptying.	All arms had apple juice 10 ml/kg at 5.30am (3 h before), plus: 1. Omeprazole (20 mg oral) at 9pm + omeprazole at 5.30am (n=25). 2. Omeprazole (30 mg oral) at 9pm + placebo at 5.30am (n=25). 3. Placebo (30 mg oral) at 9pm + omeprazole at 5.30am (n=25). 4. Placebo (30 mg oral) at 9pm + placebo at 5.30am (n=25).	a: 1 vs. 4 b: 2 vs. 4 c: 3 vs. 4	~5.9 y (4 to 9)	n	Premedication – none. Mean duration of fast not stated. Induction of anaesthesia was started at 8.30am in all cases.

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – studies with solid intake (and fluids for Meakin) without H_2RAs								
Kushikata et al., 1996	20	'Healthy'	Elective ENT surgery. Exclusions: not listed.	1. Rice porridge (semi-fluid, about 5.5 h preoperatively) + clear fluids (<200ml, up to 5 h); Porridge was 55 g rice + 245 ml water (1:1)+ some salt (n=10). 2. Clear fluids up to 5 h, < 200 ml (n=10). Mean fast not stated.		7.5 y (5 to 12)	y	Premedication (0.3 mg/kg of diazepam syrup 1.5 h preoperatively). iv fluids. Porridge is like a thick soup. No solids particles observed in either group. All produced aspirate.
Meakin et al., 1985	116	I-II	Tonsillectomy or body wall surgery. Exclusions: those with known gastrointestinal disorders, those scheduled for intra-abdominal or major surgery.	1. Orange squash 10ml/kg max 200 ml, 2-4 h preoperatively (n=35). 2. Plain biscuits (x2) + squash to 2 h (n=32). 3. Squash 4-6 h preoperatively (n=15). 4. Biscuits(x2) + squash to 4 h (n=14). 5. Standard fast = NPO for at least 6h (mean 7h) (n=20).	a: 1 vs. 5 b: 2 vs. 5 c: 2 vs. 1 d: 4 vs. 3 e: 3 vs. 5 f: 4 vs. 5 g: 2 vs. 4 h: 1 vs. 3	7 y (1 to 16)	n	Premedication – none Mean fast duration: 1) 3.0 h (range 2.1 to 3.8) 2) 3.1 h (range 2.1 to 3.9) 3) 5.0 h (range 4.1 to 5.9) 4) 5.1 h (range 4.4 to 5.8)

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Healthy paediatric patients – sweets (lollipops)								
Stanley et al., 1989	64	I-II	Elective orthopaedic, ophthalmologic, otolaryngologic or urologic outpatients. No exclusions stated.	1. Candy lollipop approximately 0.5 to 1 h preoperatively (n=19). 2.Candy lollipop with fentanyl citrate (15 to 20 µg/kg) approx 0.5 to 1 h preoperatively (n=18). 3. No intervention (n=18).	a: 1 vs. 3 b: 2 vs. 3 c: 2 vs. 1	5 to 12 y	n	30 to 60 min before operation child was given a lollipop and asked to suck rapidly without biting/chewing. Significant difference in time to consume lollipops 1) and 2).
Higher-risk group								
Nicolson et al., 1992	100	II-IV	Cardiac surgery. Exclusions: history of gastrointestinal disease, taking medication known to affect gastric contents	1. Clear fluids; unlimited amount; up to 2 h, and required to drink within 2-3h of induction; mean fast duration 2.5 h, SD 0.5 (n=47). 2. Standard fast - depends on age (no solids/non-clear liquids after 8 pm) (n=44).		3 y (< 6 mo to > 5 y)	y	Standard fast = after 12 a.m. Clear fluids [unlimited] up to 4 h (< 6 months), 6 h (6mo-5 y), 8 h (> 5 y). Premed given at 1.5 h: < 6 mo = atropine, 6-12 mo = atropine + pentobarbital, > 1 y = meperidine.

Appendix B2: Excluded studies – paediatric review

Study	Reason for exclusion	Study	Reason for exclusion
Bevan and Burn, 1973a	Not said to be randomised.	Nilsson et al., 1984	Comparison of intra-operative infusions.
Bevan and Burn, 1973b	Not said to be randomised; not measuring gastric content or aspiration.	O'Flynn and Milford, 1989	Observational study.
Ghaffar et all., 2002	Not randomised; sedation.	Sandström et al., 1993	Not randomised; not gastric content or aspiration.
Graham, 1979	Observational study.	Schneider and Nahrwold, 1982	Observational study; plasma glucose measurements only.
Ingebo et al., 1997	Sedation.	Shigemi et al., 2000	Comparison of anaesthetics; all patients had a lollipop.
Morrice et al., 1974	Milk versus standard fast, but gastric contents and aspiration not measured, only plasma glucose level.	Higher-risk patients	
Niiya et al., 1999	Not said to be randomised.	Schwartz et al., 1998	Observational study in paediatric patients with gastrointestinal disorders; all patients were fasted.

Appendix B3: Included studies, milk

Study	Number of patients	ASA group	Operation type	Interventions	Key	Age mean (range)	Pre-med	Study comments
Litman et al., 1994	77	I-II	Elective surgery. Exclusions: history of gastroesophageal reflux or gastrointestinal disorders or taking medications that affect gastric motility or pH.	1. Clear fluids; 2 to 8 oz; as close as possible to 2 h preoperatively; mean 2.2 h (SD 0.4) (n=46). 2. Breast milk, usual feed amount, as close as possible to 2 h preoperatively and up to 1.5 h; mean 2.3 h (SD 0.5) (n=24).		0.3 - 0.4 y (SDs 0.1)	y	All patients allowed solids/milk up to 6 h; atropine premedication 30 to 60 min preoperatively; study was discontinued because of high gastric volumes in the breast milk group.
Sethi et al., 1999	60	I	Operation not carried out, but patients in hospital for routine surgical procedures. Exclusions: gastrointestinal disease and medication affecting motility or composition.	1. Glucose (35 g / 200 ml) 10 ml/kg; max 100 ml; gastric contents measured at mean 1.53 h, SD 0.25, range 1.00-1.75 h. 2. Low fat milk (3% fat) max 100 ml; measured at mean 2.32 h, SD 0.31, range 1.75-2.75 h (n=15). 3. Standard fast (12 h) (n=15). 4. Breast feeding unlimited amount; measured at mean 2.43 h, SD 0.27, range 2.00-2.75 h (n=15). Groups 1 and 2 randomised, others not.	a: 1 vs. 2 b: 2 vs. 3	2 months to 5 years. Patients mainly older than one year, except group 4.		Not undergoing an operation (but expecting one later). Gastric contents sampled after gastric antral area returned to baseline values - so different fasting times. Volume in ml/kg calculated using the mean weight.
Thomas, 1974	62	Not stated	Correction of strabismus. Exclusions: none stated.	1. Milk, 10 ml/kg max 300 ml 4 h preoperatively (n=33). 2. Standard fast (8-10 h) (n=29).		19 to 166 months (1.6 to 13.8 y)	y	Morphine and atropine 1h preoperatively. Mean duration not stated.
van der Walt et al., 1990	62	Not stated	Routine surgery. Exclusions: feeding disorders, gastrointestinal abnormalities.	1. Breast milk; unlimited amount; 3 to 4 h preoperatively (n=30). 2. Formula milk to 3 h. unlimited amount (n=32).		2 months (1 to 3)	n	No infant received iv fluids before surgery; no premedication. Mean fast duration: 1) 4.4 h (SD 1.2), range 2.7 to 6 h 2) 4.7 h (SD 0.9), range 2.7 to 6 h

Appendix B4: Quality of included studies, paediatric patients, preoperative

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Aun and Panesar, 1990	Adequate (drawing lots; unpublished data).	Adequate (drawing lots by person independent of trial; unpublished data).	Yes (unpublished data).	Yes, but missing aspirate.		Not stated.	Yes	Comparable for age and weight.	Yes calculated	Small study (n=20); no gastric aspirate for 4/20 [1/10 (10%) glucose, 3/10 (30%) fasted].
Cook Sather et al., 2003 (infants)	Adequate (computer generated sequence).	Partial (allocated by coded envelope).	Yes	No (>20% dropouts)	Protocol deviation 22/58 (38%) from group 1 and 8/39 (21%) from group 2.	Yes	Yes	Age, weight, gender, feed volume.	No	Much missing aspirate: 64% group 1, 55% group 2 (=> limited pH information).
Crawford et al., 1990	Adequate (random numbers table).	Unclear	Yes	No (≤ 20% dropouts)	Unclear	No	Yes, but limited data.	Only age noted.	No	Number of patients in each arm not stated – but worked out from IPD graph.
Fry and Ibrahim, 1976	Adequate (random numbers table).	Unclear	Unclear	Yes		Not stated.	Yes, but limited data.	Only operation time.	No	
Gombar et al., 1997	Adequate (computer generated random numbers).	Unclear	Unclear: thirst/ behaviour assessor blinded.	Yes		No	Yes	Age, gender, weight, time between premed and aspiration.	No	1/25 patients in water group had no aspirate.

Quality of included studies, paediatric patients, preoperative

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Goresky et al., 1992	Unclear	Unclear	Yes	No (≤ 20% dropouts).	41/240 (17%) excluded from analysis (not different across the four groups), some because of no aspirate.	Not stated.	Yes	Comparable for age, gender, weight and height.	No	Three participating centres; volume calculated from IPD graph; pH reported in article.
Jensen et al., 1982	Unclear	Unclear	Unclear	Yes		Not stated.	Yes	Age and weight.	No	
Kushikata et al., 1996	Inadequate (alternate cases unpublished data).	Inadequate (alternate cases; unpublished data).	Unclear	Yes		No	Yes	Age, gender, weight, height.	No	IPD given
Maekawa et al., 1993	Unclear	Unclear	Yes	Yes, but missing aspirate.		Not stated.	Yes	Age and weight.	No	Overall, 28/105 samples of aspirate were too small to measure pH (8/35 (23%) intervention group, 10/35 (29%) control)
Meakin et al., 1985	Inadequate (by operating list; unpublished data).	Inadequate	Yes (pH and food particle evaluation adequate, volume inadequate).	Yes, but missing aspirate.		Not stated.	Yes, but limited data.	Age and weight.	Yes calculated.	Some patients had no aspirate (4/34 (12%) 2h fluids group, 3/32 (9%) 2h solids, 16/55 (29%) in 6h control + both 4h groups). pH values calculated from median and range

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Miller et al., 1990	Adequate (table of random numbers).	Unclear	Yes	Yes, but missing aspirate.		Not stated.	Yes	Age and weight comparable.	No	Insufficient gastric aspirate for 23/44 participants (9/19 (47%) at 3h and 13/25 (52%) for standard fast). Volume calculated assuming v=0 for these patients.
Sandhar et al., 1989	Adequate (table of random numbers).	Unclear	Unclear	No (>20% dropouts).	15/88 (17%) excluded initially, then further 8/21(38%) had protocol violations in orange group.	Not stated.	Yes	Age and weight comparable.	Yes calculated.	No gastric aspirate for 1/13 (8%) orange juice, 3/18 (17%) for OJ + ranitidine, 2/19 (11%) control and 1/15 (7%) ranitidine control. pH values for extra seven patients not reported.
Sarti et al., 1991	Unclear.	Unclear	Unclear	Yes		Not stated.	Not stated.		No	
Schreiner et al., 1990	Adequate (shuffled envelopes; unpublished data).	Partial (opaque sealed envelopes; unpublished).	Yes	No (≤ 20% dropouts)	6/121 (5%) not analysed.	Not stated.	Yes	Age, gender, weight all comparable.	No	No gastric aspirate for 13/48 (27%) study group and 19/67 (28%) control.
Splinter et al., 1989	Adequate (random numbers table)	Unclear	Yes	Yes	Three children (< 5y) unable to answer some questions.	Not stated.	Yes	Age, gender, ASA status, weight all comparable.	No	

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
Splinter et al., 1990	Adequate (random numbers table; unpublished data).	Unclear	Yes	Yes	Two children (5 years) were unable to answer some questions.	Yes	Yes mainly.	Age, gender, ASA status all comparable; weight of group 2 significantly less than other groups.	No	
Splinter et al., 1991	Adequate (random numbers table; unpublished data).	Unclear	Yes	Yes		Yes	Yes	Age, gender, weight, ASA status, inpatient/out patient status – all comparable.	No	
Splinter-Shaefer 1990_1a	Adequate (random numbers table; unpublished data)	Unclear	Yes	Yes		Yes	Yes	Age, gender, ASA status, weight.	No	
Splinter-Shaefer 1990_1b	Adequate (random numbers table; unpublished data).	Unclear	Yes	Yes		Yes	Yes	Age, gender, ASA status, weight.	No	
Splinter-Shaefer 1990_2	Adequate (random numbers table; unpublished data).	Unclear	Yes	Yes		Yes	Yes	Age, gender, weight, ASA status – all comparable.	No	
Splinter-Shaefer 1990_3	Unclear	Unclear	Yes	Yes		Yes	Yes	Age, gender, ASA status, weight, inpatient/outpatient status, milk ingestion - all comparable.	No	

Study	Generation code	Concealment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Pseudo-values	Overall comments
van der Walt and Carter, 1986 (infants)	Adequate (random numbers table; unpublished data).	Unclear	Yes, unpublished data.	Yes, but missing aspirate.		Not stated.	Yes	Assumed comparable for age and weight.	Yes calculated.	Missing aspirate: 14/29 (48%) dextrose, 17/31 (55%) milk, 13/30 (43%) polyjoule, 20/33 (61%) control).
Welborn et al., 1993	Inadequate (assignment based on day of week).	Inadequate (assignment based on day of week).	Unclear	Yes, but missing aspirate.		Not stated.	Yes	Age, weight, duration of surgery, blood glucose concentrations - all comparable.	Yes calculated.	Gastric aspirate not available for 46/87 (47%) intervention group and 70/113 (62%) control. Volume calculated for rest.
Higher-risk group										
Nicolson et al., 1992	Unclear	Partial (sealed envelopes).	Yes (unpublished data).	No (≤ 20% dropouts)	6/50 (12%) study group and 3/50 (6%) excluded from analysis	Yes	Yes	Age, gender, weight, ASA status, type of procedure all comparable.	No	Insufficient aspirate in 22/44 (50%) study group, 27/47 (57%) control group.
Sweets (lollipops)										
Stanley et al., 1989	Unclear	Unclear	Unclear (recovery room nurses blinded, unclear about gastric content outcomes).	No (≤ 20% dropouts).	9/64 (14%) not evaluated because of protocol deviations.	Not stated.	Yes	Age, weight, height, gender, surgical procedure all comparable; time to consume premed lolly significantly longer than placebo lolly.	No	Two patients had no aspirate in group 3 because of technical difficulties. 3/18 (group 3) and 3/18 (group 2) had insufficient aspirate for pH measurement.

Appendix B5: Quality of included studies: milk

Study	Prospective	All eligible selected	Outcome blinding	ITT code	ITT details	Baseline OK?	Baseline comments	Overall comments
Litman et al., 1994	Yes	Yes	Yes	No (≤ 20% dropouts).	7/53 excluded from clear fluids group (protocol deviations).	Yes	Age, gender, weight and duration of fast all comparable.	Insufficient aspirate in 36/46 (78%) clear fluids and 16/24 (67%) breast milk group.
Sethi et al., 1999	Yes	Yes	Unclear (gastric antral area measurements blinded).	Yes, but missing aspirate.	Gastric aspirate missing only in glucose group (53%).	No	Breast fed patients were significantly younger (0.81 versus 2.43 - 3.20 y) and weighed less. Otherwise groups comparable.	Random sample of patients. Two groups randomised, two not – no details about randomisation or allocation concealment.
Thomas, 1974	Yes	Unclear	Unclear	Yes		Yes	Age, weight comparable.	
van der Walt et al., 1990	Yes	Unclear	Unclear	Yes, but missing aspirate.		No	Group given formula milk significantly older (72 versus 48 days) and heavier than breast fed infants	27/30 (90%) in the breast milk group and 24/32 (75%) in the formula milk group had insufficient aspirate.

Appendix B6: Studies in children, by duration

Shortened fast versus standard fast – duration sub-groups

Primary outcomes

Duration: up to 2h

Number of comparisons 5 **Number of patients** 417

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.00 (-0.08 0.08)	2.54	4	0.64	0	Very little difference
Gastric pH (WMD)	0.03 (-0.13 0.18)	0.37	4	0.98	0	Little difference, highly homogeneous

Duration: up to 2.5h

Number of comparisons 3 **Number of patients** 173

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.07 (-0.25 0.39)	8.92	2	0.01	78	Heterogeneous
Gastric pH (WMD)	0.19 (-0.11 0.49)	3.36	2	0.19	41	Little difference

Duration: up to 3h

Number of comparisons 5 **Number of patients** 407

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.08 (-0.17 0.01)	7.94	4	0.09	50	Heterogeneous; without Moyao Garcia WMD -0.05 (95%CI -0.11, 0.02) p(heterogeneity)=0.93; I^2=0%
Gastric pH (WMD)	0.43 (-0.07 0.92)	53.13	4	<0.00001	93	Highly heterogeneous; without Moyao Garcia WMD 0.16 (95%CI 0.02, 0.30) p(heterogeneity)=0.85, I^2=0%; i.e. statistically significantly in favour of shortened fast

Duration: up to 4h

Number of comparisons 3 **Number of patients** 141

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.03 (-0.10 0.16)	1.32	2	0.52	0	Little difference
Gastric pH (WMD)	0.00 (-0.25 0.26)	0.10	1	0.75	0	Very little difference

Secondary outcomes

Duration: up to 2h

Number of comparisons 1 **Number of patients** 121

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Irritability (parent rated) - VAS	-2.10 (-2.95 -1.25)			1 trial		Single study (Schreiner, n=121), statistically significantly less irritability for shorter fast; mean -2.1, VAS (0-10)
All secondary						No further information

Duration: up to 2.5h

Number of comparisons 3 **Number of patients** 173

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst (parent rated) - VAS (WMD)	-1.40 (-2.45 -0.35)			1 trial		Single study (Splinter 1989, n=80); statistically significantly less thirst for shortened fast; mean -1.4; VAS 1-10cm
Thirst (child-rated) - VAS (WMD)	-0.85 (-2.06 0.36)	0.77	2	0.68	0	Wide confidence interval => results uncertain
Hunger (parent rated) - VAS	-1.30 (-2.57 -0.03)			1 trial		Single study (Splinter 1989, n=80); statistically significantly less hunger for shortened fast; mean -1.30; VAS 1-10cm
Hunger (child-rated) - VAS	-1.58 (-2.56 -0.60)	0.30	2	0.86	0	Statistically significantly less hunger for shortened fast; mean -1.58; VAS 1-10cm
Irritability (parent rated) - VAS	-1.31(-2.67 0.06)	0.18	1	0.67	0	Two comparisons in one study (Splinter 1990); wide confidence interval => uncertain results; VAS 1-10cm

Duration: up to 3h

Comments

Number of comparisons 2 **Number of patients** 205

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst (parent rated) - VAS (WMD)	-2.64 (-3.64 -1.64)			1 trial		Single study (Gombar, n=50); statistically significantly less thirst for shortened fast; mean -2.64; VAS 0-10cm
Thirst - descriptive						Single study (Splinter 1991, adolescents, n=152); child-rated VAS thirst, median significantly less thirst vs. standard fast (p<0.05)
Hunger - descriptive						Single study (Splinter 1991, adolescents, n=152); child-rated VAS hunger, median NS
Irritability (parent rated) - VAS	-2.08 (-3.39 -0.77)			1 trial		Single study (Gombar, n=50); statistically significantly less irritability for shortened fast; mean -2.08; VAS 0-10cm

Duration: up to 4h

Comments

Number of comparisons 1 **Number of patients** 20

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Postoperative vomiting in recovery						No vomiting for either group; one small study (Aun and Panesar, 1990, n=20)
All secondary						No evidence

Head-to-head comparisons of different durations

Duration: head-to-head 'up to 2 h' vs. 'up to 2.5 h'

Comments Single trial (Splinter Schaefer 3c).

Number of comparisons 1 **Number of patients** 100

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.06 (-0.05 0.17)			1 trial		Little difference; one study (n=100)
Gastric pH (WMD)	0.10 (-0.41 0.61)			1 trial		Little difference; one study (n=100)

Duration: head-to-head 'up to 2 h' vs. 'up to 3 h'

Comments

Number of comparisons 2 **Number of patients** 248

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.04 (-0.08 0.15)	0.50	1	0.48	0	Little difference
Gastric pH (WMD)	0.12 (-0.36 0.61)	3.09	1	0.08	68	Heterogeneous

Duration: head-to-head 2 to 4 h vs. 4 to 6 h

Comments Additional comparison in quasi-randomised trial (Meakin et al., 1985) not included.

Number of comparisons 2 **Number of patients** 120

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.00 (-0.14 0.14)	0.33	1	0.57	0	Very little difference
Gastric pH (WMD)	-0.01 (-0.29 0.26)	0.41	1	0.52	0	Very little difference

Duration: head-to-head ‘up to 2.5 h’ vs. ‘up to 3 h’

Comments

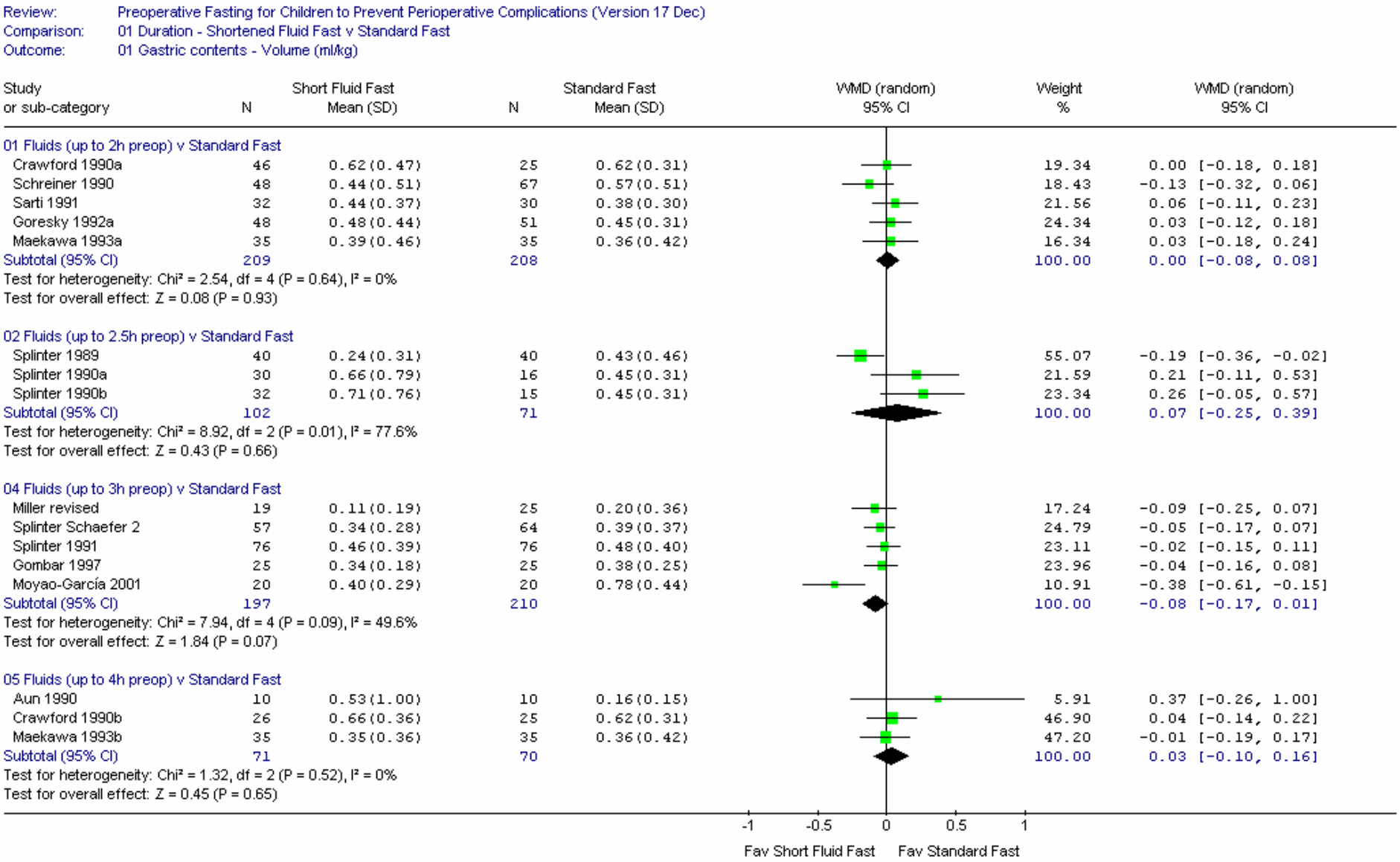
Number of comparisons 2 **Number of patients** 180

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.04 (-0.16 0.09)	0.43	1	0.51	0	Little difference
Gastric pH (WMD)	0.19 (-0.12 0.50)	0.40	1	0.53	0	Little difference

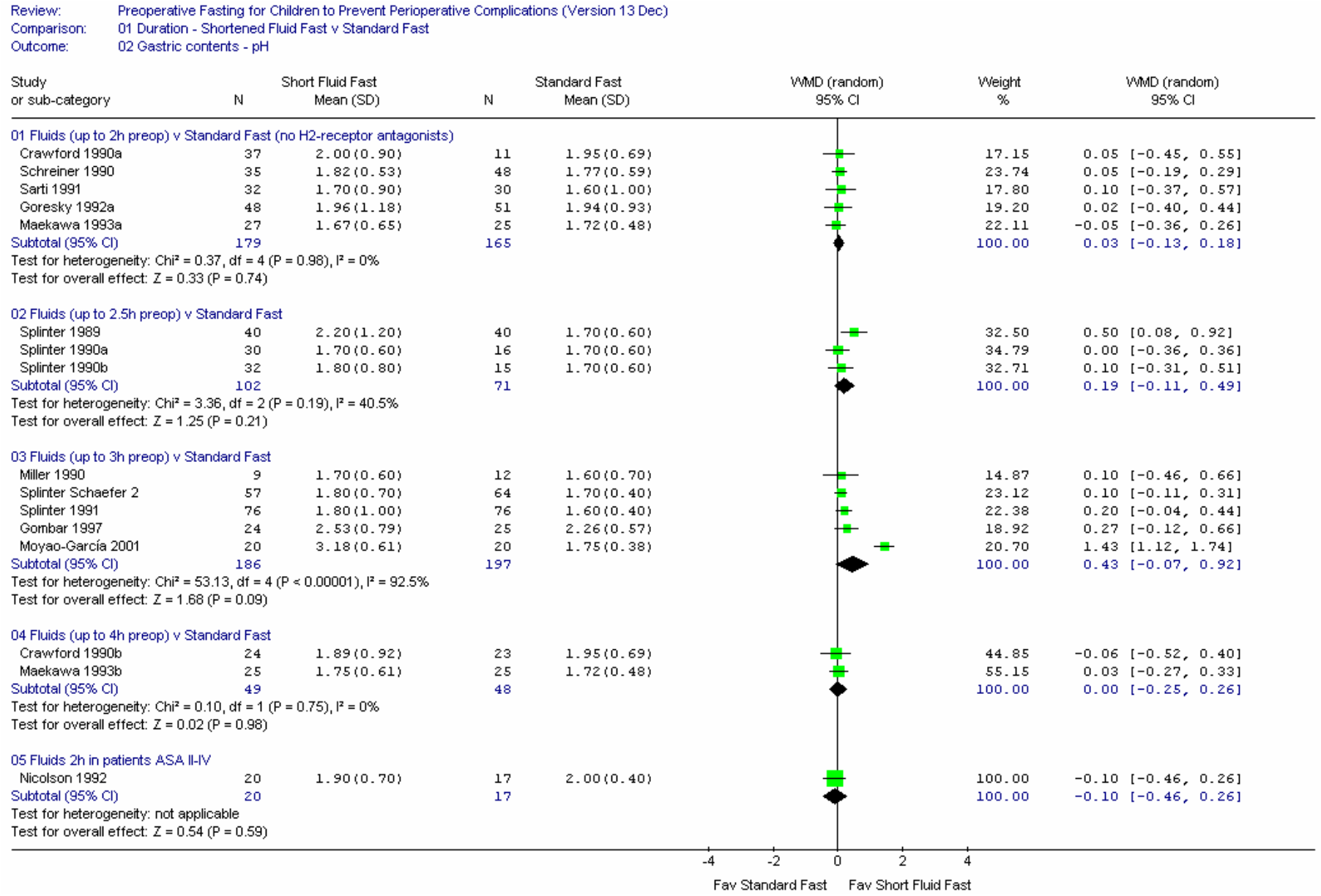
Secondary outcomes

There were no secondary outcomes recorded for these comparisons.

