The Influences of the Religious Tradition of Ramadan on Dietary Intake and Body Composition in Adolescent Athletes: An Evidence-to-Practice Review

Regina A. Duncan, MS, SCAT, ATC*; Shannon E. Ryan, MS, SCAT ATC‡; Erin M. Watlington MS, ATC†; Nancy A. Uriegas, MS, SCAT, ATC§; Zachary K. Winkelmann, PhD, SCAT, ATC, CHSE§
*Prisma Health Orthopedics, Columbia, SC; ‡Cintas, Albany, NY; †QuarterLine, Joint Base Lewis-McChord, WA; §University of South Carolina, Columbia, SC

ABSTRACT

When participating in the religious tradition of Ramadan, the body is subject to changes that adjust an athlete's regimented dietary intake. The guiding systematic review and meta-analysis were conducted to gather the results of the limited research on the effect of Ramadan observance on body mass, body composition, and dietary intake in adolescent athletes. Data were extracted from two different databases, and a search through several journals exploring body mass and/or body composition and/or dietary intake was conducted. The methodological quality of each study was assessed via QualSyst. No significant differences were found when comparing the body mass, body composition, body fat percentage, lean mass, and dietary intake pre-Ramadan and throughout Ramadan. Body mass remained unchanged from pre-Ramadan to the first week of Ramadan, from pre-Ramadan to the second week of Ramadan, or from pre-Ramadan to the fourth week. Body composition did not change from pre-Ramadan to the first week of Ramadan or from pre-Ramadan to the fourth week of Ramadan. Body fat percentage did not change from pre-Ramadan to the second week of Ramadan or from pre-Ramadan to the fourth week of Ramadan. Lean body mass was unchanged from pre-Ramadan to the fourth week of Ramadan. Finally, the dietary intake of total energy, fat, protein, carbohydrates, and water did not change throughout Ramadan. Therefore, adolescent athletes continuing to train throughout the duration of Ramadan observance has no effect on body mass or composition and dietary intake.
Content Focus: Health Care Competency

Correspondence
Dr. Zachary Winkelmann, 1300 Wheat Street, Columbia, SC 29208.
E-mail: winkelz@mailbox.sc.edu
Twitter: @zachwinkelmann

Full Citation
Duncan RA, Ryan SE, Watlington EM Uriegas NA, Winkelmann ZK. The influences of the religious tradition of Ramadan on dietary intake and body composition in adolescent athletes: An evidence-to-practice review. *Clin Pract Athl Train.* 2023;6(2): 21-27. https://doi.org/10.31622/2023/0006.02.3

ORIGINAL REFERENCE

Trabelsi, K, Ammar A, Boukhris O, et al. Effects of Ramadan Observance on Dietary Intake and Body Composition of Adolescent Athletes: Systematic Review and Meta-Analysis. Nutrients, 2020;12(6): 1574.

SUMMARY

CLINICAL PROBLEM AND QUESTION

Athletic success is often defined as an athlete's performance on the field; however, several other factors contribute to one's success. Many athletes look to elevate their performance by turning to controllable and manipulatable factors such as body mass and composition. Body composition is the percentage of fat, bone, and muscle in one's body, whereas body mass index is a representation of one's weight and height.[1] These factors have been linked to a possible increase in performance outcomes when maintaining a low-fat mass and a high value of lean mass in athletic performance.[1] Therefore, optimizing intake, type, quantity, and timing of specific foods, fluids, and supplements is widely used across the athletic population to improve performance outcomes.[1] However, these variables need to be highly individualized from athlete to athlete while maintaining positive dietary behaviors. Not only does each sport have specific demands, but each athlete does as well. Therefore, their own optimal body composition and mass will need to reflect these

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188

individual factors. Recognizing this need between athletes and being able to adjust body mass and composition in accordance with proper dietary intake is a significant factor in athletic success.

