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Reduced salt intake compared to normal dietary salt, or high intake, in pregnancy (Review)

Duley L, Henderson-Smart DJ

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TABLE OF CONTENTS

[Intervention Review]

Reduced salt intake compared to normal dietary salt, or high intake, in pregnancy

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ABSTRACT

Background

In the past women have been advised that lowering their salt intake might reduce their risk of pre-eclampsia. Although this practice has largely ceased, it remains important to assess the evidence about possible effects of advice to alter dietary salt intake during pregnancy.

Objectives

The objective of this review was to assess the effects of dietary advice to alter salt intake compared to continuing a normal diet, on the risk of pre-eclampsia and its consequences.

Search methods

We searched the register of trials maintained and updated by the Cochrane Pregnancy and Childbirth Group, and the Cochrane Controlled Trials Register Disc Issue 4, 1998.

Selection criteria

Studies were included if they were randomised trials of advice to either reduce or to increase dietary salt during pregnancy.

Data collection and analysis

All data were extracted independently by both reviewers.

Main results

Two trials were included, with 603 women. They compared advice about a low salt diet with no dietary advice. The confidence intervals for all of the outcomes reported were wide, and cross the no effect line. This includes pre-eclampsia (relative risk 1.11, 95% confidence interval 0.46 to 2.66). Even when taken together, these trials are insufficient to provide reliable information about the effects of advice on salt restriction during normal pregnancy.

None of the trials included women with pre-eclampsia, so this review provides no reliable information about changes in salt intake for treatment of pre-eclampsia.

Authors' conclusions

Salt consumption during pregnancy should remain a matter of personal preference.

PLAIN LANGUAGE SUMMARY

Reduced salt intake compared to normal dietary salt, or high intake, in pregnancy

To be prepared.

BACKGROUND

In the early part of this century a low salt diet was often recommended as treatment for oedema, in both pregnant and non-pregnant people. At that time oedema was included in the definition of pre-eclampsia, although it is now recognised to be part of normal pregnancy, occurring in 80% of pregnant women. This led to the idea that restricting salt intake would treat, and also prevent, pre-eclampsia (Green 1989). By the 1940s a low salt diet was standard during pregnancy, particularly for women with pre-eclampsia. In the late 1950s and early 1960s this practice began to be questioned, and it was even suggested that high salt intake might prevent or treat pre-eclampsia (UK 1958, UK 1961). Subsequently, interest in salt consumption during pregnancy has largely faded away.

In most parts of the world women are no longer advised by clinicians to alter their salt intake during pregnancy. A notable exception is in the Netherlands where this practice has, until recently, remained widespread. Nevertheless, some lay literature aimed at pregnant women continues to advocate salt restriction during pregnancy.

Salt is a widely used flavour enhancer. Those who are used to salt in their diet may find a low salt diet unpalatable. This may be particularly relevant during the first half of pregnancy when nausea and vomiting is common, and taste can also be altered. Low salt foods can also be less convenient and more expensive than salted alternatives. Women should not be advised to alter their dietary salt during pregnancy unless there is reasonable evidence of benefit.

This review aims to summarise the evidence about the effects of advice to alter dietary salt intake during pregnancy.

OBJECTIVES

To assess the effects of advice to have either a low or a high salt intake, compared to normal dietary salt, during pregnancy on prevention and treatment of pre-eclampsia and its complications.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised controlled trials of advice to alter salt intake during pregnancy. Quasi randomised trials were excluded, as inadequate concealment of the allocation may have introduced bias. For an intervention such as dietary advice where foreknowledge of the allocation may influence recruitment, adequate concealment of the allocation is of particular importance in avoiding bias.

Types of participants

Normal pregnant women, regardless of their risk of pre-eclampsia, and women with pre-eclampsia.

Types of interventions

Any study evaluating dietary advice to alter salt intake during pregnancy.

Types of outcome measures

For the woman: pregnancy-induced hypertension, pre-eclampsia (hypertension with proteinuria), placental abruption, caesarean section, serious maternal morbidity, admission to hospital and use of other hospital resources.
For the baby: death, prematurity, birthweight, intrauterine growth restriction, admission to special care nursery, ventilation, measures of long term growth and development.

Search methods for identification of studies

Electronic searches

The register of trials maintained by the Pregnancy and Childbirth Group was searched for relevant trials. The Cochrane Controlled Trial Register, Disc Issue 4 1998, was also searched.

