

The Optimal Time of Day for Training during Ramadan: A Review Study

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Review article</p> <hr/> <p><i>Article History:</i> Received: 07 March 2014 Revised: 02 Apr 2014 Accepted: 09 Apr 2014 Published: 17 Apr 2014</p> <hr/> <p><i>Keywords:</i> Fast Islam Sports Time-of-day Training</p>	<p>Literature concerning the effects of Ramadan fasting on sports performance presents conflicting results. In this context, some studies reported a significant impairment of sports performance during the month of Ramadan. However, other studies suggested that Ramadan fasting has no significant effect on physical performance.</p> <p>The discrepancies between the studies could be explained by time-of-day variations in testing. In this regard, recent studies reported that Ramadan negatively affects the afternoon sports performance; however, the morning and the evening (after breaking the fast) performances were not affected by fasting. This suggests that the optimal time of day for training during Ramadan is the morning or the evening. Therefore, coaches should schedule the training sessions in the morning or evening during the month of Ramadan. However, further studies should investigate the effect of training at a specific time of day on sports performance during Ramadan.</p>

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Introduction

Recent studies concerning the effect of Ramadan fasting on sports performance shows conflicting results (1-3). Previous studies demonstrated a significant reduction in the sports performance of soccer players (muscle power during the repeated-sprint exercise and 30s Wingate test, maximal aerobic velocity, maximal oxygen uptake, and the total distance covered during the Yo-Yo intermittent recovery test) during the month of Ramadan, compared to the pre-Ramadan period (4-6). However, it was reported that intermittent Ramadan fasting did not affect sports performance when the athletes maintained the same training load during this month (7).

The discrepancies between the results of these studies could be due to the time-of-day

variations in testing (2, 3). In this context, it is well established that many physiological and psychological parameters vary in an individual during the daytime, with higher values generally observed in the afternoon than the morning (8, 9). Previous studies showed that short- and long-duration performances are time-of-day dependent, with higher values observed in the afternoon than the morning (10, 11).

These diurnal variations of sports performance could be adjusted by time-of-day modifications in training (12-14). According to some studies, the amplitude (morning-evening differences) of the diurnal variation of maximal short-term performances reduced after a regular training in the morning hours (12-14). However, the morning-evening difference of

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maximal short-term performance was more significant than a regular training in the afternoon hours (12-14).

Recent studies showed that sports performance (i.e., muscle power during the repeated-sprint exercise and the 30s Wingate test, maximal aerobic velocity, maximal oxygen uptake, and the total distance covered during the Yo-Yo intermittent recovery test) was affected by Ramadan fasting in the afternoon hours, unlike the morning hours (4, 15, 16). This suggests that athletes could train in the morning during Ramadan to support the training load.

To the best of our knowledge, regarding the temporal specificity in training during Ramadan, only Aziz *et al* (17) have investigated the effect of a high-intensity exercise session at different times of day during the fasting period on sports performance. They concluded that the optimal time of day to perform an acute high-intensity exercise session during Ramadan is the evening, after breaking the daily fast.

Souissi *et al* (18) investigated the optimal time of day for performing a short-term high intensity exercise (30s Wingate test) during Ramadan. They showed that short-term high intensity performance was affected by fasting in the afternoon and the evening during Ramadan; however, the morning performance did not reduce during the fasting month.

In view of the above considerations, we aimed to review:

- (i) the effect of Ramadan fasting on sports performance,
- (ii) the effect of Ramadan fasting on the diurnal variations of sports performance, and
- (iii) time-of-day effect of training during Ramadan on sports performance.

Ramadan and sports performance

Ramadan

One of the five main religious practices of Islam is Ramadan fasting. Healthy devout Muslims after going through puberty are obliged to fast during Ramadan for 28-30 days, based on the visual sighting of the crescent moon. During the month of Ramadan, Muslims abstain from eating, drinking, smoking, and sexual relations during daylight hours (from dawn until sunset).

The impact of fasting during this month is largely dependent on climatic conditions and

geographical location. With respect to the Gregorian calendar, this month (the ninth month in the Islamic calendar) shifts every year by approximately 11 days. Therefore, the effects of fasting during summer at high altitudes are different from fasting in winter. Moreover, in the summer of regions with temperate climates, fasting duration could be as long as 18 hrs per day.

During Ramadan, food and fluid intake is allowed from a pre-fasting meal called *Sahar* until the fast-breaking meal, known as *Iftar*. It should be noted that food intake during nighttime hours leads to several behavioral changes (19).

Several studies have investigated the effect of Ramadan fasting on sports performance and have presented inconclusive findings.

