Health Perspectives of Dairy Calcium: Mini Review

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Abstract
Dairy products are enriched with the combination of vital nutrients which are almost unable to attain through dairy-free diets and hence it is very unlikely for people taking dairy-free diet to meet recommended daily intake of calcium. In-spite of extensive documentation of stupendous benefits of healthy bones some people avoid to adding dairy products to their diet owing to contrary belief that dairy products are detrimental to health, especially those who are overweight, are at risk of suffering from cardiovascular diseases, intolerance to lactose and are suffering from osteoarthritis or rheumatoid arthritis. This review will serve as strategic partner for health specialists to prompt the intake of dairy products into their balance diet. The people who are suffering with lactose intolerance and arthritis may not totally avoid dairy products from their diet. Low fat dairy products, do not enhance the chances of cardiovascular disease. It is believed to be safe to take around three servings of dairy foods each day and they will deliver good benefits for the health of bones.

Keywords: Dairy products, Calcium, overweight, Cardiovascular disease, Arthritis, Lactose intolerance

Introduction
Dairy foods have formed major portion of human diet for around eight thousand years around the world [1]. According to World Health Organization (WHO) about 42 million tons of milk production comes through the Pakistan dairy industry each year as a source of dairy products [2]. Dairy products are enriched with the combination of vital nutrients which are almost unlikely to attain through dairy-free diets, like vegetables or other dairy restrictive diets. It can be said with assurance that dairy foods are great source of calcium, phosphorus, potassium and protein [3]. Dietary Reference Intake (DRI) of calcium obtained through dairy foods is around 52–65 % whereas protein obtained by them is around 20–28 % [4]. Many researches are still ongoing related to the intake of dairy products and its significances on human health [3]. This review article highlights few clinical evidences and help health specialists to prompt their patient intake of dairy products as a part of healthy diet. Effect of dairy products on bones, heart ailments, arthritis and obesity are specifically deliberated [5].

Nutrients in Dairy Products
Dairy foods along with green vegetables and mineral waters serve as good dietary source for calcium, magnesium, potassium, phosphorus, zinc and protein. Dairy foods are easily available and are cost effective thus making their daily consumption a viability. Moreover, they can also help to meet optimum level of daily calcium requisite [6]. Table 1 shows the essential nutrients content in 100g of dairy foods [3]. Nutrients present in these products are very much important for improving bone mass density (BMD).

There are so many non-dairy sources available in the market like dark green vegetables, kale, dried beans, legumes and mineral water; these things contain least amount of calcium which cannot meet its daily requirement [7]. Calcium fortified foods, like soy juice and orange juices are now accessible at very low cost in the market, provide equivalent quantity of calcium as delivered by single serving of dairy food [8]. Normally, milk and cheese contains about 30–40 % of calcium and about 28-36 % of calcium is absorbed from them [9]. Calcium is available in green leafy vegetables in a reasonable amount as shown in Table 2 [10]. Although, large amount of calcium from green leafy vegetables is insoluble due to the presence of oxalic acid, fibers and phytic acid which may reduce its bioavailability. Boiled spinach has 115 mg of calcium per serving but 6 % of it is absorbed because spinach contains a high proportion of oxalates and phytates, which bind with calcium and form insoluble salt compounds with calcium [11]. Intake of 1 cup (240ml) of milk per day may be achievable to provide 96 mg of absorbed calcium, which is equivalent to the intake of 16 servings of spinach/day to provide the same quantity of bioavailable calcium.

Calcium Intake and Bone Health
Increased knowledge about the availability of dietary supplements and impact of nutrition on health has made them priority options for the consumers, almost 43 % of Americans are using calcium supplements [12]. Calcium is absorbed from calcium carbonate and calcium citrate. The rate of absorption is almost 30-40 % and it is balanced by food intake and intake of protein containing meals in the day [13]. Calcium supplements usually interact with medications like antibiotics, digoxin, phenytoin, thiazide and diuretics. As compared to natural calcium containing foods, calcium supplements do not have the additional nutrients like protein magnesium and potassium. Dairy foods are important for proper bone mineralization. There has not been much evidence that the dairy calcium is absorbed better...
than calcium from mineral salts [14]. Dietary calcium is also essential for adequate bone growth even before birth. Pregnant women are given calcium rich diets such as dairy foods, green leafy vegetables, fruits to enhance the skeletal growth of the fetus and beneficial effects on the bone size and bone mineral density. Dairy consumption in pregnant women promotes bone health in the child. For growth and bone health the dairy products are beneficial during childhood [15]. Smaller statures, lower bone mineral mass and increased risk of bone fractures is linked with long-term avoidance towards milk intake in growing children. The largest randomized controlled trial (RCT) found significantly higher gains in height with dairy products, body weight, and bone mineral content (BMC) and BMD in school going girls aged ten years receiving milk on school days for two years compared with the control group [16].

