any reason to suppose that muscular activity increases the demand, or that any one vitamin may play a part in athletic efficiency so that a generous supply should be deliberately administered?

The world has become vitamin-conscious, an attitude of mind sustained by skilful advertising of synthetic preparations. Not only is the most preposterous pseudo-scientific nonsense bandied about, but even scientific application is far from satisfactory. We recall the series of experiments during the War, some advancing evidence of improved health, well-being and enhanced physical efficiency as a consequence of their routine administration; others at least equally authoritative proving the entire absence of any advantage.

There may be elusive substances not yet isolated which contribute to athleticism. If so, I am inclined to think that Nature will express this need by an instinctive craving for some foodstuffs in which they are present. With this possibility in view a trainer ought to sympathize with idiosyncrasies rather than reprobate them as he is inclined to do on traditional lines of training dietetics.

Those who are infatuated with the potency of nutrition, and in particular with the vitamins, advance these as an explanation of the athletic records that have been continuously created in the last half-century. I do not believe that present-day athletes are at all physically superior to their predecessors of, say, 60 or 70 years ago. The creation of records is, in my opinion, satisfactorily explained, partly by improvement in technique, but much more by the vast increase in competition and the extension of the cult of athleticism throughout the world. In this way naturally gifted performers are discovered or, shall I say, reveal themselves, sometimes in the most unexpected situations. No doubt records will continue to be broken although to a diminishing extent. All this has nothing to do with food, it is simply natural selection.

REFERENCE

Schenk, P. (1936). *Münch. med. Wschr.* **83**, 1535.

Some Practical Aspects of the Nutrition of Athletes

By R. N. A. LEYTON, 10 *Harley Street, London, W.* 1

The problems involved in the consideration of the nutritional side of the training of athletes are both many and interesting. So far as this country is concerned rationing has added to the difficulties of all trainers, making adequate preparation almost impossible.

When considering the question of body nutrition and training it is essential first to make clear the fact that the amount of food required varies greatly with individuals. One man will require 3000 Cal. for even light work whereas another will not lose weight under normal conditions with a diet as low as 2200 Cal. This must clearly be taken into account when deciding what added nutrition is required for training purposes. The same differences are apparent as far as the time of meals before a race is concerned.

One man will want his food 2·5–3 hr. before a contest, another will be unable to put forth full exertion unless there is some food left in the stomach.

Training is clearly a long-term policy. A man may have to lose weight in the early stages but, after fat has initially been lost, enough nutriment must be ingested daily for the maintenance of body tissues and for the repair of muscle breakdown.

Actual calorie expenditure during contests varies greatly. This can best be seen by some concrete examples. A man rowing all out for 20 min. in the Boat Race over 4·5 miles from Putney to Mortlake will need about 600 Cal. (McCurdy & Larsen, 1939). A 2 hr. Marathon race may use 2000 Cal.; a five-set tennis match 1200. These are amounts used during the actual exercise and do not take into account the added calories required over and above the basic normal until the body has resumed its regular basic metabolic rate, sometimes a matter of 24, or even 48 hr.

It is therefore convenient to divide nutrition and its connexion with athletics into two periods and to consider nutriment essential over a long period and that which it may be possible to give the athlete during his contest for immediate use.

A good training diet must include, in addition to bread, meat, eggs and potatoes, a liberal supply of oranges, grape fruit, tomatoes, fresh beans, cabbage, carrots, greens, lettuce, cauliflower and spinach. All these last foods are relatively rich in vitamins, and they also assist in avoiding constipation.

Sherman & Smith (1922) have shown that athletes may well require added amounts of vitamins A, B and C for the full stimulation of all body secretions and the prevention of nervousness.

So far as fluids are concerned the intake should be in the region of 5 pt./day made up, as far as possible, of bland liquids. There does not appear to be any objection to drinking with meals provided the amount taken is not excessive and that it does not wash undigested food into the duodenum.

Tea and coffee are best left out of the training diet. Voigt (1936) has shown that caffeine decreased muscular efficiency by as much as 23%.

Some individuals find that a cigarette is almost essential for their mental well-being some time during the day. The question arises whether this can help digestion from a psychological aspect sufficiently to overcome the undoubted lowering of ability. It has been shown that, owing to a reduction of the oxygen-carrying power of the blood and the paralysing effect of nicotine on the synapses at the myo-neural junctions, speed is lost. One feels, however, that the benefit derived from one cigarette after a meal more than counterbalances any deleterious effect there may be, and that it should be permitted.

That, very briefly, summarizes the position so far as the pretraining period is concerned.

Is it possible to assist the athlete during the contest?

We know that 20 min. of all-out effort uses about 1 oz. of sugar. A Marathon runner may use, therefore, nearly 8 oz. during his race.

Fortunately, though it takes 6 hr. for 1 pt. of raw milk to be absorbed from the stomach and intestines, 4 oz. of sugar are completely absorbed in 2 hr., and small amounts are very rapidly taken into the blood stream, as is witnessed by the rapid

recovery of a patient with hypoglycaemia on swallowing a lump of sugar. This is the only type of energy that can be given to an athlete during the contest, and it is one which many at the present time have taken when feeling the effects of exertion.

The effect of diet on staleness must not be left out of consideration. A varied diet may make all the difference between keenness and the feeling of lassitude which is the first sign of this condition, which it is almost impossible to cure without a complete break in training.

It is perfectly true that the nutritionist has a place where athletes' training is concerned. But one is forced to the conclusion that probably the body itself is as good a judge as any of what it requires in the broad manner; it is just in the finer points that the scientist can help.

In Britain to-day trainers do not have an easy time to provide the necessary total calories in the right proportions, and neither can the body always get what it feels it wants. For that reason more than any other one thinks that the expert, with his knowledge, can be a very useful adjunct to a man preparing for an important contest.

REFERENCES

McCurdy, J. H. & Larsen, L. A. (1939). *Physiology of Exercise*, p. 256. London: H. Kimpton.
Sherman, H. C. & Smith, S. L. (1922). *The Vitamins*, p. 61. New York: The Chemical Catalog Co. Inc.
Voigt, G. (1936). *Dtsch. med. Wschr.* **62**, 179.

Summing up

By J. R. MARRACK, *London Hospital Medical College, Whitechapel, London, E.* 1

Fifty years ago the relation of disease to nutrition was generally ignored; it is remarkable that the importance of diet in the training of athletes was, as it now appears, exaggerated. Since then we have gained a much fuller understanding of the processes that take place in a muscle during contraction and of the essentials of an adequate diet; can anything about the feeding of athletes be learnt from these advances?

Needham (1948) and Eggleton (1948) have discussed the sources of energy in muscular contraction. Creatine phosphate serves as a reserve of energy; creatine is made from arginine, which is one of the essential amino-acids. But is there any evidence that the supply of arginine is ever a limiting factor in muscular work? Bourne (1948) has reviewed experiments bearing on the effect of vitamins on muscular exercise. The evidence is conflicting, and it is doubtful whether, in ordinary conditions, athletic performances are improved by supplements of vitamins.

Eggleton (1948) dealt also with the blood supply to muscles. The amount of energy that can be expended by muscles in a given time depends not only on the muscle