Running performance during the Holy Month of Ramadan in Elite Professional Adult Soccer Players in Russia

Bezuglov Eduard1,2,5,6,7, Talibov Oleg 7,8, Khaitin Vladimir 3,4, Pirmakhanov Bekzhan11,12, Waśkiewicz Zbigniew 1,10 , Butovskiy Mikhail2,9 , Morgans Ryland1,5

1. Sechenov First Moscow State Medical University of the Ministry of Health of the Russian Federation, Department of Sports Medicine and Medical Rehabilitation, Moscow, Russian Federation;

2. «Smart Recovery» Sports Medicine Clinic LLC, Moscow, Russian Federation;

3. Pavlov First Saint Petersburg State Medical University, Department of Physical Methods of Treatment and Sports Medicine, St. Petersburg, Russian Federation;

4. FC Zenit, St. Petersburg, Russian Federation;

5. PFC CSKA, Moscow, Russian Federation;

6. Russian Football Union, Moscow, Russian Federation;

7. High Performance Sport Laboratory, Moscow Witte University, Moscow, Russian Federation;

8. Moscow State University of Medicine and Dentistry, Moscow, Russian Federation;

9. FC Rubin, Kazan, Russian Federation;

10. Institute of Sport Science, Jerzy Kukuczka Academy of Physical Education, Katowice, Poland;

11. Al-Farabi Kazakh National University, Faculty of Medicine and Health Care, Department of Epidemiology, Biostatistics and Evidence-Based Medicine, Almaty, Kazakhstan;

12. FC Kairat, Almaty, Kazakhstan;

Corresponding author: Pirmakhanov Bekzhan

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**Declaration statement:**

**Ethical statement:** The study was approved by the local Ethics Committee of Sechenov First Moscow State Medical University with the number N 11-19.

**Conflict of interest:** Authors declare no conflict of interest.

**Ethical standards:** All procedures performed involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments. All participants gave their written informed consent for the analysis of their running performance during competitive matches.

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**Abstract**

Religious fasting in the Holy Month of Ramadan is an important element of the Muslim culture during which no eating or drinking is permitted from dawn till dusk. A considerable number of Muslim soccer players abide by these restrictions, which may cause a negative impact on key running performance parameters during competitive matches. Alterations to diet and water intake during the Holy Month of Ramadan may affect various running performance parameters in elite Muslim professional adult soccer players. This study was conducted with two groups of soccer players from the Russian Premier League: the Exposure Group (EG) consisted of Muslims abiding by religious fasting and the Control Group (CG) included non-Muslims. Using the Instat system, the running performance of each player was controlled in both groups during matches from the Russian Premier League before and in the 3rd week of Ramadan (a total of 2 matches for every player). The total distance during the match (m), the average running speed during the match (km/h), the total distance covered at high-intensity per match and for each half, the total distance covered sprinting per match and for each half, and the number of sprints were analyzed. None of the measured parameters demonstrated significant changes in any match. In conclusion, restrictions in diet and liquid intake during the Holy Month of Ramadan had no negative influence on the running performance of elite Muslim professional adult soccer players during daytime matches.

Key words: Ramadan, soccer players, soccer, match performance

**Introduction**

Soccer is one of the most popular sports in the world [1] played by many people including Muslims [2]. The total number of soccer players in Asia and Africa – two regions most populated by Muslims – was 131 million in 2007 [3]. Although, it can be expected to continually rise parallel with increases in the general population and the ever-evolving popularity of soccer. It is estimated that ~25% of the world population will be practicing Islamic religion by 2022 [5] and with the growing popularity of soccer in Islamic countries it can be purported that sport professionals need to better understand Muslim soccer players, especially during Ramadan. Ramadan is a Holy Month of obligatory fasting, during which faithful Muslims refrain from food and liquids during daylight [2]. Food is consumed before sunrise prior to the Morning Prayer and after sunset following the Evening Prayer [2]. Thus, the duration of fasting during the day depends on the number of daylight hours, which also changes every year due to the month of Ramadan being determined by the lunar calendar [2].