There are more bone health benefits for dairy foods over the calcium supplements when intervention trials were conducted. In a study, which was performed on postmenopausal women, using dairy low-fat milk and milk products and those fortified with concentrated milk protein had greater improvements in arm, pelvis, total spine and total-body bone mineral density (BMD) as compared to those receiving calcium supplements [17]. Another trial suggested that cheese is more beneficial than calcium supplements for tibia cortical bone mass occurring in children. This may be due to better absorption of dairy calcium and consumption of calcium naturally in small doses throughout the day rather than having two large amounts from the supplements. This may hinder the protein or micronutrient intake. Insulin-like growth factor-I (IGF-I) which helps bone formation is also found in dairy foods as higher amounts when compared with calcium supplements [1]. Pharmacological Belgian Bone Club recommended that management of osteoporosis through non-pharmacological methods should not opt for single nutrient supplements and should prefer the complete foods like dairy products [18]. Therefore, calcium supplements should only be limited to those who are unable to complete their calcium requirements and are at high risk for osteoporosis or fracture [19]. Menopause leads to annual bone loss of 3-5% in first few years and then 1% afterwards. The effect on the fracture risk after menopause solely depends upon the level of peak bone mass gained during the childhood and adolescence as well as on the rate of bone loss [20]. Exploiting peak bone mass may be a factor for reducing fracture risk in children as well as in the elder people. Protein intake and dietary calcium are the essential components to gain optimum peak bone mass and prevent bone loss in elder years [21].

### Health Perspectives of Calcium Intake

In this section, some of consequences of intake of dairy products on human health are discussed briefly. It includes overweight and obesity, cardiovascular diseases, lactose intolerance and osteoporosis.

Body weight plays an essential role in regulation various physiological processes in body. It is the prime risk factor for osteoarthritis in overweight people as excess of body fat compromised the joint and bone health. Consumption of milk and dairy products has been studied extensively for their protective role in regulation of body weight [22]. A recent study showed that teenage girls who were underweight has low calcium and vitamin D in their blood so, their bones and joints are weak as compared to

