Asian Journal of Sports Medicine

ORIGINAL ARTICLE

Investigating Two Different Training Time Frames during Ramadan Fasting

Ramin Kordi[1,2], MD, PhD; Mohammad Abdollahi[2]; Amir-Hossein Memari*[1], MD; Mahboubeh Ghayour Najafabadi[3], MSc

Authors' Affiliation:

1. Sports Medicine Research Center, Tehran University of Medical Sciences, Tehran, Iran
2. School of Medicine, Tehran University of Medical Sciences, Tehran, Iran
3. Faculty of Sports Sciences and Physical Education, University of Tehran, Iran

*** Corresponding Author;**
Address: Sports Medicine Research Center, No 7, Al-e-Ahmad Highway, Tehran, P.O Box: 14395-578, Iran

E-mail: sportpsych@tums.ac.ir

Received: *Aug 05, 2011*
Accepted: *Aug 27, 2011*

Key Words: Ramadan Fasting; Athletes; Training time frame; Athletic Performance; Sports

Abstract

***Purpose*: Muslim athletes may continue training and competing while they are fasting. There is a concern about negative effects of fasting on sports performance. This study aimed to investigate the influence of two training time frames on athletes' body composition and performance during Ramadan fasting.**

***Methods*: An observational study was conducted and thirty four male volunteer athletes from different sports including volleyball, karate, taekwondo and football were assigned in two groups. The first group included 14 elite athletes who during Ramadan voluntarily participated in training sessions at 1 hour before Iftar (BI) and the second group of 20 elite athletes who during Ramadan participated in training sessions at 3 hours after Iftar (AI). Testing was performed one week before; in the first and fourth weeks of Ramadan and one week after Ramadan. Weights, heights and skinfold thickness were assessed at each time point and body mass index was calculated. Each player was assessed for agility and explosive strength as well.**

***Results*: The mean weight and body mass index of both groups decreased significantly during Ramadan (P<0.001). Performance variables were not negatively affected by fasting in BI or AI group athletes.**

***Conclusions*: Weight reduction might come with either BI or AI training schedules in Ramadan. Daytime or evening training did not inversely affect the agility and power performances in a group of elite athletes during Ramadan fasting.**

Asian Journal of Sports Medicine, Volume 2 (Number 3), September 2011, Pages: 205-210

INTRODUCTION

The major religious period of the Islamic calendar is Ramadan when many millions of Muslims fast throughout the daylight hours. They are not permitted to drink and eat during the days and are allowed only at nights [1]. The duration of a daily fasting episode is influenced by seasonal and geographical conditions which may vary from 11 to 18 hours per day [2].

The different physiological effects of Ramadan have been the interest of research for many years. There are evidenced alterations from normal lifestyle behaviours and circadian rhythms with phase shift in biological and behavioral indexes [3-5]. These changes in daily habits are likely to also have effects on body weight and the body composition profile.

It has been suggested that Ramadan fasting may be accompanied by a reduction in physical activity by

Muslims [6,7]. On the other hand, several sporting competitions are held during Ramadan and a number of athletes continue training and competing while they don't give up fasting [8]. However some athletes suspend fasting on competition days because they are afraid of adverse effects of fasting on their performance [8]. More recently, literature has emerged that offers contradictory findings about Ramadan's impact on athletic capacities; the effects of Ramadan fasting on body weight and composition were widely variable. Although a reduction in body weight was reported from some studies, others showed weight gain during Ramadan [9-11]. Some researchers showed that Ramadan fasting might lead to a significant decline in sport performance [12,13], however there are several studies which indicated athletic performance would remain intact during Ramadan [14,15]. The conflicts existing in the literature can be attributed to different lengths of periods of food and water deprivation, different performance test protocols, and failing to purge masking and exacerbating factors [16].

Although a sound description for mechanisms underlying declines in exercise performance during Ramadan has not yet been provided; it is proposed that these alterations may be determined by a combination of several factors including change in sleep-wake cycle, food and fluid intakes and shift in circadian rhythms [15,17]. On the other hand, studies indicated that motivation, compensatory efforts and habituations might be responsible for maintaining the performance level by athletes during Ramadan [17].

