



Teaching Physical Education During Ramadan Observance: Practical Recommendations

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Abstract

Teenage students continue to participate in physical education lessons during the month of Ramadan. The combination of intermittent fasting and physical activity may result in impairment in both physical and cognitive performances. Additionally, dietary intake, sleep and hydration status may be negatively affected. To counteract the possible negative effects of intermittent fasting upon health and athletic performance of adolescent students, some practical recommendations should be outlined including (i) nutrition and sleep education of students, (ii) reducing the intensity and increasing the recovery periods during physical education lessons and (iii) practicing physical education in indoor. Additionally, teachers should be aware of clinical signs and symptoms of dehydration and hypoglycemia.

Keywords: Ramadan Observance, Hydration, Metabolism, Performance, Recommendations, Physical Education

1. Context

It is well known that physical activity is inherently 'good' for school-aged children and youth in respect of varied biological (e.g., growth, bone health) and psychosocial outcomes including self-esteem and cognitive functioning (1-3). The Centers for Disease Control and Prevention (4) recommends that children (> 8 years of age) should participate at least to 60 minutes of physical activity each day. However, increased sedentary behaviors (e.g., watching television, video game) in young people may lead to not meet the international recommendations for physical activity practicing (5).

Structured physical activity, with instructional purpose, practiced in schools is considered as a key setting for the delivery of children and adolescent physical activity initiatives as they provide almost universal access to children (6). Additionally, physical education (PE) is of important since it represent a teaching subject that can influence the academic success of adolescent students.

Given the importance of physical activity for teenagers' health, well-being and academic success, lessons of PE should not be stopped throughout the year, even during Ramadan observance. During the religious month of Ramadan, healthy pubescent subjects must abstain from both food and fluid ingestion from dawn to sunset dur-

ing 29 or 30 days (7-9). Additionally, with respect to the Gregorian calendar, Ramadan month advances by ~11 days each year and can, therefore, occur during any of the four seasons (10-13). It is worthy to note that the effects of daytime fasting are strongly influenced by climatic conditions. In fact, Ramadan occurring in summer at high altitudes presents very different features compared with Ramadan in winter at lower altitudes (14-17). The fast duration depend, also, by the season of the year. For example, it can be as long as 18-hours a day in the summer of temperate regions and in some other countries located more to the poles, the fast duration could be longer, representing a real challenge for fasters (14, 18). Each day before dawn, Muslims ingest a pre-fast meal called *Sahour* and fast until sunset. The fast-breaking meal is known as *Iftar*. Then, unlimited food intake and hydration are allowed till dawn. The obligation to eat only within a short overnight span leads to several behavioral changes in sleep (19, 20), alertness (21), meal times (21, 22) and eating schedule (21, 22). Additionally, in adults, physiological changes may be observed during Ramadan observance such as dehydration (14, 19, 23-29), metabolic responses (24, 25, 27, 28) and the circadian variation of body temperature, cortisol and melatonin (30, 31). Behavioral and physiological changes reported in adults may be exacerbated in adolescent students participating in PE lessons during Ramadan obser-

vance and leading, consequently, to impairment of physical and cognitive performances.

To avoid the possible negative effects of the combination of intermittent fasting and instructional physical activity during PE lessons, it appears mandatory to provide some practical recommendations to PE teachers that must be applied during Ramadan month.

2. Changes Associated with Ramadan Observance in Adolescent Fasters

2.1. Dietary Intake

Eating patterns and the quality of foods during Ramadan month may be different from other months of the year. For example, Farooq et al. (32) examined the effects of Ramadan fasting on the dietary intakes in nine sedentary teenagers aged 13 - 15 years. Results showed that protein intake increased significantly during compared to before Ramadan; perhaps because of increased protein-rich foods during the holy month (32).