The effect of Ramadan fasting on sports performance

The current literature concerning the effect of Ramadan fasting on sports performance presents somewhat conflicting results (2, 20). While some studies showed that Ramadan did not affect sports performance (7, 21, 22), others showed a significant decrease in sports performance (5, 23).

In this regard, Chaouachi *et al* (7) investigated the effect of Ramadan fasting on short- and long-duration exercise performances. They reported that the performance during squat jump test, countermovement test, 5, 10, and 30m sprints, and maximal oxygen uptake during the Multi-stage Fitness Test was not adversely affected by Ramadan fasting. Likewise, Zerguini *et al* (22) showed that vertical jump test and 5, 10, and 20m sprint performances were not affected by fasting. Recently, Bouhlel *et al* (23) showed that muscle strength (hand grip strength) and power (countermovement jump) were maintained during Ramadan (compared to the pre-Ramadan period).

On the other hand, Chtourou *et al* (5) investigated the effect of Ramadan fasting on muscle power during the 30s Wingate test, repeated-sprint test, maximal aerobic velocity, and the total distance covered during the Yo-Yo intermittent recovery test in twenty soccer players. They showed that Ramadan fasting

significantly reduced the physical performance of soccer players. In fact, during the 30s Wingate test, repeated-sprint test, the maximal aerobic velocity, and the total distance covered during the Yo-Yo intermittent recovery test, muscle power was significantly lower during Ramadan in comparison with the pre-Ramadan period.

Similarly, in ten physical education students, Bouhlel *et al* (23) showed a significant impairment of performance, indicated by the force-velocity test (the maximal power of arms and legs), during Ramadan in comparison with the pre-Ramadan period.

The discrepancies between the results of these studies could be due to several factors: the test protocols, environmental conditions, training status, fasting duration, and the time of day of testing (20). In this context, recent studies showed that maintaining the training load during the month of Ramadan might lead to performance decrement during the fasting period (7, 21). Recently, Rebaï *et al* (24) showed that a 2-week tapering period during Ramadan might enhance the muscle strength during Ramadan. However, when this period changed to 4 weeks, the performance significantly reduced during the last two weeks of Ramadan, compared to the two first weeks of the fasting month.

Ramadan and diurnal variations of sports performance

Time of day and sports performance

It is well established that sports performance and many physiological parameters (25) are time-of-day dependent (8, 9, 26). In fact, both mental (27, 28) and physical (29, 30) performances fluctuate during the daytime. For instance, the muscle power (mean and peak power) during the Wingate test was higher in the afternoon compared to the morning in adults (31-35) and boys (14, 36, 37). Likewise, during short-term explosive exercises, previous studies reported a significant time-of-day effect on vertical jump performance (the squat and countermovement jumps) with higher and lower values in the afternoon and morning, respectively (12, 13, 38).

Previous studies also reported higher muscle power (exercises performed on a cycle ergometer) in the repeated-sprint exercises

during the first 2-3 sprints (4, 39, 40). However, after the first 2-3 repetitions, the diurnal variation of performance disappeared (4, 39, 40). Lack of time-of-day effect on muscle power during the repeated-sprint exercises could be explained by a higher muscle fatigue in the afternoons compared to mornings (41). In this regard, Racinais *et al* (42) showed that the higher reduction of muscle power in the afternoon compared to the morning could be due to the higher initial power during the first 2-3 repetitions.

The diurnal variations of short-term maximal performances could be partially explained by the higher core temperature observed in the afternoon compared to the morning (33, 43). Therefore, the first 2-3 repetitions during the repeated-sprint exercises could act as a warm-up, which improves the morning core temperature to the same level as the afternoon (8, 9).

Considering long-duration exercises, the literature presents somewhat conflicting results (8). In soccer players, recent studies showed a significant time-of-day effect on performance during the Yo-Yo intermittent recovery test (16, 41, 43). In this regard, Hammouda *et al* (16), Chtourou *et al* (41), and Hammouda *et al* (43) showed that maximal aerobic velocity, maximal oxygen uptake, and the total distance covered during the Yo-Yo intermittent recovery test were higher in the afternoon compared to the morning.

Ramadan and time-of-day effects on sports performance

As indicated above, the discrepancies between the results concerning the effect of Ramadan fasting on sports performance could be attributed to the time of day of testing (3). Recent studies showed that sports performance was adversely affected by fasting during Ramadan in the afternoon, just before the sunset (4, 6, 15, 44). However, some hours after the sunrise, there were no significant adverse effects of Ramadan fasting on sports performance.

Chtourou *et al* (15) studied the effect of Ramadan fasting on the muscle power of soccer players during the Wingate test and its diurnal variation. They showed that muscle power was

impaired during Ramadan when the tests were performed in the afternoons; however, when the tests were carried out in the morning, no adverse effects of fasting were observed.

