

Dairy and Weight Management

An update on the latest advances

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Overweight and obesity continue to be leading public health concerns. In the U.S., recent research indicates that more than 66% of adults and 17% of children aged 2–19 years are overweight or obese. Researchers estimate that if current trends continue, nearly half of the children in North and South America will be overweight by 2010. Excess body fat increases the risk of premature death, coronary heart disease, type 2 diabetes, hypertension, stroke, some types of cancer and other debilitating conditions. Because of these health outcomes, as well as the adverse economic consequences of overweight and obesity, numerous government programs are focused on obesity prevention.

The cause of overweight and obesity is multifactorial and successful prevention or treatment depends on multiple actions. Although attention has focused primarily on reducing energy (calorie) intake and/or increasing energy expenditure (physical activity), a promising beneficial role for dietary calcium and dairy products in weight management has emerged. This article reviews the current scientific evidence, including human clinical, observational and animal model studies that have explored the relationship between the consumption of dairy foods and weight management as well as plausible mechanisms by which dietary calcium in dairy products may favorably affect body weight, body fat, and lean mass.

Dairy and weight management

Clinical studies—Controlled feeding studies in humans are considered the “gold standard” of proof and have provided the strongest evidence for a beneficial role of dairy foods and calcium on body weight and body fat. Since 1998, several clinical studies have evaluated the impact of calcium and/or dairy product consumption on body weight and fat loss. In many of these studies, overweight or obese adults (males, females, Caucasians, African Americans) who followed moderately reduced-calorie diets for 12 or 24 weeks, and increased consumption of dairy foods from one serving or less/day (inadequate calcium) to three servings/day (adequate calcium) experienced enhanced body weight and/or body fat loss, reduced abdominal (trunk) obesity, and minimal loss of lean body mass compared those consuming little or no dairy. Moreover, the intake of dairy foods had a substantially greater effect on both weight and/or fat loss compared to an equivalent amount of calcium alone.

Importantly, three physiological and dietary conditions were common in those studies showing favorable weight loss effects of dairy/calcium. First, all study subjects were obese or overweight. Second, the subjects habitual calcium intakes were low and inadequate (<600 mg/day). Third, all subjects consumed moderately



■ In the U.S. more than 66% of adults and 17% of children are overweight or obese. A new body of scientific evidence suggests dairy foods can help manage weight.

reduced-calorie diets to induce weight loss (i.e. 500 kcal/day less than necessary to maintain weight).

Dairy-rich diets appear to increase weight loss by targeting the fat compartment during calorie restriction, according to findings from a multi-center 12-week clinical study in overweight and obese adults. In this study, consuming 3 servings a day of dairy foods (about 1,400 mg total calcium/day) while restricting calories for weight loss (-500 kcal/day) resulted in significantly greater loss of body fat, trunk fat, waist circumference and a trend for greater weight loss compared to groups receiving a low calcium (~600 mg/day) control diet or an elemental calcium-rich diet supplied by calcium supplements (~1,400 mg total calcium/day). The elemental calcium-rich diet in this study had no significant effects on weight loss or body composition compared to the low calcium control diet. Another study has also reported no differences in weight and body fat loss in overweight and obese women supplemented with elemental calcium (1,200 mg/day) and vitamin D (400 IU/day) compared to a control low-calcium diet.

Some studies have not observed significant differences in body weight and fat reductions between inadequate dairy and adequate dairy intakes. In a one-year study of obese subjects, authors concluded that a diet with recommended dairy servings does not substantially improve weight loss beyond what can be achieved in a behavioral intervention. In another one-year study, which investigated the impact of moderate (2 servings dairy/day) versus adequate calcium/dairy intakes (4 servings dairy/day) in obese subjects under caloric restriction, there were no significant differences in weight or body fat loss between the groups. However, in both of these studies, subjects consuming adequate dairy consumed on average more calories than those consuming lower amounts of dairy but still lost equivalent amounts of body weight and fat.

A study in healthy normal weight young women, who were on diets that did not restrict calories, reported no significant differences in body fat or lean mass in those who increased calcium intake from 800 mg/day up to 1300-1400 mg/day through dairy products for one year compared to those who maintained inadequate intakes. However, after 1.5 years, women who continued to consume adequate dairy had significantly less body fat than those who remained on an inadequate calcium/dairy diet.

Taken together, these studies indicate that the impact of dairy foods on augmenting body weight and body fat loss depends on

factors such as calorie intake, baseline calcium or dairy food intake and initial body weight (i.e. overweight or normal weight).

