MILK

Nutritious by nature

The science behind
the health and nutritional impact
of milk and dairy foods

Blood pressure

Observational and clinical studies suggest that milk and dairy intake, particularly low-fat dairy, could have a beneficial effect on blood pressure and contribute to the prevention of hypertension. The DASH (Dietary Approaches to Stop Hypertension) diet, which focuses on fruit and vegetables and low-fat dairy foods, has been found to be an effective way to lower blood pressure.
Milk and dairy foods contain several nutrients and other bioactive components in the dairy matrix including calcium, potassium, phosphorus and bioactive peptides, which may be involved, individually or in combination, in the beneficial effects on blood pressure.

Observational studies

A number of observational studies have noted an association between milk and dairy intake and lower blood pressure, including in European populations. For example, in Welsh men, milk intake predicted systolic blood pressure: in the group with the highest milk intake (around a pint / 586ml of whole milk per day), systolic blood pressure was 10.4 mmHg lower than those who drank little or no milk after a 23-year follow-up[1]. Similarly, for older people (over 55 years) in the Rotterdam Study, the risk of hypertension decreased with increasing low-fat dairy consumption; although no relationship between dairy and blood pressure was seen in a wider age range of the Dutch population (20–65 years)[2,3]. In the French DESIR cohort, dairy (milk or yogurt) and cheese consumption were associated with lower diastolic blood pressure after the 9-year follow-up[4]. Cross-sectional data from the French cohort of the MONICA study also showed higher dairy intake was associated with lower systolic blood pressure[5]. A recent analysis of the National Adult Nutrition Survey in Ireland also reports an association between higher total dairy, and specifically milk, intake and lower systolic and diastolic blood pressure[6].

In a meta-analysis of five cohort studies, consumption of dairy foods was associated with a 13% reduced risk of elevated blood pressure[7]. Further analysis suggested that the effect may be driven by low-fat dairy and 'fluid' dairy (defined as milk and yogurt); cheese and full-fat dairy foods had no association with risk of high blood pressure. In another meta-analysis, of nine prospective cohort studies in 2012, dairy consumption was also associated with a reduced risk of hypertension[8]. Again, the effects were specific for low-fat dairy and milk (3% reduction per 200g/day) whereas there was no association for cheese, full-fat dairy, total fermented dairy and, in this case, for yogurt. Both meta-analyses suggest that milk and low-fat dairy could contribute to the prevention of hypertension. This concurred with the US Dietary Guidelines Advisory Committee's assessment of the science in 2010 which concluded that there was a moderate body of evidence that high intake of milk and milk products is associated with lower blood pressure[9]; subsequent studies have strengthened this conclusion. A systematic review published in 2016 of the association between dairy product consumption and risk of various cardiovascular-related clinical outcomes reports favourable associations between intakes of total dairy, low-fat dairy and milk and the risk of hypertension[10].

The DASH diet

The best known intervention involving dairy, the DASH (Dietary Approaches to Stop Hypertension) diet, has proved an effective way to lower blood pressure in those with and without hypertension[11-13]. The DASH eating plan, which emphasises fruit, vegetables, wholegrains and low-fat dairy products (around 3 servings a day), has been widely promoted in the USA for the prevention and treatment of high blood pressure[14]. Although this intervention was first conducted as a feeding trial, further studies have found that DASH dietary advice can also be effective at lowering blood pressure in free-living populations[15,16]. European guidelines on the management of hypertension now also include a 'DASH diet' approach recommending increased consumption of vegetables, fruits, and low-fat dairy products[17]. Observational studies have suggested that in children too, a 'DASH' dietary pattern may have beneficial effects on blood pressure[18,19]. A recent trial has also indicated that when higher-fat dairy foods are incorporated into the DASH pattern, blood pressure lowering effects are still evident[20]. In addition, three controlled trials which examined the impact of dairy products per se on blood pressure (rather than as part of a dietary pattern such as DASH) reported beneficial effects[21-23]. These included an intervention using full-fat hard cheese (two months of 30g/day of Grana Padano) compared with a placebo consisting of flavoured bread mixed with fats and salts in the same concentrations as the cheese[23].

Potential dairy matrix mechanisms

Milk and dairy foods contain several nutrients and other bioactive components which have been associated with blood pressure control. Recent research has focused on the importance of **bioactive peptides** in the regulation of blood pressure, including those from dairy. For example, a group of peptides (lactotripeptides), released from milk and dairy products during digestion of casein proteins in the gut or by fermentation, have been shown to have anti-hypertensive properties and to regulate blood pressure by inhibiting ACE-1, a potent vasoconstrictor[24-26]. Similarly, in a recent clinical trial, whey protein also lowered blood pressure and improved endothelial function in adults with pre-hypertension and mild hypertension[27].

Blood pressure-lowering effects of the B vitamin riboflavin, of which milk is a good source, have also been reported[28]. This reflects the role of riboflavin in regulation of homocysteine levels in those with a genetic defect in homocysteine metabolism (about 10% of the European population); an elevated level of homocysteine has been associated with hypertension[29].

The minerals in milk including calcium, potassium and magnesium are also linked to blood pressure regulation through their effects on intracellular mechanisms and production of vasodilators[30,31]. **Calcium**, for example, may have a direct impact on blood pressure through effects on vascular smooth muscle, as well as through parathryroid hormone (PTH) and vitamin D secretion, and increased sodium excretion[31]. **Phosphorus** in the dairy matrix may be involved too[31]. It has been reported that phosphorus from dairy products, but not from other sources, is associated with lower baseline blood pressure and reduced risk of hypertension[32]. This may indicate that the benefits of phosphorus are dependent on interactions with other dairy components. Indeed, it is likely that the blood pressure lowering effects of milk and dairy products are the results of interactions between the constituents of the dairy matrix[33].

The weight of the evidence to date suggests that milk and dairy foods, particularly low-fat dairy, can help lower blood pressure and contribute to the prevention of hypertension. This is important given that high blood pressure is a major risk factor for cardiovascular disease, particularly stroke, and even values at the high end of the normal range increase the risk. Around 30% to 45% of the European population has hypertension, with a steep increase with ageing, so even small reductions in prevalence could have public health benefit[17].

Milk nutritious by nature - nutrient richness **- an important part of European dietary guidelines**

Blood pressure

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September 2017 ref 2383