Data collection and analysis

Trials were checked for inclusion criteria and data were extracted independently by both reviewers. Discrepancies were resolved by discussion. There was no blinding of authorship or results. A quality score for concealment of allocation was assigned to each trial, using the following criteria:

(A) adequate concealment of allocation
(B) unclear whether adequate concealment of allocation
(C) inadequate concealment of allocation, quasi-randomisation.

Studies were excluded if either it was not possible to enter data based on intention to treat, or >20% of participants were excluded from that outcome.

RESULTS

Description of studies

The two included trials, involving 603 women, were conducted in the Netherlands. The women in the studies were all healthy and nulliparous. Neither study included women with pre-eclampsia, although one (Netherlands 1998) included women with mild hypertension. Both compared low dietary salt (20 or 50mmol/day) with an unchanged diet. Compliance was assessed by checking urinary sodium excretion. Although this was higher than the target level for the low sodium group, sodium excretion was still lower than for the normal diet group.

There was no blinding of the intervention and, although it is not mentioned in the reports, blinding of outcome assessment is unlikely.

Risk of bias in included studies

For both trials allocation was adequately concealed. One (Netherlands 1997) was conducted in two centres, and subsets of data from both hospitals have been published in a wide variety of formats. Ten per cent of women in this study were excluded from the analyses, and the proportion was higher in the low salt group as 17 women did not want to use the recommended diet. The other study (Netherlands 1998) involved eight centres and there was complete follow-up for all women.

Effects of interventions

Two trials were included, with data reported for 603 women. Both compared advice to restrict dietary salt with advice to continue a normal diet. Confidence intervals for all the outcomes reported in this review are wide, and cross the no effect line. For example, the relative risk for pre-eclampsia is 1.11, 95% confidence interval 0.44-2.78. This means that the true effect could be anything from over a halving in the risk of pre-eclampsia associated with salt restriction to a more than doubling.

No included trials evaluated a high salt diet, and none included women with established pre-eclampsia.

DISCUSSION

The aim of this review was to evaluate the effect of advice about dietary salt during pregnancy. Both trials evaluated advice on a low salt diet, and in both the low salt group did have lower urinary excretion than the normal diet group.

The trials in this review were not large and, even when taken together, they are insufficient to provide reliable information about the effects of advice to restrict salt intake during normal pregnancy. None of the trials enrolled women with pre-eclampsia, so this review provides no information about the effects of advice to restrict salt intake for treatment of pre-eclampsia.

Women's preferences were not reported. However, in one study (Netherlands 1997) 13% of women in the salt restriction arm were excluded as they did not want to follow the diet. In the other study only 24% of women successfully reduced their urinary sodium excretion to below the target level. This was presumed to be because a low salt diet is not very palatable and is therefore difficult to follow.

Although no included trials evaluated a high salt diet, three excluded studies did. In one study this was to evaluate prevention of pre-eclampsia (UK 1958), and in the other two salt was used for treatment of pre-eclampsia (UK 1961, USA 1961). All were excluded because the use of a quasi randomised design introduced substantial potential for bias. In the largest trial (2077 women) the relative risk for pre-eclampsia was 0.45, 95% confidence interval (0.26-0.75), a reduction that appeared to be reflected in fewer complications (UK 1958). The excluded trials of salt for treatment of pre-eclampsia involved nearly 1000 women, and neither detected any effect on the course of pre-eclampsia. In view of the methodological limitations of these studies it is difficult to draw firm conclusions, beyond saying that it seems unlikely that a high salt diet will increase the risk of pre-eclampsia.

AUTHORS' CONCLUSIONS

Implications for practice

A low salt diet is often unpalatable. In the absence of evidence that advice to reduce salt intake during pregnancy has any beneficial effect in prevention or treatment of pre-eclampsia, or of any other outcome, salt consumption during pregnancy should remain a matter of personal preference.

Implications for research

Salt restriction during pregnancy does not seem promising for the prevention of pre-eclampsia. Very large numbers of women would need to be randomised to detect a moderate-small effect. Such trials might be justified in the context of a setting where this form of dietary advice was already widespread practice, but they would be difficult to justify elsewhere. Unless new and plausible hypotheses emerge, further trials of salt intake are unlikely to be a priority.

ACKNOWLEDGEMENTS

None.

REFERENCES

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Netherlands 1997 *{published data only}*

Steegers EAP, Van Lakwijk HPJM, Jongsma HW, Fast JH, De Boo T, Eskes TKAB, et al. (Patho)physiological implications of chronic dietary sodium restriction during pregnancy; a longitudinal prospective randomized study. *Br J Obstet Gynaecol* 1991;**98**:980-7.

