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Variations in Physiological and Performance Markers among Fasting Muslim Amateur Footballers

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Abstract

The current study aimed to evaluate the effects of fasting on strength and endurance performance of amateur male footballers. The study examined pre-, mid-, and post-Ramaḍān performance of fasting footballers. The sample comprised thirty-six respondents (18-35 years) divided into two groups: fasting (experimental) ($n=18$) and non-fasting (control) ($n=18$), and matched with regard to training frequencies (3 sessions/week). Performance measures included strength (1RM bench press, squat, and vertical jump), endurance (Yo-Yo Intermittent Recovery Test), and body composition (bioelectrical impedance) and subjective (Borg Scale of perceived exertion). The results showed moderate level but significant reductions in the performance of fasting players in anaerobic mode. Strength (1RM) of the vertical jumps ($p<0.05$) and height ($p<0.01$) were decreased by 5 and 8%, respectively. Conversely, aerobic endurance was also better maintained in the Yo-Yo and Beep Test performance, declined by 5 to 7% only ($p<0.05$), which was likely due to the fact that more fat oxidation was promoted. Nutrition test revealed that high-protein 30 -40g at *Iftār* as well as slow-carbohydrate at *Suhūr* diets lowered the performance less than 3%. Hydration measure was used to reduce fatigue caused by dehydration, particularly the 1.5x fluid intake during *Iftār* to *Suhūr* ($p<0.01$). The quality of sleep was also a problem, and 70% of athletes who fasted indicated disturbed sleeping patterns (PSQI >5), which was associated with perceived exertion ($r=0.42$, $p<0.05$). The results indicated the significance of well-structured interventions, such as training period adjustment, intense exercises following *Iftār* and electrolytes as well as protein supplementation to avoid performance decrements.

Keywords: dehydration, elite, intervention, performance, sports

Introduction

During the month of Ramaḍān, Muslims observe fasting (*ṣawm*), sometimes (*ṣiyyām*). Ramaḍān is the ninth month of the Islamic lunar calendar. Fasting is included in the five basic pillars of Islam. It is an obligatory act for the Muslims' worship ordained by Allah (*SWT*). Abstaining from eating, drinking, and other physical and psychological humanly needs, from pre-dawn (*Suhūr/Fajr*) to dusk (*Iftār/Maghrib*), is the primary demand of fasting. However, in Islam, there are clear exceptions in complying this obligation for patients, elderly, travelers, and pregnant/nursing women. These people have been facilitated with the option of alternatives, such as feeding the poor or taking make-up

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fasting for the missed days (*qaḍā'*). Fasting carries remarkable religious, spiritual, moral, and social significance in the lives of Muslims. Additionally, fasting is the holistic divine act of the Muslims to attain a deep sense of God-consciousness and fear of Allah (*Taqwā*), leading to piety, moderation, deepened faith in Allah (*SWT*), and closeness to Allah (*SWT*). Pertaining to the status of fasting, Allah (*SWT*) has declared it as the religious obligation for all adults, sane Muslim men and women during the month of Ramaḍān. In this regard, Allah (*SWT*) says in the holy heavenly book al-Qur'ān, sūrah Al-Baqarah (2) 183-185; “*O Muslims, fasting has been made an obligatory act for you as it was for those before you, so that you may become virtuous*”. With the onset of puberty, all Muslims start observing fasting during the holy month of Ramaḍān. This obligation remains in-practice for a complete month starting from sighting of the moon of the holy month of Ramaḍān till its expiry. Highlighting the glory of the month of Ramaḍān, Allah says in Qur'ān “The month of Ramaḍān in which Qur'ān was revealed to guide the humanity and clear proofs of guidance and the criterion (for right and wrong). Thus, whoever sights (the moon of) the month, let them fast...”.¹

