Effects of interventions in pregnancy on maternal weight and obstetric outcomes: meta-analysis of randomised evidence

CRD summary
This review found that dietary and lifestyle interventions in pregnancy could reduce maternal weight gain and improve outcomes for both mother and baby. Interventions based on diet were most effective. The conclusions appropriately reflect the evidence presented but limitations in the evidence base suggests that the findings should be regarded as provisional.

Authors' objectives
To evaluate the effects of dietary and lifestyle interventions in pregnancy on maternal and foetal weight and on obstetric outcomes.

Searching
The authors searched MEDLINE, EMBASE, BIOSIS Previews, LILACS, Science Citation Index, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), DARE, HTA database and PsycINFO to January 2012. They also searched various sources of unpublished studies and grey literature (listed in the paper). No language restrictions were applied. Detailed search terms were not reported. A separate search of MEDLINE and EMBASE to March 2011 was carried out to identify studies reporting on safety of the interventions.

Study selection
Eligible randomised controlled trials (RCTs) evaluated dietary or lifestyle interventions with potential to affect maternal or foetal outcomes related to weight. Studies that involved pregnant women who were underweight (body mass index less than 18.5) were excluded. Primary outcomes were weight related changes in mother and baby. Other maternal and foetal outcomes related to pregnancy were prioritised with a two round Delphi survey of expert clinicians. Interventions were classified as diet based, physical activity based or mixed approach. In addition to RCTs, observational studies, case series and case reports were eligible for the safety review.

Included trials recruited women of any weight or only overweight or obese women. Some included women with gestational diabetes or pre-existing diabetes. Details of interventions varied (reported in an appendix). Control participants in some trials received education or information packs, but there was little information on control groups in general.

Two reviewers independently selected studies for inclusion; any disagreements were resolved by consensus or arbitration by a third reviewer.

Assessment of study quality
Study quality was assessed based on sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting and other potential sources of bias.

Two independent reviewers performed the quality assessment.

Data extraction
Data were extracted to calculate relative risks (RRs) and associated 95% confidence intervals (CIs) for dichotomous outcomes and mean differences for continuous outcomes. For adverse events, data were extracted to calculate the percentage occurrence and relative risks.

Data were extracted by two independent reviewers. The reviewers attempted to obtain missing data by contacting investigators.

Methods of synthesis
Studies were pooled by meta-analysis with fixed-effect models. Heterogeneity was assessed with $I^2$; greater than 50% $I^2$ indicated substantial heterogeneity. Predefined subgroup analyses were used to explore heterogeneity. When heterogeneity was not explained by subgroup analysis a random-effects meta-analysis was performed. Funnel plots were used to display small study effects; funnel plot asymmetry was evaluated with Egger's test. The GRADE system was used to evaluate the overall strength of evidence for key outcomes.

**Results of the review**

**Intervention effects**: Forty-four RCTs (7,278 participants) were included. Quality varied and allocation concealment and blinding for subjective outcomes was unclear in most trials.

Across all interventions, weight gain in pregnancy was significantly reduced by dietary and lifestyle interventions (weighted mean difference, WMD, -1.42kg, 95% CI -1.89 to -0.95; 34 RCTs; $I^2=80\%$). The effect was largest with dietary interventions (WMD -3.84kg, 95% CI -5.22 to -2.45; 10 RCTs; $I^2=92\%$). The difference between subgroups based on intervention type was statistically significant ($p<0.001$).

There were no statistically significant differences overall for birth weight, small for gestational age or large for gestational age. Physical activity interventions significantly reduced birth weight (WMD -60g, 95% CI -120 to -0.10; 14 RCTs; $I^2=0\%$). Strength of evidence was rated as moderate for the primary outcomes. Results for other outcomes and subgroups were reported. Overall evidence rating was low to very low for pre-eclampsia, gestational diabetes, gestational hypertension and preterm delivery.

**Safety**: Two RCTs (277 women) and 24 observational studies (468,581 women) were included. The RCTs evaluated physical activity and did not show an increase in meconium staining of amniotic fluid, uterine atony or chorioamnionitis. Severe reductions in energy intake during pregnancy were associated with a range of adverse effects in babies. There were no significant maternal or foetal adverse effects associated with physical activity during pregnancy.

**Authors' conclusions**

Dietary and lifestyle interventions in pregnancy could reduce maternal weight gain and improve outcomes for both mother and baby. Across the interventions, those based on diet were most effective.

**CRD commentary**

The inclusion criteria were broad but generally clear. The search covered a wide range of relevant sources that included both published and unpublished studies. Search terms were not reported but it seems unlikely that significant relevant studies were missed. Study selection, quality assessment and data extraction were carried out by two reviewers independently, which minimised the risk of errors or bias. Standard methods were used for quality assessment and meta-analysis, including investigation of heterogeneity. Statistical heterogeneity was high for some outcomes, so the appropriateness of statistical pooling was uncertain.

The authors' conclusions generally reflected the evidence presented and seemed appropriate. However, the conclusion that dietary interventions were more effective than other types was limited by being based largely on indirect comparisons; the low quality of evidence for some important outcomes should also be taken into account when interpreting the conclusions. This suggested that the conclusions should be regarded as provisional and supported the authors' call for further research.

**Implications of the review for practice and research**

**Practice**: The authors stated that a balanced diet individualised to the needs of the mother could reduce weight gain in pregnancy by 4kg on average without any evidence of adverse maternal or foetal outcomes. Overweight and obese women benefit most and could be targeted in clinical practice.

**Research**: The authors stated that further evidence synthesis with individual participant data was needed to assess differential effects of dietary and lifestyle interventions on different groups. They also called for better reporting of the interventions and for large prospective studies that focused on important outcomes such as long-term effects on the mother and baby.
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