In a recent cohort study carried on 366 sedentary adolescents (age = 15.9 ± 1.8 years) in junior high schools, Ali and Abizari (33) showed that consumption of vitamin A-rich fruits, other fruits, and milk and milk products increased significantly during Ramadan. Conversely, Ramadan observance is associated with a decrease in the consumption of foods from tubers and roots, nuts and legumes, and dark green leafy vegetables while other food groups remained unchanged (33). In another study, Poh et al. (34) showed that fat, carbohydrate and thiamine intakes decreased significantly during Ramadan in 117 schoolchildren (age: 10 - 13 years).

In adolescent athletic population, previous studies concerning the effect of Ramadan fasting on the dietary intakes are controversial (35-37). For example, many reports indicated the absence of change in caloric intake during compared to before Ramadan in soccer players (35, 37-39). Other studies showed that caloric intake decreased significantly during Ramadan in amateur boxers (36) and soccer players (40, 41). Surprisingly, two studies showed increased caloric intakes during Ramadan in Karate athletes (36, 42). Clearly, differences in nutritional habits between countries (18) and/or nutritional education by coaches/physical trainers (18) may explain the contradictory findings.

Qualitative analysis of food have indicated that fat intakes augmented in Karate athletes probably because of increased preferences for fatty foods (42); but did not change in soccer and basketball players (43). Conversely, other reports indicated a decrease in fat intakes in soccer players (40, 41) and boxers (36).

Carbohydrate intake did not change in soccer players (37, 40, 41) and Karate athletes (42); but decrease in boxers (36).

Protein intake may decrease (36, 42), increase (37) or not change (40, 41, 43) during Ramadan compared to a regular month.

It is difficult to explain the previous findings, but again subjects' preferences food may have contributed to the divergent findings across studies.

Total water intake was shown to increase during Ramadan in Karate athletes (34). Conversely, other reports showed decreases (36, 44) or no change (37, 44) in total water intake. It appears that Karate athletes concentrated more on water intake and liquid foods ingestion during Ramadan compared to their counterparts in other studies (36, 37, 43, 44). Moreover, the decrease in total water intake observed by Bouhleb et al. (36, 44) may provoke a state of dehydration and subsequently a decrement in physical and cognitive performances may be reported (45).

2.2. Energy Expenditure

Using a chest-worn 3-axis accelerometer, Girard and Farooq (46) evaluated the effect of Ramadan fasting on energy expenditure in 18 young non-athlete boys (age: 12.6 ± 1.5 years). The authors showed that energy expenditure did not change during compared to before Ramadan (46). In athletic population, Meckel et al. (38) reported that duration of intense physical activity decreased significantly during Ramadan; reflecting possibly the use of coping strategy during Ramadan observance.

2.3. Sleep Patterns

It is well known that adolescents present with sleep timing delay, short sleep duration (< 7 hours) and irregular sleep-wake schedules on school days, all resulting from biological and behavioral factors (47). However, today, studies evaluating the effect of Ramadan fasting on sleep patterns of adolescent are scarce.

In the study conducted by Farooq et al. (32), the Pittersburgh Sleep Quality Index questionnaire was used to determine the total sleep time (TST) in non-athletic teens. The authors reported decreases in TST by 1.8 hours at the end of Ramadan which is similar to that commonly reported for adults (30, 48). These findings were explained by the additional late-night activities (e.g., late-night prayers, shopping) during the last 10 days of Ramadan in preparation to *Eid al Fitr* (i.e., the end of Ramadan festival). Studies carried on adolescent athletes showed that TST did not change in soccer players (38, 39); possibly because players are advised to maintaining their sleep habits during Ramadan observance.