Since the majority of Muslim soccer players continue to train and compete during the Holy Month of Ramadan, sport professionals need to be fully informed regarding the potential influence on physical performance [6, 7]. Existing evidence on the effects of Ramadan on general health varies. Ramadan fasting is considered safe for healthy people, but those with various medical conditions are advised to consult their physicians and follow scientific recommendations if they encounter health problems before or during fasting [8, 9]. Several studies have reported no significant disturbances in sleep architecture between fasting and non-fasting non-athlete populations [10]. Mimiran et al. reported that Ramadan fasting may be accompanied by a moderate improvement of lipid and lipoprotein parameters [11]. While Alabbood et al. stated that in their review most studies found an improvement or no change in glycemic control parameters during Ramadan fasting [12].

The question of Ramadan influence on the physical and match performance in soccer has previously been reported in the scientific literature [2], [6-7]. However, only limited information and conflicting results regarding this problem are currently available [2], [6-7]. It is necessary to consider that not all athletes maintain their strict diet on the day of competition. The study conducted by Farooq et al. examined three National soccer teams, with a majority of Muslim players, competing in the Olympic Games held in London 2012. Findings reported that only 39% of interviewed soccer players intended to fast during the competition. In addition, none of 54 players planned to fast on the day of the match [13].

Several studies have highlighted an adverse effect of Ramadan fasting on exercise performances (see reviews of Aziz and Png, 2008; Chaouachi et al., 2009; Waterhouse, 2010) [14-16]. Although, Shephard et al. found that the effects of Ramadan on athletic performance are insignificant if training is optimimized, and sleeping habits, diet and fluid intake are consistent [17]. Rocky et al. further stated that Ramadan decreased nocturnal sleep duration and sleep time was delayed, which may have negative effects on daytime performance [18]. Kirkendall et al. observed no impact on objective measures of physical performance, such as sprinting and vertical jumps [19]. According to Carling et al. the analysis of match performance revealed no significant difference between groups of fasting and non-fasting players of the 3rd division during the Holy Month of Ramadan [20]. Aziz et al. also estimated the influence of Ramadan on the running performance of young amateur soccer players during a series of matches and showed an deteriorating effect on various markers of running performance during the second half of the match [21].

According to Stolen et al., in professional soccer match-play the total distance covered by outfield players was ~ 10–12 km, at an average work intensity of 80–90% of HRmax. Approximately 1–11% of this total distance involved sprinting, with an average sprint of 2–4 s every 90 s. There were also 1000–1400 acyclical short activities changing every 4–6 s including high intensity running every 70 s, approximately 15 tackles, 10 headers, 50 involvements with the ball, 30 passes of varying distances, and dueling activities [4]. Thus, soccer match-play can be considered a physically demanding sport where appropriate nutritional preparation is required.

However, none of the existing research involved soccer players during competitive match-play from a top division. Currently, the analysis of match performance employing sophisticated tracking systems is commonly used in professional soccer [22]. Despite the market variety, all existing systems use video-based multi-tracking to translate registered information into numerical values for further calculation and estimation of running performance [22]. Currently, none of the preferred methods are standardized for running performance analysis. However, the most widespread method involves mathematical modelling of data from fixed cameras located around the stadium at roof height [23]. The output data consists of a generated report on the running performance of all players, including the following metrics: total distance; average speed; distance covered within the different speed thresholds (high-intensity and sprinting), number of accelerations and decelerations; and maximal speed. The specific metrics may vary depending on the individual tracking system [23].

Therefore, due to scant inconsistent literature concerning the influence of Ramadan on running performance in professional soccer players, for the first time this study attempted to evaluate the relationship between Ramadan fasting and running performance during competitive matches of Muslim soccer players competing in the elite leagues of European soccer.

Our hypothesis was that fasting during daytime and restricted water intake during the holy month of Ramadan may affect various measures of motor activity (such as total distance, high-intensity distance and sprint distance) during competitive matches in elite Muslim professional adult soccer players.