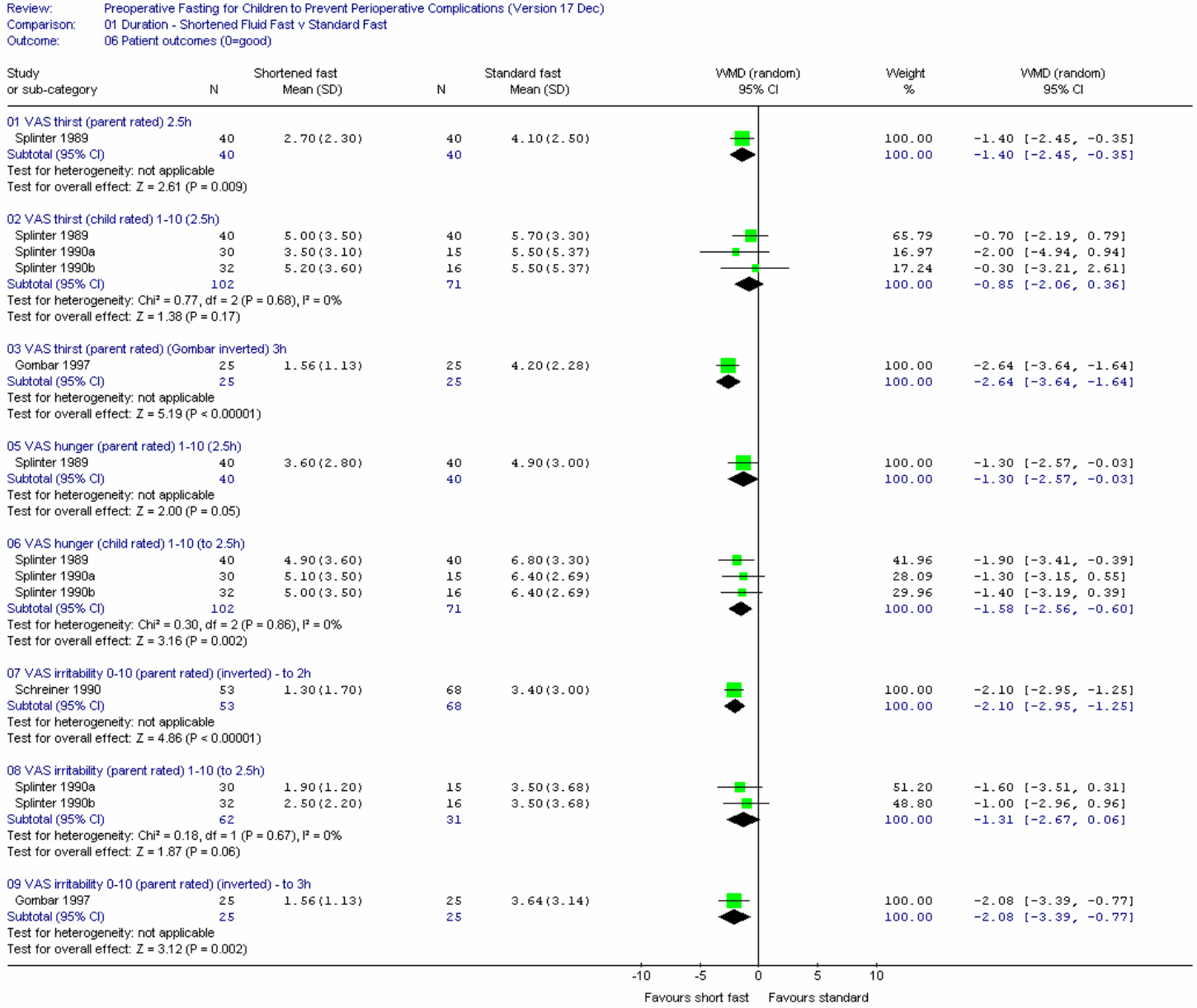
Studies in children, by duration



Studies in children, by duration

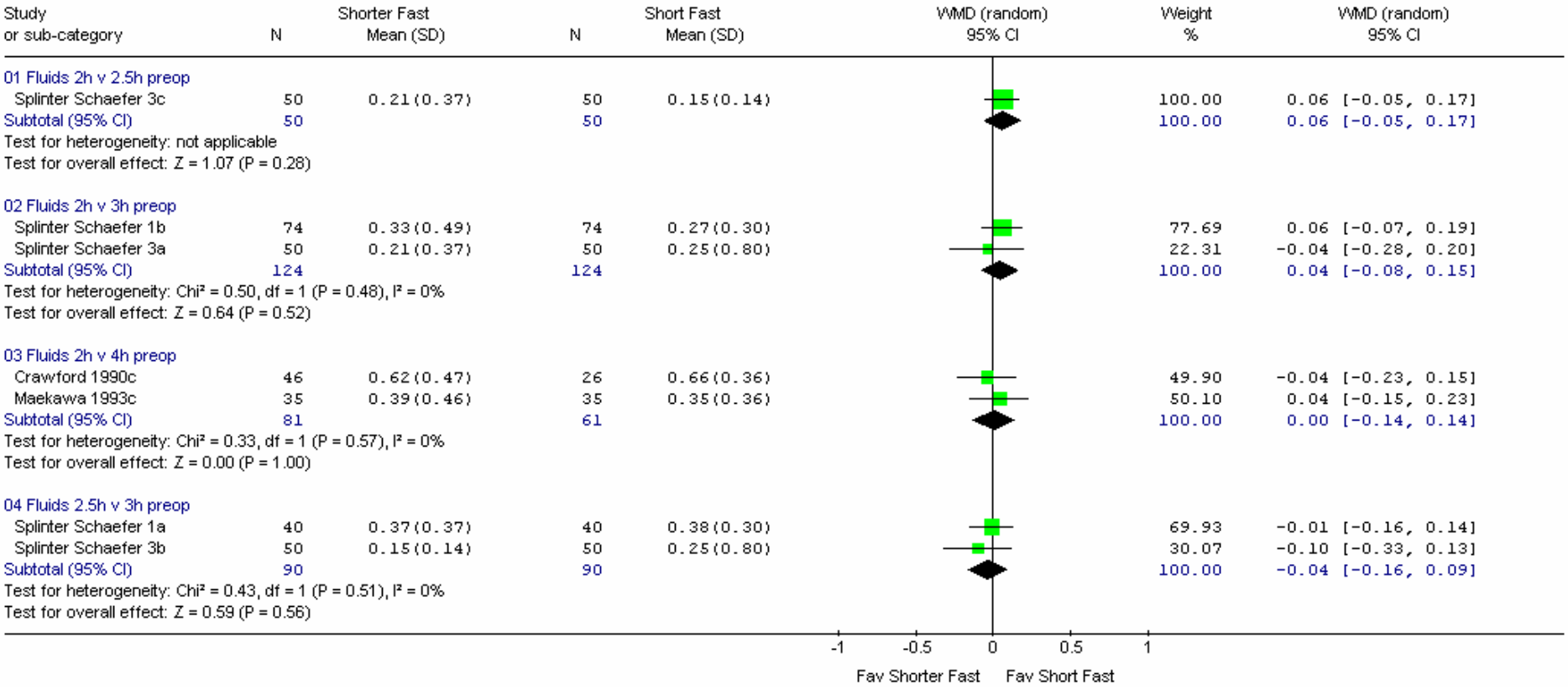


Studies in children, by duration

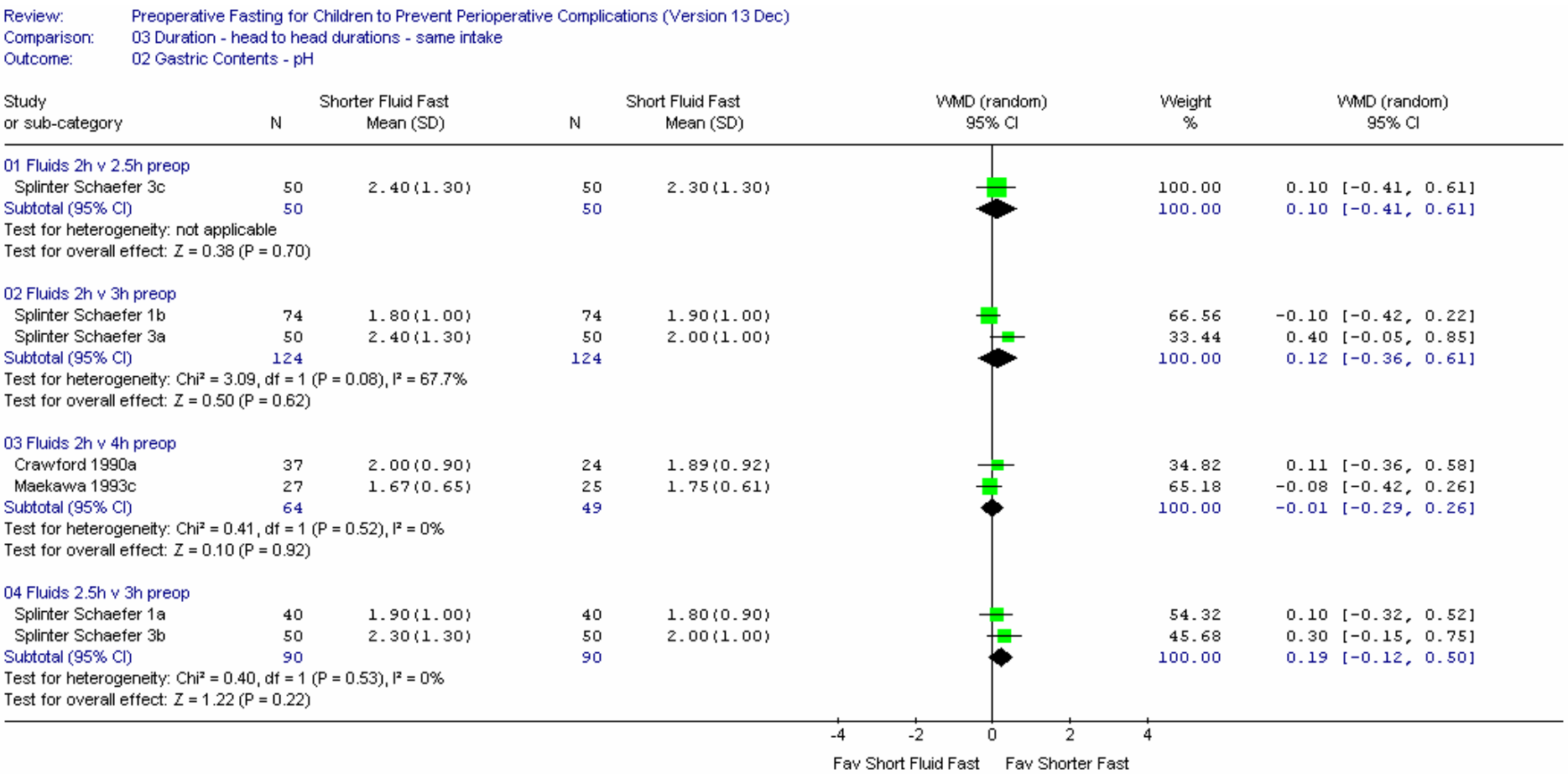


Duration head-to-head

Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 03 Duration - head to head durations - same intake
Outcome: 01 Gastric Contents - Volume (ml/kg)



Studies in children, by duration



Appendix B7: Studies in children, by type

Primary outcomes

Type of fluid or solid: water

Comments Data for two comparisons in Crawford et al., 1990 were extracted from a graph with some assumptions.

Number of comparisons 3 **Number of patients** 147

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.02 (-0.11 0.08)	0.42	2	0.81	0	Little difference
Gastric pH (WMD)	0.13 (-0.14 0.39)	1.08	2	0.58	0	Little difference

Type of fluid or solid: clear fluids

Comments Includes revised value of volume for Miller.

Number of comparisons 13 **Number of patients** 931

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.04 (-0.11 0.04)	22.83	12	0.03	47	Heterogeneous; Without Moyao Garcia WMD -0.02 (95%CI -0.08, 0.04), p(heterogeneity)=0.23, I^2=22%
Gastric pH (WMD)	0.22 (-0.02 0.46)	67.87	11	<0.00001	84	Highly heterogeneous; without Moyao Garcia WMD 0.10 (95%CI 0.01, 0.20), p(heterogeneity)=0.85, I^2=0%, i.e. statistically significantly higher pH for clear fluids

Primary outcomes

Type of fluid or solid: non-clear fluids

Comments Two quasi-randomised comparisons in single study (Meakin et al., 1985); Sandhar et al., 1989 study not included.

Number of comparisons 2 **Number of patients** 70

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.11 (-0.06 0.28)	0.42	1	0.52	0	Slightly favours standard fast, but not significantly
Gastric pH (WMD)	0.05 (-0.28 0.39)	1.38	1	0.24	27	Little difference

Type of fluid or solid: fruit juice

Comments

Number of comparisons 7 **Number of patients** 439

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.02 (-0.08 0.13)	9.71	6	0.14	38	Little difference
Gastric pH (WMD)	0.09 (-0.06 0.24)	4.77	6	0.57	0	Little difference

Secondary outcomes

Type of fluid or solid: water

Comments Single study (Gombar et al., 1997, n=50).

Number of comparisons 1 **Number of patients** 50

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst (parent rated) - VAS (WMD)	-2.64 (-3.64 -1.64)			1trial		Statistically significantly less thirst for shortened fast; mean -2.64; VAS 0-10cm
Irritability (parent rated) - VAS	-2.08 (-3.39 -0.77)			1 trial		Statistically significantly less irritability for shortened fast; mean -2.08; VAS 0-10cm

Type of fluid or solid: non-clear fluids

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
All secondary						No evidence

Type of fluid or solid: clear fluids

Number of comparisons 6 **Number of patients** 466

Outcome	WMD / RR / OR (95%CI)	Chi²	df	p (hetero)	I²	Comments
Thirst (parent rated) - VAS (WMD)	-1.40 (-2.45 -0.35)			1 trial		Single study (Splinter 1989, n=80), statistically significantly less thirst for clear fluids, mean -1.4; VAS 1-10cm
Thirst (child-rated) - VAS (WMD)	-0.85 (-2.06 0.36)	0.77	2	0.68	0	Wide confidence interval => uncertain results
Thirst - descriptive						Single study (Splinter 1991, adolescents, n=152); child-rated VAS thirst, median significantly less thirst vs. standard fast (p<0.05)
Postoperative vomiting – in recovery						No vomiting for either group; 1 small study (Aun and Panesar, 1990, n=20)
Hunger (parent rated) - VAS	-1.30 (-2.57 -0.03)			1 trial		Single study (Splinter 1989, n=80), statistically significantly less hunger for clear fluids, mean -1.3; VAS 1-10cm
Hunger (child-rated) - VAS	-1.58 (-2.56 -0.60)	0.30	2	0.86	0	Statistically significantly less hunger for clear fluids; mean -1.58; VAS 1-10cm
Hunger - descriptive						Single study (Splinter 1991, adolescents, n=152); child-rated VAS hunger, median NS
Irritability (parent rated) - VAS	-0.69 (-0.98 -0.41)	1.71	2	0.42	0	Standardised mean difference, statistically significantly less irritability for clear fluids

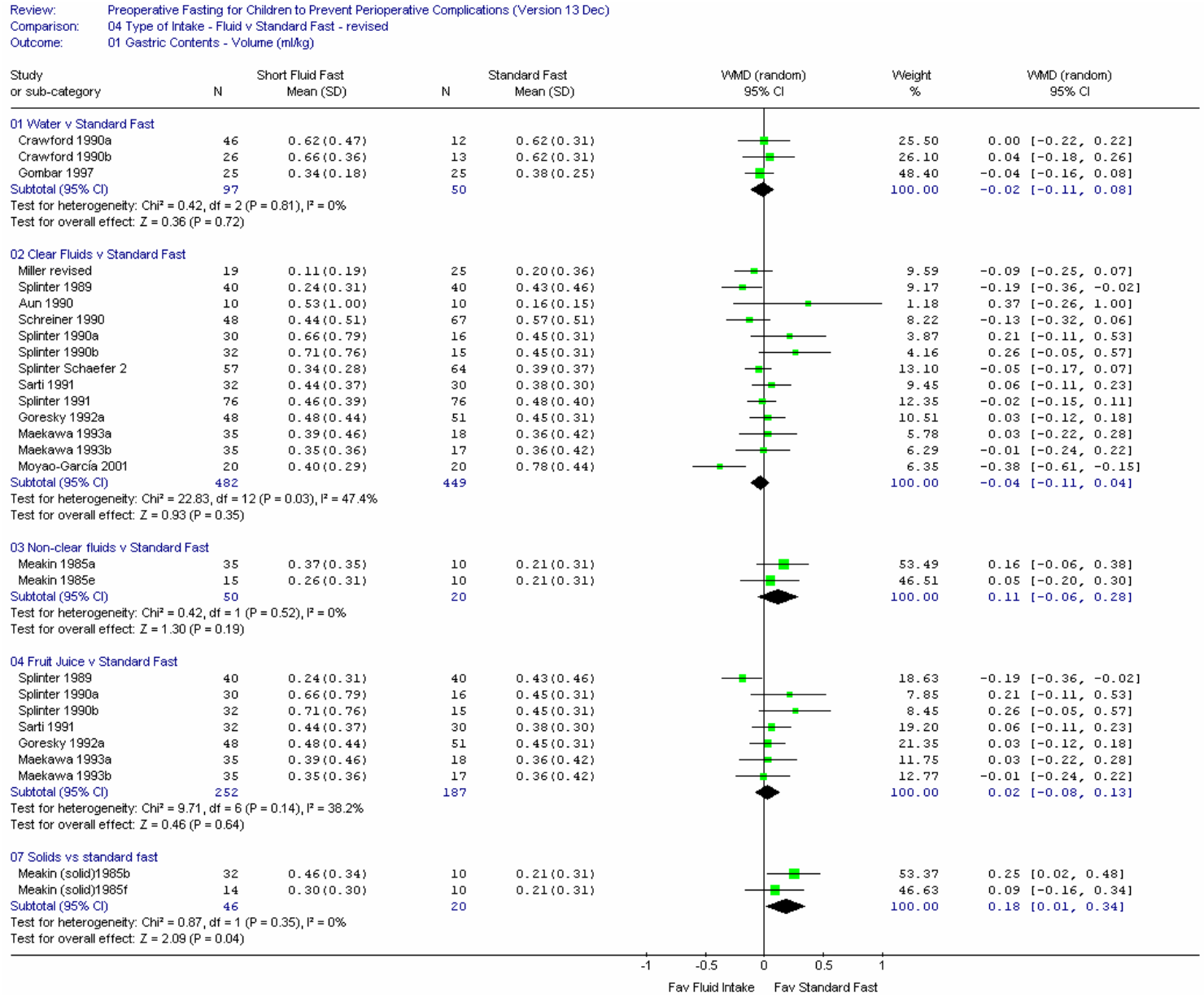
Type of fluid or solid: fruit juice

Comments Splinter et al., 1989, Splinter et al., 1990 (two comparisons).

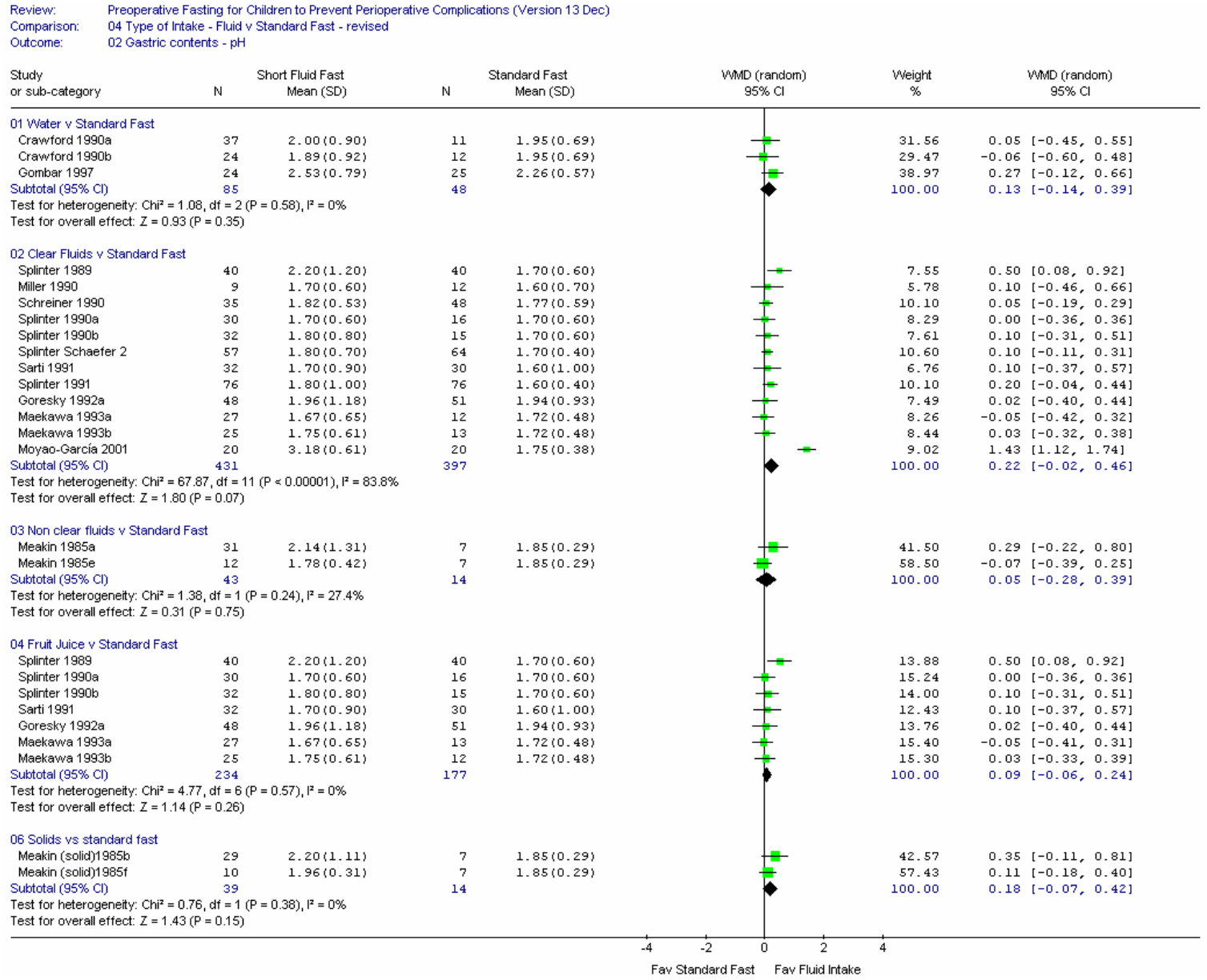
Number of comparisons 3 **Number of patients** 173