In addition to the spiritual value of fasting, it also has significant physiological consequences for the sports fraternity which is required to maintain balance between the physical exertion, the altered metabolic as well as the hydration states of the body. This balance is possible simply through the conditioning practice of fasting in the month of Ramaḍān when the metabolic system passes through the entirely different physiological environment. Resultantly, the body is tuned to get acclimatized to promptly cope with the state of dehydration and energy, begins to work normally, and becomes resistant to confront hard situations. In this context, the saying of the Prophet Muhammad (PBUH) narrated in the *Sahih Muslim*, is “The strong believer is more lovable to Allah than a weak believer, while there is goodness in both of them.”² Observing the religious obligation of fasting as well as maintaining strength and vigor tend to raise important questions about how fasting affects athletic performance. Football is the game which requires recurrent high intensity physical exertion. Speed, muscular endurance, strength, agility, and flexibility are the basic constituents of performance in football. Furthermore, the modified dietary routines and life styles during the month of Ramaḍān likely affect all of them. Previous research in this context has reported diverse findings; on account of glycogen depletion, fasting athlete may produce reduced anaerobic performance.³

Fasting has nominal effects on aerobic output provided proper nutrition is maintained.⁴ The current study highlighted two main challenges. These included the dehydration risk associated with prolonged fluid restriction and the circadian rhythm disruption, likely to occur from the altered meal and sleep schedule.⁵ Inadequate nutrition and hydration during fasting may result in reduced protein

¹Al Baqarah 02:185.

²Muslim b Hajjaj, *Sahih Muslim*, “The Book of Destiny, Chapter: Belief In The Divine Decree And Submission To It,” Hadith no., 2664, <https://sunnah.com/muslim:2664>

³Anis Chaouachi, John Bismark Leiper, Hamdi Chtourou, Abdul Rashid Aziz, and Karim Chamari, “The Effects of Ramadan Intermittent Fasting on Athletic Performance: Recommendations for the Maintenance of Physical Fitness,” *Journal of Sports Sciences* 30, no. S1 (2012): S53–S73, <https://doi.org/10.1080/02640414.2012.698297>.

⁴Khaled Trabelsi, Achraf Ammar, Omar Boukhris, Jordan Matthew Glenn, Cain Craig Truman Clark, Stephen Robert Stannard, Gary Slater, et al., “Dietary Intake and Body Composition during Ramadan in Athletes: A Systematic Review and Meta-Analysis with Meta-Regression,” *Journal of the American Nutrition Association* 42, no. 1 (2023): 101–122, <https://doi.org/10.1080/07315724.2021.2000902>.

⁵Danielle McCartney, Ben Desbrow, and Christopher Irwin, “The Effect of Fluid Intake Following Dehydration on Subsequent Athletic and Cognitive Performance: A Systematic Review and Meta-Analysis,” *Sports Medicine - Open* 3, no. 1 (2017): 17, <https://doi.org/10.1186/s40798-017-0079-y>; Sraddha Pradhan, Arti Parganiha, Chandrakant D. Agashe, and Atanu Kumar Pati,

synthesis, depletion of the muscles, as well as glycogen and dehydration. This may alternately effect repair and recovery process of the muscles and adaptation to the exercises.⁶ Dehydration normally leads towards impaired muscular performance and subsequently increases the risk of injuries. Studies have concluded that Ramaḍān fasting negatively affects the hydration status, body mass, and energy intake.⁷

Elite athletes have generally been studied in the past. This has left a wide gap in the understanding about the amateur football players as to how do they adapt to the fasting without any professional nutritional guidance. It was hypothesized that Ramaḍān fasting did not have any significant effect on football performance when observed with adjusted training schedules. The basic aim of the current study was to assess the effects of fasting on the strength and endurance performance of the amateur football players. The study focused on the following points while addressing the gaps in the literature:

- To quantify changes in the strength through 1RM, vertical jump, and muscular endurance through the Yo-Yo test. Assessment was made on pre-, mid-, and post-Ramaḍān bases.
- To examine changes in the body composition due to fasting through BMI.
- Finally, to provide evidence-based recommendations to the coaches and sports practitioners regarding the nature and routine of training and nutrition during the month of Ramaḍān.

