Factors influencing on running

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1 VO2max

Running economy is important, but can it be altered? It seems that persons beginning exercise definitely become more efficient with training, as do persons who are already trained but who continue heavy training. Conley et al. (1981) followed a single runner during 6 months of interval training and found that the subject’s running efficiency improved by between 9 and 16% at three different speeds. However, his body weight also fell about 6%, which could have been the more important factor explaining the improved running efficiency. Subsequently these authors showed that the running efficiency of Steve Scott, America’s premier 1500 m runner of the early 1980s, improved with interval running. Svedenhaug and Sjodin (1985) showed that the running efficiencies of a group of elite Swedish distance runners improved between 1 and 4% during the course of one year, changes that where in the range of those measured in the adolescent runners is studied by Daniels and Oldridge (1971). Svedenhaug and Sjodin speculated that the continual improvements in the running performances of these Swedish athletes were due to slowly progressive improvements in their running efficiencies rather than to increase in the VO2max values, which were relatively fixed, increasing only during that phase of the season when the athletes were performing high-intensity interval-type training.

Athletes appear to choose stride lengths at which they are most efficient, that is, at which oxygen uptake is the least (Cavanagh and Williams 1982). When forced to take either shorter or longer strides but to maintain the same running pace, athletes become less efficient and require an increased oxygen uptake. With training, runners increase the length of their strides and reduce their stride frequency (Nelson and Gregor 1976). Some researchers believe that this optimises running efficiency because increasing stride length is more economical than increasing stride frequency.

Although VO2max values differ between the sexes, gender has no effects on running efficiency, trained men and women are equally efficient
(Maughan and Leiper 1983). Race may influence running efficiency, researchers have found that Asians and Africans utilise 17% less energy than Europeans when lying, sitting, or standing, but no studies have compared energy uses of these groups during exercise. In a study of elite runners of different racial groups, researchers found no race-related differences in running economies (Noakes 1991).

2 Extra weight

Clothing weight is another factor that can influence an athlete's efficiency. Stevens (1983) calculated the effect of the weight of clothing on marathon racing performance. He found that the typical nylon vest and shorts worn by marathon runners weighted 150 g, 100% cotton shorts and vest weighted 234 g, and the heavy tracksuits weighted 985 g. Stevens calculated that changing from nylon to cotton clothing would increase a world-class runners marathon time by about 13 seconds and an average 3:40 marathoners time by about 23 seconds. Running in a full tracksuit should increase the average runners marathon time by about four minutes.

However, laboratory experiments do not necessarily substantiate these calculations. Cureton et al (1978) found that the addition of up to 5% of body weight to the torso increased the oxygen cost of running by only about 2.5%. Extrapolation these data suggest that the addition of even 1 kg of extra weight to the torso in the form of clothing would increase the oxygen cost of running by less than 0.5.

Extra weights added to their legs or feet appear to have a far greater effect on the running economy. Martin (1985) found that the addition of 0.5 kg to each thigh or to each foot increased the oxygen cost of running by 3.5 and 7.2%, respectively, values considerably higher than those found by Cureton et al (1978). A number of other studies show that the addition of 1 kg to the feet increases the oxygen cost of running by between 6 and 10%, or about 1% per 100 g increase in the weight of footwear. The increase is the same in men and women.

Clearly, a 1% savings in energy expenditure during a standard marathon race, for example, is not inconsiderable, if translated directly into a 1% improvement in performance it would mean a savings of 77 seconds at world-record marathon pace, equivalent to a sub 2:07 standard marathon. But we have yet to prove that these energy savings will cause an equivalent improvement in running performance.

In-shoe orthotics used in the treatment of a number of running injuries will increase shoe weight and therefore might influence running economy adversely. In the study of Burkett et al (1985), the addition to an 80-g