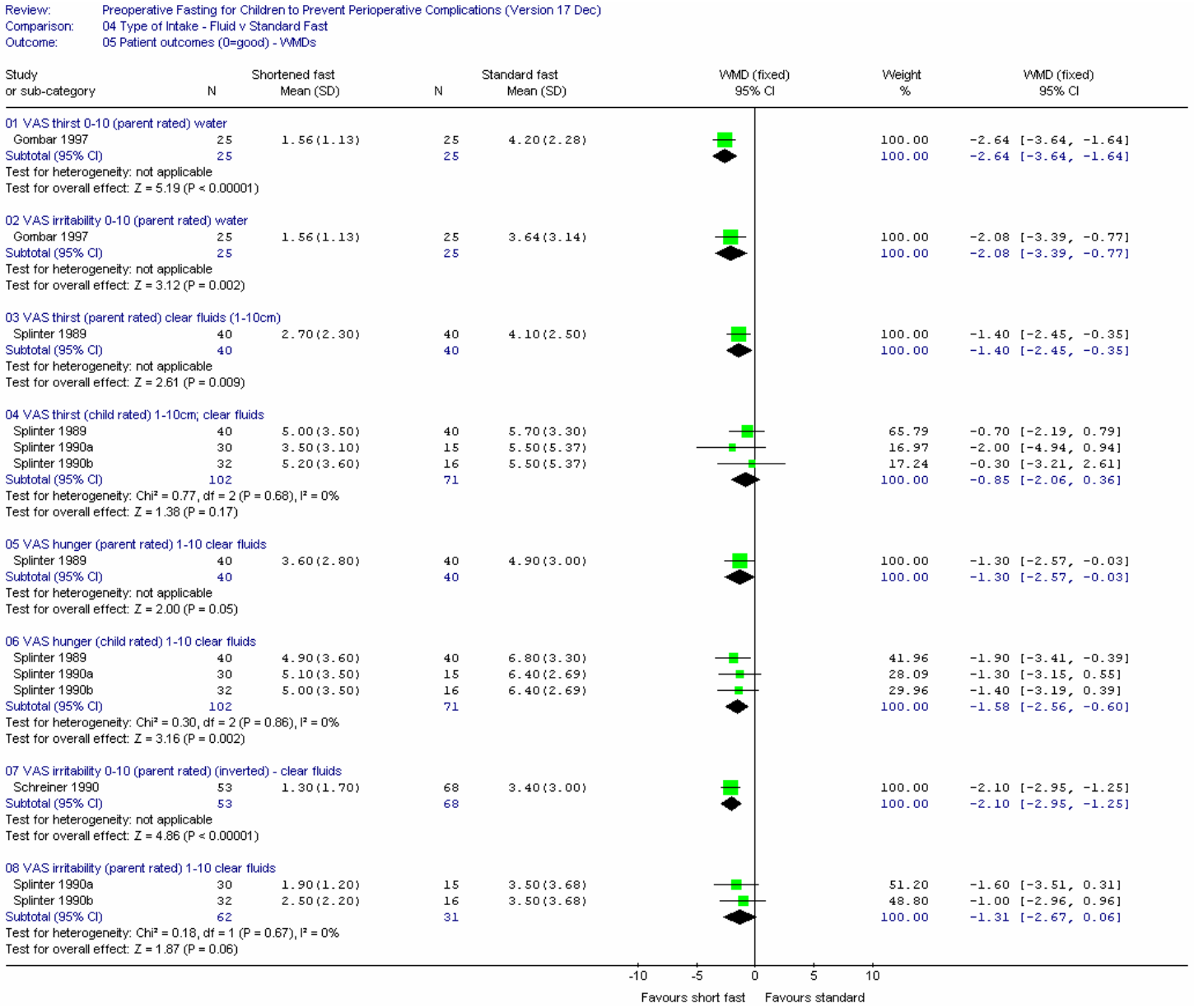
Outcome	WMD / RR / OR (95%CI)	Chi²	df	p (hetero)	I²	Comments
Thirst (parent rated) - VAS (WMD)	-1.40 (-2.45 -0.35)			1 trial		Single study (Splinter 1989, n=80); statistically significantly less thirst for shortened fast; mean -1.4; VAS 1-10cm
Thirst (child-rated) - VAS (WMD)	-0.85 (-2.06 0.36)	0.77	2	0.68	0	Wide confidence interval => uncertain results
Hunger (parent rated) - VAS	-1.30 (-2.57 -0.03)			1 trial		Single study (Splinter 1989, n=80), statistically significantly less hunger for clear fluids, mean -1.3; VAS 1-10cm
Hunger (child-rated) - VAS	-1.58 (-2.56 -0.60)	0.30	2	0.86	0	Statistically significantly less hunger for clear fluids; mean -1.58; VAS 1-10cm
Irritability (parent rated) - VAS	-1.31 (-2.67 0.06)	0.18	1	0.67	0	Two comparisons in one study; wide confidence interval => uncertain results; VAS 1-10cm

Studies in children, by type

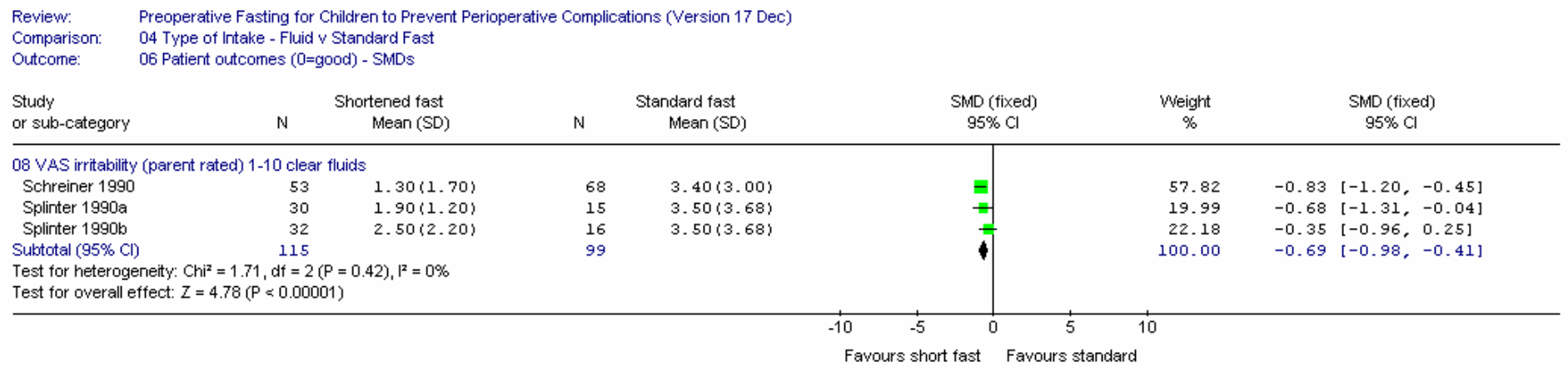


Studies in children, by type




Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 04 Type of Intake - Fluid v Standard Fast
Outcome: 05 Patient outcomes (0=good) - WMDs
Study or sub-category | N | Shortened fast Mean (SD) | N | Standard fast Mean (SD) | WMD (fixed) 95% CI | Weight % | WMD (fixed) 95% CI
01 VAS thirst 0-10 (parent rated) water
Gombar 1997 25 1.56(1.13) 25 4.20(2.28) 100.00 -2.64 [-3.64, -1.64]
Subtotal (95% CI) 25 25 100.00 -2.64 [-3.64, -1.64]
Test for heterogeneity: not applicable
Test for overall effect: Z = 5.19 (P < 0.00001)
02 VAS irritability 0-10 (parent rated) water
Gombar 1997 25 1.56(1.13) 25 3.64(3.14) 100.00 -2.08 [-3.39, -0.77]
Subtotal (95% CI) 25 25 100.00 -2.08 [-3.39, -0.77]
Test for heterogeneity: not applicable
Test for overall effect: Z = 3.12 (P = 0.002)
03 VAS thirst (parent rated) clear fluids (1-10cm)
Splinter 1989 40 2.70(2.30) 40 4.10(2.50) 100.00 -1.40 [-2.45, -0.35]
Subtotal (95% CI) 40 40 100.00 -1.40 [-2.45, -0.35]
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.61 (P = 0.009)
04 VAS thirst (child rated) 1-10cm; clear fluids
Splinter 1989 40 5.00(3.50) 40 5.70(3.30) 65.79 -0.70 [-2.19, 0.79]
Splinter 1990a 30 3.50(3.10) 15 5.50(5.37) 16.97 -2.00 [-4.94, 0.94]
Splinter 1990b 32 5.20(3.60) 16 5.50(5.37) 17.24 -0.30 [-3.21, 2.61]
Subtotal (95% CI) 102 71 100.00 -0.85 [-2.06, 0.36]
Test for heterogeneity: Chi² = 0.77, df = 2 (P = 0.68), I² = 0%
Test for overall effect: Z = 1.38 (P = 0.17)
05 VAS hunger (parent rated) 1-10 clear fluids
Splinter 1989 40 3.60(2.80) 40 4.90(3.00) 100.00 -1.30 [-2.57, -0.03]
Subtotal (95% CI) 40 40 100.00 -1.30 [-2.57, -0.03]
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.00 (P = 0.05)
06 VAS hunger (child rated) 1-10 clear fluids
Splinter 1989 40 4.90(3.60) 40 6.80(3.30) 41.96 -1.90 [-3.41, -0.39]
Splinter 1990a 30 5.10(3.50) 15 6.40(2.69) 28.09 -1.30 [-3.15, 0.55]
Splinter 1990b 32 5.00(3.50) 16 6.40(2.69) 29.96 -1.40 [-3.19, 0.39]
Subtotal (95% CI) 102 71 100.00 -1.58 [-2.56, -0.60]
Test for heterogeneity: Chi² = 0.30, df = 2 (P = 0.86), I² = 0%
Test for overall effect: Z = 3.16 (P = 0.002)
07 VAS irritability 0-10 (parent rated) (inverted) - clear fluids
Schreiner 1990 53 1.30(1.70) 68 3.40(3.00) 100.00 -2.10 [-2.95, -1.25]
Subtotal (95% CI) 53 68 100.00 -2.10 [-2.95, -1.25]
Test for heterogeneity: not applicable
Test for overall effect: Z = 4.86 (P < 0.00001)
08 VAS irritability (parent rated) 1-10 clear fluids
Splinter 1990a 30 1.90(1.20) 15 3.50(3.68) 51.20 -1.60 [-3.51, 0.31]
Splinter 1990b 32 2.50(2.20) 16 3.50(3.68) 48.80 -1.00 [-2.96, 0.96]
Subtotal (95% CI) 62 31 100.00 -1.31 [-2.67, 0.06]
Test for heterogeneity: Chi² = 0.18, df = 1 (P = 0.67), I² = 0%
Test for overall effect: Z = 1.87 (P = 0.06)
-10 -5 0 5 10
Favours short fast
Favours standard

Studies in children, by type



Appendix B8: Studies in children, by volume

Sub-group analysis by volume of fluid

Primary outcomes

Volume: low volume

Comments Highly heterogeneous group. one trial (Moyao Garcia et al., 2001) had anomalously high pH increase and volume decrease. fluid = solution of electrolytes @ 2h.

Number of comparisons 6 **Number of patients** 366

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.08 (-0.19 0.03)	12.05	5	0.03	59	Heterogeneous; without Moyao Garcia WMD -0.04 (95%CI -0.11, 0.04) p(heterogeneity)=0.36, I^2=9%; little difference between groups
Gastric pH (WMD)	0.38(-0.14 0.91)	46.94	5	<0.00001	89	Highly heterogeneous; without Moyao Garcia WMD 0.19 (95%CI -0.01, 0.39) p(heterogeneity)=0.40, I^2=1%; favours fluids

Volume: high volume

Number of comparisons 6 **Number of patients** 262

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.05(-0.07 0.18)	6.65	5	0.25	25	Little difference
Gastric pH (WMD)	0.02(-0.15 0.20)	0.38	4	0.98	0	Very little difference; highly homogeneous

Volume: unlimited

Number of comparisons 4 **Number of patients** 450

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.03(-0.10 0.04)	2.32	3	0.51	0	Little difference
Gastric pH (WMD)	0.11(-0.01 0.24)	0.77	3	0.86	0	Little difference, favours fluids (borderline significance, p=0.08)

Secondary outcomes

Volume: low volume

Comments Two comparisons, Splinter et al., 1989 and Gombar et al., 1997.

Number of comparisons 2 **Number of patients** 130

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst (parent rated) - VAS (SMD)	-0.98 (-1.83 -0.13)	4.85	1	0.03	79	Standardised mean difference; statistically significantly less thirst for fluids; each study also significant, but heterogeneous
Thirst (child-rated) - VAS (WMD)	-0.70 (-2.19 0.79)			1 trial		One study (Splinter 1989, n=80); wide confidence interval => result uncertain
Hunger (parent rated) - VAS	-1.30 (-2.57 -0.03)			1 trial		Single study (Splinter 1989, n=80); statistically significantly less hunger for shortened fast; mean -1.30; VAS 1-10cm
Hunger (child-rated) - VAS	-1.90 (-3.41 -0.39)			1 trial		Single study (Splinter 1989, n=80); statistically significantly less hunger for shortened fast; mean -1.90; VAS 1-10cm
Irritability (parent rated) - VAS	-2.08 (-3.39 -0.77)			1 trial		Single study (Gombar, n=50); statistically significantly less irritability for shortened fast; mean -2.08; VAS 0-10cm

Volume: high volume

Comments Three comparisons: Splinter et al., 1990 (2) and Aun and Panesar, 1990.

Number of comparisons 3 **Number of patients** 113

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst (child-rated) - VAS (WMD)	-1.14 (-3.21 0.92)	0.65	1	0.42	0	Wide confidence interval => results uncertain
Postoperative vomiting – in recovery						No vomiting in either group; 1 small study (n=20)
Hunger (child-rated) - VAS	-1.35 (-2.64 -0.06)	0.01	1	0.94	0	Two comparisons in one study; statistically significantly less hunger for short fast; mean = -1.35, VAS 1-10cm
Irritability (parent rated) - VAS	-1.31 (-2.67 0.06)	0.18	1	0.67	0	Two comparisons in one study; wide confidence interval => uncertain results; VAS 1-10cm

Secondary outcomes

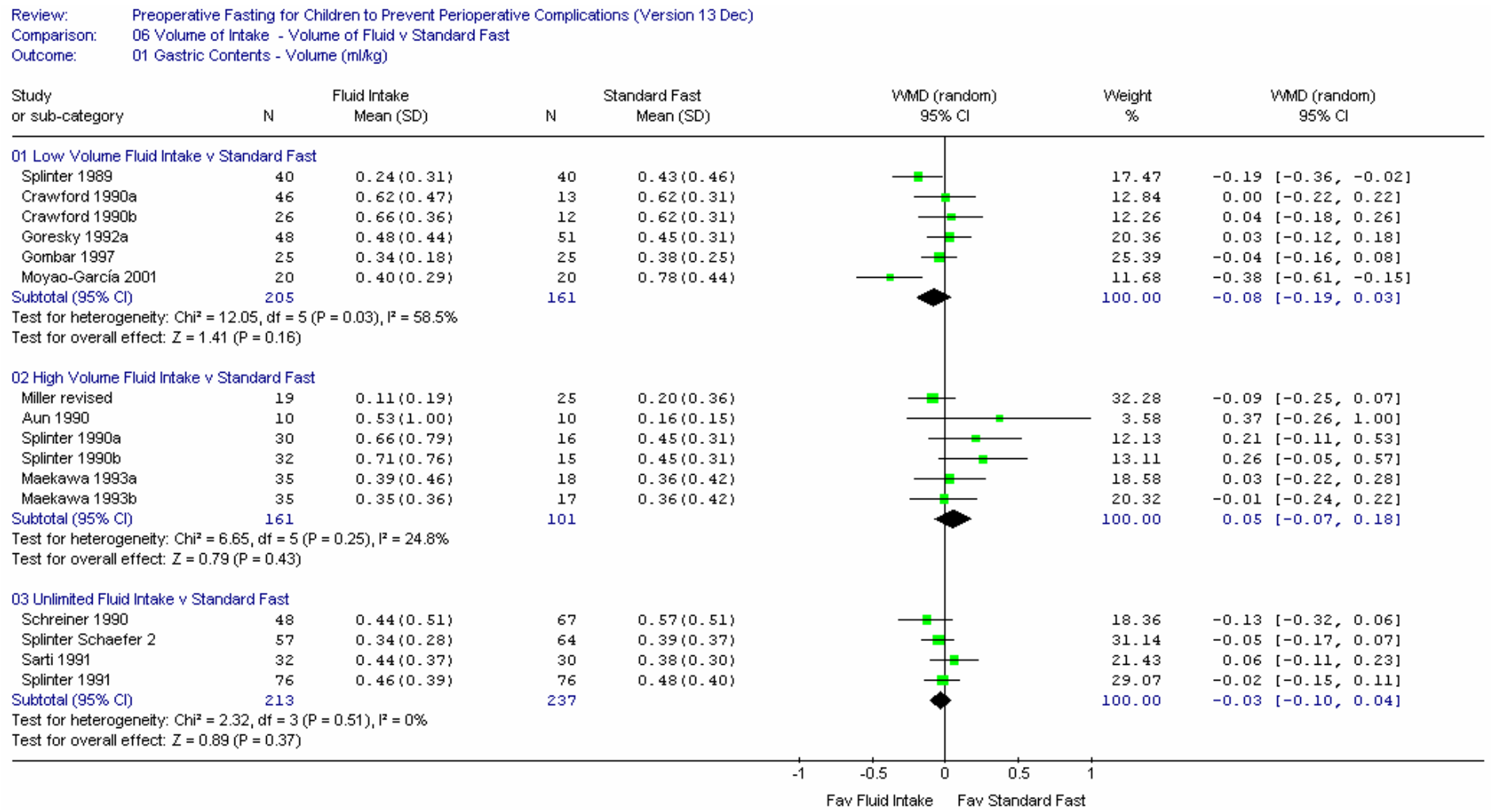
Volume: unlimited

Comments

Number of comparisons 2 **Number of patients** 273

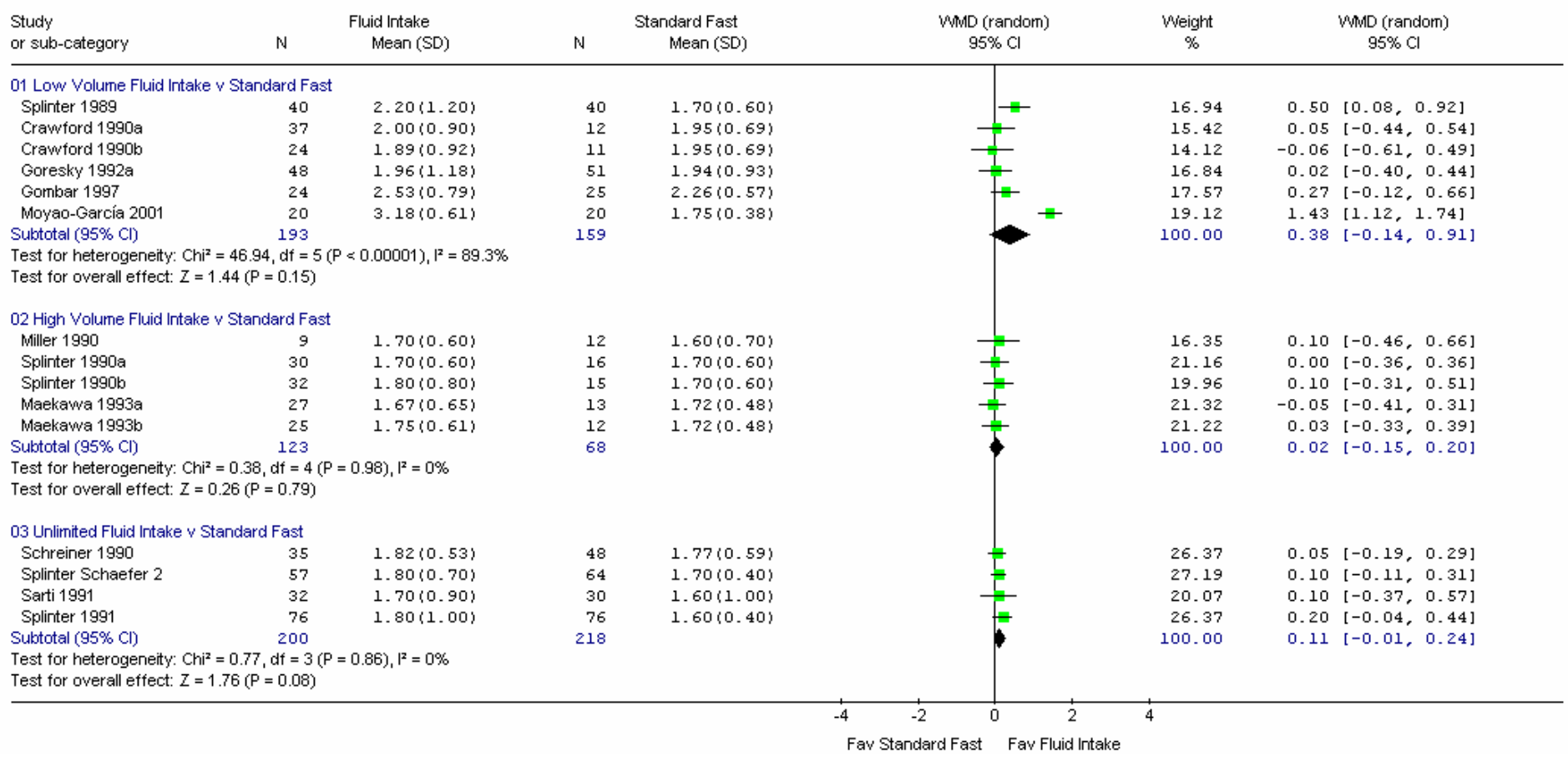
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Thirst - descriptive						Single study (Splinter 1991, adolescents, n=152); child-rated VAS thirst, median significantly less thirst versus standard fast (p<0.05)
Hunger - descriptive						Single study (Splinter 1991, adolescents, n=152); child-rated VAS hunger, median NS
Irritability (parent rated) - VAS	-2.10 (-2.95 -1.25)		1 trial			Single study (Schreiner, n=121), statistically significantly less irritability for shorter fast; mean -2.1, VAS (0-10)

Studies in children, by volume

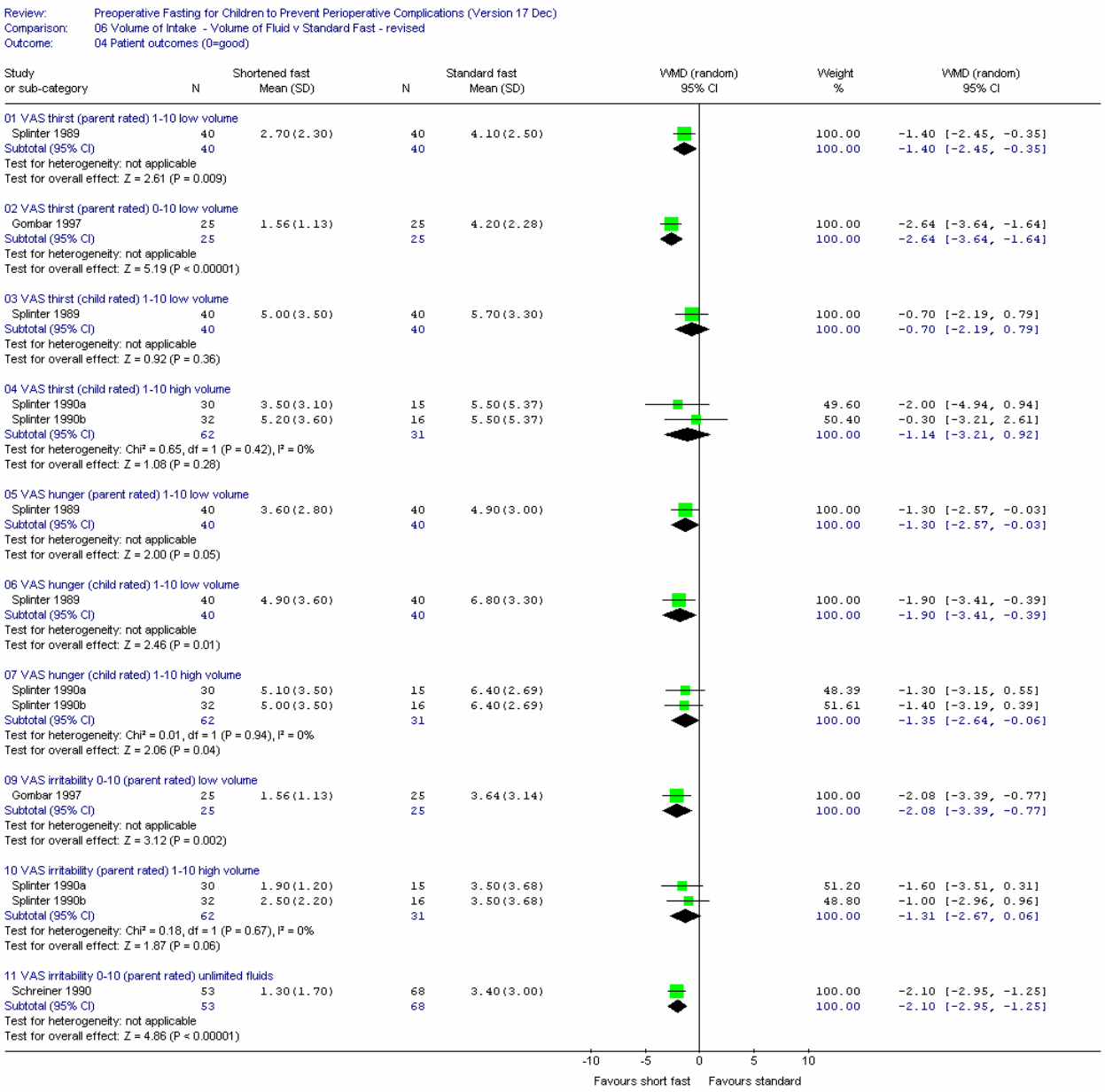


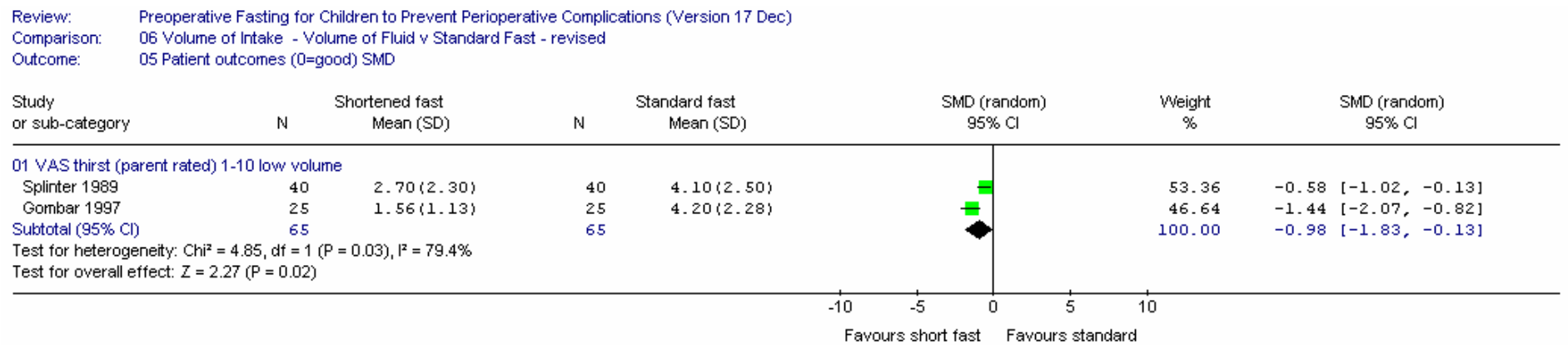
Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast
Outcome: 02 Gastric contents - pH values