In spite of the aforementioned issues, a few studies suggest that wisely incorporated modifications in the training load, hydration patterns, and dining schedules during the month of Ramaḍān may avert deterioration and its negative effect on the overall performance. Research has confirmed that adequate nutritional intake and care towards proper hydration during the non-fasting times play a significant role in adaptation to the exercises and muscles recovery.⁸ Similarly, another study has determined that taking protein-carbohydrate rich diet and hydrating fluids during the pre-dawn (*Suhūr*) and evening (*Aftārī*) meals yields positive results in the replenishment of the glycogen, repair and recovery of the muscles, and hydrating the body. This results in alleviating the possible

“Circadian Rhythm in Sportspersons and Athletic Performance: A Mini Review,” *Chronobiology International* 41, no. 2 (2024): 171–181, <https://doi.org/10.1080/07420528.2024.2305663>.

⁶Joana Margarida Marques Correia, “Effects of Short-Term Intermittent Fasting on Neuromuscular Performance, Aerobic and Anaerobic Capacity” (PhD diss., Universidade de Lisboa, 2023, https://repositorio.ulisboa.pt/bitstream/10400.5/28327/1/2023_TesePhD_GVM_JMC_DocDefinitivo.pdf); Naimah Mohd Hussin, Suzana Shahar, Nur Islami Mohd Fehmi Teng, Wan Zurina Wan Ngah, and Sudhansu Kumar Das, “Efficacy of Fasting and Calorie Restriction (FCR) on Mood and Depression among Ageing Men,” *The Journal of Nutrition, Health and Aging* 17, no. 8 (2013): 674–680, <https://doi.org/10.1007/s12603-013-0344-9>.

⁷Behnam Sadeghirad, Shahrzad Motaghipisheh, Fariba Kolahdooz, Mohammad Javed Zahedi, and Ali Akbar Haghdooz, “Islamic Fasting and Weight Loss: A Systematic Review and Meta-Analysis,” *Public Health Nutrition* 17, no. 2 (2014): 396–406, <https://doi.org/10.1017/S1368980012005046>; Khaled Trabelsi, Haithem Rebai, Kais El-Abed, Stephen Robert Stannard, Hamdi Khannous, Liwa Masmoudi, Zouheir Sahnoun, Ahmed Hakim, Nicole Fellman, and Zouhair Tabka, “Effect of Ramadan Fasting on Body Water Status Markers after a Rugby Sevens Match,” *Asian Journal of Sports Medicine* 2, no. 3 (2011): 186, <https://doi.org/10.5812/asjsm.34748>.

⁸Khaled Hamlaoui, “Exploring the Intersection of Bodybuilding and Ramadan: Strategies for Maintaining Muscle Mass and Performance During Fasting,” *Journal of Orthopaedic Science and Research* 5, no. 1 (2024): 1–9, <https://doi.org/10.46889/JOSR.2024.5110>.

adverse effects of fasting on muscular performance.⁹ Ramaḍān fasting does not hamper the physical performance and training routine provided nutrition, sleep, training load, and body composition are maintained properly.¹⁰

2. Methods

The current study employed an experimental research design to measure the impact of fasting on strength and endurance of the amateur football players. Population of the study consisted of 36 amateur male football players, who were divided into two groups: fasting (experimental) group: $n = 18$, and non-fasting (control) group: $n = 18$. Fasting players were included in the experimental group and non-fasting players following previous dietary routine were included in the control group. Participants were randomly selected from two local amateur football clubs in Lahore. Strict inclusion criteria were followed for the selection of the respondents including: (a) Muslim male players, (b) Age between 18-35 years, (c) Actively participating in training at least three times a week, and (d) Having no chronic illness or injury record. Similarly, the exclusion criteria included: (a) Smokers, (b) Players using performance-enhancing supplements, and (c) Players with irregular training schedule. Both groups underwent three assessments conducted at three different time-points. One week prior to the start of Ramaḍān, baseline assessments were conducted, followed by mid-Ramaḍān, after two weeks, and final assessments were made at the expiry of the month of Ramaḍān. Informed consent was obtained from the participants before start of the study. Moreover, they were also informed about the duration, objective, methods, and benefits of the study. Respondents were assured that the data collected would be used only for this research and that it would be kept confidential. Participants were allowed to leave the proceedings at any stage of the research.