Observational studies—Although observational or epidemiological studies do not prove a cause and effect relationship, they help generate hypothesis or critical questions. Several observational studies have examined the impact of increased dairy food consumption or increased calcium in the diet on changes in body weight or body fat. Overall, a statistically significant inverse relationship has been reported between calcium/dairy product intake and body weight/fat in most observational studies including: the Quebec Family Study, the Heritage Family Study, the Coronary Artery Risk Development in Young Adults (CARDIA) Study, the Tehran Lipid and Glucose Study, and the Portuguese Health Interview Study. In contrast, some observational studies have reported that dietary calcium or dairy food intake is not associated with changes in body weight including

“Dairy food nutrients may reduce fat calories to the body and/or stimulate its metabolic use.”



the Health Professionals Follow-up Study (men) and in a study of pre- and postmenopausal women. Inconsistencies in findings from observational studies may be explained by several factors such as level and/or range of calcium or dairy foods consumed, baseline body weight or body fatness, energy intake and methods used to assess dietary intake and body weight or body fat.

Potential mechanisms of action

Experimental animal, cellular, and human studies indicate that there may be multiple mechanisms that underlie the ability of calcium and dairy foods to regulate the use of fat calories by the body leading to lower body weight and fat. Increased consumption of calcium and dairy foods may reduce the availability of fat calories to the body through decreased absorption of fat or increased satiety, leading to decreases in food intake and/or stimulate calorie utilization through increased fat oxidation.

Dairy and fat excretion—Studies in laboratory rats and humans have demonstrated that increasing dietary calcium leads to a greater fecal fat through the binding of calcium to dietary fat in the intestine and excretion as calcium fatty acid soaps. For example, subjects consuming a moderately high calcium diet (1,800 mg/day) from dairy foods experienced increased fecal fat excretion by 2.5-fold and had significantly greater fecal calorie excretion compared subjects on a low calcium diet (500 mg/day). However, the degree of contribution of this effect on calorie balance and body composition is still unclear.

Dairy and appetite—Nutrient components in dairy foods have the potential to increase satiety and reduce food intake. Dairy products are a good source of protein, which is regarded as substantially more satiating than fat and carbohydrates. Previous short-term studies have shown that doses of 45–50 grams of whey or casein can reduce food and calorie intake of a subsequent meal. Moreover, higher protein diets (30% of energy) have been shown to reduce hunger and desire to eat compared to typical protein diets (15% of energy). However,

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■ Three servings per day of dairy foods can enhance weight loss in obese and overweight individuals when calories are restricted and dairy/calcium intake are increased from inadequate to adequate.

whether the satiating effect of protein independently contributes to body weight and fat loss by reducing food and calorie intake remains controversial.

Dairy and energy utilization—Studies in human fat cells and experimental animals have suggested possible mechanisms whereby calcium/dairy food intake may modulate energy and fat metabolism. Low-calcium diets have been shown to increase the calcium-regulating hormones, calcitriol (the active form of vitamin D) and parathyroid hormone, which increases calcium levels in fat cells. Research indicates that intracellular calcium plays an important role in regulating fat metabolism by increasing fat storage and inhibiting fat breakdown in fat cells. Conversely, a high-calcium diet inhibits the calcium regulating hormones thereby decreasing intracellular calcium, which decreases fat accumulation and increases the release of fat from fat cells.

Most of the clinical research examining the anti-obesity effect of dairy foods and calcium has focused on their impact on energy utilization. Results from some clinical studies, that have evaluated the effect of dairy and/or calcium on fat metabolism indicate that the enhanced body fat loss seen with recommended dairy intakes may be the result of

increased body fat oxidation (fat burning). In some of these studies, subjects consuming adequate dairy/calcium diets demonstrated significantly greater fat oxidation compared to a low calcium diet; whereas, other studies have shown no differences. Direct confirmation that greater fat oxidation results in the loss of fat mass requires long-term studies.

Summary

Overall, the body of scientific evidence including human clinical, observational, animal and cellular studies supports a relationship between the consumption of dairy foods and weight management. The clinical studies to date demonstrate that diets including three servings per day of dairy foods, high in calcium and a good source of protein enhance body weight and/or fat loss in obese and overweight individuals when calories are restricted and dairy/calcium intakes are increased from inadequate to adequate. While consumption of dairy has been shown to exert a greater impact than calcium alone, studies continue to examine the mechanism to explain this phenomenon, which appears to be multi-factorial and may involve bioactive components found in dairy foods (e.g. calcium, protein, branch chain amino acids, ACE inhibitory peptides). ■

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