The role of dairy in the prevention and management of metabolic syndrome

Dairy refers to an array of foods that include nutrients and other bio-active components. An intricate link exists between dairy intake and aspects of metabolic syndrome, which, in turn, is characterised by a number of risk factors associated with developing type 2 diabetes mellitus and artherosclerotic cardiovascular disease. These include hypertension, dyslipidaemia, obesity and insulin resistance (see figure 1).[1]

WHOLE DAIRY FOODS

Researchers increasingly suggest that foods and dietary patterns, in addition to nutrients or other components, should be considered when investigating the link between nutrition and disease – people eat foods, not just their parts! Foods and components may interact and thus the matrix appears to be critical. Since milk, cheese and yoghurt are complex foods, differential associations exist between these and metabolic syndrome.[2,3,4,5]

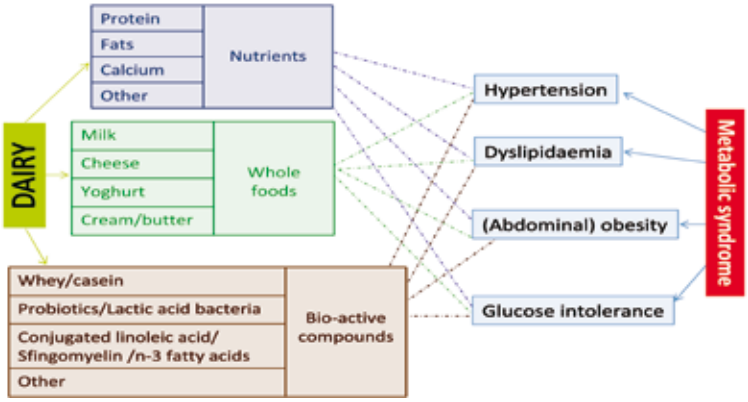

Figure 1: Dairy and the metabolic syndrome: intricately linked

Dairy and blood pressure

A synergistic relationship exists between components of food and probiotic cultures. Food naturally buffers stomach acid and so enhances the stability of consumed probiotics. Incorporating foods containing probiotics becomes a lifestyle habit and overcomes the long-term compliance obstacle of taking supplements.[3]

Dietary Approaches to Stop Hypertension (DASH), a widely acknowledged intervention study, showed that diets rich in fruit and vegetables and low-fat dairy reduced both systolic and diastolic blood pressure of patients significantly more than the control diet. About half of this reduction was attributed to dairy. Similarly, in the National Health and Nutrition Examination Survey (NHANES), low milk intake was associated with high incidence of hypertension.[3] Dairy-derived calcium offers several potential mechanisms for the positive effect of dairy on blood pressure[6] and has been particularly evident in people who consume little dietary calcium.[7] Angiotensin-I-converting enzyme (ACE), a bioactive peptide from dairy protein, may play a role in regulating peripheral blood pressure.[6]

Dairy and dyslipidaemia

At least three studies, each using different types of cheese with a fat content of 20%, revealed an insignificant increase in LDL-cholesterol. The mechanism is unknown, but it is possible that fermentation may play a role.[4] The effect of yoghurt and probiotic bacteria on plasma lipids provides a rather confusing picture,[4,8,9] while the LDL-cholesterol-raising effect of butter, attributed to its saturated fatty acid and cholesterol content, is well documented.[4] Modest consumption of milk has a minor effect on plasma lipids, as the concentration of fat appears to be insufficient to raise LDL-cholesterol.[4]

The mechanism underlying these observations is unclear. Although the conjugated linoleic acid in dairy (rumenic acid) may have hypolipidaemic effects,[5] it is unclear whether the amounts found in dairy are high enough to be responsible.[6]

It is possible that calcium may inhibit fat absorption and so decrease total and LDL-cholesterol serum concentrations, which, in turn, may contribute to the improved lipoprotein profile associated with consumption of specific dairy products.[6]

Dairy and insulin resistance

Preliminary studies suggest that dairy may reduce the risk of developing type 2 diabetes mellitus,[3,6,18] possibly owing to whey being insulinotropic and medium-long chain triglycerides improving insulin sensitivity.[9]

Dairy and metabolic disease

Metabolic syndrome refers to a cluster of risk factors for developing disease and not disease in itself. Meta-analysing case–control studies, Elwood *et al*. (2008) showed that milk and dairy intake imparts an overall survival advantage when metabolic disease manifests. The relative risks for developing metabolic syndrome and resulting myocardial infarct among people with high milk intake were 0.74 (95% CI = 0.64–0.84) and 0.84 (95% CI = 0.66–0.99) respectively. Similarly, in the case of prospective studies, the relative risks for stroke and ischaemic heart disease were 0.79 (95% CI = 0.75–0.82) and 0.84 (95% CI = 0.76–0.93) respectively. Low-fat milk was used in the latter study. For incident diabetes mellitus the relative risk in the high milk intake group was 0.92 (95% CI = 0.86–0.97).[1]