In view of mentioned deteriorating and facilitating factors, the time of training, is perceived to have an important role in athletic performance. Athletes usually prefer to set up training sessions during the daytime for reasons of convenience and effectiveness. On the other hand, it has been revealed that daytime training in Ramadan is likely to result in a decreased value of the training regimen [17]. Preliminary studies suggested that other times of training like evening would be less effective and perceived as being harder. However, due to recent findings, there might be benefits to exercising in the evening since the first meal after sunset ('Iftar') would compensate partially the fluid and calorie deficits accumulated during fasting [18]. Even though there is also evidence that the habituation effect could occur when athletes continue training at a particular time of the day [19], it is not obvious whether such an adaptation effect will be achievable when training is delayed until the evening.

Given that the 2012 Olympics Games in London will occur over Ramadan, there has been an increasing interest in examining the strategies which may modify the probable adverse effects of Ramadan on athletic capacities. However, there is no reliable evidence on which specific schedule will be more suitable for elite athletes; training at daytime or evening? The aim of this study was to investigate the impact of one month of Ramadan fasting on body mass index, body composition and physical performance in those who train in two different schedules at before or after Iftar.

METHODS AND SUBJECTS

Participants:

Thirty four male elite athletes at local and national level were assigned to the study as two groups. Participants were recruited from different sports including volleyball (n=13), karate (n=5), taekwondo (n=7) and football (n=9). The first group included 14 athletes who during Ramadan voluntarily participated in training sessions 1 hour before Iftar (BI) and the second group had 20 subjects who during Ramadan scheduled training sessions 3 hours after Iftar (AI) on their own accord. Before Ramadan, players were regularly participating in their sport-specific training sessions at the same time as during Ramadan. Training sessions' duration also remained unchanged during Ramadan.

Procedure:

An observational study was conducted in Iran in the month of Ramadan from the 14th of August to 27th of September 2009. All subjects were evaluated four times: T1: one week before Ramadan; T2: 1st week of Ramadan; T3: 4th week of Ramadan and T4: one week after the end of Ramadan. They were tested just before their training time on all four occasions, therefore the BI group was examined 1 hour before Iftar, and

athletes in the second group were tested 3 hours after Iftar. In trials T2 and T3 all subjects fasted for approximately 14 hours every day of Ramadan. The study was approved by the Ethics Committee of Tehran University of Medical Sciences. Participants were provided with full information about the study to obtain consent.

Body Composition

Standard, calibrated scales and stadiometers were used to determine height and body weight with a precision of 0.1 cm and 0.1 kg respectively; body mass index (BMI) was then calculated. Skinfold measurement were taken using standard Harpenden skin fold caliper (British Indicators Ltd, UK) at three sites (Abdominal, Biceps and Thigh) by an experienced technician.

Agility test

The agility test consisted of a 4 × 10 m shuttle run which is frequently used for evaluating athletic performance [20]. Two turning points were marked 10 meters apart by two cones. The subject started at one side and ran at maximal speed to the other marked line. He then turned and ran back to the baseline, turned again, and performed the same back and forth run. Each subject performed 2 trials, so the best time was accepted as his score. Time has been recorded in the precision of 0.01 second. All had at least 5 min active rest between the trials.

Broad jump test

Broad jump test was performed to evaluate lower limb muscle power and explosive strength. The subjects stand with both feet together and completely behind the start line. Then they jump as far as possible. Broad jumping was repeated 3 times and the best of attempts was recorded [21]. Athletes were asked to perform both the agility and broad jump test on a wooden floor (parquet) while they all wore running shoes. They were also allowed to practice at least 2 times before real test trials.

Data analyses

Descriptive statistics were calculated. The data were analyzed using a mixed-model (Time × Group) repeated-measures analysis of variance. Age adjustment was performed for between-group analysis; however results showed no significant differences between adjusted and non adjusted data. Where appropriate, a Student's t-test with Bonferroni correction was used to make pair-wise comparisons. The level of significance was set at < 0.05. Statistical analysis was performed using SPSS version 18.0 (SPSS Inc, Illinois, USA).

RESULTS

Fourteen athletes aged 21.6 (±4) years old, with height of 171 (±5) cm, body weight of 70.6 (±10) kg and body mass index of 23.9 (±2.3) participated in the BI group and twenty participants aged 17.4 (±3.8) years old with height of 180 (±7) cm, body weight of 68 (±8.2) kg and body mass index of 20.9 (±3.4) were observed in the AI group.