Ramadan, observed during the 9th month of the Islamic calendar, is a Muslim tradition that requires anyone in observance to abstain from eating, drinking, and sexual activity from sunrise to sunset over a 29–30-day period.[1,14,15] The observance is in commemoration of Muhammad's first revelation and is regarded as one of the five Pillars of Islam.[1] During the observance of Ramadan, an individual's body may go through several changes to adjust to the new dietary demands. The known bodily change is significant to note in pubescent athletes who are under higher-than-normal physical demands during their sports training. Therefore, these athletes may experience difficulty in performance training adaptations during Ramadan due to less-than-optimal training conditions.[1] This period of change can impact dietary intake, body composition, and physical performance due to diet modifications to accommodate late-night training.[1]

Additionally, pubescent athletes at this stage in life often rely on others for the purchase and preparation of foods due to their young age and lack of nutritional knowledge, which may lead to unhealthy eating habits placing an increased emphasis on the importance of monitoring changes during the observable period of Ramadan.[1,18-22] The evaluation of the effects of Ramadan observance on the adolescent athlete's body mass, body composition, and dietary intake is essential to note for athletic trainers working with youth and pediatric patients. Therefore, the primary clinical question of the guiding systematic review and analysis was to evaluate the effects of Ramadan observance on body mass, body composition, and dietary intake in adolescent athletes.[1]

SUMMARY OF LITERATURE

Existing literature included in the guiding systematic review was chosen based on predetermined criteria to encompass the scope of the clinical question best. Inclusion criteria were defined as studies 1) written in English and French languages, 2) published or accepted for publication in peer-reviewed journals, 3) investigated athletes continuing to train during Ramadan observance, 4) included athletes 10-19 years old, and 5) were observed during the entire month of Ramadan.[1] Exclusion criteria were defined as descriptive or review articles, conference proceedings, and articles based on sedentary or obese individuals. Included articles must have assessed dietary intake made by a nutritionist and body mass and/or body composition. An initial search of electronic databases, PubMed, and Web of Science resulted in 40 potential studies. Following the literature search, 45 articles were identified, including five additional sources cited in the 40 identified initially. Once duplicate articles were removed, 36 remained. After screening the full texts and related citations, 12 studies were included in the guiding systematic review, totaling 192 male athletes ranging from 13 to 19 years old. The authors examined the methodological quality of the twelve quantitative studies using the QualSyst assessment tool. The guiding systematic review was the first to analyze the effects of Ramadan observance on body mass, body composition, and dietary intake in adolescent athletes.

SUMMARY OF OUTCOMES

The authors from the guiding systematic review and meta-analysis examined the effects the religious month of Ramadan has on body mass, body composition, and dietary intake in adolescent athletes between the ages of 10 and 19.[1] Of the twelve studies included in the systematic review and meta-analysis, eight studies reported data for body mass and seven studies reported data for body composition.[2-13] Body fat was measured in one study[6] using a foot-to-foot bioelectric impedance analyzer and the remaining studies used a skinfold caliper.[4-7,10,13]

Of the twelve studies included in the systematic review and meta-analysis, ten studies assessed dietary intake by assessing at least one component of the participant's dietary diary (Table 1).[3-8,10,11,13,14] Components that were considered for assessment were caloric intake, proteins, fat, carbohydrate, and water intake. Overall,

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188

three studies examined caloric intake only,[6,11,14] one study assessed caloric intake and water intake,[5] two studies examined caloric intake, proteins, fat, and carbohydrate intake,[7,8] and four studies examined caloric intake, proteins, fat, carbohydrate, and water intake.[3,4,10,12] Dietary diaries were used to record dietary intake for all participants in the ten studies.[3-8,10,11,13,14] Two studies used a 2-day dietary diary without an interview by a trained nutritionist,[6,11] Two studies used a 3-day dietary diary with an interview by a trained nutritionist,[10,12] Two studies used a 3-day dietary diary without an interview by a trained nutritionist,[3,14] and four studies used a 7-day dietary diary without an interview by a trained nutritionist.[4,5,7,8]

Table 1. Participant Dietary Diary Outcomes

Studies	Dietary Intake Assessed	Dietary Diary / Interview with Nutritionist
Aziz et al.[2]		
Aziz et al.[3]	Caloric, proteins, fat, carbohydrate, water	3-day dietary diary & no interview
Bouhlel et al.[4]	Caloric, proteins, fat, carbohydrate, water	7-day dietary diary & no interview
Bouhlel et al.[5]	Caloric, water	7-day dietary diary & no interview
Güvenç[6]	Caloric	2-day dietary diary & no interview
Hammouda et al.[7]	Caloric, proteins, fat, carbohydrate	7-day dietary diary & no interview
Hammouda et al.[8]	Caloric, proteins, fat, carbohydrate	7-day dietary diary & no interview
Maughan et al.[10]	Caloric, proteins, fat, carbohydrate, water	3-day dietary diary & interview
Meckel et al.[11]	Caloric	2-day dietary diary & no interview
Zarrouk et al.[12]	Caloric, proteins, fat, carbohydrate, water	3-day dietary diary & interview
Zarrouk et al.[13]		
Aloui et al.[14]	Caloric	3-day dietary diary & no interview