2.4. Hydration Status

To the best of our knowledge, studies evaluating the effect of fasting during Ramadan month on the hydration status of sedentary adolescents are lacking and the existing studies were only carried on adolescent athletes (37, 39, 43, 49). The latter studies used several markers to assess the hydration status of adolescent athletes during Ramadan. For example, hemoglobin and hematocrit decreased significantly during Ramadan in soccer players (37); possibly because the collection of blood samples was realized in the morning (9:00). The latter finding was supported in the same population by the absence of change in urine specific gravity values (49); perhaps because of unchanged total water intake during Ramadan. In another study, Güvenç (39) showed that urine specific gravity remained unchanged during Ramadan in adolescent soccer players. Similarly, urine osmolality did not change during Ramadan in soccer and basketball players (43). The aforementioned results suggest that Ramadan fasting has no effect on the hydration status of adolescent athletes. However, evaluating the effect of hot and humid Ramadan month on the hydration status of adolescent athletes is warranted.

2.5. Physical Performance

In non-athletic boys fasting for the first time, Fenneni et al. (50) examined the effects of Ramadan observance on both short-term (i.e., 20-minute and 30-minute sprints, vertical and horizontal jump tests, medicine ball throw) and long-duration sub-maximal test (i.e., 6-minute walking distance measured during the 6-minute walk test). The results showed impaired sub-maximal aerobic capacity without changes in short-term maximal performance (50).

Examining the effects of Ramadan observance, in young soccer players, on short- and long-duration exercise performances, Chtourou et al. (51) reported ~1.6% - 1.9% and 2.4% - 2.9% decreases in peak and mean power recorded by the 30-second Wingate test during the second and the fourth weeks of Ramadan in comparison with before Ramadan. Likewise, 3.8% decreases in the total work during a repeated sprint exercise (i.e., 5 × 6 seconds repeated sprint test (with 24 seconds of recovery in-between)) were reported (51). Total distance covered during the Yo-Yo intermittent recovery test and estimated maximal aerobic velocity were both reduced by 3.7% and 11.9% during in comparison with before Ramadan. In the other hand, the results of this study reported increases of 11 and 12.6% in the rating of perceived exertion scores and 12 and 22.8% in the fatigue estimated by the profile of mood state during the second and the fourth weeks of Ramadan in comparison with before Ramadan (51).

In youth soccer players, Güvenç (39) reported that peak running distance, time, and velocity recorded during the 20 m shuttle run test were not adversely affected by Ramadan observance. In Karate players, during Ramadan, Zarrouk et al. (52) reported that maximal voluntary contraction (MVC) of the knee extensors and time to exhaustion at 75% of MVC were not adversely affected by Ramadan observance. Conversely, in soccer players, Kirkendall et al. (53) showed that agility time during the 4-line agility test, 7 × 30 m repeated sprint time, counter-movement jump height, 10 m sprint time, and the running distance during a 20 m multistage shuttle run test were greater during in comparison with before Ramadan. However, no-significant differences were observed between the fasting and the non-fasting participants in this study indicating that Ramadan had little effect on performances of youth soccer players (53).

Although speculative, the most proposed explanations of changes of performance during Ramadan were: dehydration and possible alterations in body composition, disturbances of circadian rhythms and the sleep wake cycle, training load/regimen changes and environmental conditions (38).

2.6. Cognitive Performance

In adults, mood states, alertness and reaction time have been reported to decrease by Ramadan observance (54, 55). These changes may negatively affect cognitive performances during the daytime of Ramadan (54).

In adolescents, Farooq et al. (32) showed that spatial planning ability and working memory capacity were enhanced during the end of Ramadan observance. However, due to the lack of comparison with a non-fasters group, no firm conclusion can be advanced and a possible learning effect may explain these findings.

In Karate athletes, Zarrouk et al. (42) showed no-significant changes in the simple reaction time evaluated before and after maintained 75% of the MVC during Ramadan.

2.7. Metabolic Markers

The evolution of markers of carbohydrate metabolism during Ramadan observance was studied by Maughan et al. (37). In 78 Tunisian junior male soccer players aged 16 - 19 years who continued their usual schedule of daily training and weekly competition, the authors showed that glycemia did not change during compared to before Ramadan (37). In Karate athletes, the same findings were reported (44). It appears that the continuation of training during Ramadan observance has no marked effect on carbohydrate metabolism.

