

# Energy Expenditure during Training of Middle-Distance Athletes at Mild High Altitude

Koyo Mochizuki (Shizuoka University)

## 1. Purpose

The purpose of this study is to clarify the energy expenditure (EE) of middle-distance athletes at mild high altitude (MH) from the HR-VO<sub>2</sub> regression equation at sea level (SL).

## 2. Methods

This study consists of 4 experiments from Exp.1 to Exp.4. Each experiment is as follows.

Exp.1: To compare the HR-VO<sub>2</sub> relationship equation, the maximal exercise test with a bicycle ergometer was performed on 9 male subjects at SL and MH.

Exp.2: To check whether the increase in HR during running was similar in SL and MH, HR during the 20m-shuttle run test was compared for 4 males and 4 females at SL and MH.

Exp.3: To clarify an estimation method of EE by HR for high-performance training such as that performed by middle-distance athletes, EE was compared during same trainings at SL and MH. The subjects were SL: 6 males and 6 females, MH: 5 males and 5 females.

Exp.4: EE of the 4 male elite middle-distance athletes was estimated using the methods of Exp.1 to Exp.3 during training camps in MH.

## 3. Results and Discussion

Exp.1: There were no significant differences in the slope and intercept of the HR-VO<sub>2</sub> regression equation during exercise between SL and MH. The HR-VO<sub>2</sub> relationship in MH was similar to that in SL, as suggested that the equation in SL can be available in MH.

Exp.2: There were no significant differences

in HR during submaximal exercise between SL and MH, but exercise duration and HR<sub>max</sub> were significantly lower during MH ( $P < 0.05$ ). It concluded that including HR during recovery is important for estimating EE of high-performance training.

Exp.3: There were no differences in EE for the 20m shuttle run, and EE estimation was available in MH for aerobic training. During high-performance training, such as demanding anaerobic power, the method of EE estimation that measures HR during exercise and recovery would be recommended for male athletes.

Exp.4: In the male middle-distance athletes, it was calculated that their EE is  $50.3 \pm 7.5$  kcal/kg (60 kg body weight; about 3,000 kcal) during training camp in a day at MH.

## 4. Conclusion

It was clarified that the method of HR-based EE estimation in MH can HR-VO<sub>2</sub> relationship equation in SL, and HR during recovery was important for high-performance training. It was found that male middle-distance athletes involved EE about 3,000 kcal during training camp in a day at MH.

## 5. References

- 1) Fukuda T et al. ;Effects of acute hypoxia at moderate altitude on stroke volume and cardiac output during exercise. *Int Heart J.* 51(3), pp.170-5, 2010
- 2) Medbø JI et al. ;Anaerobic capacity determined by maximal accumulated O<sub>2</sub> deficit. *J Appl Physiol.* 64(1):50-60. 1988