



## THE NUTRITIONAL VALUE OF MILK

Milk has been part of the human diet for millennia and is valued as a natural and traditional food. Milk and dairy foods are considered to be one of the main food groups important in a healthy balanced diet, and as such feature in the majority of national food-based dietary guidelines from the British Eatwell<sup>1</sup> and Australian plate model<sup>2</sup>, to the Chinese Pagoda<sup>3</sup> and the Japanese Spinning top<sup>4</sup>, the US pyramid<sup>5</sup>, the Guatemalan pot<sup>6</sup> and many others. As milk provides a substantial amount of vitamins and minerals in relation to its energy content, it is considered a nutrient dense food<sup>7</sup>.

Cows' milk provides a wide range of essential nutrients to the diet. Whilst milk as a source of calcium is often recognized, it is perhaps less commonly known that milk and milk products are also an important source of good quality protein, the B vitamins, B<sub>2</sub> (riboflavin) and B<sub>12</sub>, and the minerals iodine, potassium and phosphorus<sup>8</sup>.

Milk consumption has been called a marker for an overall healthy diet because of its association with increased nutrient intake<sup>9</sup>. There is some data to show that nutrient intake is enhanced when dietary patterns include milk and dairy products. For example, in an 18 month randomised controlled trial, British girls in the intervention group were asked to drink extra milk, whilst the control group maintained their usual diet. Consuming an approximate additional glass (186ml) of milk every day significantly increased intakes of protein, calcium, phosphorus, magnesium, zinc and riboflavin, whilst milk consumption and nutrient intake were unchanged in the control group<sup>10</sup>. In a US study of milk drinkers, both flavoured and plain, intakes of vitamin A, calcium, phosphorus, magnesium, potassium were significantly higher than non milk drinkers<sup>11</sup>. Indeed the Dietary Guidelines for Americans advisory committee report determined that without milk products, 19-50 year old women would reach only 44% of calcium recommendations, 57% of magnesium recommendations and 57% of potassium recommendations<sup>12</sup>.

For all age groups in the UK, milk and dairy are major contributors to calcium, riboflavin (vitamin B<sub>2</sub>), phosphorus and iodine intake in the diet<sup>13-18</sup>. For young children they also contribute significantly to protein, vitamin A, potassium, magnesium and zinc intake<sup>13</sup>. In countries such as the US where milk is fortified, dairy foods can make an important contribution to vitamin D intake<sup>19</sup>, but this is not the case in the UK.

### Contribution of milk to nutrient intake (% total) in the UK diet

	1.5-4.5 years <sup>13</sup>	4-18 years <sup>14</sup>	19-64 years <sup>15,16,17</sup>	65+ years <sup>18</sup>
Protein	24	11	9.7	13.6
Vitamin A	30.5	10.9	7.0	13.0
Riboflavin (B2)	37.5	24.8	23.3	26.7
Vitamin B6	22.5	9.4	8.3	14.0
Vitamin B12	39.7	36.6	29.1	24.7
Calcium	46.9	28.3	26.2	36.1
Iodine	39.6	33.7	28.5	25.5
Magnesium	22.2	10.3	8.1	13.5
Phosphorus	32.7	16.4	15.1	21.2
Potassium	25.6	13.0	10.8	15.7
Zinc	25.0	13.0	9.7	13.6

### Nutrients in Milk

#### ***Vitamins and minerals***

#### **B Vitamins**

Milk is a good source of the B vitamins, riboflavin or B<sub>2</sub> and B<sub>12</sub>.

Significant amounts of riboflavin are present in milk<sup>8</sup>. Riboflavin is necessary for the release of energy from foods and the health of the body's membranes including the skin. It is also crucial for the maintenance of normal vision, normal red blood cells and functioning of the immune system. Riboflavin further contributes to the protection of DNA, proteins and lipids from oxidative damage<sup>20</sup>. Milk and milk products are the main sources of riboflavin in pre-school children's diets and the diets of school children and adolescents (4-18 years), adults (19-64 years), and the elderly (65 years and over)<sup>13-18</sup>. A 200ml glass of semi-skimmed milk provides 45% of an adult's (19-50 years) daily requirement for riboflavin<sup>8,21</sup>.

Vitamin B<sub>12</sub> is required for the maintenance of healthy nerves and red blood cells, as well as normal energy production and cell division. It is also needed for normal function of the immune system, neurological and psychological function, and reduction of tiredness and fatigue<sup>22,23</sup>. Milk products are the main sources of B<sub>12</sub> in the diets of pre-school children diets, children and adolescents (4-18 years) and adults (19-64 years)<sup>13-18</sup>. A 200ml glass of semi-skimmed milk will provide both a 6-year-old child and adult with their entire vitamin B<sub>12</sub> daily requirement<sup>8,21</sup>.

#### **Calcium**

Milk is an excellent source of calcium<sup>8</sup> which, as commonly recognized, is essential for the healthy growth and maintenance of teeth and bones. Calcium is also important for normal blood coagulation, normal energy yielding metabolism, normal muscle and nerve function, normal digestive function and normal regulation of cell division and differentiation<sup>24,25</sup>.

Milk and milk products are the main sources of calcium in pre-school school children and adolescents (4-18 years), adults (19-64 years) and the elderly (65 years and over)<sup>13-18</sup>. A 200ml glass of semi-skimmed milk can provide a 6-year-old child with over half (55%) of his or her calcium requirement and can provide an adult (19-64 years) with over a third (35%) of his or her daily calcium requirement<sup>8,21</sup>.