**Subjects and methods**

**Ethical approval**

The study was approved by the local Ethical Committee of the Sechenov First Moscow State Medical University with the number N 11-19. All subjects gave their written informed consent for the analysis of their running performance during competitive matches.

**Subjects**

All subjects met the following inclusion criteria: age >13 years, strict fasting during the Holy Month of Ramadan for the past five years, no injuries during the analyzed period, a registered player for a Russian Premier League club for at least one year before the study period. The exclusion criteria were: age <18 years, normal diet during the Holy Month of Ramadan for less than five years, injuries during the analyzed period, a registered player for a Russian Premier League club for less than one year before the analyzed period. The study only included competitive matches played in the Russian Premier League at official stadiums where Instat match tracking systems were installed. Matches were scheduled to finish before sunset. Matches not meeting these criteria were excluded. Goalkeepers and injured players were also excluded from the study.

The study comprised of 26 players of the Russian Premier League. The Exposure Group (EG) consisted of 13 Sunni Muslims [age 24.0±2.8 years], fully adherent to the restrictions of Ramadan, neither eating or drinking during daylight hours (from about 5 am till 9 pm). Non-Muslim players [age 26.0±4.4 years] from the same clubs were included in the Control Group (CG), corresponding with the players of the EG in age, Body Mass Index (BMI), and playing position. The demographic data were collected from team physicians. All Muslims had fasted during the previous five years and believed that it did not restrict their physical activity.

Training processes and the measures of warm-up before each match did not change during the Holy Month of Ramadan in the subjects of the EG. All subjects played in regular matches of the Russian Premier League on days immediately before Ramadan (between the 7th and the 20th April, 2019) and during the 3rd week of Ramadan (from the 19th till the 26th May, 2019). All matches took place during daylight hours, starting between 2.00 p.m. and 7.00 p.m. The outside temperature ranged from 9 to 16⁰C during the matches before Ramadan, and from 16 to 26⁰C during matches at the end of Ramadan. Thus, prior to every match each fasting player did not consume any food or liquid for 9-14 h and the EG subjects also did not consume any items at half-time. All subjects played in the same position during both matches and maintained an injury-free status. Subjects were unaware that the influence of Ramadan was being examined against match running performance. The characteristics of included subjects are presented in Table 1.

**Table 1.** The characteristics of the subjects

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **Exposure Group (n=13)** | **Control Group (n=13)** | **p-value** |
| **Age (M±SD; min-max)** | | 24.0±2.8; 20-30 | 26.0±4.4; 19-32 | 0.4058 |
| **Body Height (M±SD; min-max)** | | 181.0±5.8; 173-190 | 184.0±9.3; 170-196 | 0.2468 |
| **Body Weight (M±SD; min-max)** | | 74.0±5.0; 61-81 | 78.0±8.5; 65-91 | 0.2294 |
| **BMI (M±SD; min-max)** | | 23.0±0.93; 21-25 | 23.0±1.2; 21-26 | 0.8711 |
| **Playing Minutes before Ramadan**  **(Me; Q1-Q3; min-max)** | | 91; 87-95; 73-96# | 94; 90-96; 90-98## | 0.2513 |
| **Playing Minutes 3rd week of Ramadan (Me; Q1-Q3; min-max)** | | 95; 92-95; 73-98# | 95; 92-95; 92-98## | 0.5777 |
| **Player Position** |  | | | |
| **Defender; n (%)** | | 3(23) | 4(31) | 0.6420 |
| **Midfielder; n (%)** | | 6(46) | 7(54) |
| **Forward; n (%)** | | 4(31) | 2(15) |

# - p=0.1548 (within-group Wilcoxon test)

## - p=0.2080 (within-group Wilcoxon test)

**InStat Kinematic System**

InStat kinematic system was used during this assessment. To capture the outfield players, six cameras were placed around the perimeter of the field. The frame frequency was 25 frames per second. Cameras were located at the minimal height of 12 m. Cameras passed information to a central computer for further analysis. The following parameters of running performance were selected to estimate the match performance of players: total distance during the match and during each half (m), the average speed during the match and during each half (km/h), maximal speed (km/h); the total distance covered at high-intensity (m) (speed range 19.8–25.2 km/h) per match and for each half, the total distance covered sprinting (m) (speed above 25.2 km/h) per match and for each half, and the number of sprints were analyzed. The speed thresholds for each category are similar to those reported previously [24] and have been universally accepted.