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Netherlands 1998 *{published data only}*

Knuist M, Bonsel GJ, Zondervan HA, Treffers PE. Low sodium diet and pregnancy-induced hypertension: a multi-centre randomised controlled trial. *Br J Obstet Gynaecol* 1998;**105**:430-434.

References to studies excluded from this review

Australia 1986a *{published data only}*

Brown MA, Gallery EDM. Sodium excretion in human pregnancy: a role for arginine vasopressin. *Am J Obstet Gynecol* 1986;**154**:914-919.

Australia 1986b *{published data only}*

Brown MA, Sinosich MJ, Saunders DM, Gallery EDM. Potassium regulation and progesterone-aldosterone interrelationships in human pregnancy: a prospective study. *Am J Obstet Gynecol* 1986;**155**:349-353.

UK 1958 *{published data only}*

Robinson M. Salt in pregnancy. *Lancet* 1958;**1**:178-181.

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Bower D. The influence of dietary salt intake on pre-eclampsia. *J Obstet Gynaecol Br Cmmwlth* 1961;**63**:123-126.

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Duley L. Low vs high salt intake in pregnancy.. *Keirse MJNC, Renfrew MJ, Neilson JP, Crowther C (eds.) Pregnancy and Childbirth Module. In: The Cochrane Pregnancy and Childbirth Database.* 1995, Issue 2.

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Netherlands 1997

Methods	"Closed envelope system", no further information. 28 women (10%) women excluded. Low salt 23 excluded: 17 refused diet, 3 social reasons, 2 medical reasons, 1 fetal trisomy. Normal salt 5 excluded: 2 social reasons, 3 medical reasons.
Participants	270 nulliparous women with a singleton pregnancy after 12 weeks, by dates and ultrasound. Excluded if pre-existing HT, diabetes, renal disease, cardiovascular disease.
Interventions	Low: diet with about 20mmol sodium per day. Oral and written instruction by dietician, no added salt and ready made foods only if no salt in preparation. Normal: no dietary restriction.

Netherlands 1997 *(Continued)*

Outcomes	Woman: PIH, PE, severe HT, small for gestational age, preterm delivery Baby: death.
Notes	Mean urinary sodium after randomisation was around 70mmol/day in the low sodium group and 135mmol/day in the normal diet group.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Netherlands 1998

Methods	Sealed numbered opaque envelopes. Blocks of 10 stratified by centre.
Participants	361 women booked for midwifery care, nulliparous, DBP <90mmHg at booking visit before 20 weeks. Randomised if DBP >85 x2 in subsequent visit, or weight gain >1kg/week for 3 consecutive weeks, or excess oedema. Excluded if planning to leave the city or risk factors for PIH.
Interventions	Low: sodium restricted diet, aimed at less than 50mmol/day. Written dietary instructions given by midwife. Normal: asked not to change eating habits.
Outcomes	Woman: highest DBP, pre-eclampsia, eclampsia, referrals and admissions for hypertension, time to delivery, abruption, mode of delivery. Baby: gestation at delivery (mean), birthweight, Apgar at 5 minutes, paediatric admission, death.
Notes	Multicentre study involving 8 midwifery practices. Mean urinary sodium after randomisation 84mmol/day in low sodium group, 124mmol/day for normal diet.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

DBP=diastolic blood pressure, PIH=pregnancy induced hypertension, PE=pre-eclampsia, HT=hypertension

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Australia 1986a	No clinical outcomes reported. Participants: 58 primigravid women. Intervention: one week of either high salt or low salt diet. Study design: 'assigned randomly'.
Australia 1986b	No clinical outcomes reported. Participants: 40 primigravid women. Intervention: one week of either high salt or low salt diet. Study design: 'assigned randomly'.