Body composition

Table 1 summarizes anthropometric indexes and level of significance across Ramadan fasting. It is apparent from this table that there was a significant main effect of time on participants' weight and BMI in AI ($P<0.001$) and BI groups ($P=0.005$). In the end of the first week of Ramadan, BMIs decreased significantly in both the BI group [$P= 0.02$, 95% confidence interval ($^{95\%}$CI): 0.07- 1.15] and AI group ($P=0.004$, $^{95\%}$CI: 0.19-1.16). Further, there was also a significant increase in BMI scores after Ramadan compared to the 4th week of Ramadan in the BI group ($P=0.009$, $^{95\%}$CI: 0.08-0.68) but not in the AI group. There was no significant main effect and interaction for the sum of skinfolds. However pair-wise comparisons revealed that players in the AI group experienced a significant decrease in skinfold measure in the first week of Ramadan (T2) compared to the baseline (T1) ($P<0.001$).

Broad jump and agility test

Baseline analysis for performance measures showed that there was no difference in broad jump as well as agility scores between players in the two groups.

Table 1: Anthropometric variables and level of significance across the study in BI and AI groups; mean (SD)

Parameter	Groups	Pre Ramadan	First week	4th week	Post Ramadan	P value* (overall)	P value 1 VS 2	P value 1 VS 3	P value 1 VS 4	P value 3 VS 4
Weight (kg)	BI	70.6 (10.0)	68.8 (9.5)	68.5 (9.0)	69.64 (8.8)	0.005	0.02	0.02	NS	0.01
	AI	68 (8.2)	65.8 (7.4)	66.3 (7.4)	66.5 (7.5)	<0.001	0.004	0.002	0.009	NS
BMI (kg/m^2)	BI	23.9 (2.3)	23.3 (2.2)	23.2 (2.0)	23.6 (1.9)	0.005	0.02	0.02	NS	0.009
	AI	20.9 (3.4)	20.3 (3.1)	20.4 (3.2)	20.5 (3.0)	<0.001	0.004	0.002	0.009	NS
Sum of skin folds (mm)	BI	44.8 (20.1)	43.7 (20.1)	42.6 (18.8)	42.5 (18.1)	0.3	NS	NS	NS	NS
	AI	32.4(14.8)	29.7 (14.1)	31.1 (19.5)	31.8 (16.7)	0.1	<0.001	NS	NS	NS

SD: Standard Deviation / BI: athletes who during Ramadan trained 1 hour before Iftar / AI: athletes who trained 3 hours after Iftar
* *P* value for main effect of time/ NS: non-significant (*P*>0.05)

Further, combined data for the Broad Jumping showed that there was no significant main effect of time in either the BI group (*P*>0.05) or AI group (*P*>0.05). There was also no significant interaction between group and time (*P*>0.05) (Table 2). There was a main effect of time in AI players (*P*=0.003). Results showed a significant improvement in the agility scores from the pre-Ramadan (T1) to 4th week of Ramadan (T3) (*P*=0.003, 95%CI: 0.08-0.42) and to post-Ramadan (T4) (*P*=0.001, 95%CI: 0.20-0.93) in the AI group players. There was no main effect for fasting in participants of the BI group (*P*=0.8) (Table 2).

DISCUSSION

While the literature on Ramadan revealed limited evidence on how different training time frames might adjust the physical performances and body indexes in sports players, we aimed to investigate two distinct training schedules of athletes during Ramadan. Our results showed that body weight and BMI in athletes decreased significantly by the Ramadan fasting curriculum disregarding the time of training. Further, it would be explained that a decrease in body weight and not in sum of skin folds especially in BI subjects might be suggestive of a state of dehydration or decrease in body lean mass as the main attribution factors. In any case, subjects' weight loss might be interpreted by the variables imposed by fasting itself rather than dehydration.

Our results were consistent with a number of studies which showed that participants experienced a decrease in body mass or body fat during Ramadan [22]. However, our players experienced more prominent weight loss, about 2 kg in average. It was indicated that most of this loss occurred during the first week of Ramadan [23,24].

On the contrary, there were several findings in healthy active and sedentary people which indicated no change in body composition during observance of Ramadan [25-27]. It might be explained by compensatory strategies used especially by sedentary individuals, such as decreasing physical activity level when it is not possible for elite athletes since they could not stop the training and competition during Ramadan.