Study or sub-category	Fluid Intake N	Fluid Intake Mean (SD)	Standard Fast N	Standard Fast Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 Low Volume Fluid Intake v Standard Fast							
Splinter 1989	40	2.20(1.20)	40	1.70(0.60)		16.94	0.50 [0.08, 0.92]
Crawford 1990a	37	2.00(0.90)	12	1.95(0.69)		15.42	0.05 [-0.44, 0.54]
Crawford 1990b	24	1.89(0.92)	11	1.95(0.69)		14.12	-0.06 [-0.61, 0.49]
Goresky 1992a	48	1.96(1.18)	51	1.94(0.93)		16.84	0.02 [-0.40, 0.44]
Gombar 1997	24	2.53(0.79)	25	2.26(0.57)		17.57	0.27 [-0.12, 0.66]
Moyao-García 2001	20	3.18(0.61)	20	1.75(0.38)		19.12	1.43 [1.12, 1.74]
Subtotal (95% CI)	193		159			100.00	0.38 [-0.14, 0.91]
Test for heterogeneity: Chi² = 46.94, df = 5 (P < 0.00001), I² = 89.3%							
Test for overall effect: Z = 1.44 (P = 0.15)							
02 High Volume Fluid Intake v Standard Fast							
Miller 1990	9	1.70(0.60)	12	1.60(0.70)		16.35	0.10 [-0.46, 0.66]
Splinter 1990a	30	1.70(0.60)	16	1.70(0.60)		21.16	0.00 [-0.36, 0.36]
Splinter 1990b	32	1.80(0.80)	15	1.70(0.60)		19.96	0.10 [-0.31, 0.51]
Maekawa 1993a	27	1.67(0.65)	13	1.72(0.48)		21.32	-0.05 [-0.41, 0.31]
Maekawa 1993b	25	1.75(0.61)	12	1.72(0.48)		21.22	0.03 [-0.33, 0.39]
Subtotal (95% CI)	123		68			100.00	0.02 [-0.15, 0.20]
Test for heterogeneity: Chi² = 0.38, df = 4 (P = 0.98), I² = 0%							
Test for overall effect: Z = 0.26 (P = 0.79)							
03 Unlimited Fluid Intake v Standard Fast							
Schreiner 1990	35	1.82(0.53)	48	1.77(0.59)		26.37	0.05 [-0.19, 0.29]
Splinter Schaefer 2	57	1.80(0.70)	64	1.70(0.40)		27.19	0.10 [-0.11, 0.31]
Sarti 1991	32	1.70(0.90)	30	1.60(1.00)		20.07	0.10 [-0.37, 0.57]
Splinter 1991	76	1.80(1.00)	76	1.60(0.40)		26.37	0.20 [-0.04, 0.44]
Subtotal (95% CI)	200		218			100.00	0.11 [-0.01, 0.24]
Test for heterogeneity: Chi² = 0.77, df = 3 (P = 0.86), I² = 0%							
Test for overall effect: Z = 1.76 (P = 0.08)							



Studies in children, by volume




Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 06 Volume of Intake - Volume of Fluid v Standard Fast - revised
Outcome: 05 Patient outcomes (0=good) SMD
Study or sub-category
Shortened fast N Mean (SD)
Standard fast N Mean (SD)
SMD (random) 95% CI
Weight %
SMD (random) 95% CI
01 VAS thirst (parent rated) 1-10 low volume
Splinter 1989 40 2.70(2.30) 40 4.10(2.50) 53.36 -0.58 [-1.02, -0.13]
Gombar 1997 25 1.56(1.13) 25 4.20(2.28) 46.64 -1.44 [-2.07, -0.82]
Subtotal (95% CI) 65 65 100.00 -0.98 [-1.83, -0.13]
Test for heterogeneity: Chi² = 4.85, df = 1 (P = 0.03), I² = 79.4%
Test for overall effect: Z = 2.27 (P = 0.02)
-10
-5
0
5
10
Favours short fast
Favours standard

Appendix B9: Infants' studies by duration

Clear fluids

Duration: up to 2h

Comments One study (Cook Sather et al.,); many protocol deviations; clear fluids up to 2 h versus formula milk up to 4h.

Number of comparisons 1 **Number of patients** 97

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.03 (-0.20 0.14)			1 trial		Single trial; little difference; protocol deviations
Gastric pH (WMD)	0.40 (-0.06 0.86)			1 trial		Single trial; little difference
No. of pts with particles in aspirate (OR)	0.28 (0.01 7.09)			1 trial		Very wide confidence interval => results uncertain
Parent satisfaction - VAS (WMD)	-1.00 (-2.03 0.03)			1 trial		Wide confidence interval => results uncertain
Hunger (parent rated) - VAS (WMD)	-0.50 (-2.06 1.06)			1 trial		Wide confidence interval => results uncertain
Irritability (parent rated) - VAS (WMD)	-0.60 (-1.82 0.62)			1 trial		Wide confidence interval => results uncertain

Duration: up to 3h

Comments Two comparisons in one study (van der Walt and Carter, 1986); much missing aspirate for pH measurement; high volume (10ml/kg)

Number of comparisons 2 **Number of patients** 92

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.38 (-0.67 -0.09)	0.00	1	0.95	0	Statistically significantly in favour of fluids; mean decrease 0.38 ml/kg
Gastric pH (WMD)	-1.37 (-3.18 0.45)	0.16	1	0.69	0	Wide confidence interval => uncertain results (n=45 for this outcome)
All secondary						No evidence

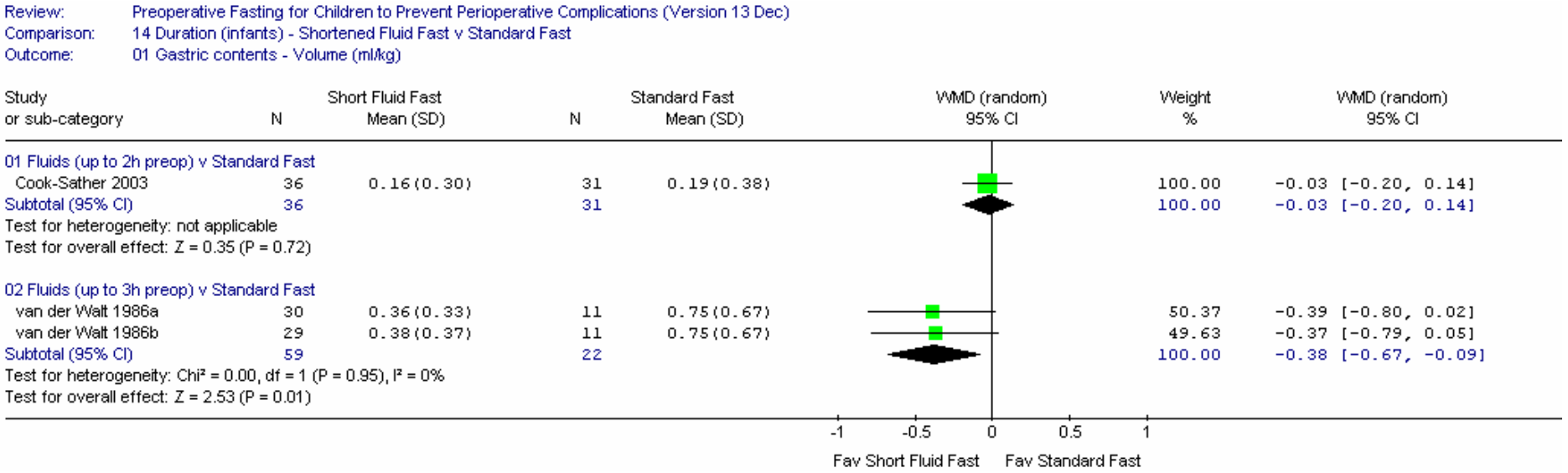
Head-to-head dextrose vs. polyjoule

Duration: up to 3h

Comments One study (van der Walt and Carter, 1986); many results missing for pH.

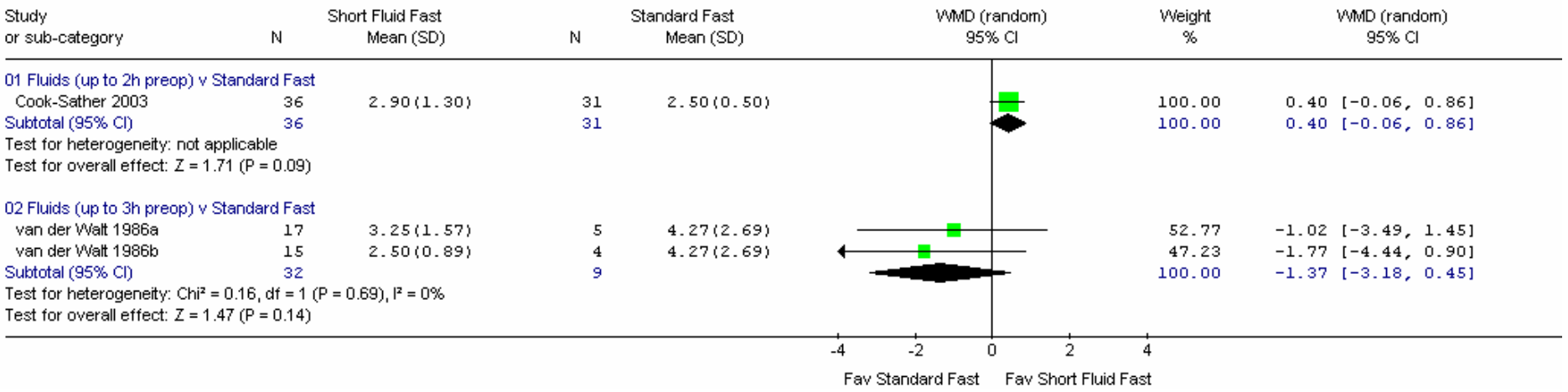
Number of comparisons 1 **Number of patients** 59

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.03 (-0.15 0.21)			1 trial		Little difference
Gastric pH (WMD)	-0.75 (-1.62 0.12)			1 trial		Fairly wide confidence interval; favours polyjoule, not significant; n=32 for this outcome
All secondary						No evidence

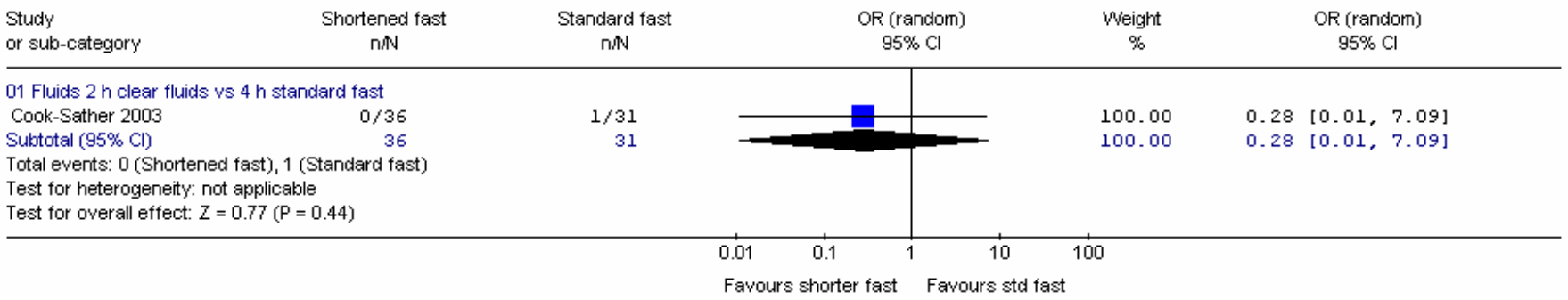


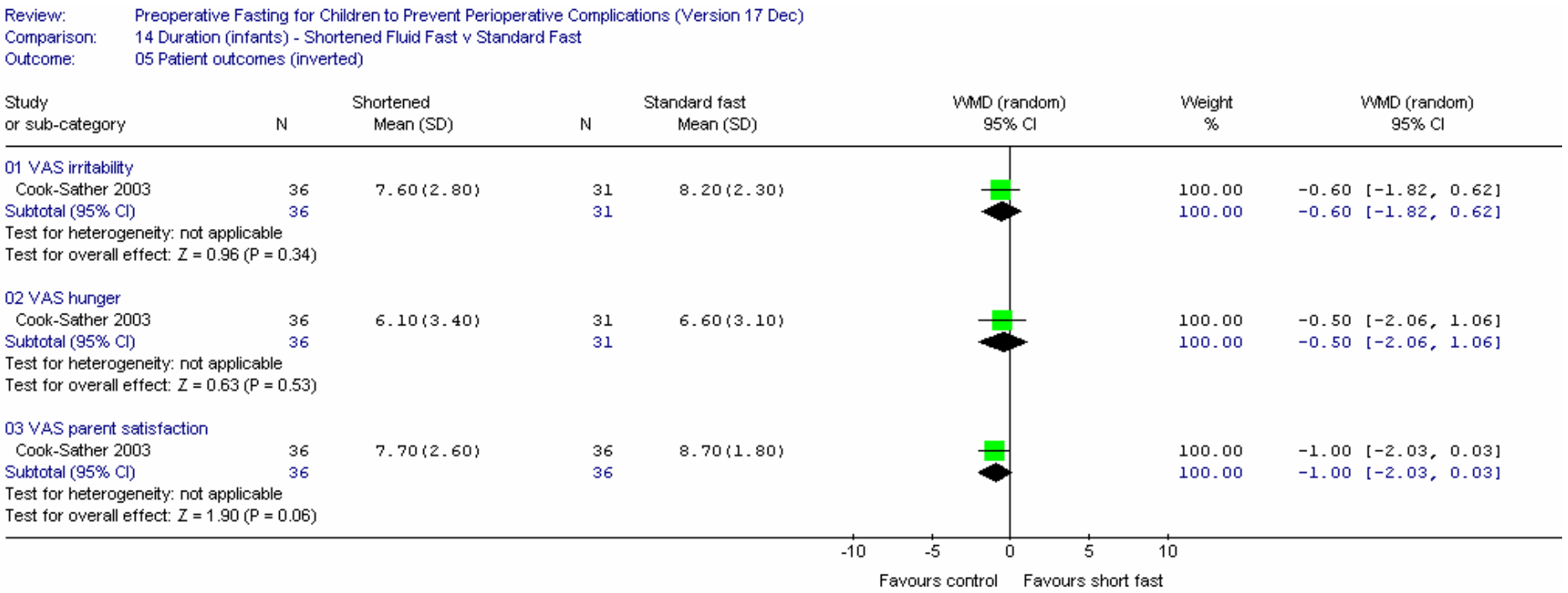
Infants' studies, by duration

Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 14 Duration (infants) - Shortened Fluid Fast v Standard Fast
Outcome: 02 Gastric contents - pH



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 14 Duration (infants) - Shortened Fluid Fast v Standard Fast
Outcome: 04 Number of patients with bits

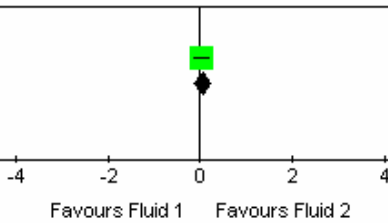



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 14 Duration (infants) - Shortened Fluid Fast v Standard Fast
Outcome: 05 Patient outcomes (inverted)
Study or sub-category
N
Shortened Mean (SD)
N
Standard fast Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
01 VAS irritability
Cook-Sather 2003 36 7.60(2.80) 31 8.20(2.30) 100.00 -0.60 [-1.82, 0.62]
Subtotal (95% CI) 36 31 100.00 -0.60 [-1.82, 0.62]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.96 (P = 0.34)
02 VAS hunger
Cook-Sather 2003 36 6.10(3.40) 31 6.60(3.10) 100.00 -0.50 [-2.06, 1.06]
Subtotal (95% CI) 36 31 100.00 -0.50 [-2.06, 1.06]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.63 (P = 0.53)
03 VAS parent satisfaction
Cook-Sather 2003 36 7.70(2.60) 36 8.70(1.80) 100.00 -1.00 [-2.03, 0.03]
Subtotal (95% CI) 36 36 100.00 -1.00 [-2.03, 0.03]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.90 (P = 0.06)
-10
-5
0
5
10
Favours control
Favours short fast

Head-to-head type of fluid

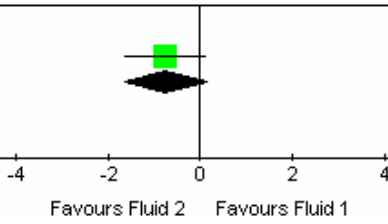
Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 16 Type of Intake (infants) - Fluid 1 [F1] v Fluid 2 [F2]
Outcome: 01 Gastric Contents - Volume (ml/kg)

Study or sub-category	N	Fluid 1 [F1] Mean (SD)	N	Fluid 2 [F2] Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 [F1] Dextrose Water v [F2] Poly-joule							
van der Walt 1986d	29	0.39(0.36)	30	0.36(0.33)		100.00	0.03 [-0.15, 0.21]
Subtotal (95% CI)	29		30			100.00	0.03 [-0.15, 0.21]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 0.33 (P = 0.74)							



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 16 Type of Intake (infants) - Fluid 1 [F1] v Fluid 2 [F2]
Outcome: 02 Gastric contents - pH

Study or sub-category	N	Fluid 1 [F1] Mean (SD)	N	Fluid 2 [F2] Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 Dextrose [F1] v Polyjoule [F2]							
van der Walt 1986d	15	2.50(0.88)	17	3.25(1.58)		100.00	-0.75 [-1.62, 0.12]
Subtotal (95% CI)	15		17			100.00	-0.75 [-1.62, 0.12]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 1.68 (P = 0.09)							



Appendix B10: Studies in children, by duration - solids

Type of solids: **biscuits**

Duration: **2 to 4 h**

Comments Single trial (Meakin et al., 1985, quasi-randomised).

Number of comparisons 1 **Number of patients** 52

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.25 (0.07 0.43)			1 trial		Statistically significantly in favour of standard fast; mean increase 0.25 ml/kg
Gastric pH (WMD)	0.35 (-0.08 0.78)			1 trial		Slightly favoured solids, but not significantly
No. of patients with particles in aspirate (RR)	17.18 (1.08 273.96)			1 trial		Statistically significantly in favour of standard fast; relative risk 17; huge confidence interval; 1 study(n=52)
All secondary						No evidence

Type of solids: biscuits

Duration: **4 to 6 h**

Comments Single trial (quasi-randomised).

Number of comparisons 1 **Number of patients** 34

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.09 (-0.12 0.30)			1 trial		Little difference; fairly wide confidence interval
Gastric pH (WMD)	0.11 (-0.13 0.35)			1 trial		Little difference
No. of pts with particles in aspirate (RR)	9.80 (0.55 176.01)			1 trial		Huge confidence interval => results uncertain
All secondary						No evidence

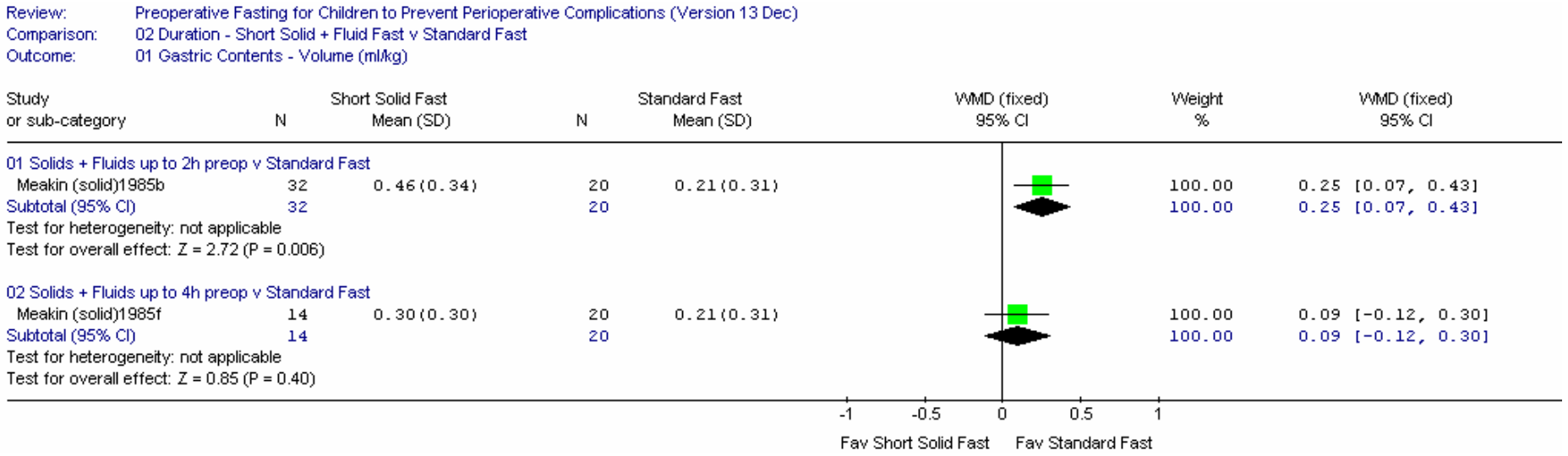
Type of solids: biscuits

Duration: head-to-head 2 to 4 vs. 4 to 6 h

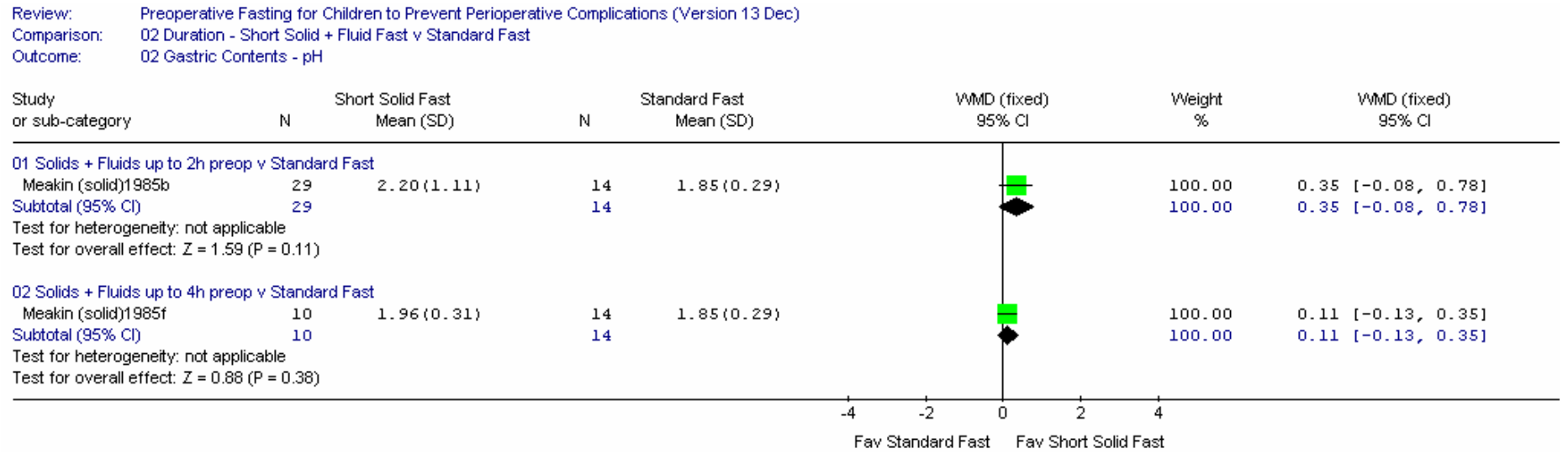
Comments Single study (Meakin et al., 1985; quasi-randomised).