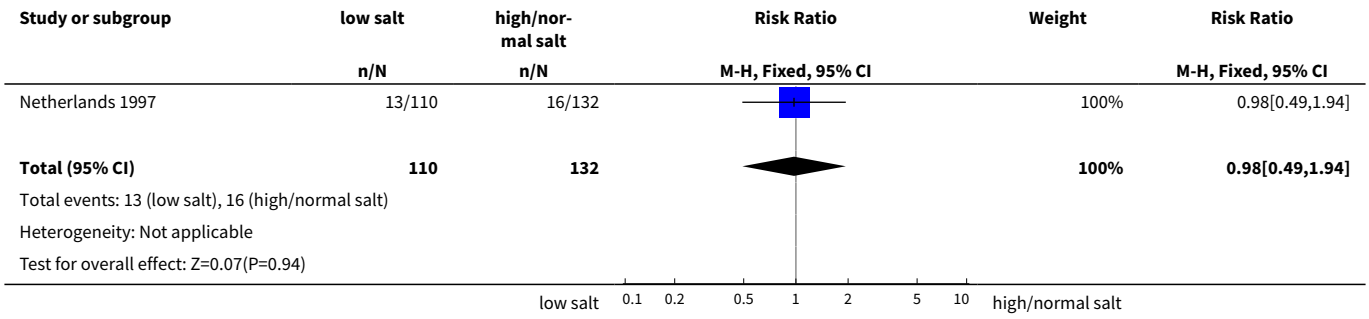
Study	Reason for exclusion
UK 1958	Not a randomised trial. Quasi random, using alternate allocation of women attending clinic. Participants: 2077 women at booking clinic, 58 excluded. Intervention: high salt diet with advice to add salt to diet and eat salty food versus low salt with advice to avoid adding salt to food and not to eat salty food.
UK 1961	Not a randomised trial. Allocation by ward and by consultant. Participants: 739 women with high blood pressure, oedema and proteinuria. Excluded if <24 hours from admission to delivery. Interventions: 2g salt versus 10g versus 25g.
USA 1961	Not a randomised trial. Quasi random using alternate allocation. Participants: 48 women with pre-eclampsia. Interventions: 1-2g salt versus 10-12g.

DATA AND ANALYSES

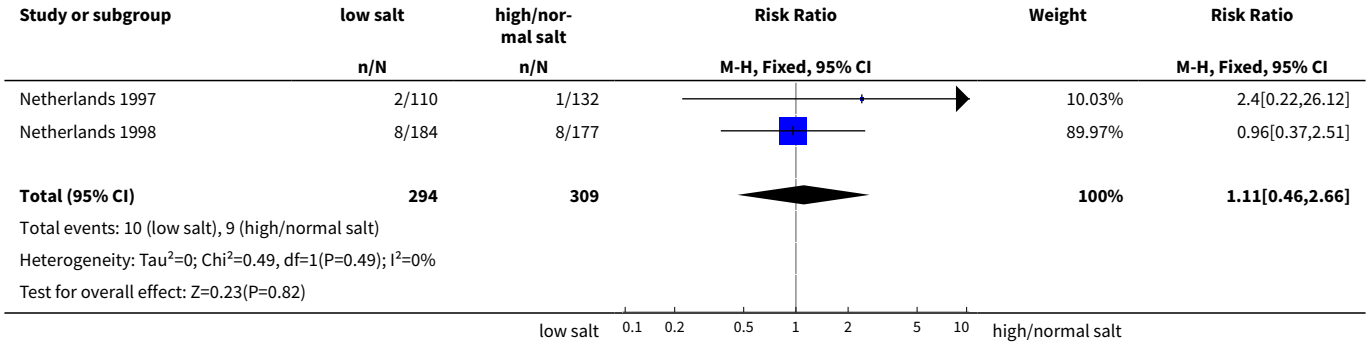
Comparison 1. Low vs normal salt intake in pregnancy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Hypertension	1	242	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.49, 1.94]
2 Pre-eclampsia	2	603	Risk Ratio (M-H, Fixed, 95% CI)	1.11 [0.46, 2.66]
3 Referral to hospital, no admission	1	361	Risk Ratio (M-H, Fixed, 95% CI)	1.05 [0.48, 2.32]
4 Admission to hospital	1	361	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.56, 1.22]
5 Placental abruption	1	361	Risk Ratio (M-H, Fixed, 95% CI)	0.19 [0.01, 3.98]
6 Caesarean section	1	361	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.44, 1.27]
7 Perinatal mortality	2	409	Risk Ratio (M-H, Fixed, 95% CI)	1.92 [0.18, 21.03]
8 Birthweight <10th centile	1	242	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.73, 3.07]
9 Birthweight <2500g	1	361	Risk Ratio (M-H, Fixed, 95% CI)	0.84 [0.42, 1.67]
10 Preterm delivery	1	242	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.46, 2.56]
11 Apgar at 5 min <7	1	361	Risk Ratio (M-H, Fixed, 95% CI)	1.37 [0.53, 3.53]
12 Paediatric admission	1	361	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.69, 1.40]

