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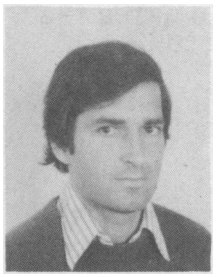

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THE EFFECT OF PURE AEROBIC TRAINING ON AEROBIC AND ANAEROBIC CAPACITY

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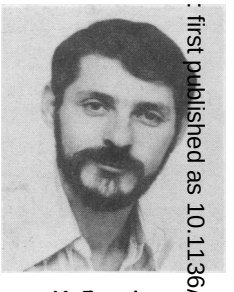

Y. Epstein

ABSTRACT

Twenty men (Group I) and twenty-seven men (Group II) took part in a 3-week training course. The training was aerobic and consisted of marching and hiking. The intensity of the training regimen in Group II was greater than for Group I. The maximal oxygen uptake ($\dot{V}O_2$ max) increased significantly in both groups, more in Group II than in Group I, though no significant change was found in anaerobic capacity. It can be concluded that aerobic training cannot induce improvement in anaerobic capacity.

The aerobic working capacity and its main determinant, maximal oxygen uptake ($\dot{V}O_2$ max) were discussed and investigated thoroughly in the past. Anaerobic performance which is nowadays considered not less important was on the other hand neglected (Burke 1953, Petrofsky 1975).

Daily physical activities of modern populations do not last for more than a few minutes or even seconds and activities of that duration make use of anaerobic resources for their completion (Ayalon 1974).

It is agreed today that anaerobic training can improve anaerobic capacity significantly (Fox 1975, Inbar 1977). The present study was designed to determine the effect of pure aerobic training on aerobic and anaerobic capacities.

MATERIAL AND METHODS

Forty-seven healthy men were divided randomly into two training courses. Twenty subjects, whose average age was 25.2 ± 1 years, weight 76.7 ± 9.3 kg, and height 175 ± 7 cm, attended the first course (Group I), whereas the other 27 subjects, whose mean age was 24.8 ± 2 years, weight 78.6 ± 10 kg, and height 176 ± 7 cm, participated in the second course (Group II). The duration of the training course was 3 weeks.

The training of each regimen was purely aerobic and consisted of running, jogging and hiking alternately about 4 hours per day (2 hours a.m. and 2 hours p.m.). Walking was at a speed of 5 km/h whereas running was at a speed of 8-10 km/h. The second course was more intensive and ran at a higher speed than the first course. The training was not too severe and the participants did not reach maximal heart rates.

Prior to, and following, the course, the subject's weight and heart rate at rest were recorded. The predicted maximal oxygen uptake ($\dot{V}O_2$ max) according to the multistage ergometric test of Åstrand and Rodahl (1970) was determined on the Monark ergometric cycle. The anaerobic capacity was measured according to a modification of the test of Inbar et al as follows (Bar Or 1978):

Before performing the test, the examinee warms up on the ergometer intermittently for 10 minutes and then rests 5 minutes. Then, at the command "start" he has to pedal as fast as he can, against low resistance which is set to a predetermined level within 3-4 seconds. At this stage a stopwatch and electrically triggered counter are activated and measurements initiated. The number of revolutions during a total of 30 seconds is recorded.

The optimal load for attaining maximal power output on the Monark ergometer is 0.075 kg per kg of body weight. The total anaerobic capacity per minute is determined by the following formula, and is given in kg.m/min:

Anaerobic capacity = number of revolutions in 30 s x 6 x resistance x 2. This method, similar to the test

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described by Margaria in 1966, is simple, and computes work output during short activity at maximal effort (30 s x 2 = 60 s). The number of revolutions x 6 gives the distance in metres, as every revolution on the standard Monark cycle is equal to six metres. It is easy, therefore, to calculate work output per minute by the formula:

(No. of revs x 6) x (30 x 2) x (Resistance), expressed in kg.m/min., and converted to Watts by multiplying by $\frac{9.8}{60}$.

The student paired-t-test was used for intragroup statistical evaluation of the effect of training in each group. The results were considered significant when $p < 0.05$.

