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Research Article

The Effect of Ramadan Fasting on Body composition and Aerobic performance among Female Students of College of Sports Sciences at University of Jeddah

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Abstract

The aim of this study is to highlight the influence of fasting on the variations of physical and anthropometric parameters among young female students of Jeddah University. Twenty-four female students with ages ranging from 20 to 26 years consented to take part in our study. They were tested on 2 occasions: before and, during, the month of fasting. To this end, we took anthropometric measurements, and an exercise test. The analysis and interpretation of the results showed no significant change in the anthropometric parameters despite the variations observed during the month of fasting ($P > 0.05$). However, we could mention significant decreases in physical parameters ($P < 0.05$). Fasting appears to negatively affect aerobic performance.

Keywords: Fasting; Female Students; Aerobic Performance; Anthropometric Parameters; Ramadan

Introduction

The position of sport as a phenomenon conveying the idea of health, immunity against certain diseases and productivity in an industrial and economic environment, has led to the establishment of a methodical system based on scientific data, especially known in top-level sport, whose essential aim is to achieve good performances at certain times of the year [1].

At the same time, the athlete is subjected to ever-increasing workloads throughout the year. Top-level athletes are no exception in this respect, obliged to carry out more than 500 training sessions a year while taking advantage of a few short periods to rest and regenerate their psychophysical capacities. Muslim athletes, on the other hand, cannot keep up with this training load all year round at the same pace, as they are required to fast for an entire month of the year, varying from season to season between 11 and 18 hours [1]. Changes in meal frequency and eating habits during the month of fasting can affect various aspects of human health [2].

On the other hand, the approach to fasting regularly gives rise to controversy and even controversy. The change in dietary rhythms essentially translates into the taking of a main meal at the break of the fast at sunset, and a modification of the sleep-wake cycle with a more pronounced night life [3]. The opinions of scholars, doctors, athletes, trainers and managers differ. From the point of view of doctors and trainers, many declare that fasting is a great risk for the individual making intense efforts [2]. Others claim the complete opposite [4]. As far as anthropometric parameters are concerned,

the effects of fasting are controversial in the various studies. A reduction in weight was found in some studies [5-8], while others reported weight gain [9-11]. Others reported no significant change in body weight or body composition [12-15]. At the same time, Syam., *et al*. [16] report a reduction in fat while preserving protein mass. Similarly, Aybak., *et al*. [17] reported an increase in total protein.

As regards the impact of the fasting month on physical performance, the results are as yet unconfirmed [18]. Because performance is affected by several factors, food and fluids [19]. Lack of sleep and insufficient training [20,21]. Given the changes in biological rhythm involved, fasting should theoretically have a negative effect on physical performance [22]. However, physical performance in the various studies improved significantly beyond the third week and the following two weeks. This decrease was very marked in the first two weeks, with a return to normal and stabilization thereafter, testifying to a phenomenon of adaptation by the organism [23]. Some authors also report that fasting has no negative effects on performance [20,24,25].

In fact, a number of studies have concluded that fasting is highly beneficial, and has long been used for its dietary and therapeutic virtues. A diet lasting several days can regenerate the body, purify the skin and improve well-being, provided a few rules are observed. Other results, however, have shown an adverse effect on the human organism, and particularly on athletes.

Questions may be asked. Does the month of fasting have a positive or negative influence on athletes' bodies? Is it incompatible with sport, as some authors report, and does it contribute, among other risks, to putting the body in energy conditions unfavorable to physical activity?

Our aim is to monitor the dynamics of variations in a number of anthropometric and physical parameters in young athletes before and during the month of fasting.

Materials and Methods

Subjects of the study

The sample of our research includes 24 female students from the Department of Physical Activity of the College of Sports Sciences at the University of Jeddah. Their ages range from 20 to 26 years. All the subjects are healthy, non-smokers and have no contraindications for sports practice. They were reassured that the study data would be collected while respecting their confidentiality and anonymity. Each subject included in this study was informed about the purpose, protocol, and potential risks of the study and then asked to sign a written consent. The subjects participating in the study underwent anthropometric measurements and exercise testing, before and during, the month of fasting.

