Milk and dairy foods: implications for cardiometabolic health

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Improved healthcare provision has led to substantial increases in life expectancy, yet cardiometabolic diseases (CMD) [cardiovascular diseases (CVD) plus type 2 diabetes] remain major causes of death and morbidity. In particular, the prevalence of type 2 diabetes continues to increase rapidly in the UK and other parts of the European Union. It therefore remains critical that diet, an important chronic disease risk modifier, is optimized to reduce risk. Milk and dairy products are perhaps the most misunderstood foods habitually consumed by large sections of the population.

Many cohort studies have investigated the association of milk and dairy food intake and CMD. Although such prospective data are regarded as providing weaker evidence than randomized controlled trials (RCT), they have the advantage of looking at long-term effects and use real disease outcome measures. Very long-term RCT using disease data outcomes are impractical and would be very expensive, with the result that most RCT use markers of disease risk [e.g. low-density lipoprotein cholesterol (LDL-C)] as primary outcome measures. Meta-analysis of prospective studies is a valuable tool for looking at the overall association between dairy foods and CMD and recent developments of dose–response meta-analysis provide greater confidence of associations.

Early meta-analyses of prospective cohort studies reported that overall, high milk consumption does not increase the relative risk of CMD; for example, the study by Elwood *et al.* [1] indicated a reduced relative risk of all-cause mortality, coronary heart disease, stroke and diabetes in high versus low dairy consumers. Recently, a series of meta-analyses has been published examining the of dose–response association between dairy food consumption and type 2 diabetes [2], stroke [3], CVD and all-cause mortality [4]. The outcomes of these meta-analyses are

summarized in Table 1. Overall, these show no increase in risk of CMD per unit increase in milk and cheese consumption and a significant reduction in risk of stroke per unit intake of cheese and milk. The association of yoghurt with reduced risk of type 2 diabetes is of particular interest given the large ongoing increase in its prevalence. There is increasing evidence of the mechanisms underlying these effects that support the findings seen in meta-analysis of prospective studies [5,6].

Milk and milk-derived products contain proteins (whey, casein and specific bioactive peptides), some of which have been associated with beneficial hypotensive effects, either independently [7] or synergistically [8]. This may have connection with the reduced risk of stroke in particular. Given the evidence linking saturated fatty acids (SFA) with LDL-C and LDL-C with CVD and the fact that dairy foods are major contributors to SFA, the consistent neutral or beneficial associations between dairy foods and CVD from analysis of prospective data remains something of a paradox to many. However, as recently reviewed [9], the so-called food matrix effect, particularly of cheese, can reduce the amount of dairy fat that is digested leading to a moderation of the rise in plasma LDL-C. This may in part explain the prospective observation that the effects of SFA from dairy foods and meat differ [10]. This study estimated that the replacement of 2% of SFA energy from meat (including red and processed meat, fish and poultry) with that from dairy (excluding butter) was associated with a 25% lower risk (as hazard ratio and confidence interval) of CVD (hazard ratio: 0.75, 95% confidence interval: 0.63–0.91). Other studies [11,12] have also cast doubts on the simplistic view of SFA as a risk for CVD. Although there remains good evidence that elevated plasma LDL-C is a CVD risk factor (although there should be emphasis on the relative atherogenicity of LDL subtypes), there is also good evidence that the

Table 1 Recent dose–response meta-analyses examining the relative risk of cardiometabolic disease in relation to consumption of dairy foods

Dairy foods	Outcome	RR (95% CI)	References
Milk (per 244 g/day)	All-cause mortality	1.00 (0.93–1.07)	Guo <i>et al.</i> [4]
Milk (per 244 g/day)	CVD	1.01 (0.93–1.10)	Guo <i>et al.</i> [4]
Cheese (per 10 g/day)	CVD	0.98 (0.95–1.00)	Guo <i>et al.</i> [4]
Yoghurt (per 50 g/day)	CVD	1.03 (0.97–1.09)	Guo <i>et al.</i> [4]
Milk (per 200 g/day)	Stroke	0.93 (0.88–0.98)	De Goede <i>et al.</i> [3]
Cheese (per 40 g/day)	Stroke	0.97 (0.94–1.01)	De Goede <i>et al.</i> [3]
Yoghurt (per 80 g/day)	Type 2 diabetes	0.86 (0.83–0.90)	Gijsbers <i>et al.</i> [2]

CI, confidence interval; CVD, cardiovascular diseases; RR, relative risk.

relationship between dietary SFA and plasma LDL-C is not simple. It thus follows that dietary SFA themselves should not be regarded as a direct risk factor, although further work is needed to fully understand matrix effects, how they influence nutrient bioavailability and how they relate to specific foods and/or methods of processing [9].

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Conflicts of interest

There are no conflicts of interest.

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