Number of comparisons 1 **Number of patients** 46

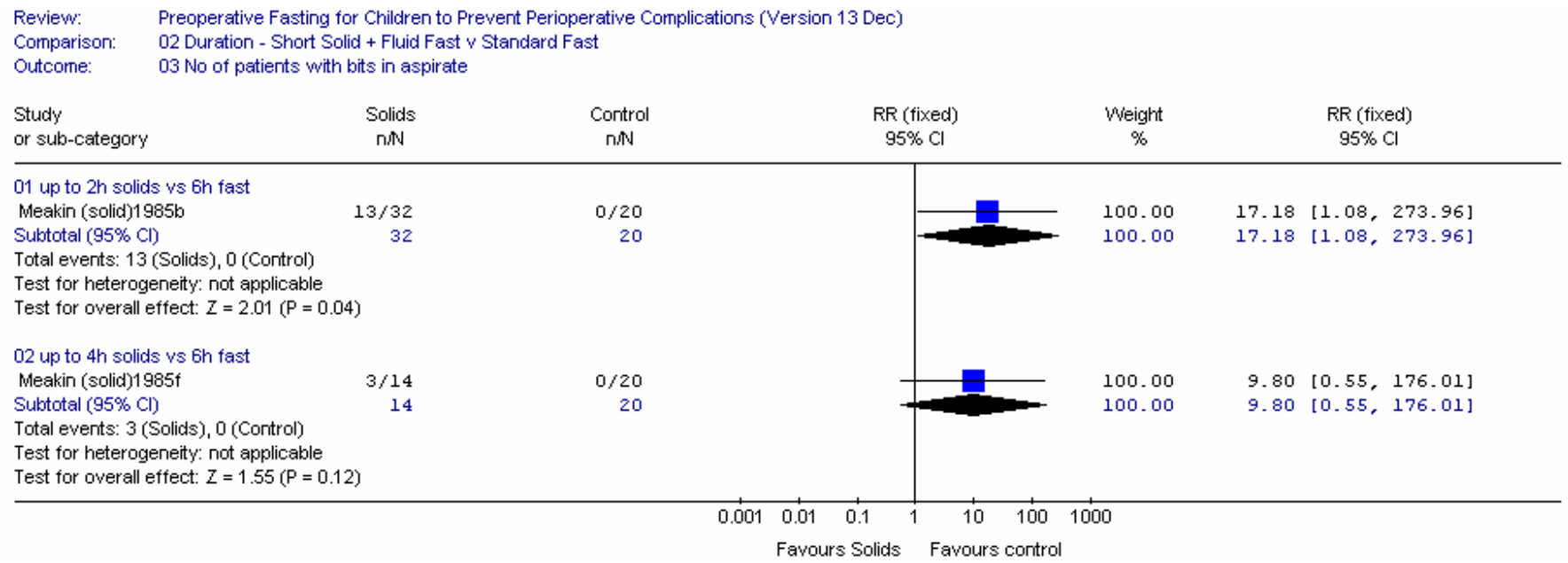
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.16 (-0.04 0.36)			1 trial		Favours longer duration; not significant; 1 study (n=46)
Gastric pH (WMD)	0.24 (-0.21 0.69)			1 trial		Little difference; 1 study (n=46)
No. of pts with particles in aspirate (RR)	1.90 (0.64 5.62)			1 trial		Wide confidence interval => uncertain results



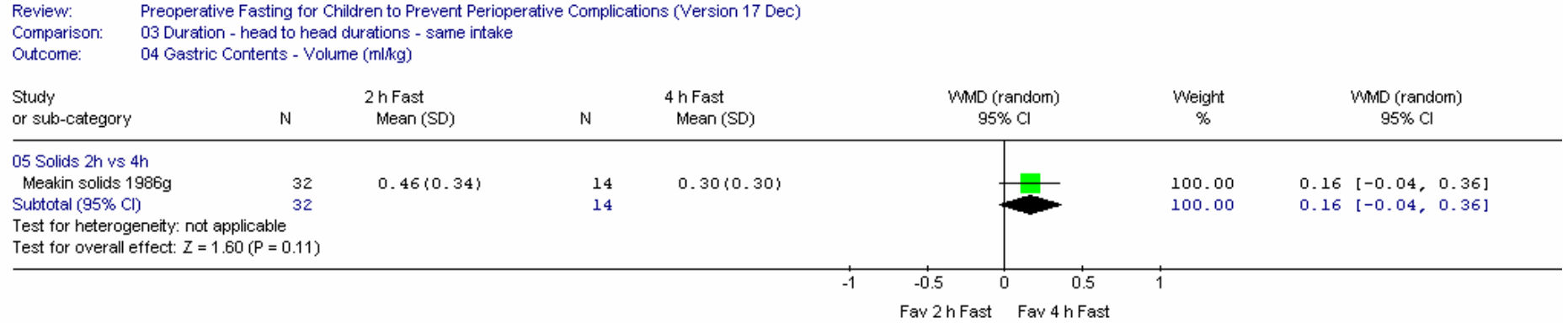
Studies in children, by duration - solids

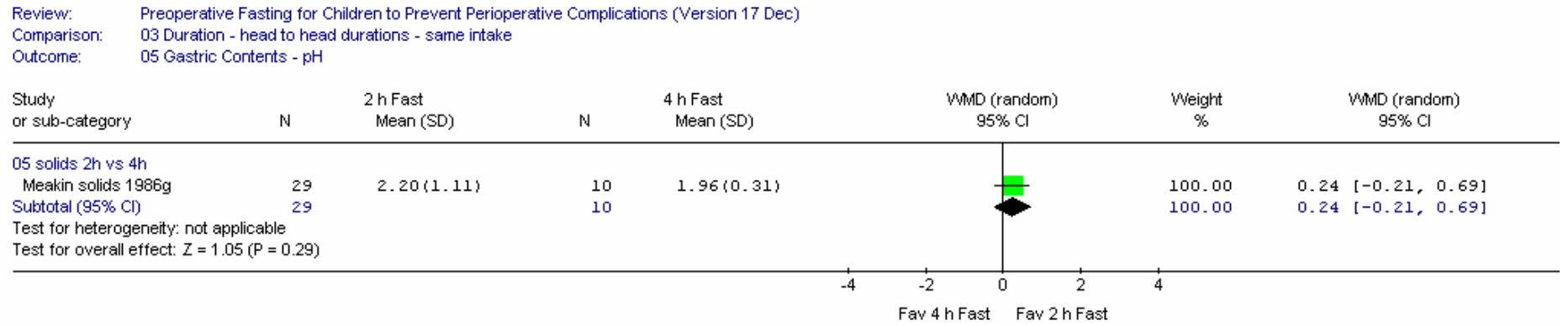


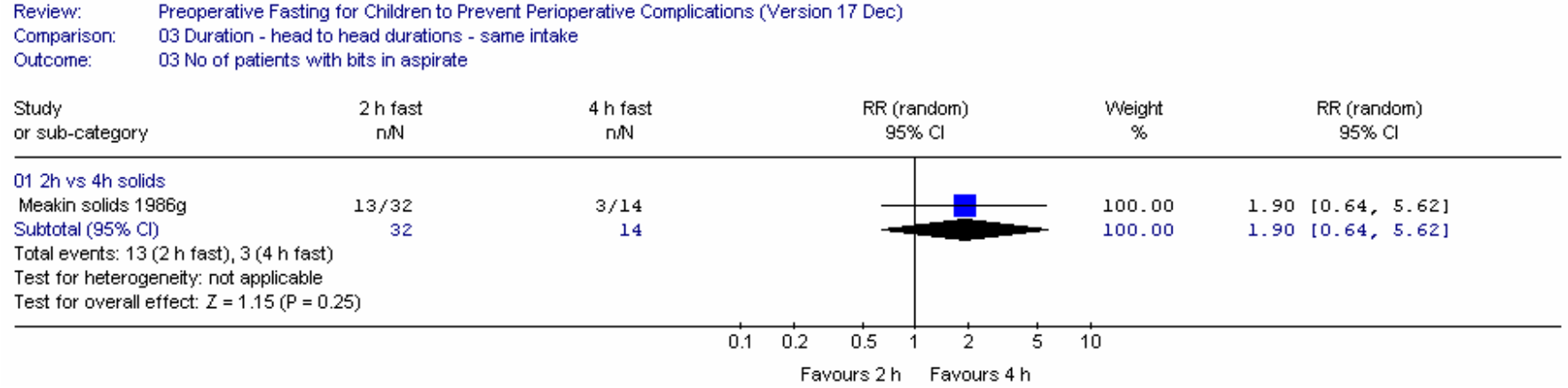
Studies in children, by duration - solids



Head-to-head durations




Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 03 Duration - head to head durations - same intake
Outcome: 05 Gastric Contents - pH
Study or sub-category
N
2 h Fast Mean (SD)
N
4 h Fast Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
05 solids 2h vs 4h
Meakin solids 1986g 29 2.20(1.11) 10 1.96(0.31) 100.00 0.24 [-0.21, 0.69]
Subtotal (95% CI) 29 10 100.00 0.24 [-0.21, 0.69]
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.05 (P = 0.29)
-4
-2
0
2
4
Fav 4 h Fast
Fav 2 h Fast


Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 03 Duration - head to head durations - same intake
Outcome: 03 No of patients with bits in aspirate
Study or sub-category
2 h fast n/N
4 h fast n/N
RR (random) 95% CI
Weight %
RR (random) 95% CI
01 2h vs 4h solids
Meakin solids 1986g 13/32 3/14 100.00 1.90 [0.64, 5.62]
Subtotal (95% CI) 32 14 100.00 1.90 [0.64, 5.62]
Total events: 13 (2 h fast), 3 (4 h fast)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.15 (P = 0.25)
0.1
0.2
0.5
1
2
5
10
Favours 2 h
Favours 4 h

Appendix B11: Studies in children, head-to-head solids vs. fluids

Type of fluid or solid: head-to-head biscuits+fluid vs. fluid

Comments Two comparisons in same study (Meakin et al., 1985; quasi-randomised).

Number of comparisons 2 **Number of patients** 96

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.07	(-0.06	0.20)	0.13	1	0.72	0	Little difference
Gastric pH (WMD)	0.16	(-0.12	0.43)	0.11	1	0.74	0	Little difference

Type of fluid or solid: head-to-head porridge+fluid vs. fluid

Comments Rice porridge at 5.5h and fluids (both arms) up to 5h; 1 small trial (Kushikata et al., 1996).

Number of comparisons 1 **Number of patients** 20

Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.12	(-0.30	0.54)			1 trial		Wide confidence interval =>results uncertain; 1 small trial (n=20)
Gastric pH (WMD)	0.46	(-0.03	0.95)			1 trial		Favoured solids + fluids, borderline significance (p=0.07); one small trial (n=20)
No. of patients with particles in aspirate								No evidence of particles in the aspirate of either group
Hunger (child-rated) - VAS	-0.60	(-1.31	0.11)			1 trial		Favours solids group, but not significantly; one small trial (n=20)

Type of fluid or solid: head-to-head solids+fluid vs. fluid

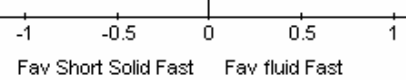
Comments Two trials with biscuits + fluid, one with porridge + fluid.

Number of comparisons 3 **Number of patients** 116

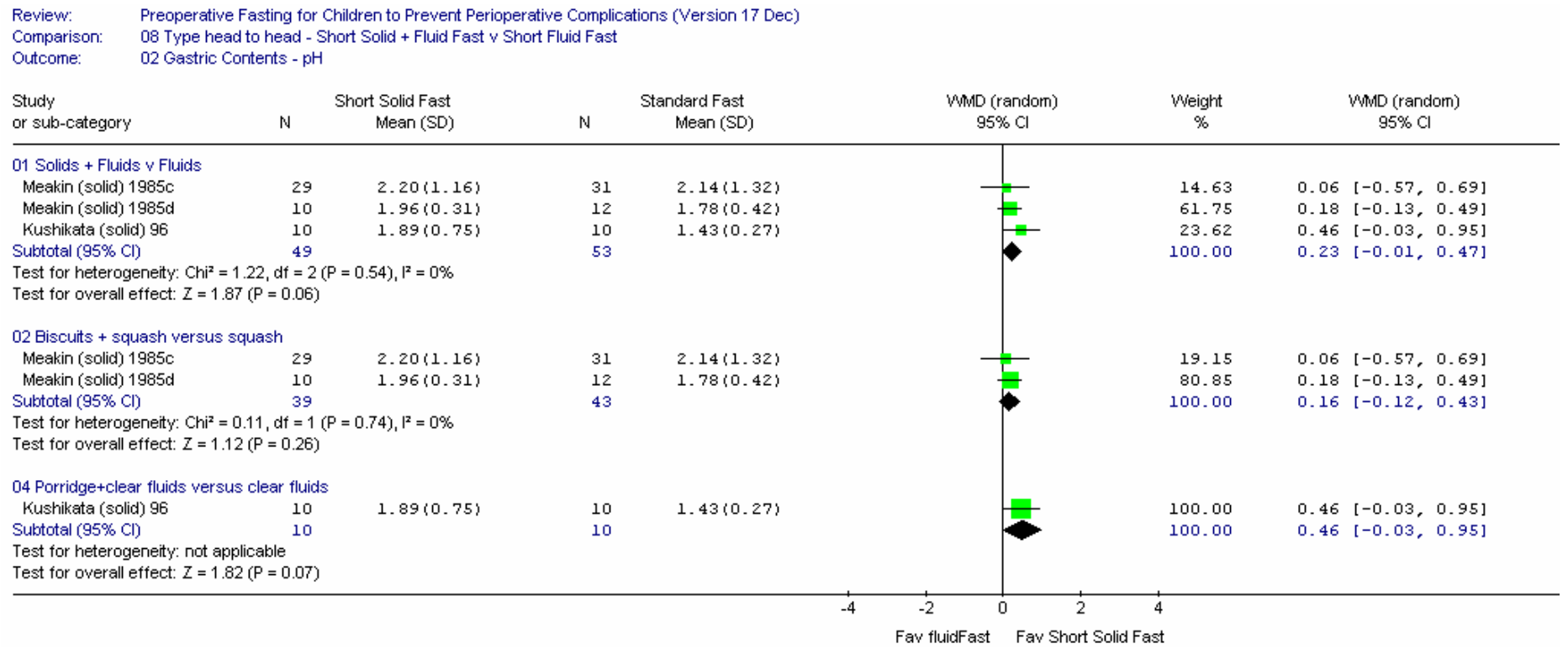
Outcome	WMD / RR / OR (95%CI)			Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.08	(-0.05	0.20)	0.17	2	0.92	0	Little difference
Gastric pH (WMD)	0.23	(-0.01	0.47)	1.22	2	0.54	0	Slightly favoured the solids+fluids fast; borderline significance (p=0.06)
Hunger (child-rated) - VAS	-0.60	(-1.31	0.11)			1 trial		Favours solids group, but not significantly; one small trial (n=20)

Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 08 Type head to head - Short Solid + Fluid Fast v Short Fluid Fast
Outcome: 01 Gastric Contents - Volume (ml/kg)

Study or sub-category	Short Solid Fast N	Short Solid Fast Mean (SD)	Short Fluid Fast N	Short Fluid Fast Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 Solids + Fluids v Fluids							
Meakin (solid) 1985c	32	0.46(0.34)	35	0.37(0.35)		58.41	0.09 [-0.08, 0.26]
Meakin (solid) 1985d	14	0.30(0.30)	15	0.26(0.31)		32.37	0.04 [-0.18, 0.26]
Kushikata (solid) 96	10	0.55(0.59)	10	0.43(0.32)		9.22	0.12 [-0.30, 0.54]
Subtotal (95% CI)	56		60			100.00	0.08 [-0.05, 0.20]
Test for heterogeneity: Chi² = 0.17, df = 2 (P = 0.92), I² = 0%							
Test for overall effect: Z = 1.19 (P = 0.23)							
02 biscuits + squash vs squash							
Meakin (solid) 1985c	32	0.46(0.34)	35	0.37(0.35)		64.34	0.09 [-0.08, 0.26]
Meakin (solid) 1985d	14	0.30(0.30)	15	0.26(0.31)		35.66	0.04 [-0.18, 0.26]
Subtotal (95% CI)	46		50			100.00	0.07 [-0.06, 0.20]
Test for heterogeneity: Chi² = 0.13, df = 1 (P = 0.72), I² = 0%							
Test for overall effect: Z = 1.07 (P = 0.29)							
04 Porridge + clear fluids vs clear fluids							
Kushikata (solid) 96	10	0.55(0.59)	10	0.43(0.32)		100.00	0.12 [-0.30, 0.54]
Subtotal (95% CI)	10		10			100.00	0.12 [-0.30, 0.54]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 0.57 (P = 0.57)							



Studies in children, head-to-head solids vs. fluids



Appendix B12: Studies in children - sweets

Type of solids: sweets

Duration: up to 30 min

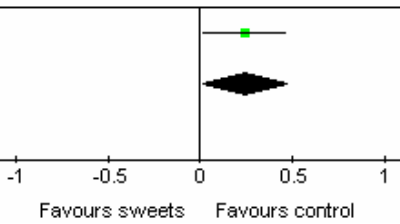
Comments Age 5-12 years; 30-60 min before operation given lollipop containing placebo. One small study.

Number of comparisons 1 **Number of patients** 37

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.24 (0.02 0.46)			1 trial		Statistically significantly in favour of standard fast; mean increase 0.24 ml/kg
Gastric pH (WMD)	0.03 (-0.18 0.24)			1 trial		Little difference; fairly wide confidence interval
Anxiety - no. of pts with little/none (RR)	1.89 (0.91 3.96)			1 trial		Borderline significance (p=0.09) in favour of lollipop; fairly wide confidence interval
Postop vomiting – no. of patients (RR)	0.95 (0.22 4.10)			1 trial		Wide confidence interval => results uncertain
Postop nausea – no. of patients (RR)	6.65 (0.37 120.36)			1 trial		Very wide confidence interval => results uncertain

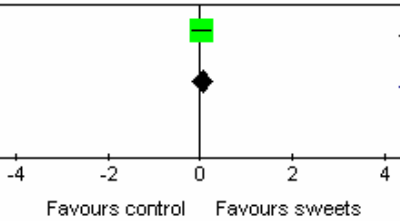
Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 10 Sweets vs standard fast
Outcome: 01 Sweets volume

Study or sub-category	N	Sweets Mean (SD)	N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Stanley 1989	19	0.54(0.45)	16	0.30(0.20)		0.00	0.24 [0.02, 0.46]
Total (95% CI)	19		16			0.00	0.24 [0.02, 0.46]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 2.09 (P = 0.04)							

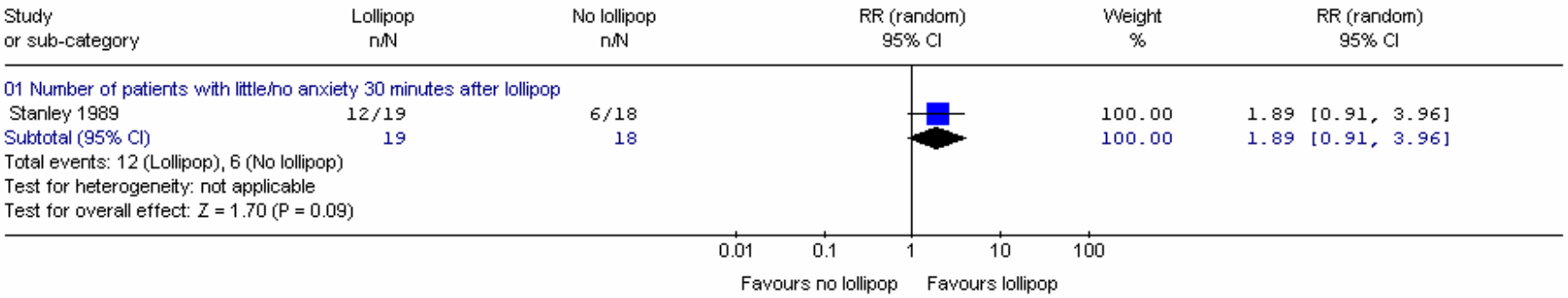


Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 10 Sweets vs standard fast
Outcome: 02 Sweets pH

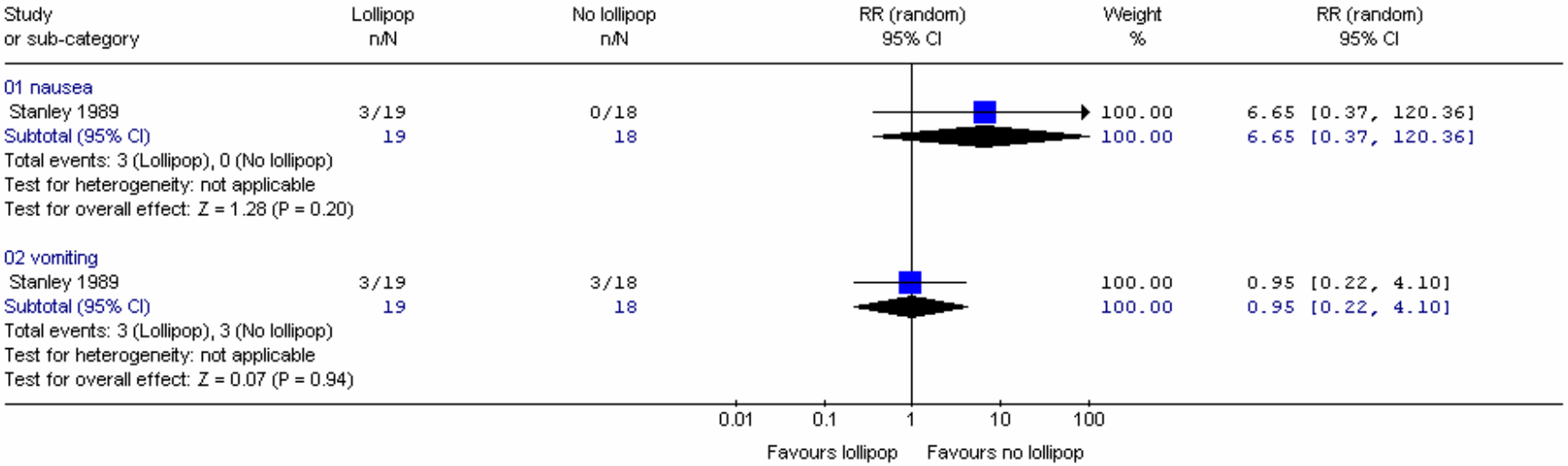
Study or sub-category	N	Sweets Mean (SD)	N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Stanley 1989	19	1.72(0.28)	13	1.69(0.31)		100.00	0.03 [-0.18, 0.24]
Total (95% CI)	19		13			100.00	0.03 [-0.18, 0.24]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 0.28 (P = 0.78)							



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 10 Sweets vs standard fast
Outcome: 04 Secondary outcomes - sweets



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 10 Sweets vs standard fast
Outcome: 03 Postoperative nausea and vomiting in recovery room - sweets



Appendix B13: Infants' studies - milk

Type of fluid or solid: milk (cows) vs. standard fast

Duration up to 3 h **Type of evidence:** RCT

Comments One study (van der Walt and Carter, 1986); much missing aspirate.

Number of comparisons 1 **Number of patients** 64 **Age:** 5 days to 3 months

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	0.08 (-0.41 0.57)			1 trial		Wide confidence interval => uncertain results
Gastric pH (WMD)	0.01 (-1.93 1.95)			1 trial		Wide confidence interval => uncertain results (n=27 for this outcome)
Secondary outcomes						
All secondary						No evidence

Type of fluid or solid: milk vs. standard fast

Duration up to 4 h **Type of evidence:** controlled clinical trial

Comments One study (Thomas 1974); ml/kg calculated from mean weight.

Number of comparisons 1 **Number of patients** 62 **Age:** 19 to 166 months

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	0.08 (0.00 0.16)			1 trial		Borderline significance (p=0.05)

Type of fluid or solid: milk (formula) vs. standard fast

Duration 2 - 3 h between ingestion and aspiration **Type of evidence:** prospective non-randomised study

Comments One study (Sethi et al., 1999); non-randomised. Most patients >1y, up to 5y . Not preoperative (although expecting an operation); no dropouts; unclear when gastric contents sampled for control group.

Number of comparisons 1 **Number of patients** 30 **Age:** 0.7 to 5.0 years

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	-0.08 (-0.15 -0.01)			1 trial		Statistically significantly in favour of milk; non-randomised; mean decrease 0.08 ml/kg
Gastric pH (WMD)	0.20 (-0.01 0.41)			1 trial		Little difference; borderline significance (p=0.07), favours milk

Type of fluid or solid: head-to-head cows' milk vs. clear fluids

Duration up to 3h **Type of evidence:** meta-analysis of RCTs

Comments Two comparisons in one study (van der Walt and Carter, 1986); much missing aspirate so pH measurements limited.

Number of comparisons 2 **Number of patients** 90 **Age:** 5 days to 3 months

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	0.45 (0.16 0.75)	0.01	10.92			0Statistically significantly in favour of clear fluids; mean increase 0.45 ml/kg
Gastric pH (WMD)	1.40 (0.06 -2.74)	0.30	10.58			0Statistically significantly in favour of milk; mean decrease 1.4 units

Type of fluid or solid: head-to-head low fat milk vs. glucose

Duration 1.5 h and 2.3 h ingestion to aspiration time **Type of evidence:** RCT

Comments Sethi et al., 1999; Most patients older than 1 y; not preoperative conditions (although expecting an operation); different fast times (mean 1.5 vs. 2.3 h)

Number of comparisons 1 **Number of patients** 45 **Age:** 0.7 to 5.0 y

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	0.22 (0.16 0.28)		1 trial			Different fast times; volume divided by mean weight; statistically significantly in favour of glucose; mean increase 0.22 ml/kg
Gastric pH (WMD)	0.37 (0.02 0.72)		1 trial			Different fast times; statistically significantly in favour of milk (mean increase 0.37)

Type of fluid or solid: head-to-head breast milk vs. clear fluids

Duration up to 2h **Type of evidence:** prospective non-randomised study

Comments Litman et al., 1994; not randomised, many had missing aspirate in both groups; baseline similar; from IPD assumes v=0 for missing aspirate.

Number of comparisons 1 **Number of patients** 18 **Age:** 0.35 (0.2 to 0.5) y

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	0.38 (-0.14 0.90)			1 trial		Wide confidence interval => results uncertain
Gastric pH (WMD)	0.50 (-0..59 1.59)			1 trial		Wide confidence interval => results uncertain; much missing aspirate

Type of fluid or solid: head-to-head breast vs. formula milk

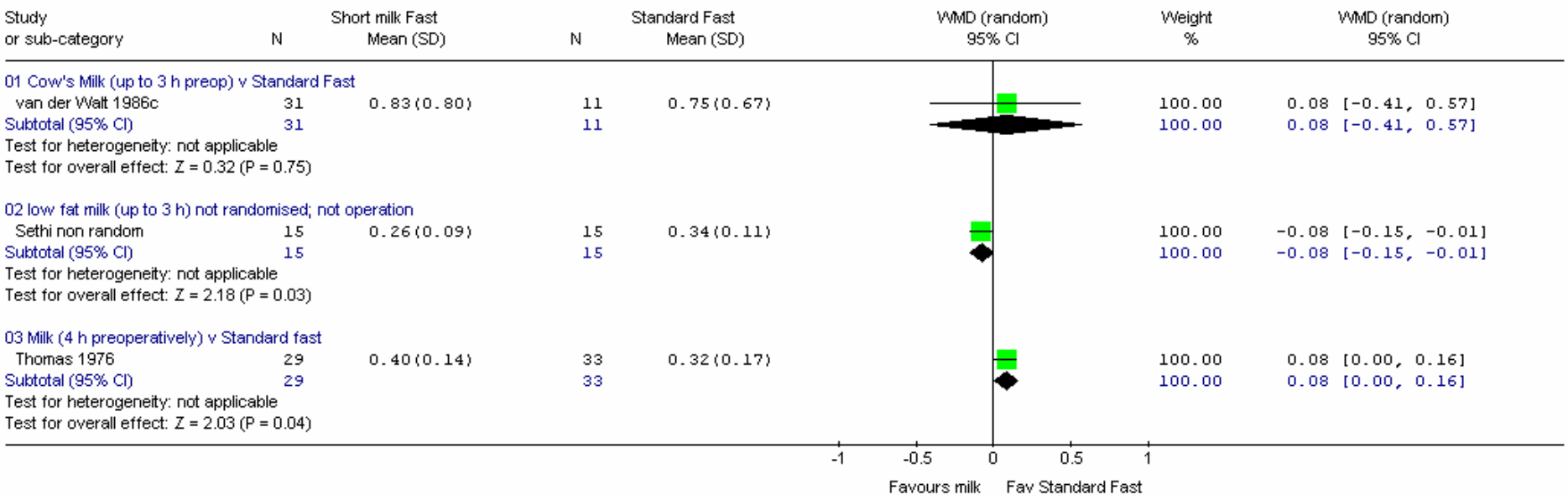
Duration up to 3h **Type of evidence:** prospective non-randomised study

Comments Van der Walt et al., 1990; non-randomised study; very few patients (11/62) had aspirate; volume calculated making assumptions.

