



BRAIN HEALTH: the vital role of Vitamin B₁₂ in dairy

Vitamin B₁₂ is essential for normal blood formation and neurological function. Research has demonstrated that the vitamin B₁₂ contained in dairy products, particularly milk, is more bioavailable and has the strongest correlation with blood levels of vitamin B₁₂ compared to other animal source foods. Observational research has also shown correlations between vitamin B₁₂ deficiency and neurodegenerative diseases, emphasising how important it is to maintain adequate dietary levels of vitamin B₁₂ for healthy brain ageing.

Dietary sources of vitamin B₁₂

Animal sources, the richest sources of vitamin B₁₂, should be consumed to obtain the requirement of vitamin B₁₂ from the diet (Table 1) since foods of plant origin contain no vitamin B₁₂ beyond that derived from contamination or bacterial synthesis.¹ The Nutrient Reference Value (NRV) of vitamin B₁₂ for adults older than 14 years is 2.4 µg/day.² One serving of milk (250 ml) provides almost half of the NRV for adults, indicating that the dairy recommendation of "three servings a day" is sufficient to meet the recommended dietary allowance for vitamin B₁₂ for normal healthy adults.

Bioavailability of vitamin B₁₂ in cow's milk

Although vitamin B₁₂ content of milk is not high compared to other animal sources (Table 1), it has been found to be highly bioavailable:^{4,5}

- Vitamin B₁₂ naturally present in cow's milk is more available than cyanocobalamin, the most commonly used synthetic form of vitamin B₁₂⁴
- Mean vitamin B₁₂ absorption from milk in adult subjects was reported as 65%, ranging from 48 to 88%⁵

Vitamin B₁₂ status and dairy consumption

Observational studies in humans not only show high correlations of vitamin B₁₂ intake and vitamin B₁₂ status with dairy product intake but also suggest a higher bioavailability of the vitamin from dairy products:⁶⁻⁹

- People with the highest vitamin B₁₂ intake from dairy foods consume about twice the average total vitamin B₁₂ compared to those with the lowest intake. The relationship between plasma concentrations of vitamin B₁₂ and its intake from dairy products was higher than the relationship with the intake from meat, poultry or fish.⁶
- Plasma vitamin B₁₂ is associated with intakes of increasing amounts of vitamin B₁₂ from dairy products or fish but not with intakes of vitamin B₁₂ from meat or eggs.⁷
- Vitamin B₁₂ status of vegetarians was positively correlated with their intake of dairy products, especially milk, but not of eggs or seafood.⁸
- Plasma vitamin B₁₂ showed a strong positive association with frequent intake of beef, chicken, and dairy products in a dose-response manner among Colombian school children.⁹

Experimental studies support the associations found in observational studies:

- Adults consuming 3 cups of milk per day for 12 weeks significantly increased their vitamin B₁₂ intakes.¹⁰
- Milk (200–250 ml/d), added to the diet of undernourished school children, significantly increased their vitamin B₁₂ concentrations in the blood after one year. The prevalence of severe plus moderate vitamin B₁₂ deficiency also fell from 71.6 to 45.1%.¹¹

Table 1 Vitamin B₁₂ content and bioavailability of dietary sources³

Dietary source	Bio-availability	Content (µg/100g)
Animal meats		
Mutton, cooked	56%–89%	2.6
Chicken, cooked	61%–66%	9.4
Dairy		
Cow's milk	65%	0.4
Eggs	9%	1.3
Shellfish		
Oyster		46.3, 28.1
Mussel		15.7, 10.3
Short-necked clam*		37.0, 52.4
Fish meats		
Skipjack, dark muscle*		158.5
Yellow fin tuna, dark muscle		52.9
Rainbow trout, cooked	42.0%	4.9

*foods that are not well known in SA

Vitamin B₁₂ deficiency and Cognition

Vitamin B₁₂ deficiency is a common cause of megaloblastic anaemia and also produces neurologic abnormalities. Prolonged deficiency can cause permanent nerve damage.¹ Methyl acceptors such as myelin, neurotransmitters and membrane phospholipids are essential for maintaining the integrity of the nervous and haematopoietic system. Methyl acceptors receive their methyl group (CH₃) when methionine is activated to S-adenosyl-methionine. Vitamin B₁₂ is required for the methylation of homocysteine to methionine. Insufficient vitamin B₁₂ disrupts this cycle resulting in intracellular accumulation of homocysteine which is potentially toxic to neurons.¹²

Both vitamin B₁₂ deficiency and raised homocysteine levels have been associated with cognitive decline and neurodegenerative diseases.^{12,13} A recent systematic review concluded that low serum vitamin B₁₂ levels are associated with neurodegenerative diseases (Alzheimer's disease, vascular dementia, and Parkinson's disease) and cognitive impairment.¹³ Vitamin B₁₂ is an important vitamin for maintaining proper metabolism of homocysteine, since raised homocysteine levels can cause the brain to become more susceptible to oxidative damage and apoptosis.

Dairy products can potentially play an important role in ensuring adequate homocysteine metabolism, particularly during ageing.¹⁴

CONCLUSION

Milk and dairy products provide a highly bioavailable source of vitamin B₁₂ which can significantly contribute to dietary vitamin B₁₂ intakes, while possibly providing additional protection against low plasma vitamin B₁₂ status and neurodegenerative diseases.



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