Cochrane corner: does increasing intake of dietary fibre help in the prevention of cardiovascular disease in healthy individuals and those at high risk of developing the disease?

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BACKGROUND

Targeting modifiable cardiovascular risk factors is the key priority for public health in preventing the onset of cardiovascular disease (CVD). One area that has received a lot of attention is the intake of certain dietary components and dietary patterns which have been linked to the development of CVD,[1] and a key focus of research has been identifying dietary components and patterns which may reduce the risk of CVD. Some food manufacturers have exploited this message in their marketing strategies, for example claiming that their products are 'heart healthy'. But how much of this is based on high quality systematic reviews? Evidence for the potential benefits of various dietary components and patterns have been reviewed by the Cochrane Heart Group over recent years and the current review on dietary fibre adds to this evidence base. We have conducted a Cochrane review of randomised controlled trials (RCTs) to investigate the potential effects of increasing dietary fibre to reduce cardiovascular disease events and risk factors.[2]

There are thought to be several potential mechanisms by which fibre can lower CVD risk, including reducing the effect of postprandial blood glucose and lipid increases,[3] increasing satiety and reducing low-density lipoprotein (LDL) cholesterol and total cholesterol through increased bile acid excretion. Two different types of fibre are proposed to benefit risk factors for CVD, soluble fibre (e.g. found in oat cereal, bran and pears) and insoluble fibre (e.g. found in whole grains, brown rice and cabbage). It is not however clear whether soluble and insoluble fibre may be equally beneficial for cardiovascular health or whether one is superior. Despite observational studies suggesting that increased dietary fibre intake reduces the risk of mortality,[4] general population studies show that levels of fibre consumption are well below recommendations.[5] With fibre food products being of relatively low cost, it is possible the use of more fibre in diets to prevent CVD could be an inexpensive intervention to implement.

REVIEW METHODS

We examined evidence from RCTs of either dietary advice, the provision of high fibre foods or use of fibre supplements to prevent CVD. We followed the methods of the Cochrane Handbook for Systematic Reviews (http://community.cochrane.org/handbook) following a protocol which defined the research question using inclusion criteria as outlined in Table 1. Bibliographic databases (including the Cochrane library, MEDLINE, EMBASE and Web of Science) were searched from inception until January 2015.

Table 1: PICO summary for included RCTs assessing the effects of increased intake of dietary fibre to prevent CVD and key results.	
Population	Adults at high risk of CVD (e.g.those who are overweight, have metabolic syndrome, hypertension or raised cholesterol) Adults from the general population in primary prevention trials
Intervention	Dietary fibre interventions including advice to increase consumption or the provision of fibre supplements or high-fibre foods
Comparator	No intervention or minimal input interventions (e.g. the provision of a leaflet on dietary advice with no face to face reinforcement)

Outcome	Primary • All-cause mortality • Cardiovascular mortality • Non-fatal endpoints (myocardial infarction, revascularisation, angiographically defined coronary heart disease, angina, stroke, carotid endarterectomy, peripheral artery disease) Secondary (surrogate markers of CVD risk) • Blood pressure • Blood lipids • Occurrence of type 2 diabetes • Health-related quality of life • Adverse effects • Costs
Results	
Total cholesterol	MD -0.20 mmol/L, (95% CI -0.34, -0.06), 20 comparisons, 1067 participants, Heterogeneity 46%
LDL cholesterol	MD -0.14 mmol/L, (95% CI -0.22, -0.06), 18 comparisons, 995 participants, Heterogeneity 36%
HDL cholesterol	MD -0.03 mmo//L, (95% CI -0.06, -0.01), 18 comparisons, 982 participants, Heterogeneity 0%
Triglycerides	MD 0.00 mmol/L, (95% CI -0.04, 0.05), 18 comparisons, 982 participants, Heterogeneity 32%
Systolic blood pressure	MD -1.92 mmHg, (95% CI -4.02, 0.19), 10 comparisons, 661 participants, Heterogeneity 69%
Diastolic blood pressure	MD -1.77 mmHg, (95% CI -2.61, -0.92), 10 comparisons, 661 participants, Heterogeneity 7%