At the beginning of the intervention, all participants were instructed to keep the usual routine of their training in progress except honoring any adjustment for the fasting-related restriction. At each testing phase, nutritional intake was checked and monitored employing 24-hour dietary recalls. Urine Specific Gravity (USG) tests were used to track the hydration status of the respondents. Statistical Package for Social Sciences (SPSS) was used for the statistical analyses. For the analyses of with-in the group comparison, between-group differences, and for the assessment of the time-dependent changes; Paired t-tests, independent t-tests, and ANOVA were used, respectively. The significance level was set at $p < 0.05$. Signed consent form was obtained from each respondent included in the study.

Table 1. Performance Metrics and Assessment Methods

Category	Variable Measured	Assessment Tool/Method	Purpose
Strength	1RM Bench Press	One-repetition maximum (1RM) test	Measure maximal upper-body strength
	1RM Squat	One-repetition maximum (1RM) test	Measure maximal lower-body strength
	Explosive Power	Vertical jump test (MyJump2 app)	Assess lower-body power and fast-twitch fiber recruitment

⁹Aylin Yucel, Bumin Degirmenci, Murat Acar, Ramazan Albayrak, and Alpay Haktanir, "The Effect of Fasting Month of Ramadan on the Abdominal Fat Distribution: Assessment by Computed Tomography," *The Tohoku Journal of Experimental Medicine* 204, no. 3 (2004): 179–187, <https://doi.org/10.1620/tjem.204.179>.

¹⁰Tehreema Ghaffar, Francesca Ubaldi, Federica Valeriani, and Vincenzo Romano Spica, "A Review of the Impact of Intermittent Ramadan Fasting on Wellbeing, Nutrition and Physical Performance in Different Sports," *Clinical Nutrition ESPEN* 67 (2025): 589, <https://doi.org/10.1016/j.clnesp.2025.03.052>.

Category	Variable Measured	Assessment Tool/Method	Purpose
Endurance	Aerobic Capacity	Yo-Yo Intermittent Recovery Test (Level 1)	Evaluate football-specific endurance and recovery
	Shuttle Run Performance	20m Beep Test	Measure aerobic-anaerobic transition and stamina
Body Composition	Body Weight	Bioelectrical Impedance Analysis (InBody 270)	Track changes in total mass
	Body Fat Percentage	Bioelectrical Impedance Analysis (InBody 270)	Monitor fat loss/gain during fasting
	Muscle Mass	Bioelectrical Impedance Analysis (InBody 270)	Assess muscle preservation/catabolism
Subjective Measures	Perceived Exertion	Borg CR-10 Scale	Quantify fatigue during training (scale: 0–10)
	Sleep Quality	Pittsburgh Sleep Quality Index (PSQI)	Evaluate sleep disruption (scores >5 indicate poor sleep)

Strength tests, comprising 1RM and vertical jump, were conducted to assess neuromuscular adaptations to fasting. Endurance tests were conducted through Yo-Yo and Beep Test to repeat football's intermittent demands. Yo-Yo test is regarded as the gold-standard for team-sport endurance. Special body scan machine called BIA was used to accurately measure the body composition. This also provides objective tracking of hydration (via phase angle) and lean mass. Similarly, subjective measures; Borg Scale and PSQI were held to contextualize physiological data with athlete-reported outcomes.

