Science Summary
Dairy Matrix

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Overview

The 2020-2025 Dietary Guidelines for Americans (DGA) recommends including dairy foods like milk, cheese and yogurt in healthy dietary patterns to meet nutrient needs and reduce the risk for chronic diseases. Historically, the DGA has recommended that most Americans choose low-fat or fat-free dairy foods, because whole- and reduced-fat dairy foods contain more calories as well as more saturated fat, a type of fat that increases blood levels of low-density lipoprotein cholesterol (LDL-C), a blood biomarker used to predict CVD risk.[1,2] Emerging evidence that will be described in this summary indicates that consuming dairy foods, even whole-fat dairy foods, is not linked to higher risk for CVD and, in some cases, is linked to lower risk. Considering the physical structure of dairy foods alongside their nutrient and non-nutrient components may help explain why whole-milk dairy foods have different health impacts than would be expected based on their saturated fat content alone. This science summary explores the emerging body of research on the food structure or food matrix and the bioactive components of food, both potential reasons why sometimes foods, including dairy foods, and nutrients, like saturated fats, do not always have a predictable impact on health.

People eat food, not nutrients: defining the food matrix

The food matrix refers to the relationships between the nutrient and non-nutrient components of foods, including vitamins, minerals and bioactive components as well as physical structure, texture and form (e.g., solid, gel, liquid).[3] The food matrix concept can be used to address how the relationships between nutrient and non-nutrient components impact digestion, absorption and physiological functions important for health. In a commonly cited study about the matrix effect,[4] researchers assessed how well carotenoids (beta-carotene and alpha-carotene) were released and available for absorption in a model of the human digestion system when different preparations of carrots (raw bite size pieces, cooked bite size pieces, raw pulp, raw pulp with oil, cooked pulp, cooked pulp with oil) were added. Even though the same food with the same nutrients was used in each case, cooking, pulping and adding oil all affected the amount of beta-carotene accessible for absorption. The preparation of the carrots and changes to their physical structure impacted how much of their nutrients were available for use by the human body. A similar study found that the manner in which almonds were prepared (whole unroasted almonds, whole roasted almonds, chopped roasted almonds and almond butter) affected the amount of calories available for absorption.[5] The "matrix effect" occurs with other foods as well, including dairy foods.

Food structure may explain why whole-fat dairy foods have different health impacts than expected

The examples with carrots and almonds illustrate how food form can affect digestion and absorption of nutrients. The matrix concept applied to dairy foods may help explain why whole-fat dairy foods do not have the same impact on CVD risk as other foods that contain saturated fat. Results of two randomized controlled trials,[6,7] a prospective cohort trial,[8] and a meta-analysis[9] provide a snapshot of the evidence that indicates consuming dairy foods like milk, cheese and yogurt is not linked with higher CVD risk, even when whole-fat options are selected instead of low-fat or fat-free ones. A randomized crossover trial compared the impacts on blood lipids of drinking 2 cups of whole milk or 2 cups of fat-free milk daily.[6] After three weeks, the group drinking whole milk had higher levels of high-density lipoprotein cholesterol (HDL-C), but there were no other differences between the two groups.[6] Another randomized controlled trial[7] compared a modified Dietary Approaches to Stop Hypertension (DASH) diet containing 2-3 daily servings of whole-fat dairy foods to the standard DASH diet, which includes 2-3 servings per day of low-fat or fat-free dairy foods.[10] The modified DASH diet with whole-fat dairy foods lowered blood pressure, reduced blood levels of triglycerides, did not increase total cholesterol or LDL-C and also did not decrease HDL-C, effects similar to those observed with a standard DASH diet.[7]

A prospective cohort trial found that consuming saturated fat from dairy foods posed a lower risk for developing CVD than consuming saturated fat from meat.[8] The authors note that the "health effects of the entire food rather than the content of any single nutrient might be most relevant to understanding associations between dietary consumption and health outcomes." Finally, a meta-analysis by Chen et al. indicates that eating cheese, even regular-fat cheese, was not linked with an increased risk for total CVD or coronary heart disease.[9] These studies indicate that consuming whole-fat milk, cheese and yogurt is not linked with higher risk for CVD. The fat in milk is the most complex fat naturally occurring in food with over 400 types of fatty acids.[11] This complexity of dairy fat, part of the dairy matrix, might help explain why the link between dairy food consumption and CVD risk is independent of saturated fat content. However, research in this area is ongoing, and there is not yet a precise understanding of the mechanisms involved.

Dairy foods are more than the sum of their nutrients: introducing dairy bioactives

As researchers seek to understand how dairy foods impact chronic disease risk, there is increasing interest in the myriad of unique non-vitamin and non-mineral components in dairy foods known as bioactive compounds. All dairy foods begin as milk, a complex food designed by nature to provide life-sustaining nutrition. Milk contains hundreds of bioactive compounds embedded within its macronutrients (fat, carbohydrates, protein) and inherent physical structure. These bioactive compounds may help explain why saturated fat from whole- and reduced-fat cheese, milk and yogurt does not have the same physiological effects as non-dairy sources of saturated fat. Bioactive peptides, or protein fragments, that may benefit health are among the most well-known of milk's bioactive compounds.[12] While most of the research to date has been conducted in animal or *in vitro* studies rather than human clinical trials, milk-based bioactive peptides have been shown to exhibit antihypertensive, antimicrobial, antithrombotic, immunomodulatory, antioxidant and mineral binding functions, with some peptides having bioactivity in multiple areas.[12–14] There is also some research on bioactive dairy lipids and carbohydrates but, as with bioactive peptides, much of this research has not been conducted in humans. This emerging area of research on dairy bioactives may help progress understanding of the mechanisms behind the health benefits linked with consuming dairy foods.

References

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