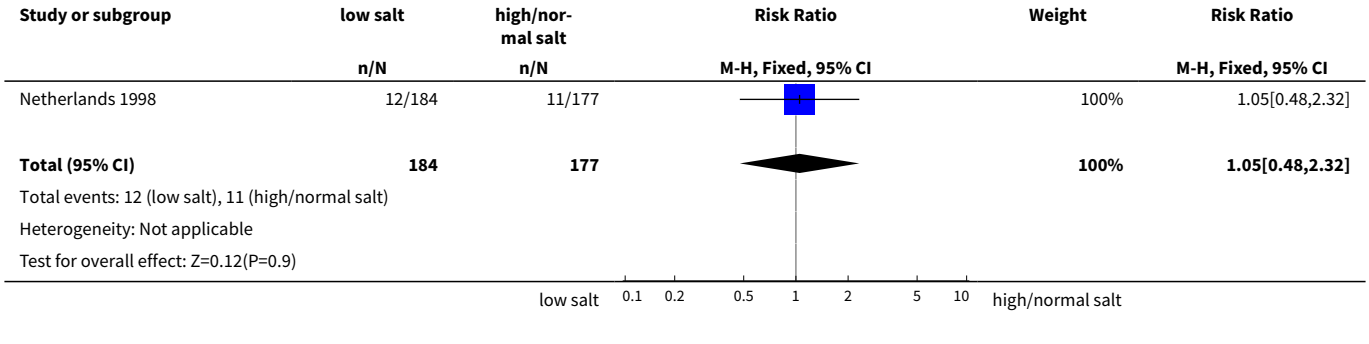
Analysis 1.1. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 1 Hypertension.



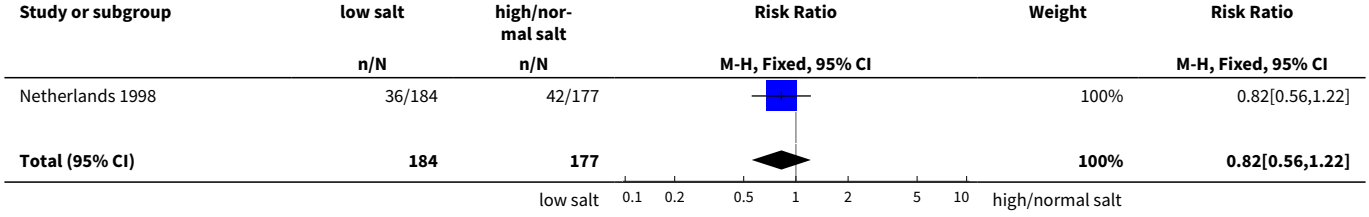
Analysis 1.2. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 2 Pre-eclampsia.

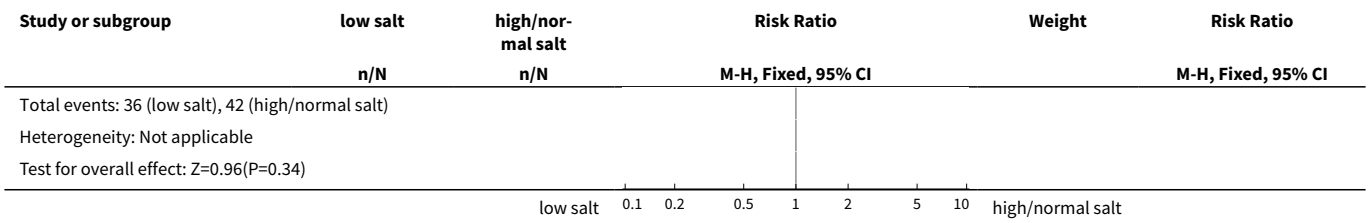


Analysis 1.3. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 3 Referral to hospital, no admission.