FINDINGS AND CLINICAL APPLICATION

A total of twelve studies were included, with participants residing in Tunisia, Turkey, Singapore, Morocco, and Israel. Furthermore, the mean age for the participants of the studies ranged from 15 to 19 years, and they predominately participated in soccer (n=6)[3,6,7,9-11]and Karate (n=4),[5,8,12,13] Other sports included were boxing,[4] martial arts,[2] running,[9] and basketball.[3] The number of training sessions ranged from 3-7 across the studies, the duration was between 1-2 hours, and not all studies reported the time of day of training of those who did two reported training before breaking the fast[3,10] and four trained after breaking the fast.[6,7,12,13] Overall, four outcomes were measured to examine the effects Ramadan has on the human body over the course of participating in the observance of Ramadan. The outcomes examined were body mass, body composition (i.e., fat mass, fat percentage), lean mass, and dietary intake (i.e., total caloric intake, macronutrient intake, fluid intake).[1]

Outcome 1 – Body Mass

The body mass of a varying number of participants was assessed before the start of Ramadan and after either one, two, or four weeks of fasting. There were no significant changes to body mass from before Ramadan to the first week of Ramadan fasting.[1] At one week, body mass was reported to have no changes in five studies,[3,5,6,9,12] a decrease in one study,[5] and an increase in one study.[9] When comparing the effects of body mass before Ramadan fasting to the second week of Ramadan fasting, there were no significant changes in body mass.[1] Body mass was recorded to have no changes in three studies,[3,9,10] a decrease in two

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188

studies,[7,8] and an increase in one study at two weeks.[9] Studies that compared body mass before Ramadan fasting to after four weeks of Ramadan fasting concluded there were no significant differences between the two.[1] Eight studies[2,3,5,6,9-12] concluded no change in body mass, three studies[4,7,8] reported a decrease in body mass, and one study[9] showed an increase in body mass from before the start of Ramadan fasting to after four weeks of Ramadan fasting

Outcome 2 – Body Composition

Fat Mass

The body composition of a varying number of participants was assessed before the start of Ramadan and after either one or four weeks of Ramadan fasting. Body fat mass was measured in kilograms for body composition.[1] There was no significant change in body composition one week after Ramadan fasting compared to before Ramadan.[1] All three studies concluded there were no changes to body fat mass at one week.[4,5,13] When comparing the effects of before Ramadan fasting to the fourth week of Ramadan fasting, there were no significant changes in body composition.[1] Body fat mass did not change in three studies[4,5,13] and decreased in one study at four weeks.[8]

Body Fat Percentage

The body fat percentage of a varying number of participants was assessed before the start of Ramadan and after either two or four weeks of Ramadan fasting. There were no changes in the two studies that examined the effects on body fat percentage before Ramadan and after two weeks of Ramadan fasting.[7,10] After reviewing these two studies, it was determined that there was no significant change in body fat percentage from before Ramadan to after two weeks of Ramadan fasting.[1] From before the fourth week of Ramadan fasting, there was no significant change in body fat percentage.[1] One study concluded a decrease in body fat percentage[7] and two studies concluded no change in body fat percentage at four weeks.[6,10]

Outcome 3 – Lean Mass

The lean mass of a varying number of participants was calculated in kilograms before the start of Ramadan and after four weeks of Ramadan fasting.[1] There was no significant change in lean mass from the two studies.[1] Both studies reported no change in lean mass from before Ramadan to after four weeks of Ramadan fasting.[7,13]