Although previous studies suggested that daytime training in Ramadan might lead to a decreased value of

Table 2: Mean (SD) Scores on broad jump and agility test values in BI and AI participants over the course of Ramadan

Test	Groups	Pre Ramadan	First week	4th week	Post Ramadan	P value (overall)
Broad jump(cm)	BI	238 (15)	236 (15)	233 (13)	240 (15)	0.1
	AI	233 (2)	238 (23)	234 (18)	235 (18)	0.6
Agility(s)	BI	9.78 (0.61)	9.70 (0.77)	9.76 (0.63)	9.73 (0.63)	0.8
	AI	10.02 (0.55)	9.78 (0.74)	9.76 (0.5)*	9.45 (0.62)**	0.003

BI: athletes who during Ramadan trained 1 hour before Iftar / AI: athletes who trained 3 hours after Iftar
* For comparison of 4th week with baseline value, *P*<0.01 / ** For comparison of post-Ramadan with baseline value, *P*<0.01

the training regimen, our findings emphasized the idea of habituating to training at a particular time of the day [19]. This could be also interpreted by the significance of other components of the circadian rhythm in performance which is in phase with the core temperature theorem; In other words, athletes could normally tolerate intensive work in the late afternoon [18]. Furthermore, other adaptations like an increase in the amount of daytime sleep could alleviate the negative effects of energy and fluid withdrawal on athletic performance during the afternoon [28,29].

In addition, the current findings add to the literature demonstrating that performance capacities would not be adversely affected by Ramadan when before Ramadan athletes had been training in the evening. It could be explained by the fact that training in the evening, 2–3 h after the sunset meal leads to fluid and energy replacement, and there is an opportunity for athletes' restoration of activity as normally occurs. It also seems possible that a delay in the body clock during Ramadan could displace the time of peak performance from late afternoon to the evening [18]. More benefits from training in the evening might be raised from motivation and impulses induced by social and mental activities started or improved after Iftar [30]. It has been also evidenced that habituation to training could take place at the evening time even though it might not be appreciated by athletes in normal situations.

It could be argued that athletes have a greater mental and physical readiness to perform the tasks compared to sedentary subjects. In other words, it was hypothesized that elite athletes would compensate for possible adverse effects of sleep, calorie and fluid deprivation by upgrading their mental efforts and motivations. This might be the case of difference in the results of studies focused on performance in athletes [30] against other studies of non-athlete healthy people [31].

It is worth noting that the improving trend in agility scores over time was most likely due to training effect and familiarity with testing procedures. Further, it is possible that a body mass decrease is able to enhance the agility scores. It is therefore recommended that future studies utilize sport-specific tests which are more immune from training effect expectedly.

The results of the present study should be interpreted in the context of its limitations. Nutritional, hydration and sleep status although outside the scope of the current study, is a viable domain for future research since those are likely associated with athletic performances. Furthermore it is proposed to employ a comprehensive test battery to measure a wide variety of physical and mental variables as deterministic factors of different training schedules. It is also recommended that future studies investigate different samples of athletes with various levels of competition and expertise.

CONCLUSION

In Conclusion, findings pointed out that body mass reduction might come with both of the two different times of training in Ramadan. Our results supported the hypothesis that either daytime or evening training might not inversely affect the agility and power performances in a group of elite athletes during Ramadan fasting.

ACKNOWLEDGMENTS

The research was supported by Sports Medicine Research Center, Tehran University of Medical Sciences.

Conflict of interests: None

REFERENCES

1. Maughan RJ, Leiper JB, Bartagi Z, et al. Effect of Ramadan fasting on some biochemical and haematological parameters in Tunisian youth soccer players undertaking their usual training and competition schedule. *J Sports Sci* 2008;26:S39-46.