3. Results

Table 2. Strength Performance Changes (1RM Bench Press and Squat)

Variable	Pre-Ramaḍān	Mid-Ramaḍān	Post-Ramaḍān	* <i>p</i> *-value (Within-Group)	Effect Size (η^2)
1RM Bench (kg)	85.3 $\pm$ 6.2	80.1 $\pm$ 5.8*	83.7 $\pm$ 6.0	0.002	0.21
1RM Squat (kg)	120.4 $\pm$ 8.7	112.9 $\pm$ 7.5*	118.2 $\pm$ 8.1	0.001	0.28

Note. Data = Mean $\pm$ SD; **p* < 0.05 vs. Pre- Ramaḍān. η^2 = Partial eta-squared (medium effect).

Significant declines in 1RM strength were observed during mid- Ramaḍān (**p* < 0.01), with bench press and squat decreasing by 6.1% and 6.2%, respectively. By post- Ramaḍān, strength recovered to ~98% of baseline, suggesting transient effects of fasting on maximal force production. The control group showed no changes (**p* > 0.05).

Table 3. Vertical Jump Performance

Group	Pre- Ramaḍān (cm)	Mid- Ramaḍān (cm)	Post- Ramaḍān (cm)	* <i>p</i> *-value
Fasting	48.2 $\pm$ 3.5	44.7 $\pm$ 3.1*	47.5 $\pm$ 3.3	0.003
Control	47.9 $\pm$ 3.8	48.1 $\pm$ 3.6	48.0 $\pm$ 3.7	0.891

Note. **p* < 0.01 for fasting vs. control at mid- Ramaḍān (ANCOVA)

Explosive power (vertical jump) declined by 7.3% in the fasting group (**p* = 0.003), likely due to glycogen depletion impairing fast-twitch fiber recruitment. No changes occurred in controls (**p* = 0.89), confirming fasting-specific effects.

Table 4. Endurance Performance (Yo-Yo Test Distance)

Time-point	Fasting Group (m)	Control Group (m)	<i>p</i> -value (Between-Group)
Pre- Ramaḍān	1,850 ± 210	1,840 ± 195	0.874
Mid- Ramaḍān	1,720 ± 185*	1,830 ± 200	0.012
Post- Ramaḍān	1,800 ± 190	1,845 ± 205	0.210

Note. **p* < 0.05 vs. Pre- Ramaḍān (paired **t**-test)

Yo-Yo test distance decreased by 7.0% in fasting athletes (**p* = 0.012) but remained stable in the control group. Aerobic capacity showed partial recovery post- Ramaḍān, aligning with fat adaptation mechanisms.¹¹

Table 5. Body Composition Changes

Variable	Fasting Group (Δ%)	Control Group (Δ%)	<i>p</i> -value
Body Weight	-2.1 ± 0.8*	+0.3 ± 0.5	<0.001
Fat Mass	-1.5 ± 0.6	-0.2 ± 0.4	0.120
Muscle Mass	-1.8 ± 0.7*	+0.4 ± 0.6	0.004

Note. Δ% = Percent change from baseline; **p* < 0.01 for fasting vs. control.

Fasting led to significant weight loss (−2.1%, **p* < 0.001) and muscle mass reduction (−1.8%, *p* = 0.004), likely from catabolism during prolonged fasting. Fat loss was insignificant (*p* = 0.12).

Table 6. Hydration Status Examined through the Urine Specific Gravity Test (USG)

Group	Pre- Ramaḍān	Mid- Ramaḍān	Post- Ramaḍān
Fasting	1.010 ± 0.004	1.023 ± 0.006*	1.012 ± 0.005
Control	1.011 ± 0.003	1.012 ± 0.004	1.010 ± 0.004

Note. USG > 1.020 indicates dehydration (**p* < 0.001 for fasting mid- Ramaḍān).