Conduct of the study

Under the same climatic conditions of temperature and humidity, the anthropometric measurements and exercise testing were performed during two periods: two weeks before the month of fasting, and half of the fasting time (end of the second week of fasting), the study was conducted as follows:

Anthropometric measurements

This concern the body weight (BW), height (H), body mass index (BMI), fat mass (FM), and lean weight (LB):

- The height (in cm) is measured with a measuring tape,
- The BW (in Kg) is measured with a scale (Kuhen and Fleichel),
- The adult body fat percentage (% BF) is calculated using the equations of Paul Deurenberg., *et al*. [26]: %BF = (1.20×IMC) + (0.23×Age) − (10.8×Sex) − 5.4 For women, the «Sex» value is equal to 0
- The MM is calculated from the body mass according to the equation:
- LB=BM-[BM× (%BF/100)],
- Anthropometric measurements are taken before the start of the exercise test.

Evaluation of maximal oxygen consumption: VO2max

The VO2max is evaluated from the shuttle run test with one-minute increments (test of Leger [27,28]. This is a test that indirectly evaluates the VO2 max expressed in ml/Kg/min and by a linear function of the Maximum Aerobic Speed (VMA) [29].

The test is chosen because it is recognized by its manufacturers as valid, accurate and precise [30], and has a high degree of correlation with the direct test [28], especially because it is easy to perform and accessible to all [31].

The test is of the maximal and progressive type: the subjects run as long as possible until they can no longer keep up with the imposed speed, which starts at 8.5 Km/h with an increasing and progressive order of 0.5 km/h every minute. The subject is stopped when he/she is two successive times behind a sound signal broadcast on a magnetic tape used as audiovisual support for the test. The test takes place in a sports hall at 2:30 pm during the 2 periods.

Statistical analysis

For descriptive statistics, we calculated the arithmetic mean and standard deviation. For analytical statistics, we used Student's T test to study the variance between the different periods, with a significance level of ($p < 0.01$). Statistical analysis was carried out on computer using SPSS 20 software.

Results and Discussion

Results

The results are presented in two parts: results of anthropometric parameters and results of the performance achieved in the exercise test. All parameters are expressed in descriptive (mean ± standard deviation) and analytical results (comparison of results by Student's T).

Anthropometric parameters

The mean values and standard deviations of anthropometric parameters, as well as the result of statistical comparisons between measurement periods, are shown in Table 1.

	Before Fasting	During Fasting	Student's T
Weight BW (kg)	55.04 ± 5.58	54.79 ± 5.744	-0.18 NS
BMI (kg/m2)	22.27 ± 1.57	21.26 ± 1.51	-0.4 NS
Fat Mass FM (kg)	14.62 ± 2.11	14.48 ± 2.21	0.53 NS
Lean Weight LB (kg)	46.89 ± 3.69	46.74 ± 3.76	0.65 NS

Table 1: Variation of anthropometric parameters before, and during the month of fasting.

*significant per 5%, NS: not significant.

The results show that no significant changes were observed for anthropometric parameters during either evaluation period, despite a drop in values during the fasting month ($P > 0.05$). This means that the month of fasting does not seem to affect anthropometric parameters.

Performance parameters

The mean values and standard deviations of physical performance parameters, as well as the result of statistical comparisons between measurement periods, are shown in Table 2.

	Before Fasting	During Fasting	Student's T
ύO2max (ml/Kg/min)	28.10 ± 3.32	24.97 ± 1.97	2.94*
VMA (Km/h)	9.82 ± 0.88	9.13 ± 0.48	-1.43*

Table 2: Physical performance variation before and during the month of fasting.

*significant per 5%,NS: not significant.

Analysis of the results for physical performance parameters shows significant differences for the two measurement periods ($P < 0.01$). Indeed, vo_2max values decreased significantly (24.97 ± 1.97ml/Kg/min) during the month of fasting. The same variations appear for maximum aerobic speed VMA: decrease in maximum speed during fasting (9.13 ± 0.48 Km/h) vs (9.82 ± 0.88 Km/h) compared to periods before the month of fasting. This means that the month of fasting appears to negatively affect aerobic performance.

Discussion

Anthropometric parameters

Anthropometric parameters were measured twice, the first time to establish a baseline as a control. The second to determine the effects of the fasting month on these parameters.

Our results confirm that the beneficial effects of the fasting month are transient, and despite the non-significant difference after fasting, the upward trend and recovery of values after the fasting month can be seen [32,33]. These results concur with the work of El Ati., *et al.* [34], who found that after a month of fasting, and despite non-significant differences, anthropometric

parameters measured before, during and after the month of fasting returned to their initial.

