Islam, a monotheistic religion based on the Quran, is the world’s second largest religion and one of the fastest-growing religions in the world. One of the most holy Islamic observances is the month of Ramadan, the ninth month of the Islamic lunar calendar. Because the Islamic lunar calendar is slightly shorter than the typically used Gregorian calendar, the month of Ramadan shifts by approximately 10-11 days every year (Table 1). Muslims believe this month to be the time when the first ayah, or verse, of the Quran was revealed to the Prophet Muhammad. Thus, fasting during Ramadan, an act of devotion, is one of the five pillars of Islam that every physically and mentally able Muslim must perform.

Ramadan, the spiritual period of abstaining from eating, drinking, smoking, chewing, and sexual relations during daylight hours, seeks to replace aggressive thoughts and behaviors with ideal principles of reflection, piety, charity, patience, righteousness, and restraint. Muslims show their devotion to God by using self-control to develop a stronger sense of piousness as well as discipline and improvement of oneself rather than a mere exercise of deprivation.

In predominantly Muslim countries, Ramadan is a time when business, school, and work slow down to concentrate on the fast during the day. A typical day in Ramadan starts with a very early breakfast, or “Suhoor,” which begins hours before the break of dawn. Following Suhoor, a Muslim may then go to the mosque for dawn prayers and to recite verses of the Quran. Many Muslims then go back to bed before carrying on with daily activities. At sunset, the fast is broken with a meal called “Iftar.” After Iftar, Muslims complete the regularly scheduled prayers, along with extra “Taraweeh” prayers and late-night recitations of the Quran. Therefore, the impacts of Ramadan include alteration of sleeping patterns and change in dietary practice, i.e., no food and fluid consumption between dawn and sunset.

For Muslim athletes who observe this month, the combined food and fluid intake restrictions, as well as the changes in eating and sleeping patterns, are of obvious importance. As athletics become more popular among Muslims, an understanding of the effects of Ramadan on Muslim athletes is essential. There is limited information available about the responses of athletes who train through Ramadan, but there have been several studies pertaining to the nutritional, metabolic, and body composition changes that take place during Ramadan.1-11 Dietary

**KEY POINT**
Ramadan causes a phase shift in food and fluid intake as well as sleep cycle, which results in altered exercise and psychomotor-related performance capabilities.
intake is unlikely to have a significant impact on performance, but the phase shift of food intake, fluid intake, and change in sleep patterns can affect physical performance,\(^4\) as well as level of alertness and mood.\(^12\)

### Dietary and Food Intake During Ramadan

Research suggests that neither energy intake nor body mass change significantly during the Ramadan fasting period.\(^3,8,11,13-16\) There may be regional and cultural variations in dietary practices, however. Increased energy intake has been observed among Saudi Muslims,\(^2\) but decreased energy intake has been observed among Indian Muslims.\(^17\) Another study documented significant body fat losses among young elite judo athletes who had a constant energy intake during the month of Ramadan.\(^18\) A decrease of dietary iron has been reported in a fasting group and an increase in dietary iron intake in a nonfasting group.\(^13\)

#### The Effects of Fasting on Metabolism and Performance

Research has demonstrated that carbohydrate, lipid, and protein metabolism were not significantly affected during Ramadan.\(^4\) Within a few hours of fasting, carbohydrate oxidation decreases and fatty acid oxidation increases.\(^19\) In a fasted state, fat oxidation is favored, which was indicated by a decreased rate of carbohydrate utilization.\(^6\) A glycogen restoration phase lasts about an hour following an exercise session.\(^20\) In the absence of carbohydrate feeding following a high-intensity exercise, such as that which occurs during Ramadan practices, high concentrations of lactate stimulate the recovery of stored glycogen.\(^21\) In the absence of exercise, muscle glycogen content is not affected by a few days of fasting.\(^6\)

Research has suggested that submaximal factors (e.g., heart rate) are hardly affected by fasting, whereas maximal work declined.\(^1\) Psychomotor performance, alertness, and nocturnal sleep patterns have been shown to suffer during altered food intake.\(^22\) Significant reductions in speed, agility, dribbling speed, and endurance have been observed in professional Algerian soccer players,\(^23\) as well as Israeli adolescents.\(^7\) The effect of fasting was most notable on vertical jump performance.\(^4\) A 2–4% body mass reduction resulting from change in total body water content reduced strength by approximately 2%, power was reduced by approximately 3%, and high-intensity endurance was reduced by approximately 10%.\(^24\) Body mass reduction of 2–3% had no significant effect on sprint running performance if the subject was not overweight.\(^24\)

Endurance\(^13\) and high-intensity\(^25\) exercise performances have been shown to be impaired during periods of 24–36 hour fasts. Endurance exercise performance was reduced by a 2–7% reduction in total body water content, but endurance exercise performance that lasted less than 90 minutes was not affected by a 1–2% reduction in total body water content.\(^26\) The results of study of the effects of Ramadan on a 60-minute endurance running performance

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**Table 1. Estimated Ramadan Dates for the Next 10 Years**

