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EFFECT OF FASTING ON THERMOREGULATION BALANCE AND AEROBIC ENDURANCE IN MIDDLE-DISTANCE RUNNERS

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Abstract
This study aims to evaluate the influence of fasting on the balance of thermoregulation and the aerobic endurance performance in middle distance runners. 13 male athletes (aged 21-33), specialists in middle distance, were evaluated 11 days before the fasting period, then the 25th day of the fast and finally the 119th day after the end of the fasting period. In order to make the study operational, we took axillary temperature measurements before the preparatory warm-up and, also, just after the end of each running event over a distance of 3000 meters. Statistical analysis shows that the fasting period generates significant changes in thermoregulation balance and, also, aerobic endurance performance of middle distance runners.
Key words: fasting, balance, thermoregulation, aerobic, endurance.

1- INTRODUCTION

Regular practice of high-intensity endurance exercises, without sufficient rehydration, negatively affects not only work capacity, and therefore athletic performance, but also fluid balance and central body temperature (Mazer, 2004). Scientific studies agree that dehydration is accompanied by a significant decline in physical ability and exposed to many complications, such as the appearance of cramps, musculo-tendinous lesions, stroke heat or even death, as is the case of the Minnesota Vikings American footballer Korey Stringer, victim of a heat stroke, which collapsed during an intense training in the heat, His central temperature was 40 ° C, 13 hours after this incident, he died (Wilmore, JH, et al., 2009).

During the sports effort, as body temperature increases, sweat losses rise to avoid hyperthermia. When the sports effort is intense and prolonged, sudation increases and the amount of water produced by the cells to prevent dehydration is insufficient. If in parallel, there is no compensation, at least partly losses due to evaporation, the performance will be affected. Indeed, according to Wilmore, J-H., Et al. (2006, pp.357-358), dehydration also affects the functioning of cardiovascular and thermoregulatory systems. A loss of water equivalent to 2% of the body weight leads to an increase in heart rate, an increase in body temperature and a decrease in running performance (1500m, 5000m and 10000m).

Maintaining fluid and electrolyte balance during exercise is, therefore, essential for performance. Moreover, the recommendations from the scientific work are unanimous as to the need for adequate hydration before, during and after the practice of physical and sports effort, to which it is advisable to add mineral elements in case of necessity (Paillard, 2010, Wilmore et al., 2006; Stéphane Cascua & Rousseau, 2005; Mazer, 2004; Pasquet, Hascoat, 2004; Basdekis, 2003).

In this context and, also, taking into account the fact that high-level Muslim athletes must pursue intensive sports training programs, during the fasting period that begins before sunrise and extends to sunset during the entire month of Ramadan, we want to ask the following question: Does fasting significantly affect the thermoregulation balance and the performance of middle-distance runners?

2- METHODS AND TOOLS

2-1- The subjects of study

The sample of our study is made up of 13 competitive male athletes, specialists in middle distance race, aged between 21 and 33 years old. They all live in the same sports center and, they are subject to the same training conditions.

2-2-Tests and Data Acquisitions.

- Endurance test: To evaluate the relative aerobic endurance capacity of the athletes, we used the running test over o distance of 3000 meters.

- Measurement of the axillary temperature: The axillary temperature is obtained using the medical mercury thermometer.

2-3- Protocol of the study

The race tests over a distance of 3000 meters are performed at the same time and under the same conditions: The first evaluation (EVAL-endur 1) is performed 11 days before the beginning of the month of fasting; the second evaluation (EVAL-endur 2) 25 days after the start of the fast and, the third evaluation (EVAL-endur 3) 119 days after the end of the fasting period.

The evaluation of the axillary temperature (Temp-test) is carried our just before the preparatory warm-up and, also, just after the end of each evaluation. The procedure is to keep the thermometer 120 seconds under the armpit.

2- 4- Statistical analysis.

Means and standard deviations were computed for all the different evaluations. A T-test for paired groups was used to evaluate the differences between the performances of the different evaluations. The level of significance was set at $p < 0.05$.

3-RESULTS

Table 1: Statistical Analysis of the Different Evaluations (EVAL-endur) Related to the Middle - distance test over a distance of 3000 meters.

Statistical Parameters	Evaluation		
	EVAL-endur 1	EVAL-endur 2	EVAL-endur 3
N	13	13	13
Means (seconds)	557,52	592,39	531,78
Standard deviation (SD)	30,36	53,19	26,80
t-test	(EVAL- endur 1 with EVAL-endur 2) (T-test = 5.16 significant at $p < (0.05)$ (EVAL- endur 2 with EVAL- endur3) (T-test = 7.01 significant at $p < (0.05)$		

Table 2: Means, Standard-deviation of different Axillary Temperature tests.