Dairy and body weight

Recent studies have shown that dairy has a positive effect on weight loss. An inverse association between dairy or calcium intake and body weight, body fat or body mass index has been proposed.[10] In addition, a study by Shahar *et al*. (2010) also showed that increased dairy calcium intake and higher serum vitamin D levels result in greater diet-induced weight loss. Even if only a small effect, this may, over time, have substantial implications for the incidence of obesity.[12]

Several possible mechanisms have been proposed to underlie the favourable effect of dairy consumption on attaining healthy body weight. Calcium and vitamin D may play a role in forming non-absorbable faecal fatty acid complexes, promoting lipolysis and fatty acid oxidation, and increasing the thermic effect of a meal.[6,12,13,14] The weight loss effects of calcium appeared to be more pronounced for dairy-derived calcium.[15] The positive effect of dairy specifically on waist circumference and sagittal diameter in persons with a low calcium intake suggests that the effect of dairy is more applicable to people with low calcium intakes.[16]

The satiety effect of dairy-derived protein, and whey protein in particular, is another possible mechanism for weight management.[6,17]

Conclusion

Dairy products are continuously being shown to contribute significantly to nutrient intake and overall diet quality and balance. Although research is not yet conclusive, the majority of studies suggest that dairy foods may play an important role in preventing and managing aspects of metabolic syndrome[6,8] and improving survival rates for the associated diseases.[1,19]

REFERENCES

1. Elwood PC, Givens DI, Beswick et al. The survival advantage of milk and dairy consumption: an overview of evidence from cohort studies of vascular diseases, diabetes and cancer. *J Am Coll Nutr* 2008;27(6):723S-34S.
2. Beydoun MA, Gary TL, Caballero BH et al. Ethnic differences in dairy and related nutrients consumption among US adults and their association with obesity, central obesity, and the metabolic syndrome. *Am J Clin Nutr* 2008;87:1914-25.
3. Lamarche B. Review of the effect of dairy products on non-lipid risk factors for cardiovascular disease. J Am Coll Nutr 2008;27:741S-46S.
4. Nestel PJ. Effects of dairy fats within different foods on plasma lipids. *J Am Coll Nutr* 2008;27:735S-40S.
5. Steijns JM. Dairy products and health: Focus on their constituents or on the matrix? *Int Dairy J* 2008;18:425-35.
6. Meijl LEC, Vrolix R, Mensink RP. Dairy product consumption and the metabolic syndrome. *Nutr Res Rev* 2008;21:148-57.
7. Reid IR, Ames R, Mason B et al. Effects of calcium supplementation on lipids, blood pressure, and body composition in healthy older men: a randomized controlled trial. *Am J Clin Nutr* 2010;91:131-9.
8. German JB, Gibson RA, Krauss RM et al. A reappraisal of the impact of dairy foods and milk fat on cardiovascular disease risk. *Eur J Nutr* 2009;48:191-203.
9. Pfeuffer M, Schrezenmeir J. Milk and the metabolic syndrome. *Obes Rev* 2006;8:109-18.
10. Van Loan M. The role of dairy foods and dietary calcium in weight management. *J Am Coll Nutr* 2009;28:120S-9S.
11. Shahar DR, Schwarzfuchs D, Fraser D et al. Dairy calcium intake, serum vitamin D, and successful weight loss. *Am J Clin Nutr*. 2010 Sep 1. [Electronic publication ahead of print]
12. Teegarden D. The influence of dairy product consumption on body composition. *J Nutr* 2005;135:2749-52.
13. Christensen R, Lorenzen JK, Svith CR et al. Effect of calcium from dairy and dietary supplements on faecal fat excretion: a meta-analysis of randomized controlled trials. *Obes Rev* 2009;10:475-86.
14. Teegarden D, White KM, Lyle RM et al. Calcium and dairy product modulation of lipid utilization and energy expenditure. *Obes* 2008;16:1566-72.
15. Scholz-Ahrens KE, Schrezenmeir J. Milk minerals and the metabolic syndrome. *Int Dairy J* 2006;16:1399-1407.
16. Wennersburg M, Smedman A, Turpeinen A et al. Dairy products and metabolic effects in overweight men and women: results from a 6-mo intervention study. *Am J Clin Nutr* 2009;90:960-8.
17. Luhovyy BL, Akhavan T, Anderson GH. Whey proteins in the regulation of food intake and satiety. *J Am Coll Nutr* 2007;26:704S-12S.
18. Trembley A, Gilbert JA. Milk products, insulin resistance syndrome and type 2 diabetes. *J Am Coll Nutr* 2009;28 Suppl 1: 91S-102S.
19. Warensjo E, Jansson J-H, Cederholm T *et al*. Biomarkers of milk fat and the risk of myocardial infarction in men and women: a prospective, matched case-control study. Am J Clin Nutr 2010;92:194-202.

AN INITIATIVE BY THE CONSUMER EDUCATION PROJECT OF MILK SA
For further information contact: Tel: 012 991 4164 • Fax: 012 991 0878
www.rediscoverdairy.co.za • info@dairy.co.za