Systematic review and meta-analysis of different dietary approaches to the management of type 2 diabetes

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CRD summary

The review concluded that low-carbohydrate, low-GI, Mediterranean and high-protein diets were effective at improving various markers of cardiovascular risk in people with diabetes. In view of the potential for bias in the systematic review process and the included studies, along with the significant heterogeneity between studies, these conclusions may not be reliable.

Authors' objectives

To assess the effect of various diets on glycaemic control, lipids and weight loss.

Searching

PubMed, EMBASE and Google Scholar were searched up to July 2011, key search terms were reported. Reference lists of included studies and relevant reviews and guidelines were checked for additional relevant studies.

Study selection

Randomised controlled trials (RCTs) of a dietary intervention lasting at least six months, in adults with type 2 diabetes were eligible for inclusion. The interventions of interest were low- and high-carbohydrate, high-protein, vegetarian and vegan, low-glycaemic index (GI), high-fibre and Mediterranean diets compared with any control diet. Outcomes of interest were glycated haemoglobin (Hb A_{1c}), weight loss and changes in high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol and triglycerides.

Trials were conducted in adults with type 2 diabetes; most were conducted in patients who were overweight, obese or severely obese. One trial was conducted in post-menopausal women, others included both men and women. Dietary interventions lasted between six months and four years. Low-carbohydrate diets were compared with low-fat, low-GI or conventional diets. Low-GI diets were compared with American Diabetes Association, high-GI, or high-fibre diets. Mediterranean diets were compared with American Diabetes Association diets or usual care. High-protein diets were compared with low-protein or high-carbohydrate diets. Vegan and vegetarian diets were compared with American Diabetes Association or European Association for the Study of Diabetes diets. A high-protein diet was compared with a high-monounsaturated fatty acid diet. Finally, a high-carbohydrate and high-fibre diet was compared with a low-fat diet.

The authors did not state how many reviewers assessed studies for inclusion in the review.

Assessment of study quality

The quality of the included trials was assessed against criteria outlined in the Cochrane handbook, including criteria for randomisation, concealment of allocation, blinding of outcome assessors, completeness of outcome data and selective reporting. The authors did not state how many reviewers undertook quality assessment.

Data extraction

Mean differences in outcomes between intervention and control groups at follow-up were extracted. Study authors were contacted for missing data, where necessary. The authors did not state how many reviewers undertook data extraction.

Methods of synthesis

When data of sufficient quality from more than one trial were available, they were pooled using a fixed-effect model to calculate the weighted mean difference with associated 95% confidence intervals. Studies were excluded from the meta-analysis if they had no other studies for comparison (i.e. no other study assessed that type of diet) or because they did not report separate results for patients with diabetes.

Results of the review

Twenty RCTs (3,073) were included in the review, of which 16 were pooled using meta-analysis. The method of randomisation was reported in 17 RCTs, 10 RCTs reported the method of allocation concealment and six RCTs analysed data on an intention-to-treat basis.

The following diets resulted in a statistically significantly greater improvement in glycaemic control than control diets: low-carbohydrate (Hb A1c reduction of -0.12%, 95% CI -0.24 to -0.00; eight RCTs; I^2=75%); low-GI (-0.14%, 95% CI -0.24 to -0.03; three RCTs; I^2=80%); Mediterranean (-0.41%, 95% CI -0.58 to -0.24; three RCTs; I^2=82%); and high-protein (-0.28%, 95% CI -0.38 to -0.18; two RCTs; I^2=60%). There was evidence of significant heterogeneity between trial results.

The Mediterranean diet also led to greater weight loss than control diets; -1.84 kg (95% CI -2.54 to -1.15). There was no statistically significant difference in weight loss with low-carbohydrate, low-GI and high-protein diets compared with control diets.

HDL was increased with the low-carbohydrate, low-GI and Mediterranean diets, compared with control diets, but not with the high-protein diet. The Mediterranean diet also significantly reduced triglycerides.

Results of individual studies that were not included in the meta-analysis were also presented.

Authors' conclusions

Low-carbohydrate, low-GI, Mediterranean and high-protein diets were effective at improving various markers of cardiovascular risk in people with diabetes.

CRD commentary

The review question and inclusion criteria were clear. The search strategy appeared to have been adequate, although it was unclear whether any language or publication status restrictions were applied. It was unclear whether attempts were made to minimise error and bias during study selection, data extraction and quality assessment procedures. Many of the included studies failed to report the method of allocation concealment and blinding of outcome assessors, so the included studies may have been biased. There were differences between studies in terms of the diets assessed (the specific macronutrient composition) and study participants' baseline characteristics (such as weight and Hb A_{1c}), which means that statistical pooling of the studies may not have been appropriate. In addition, some of the control diets included aspects of the diets being evaluated. There was significant heterogeneity between study results. The clinical significance of many of the results was not reported, other than an acknowledgement that the reduction in glycaemic control with a low-GI diet (0.14%) may not be clinically significant.

In view of the potential for bias in the systematic review process and the included studies, along with the significant heterogeneity between studies, the authors' conclusions may not be reliable.

Implications of the review for practice and research

Practice: The authors stated that low-carbohydrate, low-GI, Mediterranean and high-protein diets should be considered in the overall strategy of diabetes management. However, dietary behaviours and choices are often personal, so dietary modification should be individualised rather than standard for all patients. There may be a range of beneficial dietary options for people with type 2 diabetes.

Research: The authors stated that large trials comparing all of these diets in participants with similar characteristics were required. In order to separate the effect of the diet from the effect of weight loss on markers of cardiovascular risk, future studies should aim to keep weight constant or ensure an equal caloric intake in all study arms. In addition, further research should be done to determine whether vegan and vegetarian diets were beneficial for people with diabetes.

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