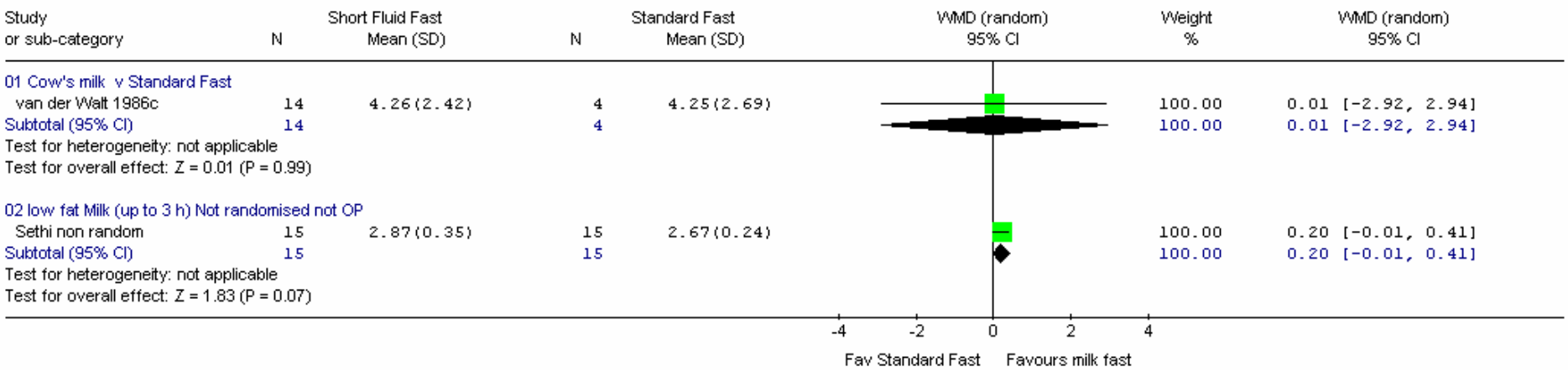
Number of comparisons 1 **Number of patients** 62 **Age:** 2 (1 to 3) months

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Primary outcomes						
Gastric volume (WMD)	-0.03 (-0.08 0.02)			1 trial		Calculated making many assumptions; little difference between groups
Gastric pH (WMD)						Not reported

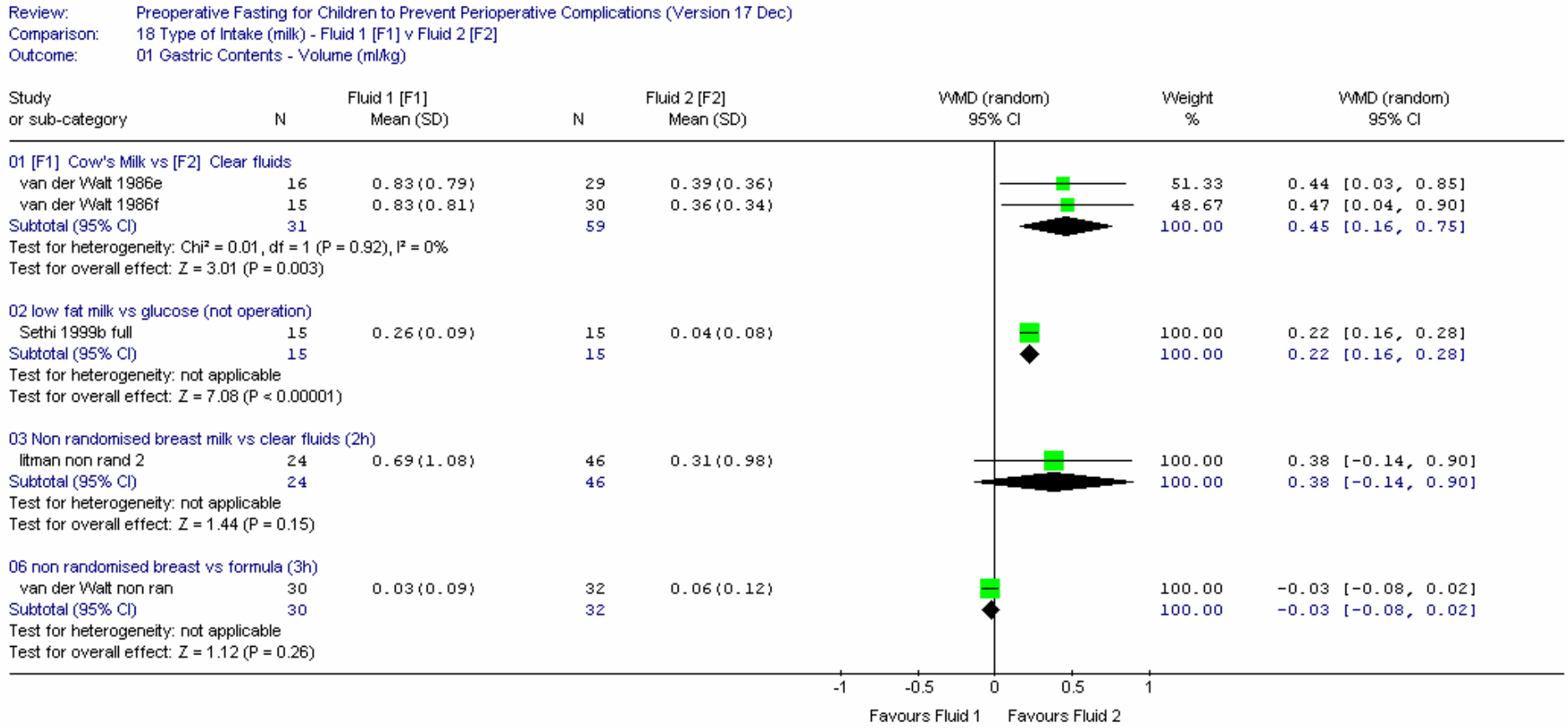
Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 28 Type of intake (Milk) - Shortened Fluid Fast v Standard Fast
Outcome: 01 Gastric contents - Volume (ml/kg)

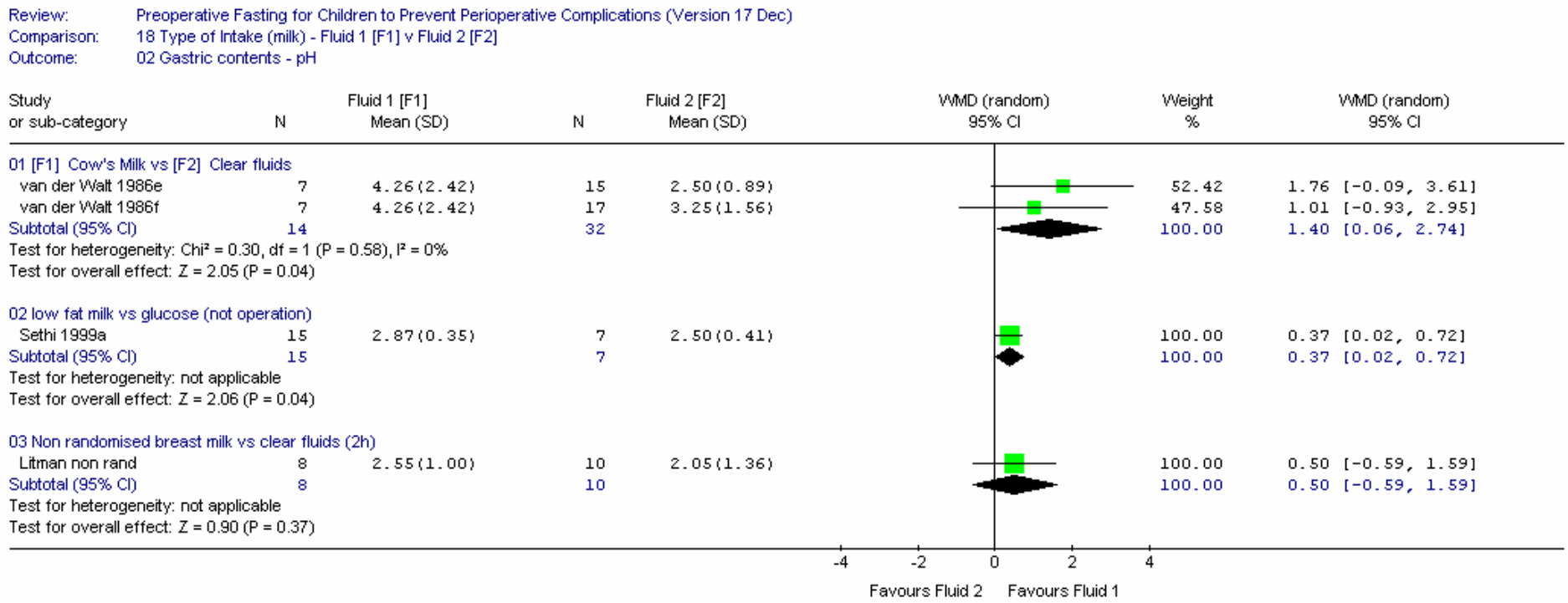


Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 28 Type of intake (Milk) - Shortened Fluid Fast v Standard Fast
Outcome: 02 Gastric contents - pH



Head-to-head comparisons




Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 18 Type of Intake (milk) - Fluid 1 [F1] v Fluid 2 [F2]
Outcome: 02 Gastric contents - pH
Study or sub-category
Fluid 1 [F1] N Mean (SD)
Fluid 2 [F2] N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
01 [F1] Cow's Milk vs [F2] Clear fluids
van der Walt 1986e 7 4.26(2.42) 15 2.50(0.89) 52.42 1.76 [-0.09, 3.61]
van der Walt 1986f 7 4.26(2.42) 17 3.25(1.56) 47.58 1.01 [-0.93, 2.95]
Subtotal (95% CI) 14 32 100.00 1.40 [0.06, 2.74]
Test for heterogeneity: Chi² = 0.30, df = 1 (P = 0.58), I² = 0%
Test for overall effect: Z = 2.05 (P = 0.04)
02 low fat milk vs glucose (not operation)
Sethi 1999a 15 2.87(0.35) 7 2.50(0.41) 100.00 0.37 [0.02, 0.72]
Subtotal (95% CI) 15 7 100.00 0.37 [0.02, 0.72]
Test for heterogeneity: not applicable
Test for overall effect: Z = 2.06 (P = 0.04)
03 Non randomised breast milk vs clear fluids (2h)
Litman non rand 8 2.55(1.00) 10 2.05(1.36) 100.00 0.50 [-0.59, 1.59]
Subtotal (95% CI) 8 10 100.00 0.50 [-0.59, 1.59]
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.90 (P = 0.37)
-4
-2
0
2
4
Favours Fluid 2
Favours Fluid 1

Appendix B14: Studies in children, by premed and fluid type

Type of intervention: water and other clear fluid

Primary outcomes

Type of premedication: none

Comments Premedication none - all durations.

Number of comparisons 13 **Number of patients** 844

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.03 (-0.10 0.03)	20.13	12	0.06	40	Some heterogeneity; without Moyao Garcia WMD -0.02 (95%CI -0.07, 0.03), p(heterogeneity)=0.42, I^2=3%; i.e., little difference between groups
Gastric pH (WMD)	0.22 (-0.01 0.46)	66.43	12	<0.00001	82	Highly heterogeneous; without Moyao Garcia WMD 0.12 (95%CI 0.02, 0.22), p(heterogeneity)=0.85, I^2=0%; i.e. statistically significantly in favour of shortened fast; mean = 0.12 (clinically small)

Type of premedication: all types of premed

Comments

Number of comparisons 3 **Number of patients** 234

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.01 (-0.18 0.15)	3.21	2	0.20	38	Little difference
Gastric pH (WMD)	0.04 (-0.17 0.25)	0.01	1	0.90	0	Little difference

Type of intervention: water and other clear fluid

Primary outcomes

Type of premedication: opioid

Comments No pH values for one study (Aun and Panesar, 1990).

Number of comparisons 2 **Number of patients** 135

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.03 (-0.43 0.48)	2.24	1	0.13	55	Wide confidence interval => uncertain results
Gastric pH (WMD)	0.05 (-0.19 0.29)			1 trial		Little difference; 1 study (n=83)

Type of premedication: non-opioid

Comments Benzodiazepines. One study (Goresky et al., 1992).

Number of comparisons 1 **Number of patients** 214

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.03 (-0.12 0.18)			1 trial		Little difference
Gastric pH (WMD)	0.02 (-0.40 0.44)			1 trial		Little difference

Type of intervention: sweets

Primary outcomes

Type of premedication: head-to-head premedication vs. none

Comments Premedication is transmucosal fentanyl citrate contained in a lollipop. One small study.

Number of comparisons 1 **Number of patients** 37

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	0.03 (-0.24 0.30)			1 trial		Wide confidence interval => results uncertain
Gastric pH (WMD)	0.20 (-0.10 0.50)			1 trial		Little difference

Secondary outcomes

Type of premedication: head-to-head premedication vs. none

Comments Premedication is transmucosal fentanyl citrate contained in a lollipop. One small study.

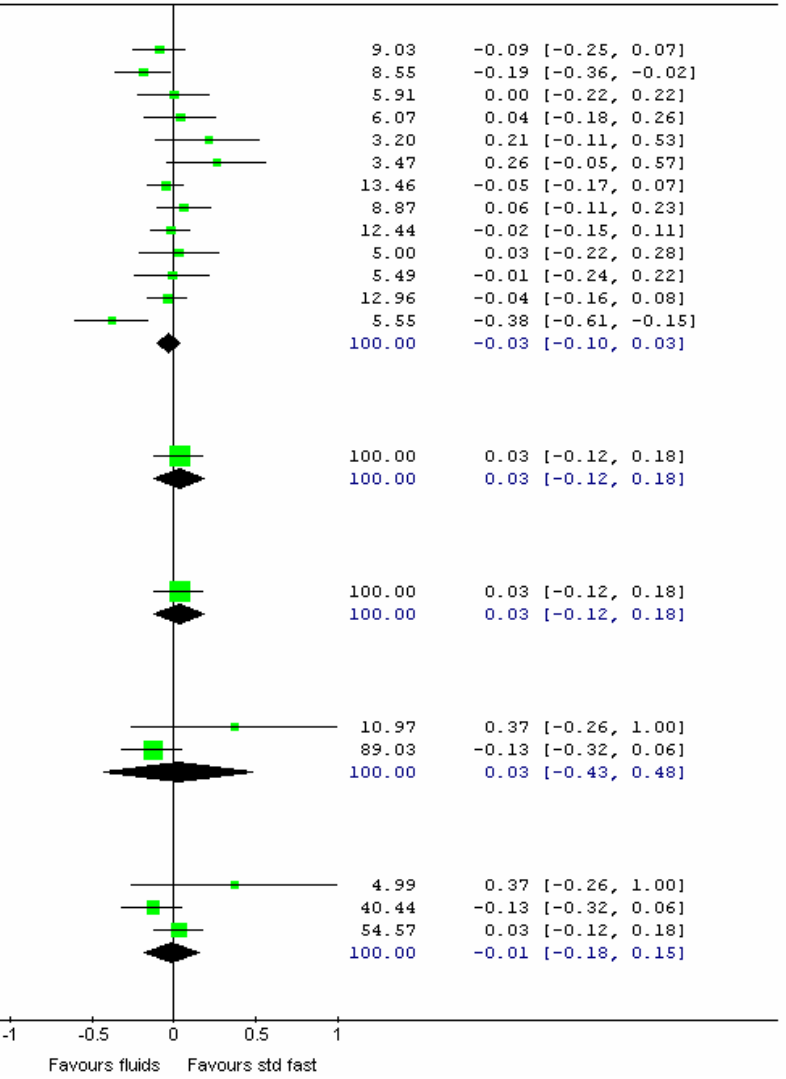
Number of comparisons 1 **Number of patients** 37

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Anxiety - number of patients with none (RR)	1.58 (1.12 2.23)			1 trial		Statistically significantly in favour of premedication lolly; 1.6 times less anxiety compared with placebo lollipop
Postoperative vomiting number of patients (RR)	1.41 (0.36 5.43)			1 trial		Wide confidence interval => results uncertain
Postoperative nausea number of patients (RR)	2.81 (0.88 8.98)			1 trial		Wide confidence interval => results uncertain

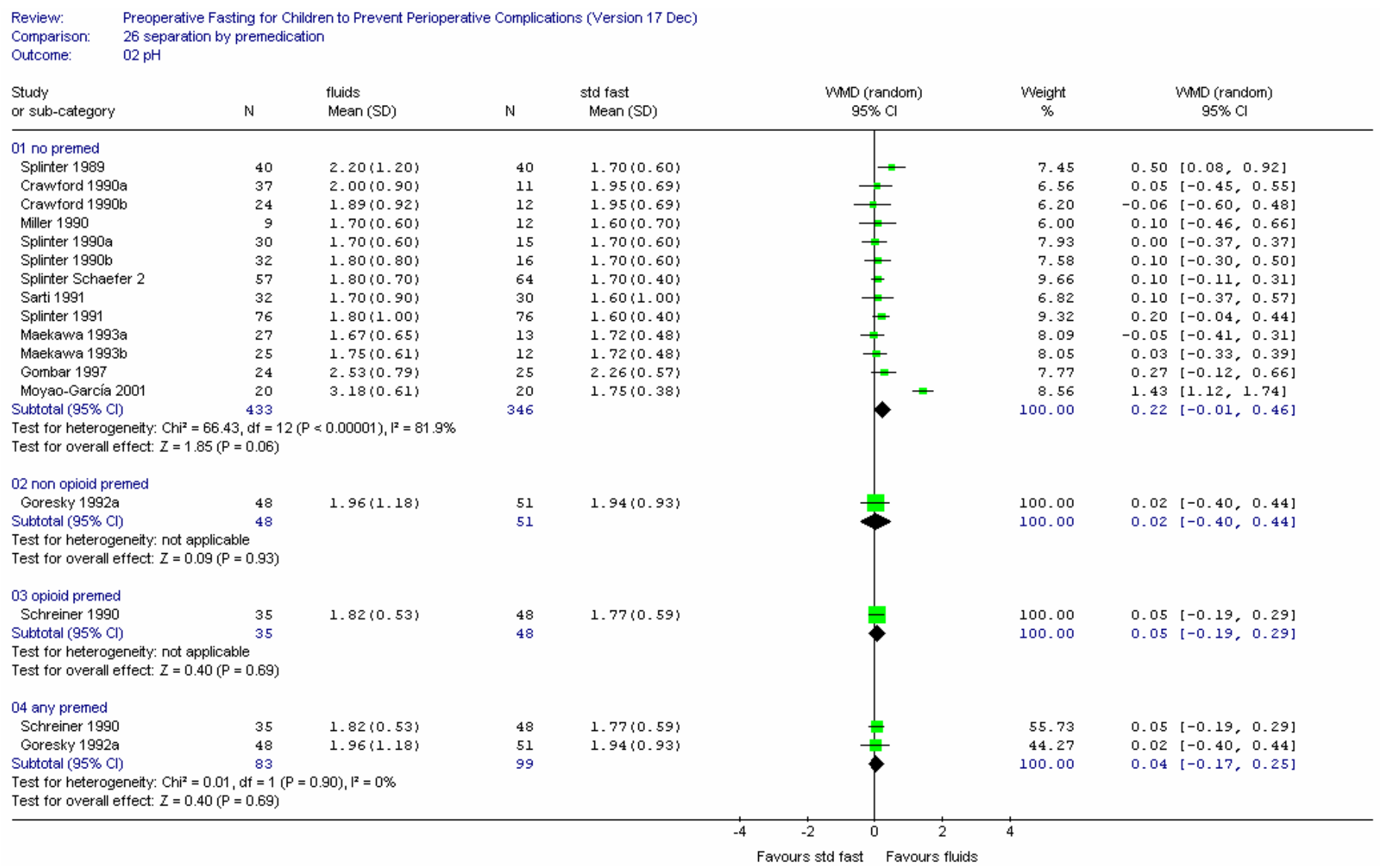
Studies in children, by premed and fluid type

Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 17 Dec)
Comparison: 26 separation by premedication
Outcome: 01 Volume

Study or sub-category	N	fluids Mean (SD)	N	Control Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
01 no premed							
Miller revised	19	0.11(0.19)	25	0.20(0.36)		9.03	-0.09 [-0.25, 0.07]
Splinter 1989	40	0.24(0.31)	40	0.43(0.46)		8.55	-0.19 [-0.36, -0.02]
Crawford 1990a	46	0.62(0.47)	12	0.62(0.31)		5.91	0.00 [-0.22, 0.22]
Crawford 1990b	26	0.66(0.36)	13	0.62(0.31)		6.07	0.04 [-0.18, 0.26]
Splinter 1990a	30	0.66(0.79)	16	0.45(0.31)		3.20	0.21 [-0.11, 0.53]
Splinter 1990b	32	0.71(0.76)	15	0.45(0.31)		3.47	0.26 [-0.05, 0.57]
Splinter Schaefer 2	57	0.34(0.28)	64	0.39(0.37)		13.46	-0.05 [-0.17, 0.07]
Sarti 1991	32	0.44(0.37)	30	0.38(0.30)		8.87	0.06 [-0.11, 0.23]
Splinter 1991	76	0.46(0.39)	76	0.48(0.40)		12.44	-0.02 [-0.15, 0.11]
Maekawa 1993a	35	0.39(0.46)	18	0.36(0.42)		5.00	0.03 [-0.22, 0.28]
Maekawa 1993b	35	0.35(0.36)	17	0.36(0.42)		5.49	-0.01 [-0.24, 0.22]
Gombar 1997	25	0.34(0.18)	25	0.38(0.25)		12.96	-0.04 [-0.16, 0.08]
Moyao-García 2001	20	0.40(0.29)	20	0.78(0.44)		5.55	-0.38 [-0.61, -0.15]
Subtotal (95% CI)	473		371			100.00	-0.03 [-0.10, 0.03]
Test for heterogeneity: Chi² = 20.13, df = 12 (P = 0.06), I² = 40.4%							
Test for overall effect: Z = 1.01 (P = 0.31)							
02 some premed							
Goresky 1992a	48	0.48(0.44)	51	0.45(0.31)		100.00	0.03 [-0.12, 0.18]
Subtotal (95% CI)	48		51			100.00	0.03 [-0.12, 0.18]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 0.39 (P = 0.70)							
03 non opioid premed							
Goresky 1992a	48	0.48(0.44)	51	0.45(0.31)		100.00	0.03 [-0.12, 0.18]
Subtotal (95% CI)	48		51			100.00	0.03 [-0.12, 0.18]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 0.39 (P = 0.70)							
04 opioid premed							
Aun 1990	10	0.53(1.00)	10	0.16(0.15)		10.97	0.37 [-0.26, 1.00]
Schreiner 1990	48	0.44(0.51)	67	0.57(0.51)		89.03	-0.13 [-0.32, 0.06]
Subtotal (95% CI)	58		77			100.00	0.03 [-0.43, 0.48]
Test for heterogeneity: Chi² = 2.24, df = 1 (P = 0.13), I² = 55.4%							
Test for overall effect: Z = 0.12 (P = 0.91)							
05 any premed							
Aun 1990	10	0.53(1.00)	10	0.16(0.15)		4.99	0.37 [-0.26, 1.00]
Schreiner 1990	48	0.44(0.51)	67	0.57(0.51)		40.44	-0.13 [-0.32, 0.06]
Goresky 1992a	48	0.48(0.44)	51	0.45(0.31)		54.57	0.03 [-0.12, 0.18]
Subtotal (95% CI)	106		128			100.00	-0.01 [-0.18, 0.15]
Test for heterogeneity: Chi² = 3.21, df = 2 (P = 0.20), I² = 37.7%							
Test for overall effect: Z = 0.17 (P = 0.87)							



Studies in children, by premed and fluid type

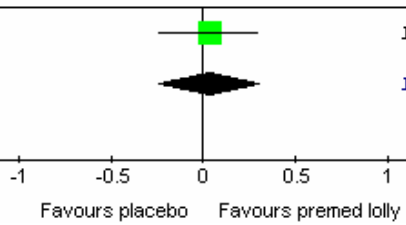


Head-to-head premedication – lollipops

Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 27 Sweets - head to head premed
Outcome: 01 Sweets volume

Study or sub-category	N	Premed lolly Mean (SD)	N	Placebo lolly Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Stanley 1989	18	0.57(0.39)	19	0.54(0.45)		100.00	0.03 [-0.24, 0.30]
Total (95% CI)	18		19			100.00	0.03 [-0.24, 0.30]

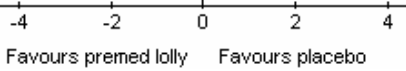
Test for heterogeneity: not applicable
Test for overall effect: Z = 0.22 (P = 0.83)



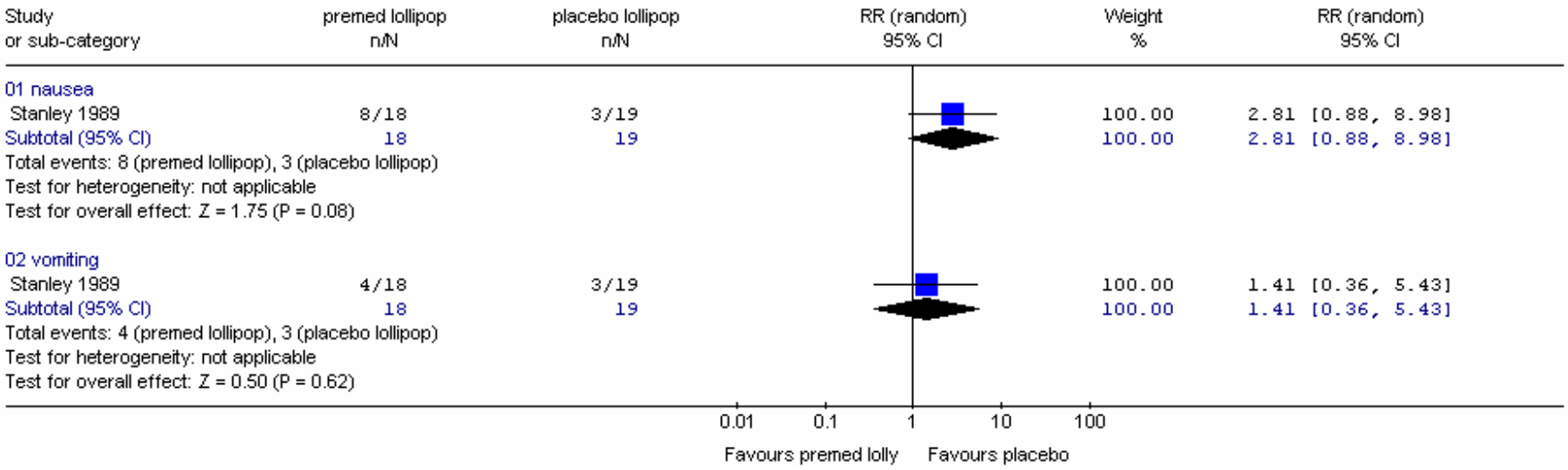
Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 27 Sweets - head to head premed
Outcome: 02 Sweets pH

Study or sub-category	N	Premed lolly Mean (SD)	N	placebo lolly Mean (SD)	WMD (random) 95% CI	Weight %	WMD (random) 95% CI
Stanley 1989	15	1.92(0.53)	19	1.72(0.28)		0.00	0.20 [-0.10, 0.50]
Total (95% CI)	15		19			0.00	0.20 [-0.10, 0.50]

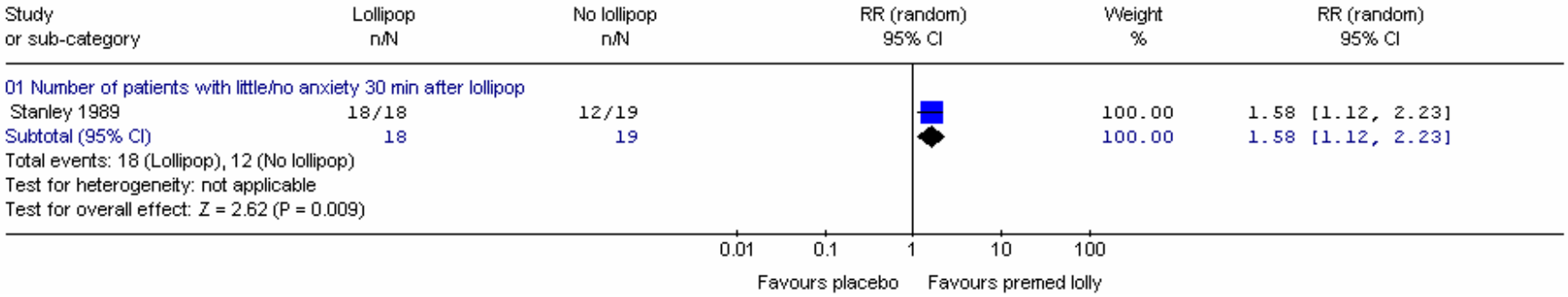
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.32 (P = 0.19)



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 27 Sweets - head to head premed
Outcome: 03 Postoperative nausea and vomiting in recovery room - sweets



Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 27 Sweets - head to head premed
Outcome: 04 Secondary outcomes - sweets



Appendix B15: Studies in children, with H_2RAs and PPIs

Shortened fast versus standard fast

Comments Goresky et al., 1992 and Sandhar et al., 1989.