<table>
<thead>
<tr>
<th>Dairy Products</th>
<th>Calcium (mg)</th>
<th>Protein (g)</th>
<th>Magnesium (mg)</th>
<th>Phosphorus (mg)</th>
<th>Potassium (mg)</th>
<th>Zinc (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, full-fat</td>
<td>119</td>
<td>3.3</td>
<td>13</td>
<td>93</td>
<td>151</td>
<td>0.38</td>
</tr>
<tr>
<td>Milk, skimmed</td>
<td>122</td>
<td>3.4</td>
<td>11</td>
<td>101</td>
<td>156</td>
<td>0.42</td>
</tr>
<tr>
<td>Yogurt, plain low-fat</td>
<td>183</td>
<td>5.3</td>
<td>17</td>
<td>144</td>
<td>234</td>
<td>0.89</td>
</tr>
<tr>
<td>Yogurt, fruit low-fat</td>
<td>169</td>
<td>4.9</td>
<td>16</td>
<td>133</td>
<td>216</td>
<td>0.82</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>721</td>
<td>24.9</td>
<td>28</td>
<td>512</td>
<td>98</td>
<td>3.11</td>
</tr>
<tr>
<td>Cottage cheese, non-fat</td>
<td>86</td>
<td>10.3</td>
<td>11</td>
<td>190</td>
<td>137</td>
<td>0.47</td>
</tr>
<tr>
<td>Ice cream, vanilla</td>
<td>128</td>
<td>3.5</td>
<td>14</td>
<td>105</td>
<td>199</td>
<td>0.69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food items</th>
<th>Serving size (g)</th>
<th>Calcium content (mg)</th>
<th>Calcium absorbed (mg)</th>
<th>Servings equal 240 ml milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>240</td>
<td>300</td>
<td>96</td>
<td>1</td>
</tr>
<tr>
<td>Yogurt</td>
<td>240</td>
<td>300</td>
<td>96</td>
<td>1</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>42</td>
<td>303</td>
<td>97</td>
<td>1</td>
</tr>
<tr>
<td>Tofu with calcium</td>
<td>126</td>
<td>258</td>
<td>80</td>
<td>1.2</td>
</tr>
<tr>
<td>Kale</td>
<td>85</td>
<td>61</td>
<td>30</td>
<td>3.2</td>
</tr>
<tr>
<td>Broccoli</td>
<td>71</td>
<td>35</td>
<td>21</td>
<td>4.5</td>
</tr>
<tr>
<td>Spinach</td>
<td>85</td>
<td>115</td>
<td>6</td>
<td>16.3</td>
</tr>
<tr>
<td>Red beans</td>
<td>172</td>
<td>41</td>
<td>10</td>
<td>9.7</td>
</tr>
<tr>
<td>White beans</td>
<td>110</td>
<td>113</td>
<td>25</td>
<td>3.9</td>
</tr>
</tbody>
</table>
girls who were at their ideal body weight and had regular intake of milk for calcium intake [23]. Intake of milk and milk products has been associated in decreasing the risk factors of metabolic syndrome and obesity. A study demonstrated the effect of dairy consumption is positive in reducing the body fat stores and not essentially the body weight and it is due to maintenance of lean body mass. Epidemiological studies have shown that low intake of calcium is a risk factor for incidence of obesity. It is due to the consequence of insoluble salts of calcium with fatty acids and bile salts which affect the fat absorption from intestinal epithelial cells and hence decreasing the digestible energy from diet [24]. The rate of mortality from cardiovascular diseases around the globe is increasing and it has high prevalence in developed countries as fat is major constituent of western diet regimes. The risk factors for incidence of cardiovascular disorders are low plasma level of high density lipoproteins (HDL) and elevated plasma levels of low density lipoproteins (LDL), total serum cholesterol and triglycerides [25]. High blood pressure or hypertension is leading cause of death from myocardial infarctions and heart stroke which is result of lipid oxidation in blood vessels. Many dietary and lifestyle modifications seems to play an essential role in prevention of cardiovascular diseases which include calcium and vitamin D supplementation. DASH (Dietary Approaches to Stop Hypertension) diet which include low fat dairy or fat-free dairy products helps in managing the complications in later years of life. The low-fat milk and milk products have protective role against coronary and ischemic heart disease. The recent meta-analysis shows that low-fat dairy consumption has protective effect against cardiovascular diseases and more research is to be needed for full-fat dairy consumption [26].

The lactose sugar that is a disaccharide is present naturally in milk and dairy products. Lactose is hydrolysed by the activity of enzyme beta-galactosidase into galactose and lactose in proximal part of small intestine. The enzymatic activity of lactase reduces in most people from age 4 to 6 years [27]. The consumption of lactose cause lead to symptoms like flatulence, abdominal pain, diarrhea and bloating because the unabsorbed form of lactose reached to colon of large intestine where gut microbes fermented the sugar and by this process gas is produced. The phenomenon is termed as lactose intolerance. In general, the people from lactose intolerance are self-diagnosed and are abstained from milk and milk products. However, small amounts of milk are digested by most of lactose intolerant people. They are also able to consume cheese that has no or very little amount of lactose. As compared to milk, the lactose content of yogurt is usually less by one third. A meta-analysis shows that in-spite of lactose content in yogurt, it is well tolerated by lactose intolerant people. This is due to presence of living lactate bacteria in fermented milk products which pass the harsh acidity of stomach and also due to small amount of lactose present in these products [28]. Milk and dairy products are major source of calcium and this mineral has small amount of lactase present in these products [28]. Milk and dairy products are consumed in form of full-fat increases the risk of obesity by elevating adiposity. Balance diet with regular physical activity is essential for avoiding all these complications in early or especially in later life [31].

**Conclusion**

Dairy products are enriched with the combination of vital nutrients which are almost unable to attain through dairy-free diets and hence it is very unlikely for people taking dairy-free diet to meet recommended daily intake of calcium. Focus of this article is to highlights the positive perspectives of calcium intake through dairy products. Intake of milk and milk products on regular basis not only reduces the risk of developing fractures, osteoporosis but also play significant role in the reduction of various ailments like obesity, heat and lactose intolerance. It is believed to be safe to take around three servings of dairy foods each day and they will deliver good benefits for the health of bones.

**References**


