The importance of the dairy (food) matrix in the evaluation of the nutritional quality and health effects of food

It is increasingly recognized that the effects of milk and dairy foods on health extend beyond the benefits of the individual nutrients they contain. Rather, the unique combination of nutrients and bioactive factors, and how they interact with each other in the dairy matrix, combine to produce the overall effect on health.

Nutrition research has traditionally focused on identifying the specific mechanisms through which single nutrients impact on health - for example, associations between nutrients (such as calcium, protein or saturated fat) and positive health outcomes or disease risk factors. More recently, however, nutrition research has shifted focus to examine the association of whole foods with health. This includes recognizing that foods have numerous nutritional attributes but also that the effect of one attribute is likely dependent on the combination of nutritive attributes contained in the whole food.

This is also based on the fact that people do not eat nutrients in isolation but as a food, and usually in conjunction with meals. From this research, a different picture has emerged than might be predicted from the nutrient content of the foods investigated. For example, for some dairy products the expected negative effects of salt and saturated fat on health are not found. In fact it may be quite to the contrary.

An eminent group of researchers have characterised this as a 'food matrix' effect. This recognises that the health effects of a food are much more complex than that of a single nutrient it contains or even a few nutrients. Rather, they are a function of both a food's structure and its nutrient composition, and how these nutrients interact with each other – i.e. the "food matrix".

Foods consist of a large number of different nutrients that are contained in a complex physical structure. The nature of the physical structure together with the mix of nutrients and bioactives can impact on nutrient digestion, absorption and metabolism, affecting the overall nutritional and health properties of the food.

Milk and dairy products are broadly recommended as part of healthy eating patterns. The key role they play in human nutrition, health and development throughout life is generally attributed to their nutrient richness. Dairy foods are excellent sources of calcium, vitamins B2 and B12, high-quality protein, iodine, and also rich in magnesium, potassium, and various fatty acids.

Dairy foods also come in many different forms with complex physical matrices. Although cheese has a high fat content, its nutritional composition is more similar to that of yoghurt and milk than to that of butter when looking at protein, vitamins and minerals, in variable amounts. Yoghurt and cheese are both fermented dairy products with bacteria that produce vitamin K2, bioactive peptides and short-chain fatty acids (SCFAs). The structure of dairy products varies from the solid matrix of cheese, to the gel-like structure of yogurt, to liquid milk.

Cultured products are easy to digest and absorb by virtue of buffering action and low levels of lactose. Further, the β-galactosidase produced by fermentative bacteria helps lactose digestion. Besides providing beneficiary nutrients the fermented products, such as dahi/curd, kefir, koumiss, laben, have also been shown to be beneficial against stomach and intestinal disorders.

Given this complexity, it is perhaps not surprising that there is increasing evidence that the health effects of dairy foods extend beyond their constituent parts. Many people associate milk and dairy with calcium and bone building, but dairy foods offer much more extensive nutritional benefits and are being linked to a variety of positive health effects. Systematic reviews and meta-analyses have shown that increased dairy consumption can protect against weight gain and obesity. Dairy may significantly reduce the risk of type 2 diabetes and associated cardiovascular disease. One daily serving (>= 60 gram) of yoghurt is associated with a 10-15% lower risk of type 2 diabetes.

The complex interaction between the quite different dairy constituents can be noted in the benefits of milk and dairy foods on bone health, that may be due in part to positive interactions of calcium, protein and phosphorus with each other and with lactose and bioactive peptides in the dairy matrices.

In relation to cheese, the explanation for the potential beneficial rather than harmful effects on cardiovascular diseases (CVD) might be the interactions between components of the cheese matrix, including calcium, phosphorus, the milkfat globule membrane, and starter cultures, which together modify saturated fatty acid-induced increases in blood lipids.

Further research will continue to reveal more in depth insights about the benefits of looking at dairy foods as a matrix, including the mechanisms and pathways through which the different components work together and their impact on health. The matrix concept embraces the importance of considering whole foods, alongside the individual components they contain. This is particularly important in relation to public health policy. Dietary guidance should be based on an evaluation of the health effects of whole foods, including dairy, not just single nutrients.

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