INTRODUCTORY REMARKS

Vitamin preparations have been a stalwart of the supplement industry. They reflect both our understanding that they are, by definition, essential for optimal health and function, as well as our fears that either the food supply, or the way we consume it, fails to provide us with optimal amounts of these micronutrients. In the case of B-vitamins, the greatest research interest in supplementation occurred around World War II, tied to the reasonably new discovery of many of these vitamins and the interest in adequate war rations and military feeding plans. Even with the more targeted interest in sports nutrition, the topic of vitamin supplementation seems dated, with most available studies dating back to the early 1990s. The interest in vitamin K in sports nutrition, however, is more contemporary, due to its role in bone health.

VITAMIN B

M K Ranchordas

The B-vitamins are water-soluble vitamins that play crucial roles in energy metabolism. There are eight B-vitamins: thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5) pyridoxine (B6), biotin (B7), involved in energy-producing pathways; folate acid (B9), cobalamin (B12) involved in synthesising new cells, red blood cells and in cell repair. The richest sources of B-vitamins are unprocessed foods such as whole grains, green leafy vegetables, nuts, dairy products and animal foods such as meat and eggs but, in many countries, foods such as cereals and bread are fortified with these vitamins.

It has been reported that inadequate intake and deficiencies in B-vitamins could impair athletic performance.1 2 Studies examining dietary intakes of B-vitamins in athletes have found that males typically report higher intakes than females because of their overall higher energy intake.3 Female athletes on an energy restricted diet and/or who exhibit disordered eating practices have lower intakes of riboflavin, folate and pyridoxine.4–7 Limited data on B-vitamin status in athletes exist: the few studies available have examined the status of thiamin, riboflavin, pyridoxine, folic acid and cobalamin.

Some studies reported thiamin status to be adequate8 9 and, moreover, that exercise training does not appear to alter thiamin status.10 Similarly, studies on cobalamin also observed adequate status.11 12 However, there are no studies on the effects of pyridoxine supplementation on performance per se. High folate and cobalamin intakes in conjunction with regular exercise may reduce plasma homocysteine concentrations which, in turn, can lower the risk factor for cardiovascular disease.13 Further well-controlled studies are required to investigate the effects of B-vitamin supplementation on exercise performance in athletes, and on physical activity and health, against a background of both adequate and inadequate status.

VITAMIN K

B Lundy

Vitamin K is of interest to sports performance through its identified potential either to prevent or enhance the healing of bone injury. Vitamin K is a co-enzyme involved in the γ-carboxylation of certain proteins in bone, including osteocalcin. Vitamin K is found in plant-based food as phylloquinone (K1) and can be synthesised by bacteria as menaquinones (K2).14 Current recommended dietary intakes for vitamin K are based on a diet sufficient to promote normal blood clotting and it is possible that this is inadequate for optimal bone health.15 Low vitamin K status has also been linked with increased risk of hip fracture.16 Reduction in
the number of bone injuries or the time taken to recover from these could be a significant performance enhancer in sport by reducing training time lost to injury.

The impact of vitamin K on bone health has been examined mostly in postmenopausal women. In a recent meta-analysis by Cockayne et al. the impact of supplementation was assessed against bone loss and fracture risk with the conclusion that vitamin K2 supplementation may decrease fracture risk and that both K1 and K2 reduced bone loss. Another meta-analysis, by Fang et al., examined the relationship between vitamin K supplementation and bone mineral density (BMD). It was concluded that supplementation with K1 may improve bone density at the lumbar spine but not at the femoral neck, although there was a large heterogeneity in results between studies. Doses studied varied between 1 and 45 mg/day which are well above the current Australian adequate intake of 60–70 μg/day. In both meta-analyses the majority of studies were undertaken in postmenopausal Asian women, which means this may not be generalised to other population groups such as athletes.

To date only two studies have been conducted in athletic populations. The first found that K1 supplementation (10 mg/day for 4 weeks) improved markers of bone formation in athletes. Five of eight athletes were classed as deficient in vitamin K at baseline and supplementation had a larger effect on bone markers in these athletes. It is unclear as to why there was such a high incidence of deficiency in this group and whether this is representative of status in athlete populations generally. Braam et al. undertook a 2-year follow-up study looking at supplementation (10 mg/day, K1) in 115 female runners. Menstrual status was assessed and bone loss was measured by BMD. No benefit of supplementation was found. Limitations of the study were infrequent follow-up (6 monthly contact) and no adherence measures.

While research relating to vitamin K is interesting, further studies are required before it is routinely considered in the management of bone health in athletes.

**CONCLUDING COMMENTS**

B-vitamins play crucial roles in energy metabolism, in synthesis of new cells, red blood cells and in cell repair. Thus, it is logical that inadequate intake and status of B-vitamins would impair athletic performance. Athletes and female athletes in particular, who eliminate certain food groups such as dairy or milk, restrict energy intake and engage in disordered eating practices, are at a greater risk of developing inadequate status of B-vitamins. Regular exercise training may increase the requirements for some B-vitamins such as riboflavin and pyridoxine: however, further research is necessary to establish whether this is the case for folate and cobalamin. According to current evidence, when adequate intakes and status of B-vitamins are present, further supplementation does not enhance exercise performance. The role of vitamin K status is of interest in relation to promoting bone formation and healing. Further information on vitamin K status of athletes and of the effect of vitamin K supplementation on bone health is required, however, before definitive recommendations can be made regarding the level of importance that this piece of the jigsaw of bone health holds.

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