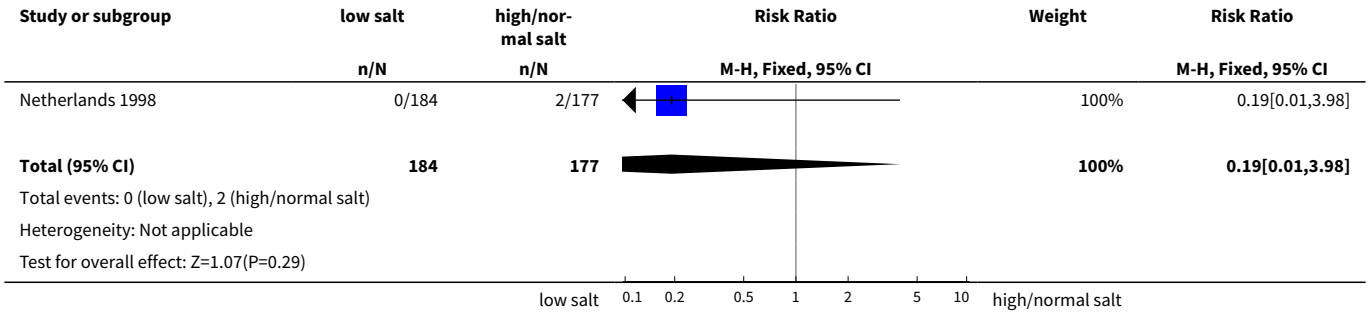


Analysis 1.4. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 4 Admission to hospital.

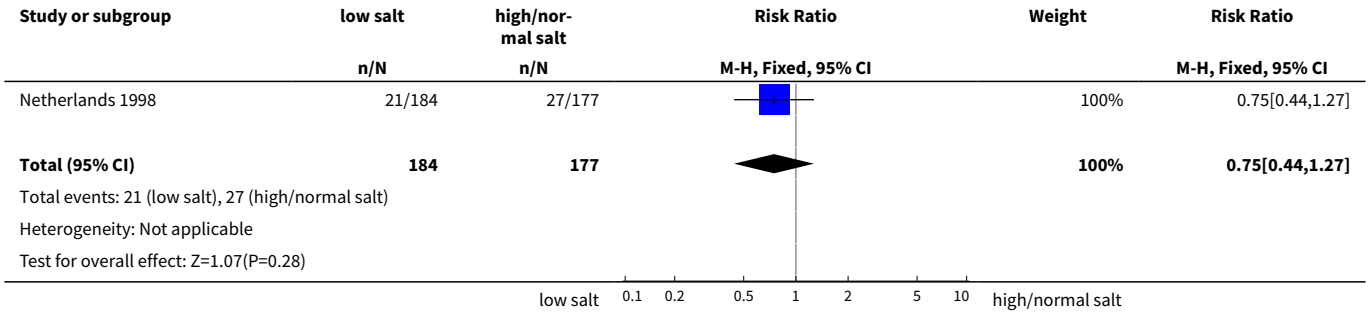




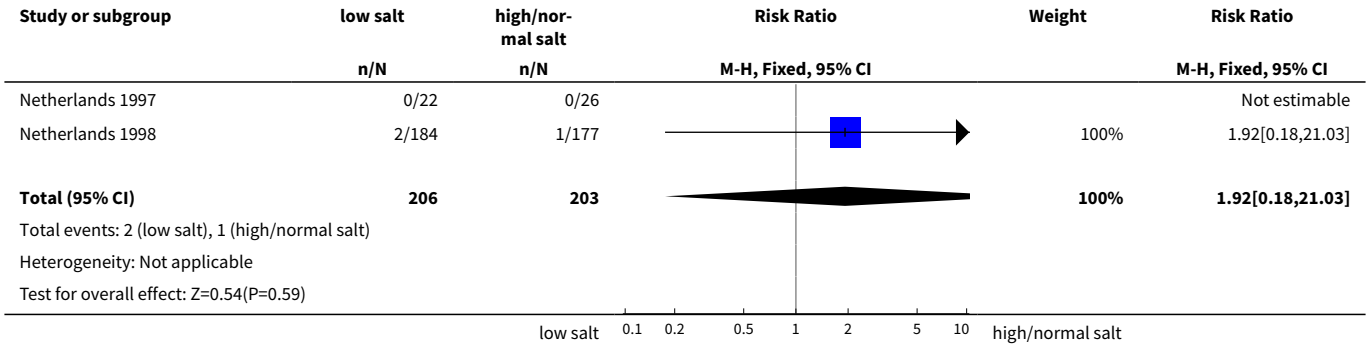
Analysis 1.5. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 5 Placental abruption.