Statistical Parameters	Temperature tests.		
	Temp-test 1	Temp-test 2	Temp-test 3
N	13	13	13
Means (seconds)	37,21	37,58	37,22
Standard deviation (SD)	0,11	0,03	0,02
t-test	Temp-test 1 with Temp-test 2 (T-test = 3.59 significant at $p < 0.05$) Temp-test 2 with Temp-test 3 (T-test = 5.98 significant at $p < 0.05$) Temp-test 1 with Temp-test 3 (T student = 0.07 Not significant at $p < 0.05$)		

4-DISCUSSION

The study's aim is to evaluate the effect of fasting on thermoregulation balance and the aerobic endurance performance in middle distance runners. The statistical data (Table 1) shows, indeed, that the performances obtained during the fasting period (EVAL-endur 2 = 592.39) decreased significantly (- 0.331m / s) (t-test = 5.16 is significant at $p < 0.05$) compared to those obtained 11 days before the beginning of the month of fasting (EVAL-endur1 = 557,52). However, in the third evaluation (EVAL-endur 3 = 531.78), the athletes significantly improved their performances (+ 0.624 m / s) compared to those of the second evaluation (EVAL-endur 2) (t-Test = 7.01 is significant at $p < 0.05$).These results are in agreement with the explanations of Mazer (1995) and weineck (1997) who claim, that high-intensity aerobic exercise, without sufficient rehydration, negatively affects the athletic performance.

The statistical data (Table 2) show that the axillary temperature of middle-distance runners has increased significantly during the fasting period. Indeed, the differences between the averages of temperatures taken 11 days before the beginning of the month of fasting (Temp-test1 = 37,21) and, those obtained 25 days after the beginning of the period of fasting (Temp-test 2 = 37.58), are statistically significant (T-test = 3.59) at $p < 0.05$. The same observation is observed when comparing the average temperatures taken 119 days after the end of the fasting period (Temp-test 3 = 37,22) with those obtained 25 days after the start of the fasting period (Temp-test 2 = 37.58). On the other hand, we note that the comparison between the mean of Temp-test 3 (37,22) and that of Temp-test1 (37,21) is is not significant (T-test = 0,07) at $p < 0,05$.

The decrease in the performance level of the athletes, during the fasting state, could be explained by the effect of the interaction of several factors. Among them, the water balance and in parallel the preservation of the electrolyte balance (sodium, potassium, ...) which are of capital importance in the maintenance of an optimal functional level of the metabolic and enzymatic activity and, also, thermal regulation; on the other hand, excessive loss of water and electrolytes can be directly related to a series of psychological and physical phenomena that affect performance (Weineck, 1996, p.495). The results in Table 2 show, indeed, that the differences between temperatures taken 11 days before the beginning of the month of fasting (Temp-test1 = 37,21) and, those obtained 25 days after the beginning of the period of fasting (Temp-test 2 = 37.58), are statistically significant (T-test = 3.59) at $p < 0.05$. The same thing is observed when comparing the average temperatures taken 119 days after the end of the fasting period (Temp-test 3 = 37,22) with those obtained 25 days after the start of the fasting period (Temp-test 2 = 37.58). On the other hand, we note that the comparison between the results of Temp-test 3 (37,22) and those of Temp-test1 (37,21) is not significant (T-test = 0,07) at $p < 0,05$. This result is in agreement with the explanation of wilmore and Costill (2006) who confirm that excessive loss of water and electrolytes, especially in athletes, during thermal regulation, particularly through transpiration, is directly linked to a series of physical and psychological factors that negatively influence sports performance (Wilmore & Costill, 2006).

CONCLUSION

Determining the influence of fasting on thermoregulation balance and aerobic endurance performance in middle distance runners was the purpose of this study. Through the results obtained, we can confirm that fasting influences the capacity of aerobic endurance. Indeed, the statistical analysis of athletes' performance in the 3000-meter race test performed before, during and after the month of fasting confirms that diurnal food abstinence and, in particular, water deprivation, negatively influences aerobic endurance capacity. It was, also, observed a large amplitude of the axillary thermal gap during the fasting period which explains, to a certain extent, the decrease in the capacity and physical performance of the athletes in the race event.

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