



# Metabolic health: the impact of the dairy matrix

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Dairy products are the major source of saturated fatty acids (SFA) and the main targets of the WHO to reduce intake of SFA. However, dairy is also a major source of protein, calcium, and other nutrients, and food-based meta-analyses consistently find no association between dairy foods and increased risk of CVD. Recently, the large scale PURE-study reported dairy consumption to be associated with lower risk of mortality and major cardiovascular disease events in a diverse multinational cohort. Indeed, both mechanistic research and observational studies find that whole-fat fermented dairy, e.g. cheese and yogurts, may actually reduce CVD and diabetes risk. Whole-fat dairy may play a particular role in the prevention of type 2 diabetes, a known risk factor for CVD. Moreover, a pooled individual-level analysis of nearly 65,000 participants across international cohorts found that circulating and tissue biomarker concentrations of odd-chain SFA (15:0, 17:0) and natural ruminant TFA (trans-16:1n7), that at least partly reflect dairy fat consumption, are associated with significantly lower incidence of diabetes.

Cheeses and yogurts consist of complex food matrices and ingredients that include different fatty acids, proteins (whey and casein), minerals (calcium, magnesium, phosphate), sodium, and phospholipid components of milk fat globule membrane (MFGM). Cheese has a high fat content but is more similar in composition to yogurt and milk than to butter, due to protein, mineral, and MFGM contents. Yogurt and cheese are also fermented dairy products containing bacteria and bacterially-produced bioactive peptides, short chain fatty acids, and vitamins such as vitamin K2. Recommendations to reduce intake of total SFA without considering specific fatty acids and food sources are not evidence-based and will distract from other more effective food-based recommendations. On the contrary, there is a risk that such recommendations may cause a reduction in the intake of nutrient-dense foods that are important for preventing disease and improving health. The WHO SFA guidelines should consider different types of fatty acids and, more importantly, the diversity of foods containing SFA that may be harmful, neutral, or even beneficial in relation to major health outcomes.



## Abstract



# Effects of dairy matrix on musculoskeletal health

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Adequate supplies of dietary protein are required for optimal bone growth and for maintaining the integrity and function of bone and skeletal muscles. In a balanced western diet, dairy products are responsible for about 50 to 70% of total dietary calcium intakes and 20-28% of total protein intakes. In adults, areal bone mineral density (BMD) is positively correlated to dietary protein intakes. Regarding bone microstructure, which is another important determinant of bone strength not captured by areal BMD, estimated from microstructure bone strength, trabecular and cortical microstructure are positively correlated with total protein intakes and to dairy proteins. In older people with osteoporosis, higher protein intake is associated with a slower rate of bone loss, and reduced risk of hip fracture, provided that dietary calcium intakes are adequate. Intervention with dairy products attenuate age-related BMD decrease, and reduce bone turnover markers levels, together with an increase in IGF-I and a decrease in PTH. Probiotics can modify gut microbiota, decrease large intestine pH, increase calcium absorption and enhance bone growth, in both animals and humans. Probiotics can reduce ovariectomy-induced increased bone resorption and bone loss. Calcium or vitamin D supplementation may modulate gut microbiota composition. Conversely, some probiotics may increase 25-hydroxyvitamin D levels. In addition to providing calcium and protein, fermented dairy products are a source of probiotics. Radius cortical bone loss is attenuated in yogurt consumers independently of total calcium and protein intakes total dairy products intakes, or physical activity. Dairies have been shown to be a cost-effective way of reducing fracture risk. By providing calcium and protein, dairy products help to maintain bone health during aging.