CI: confidence interval; CVD: Cardiovascular disease; HDL High density lipoprotein; LDL; MD: mean difference, PICO: population, intervention, comparator, outcomes; RCT: Randomised controlled trial

REVIEW FINDINGS

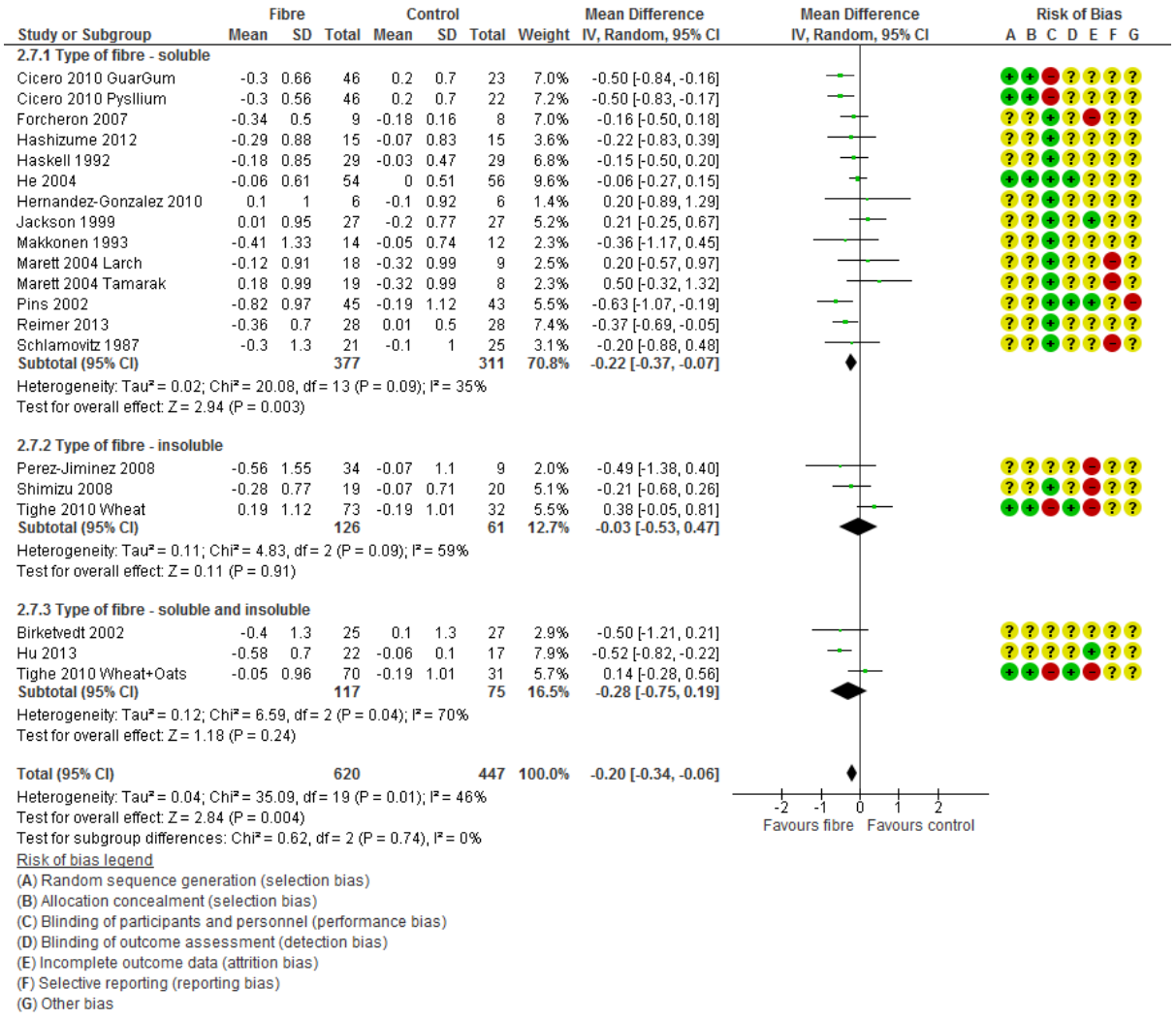
After sifting 4207 hits from searches and screening 253 full text papers, we found 23 RCTs that met our inclusion criteria. Participants in the 23 RCTs were heterogeneous, with mean ages ranging between 35 to 58 years and the proportion of males ranging between 32% and 73%. The majority of studies (n=16) were small with fewer than 40 participants. These studies were synthesized in meta-analyses where possible. Unfortunately, we did not identify any studies that assessed our primary outcomes of mortality or cardiovascular events. However, studies were relatively short term (between 12 and 26 weeks duration) so there would not have been time for clinical events to accrue. Outcomes in the included trials were surrogate markers of CVD risk, including cholesterol and blood pressure.

