Nutrition education and counselling provided during pregnancy: effects on maternal, neonatal and child health outcomes
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CRD summary
The authors concluded that nutritional education and counselling, during pregnancy, could reduce the risk of anaemia, increase gestational weight gain, and improve birth weight. Combined with nutrition support, it produced a greater effect. The evidence was low quality and further research was needed. Given the quality of the evidence and uncertainty regarding some analyses, these conclusions may not be reliable.

Authors’ objectives
To assess the impact of nutritional education and counselling, during pregnancy, on maternal and neonatal health outcomes.

Searching
PubMed, POPLINE, Web of Science, CINAHL and EMBASE were searched, up to July 2011, for articles in English. Search terms were reported. Seven relevant journals were searched, and the references of relevant articles and reviews were handsearched.

Study selection
Randomised controlled trials (RCTs), cluster RCTs and quasi-experimental studies, comparing nutritional education and counselling, for pregnant adults or adolescents, with a concurrent control group, were eligible for inclusion. The intervention had to focus on improving maternal diet and nutritional status. Where both groups received nutritional education and counselling, the method of delivery, number of sessions or intensity had to differ between groups. Studies of pregnant women, with specific health conditions or rare or congenital diseases, and studies prescribing special diets, were excluded. The maternal outcomes of interest were gestational weight gain, pregnancy-induced hypertension, haemorrhage, gestational diabetes, anaemia and deaths. Neonatal outcomes of interest were birth weight, low birth weight, prematurity, gestational age, intra-uterine growth retardation, small-for-gestational age, deaths, morbidity and infant growth.

In the included studies, the type of nutritional education and counselling was categorised as delivered alone; delivered as part of a wider health education package, such as stress management or smoking cessation; or delivered with nutritional support, such as food baskets or supplements. The studies were conducted in the USA, the UK, Australia, India, Egypt, Nepal, Sri Lanka, Finland, Argentina, Colombia, Mexico, Brazil, Greece, Senegal or China.

Three reviewers selected studies from their titles and abstracts, for full-text review. Two reviewers independently selected studies at the full-text stage. Disagreements were resolved through consultation with a third reviewer.

Assessment of study quality
The quality of the included studies was assessed using the Child Health Epidemiology Reference Group's adaptation of the GRADE criteria. This covered sequence generation, allocation concealment, blinding, loss to follow-up, use of intention-to-treat analyses, and the presence of other bias. Studies were categorised as very low, low, moderate or high quality. The overall quality of the evidence for each key outcome was graded according to the consistency of the effect, the generalisability of the findings, and the sources of bias.

The authors did not state how many reviewers assessed quality.

Data extraction
For dichotomous outcomes, the number of events, in each group, was extracted and used to calculate relative risks, with 95% confidence intervals. For continuous outcomes, the mean and standard deviation, for each group, was extracted and used to calculate mean differences, with 95% confidence intervals.
The data were extracted by more than one reviewer – the first author double abstracted a random sample of 30% of the studies.

**Methods of synthesis**
Pooled relative risks or mean differences, with 95% confidence intervals were calculated. For cluster RCTs, cluster-adjusted values were used, where available, otherwise an estimate of the intra-cluster correlation coefficient was used. Statistical heterogeneity was assessed by visual inspection of forest plots, and using $\chi^2$ and $I^2$. Meta-analyses were conducted, using fixed-effect models. Where there was substantial statistical heterogeneity, random-effects analyses were also carried out.

Subgroup analyses were carried out according to type of nutritional educational and counselling intervention, and for high-income versus low- and middle-income country (according to World Bank categories). Where meta-analysis was not possible due to heterogeneity of outcomes, a narrative synthesis was provided.

**Results of the review**
Thirty-three studies were included; the number of participants was unclear. Thirteen were RCTs, two were cluster RCTs, 14 were quasi-experimental studies, and four were cluster quasi-experimental studies. One study was rated high quality, 13 were moderate, nine were low, and 10 were very low. The overall quality of evidence was low for the outcomes of gestational weight gain, maternal anaemia, low birth weight, birth weight, and pre-term birth.

**Maternal Outcomes:** Nutritional education and counselling was associated with significantly greater gestational weight gain (MD 0.45kg, 95% CI 0.12 to 0.79; $I^2=42%$; 13 studies; 16 comparisons) and significantly reduced risk of anaemia in late pregnancy (RR 0.70, 95% CI 0.58 to 0.84; $I^2=71%$; 11 studies; 12 comparisons), compared with controls. There was evidence of moderate to high statistical heterogeneity for these outcomes. Subgroup analyses by setting or type of intervention showed that significantly greater weight gain was associated with high-income countries (MD 0.76kg, 95% CI 0.20 to 1.31; $I^2=0$; nine studies; 10 comparisons) and with nutrition education and counselling combined with nutrition support (MD 0.15kg, 95% CI 0.00 to 0.29; $I^2=1%$; six studies, eight comparisons). Seven studies assessed maternal morbidity and none found a significant association with nutritional education, but most were inadequately powered.

**Foetal and Infant Outcomes:** Nutrition education and counselling significantly improved mean birthweight (MD 105.2g, 95% CI 17.7 to 192.7; $I^2=77%$) and significantly reduced the risk of pre-term birth, compared with controls (RR 0.81, 95% CI 0.66 to 0.99; $I^2=0$). There was evidence of high statistical heterogeneity for mean birth weight, but not for pre-term birth. Subgroup analyses found that nutritional education and counselling was associated with a greater mean birth weight in high-income countries (MD 64.8g, 95% CI 1.65 to 128.0; $I^2=17%$) and with educational packages that included nutrition support (MD 297.2g, 95% CI 226.8 to 367.6; $I^2=44%$). There was no association between type of intervention or intervention setting and the risk of pre-term birth. Nutritional education and counselling was not significantly associated with the risk of low birth weight. Four studies assessed foetal or neonatal morbidity, mortality or both, and the results for these were mixed.

A narrative synthesis was reported for the secondary outcomes of dietary practices, and uptake of antenatal care.

**Authors’ conclusions**
Nutritional education and counselling, during pregnancy, could reduce the risk of anaemia, increase gestational weight gain, and improve birth weight, and it had a greater effect combined with nutrition support. The overall quality of the evidence was low and further research was needed.

**CRD commentary**
The review addressed a clear question, with well-defined inclusion criteria. Several relevant databases were searched, but the risks of language bias, publication bias, and reviewer error or bias, cannot be ruled out. A suitable tool was used to assess the quality of the included studies, and the overall quality of the evidence was low. Some studies were listed in some meta-analyses more than once. It was unclear whether these patients were double counted, and if this was the case, whether appropriate methods were used to adjust for this. Significant statistical heterogeneity was found for some outcomes, making the reliability of these analyses unclear.
Given the low quality of the available evidence and the uncertainty regarding some analyses, the authors' conclusions may not be reliable.

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

**Practice**: The authors did not state any implications for practice.

**Research**: The authors stated that further high-quality research was needed to evaluate the capacity for and cost-effectiveness of nutritional education and counselling, for pregnant women, on maternal, infant and child health outcomes. They recommended that the research should be carried out in high- and low- or middle-income countries. The impact of combining nutrition education and counselling with nutrition support should be further investigated, particularly in low- to middle-income countries. Interventions based on behaviour change theory or using adult education theories, should be investigated. Surveys should be conducted in antenatal settings to determine whether or not women receive nutrition education and counselling.

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