**Statistical analysis**

Statistical analysis was conducted using the GraphPad Prism software 8.0.0 version for Mac OS X. No imputation or substitution of missing values was performed. Normality of the quantitative data was tested using the Kolmogorov-Smirnov test. Normally distributed data were described using mean (M), standard deviation (SD), and min-max ranges. For other distributions median (Me), interquartile intervals (Q1-Q3), and min-max ranges were used. A two-sample independent T-test with Welch’s correction for unequal variances was used to assess the intergroup differences (age, height, weight and BMI) in case of normal distribution. The Mann-Whitney U-test was used to assess the significance of intergroup differences for playing minutes distributed non-normally. For the primary outcomes (functional loading parameters), the Wilcoxon test for paired measures was used as a more conservative and robust test for the relatively small number of observations. Difference of performance measures in CG and EG were also tested with non-parametric test (Mann-Whiney U-test). Categorical data (player position) were described using frequency charts showing an absolute value and its percentage share. Chi-squared test was used to estimate the differences of player position in 3x2 contingency tables. Values at p < 0.05 were considered statistically significant.

**Results**

No statistical differences were found between the EG and CG. The comparison of playing minutes in matches before and during Ramadan showed no statistical differences (Table 1).

**Table 2.** The measures of physical match performance (M±SD).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameters** | **Exposure Group** | | **P** | **Control Group** | | **P** |
| **Before** | **Week 3** | **Before** | **Week 3** |
| **Total Distance (m)** | 10613±1059 | 10654±935.2 | 0.8926 | 10643±1041 | 10952±1078 | 0.3054 |
| **Average Speed (km/h)** | 3.6±0.54 | 3.6±0.61 | 0.1606 | 3.6±0.58 | 3.6±0.65 | 0.7993 |
| **High Intensity Distance (m)** | 760±214 | 863±198 | 0.0942 | 632±268 | 778±275 | 0.1099 |
| **Sprint Distance (m)** | 130±112 | 189±61 | 0.0681 | 108±71 | 118±90 | 0.5195 |
| **High intensity and sprint count (n)** | 62±14.5 | 71.5±14 | 0.0942 | 59±23 | 66±23 | 0.1514 |
| **Maximal Speed (km/h)** | 29.9±2.38 | 30.2±1.3 | 0.5317 | 28.4±1.98 | 29.2±1.26 | 0.2241 |

Referring to the data presented in Table 2, no statistical difference in physical match performance was seen between the matches completed prior to Ramadan and during the end of the 3rd week of Ramadan. Those players who adhered to food and water restrictions demonstrated no decrease in functional performance. There was no statistical difference in functional performance between the EG and CG. The results obtained prior to Ramadan and during week 3, p>0.05 was observed for all comparisons. The comparison of the main performance measures in the 1st and 2nd half is presented in Table 3. Such factors as average speed in the EG and total distance in the CG had significant difference - these results were higher in matches performed in the third week during Ramadan. The comparison between all measures of both the EG and the CG before and during week 3 showed no statistically significant differences (p>0.05).