Nearly all of the studies had a risk of bias (Figure 1), for example, only three trials reported adequate randomisation and concealment of allocation. A funnel plot indicated a likelihood of publication bias. The effects of increasing fibre intake on our secondary outcomes are shown in Table 1. A benefit of increasing dietary fibre was seen on total cholesterol and LDL cholesterol but not triglycerides or high density lipoprotein (HDL) cholesterol (the latter of which showed the opposite

effect of that expected from increasing fibre). Results of increasing fibre on blood pressure were significant only for diastolic blood pressure. Few studies reported rates of adverse events and findings were inconsistent. All studies reporting side-effects found rates overall to be low: four studies found similar rates of gastrointestinal events between groups and seven studies found gastrointestinal events to be more frequently reported in the fibre groups. These events were typically flatulence but participants also reported constipation, nausea, bloating and diarrhoea.

Subgroup analyses looking at the type of fibre did not find any significant effects on any of the lipid or blood pressure outcomes. Although some trends were noted in the data for positive benefits for soluble fibre types (see for example Figure 1 for total cholesterol), there were generally few studies in the insoluble fibre group by which viable subgroup comparisons could be made. Therefore, we are unable to conclude whether soluble or insoluble fibre sources show different effects on these outcomes.

Figure 1 - Effect of fibre type on total cholesterol



LIMITATIONS OF THE EVIDENCE

There were various limitations in the evidence we reviewed which prevent a clear view of the impact that increasing fibre may have on CVD. Firstly, no studies looked at our primary outcomes and only CVD risk factors could be assessed. Secondly, nearly all of studies had various risks of bias which may have influenced results. For example, looking at risk of selection bias, we found that just three RCTs reported an adequate method of randomisation and allocation concealment. Other significant limitations of these RCTs included a short intervention period, mostly just 12 weeks, and small sample sizes, meaning many were likely underpowered. Finally, there was a lack of consistency in the fibre interventions used in the studies.

IMPLICATIONS

Our review found no studies examining the effects of dietary fibre on our primary outcomes of cardiovascular clinical events and therefore our findings are based on factors considered to be markers of CVD risk, lipids and blood pressure. Findings from this review of 23 RCTs are suggestive of a positive effect of dietary fibre on total cholesterol, LDL-cholesterol and diastolic blood pressure, but also a negative effect on HDL-cholesterol. Evidence is also uncertain as to whether there is a difference between soluble or insoluble fibre types, and as such we cannot make recommendations for changing practice on this basis.

REFERENCES

1. Mozaffarian D. Dietary and Policy Priorities for Cardiovascular Disease, Diabetes, and Obesity. A Comprehensive Review. Circulation. 2016;133:187-225

2. Hartley L, May MD, Loveman E, Colquitt JL, Rees K. Dietary fibre for the primary prevention of cardiovascular disease. Cochrane Database of Systematic Reviews 2016, Issue 1. Art. No.: CD011472. DOI: 10.1002/14651858.CD011472.pub2.

3. Threapleton DE, Greenwood DC, Evans CEL, et al. Dietary fibre intake and risk of cardiovascular disease: systematic review and meta-analysis. BMJ 2013;347:f6879.

4. Kim Y, Je Y. Dietary fiber intake and total mortality: a meta analysis of prospective cohort studies. American Journal of Epidemiology 2014;180:565–73.

5. British Nutrition Foundation. Dietary Fibre 2012. http://www.nutrition.org.uk/nutritionscience/nutrients/dietaryfibre?start=4 (accessed January 2014).