Resting values of blood lactate has been reported to be maintained during Ramadan (30). However, blood lactate response were only higher before and at the beginning of Ramadan observance during the multi shuttle running test at running velocities of 10, 11 and 12 km h⁻¹ (39).

In adolescent athletes, the effect of training during Ramadan observance on the lipid metabolism was examined by Hammouda et al. (41). The data showed that total cholesterol and triglycerides values decreased significantly in the late afternoon during Ramadan observance reflecting a beneficial effect of fasting associated to exercise on the lipid metabolism (41).

Regarding protein metabolism, in the late afternoon, Hammouda et al. (41) reported that plasma protein values measured before and after the Yo-Yo intermittent recovery test increased during the second and the fourth week of Ramadan compared with before Ramadan. Additionally, resting and post-exercise values of uric acid, the end product of purine breakdown, increased significantly during Ramadan (41). Trabelsi et al. (25) concluded that, in adult athletes, there is an increased fat oxidation and rate of protein breakdown during Ramadan. Other factors may also contribute to increased uric acid values during Ramadan including dehydration (25) and an excessive breakdown of RNA tissue (56).

3. Practical Recommendations

To counteract the possible negative effect of the combination of fasting during the month of Ramadan and the participation in PE lessons, some practical recommendations, issued from scientific-based literature, must be underlined:

- It is mandatory to incorporate a nutrition education into the school curriculum from the very early stages through secondary school (57, 58). Additionally, for Muslim pupils, the nutrition education should be specific to Ramadan fasting.

- Physical activity practiced in a hot and humid weather during the month of Ramadan may induce a state of dehydration (14, 24, 25). As recommended by Shephard (45), adolescent students should be encouraged to drink sufficient amount of liquid foods and water after breaking the fast. Additionally, self assessment of urine color by adolescents is considered as an effective method for day-to-day monitoring of the hydration status (59). Clearly, educating teenagers on self-assessment of hydration status, using urine color chart, is warranted.

- PE teachers must be alert to clinical signs and symptoms of dehydration including headache, dizziness and tachycardia (60).

- PE teachers should encourage teenagers to obtain adequate sleep quality and quantity [between 8 - 10 hours; Paruthi et al. (61)] during Ramadan month by:

- Educating teenagers on the importance of adequate sleep quantity and quality for health (61). It is worthy to note that sleep hygiene education may be effective by reducing sleep onset latency and irregularity in adolescent students (47).

- During Ramadan, adolescent students should implement regular short naps (< 30 minutes) to avoid difficulties of falling asleep at night (62).

- Avoiding caffeinated substances (e.g., coffee, tea, energy drinks) after breaking the fast (63).

- Avoiding the use of electronic devices (at least 1 hour prior to bedtime) (63).

- Developing a good sleep environment (dark, cool and comfortable room) (63).

- During lessons of PE, technique and skill building should be emphasized over fitness training to reduce fatigue. Additionally, the intensity should be reduced by increasing recovery periods and decreasing the maximal heart rate invested in each exercise.

- Reducing the warm-up duration.

- If Ramadan month falls in summer, PE lessons should be scheduled indoor to avoid excessive dehydration. However, if PE lesson is performed outdoor, students should recover in the shadow.

- Teachers should be aware of signs of hypoglycemia (e.g., discomfort, loss of consciousness, cognitive dysfunction seizures) (64). The occurrence of any of these signs during PE lesson requires the cessation of exercise.

- Physical and cognitive performances may be impaired during Ramadan fasting in adolescent athletes. Therefore, modifying the rating scales when evaluation sessions of PE will held during the month of Ramadan is recommended.

4. Conclusions

Adolescent students participating in PE lessons during Ramadan may have physical and cognitive performances impaired. To minimize the possible deleterious effects of fasting, sleep and nutrition education should be programmed before the start of Ramadan month. Additionally, reducing duration and intensity of PE lessons may be an effective strategy to reduce fatigue during Ramadan observance.

Footnotes

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