Moreover, Chtourou *et al* (15) showed that muscle power was significantly higher in the afternoon compared to the morning before Ramadan. However, this diurnal variation of muscle power was suppressed during Ramadan due to the impaired performance in the afternoon; the performance was maintained in the morning. The same conclusions were confirmed by Aloui *et al* (4) during the repeated-sprint test and by Hammouda *et al* (35) during the Yo-Yo intermittent recovery test in young Tunisian soccer players.

Time of day of training during Ramadan and sports performance

Time of day of training and sports performance

Previous studies have investigated the effect of regular training (aerobic (45, 46) and resistance training (12-14, 47)) on sports performance in the morning or evening hours. Hill *et al* (45) showed that after 6 weeks of aerobic training, a significantly higher ventilatory anaerobic threshold was seen in the morning compared to the afternoon in subjects who regularly trained in the morning hours. However, the ventilatory anaerobic threshold was higher in the afternoon compared to morning in subjects who regularly trained in the afternoon hours.

After 5 weeks of high-intensity training, performed at a specific time to increase work capacity, Hill *et al* (46) showed that the performance of subjects, who trained in the afternoon hours, was higher at this time of day compared to the morning hours. However, there was no significant time-of-day effect on work capacity in subjects who trained in the morning hours.

Concerning the time of day of resistance training, recent studies confirm the temporal specificity of training in adults (12, 13) and (14) boys. In this regard, after scheduling 6 weeks of resistance training, Chtourou *et al* (12) showed that subjects, who train in the morning hours, improve their performance (muscle power during the 30s Wingate test and muscle strength

during squats, leg extensions, and leg curls, one-repetition maximum test) in the morning and afternoon. However, the percentage of improvement was higher in the morning than in the afternoon (i.e., higher improvement observed at the same time of training).

The more significant improvement of morning performances may blunt the typical diurnal variation of muscle power and strength. However, subjects who trained in the afternoon hours, improved their performance at this time of day, resulting in an increased morning-evening difference in muscle power and strength. Chtourou *et al* (13) confirmed these results after designing 12 weeks of resistance training; also, Souissi *et al* (14) reached the same conclusions after 6 weeks of resistance training.

The effect of the time of day of training during Ramadan on sports performance

In physical education students, Souissi *et al* (17) investigated the effect of Ramadan fasting on muscle power during the 30s Wingate test and the force-velocity test, recorded after sunrise (07:00 a.m.) and before (5:00 p.m.) and after (9:00 p.m.) sunset. The authors showed a significant reduction in sports performance only when the tests were performed in the afternoon. Therefore, we can conclude that training sessions could be scheduled in the morning or the evening during Ramadan to avoid the negative effects of fasting on sports performance.

Recently, Aziz *et al* (18) investigated the effect of Ramadan fasting on physical performance during an intense exercise session (6 × 30s Wingate test followed by a time-to-exhaustion cycling task) performed at different times of day (08:00 a.m., 6:00 p.m., and 9:00 p.m.). For analyzing the sports performance, total work and time to exhaustion were recorded before and during Ramadan. They showed that the total work during the 6 × 30s Wingate test was adversely affected by Ramadan fasting at 08:00 a.m. and 6:00 p.m. However, during this month, the 9:00 p.m. performances were similar to those recorded before Ramadan. Likewise, the time to exhaustion was maintained at 9:00 p.m. and 08:00 a.m., and reduced at 6:00 p.m. They

concluded that the optimal time of day for performing an acute high-intensity exercise session during Ramadan is the evening, after the *Iftar* meals.

However, exercising later in the evening may improve the core temperature of the subjects and thus, may affect the normal sleep-wake cycle. In this regard, Souissi *et al* (48) showed that performing the Yo-Yo intermittent recovery test in the evening at 9:00 p.m. might adversely affect the sleep quality of individuals. These modifications in the sleep quality or sleep deprivation observed during Ramadan may affect both mental (49, 50) and physical (51, 52) performances. Therefore, scheduling the training sessions in the evening during Ramadan could disturb the sleep quality of the athletes, which may adversely affect sports performance. Therefore, for precise conclusions, more studies are required to investigate the time-of-day effect of regular training during Ramadan on sports performance.

Conclusion

The effect of Ramadan on sports performance is relatively insignificant. However, Ramadan may impair sports performance when the test sessions are scheduled in the afternoon just before breaking the fast. This reduction may blunt the typical diurnal variation of sports performance, observed before Ramadan. Ramadan fasting did not affect sports performance when the tests were performed in the morning hours or in the evening after the *Iftar* meals. Therefore, we could conclude that the optimal time of day for training during Ramadan is the evening, 2-3 hours after breaking the fast.

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