**Table 3.** The ratio of the measures of physical physical performance, 1st half versus 2nd half (M±SD).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameters** | **Exposure Group** | | **P** | **Control Group** | | **P** |
| **Before** | **Week 3** | **Before** | **Week 3** |
| **Total Distance (m)** | 0.99±0.31 | 0.94±0.9054 | 0.1094 | 0.93±0.068 | 1.0±0.049 | 0.0012^^ |
| **Average Speed (km/h)** | 0.94±0.54 | 0.96±0.041 | 0.0288^ | 0.90±0.098 | 0.94±0.054 | 0.1973 |
| **High Intensity Distance (m)** | 0.99±0.42 | 1.0±0.93 | 0.8523 | 0.99±0.29 | 0.90±0.22 | 0.4548 |

^ - median difference 0.03 (95%CI 0.01-0.06)

^^ - median difference 0.08 (95% CI 0.01-0.11)

**Discussion**

This study intended to investigate the relationship between religious fasting during Ramadan and running performance during Russian Premier League matches of elite soccer players. The first notable finding was that while abiding by strict, religious fasting running performance of elite Muslim professional adult soccer players in competitive matches showed no changes during the period of Ramadan. Therefore, the initial hypothesis should be rejected. These results can possibly be explained by other factors (i.e. tournament situation in the last match of the championship). The second significant finding was that the decrease in performance during the second half of matches for fasting players was comparable with non-fasting players. The scale of this decrease was not larger in matches that took place during the 3rd week of Ramadan.

These results correspond with the study of Carling et al. investigating the match performance in a competitive match of the 3rd division in the French Championship on the 3rd day of the Holy Month of Ramadan [20]. However, it should be noted that the running performance analyzed in this research was from one match in the beginning of the religious fasting (on the 3rd day of Ramadan). Furthermore, in the study by Carling et al. the matches took place in the evening and players had an opportunity to consume isotonic beverages during the half-time break. Additionally, Carling et al. indicated that the Muslim players examined may save energy in the 1st half of the match as they were aware that the Ramadan protocol followed may have a negative impact of their physical abilities during the match. Furthermore, the small sample size in the study should be considered (i.e. 7 Muslim soccer players with only 4 playing the full match, and 5 non-Muslim players included in the CG) [20].

On the contrary, the research by Aziz et al. involving 13 young soccer players revealed a negative effect of fasting during Ramadan on different parameters of running performance in the group of fasting players [21]. The running performance measures were analyzed a week before fasting and at the end of the 3rd week of the Holy Month of Ramadan. As a result, the majority of parameters (total distance, high-intensity distance) declined in comparison with the CG. Here, the subjects were young amateur soccer players who were not likely to use recovery strategies after matches and training sessions. Furthermore, the match was performed between the players of one team making it more friendly than competitive [21].

Zerguini et al., 2007 and Zerguini et al., 2012 explored the effect of Ramadan on various parameters of physical performance in soccer players, where the authors reported no significant negative contribution [6, 7]. However, those studies were conducted on non-elite players and in non-competitive conditions [6, 7]. It should also be noted that data on the positive effects of timely ingestion of fluids, carbohydrates, proteins and fats on the recovery processes after physical activity have been obtained [25-30].

However, in our study, the timely intake of fluids and nutrients could not be employed, and there was no negative effect due to their absence, at least not evident in the running performance during matches. Thus, it can be assumed that in a short period of time the lack of fluid and food intake during and after matches can be compensated by the internal reserves of the body. The strength of our study is that, according to our data, for the first time we studied the relationship between fasting during Ramadan and running performance during regular competitive matches in the top championship in Russia.

Our study also highlighted a number of limitations. The absence of running performance data of the subjects after the end of Ramadan can be considered a limitation of our study. Moreover, the dynamic changes of hematological parameters, cardiovascular function, and subjective fatigue after matches were not measured, although this would allow an evaluation into the actual influence of Ramadan on the entire organism. Future research should focus on the impact of Ramadan on different age group athletes and the holistic estimation of the dynamic changes in various psycho-physiological parameters before, during, and after the Holy Month of Ramadan.

**Conclusion**

Restrictions to diet and liquid intake during the Holy Month of Ramadan had no adverse effect on match performance in 2 competitive matches among adult professional soccer players from the Russian Premier League.

**Declaration statement:**

**Conflict of interest:** Authors declare no conflict of interest.

**Ethical standards:** All procedures performed involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments. All subjects gave their written informed consent for the analysis of their running performance during competitive matches.

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