RESULTS

Table I shows the predicted maximal oxygen uptake ($\dot{V}O_2$ max), and the aerobic capacity before and after the training course. There was a gradual and marked increase in maximal oxygen uptake both in Group I and Group II from 28.2 ± 5.5 and 28.7 ± 4.5 $ml.O_2.kg.BW^{-1}.min.^{-1}$ to 33.6 ± 7.0 and 38.3 ± 6.6 $ml.O_2.kg.BW^{-1}.min.^{-1}$ respectively. Thus the first group improved its $\dot{V}O_2$ max by about 20% and the second group by about 26%.

TABLE I

MAXIMAL OXYGEN CONSUMPTION, VO_2 max, ($ml.O_2 kg.Bw^{-1}.min.^{-1}$) BEFORE AND AFTER THE TRAINING COURSE (Mean ± SD)

Group	N.	Before	After	p
I	20	28.2 ± 5.5	33.6 ± 7.0	< 0.01
II	27	28.7 ± 4.5	38.3 ± 6.6	< 0.01

The results of the anaerobic test are summarised in Table II. The mean anaerobic capacity of Group I was 2830 ± 740 and 291 ± 650 $m.kg.min.^{-1}$ (462 ± 120 and 475 ± 107 W) before and following the course respectively. Group II showed slightly better results, of 3220 ± 590 and 3120 ± 490 $m.kg.min.^{-1}$ (525 ± 97 and 510 ± 80 W). The differences between the anaerobic capacities before and following the training course were not significant.

TABLE 2

ANAEROBIC CAPACITY BEFORE AND AFTER THE TRAINING COURSE (Mean ± SD)

Group	N.	Before	After	p
I	20	2830 ± 740	2910 ± 650 ($m.kg.min.^{-1}$)	> 0.05
		i.e. 462 ± 120	475 ± 107 (W)	
II	27	3220 ± 590	3120 ± 490 ($m.kg.min.^{-1}$)	> 0.05
		i.e. 525 ± 97	510 ± 80 (W)	

DISCUSSION

The results of this study show that pure aerobic training induces improvement of aerobic performance but has no significant influence on anaerobic capacity.

Both groups were trained by the same methods of running and hiking for 4 hours per day. The second group was trained more intensively, by walking and running at higher speeds than the first group. This harder training induced a significantly greater improvement in $\dot{V}O_2$ max.

It is assumed today that anaerobic training causes improvement in anaerobic capacity (Fox 1975, Inbar 1977) and that intensive anaerobic training also induces an increase in aerobic working capacity, although some studies show no such relationship (Thorstensson 1975).

The slightly greater intensity of training in the second group was in order to establish whether the difference would have any effect on anaerobic capacity. It was demonstrated that though aerobic capacity improved significantly more in the second group than in the first, the anaerobic capacity showed a tendency to decrease.

Two conclusions can be drawn from our results:

1. Pure aerobic training in itself cannot induce improvement in anaerobic capacity.
2. The intensity of the training has no significant effect on and may even induce some reduction in anaerobic performance.

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BOOK REVIEW

Title: **JIM FIXX'S SECOND BOOK OF RUNNING**

Publisher: Random House, New York

Price $10.00 U.S. 239 pages, 12 tables, 18 figs., Bibliography Hard Cover

This sequel to the bestseller "The complete book of running" is yet another addition to the current dearth of popular books on running.

Jim Fixx's first book was able to herald the running boom but this second book adds little to the regular runner's knowledge of the subject.

However for the newcomer to the running scene it provides a useful collection of information in a single volume. For the sedentary layman it gives the salient facts on the benefits of exercise and practical advice on how to start running regularly.

The chapter on equipment illustrates the excessive commercial interest which has taken advantage of the popularisation of running. A chapter on podiatry reflects the interest in this paramedical speciality in the U.S. but is of less interest to the British reader because of the general lack of development of this in this country. Again with the U.S. reader in mind the runner's directory may be helpful giving details of equipment, publication, organisation and services "worth knowing about".

A selected bibliography is available for those interested in following up some of the points made by the author but the incompleteness of these, with lack of page numbers, detracts from their usefulness.

In general each subject tackled by the author provides a balanced viewpoint with comprehensive coverage on all facets of running and is notably one of the few books to devote a section to fell running.

This book would provide a useful introduction for the reader who is just developing an interest in running but of less value to the already converted.

Wendy Dodds