Outcome 4 – Dietary Intake

The dietary intake of a varying number of participants was recorded before the start of Ramadan and during Ramadan fasting. Components of dietary intake that were examined over the twelve studies include total energy, protein, fat, carbohydrate, and total water intake. Total energy intake was reported to have no change in four studies,[3,6,11,14] an increase in two studies,[10,12] and a decrease in four studies throughout Ramadan.[4,5,7,8] The findings from these studies conclude that Ramadan fasting had no significant effect on total energy intake.[1] Ramadan fasting was shown to have no significant effect on protein consumption.[1] Throughout Ramadan, protein intake did not change in three studies,[7,8] increased in one study,[10] and decreased in one study.[4] Fat intake had no significant change reported throughout Ramadan.[1] There was no change in fat intake reported in one study,[10] an increase in one study,[12] and a decrease in three studies.[4,7,8] Carbohydrate intake was also shown to have no significant effect from before to during Ramadan.[1] Four studies noted no change,[7,8,10,12] and one study noted an increase in carbohydrate intake throughout Ramadan.[4] there was no significant effect on total water intake from before to during Ramadan.[1] Total water intake had no change in two studies,[3,10] increased in one study,[12] and decreased in two studies.[4,5]

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188

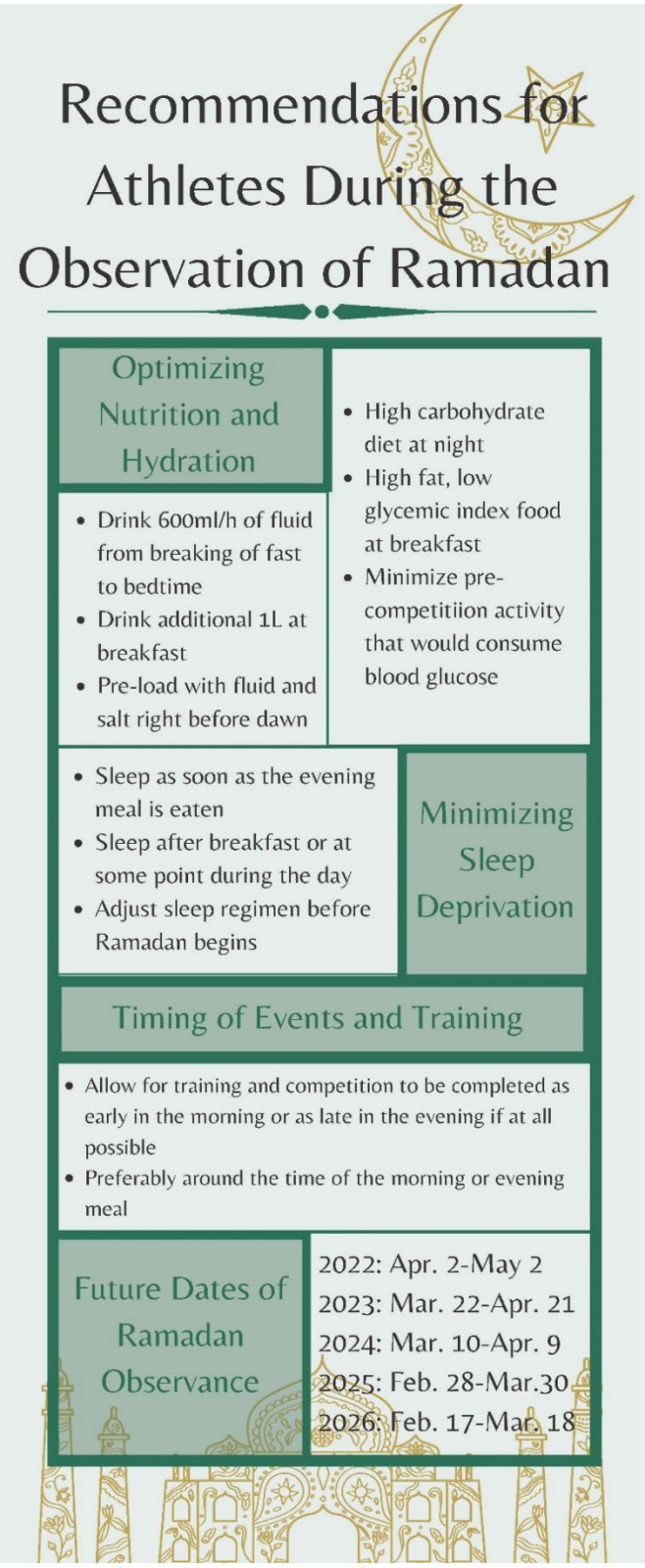

Figure 1. Dietary Recommendations

CLINICAL BOTTOM LINE

As of 2017, an estimated 3.5 million Americans practice the religion of Islam.[15] As this number continues to grow, one can only expect the prevalence of Muslim adolescent athletes to increase. Due to the physiological strain that fasting can have on the body, especially during adolescence, the guiding systematic review sought to describe the effects of Ramadan observance on factors such as body mass, body composition, and dietary intake in adolescent athletes.[1] Following the analysis, it was determined that there were no statistically significant effects of Ramadan observance on body mass, body composition, and dietary intake. Muslim athletes may continue to train at least three times/week during this month.[1]

