Peak Blood Lactate after 400 m Sprinting in Sprinters and Long-Distance Runners

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Summary Peak blood lactate following 400 m sprinting was determined in 8 sprinters and 8 long-distance runners. The mean velocity of 400 m run and peak blood lactate were significantly higher in the sprinters than in the long-distance runners. It was suggested that peak blood lactate may be a useful indication of anaerobic work capacity in long-distance runners, but not in sprinters.

Key Words: peak blood lactate, sprinter, long-distance runner.

The peak value of post exercise blood lactate is generally considered the best measure for evaluating an individual's anaerobic work capacity. We found in the previous study that peak blood lactate concentration, which was observed after supermaximal exercise for about 60 sec, correlated with running times for 100, 200, and 400 m sprints in untrained subjects (FUJITSUKA et al., 1982). However, contradictory results have been reported in trained athletes by different authors, e.g., significant correlation between muscle lactate concentration and endurance time for short-term (1–2 min) exhaustive exercise by TESCH (1978), or no correlation between peak blood lactate and mean velocity in 400 m sprinting by OHKUWA et al. (1984). The purpose of this study, therefore, was to confirm whether peak blood lactate concentration after supermaximal exercise can be used as an indication of anaerobic work capacity in trained sprinters and long-distance runners, and to examine the difference in the peak blood lactate between sprinters and long-distance runners.

The subjects for this study were 8 sprinters and 8 long-distance runners belonging to the track and field team of Chukyo University. They trained regularly 3 to 4 hr daily, 6 days a week year round and continued for at least 4 years. The average values of physical characteristics and best times of the subjects are shown.
in Table 1. The experiments were always carried out 2 hr after the last meal. Each individual was briefly informed about the experimental procedures prior to the 400 m sprint run. Four hundred meter sprinting was performed on the en-tout-cas 400 m track after warming up for about 30 min. All the subjects were asked to run as fast as they could and then lie quickly on a simple bed in a supine position for withdrawal of blood samples after running. Each runner was timed using a stopwatch for the 400 m. A 21 gauge butterfly needle with sampling vinyl tube was inserted into the antecubital vein as soon as possible after exercise. Five milliliters of venous blood were drawn in order to measure the peak value of lactate using a disposable syringe at 1, 3, 5, 7.5, and 10 min following the 400 m run. Blood lactate concentration was determined by an enzymatic method as described by HOHORST (1962). A p value less than 0.05 was considered to be statistically significant.

It was found that the 400 m times ranged from 51.4 to 54.8 sec for the sprinters and from 51.6 to 58.3 sec for the long-distance runners. Average values and standard deviations of the above running time in the two groups were 54.3±2.2 and 55.7±2.1 sec, respectively. When expressed as mean velocity in 400 m sprinting, that for sprinters was 7.51 ±0.15 m/sec and that for long-distance runners was 7.18±0.31 m/sec, the former being significantly faster than the latter.

Figure 1 shows the relationship between mean velocity and peak blood lactate concentration in both sprinters and long-distance runners. There are significant correlation (r=0.72, p<0.05) in the long-distance runners, but not in the sprinters. These results suggest that peak blood lactate obtained after 400 m sprinting may be a useful indication for anaerobic work capacity in the long-distance runners, but not in the sprinters, and that performance in 400 m sprinting may depend mainly on energy supply from glycolysis in the long-distance runners, but in the sprinter it will be influenced not only by glycolysis, but also by other factors such as ATP and CP content in the muscle (REHUNEN et al., 1982) and force per unit muscle cross-sectional area (MAUGHAN et al., 1983). On the other hand, the time of occurrence of peak blood lactate concentration during recovery ranged from 5 to 10 min in 400 m sprinting and from 5 to 7.5 min in the 3,000 m run. There were no significant differences in the occurrence times of peak blood lactate between sprint and long-distance runners. However, it was found that peak blood lactate was significantly (p<0.05) higher in the
sprinters (mean 19.06 ± 1.48 mmol/liter) than in the long-distance runners (mean 14.97 ± 1.49 mmol/liter). Our results basically agree with data of THOMSON and GARVIE (1981) and REHUNEN et al. (1982). Different training methods may explain why peak blood lactate was higher in the sprinters than in the long-distance runners. The training program of the sprinters consisted of mostly brief, high intensity running in which the fast twitch muscle (FT) fibers are the first to be engaged in contraction. By contrast, in endurance training, the work load is so relatively low that the slow twitch muscle (ST) fibers are mainly engaged. Furthermore, it has been observed that 1) skeletal muscle LDH (lactate dehydrogenase) activity is a function of its fiber composition (COSTILL et al., 1976), 2) peak blood lactate correlated significantly with the ratio of FT fiber (KOMI et al., 1977), 3) the gastrocnemius (predominantly FT fiber) muscle consistently had a greater percentage of its total net energy cost provided by anaerobic glycolysis than aerobic metabolism, which was opposite the case of the soleus (ST fiber) muscle (SAWKA et al., 1981). Since it is well established that the leg muscles of sprinters contain a high proportion of FT muscle fiber whereas endurance runners have a high proportion of ST muscle fiber (KOMI et al., 1977), the difference of peak blood lactate between the two groups may be due to the difference in the amount of FT fiber, although no significant difference was reported in the lactate concentration (JACOBS and KAISER, 1982) or the ATP or CP contents (ESSEN, 1978) between the pooled specimens of FT and ST fibers.

REFERENCES


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