Weight is an index that is highly influenced by the dietary factor, and is very sensitive to it through its fat mass component and food quantity and quality [32,35,36]. Despite fasting (absence of food and water intake), body weight did not change significantly. The weight stability observed during fasting is consistent with the findings of Graham, Belhadj and Balasekan [37]; Karli., *et al*. [13]; Abdelmalek., *et al*. [1]; Chiha [3]; Meckel., *et al*. [15]; Kara., *et al*. [38] and are in contrast to those of Bouhelal., *et al*. [39]; Ziae., *et al*. [7]; Hussain., *et al*. [5]; Sweileh., *et al*. [40]; Al Hourami [8] who observed a decrease in body weight. This weight stability could possibly be explained by the balance between energy intake and expenditure [3].

Similarly, fat mass, the parameter most influenced by diet, did not change significantly despite the slight decrease observed during the month of fasting, which is attributed to the efficient use of body fat [34,41]. In the fasting state, the body substitutes its energy source from glucose for fatty acids. Fatty acids are released from adipocytes, which can reduce body fat. These results concur with the work of several authors who found no significant change in body composition [1,3,12,13,15,34].

In the same respect, lean mass, or active mass, did not change during the two measurement periods despite the variations recorded. Our results are in perfect agreement with the work of Ramadan [12], and run counter to those of Bouhlel., *et al*. [39], who reported a significant decrease in body components in their studies.

Generally speaking, the effect of fasting on anthropometric parameters is influenced by eating habits, socio-economic and cultural differences, and the sleep-wake cycle [16].

Physical performance parameters

Analysis of the results obtained in the evaluation of stress test parameters shows that the average values of VMA and VO2 max, the determining factors of aerobic performance, fluctuated to some extent. Maximum values were obtained before the month of fasting, and then regressed during fasting. This drop in performance may be due to dehydration, reduced stroke volume and carbohydrate reserves [42]. In addition, physical activity during fasting was the cause of significant psychological and physiological stress [43]. Our results concur with those of Chennaoui., *et al*. [44], who reported a decrease in VMA on the 7th day of fasting that continued three weeks later. The same conclusion has been reported in other studies [15,45,46]. Comparison of the data obtained with what has been reported in the scientific literature shows that it is difficult to attribute the inadequacy of the results to the effects of fasting. Cardiorespiratory responses to exercise during the month of fasting depend on the individual's physical condition and level of activity [12,47].

In this context, the fluctuation in performance from one period to the next in the tests would probably be due to the increase in training load, which went up to a crescendo. Similarly, when the training program is maintained regularly, with a balanced diet and sufficient sleep, aerobic capacity results are not altered [13].

Conclusion

The literature review has enabled us to understand the mechanisms and effects of fasting on the body, but the results of the various research studies are controversial and it seems that socio-economic, cultural and geographical differences can influence dietary practices and daily habits, thus contributing to inconsistent results in the different studies. Our work is based on a study which aimed to highlight the influence of fasting on variations in physical and anthropometric parameters in young female students at the University of Jeddah. In the light of the results obtained from our experiment, we reached the following conclusions.

There was no disturbance of body components despite the variations observed during the fasting month. Anthropometric parameters do not appear to be affected by the fasting month.

Given the changes in biological rhythm involved, fasting has a negative effect on physical parameters. This decrease is particularly marked in the first two weeks.

This study, limited to certain anthropometric and physical elements in a small number of subjects, opens up opportunities for other, more detailed perspectives. Further investigations into haematological, urinary, lactatemia, enzymatic, hydric, hormonal and other parameters would provide further information on the specificities of various metabolisms in the context of fasting.

A wider range of discipline-specific tests (physical, technical, tactical) would certainly make a considerable contribution.

Dietary surveys over several days would enable objective planning of the athlete's diet in terms of quantity, quality and fluid intake.

The interactions and interdependencies between the various parameters and their impact on the organism could be elucidated through correlations.

The use of a larger sample and, if possible, of young and non-young athletes, as well as a comparison between athletes and sedentary people, will shed light on certain metabolic variations.

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Conflicts of Interest

The authors declare that they have no conficts of interest exists.

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