To provide the best patient-centered care, the sports medicine team must be culturally competent with the spiritual and religious practices of the athletes they provide care for.[16] This means understanding the practices of the religion and how observing traditions such as Ramadan may affect the health and well-being of the athlete. Although the guiding systematic review did not find any significant effects on body mass, body composition, or dietary intake, this does not mean that every athlete will fit this trend.[1] In that case, the athletic trainer should be prepared to provide patient-centered care by recognizing and addressing the many other factors that may affect an athlete during Ramadan.

Body composition is the term used to describe the components of the human body, which include lean mass, fat mass, body water, and bone mass. Overall, the authors in the studies observed no changes in overall body composition. One reason for observing no changes is that there were also no changes to the dietary intake and fluid intake in participants of their studies. It is important to note that changes in overall body composition (i.e., body mass, percent body fat, lean mass) are also impacted by changes in exercise, something that was not objectively measured in these studies. It would be important to consider the effects of Ramadan fasting on energy availability, that is, the amount of dietary energy

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188

remaining for physiological mechanisms of the body after exercise.[17] Measuring using this method would utilize both dietary energy intake and exercise energy expenditure, and changes can be related to two other components of the Athlete Triad: menstrual/reproductive function and bone mineral density.[17,18] Moreover, one should note that the newer "gold standard for body composition assessment" is Dual-Energy X-ray Absorptiometry (DXA or DEXA), which was not done by any of the studies included. Therefore, the results should account for errors in the measures used (bioelectrical impedance and skinfolds).

For adolescents who may not be solely responsible for the food available, it may be beneficial to include their legal guardians in conversations regarding the amount and quality of food consumed during Ramadan. It could also prove useful to facilitate open discussions with athletes and coaches regarding accommodations to training schedules and expectations for performance during this time. In addition to the data's recommendation of training three times a week during Ramadan observance, scheduling these training times to accommodate the adolescent's fasting schedule may improve the performance outcomes.[16,17]

To support the health and well-being of young athletes during their observance of Ramadan, there are three main recommendations for athletic trainers to consider. These involve the timing of events, minimizing sleep deprivation, and optimizing nutrient uptake and hydration.[19,20] More details regarding these recommendations can be found in the attached infographic (**Figure 1**). In addition to the previous recommendations, it is also vital to consider the accommodations that may be necessary in the instance of a medical emergency. This could include allowing access to cooling towels and/or cooling tubs to assist temperature regulation without the intake of fluids.[20] If a medical emergency is believed to be caused by dehydration and/or heat stroke, the athlete should be provided with fluids, and the emergency action plan should be activated. In summation, adolescent athletes observing the religious tradition of Ramadan can still compete without adverse effects, provided they continue a typical training pattern, ensure adequate sleep each night, and maintain their intake of energy and fluids.[19,20]

REFERENCES

1. Trabelsi K, Ammar A, Boukhris O, et al. Effects of Ramadan Observance on Dietary Intake and Body Composition of Adolescent Athletes: Systematic Review and Meta-Analysis. *Nutrients*. 2020;12(6):1574. https://doi.org/10.3390%2Fnu12061574.
2. Aziz AR, Chia MYH, Low CY, Slater GJ, Png W, Teh KC. Conducting an acute intense interval exercise session during the Ramadan fasting month: What is the optimal time of the day? Chronobiol Int. 2012;29(8):1139-1150. https://doi.org/10.3109/07420528.2012.708375.
3. Aziz AR, Slater GJ, Chia MYH, Teh KC. Effects of Ramadan fasting on training induced adaptations to a seven-week high-intensity interval exercise programme. *Sci Sports*. 2012;27(1):31-38. https://doi.org/10.1016/j.scispo.2011.03.004.
4. Bouhlel H, Bogdanis G, Hamila A, et al. Effects of Ramadan observance on repeated cycle ergometer sprinting and associated inflammatory and oxidative stress responses in trained young men. *JNFH*. 2016;4(1):39-47. https://doi.org/10.22038/jfh.2016.6890.
5. Bouhlel H, Latiri I, Zarrouk N, et al. Effet du jeûne du Ramadan et de l'exercice maximal sur le temps de réaction simple et de choix chez des sujets entraînés. *Science & sports*. 2014;29(3):131-137. https://doi.org/10.1016/j.scispo.2014.02.002.
6. Güvenç A. Effects of Ramadan fasting on body composition, aerobic performance and lactate, heart rate and perceptual responses in young soccer players. J Hum Kinet. 2011;29:79-91. https://doi.org/10.2478/v10078-011-0042-9.
7. Hammouda O, Chtourou H, Aloui A, et al. Concomitant effects of Ramadan fasting and time-of-day on apolipoprotein AI, B, Lp-a and homocysteine responses during aerobic exercise in Tunisian soccer players. *PLoS One*. 2013;8(11):e79873. https://doi.org/10.1371/journal.pone.0079873.

