

Importance of Calcium and Fortification of Calcium in Milk and Milk Products

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Vitamins and minerals are added to dairy and food products to attract the attention of health-conscious consumers (Weaver, 1998) and responded to public health needs. The fortifying foods with calcium is growing due to the difficulty for individuals to meet calcium requirements with unfortified foods. The deficiency of calcium is causing the diseases osteoporosis, especially in elderly people. Calcium is an essential mineral for human health for bone strength. Indians are more prone to osteoporosis, a debilitating bone disorder resulting from porous bones. Many peoples are suffering from life threatening disease. Major factors responsible for high prevalence of osteoporosis in India are inadequate intake of calcium and vitamin D. The Indian society for bone and mineral research (ISBMR) advised to the authorities and industry to go for calcium fortification of dairy and food products (Hindustan Times, 2002). Calcium requirements is essential an individual's life and for different age groups. Thus, it is imperative that dietary intake of calcium be increased in population groups that have sub – optimal calcium nutritional status. Poor dietary habits are seen in many people for this situation, especially when consumption of fast food or junk food is gaining acceptance. If a calcium supplement is given to a people which already has an adequate supply, this does not affect growth such as height, but increases bone density (Danone, 1999). Cow contains 125 to 150 mg/100 g calcium and buffalo contains 180 to 200 mg/100 g calcium. ICMR (1989) recommends RDA for calcium as 400 to 600 mg (1000 mg in pregnancy/lactation) and NIH (1994) recommends 1200 to 1500 mg of calcium per day. High intake of calcium will possible through formulating calcium enriched dairy and food products. Addition of calcium to milk caused in a new distribution of ions between milk serum and casein micelles, leading to physico-chemical changes in casein micelles.

Fortification with calcium

Calcium is most essential nutrient and it must be provided regularly in the diet. Calcium constitutes about 2 percent of the total body weight and most of calcium is dispersed in the bones. So, an adequate

daily intake of calcium is vital for maintaining structural integrity of the body skeleton and strength of the teeth. Apart from the structural role of calcium, it is also equally important in regulating others metabolic processes in the human body. Calcium also plays an important role in the transmission of impulse in nerve cell and in case of injury forms an important component of the blood clotting. Calcium plays an important role in the prevention and treatment of many diseases like osteoporosis, hypertension, colon cancer, kidney stones and lead absorption (National Dairy Council, 1992). The average rate of calcium accumulation in the skeleton between birth and maturity is 60 mg per day but the most rapid deposition occurs during adolescence when the positive balance required rises to about 300 mg or more per day. There is general agreement that extra dietary calcium is required for optimum skeletal growth with recommended intakes at puberty about 1200 mg or more (Vital news, 2000).

Sources of calcium and its bioavailability

Calcium source is present in significant amounts in a limited range of dairy and foods. Some vegetables like green leafy, broccoli provides quite large amounts of calcium intake, others sources include cabbage, beans etc. Milk and dairy products are major source of calcium and proteins. The level of calcium is not reduced when milk is processed like skimmed. The adsorption of calcium is affected by its solubility, chemical forms, and presence of inhibitors in the food or total diet (Allen, 1982).

The bioavailability of calcium mineral has been shown to be reduced in variety of dietary components and capable of forming insoluble complexes with calcium in the intestine. These components include oxalate, phytate and uronic acid and other components of non-starch polysaccharide (NSP) like dietary fibre. Calcium in spinach is less utilized than the calcium obtained from milk or from other green vegetables like broccoli. The high oxalate component of spinach has been reducing the absorption of calcium by forming insoluble calcium complexes in the intestine (Heaney, 1988). Calcium in milk is easily

absorbed by the intestine and it is considered to higher bioavailability than calcium in cereals and vegetables. Two factors in milk – lactose and casein, have been responsible for promoting calcium absorption and leading to apparent higher bioavailability (Miller, 1989).

Lactose delays the precipitation of calcium in vitro by forming calcium-lactose complexes (Charley and Saltman, 1963) and it may also do so in the intestinal lumen. Lactose stimulates passive component of calcium absorption in the ileum and the colon in rats Kansal (1998). Lactose enhances calcium absorption in Vitamin D deficient and Vitamin D adequate in animals. Calcium acts by increasing the proportion of soluble calcium in the intestinal lumen (Lee *et al.*, 1979). It is possible that the higher bioavailability of calcium of milk may be due to the absence of many factors, which inhibit the absorption of calcium such as oxalate and phytate. The different type of calcium source did not affect the calcium absorption, but milk components increased the apparent calcium absorption. Milk and milk products are the most important sources of calcium. There is an increasing trend in producing calcium and vitamin D enriched milk, milk products and other drinks. A part of calcium in milk is linked with the casein fraction, where it is associated with phosphorylated serine. The component caseinophosphopeptides (CPP) released in the gastrointestinal (GI) tract during normal digestion can improve passive transport of calcium in the lower portion of small intestine. These CPP forms soluble complexes with calcium phosphate salts and improve calcium absorption (Kansal, 1998). In infants, the protein and calcium requirements are generally met from milk. The micellar form of calcium found in milk is best absorbed and has high bioavailability as compared to that from vegetables and nuts such as sesame seeds, almonds, whole wheat bread, spinach etc. However, regular intake of milk will help in meeting the daily protein intake and calcium requirements (Neelam and Hemalatha, 2001).

Dietary factors affecting calcium bio availability

Optimum bone mineralization requires calcium, but phosphorous must be present for the formation of hydroxyapatite. The dissociation of

calcium intake from that of phosphorous may restrict calcium and phosphorus retention. A calcium source with a ratio Ca/P > 1 is a plus. Lactose is reported to stimulate calcium passive absorption (Vital news, 2000) because it is bound to peptides and proteins, milk calcium is more likely to remain in solution when the pH is unfavorable. Milk calcium absorbed in distant intestine in the absence of vitamin D under the effect of lactose. Milk products do not contain anything likely to inhibit the intestinal absorption of calcium such as phytates, oxalates, uronic acids or the polyphenols of certain foods. The hyper calciuric effect of sulfates from the sulphur containing amino acids of milk is offset by the hypocalciuric effect of phosphorous (Vital news, 2000). The uptake of calcium is increased when it is ingested during a meal and combined with protein and lactose as in case of milk products (Danone World News Letter, 1999). The choice of calcium fortification compound may be made more on technological grounds, since there is little variation in the bioavailability of the calcium from different compounds (Couzy, 1996). Only a fraction of about 25 to 35% calcium in the diet is absorbed, most of the dietary calcium stays in the intestinal lumen and contributes to the daily loss of calcium.

Conclusion

Vitamins and minerals are added to dairy and food products to attract the attention of health-conscious consumers. The calcium-fortified milk and dairy products speaks for itself increase the nutrition. Consumers increasingly prefer food with added nutritional value rather than taking nutritional supplements to fill up their calcium needs. Calcium is an essential mineral for human health for bone strength. Milk products are the best source of calcium and it help to fight calcium deficiency; they are further enriched with calcium achieve higher calcium intakes per serving. However, the challenge for Dairy and food manufacturers is to provide a product having high calcium content with good taste and appealing properties.

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