

# MIDDLE DISTANCE RUNNERS: A STUDY OF CARDIOMETABOLIC RECOVERY AFTER EXERCISE PERFORMED AT WORKLOADS HIGHER AND LOWER THAN ANAEROBIC THRESHOLD

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## INTRODUCTION

Middle-distance racing consists in running stages covering 800 and 1500 meters around a standard Olympic-sized track, which needs great aerobic and anaerobic power. In common practices, coach refers to the heart rate (HR) values near the anaerobic threshold (AT) as the best index of exercise recovering, from which recovery intervals between two workloads may be chosen. This research aims to investigate the differences in recovering of cardiometabolic variables after two different workloads: the first one at workload 20% less than the AT, and the second one at workload 20% over the AT. Our study on changes in cardiometabolic parameters shall allow precisely quantifying training workloads together with recoveries lasting in the middle-distance.

## METHODS

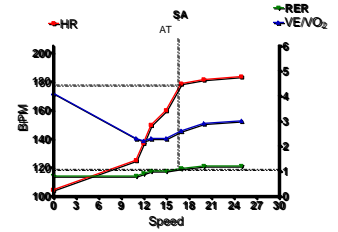
Two female and four male middle-distance runners competing on national and regional levels, were engaged in this study. By a portable mass spectrophotometer (fig. 1) the following variables were assessed: HR; Pulmonary Ventilation (Ve); oxygen consumption (VO<sub>2</sub>); carbon dioxide production (VCO<sub>2</sub>); Respiratory rate (RER); Ventilatory Equivalent for O<sub>2</sub> (VE/VO<sub>2</sub>); Excess Carbon Dioxide (CO<sub>2</sub>ex). The AT of each athlete has been assessed (Graphics 1) according to Wasserman's method (VE/VO<sub>2</sub>), Conconi's HR method and RER's method. Firstly, athletes performed a treadmill, incremental test to collect the AT. Each athlete had to run on the treadmill at an initial speed of 10km/h for three minutes, then the workload was increased each three minutes, with a speed growing of 11km/h, 12km/h, 13km/h, 15km/h, 17 km/h, 20 km/h, 24 km/h. No athlete was able to run over this highest speed. After three days lasting break the athletes came back to the laboratory to be subjected to the second trial of two tests on constant workload: the first one under the threshold (80% of AT) and the second one over the threshold (120% of AT). Each test consisted in three exercise sessions lasting 3 minutes (exe) followed by 3 minutes of exercise recovery (R1, R2 and R3). A one hour break between the two tests was allowed to let the athlete recovered by sitting.

Fig 1  
The portable mass spectrophotometer VO2000 MedGraphics is shown



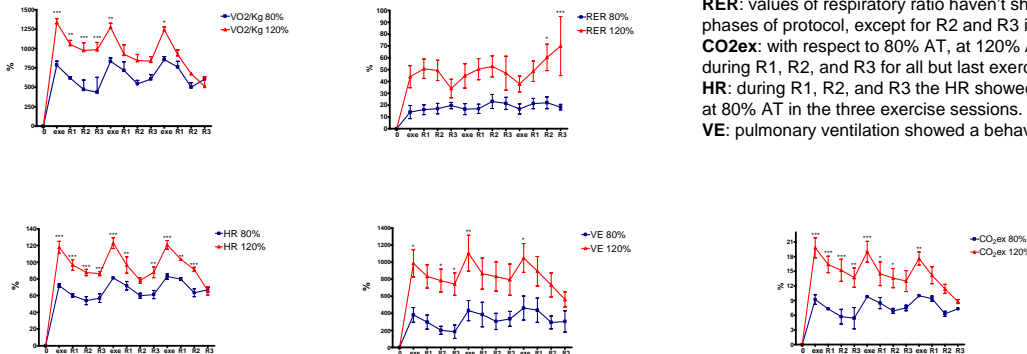
Graphics 1

AT values assesment during incremental tests



Graphics 2

Time courses of variations during the two experimental conditions (80% AT and 120% AT). Values are set in percentage variation from the pre-test values. \*P < 0,05 with respect to 80% AT.



## RESULTS

**VO<sub>2</sub>/Kg:** at 120% AT with respect to 80% AT oxygen consumption, according to body mass, was significantly higher in recovery (R1, R2, and R3 in graphics 2) only after the first exercise session, while afterwards the other two sessions it haven't shown any relevant difference between the two experimental conditions.

**RER:** values of respiratory ratio haven't shown any relevant difference between the two different phases of protocol, except for R2 and R3 in the last exercise session.

**CO<sub>2</sub>ex:** with respect to 80% AT, at 120% AT this variable showed significantly higher values during R1, R2, and R3 for all but last exercise session.

**HR:** during R1, R2, and R3 the HR showed values that were significantly higher at 120% AT than at 80% AT in the three exercise sessions.

**VE:** pulmonary ventilation showed a behavior like as that of VO<sub>2</sub>/Kg.

## DISCUSSION

Our simulation of a field interval training performance has shown some unexpected results. In fact, the performance of repeated sessions on different workload intensities (120% AT versus 80% AT) was expected to require very different recoveries, as it was assessed using the HR as sole index. However, by considering also other less well-known indexes (CO<sub>2</sub>ex; VO<sub>2</sub>/Kg; Ve), we can point out that after the second repeated session (both on 120% and 80% AT) these differences disappear.

This experimental observation can be explained, on our opinion, according to the remarks below: the HR is a defecting in sensitivity index because of it is subjected to be influenced by numerous variables as athlete's compliance with the tools and the research protocol; mood; temperature etc. The intensities of workload we have studied (80 - 120% of AT) are both considerable and they engaged subjects strongly. However, we should remark the fact that one of the scientific assumption of modern middle-distance training is threaten by our observations: to sit many repeated sessions in over-threshold or under-threshold without changing the duration of recovery between the first and the following repeated sessions, leads inevitably to accumulate some particular variations linked to the fatigue which cannot be disregarded. If this can be considered as training practice on the other hand it can be dangerous since it could cause both possible muscular accidents and overtraining. Moreover, considering the consumption of energy while running we could think that middle-distance athletes would have a better running asset at over-threshold speed (likely close their speed race) and consequently a faster recovery than expected in the under-threshold intensity; when close to this last speed, the middle-distance athlete is "forced" and this involves an unexpected consumption of energy despite the less absolute workload.

## TAKE-HOME MESSAGE

- In middle-distance runners less strictness is required in managing durations of recovery after repeated exercise sessions on under and over threshold: the last series of repeated sessions could conceal hidden dangers for the fatigue and consequently possible accidents.
- Training at speeds near the race speed involves developing an economizing of acts which yields the recovery duration to be unexpected according to mere cardiovascular and metabolic remarks.
- We conclude by surely saying that the recovery duration management after performances either under and over-threshold needs further examinations; we wish other similar research would be held to better define the changes in the human body after such pressing.