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188

8. Hammouda O, Chtourou H, Aloui A, et al. Does Ramadan fasting affect the diurnal variations in metabolic responses and total antioxidant capacity during exercise in young soccer players? Sport Sciences for Health. 2014;10(2):97-104. https://doi.org/10.1007/s11332-014-0179-8.
9. Lotfi S, Madani M, Tazi A, Zerdani I, Boumahmaza M, Talbi M. Effets du jeûne de Ramadan sur les performances physiques et la VO2 max chez les coureurs de demi-fond et les footballeurs. *Revue Sci Staps*. 2010;17:27-37.
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(sup3):S29-S38. https://doi.org/10.1080/02640410802409675.
11. Meckel Y, Ismaeel A, Eliakim A. The effect of the Ramadan fast on physical performance and dietary habits in adolescent soccer players. *Eur J Appl Physiol*. 2008;102(6):651-657. https://doi.org/10.1007/s00421-007-0633-2.
12. Zarrouk N, Hammouda O, Latiri I, et al. Ramadan fasting does not adversely affect neuromuscular performances and reaction times in trained karate athletes. *J Int Soc Sports Nutr*. 2016;13(1):1-10. https://doi.org/10.1186/s12970-016-0130-2.
13. Zarrouk N, Hug F, Hammouda O, et al. Effect of Ramadan intermittent fasting on body composition and neuromuscular performance in young athletes: a pilot study. Biol Rhythm Res. 2013;44(5):697-709. https://doi.org/10.5812%2Fasjsm.34754.
14. Aloui A, Chtourou H, Hammouda O, et al. Effects of Ramadan on the diurnal variations of physical performance and perceived exertion in adolescent soccer players. *Biological Rhythm Research*. 2013;44(6):869-875. https://doi.org/10.1080/09291016.2013.780697.
15. Mohamed B. New estimates show U.S. Muslim population continues to grow. Pew Research Center. May 30, 2020. Accessed August 22, 2023. https://www.pewresearch.org/short-reads/2018/01/03/new-estimates-show-u-s-muslim-population-continues-to-grow/.
16. Jayadevappa R, Chhatre S. Patient centered care-a conceptual model and review of the state of the art. *Open Health Serv and Policy J*. 2011;4(1). http://dx.doi.org/10.2174/1874924001104010015.
17. Nattiv A, Loucks AB, Manore MM, et al. American College of Sports Medicine position stand. The female athlete triad. Med Sci Sports Exerc. 2007;39(10):1867-1882. https://doi.org/10.1249/mss.0b013e318149f111.
18. Nattiv A, De Souza MJ, Koltun KJ, et al. The Male Athlete Triad-A Consensus Statement From the Female and Male Athlete Triad Coalition Part 1: Definition and Scientific Basis. *Clin J Sport Med*. 2021;31(4):345-353. https://doi.org/10.1097/jsm.0000000000000946.
19. Maughan RJ, Zerguini Y, Chalabi H, Dvorak J. Achieving optimum sports performance during Ramadan: some practical recommendations. *J Sports Sci*. 2012;30 Suppl 1:S109-S117. https://doi.org/10.1080/02640414.2012.696205.
20. Shephard RJ. The impact of Ramadan observance upon athletic performance. *Nutrients*. 2012;4(6):491-505. https://doi.org/10.3390%2Fnu4060491.

Copyright © by Indiana State University
All rights reserved. ISSN Online 2577-8188