<table>
<thead>
<tr>
<th>Gregorian Calendar (AD)</th>
<th>Hijri Calendar (AH)</th>
<th>Ramadan Starts</th>
<th>Ramadan Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1433</td>
<td>July 20</td>
<td>Aug 18</td>
</tr>
<tr>
<td>2013</td>
<td>1434</td>
<td>July 9</td>
<td>Aug 7</td>
</tr>
<tr>
<td>2014</td>
<td>1435</td>
<td>June 28</td>
<td>July 27</td>
</tr>
<tr>
<td>2015</td>
<td>1436</td>
<td>June 18</td>
<td>July 16</td>
</tr>
<tr>
<td>2016</td>
<td>1437</td>
<td>June 6</td>
<td>July 5</td>
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<td>2017</td>
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<td>May 27</td>
<td>June 25</td>
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<tr>
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<td>May 16</td>
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<td>May 12</td>
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<tr>
<td>2022</td>
<td>1443</td>
<td>April 2</td>
<td>May 1</td>
</tr>
</tbody>
</table>
demonstrated that participants covered significantly more distance in the first 30 minutes in a nonfasting state compared to a fasting state. Similar unfavorable effects of fasting during Ramadan have been reported for high-intensity submaximal aerobic exercise and incremental exercise to exhaustion.

**Sleep Patterns**

The time of day when exercise takes place seems to have an effect on performance. Soccer players tested in the morning were significantly slower in the performance of 10-m sprints than pre-Ramadan times through the fourth week of Ramadan, whereas players tested in the afternoon remained consistent. Beyond the fourth week of Ramadan, players tested in the morning returned to pre-Ramadan times. Among the players tested in the morning, greatest fatigue was documented at weeks 2 and 4, whereas players tested in the afternoon only demonstrated fatigue at week 4. Leg strength and anaerobic power tend to improve in the afternoon, especially in activities such as sprinting, vertical jumping, and dribbling.

A significant reduction in nocturnal sleep time has been observed during the first and third weeks of Ramadan. Alteration of sleep cycle to accommodate the phase shift of food intake appears to be a more important factor in the development of performance difficulties than hunger and thirst. As little as 2 hours of cumulative sleep loss in successive days can have negative effects.

Daytime training during Ramadan is likely to result in decreased benefit, but a change in the time of training in non-Muslim countries is unlikely. Most literature pertaining to circadian rhythms suggest that afternoon training is most beneficial. Activities that require high levels of motor coordination and “explosiveness” tend to be associated with peak performance around noon and early afternoon.

**Fluid Intake During and After Exercise**

Lack of fluid intake throughout the course of a day has more significant implications than the lack of food intake. There is evidence that active individuals are better at maintaining hydration status than sedentary individuals, but the restrictions of Ramadan will obviously increase risk for dehydration during exercise. The risk may be greatest during the first week of Ramadan, during which a state of dehydration probably exists. Changes in bowel and bladder habits during Ramadan have been recognized as contributors to mild dehydration, and increases in uric acid have been documented.

**Suggested Guidelines**

Delaying the time of training until afternoon would be advantageous for the Muslim athlete. Although training immediately after sunrise would have the benefit of recent feeding and hydration, research has demonstrated that activities requiring high levels of motor coordination and explosiveness should be performed in the early afternoon. Training sessions that commence as the break in the fast approaches will allow for recovery of glycogen stores and rehydration, but a disadvantage may be alteration of sleep pattern.

The sleep pattern of the Muslim athlete will be most affected during the second and fourth weeks, which can decrease speed, agility, and endurance, especially during daytime training. During this period, training sessions should be planned in the afternoon hours to allow Muslim athletes to perform at a higher level than is possible during morning hours.

Minimizing sweat loss during practice in a hot environment will be advantageous. Muslim athletes are most likely to suffer from dehydration during the first week of Ramadan. Ice baths and cold towels should be used, and practicing indoors with air conditioning should be done whenever possible.

Lipid, carbohydrate, and protein metabolism, and hormone levels are minimally affected by Ramadan fasting. Carbohydrate need for the maintenance of alertness and mood will vary according to the demands of an athlete’s exercise program. A high carbohydrate diet may delay gastric emptying and fluid absorption. Limiting the amount of carbohydrate consumed during the break of the fast can increase the speed of fluid replacement.

Fluid replacement should be achieved after exercise, because exercise-induced dehydration can have a negative impact on performance. Electrolytes that are lost as a result of sweating must be replaced for fluid balance to be maintained. Administration of a sports drink may speed the process of rehydration and reduce physiological stress after an exercise session.

The 2012 summer Olympics will occur during Ramadan (Figure 1). Coaches and healthcare providers
should be aware of the religious practices of Muslim athletes in order to minimize the possible adverse effects of dietary restrictions. If possible, scheduling of practice sessions and competitive events should be done with consideration for the religious beliefs and practices of all athletes. With the guidelines and suggestions that have been provided (see sidebar), Muslim athletes should be able to practice and compete more effectively during the month of Ramadan.

Figure 1 Comparison of Ramadan dates and Olympic dates 2012.

Suggested Guidelines for Athletes During Ramadan

- Change practice times to the early afternoon.
- Observe athletes for increased levels of fatigue due to changes in nocturnal sleep patterns.
- Have ice baths and cold towels available to athletes suffering from the effects of dehydration.
- Limit the consumption of carbohydrate-containing fluids.
- Consume enough fluids and sodium to create a net deficit that is greater than that of the volume of sweat lost.

References


Angy H. El-Khatib is a student in the Undergraduate Athletic Training Program at Marshall University in Huntington, WV.

Tim Tolbert is an assistant professor and Clinical Coordinator in the Undergraduate Athletic Training Program at Marshall University in Huntington, WV.

Gary McIlvain is with the Athletic Training Program at Marshall University, Huntington, WV.

Patrick McKeon, PhD, ATC, University of Kentucky, is the Report Editor for this article.