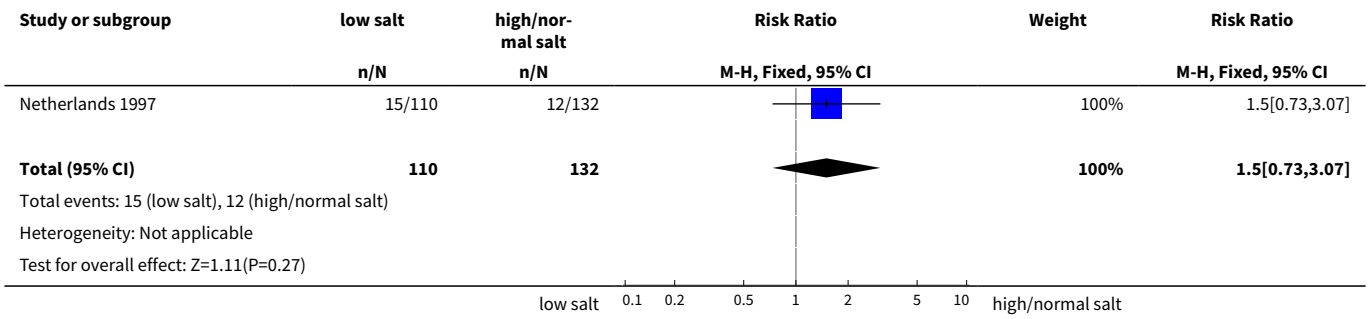
Analysis 1.6. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 6 Caesarean section.



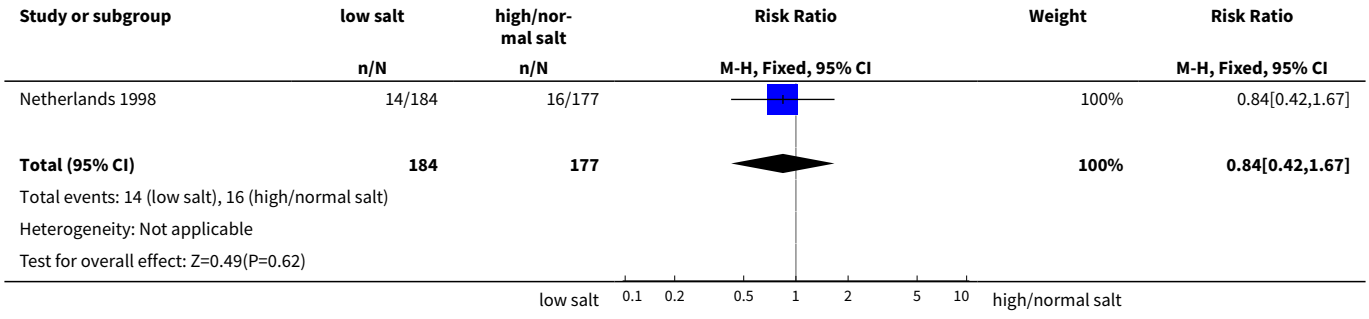
Analysis 1.7. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 7 Perinatal mortality.



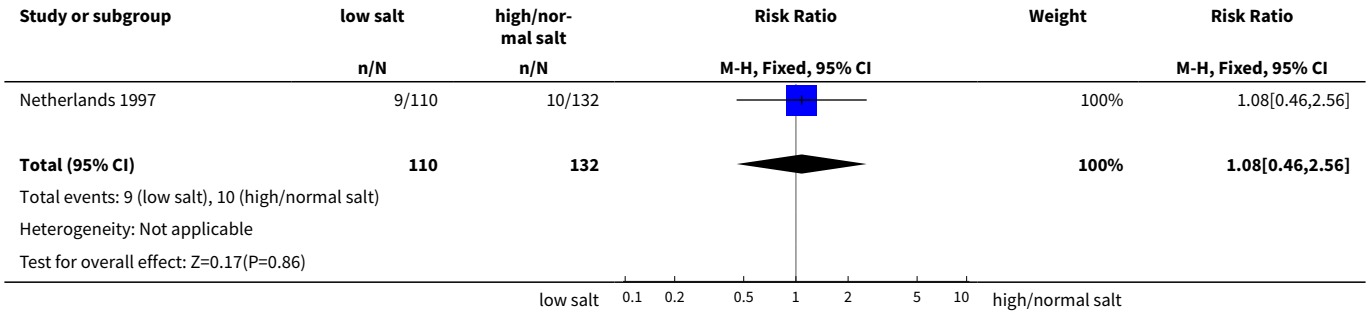
Analysis 1.8. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 8 Birthweight <10th centile.