Number of comparisons 2 **Number of patients** 133

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.02 (-0.11 0.06)	0.46	1	0.50	0	Little difference
Gastric pH (WMD)	0.53 (-0.20 1.26)	0.26	1	0.61	0	Little difference

Head-to-head H_2RA vs. none in presence of shortened fluid fast

Comments Goresky et al., 1992 (apple juice up to 2 h), Gombar et al., 1997 (water up to 3 h).

Number of comparisons 2 **Number of patients** 151

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.13 (-0.20 -0.05)	0.90	1	0.34	0	Statistically significantly in favour of H_2RAs – mean decrease 0.13 ml/kg
Gastric pH (WMD)	2.32 (1.79 2.85)	0.70	1	0.40	0	Statistically significantly in favour of H_2RAs – mean increase 2.32

Head-to-head PPI vs. placebo in presence of shortened fluid fast – PPI given at 9pm only

Comments Mikawa et al., 1995 and Nishina et al., 1994 (apple juice at 3 h).

Number of comparisons 2 **Number of patients** 102

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.39 (-0.55 −0.23)	0.45	1	0.50	0	Statistically significantly in favour of PPIs – mean decrease 0.39 ml/kg
Gastric pH (WMD)	1.06 (0.58 1.54)	1.60	1	0.21	37	Statistically significantly in favour of PPIs – mean increase 1.06

Head-to-head PPI vs. placebo in presence of shortened fluid fast – PPI given 3h preoperatively

Comments Mikawa et al.,1995 and Nishina et al., 1994 (apple juice at 3 h).

Number of comparisons 2 **Number of patients** 102

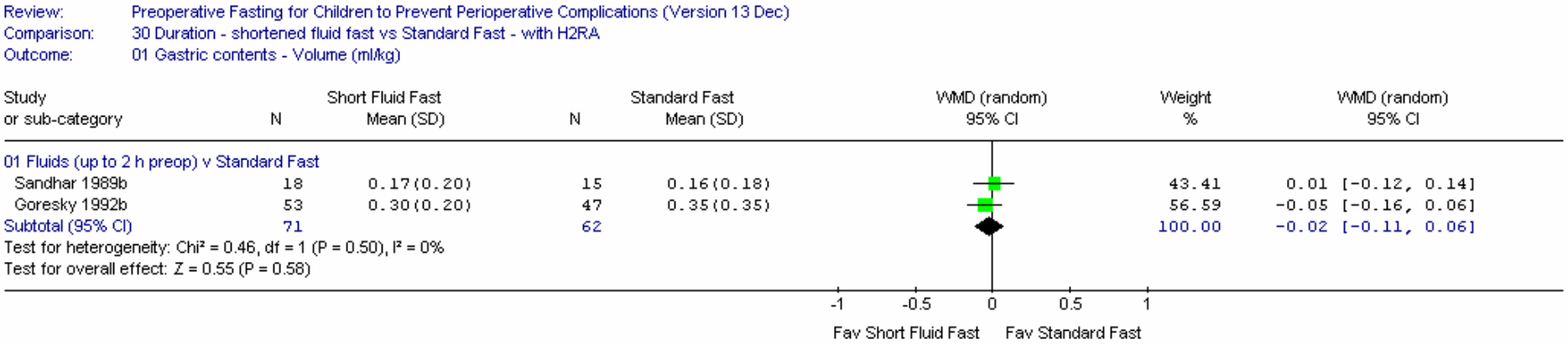
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.33 (-0.49 -0.17)	0.38	1	0.54	0	Statistically significantly in favour of PPIs – mean decrease 0.33 ml/kg
Gastric pH (WMD)	0.95 (-0.01 1.91)	5.68	1	0.02	82	Heterogeneous

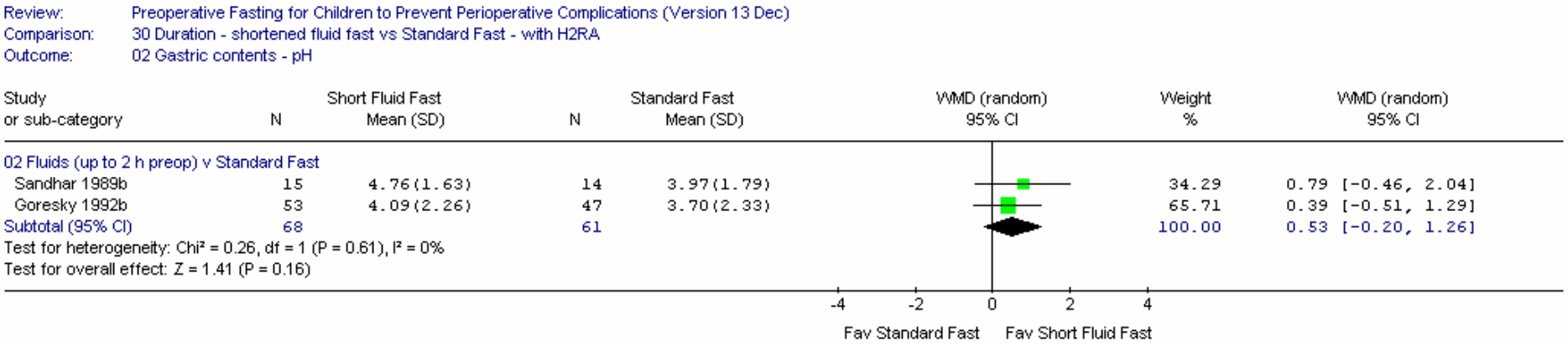
Head-to-head PPI vs. placebo in presence of shortened fluid fast – PPI given at 9pm and 3h preoperatively

Comments Mikawa et al., 1995 and Nishina et al., 1994 (apple juice at 3 h).

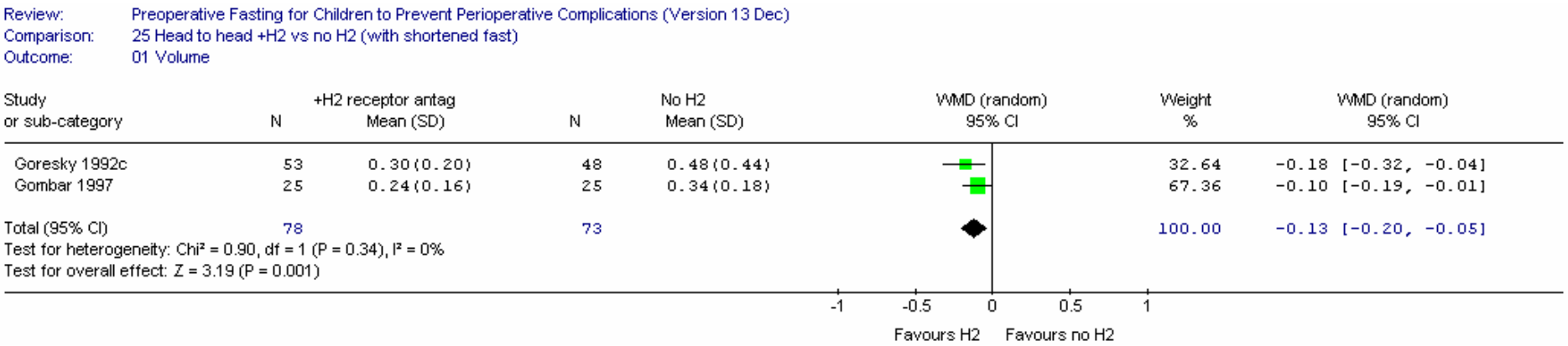
Number of comparisons 2 **Number of patients** 102

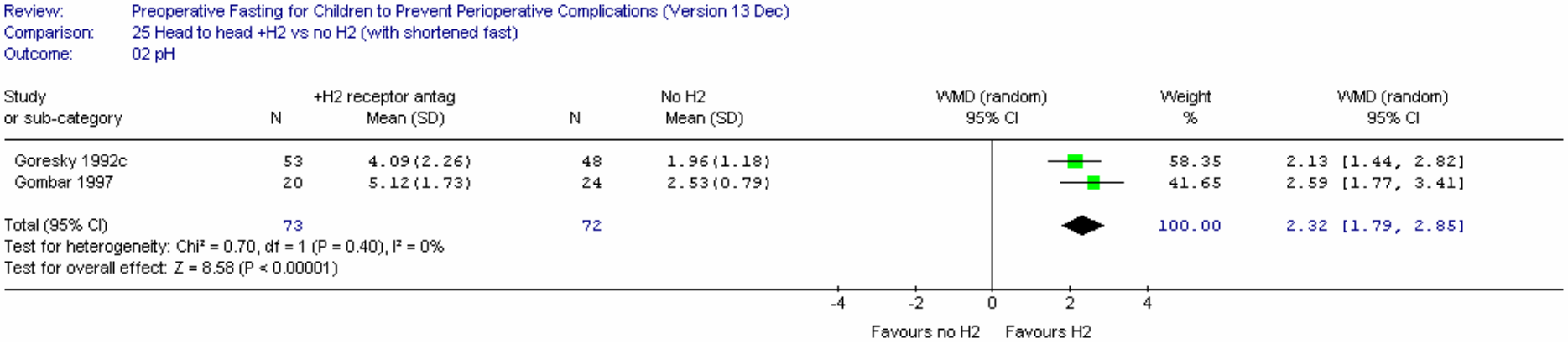
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
Gastric volume (WMD)	-0.44 (-0.60 −0.29)	0.10	1	0.75	0	Statistically significantly in favour of PPIs – mean decrease 0.44 ml/kg
Gastric pH (WMD)	2.97 (2.52 3.41)	0.35	1	0.55	0	Large, statistically significant difference in favour of PPIs – mean increase 2.97


Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 30 Duration - shortened fluid fast vs Standard Fast - with H2RA
Outcome: 01 Gastric contents - Volume (ml/kg)
Study or sub-category
Short Fluid Fast N Mean (SD)
Standard Fast N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
01 Fluids (up to 2 h preop) v Standard Fast
Sandhar 1989b 18 0.17(0.20) 15 0.16(0.18) 43.41 0.01 [-0.12, 0.14]
Goresky 1992b 53 0.30(0.20) 47 0.35(0.35) 56.59 -0.05 [-0.16, 0.06]
Subtotal (95% CI) 71 62 100.00 -0.02 [-0.11, 0.06]
Test for heterogeneity: Chi² = 0.46, df = 1 (P = 0.50), I² = 0%
Test for overall effect: Z = 0.55 (P = 0.58)
-1
-0.5
0
0.5
1
Fav Short Fluid Fast
Fav Standard Fast


Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 13 Dec)
Comparison: 30 Duration - shortened fluid fast vs Standard Fast - with H2RA
Outcome: 02 Gastric contents - pH
Study or sub-category
Short Fluid Fast N Mean (SD)
Standard Fast N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
02 Fluids (up to 2 h preop) v Standard Fast
Sandhar 1989b 15 4.76(1.63) 14 3.97(1.79) 34.29 0.79 [-0.46, 2.04]
Goresky 1992b 53 4.09(2.26) 47 3.70(2.33) 65.71 0.39 [-0.51, 1.29]
Subtotal (95% CI) 68 61 100.00 0.53 [-0.20, 1.26]
Test for heterogeneity: Chi² = 0.26, df = 1 (P = 0.61), I² = 0%
Test for overall effect: Z = 1.41 (P = 0.16)
-4
-2
0
2
4
Fav Standard Fast
Fav Short Fluid Fast

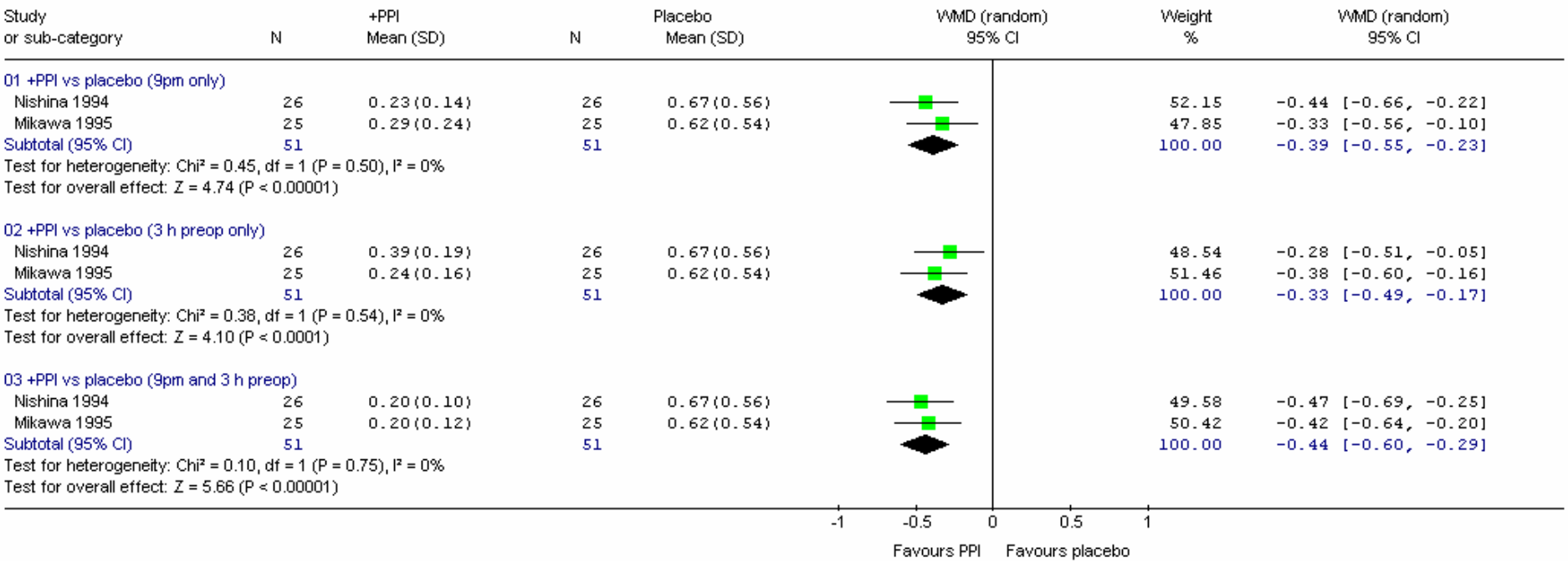
Head-to-head H_2RAs

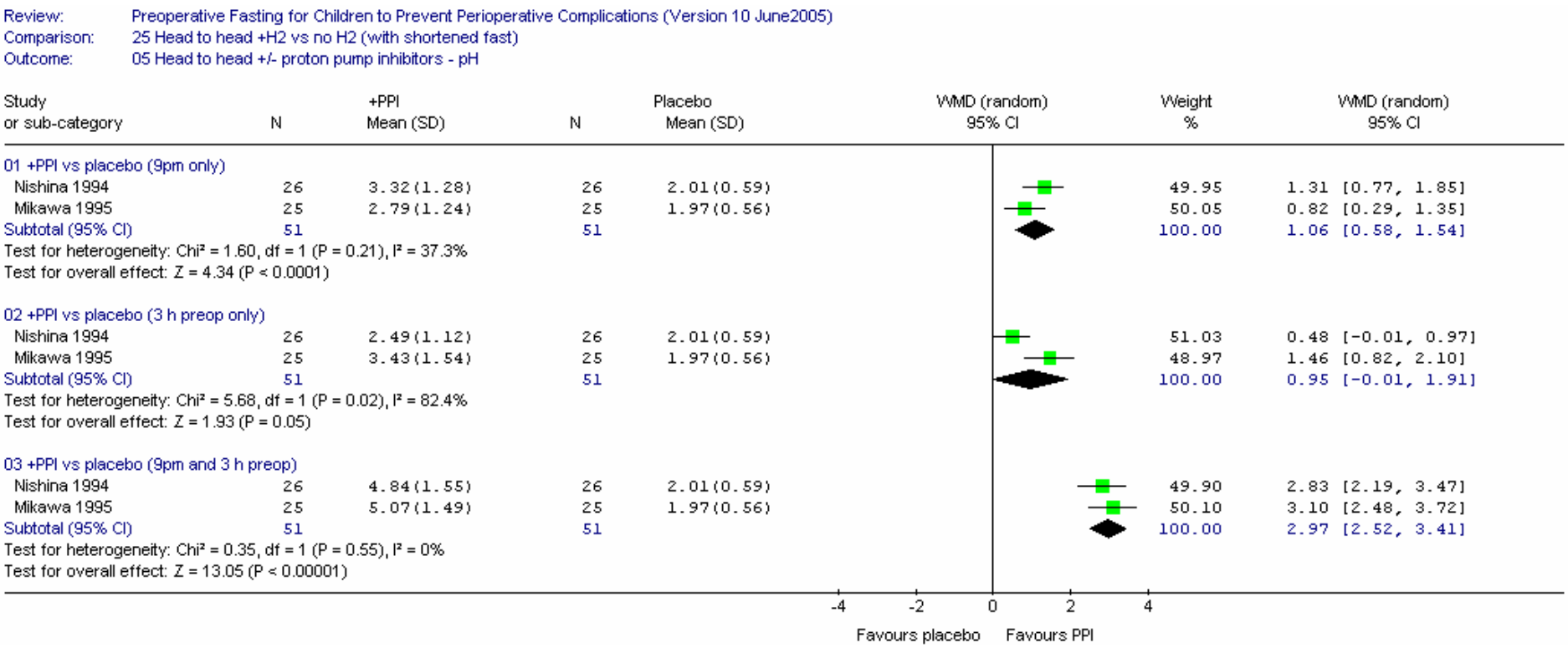




Head-to-head PPIs

Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 10 June2005)
Comparison: 25 Head to head +H2 vs no H2 (with shortened fast)
Outcome: 04 Head to head +/- proton pump inhibitors - volume




Review: Preoperative Fasting for Children to Prevent Perioperative Complications (Version 10 June2005)
Comparison: 25 Head to head +H2 vs no H2 (with shortened fast)
Outcome: 05 Head to head +/- proton pump inhibitors - pH
Study or sub-category
+PPI N Mean (SD)
Placebo N Mean (SD)
WMD (random) 95% CI
Weight %
WMD (random) 95% CI
01 +PPI vs placebo (9pm only)
Nishina 1994 26 3.32(1.28) 26 2.01(0.59) 49.95 1.31 [0.77, 1.85]
Mikawa 1995 25 2.79(1.24) 25 1.97(0.56) 50.05 0.82 [0.29, 1.35]
Subtotal (95% CI) 51 51 100.00 1.06 [0.58, 1.54]
Test for heterogeneity: Chi² = 1.60, df = 1 (P = 0.21), I² = 37.3%
Test for overall effect: Z = 4.34 (P < 0.0001)
02 +PPI vs placebo (3 h preop only)
Nishina 1994 26 2.49(1.12) 26 2.01(0.59) 51.03 0.48 [-0.01, 0.97]
Mikawa 1995 25 3.43(1.54) 25 1.97(0.56) 48.97 1.46 [0.82, 2.10]
Subtotal (95% CI) 51 51 100.00 0.95 [-0.01, 1.91]
Test for heterogeneity: Chi² = 5.68, df = 1 (P = 0.02), I² = 82.4%
Test for overall effect: Z = 1.93 (P = 0.05)
03 +PPI vs placebo (9pm and 3 h preop)
Nishina 1994 26 4.84(1.55) 26 2.01(0.59) 49.90 2.83 [2.19, 3.47]
Mikawa 1995 25 5.07(1.49) 25 1.97(0.56) 50.10 3.10 [2.48, 3.72]
Subtotal (95% CI) 51 51 100.00 2.97 [2.52, 3.41]
Test for heterogeneity: Chi² = 0.35, df = 1 (P = 0.55), I² = 0%
Test for overall effect: Z = 13.05 (P < 0.00001)
-4
-2
0
2
4
Favours placebo
Favours PPI

Appendix B16: Paediatric postoperative included studies

Study	Number of patients	ASA group	Study design	Operation type	Interventions	Preop fast	Pre-med	Study comments
Infants and children only								
Kearney et al., 1998	317	I-II	RCT	Elective day surgery requiring iv catheter: including strabismus, adenoidectomy+/- tonsillectomy, dental, urological, plastic; all had general anaesthesia. Exclusions: not stated.	1. Oral fluids required to be tolerated before discharge (unrestricted amount; n=189). 2. Oral fluids withheld for 4 h (age <2 years) or 6 h (age 2-16 years) (n=128).	2 h	ns	No premedication reported; analgesia included opioids (~70%); anti-emetics were given to 34-38%; gender (M:F=191:126; iv fluids also given; 21% of procedures had a higher risk of PONV. Age 1 month to 16 years.
Schreiner et al., 1992	1002	I-II	RCT	Elective day surgery requiring iv catheter: mainly general surgery, plus ENT, genito-urological, eye and orthopaedic. All had general anaesthesia. Exclusions: not stated.	1. Mandatory clear fluids (minimum 60 ml) prior to discharge (n=464). 2. Patients allowed clear fluids, but not required, to drink before discharge (n=525).	2 h	y	80% patients received opioid as premedication on in the operating room; analgesia included opioids (~10%); anti-emetics were given to 5-9%; gender M:F=654:335; iv fluids also given; 14% of procedures had a higher risk of PONV. Age less than 1 to 18 years.
Infants, children and adults								
Van den Berg et al., 1987	200	Unclear	Prospective non-randomised study.	Ophthalmic surgery; 20 - 190 min duration of anaesthesia. Patients randomised to anti-emetics. General anaesthesia. Exclusions not stated.	1.30 ml fluids (sips) offered hourly when patients awake (n=100). 2. No oral fluids in first 2 h in infants and children or 4 h in adults (n=100).	ns	y	Morphine and atropine premedication in all patients; iv fluids continued postoperatively until oral fluids tolerated; anti-emetics given for PONV; opioid drugs for analgesia; gender (M:F): 124:76; adult/child numbers not stated; age range less than 1 to 83 years

Appendix B17: Excluded studies – paediatric postoperative review

Study	Reason for exclusion
Harris et al., 1990	Retrospective observational study.