2. Azizi F. Research in Islamic fasting and health. *Ann Saudi Med* 2002;22:186-91.
3. Ziaee V, Razaei M, Ahmadinejad Z, et al. The changes of metabolic profile and weight during Ramadan fasting. *Singapore Med J* 2006;47:409-14.
4. Roky R, Chapotot F, Hakkou F, et al. Sleep during Ramadan intermittent fasting. *J Sleep Res* 2001;10:319-27.
5. Bahammam A. Does Ramadan fasting affect sleep? *Int J Clin Pract* 2006;60:1631-7.
6. Reilly T, Waterhouse J. Altered sleep-wake cycles and food intake: the Ramadan model. *Physiol Behav* 2007;90:219-28.
7. Degoutte F, Jouanel P, Begue RJ, et al. Food restriction, performance, biochemical, psychological, and endocrine changes in judo athletes. *Int J Sports Med* 2006;27:9-18.
8. Maughan RJ, Fallah J, Coyle EF. The effects of fasting on metabolism and performance. *Br J Sports Med* 2010;44:490-4.
9. Bouhlel E, Denguezli M, Zaouali M, et al. Ramadan fastings effect on plasma leptin, adiponectin concentrations, and body composition in trained young men. *Int J Sport Nutr Exerc Metab* 2008;18:617-27.
10. Maughan RJ, Bartagi Z, Dvorak J, Zerguini Y. Dietary intake and body composition of football players during the holy month of Ramadan. *J Sports Sci* 2008;26:S29-38.
11. Trepanowski JF, Bloomer RJ. The impact of religious fasting on human health. *Nutr J* 2010;9:57.
12. Faye J, Fall A, Badji L, Cisse F, et al. Effects of Ramadan fast on weight, performance and glycemia during training for resistance. *Dakar Med* 2005;50:146-51. (In French)
13. Zerguini Y, Kirkendall D, Junge A, Dvorak J. Impact of Ramadan on physical performance in professional soccer players. *Br J Sports Med* 2007;41:398-400.
14. Kirkendall DT, Leiper JB, Bartagi Z, et al. The influence of Ramadan on physical performance measures in young Muslim footballers. *J Sports Sci* 2008;26:S15-27.
15. Zerguini Y, Dvorak J, Maughan RJ, et al. Influence of Ramadan fasting on physiological and performance variables in football players: summary of the F-MARC 2006 Ramadan fasting study. *J Sports Sci* 2008;26:S3-6.
16. Fallah SJ. Ramadan Fasting and Exercise Performance. *Asian J Sports Med* 2010;1:130.
17. Waterhouse J. Effects of Ramadan on physical performance: chronobiological considerations. *Br J Sports Med* 2010;44:509-15.
18. Atkinson G, Edwards B, Reilly T, Waterhouse J. Exercise as a synchroniser of human circadian rhythms: an update and discussion of the methodological problems. *Eur J Appl Physiol* 2007;99:331-41.
19. Edwards BJ, Edwards W, Waterhouse J, et al. Can cycling performance in an early morning, laboratory-based cycle time-trial be improved by morning exercise the day before? *Int J Sports Med* 2005;26:651-6.
20. Ortega FB, Artero EG, Ruiz JR, et al. Reliability of health-related physical fitness tests in European adolescents. The HELENA Study. *Int J Obes (Lond)* 2008;32:S49-57.
21. Peterson MD, Alvar BA, Rhea MR. The contribution of maximal force production to explosive movement among young collegiate athletes. *J Strength Cond Res* 2006;20:867-73.
22. Sweileh N, Schnitzler A, Hunter GR, Davis B. Body composition and energy metabolism in resting and exercising Muslims during Ramadan fast. *J Sports Med Phys Fitness* 1992;32:156-63.
23. Fedail SS, Murphy D, Salih SY, et al. Changes in certain blood constituents during Ramadan. *Am J Clin Nutr* 1982;36:350-3.
24. Bouhlel E, Salhi Z, Bouhlel H, et al. Effect of Ramadan fasting on fuel oxidation during exercise in trained male rugby players. *Diabetes Metab.* 2006;32:617-24.
25. Ramadan J. Does fasting during Ramadan alter body composition, blood constituents and physical performance? *Med Princ Pract* 2002;11:41-6.
26. el Ati J, Beji C, Danguir J. Increased fat oxidation during Ramadan fasting in healthy women: an adaptative mechanism for body-weight maintenance. *Am J Clin Nutr* 1995;62:302-7.
27. Ramadan J, Telahoun G, Al-Zaid N, Barac-Nieto M. Responses to exercise, fluid, and energy balances during Ramadan in sedentary and active males. *Nutrition* 1999;15:735-9.
28. Margolis SA, Reed RL. Effect of religious practices of Ramadan on sleep and perceived sleepiness of medical students. *Teach Learn Med* 2004;16:145-9.
29. Roky R, Chapotot F, Benchekroun MT, et al. Daytime sleepiness during Ramadan intermittent fasting: polysomnographic and quantitative waking EEG study. *J Sleep Res* 2003;12:95-101.
30. Chaouachi A, Leiper JB, Souissi N, et al. Effects of Ramadan intermittent fasting on sports performance and training: a review. *Int J Sports Physiol Perform* 2009;4:419-34.
31. Roky R, Houti I, Moussamih S, et al. Physiological and chronobiological changes during Ramadan intermittent fasting. *Ann Nutr Metab* 2004;48:296-303.