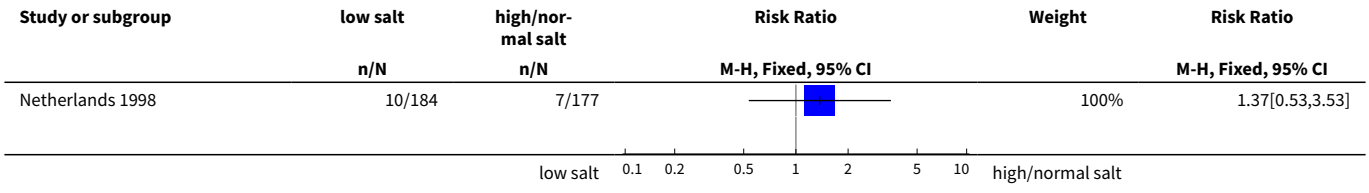
Analysis 1.9. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 9 Birthweight <2500g.

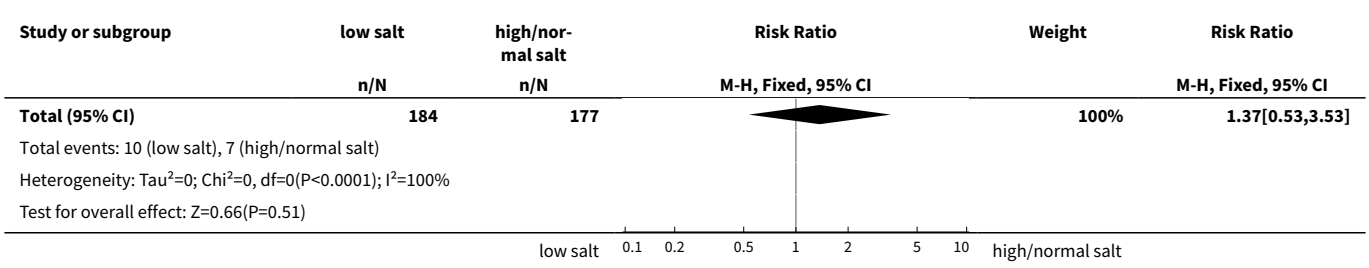


Analysis 1.10. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 10 Preterm delivery.

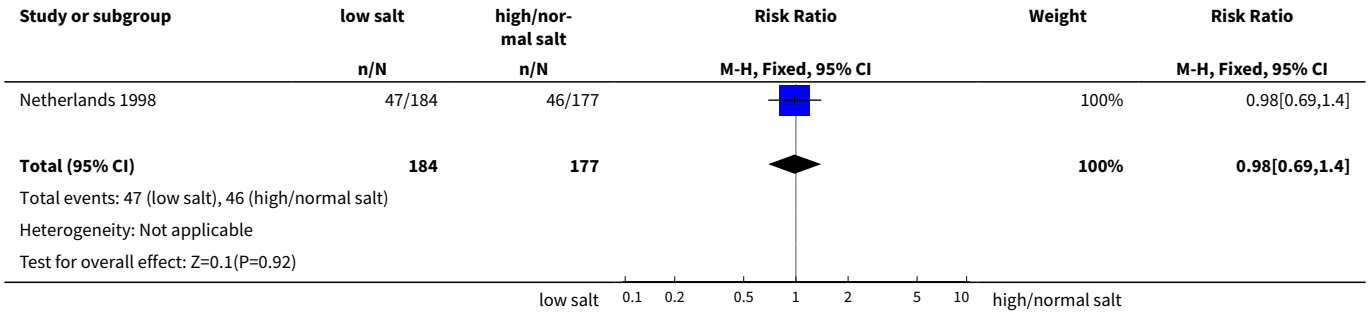


Analysis 1.11. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 11 Apgar at 5 min <7.





Analysis 1.12. Comparison 1 Low vs normal salt intake in pregnancy, Outcome 12 Paediatric admission.



WHAT'S NEW

Date	Event	Description
20 September 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

Data were extracted and checked by both reviewers. The text was drafted by Lelia Duley, with comments from David Henderson-Smart.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Centre for Perinatal Health Services Research, University of Sydney, Australia.

External sources

- Department for Interenational Development, UK.
- Medical Research Council, UK.

NOTES

This review is being updated by the publication of two reviews: one review will evaluate salt intake for preventing pre-eclampsia (see 'Reduced salt intake compared to normal dietary salt, or high intake, in pregnancy') and the other will evaluate salt intake for treating pre-eclampsia. The latter is currently being prepared. Once it has been published, this review will be withdrawn.

INDEX TERMS

Medical Subject Headings (MeSH)

*Prenatal Care; *Sodium, Dietary; Patient Education as Topic

MeSH check words

Female; Humans; Pregnancy