Appendix B18: Quality of included studies, postoperative, in paediatric patients

Randomised studies

Study	Generation code	Conceal ment	Outcome blinding	ITT code	ITT details	Power calculation	Base-line OK	Baseline comments	Overall comments
Kearney et al., 1998	Unclear (randomised as cohorts on alternating months).	Unclear	Unclear (anesthesiologists blinded).	No (patients reassigned to new groups).	1% of fluids group and 7% of later fluids group noncompliant and reassigned to 'correct' groups.	Yes	Some comp-arable.	Mean age, gender, weight, anti-emetics, opioid analgesia all comparable; type of surgery and iv fluids received were significantly different.	Fluids group had patients having surgery with a higher risk of PONV; also had much less iv fluids (total fluids less for fluids group than the later intake group).
Schreiner et al., 1992	Unclear (randomised on alternating weeks to interventions) .	Unclear	Unclear (anesthesiologist caring for patient not blinded).	No (≤ 20% dropouts).	13 patients were excluded.	Not stated.	Some comp-arable.	Gender, type of surgery, type of premedication, opioid analgesia all comparable; slight differences in age, weight and duration of surgery.	Patients in mandatory group were slightly older and heavier, and had a longer duration of surgery (not clinically significant); the mandatory group received fewer anti-emetics.

Non-randomised studies

Study	**Prospective**	**All eligible selected**	**Outcome blinding**	**ITT code**	**ITT details**	**Baseline OK?**	**Baseline comments**	**Overall comments**
Van den Berg et al., 1987	Yes	Yes	No (nursing staff knew groups).	Yes		Yes	Age, gender, weight, duration of anaesthesia, recovery time all comparable. Type of antiemetic assumed comparable.	First 100 patients assigned to early fluids, 2nd 100 to NPO group.

Appendix B19: Paediatric postoperative studies by comparison

Type of fluid or solid: early mandatory fluids vs. withheld fluids

Comments Single study (Kearney et al., 1998).

Number of comparisons 1 **Number of patients** 317

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
No. patients with vomiting in DSU (RR)	1.81 (1.23 2.64)			1 trial		Statistically significantly in favour of later fluids (2 times risk)
No. patients with vomiting after 24 h (RR)	1.35 (0.97 1.89)			1 trial		In favour of later fluids, borderline significance (p=0.07)
No. patients with vomiting overall (RR)	1.47 (1.14 1.89)			1 trial		Statistically significantly in favour of later fluids (2/3 risk)

Type of fluid or solid: mandatory fluids vs. elective fluids

Comments Single study (Schreiner et al., 1992).

Number of comparisons 1 **Number of patients** 1002

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
No. patients with vomiting in DSU (RR)	1.64 (1.25 2.14)			1 trial		Statistically significantly in favour of elective drinking (2/3 times risk)
No. patients with vomiting after 24 h (RR)	1.03 (0.84 1.27)			1 trial		Little difference
No. patients with vomiting overall (RR)	1.22 (1.03 1.44)			1 trial		Statistically significantly in favour of elective drinking (5/6 times risk)

Type of fluid or solid: mandatory fluids vs. withheld or elective fluids

Comments Meta-analysis of two studies comparing mandatory fluids with elective fluids or later fluids.

Number of comparisons 2 **Number of patients** 1306

Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
No. patients with vomiting in DSU (RR)	1.69 (1.36 2.11)	0.17	1	0.68	0	Statistically significantly against mandatory fluids (risk increased by 1.7 times)
No. patients with vomiting after 24 h (RR)	1.15 (0.88 1.48)	1.85	1	0.17	46	Little difference
No. patients with vomiting overall (RR)	1.30 (1.10 1.55)	1.40	1	0.24	29	Statistically significantly against mandatory fluids (1.3 times risk);

Type of fluid or solid: early fluids sips vs. later fluids sips

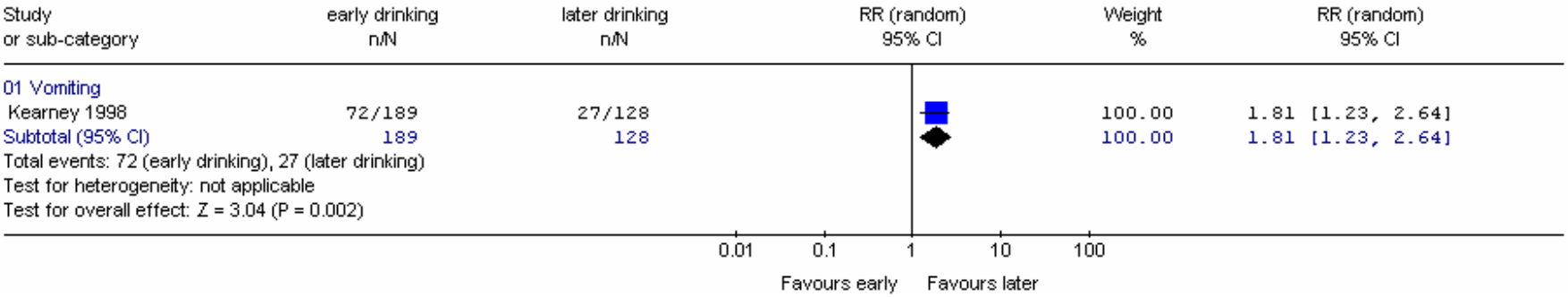
Comments Prospective non-randomised study; infants, children and adults; general anaesthesia.

Number of comparisons 1 **Number of patients** 200

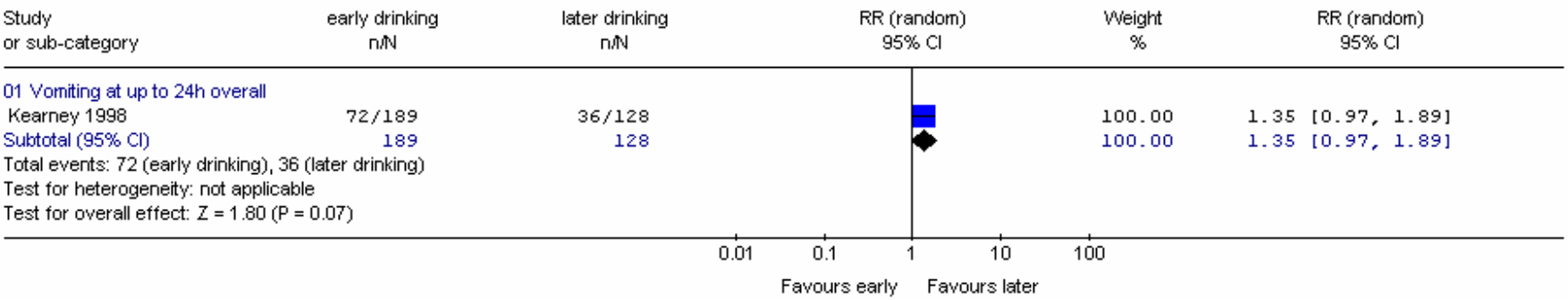
Outcome	WMD / RR / OR (95%CI)	Chi^2	df	p (hetero)	I^2	Comments
No. patients with vomiting overall (RR)	0.74 (0.45 1.23)			1 trial		Favours early fluids, not significantly

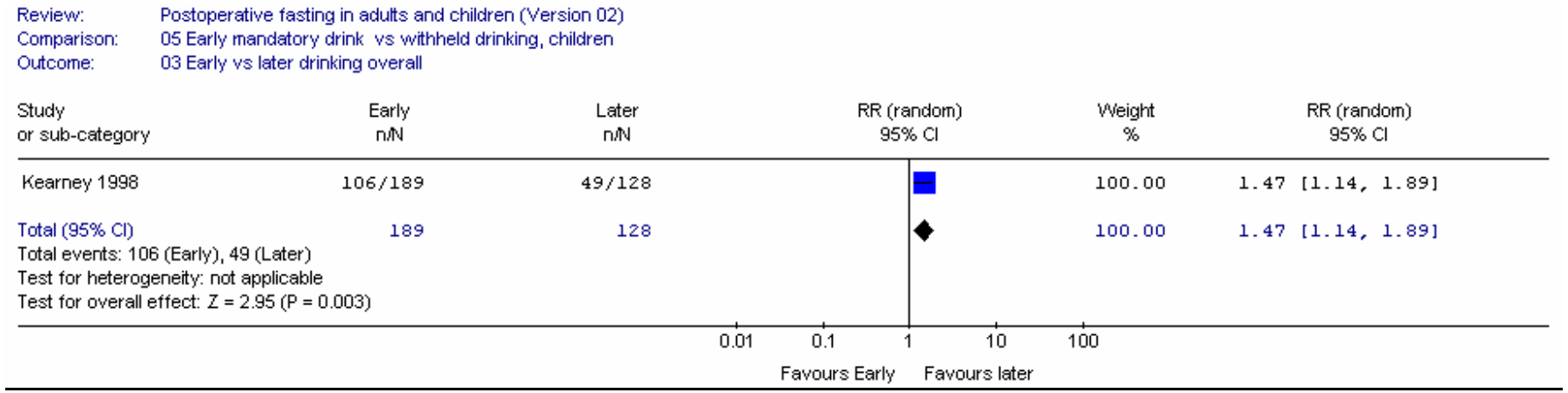
Mandatory drinking vs. fluids withheld

Review: Postoperative fasting in adults and children (Version 02)
Comparison: 05 Early mandatory drink vs withheld drinking, children
Outcome: 01 early vs later; in DSU

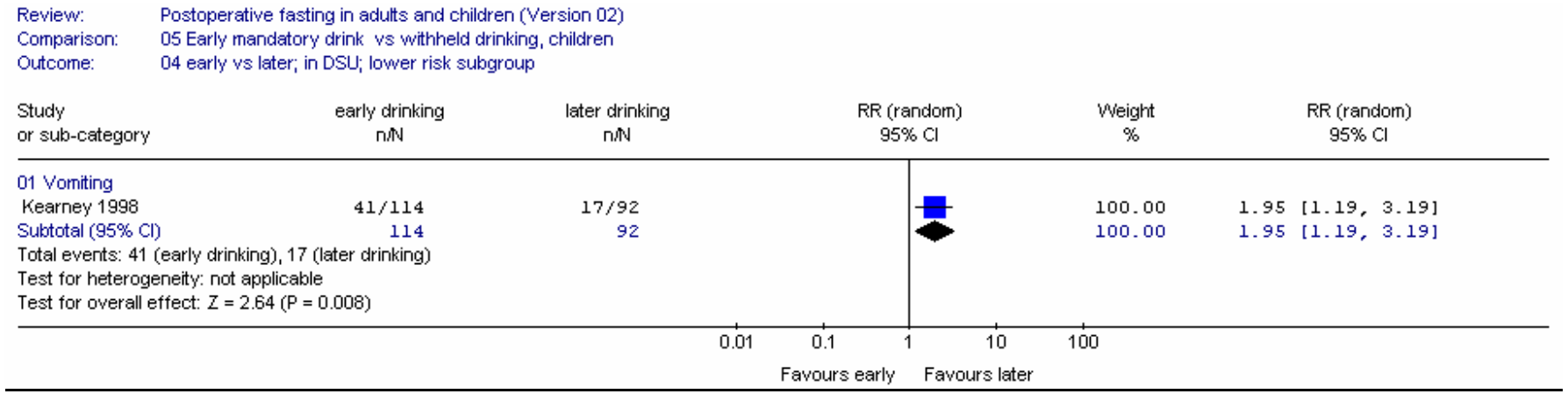


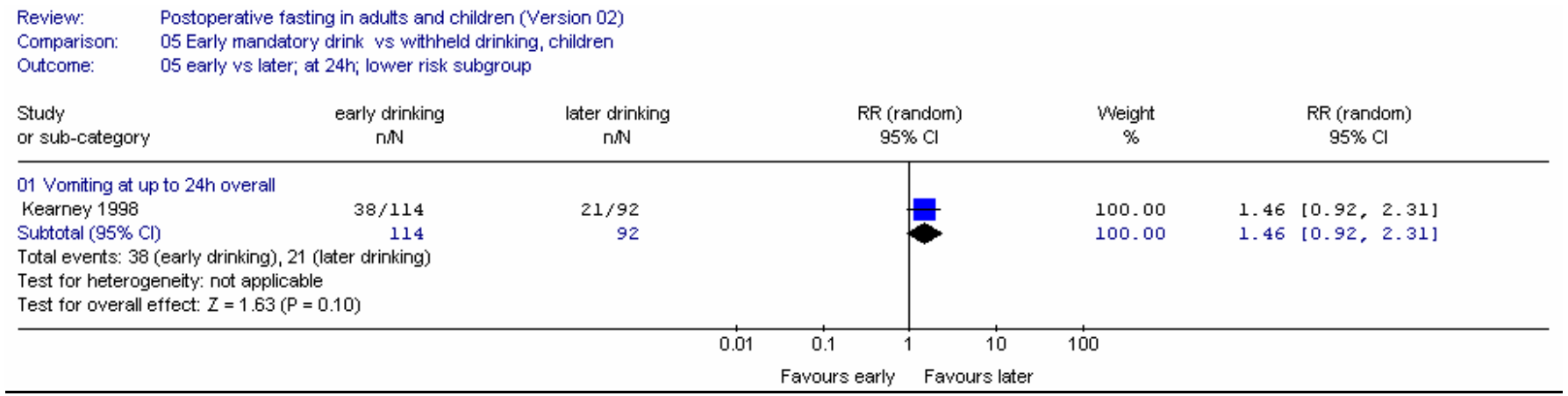
Review: Postoperative fasting in adults and children (Version 02)
Comparison: 05 Early mandatory drink vs withheld drinking, children
Outcome: 02 early vs later; at 24h



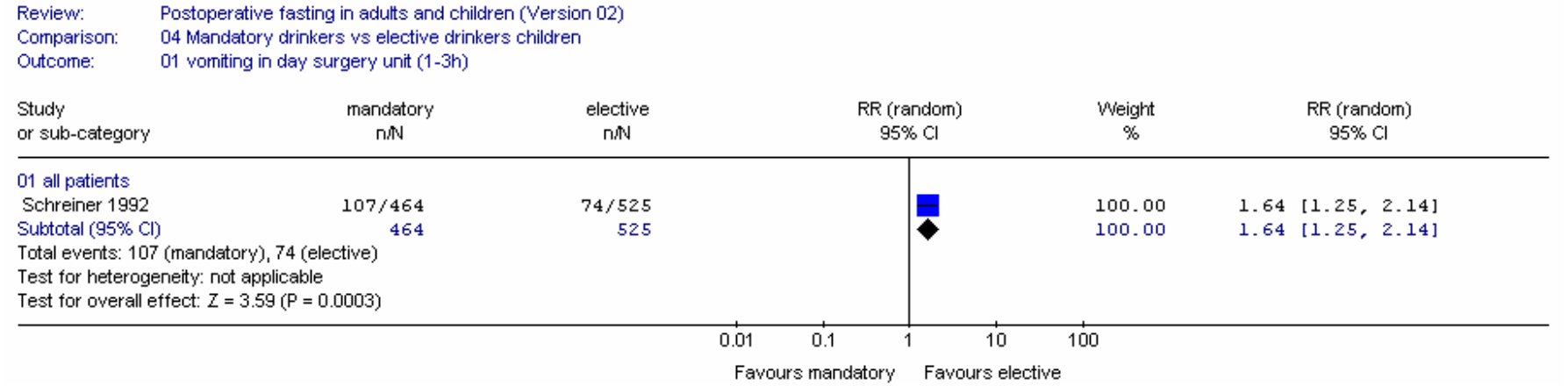


Lower risk sub-group

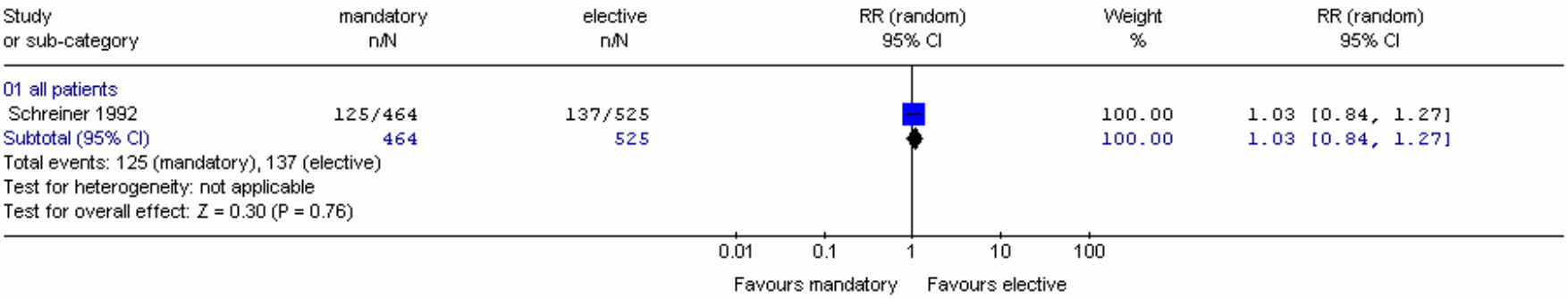




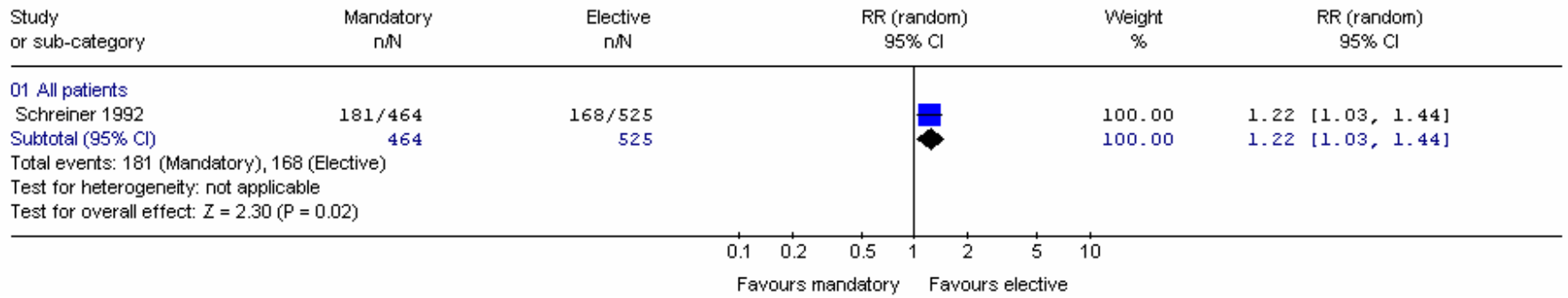
Mandatory drinking vs. elective drinking



Review: Postoperative fasting in adults and children (Version 02)
Comparison: 04 Mandatory drinkers vs elective drinkers children
Outcome: 02 vomiting after 24h (post discharge)

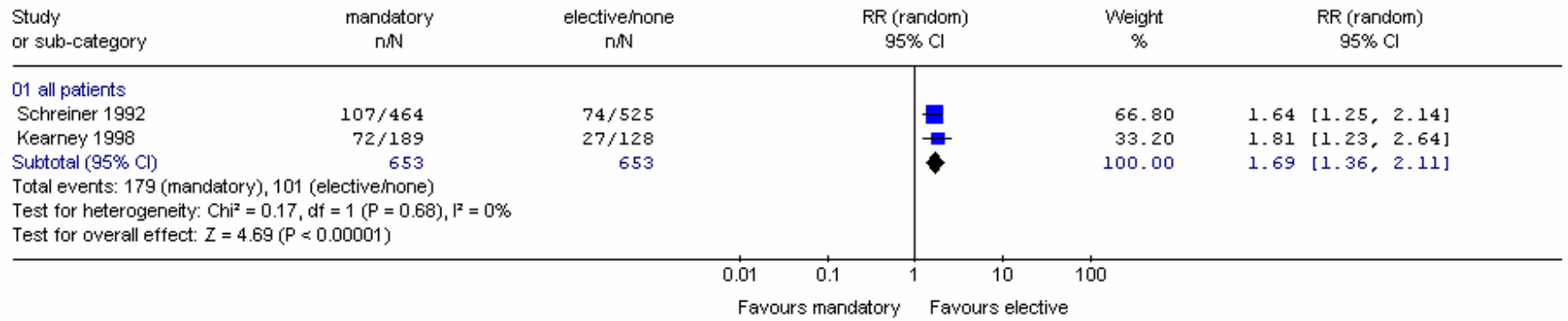


Review: Postoperative fasting in adults and children (Version 02)
Comparison: 04 Mandatory drinkers vs elective drinkers children
Outcome: 03 Total vomiting incidence up to 24h

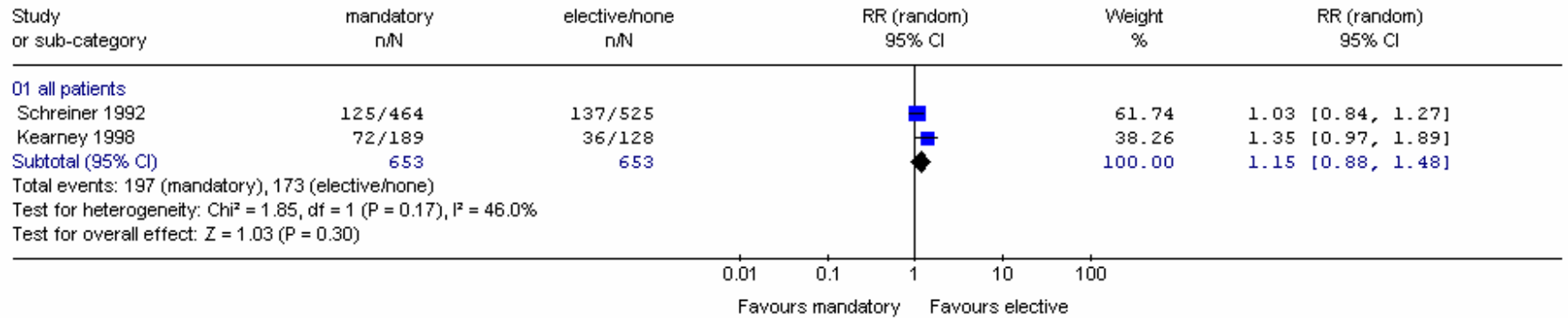


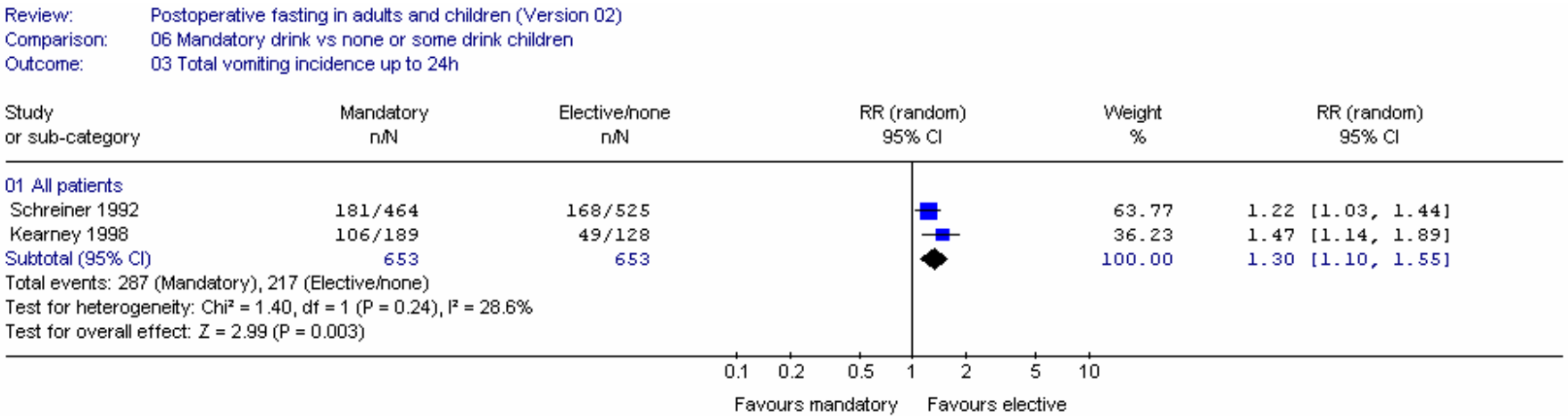
Mandatory drinking vs. elective or withheld fluids

Review: Postoperative fasting in adults and children (Version 02)
Comparison: 06 Mandatory drink vs none or some drink children
Outcome: 01 vomiting in day surgery unit (1-3h)

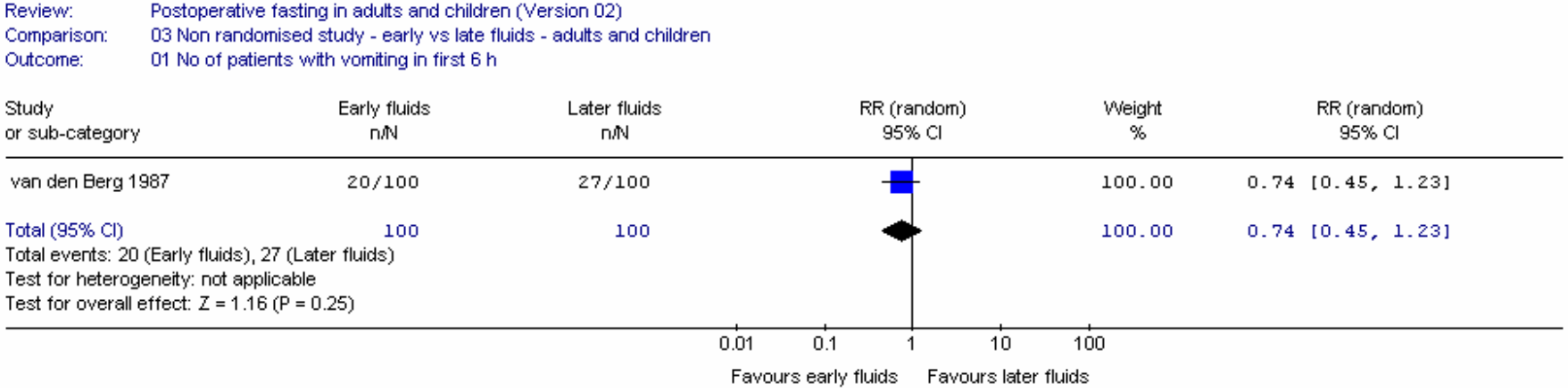


Review: Postoperative fasting in adults and children (Version 02)
Comparison: 06 Mandatory drink vs none or some drink children
Outcome: 02 vomiting after 24h (post discharge)





Non-randomised study – infants, children and adults



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CLINICAL PRACTICE GUIDELINES

Published by the Royal College of Nursing
20 Cavendish Square, London, W1G 0RN

Telephone: 020 7409 3333

November 2005

ISBN: 1-904114-20-2

Publication code: 002 800

Royal College of Nursing