## Iodine

Milk is also a good source of the mineral iodine<sup>8</sup>. Iodine is required for the production of the thyroid hormones and normal thyroid function, for normal energy yielding metabolism and contributes to the maintenance of normal skin<sup>26,27</sup>.

The main sources of iodine in the UK diet come from milk and dairy products in all age groups from pre-school children to the elderly<sup>13-18</sup>. A glass (200ml) of semi-skimmed milk will provide a child of 6 years with 96% of their daily requirement for iodine and an adult (19-50 years) with 44%, but there is some seasonal variation in the iodine content of milk<sup>8,21</sup>.

## Phosphorus

Phosphorus plays a vital role in the maintenance of healthy bones and teeth, as well as cell membrane structure and regulation of the body's rate of energy metabolism<sup>28</sup>.

The main sources of phosphorus in the UK diet come from milk and milk products throughout all age groups<sup>13-18</sup>. A 200ml glass of semi skimmed milk will provide a child of 6 years with 55% of their daily requirement for phosphorus and an adult (19-50 years) with 36%<sup>8,21</sup>.

## Potassium

Potassium is important for helping to maintain normal blood pressure and helps maintain muscular and neurological function<sup>29</sup>.

Milk and milk products are the main sources of potassium in the UK diets of pre-school children and the elderly (65 years and over), and the second largest contributor, after potatoes, in the diets of school children and adolescents (4-18 years)<sup>13-18</sup>.

A 200ml glass of semi skimmed milk will provide a child of 6 years with 29% of their daily requirement for potassium and an adult (19-50 years) with 9%<sup>8,21</sup>.

## Ranked Contribution of milk (and milk products) to vitamin and mineral intakes in the UK diet<sup>13-18</sup>.

	<b>Preschool (1.5-4.5)</b>	<b>School (4-18)</b>	<b>Adult (19-64)</b>	<b>Elderly (65+)</b>
Vitamin B2	37.5 (45.8) Largest	24.8 (31.3) Largest	23.3 (28.7) Largest	26.7(31.0) Largest
Vitamin B12	39.7 (47.8) Largest	36.6 (41.9) Largest	29.1 (36.5) Largest	24.7 (28.1) 2 <sup>nd</sup> Largest
Calcium	46.9 (58.5) Largest	28.3 (40.6) Largest	26.6 (39.2) Largest	36.1 (45.7) Largest
Iodine	39.6 (49.7) Largest	33.7 (42.0) Largest	28.5 (34.3) Largest	25.5 (31.1) Largest
Phosphorus	32.7 (41.3) Largest	16.4 (24.1) Largest	15.1 (22.5) Largest	21.2 (26.7) Largest
Potassium	25.6 (29.2) Largest	13.0 (15.4) 2 <sup>nd</sup> Largest	10.8 (12.7) 4 <sup>th</sup> Largest	15.7 (17.0) Largest

## **Macronutrients**

### **Protein**

Milk is a good source of high quality protein<sup>30</sup>.

Milk and milk products are the largest source of protein in pre-school children and the second largest contributor further to meat and meat products in all other age groups<sup>8,21</sup>.

Cows' milk contains about 3.5% protein by weight, and of this total protein, 80% is casein and 20% whey. Casein is the dominant protein in milk and can be fractionated into four major components: alpha, beta, gamma and kappa-casein. Whey protein is composed predominantly of beta-lactoglobulin and alpha-lactalbumin, but other whey proteins include serum albumin, immunoglobulins (IgA, IgG, IgM), protease peptones, lactoferrin and transferrin<sup>30</sup>.

### **Carbohydrate**

The principal carbohydrate found in milk is lactose. Cow's milk contains about 4.5g lactose per 100g milk and there is some evidence that lactose is the least cariogenic of the common dietary sugars. In addition, various other components of milk have been considered to be protective against dental caries<sup>31</sup>.

### **Fat**

The fat content of milk varies depending on whether milk is whole, semi-skimmed or skimmed. Despite a misconception that milk is 'fattening', even whole milk contains only around 3.5% fat (3.5g/100g). Semi-skimmed milk contains 1.7% fat (1.6g/100g or 1.7g/100ml). Skimmed milk contains only 0.1% fat (0.1g/100g or 0.1g/100ml). Since January 2008 1% milk, which as the name implies contains 1% fat, is now available on the market<sup>32</sup>.

Milk fat contributes unique characteristics to the appearance, texture, flavour and satiability of dairy foods. Dairy fat is a source of energy, essential fatty acids, fat-soluble vitamins, and several other components, such as conjugated linoleic acid (CLA) and sphingolipids<sup>30</sup>.

About a quarter of the fat in milk is monounsaturated<sup>33</sup>. The remainder is mostly saturated fat, although some polyunsaturated fats and other minor fatty acids are also present.

Palmitic, stearic and myristic acids are the major saturated fats found in milk<sup>30</sup>. Dairy fat is also comparatively rich in the short and medium chain saturated fats. Research continues to unravel the complexities associated with individual fatty acids and fats from different sources and it is becoming increasingly apparent that not all fatty acids, or saturated fatty acids, have the same biological effects. There are a variety of saturated fatty acids in milk and many of these have no effect on plasma cholesterol<sup>33</sup>.

### **Conclusion**

Milk is a naturally nutrient rich and affordable product, with a high nutrient to energy ratio. Milk and dairy products are an important food group in many national dietary guidelines and may play a role in dietary quality. Whilst conclusive cause and effect relationship between milk and dairy intake and chronic disease has not been established, there is little evidence of any harmful effect and indeed some studies suggest milk and dairy products in the context of a healthy balanced diet may have some health benefit.

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