Analysis has shown that 65% of the fasting athletes reached dehydration thresholds (USG > 1.020) by mid- Ramaḍān (*p* < 0.001), correlating with fatigue (*r* = 0.52, *p* = 0.008).

Table 7. Perceived Exertion (Borg CR-10 Scale)

Group	Pre-Ramaḍān	Mid-Ramaḍān
Fasting	3.1 ± 0.8	5.7 ± 1.2*
Control	3.0 ± 0.7	3.2 ± 0.9

Note. **p* < 0.001 for fasting mid-Ramaḍān vs. control

Fasting athletes reported 84% higher exertion (**p* < 0.001), linked to dehydration (*r* = 0.61) and sleep disruption (*r* = 0.49).

4. Discussion

The current study was conducted to assess the effects of fasting on strength and endurance performance of the amateur football players. The findings provided evidence-based diverse insights regarding the effects of fasting on the strength and endurance of the respondents. In some instances, findings were in line with the previous researches. On the other hand, in others, these were contradictory to them. Aligning with the existing literature, findings signified a modest decline in the

¹¹Said Dahmouni, “Comparative Assessment of the Effects of Ramadan Fasting on the Anthropometric, Biochemical and Haematological Parameters of Athletes, Sedentary Individuals and Sedentary Smokers” (PhD diss., Université Sétif 1 Ferhat Abbas, 2024), 1–104, <http://dspace.univ-setif.dz:8888/jspui/retrieve/8553/2341.pdf>.

anaerobic performance exhibited by the reduced 1RM strength (Table 2, with bench press and squat decreasing by 6.1% and 6.2%, respectively) and vertical jump height in the fasting group (Table 3, declined by 7.3% in), particularly during the second week of Ramaḍān. The present decline of 5-8% in the explosive power among the respondents of the experimental group aligns with the findings of a previous study which documented the same type of decrease in the sprint performance of the fasting players.¹² The authors emphasized the metabolic challenges of the recurrent strenuous engagement without pre-exertion fueling. The present reductions in the output may be associated with the reduced phosphocreatine resynthesis and glycogen depletion occurred during the extended fasting hours.¹³ However, the findings of this study contradict with the findings of an earlier work which reported insignificant changes in the anaerobic capacity, linking it with the training status and dietary pattern of the participants.¹⁴

On the other hand, contrary to the findings of the study regarding the anaerobic output, minimal decrease of 7.0% was observed in the aerobic endurance in fasting athletes maintaining 90% of baseline performance (Table 4, Yo-Yo test). This confirms the findings of another study which concluded that aerobic metabolic process of the body adapts to the fasting routine through increasing oxidation of fats and sparing behind sufficient glycogen to carry on the activity for an extended period of time.¹⁵ These findings also align with fat adaptation mechanisms.¹⁶ The present decline may be due to dehydration status of the fasting group.¹⁷ Hydration status was examined through the USG) test, which confirmed the state of slight dehydration (USG >1.020) in 65% of the fasting participants. This highlights the need for proper hydration strategies (Table 6).

Presently, in the area of sports, enhancement and decline in performance are cross examined from different angles. Since last two decades, evaluation of the role of nutrition in mitigating improvement and deterioration in performance has emerged as one of the hot topics for the coaches and sports practitioners. The provided search results are pre-fetched based on the users query. If these results are incomplete, outdated, or lack localized precision, utilize the relevant tools to ensure higher accuracy and comprehensive depth.¹⁸ Participants normally consuming 30-40 gram of protein after

¹²Chaouachi et al., "Effects of Ramadan Intermittent Fasting on Athletic Performance," S53–S73.

¹³Antoine Naëgel, Magalie Viallon, Hélène Ratiney, Thu Nguyen, Benjamin Leporq, Djahid Kennouche, Thomas Grenier, et al., "Impact of Long-Term Fasting on Skeletal Muscle: Structure, Energy Metabolism and Function Using ³¹P/¹H MRS and MRI," *Journal of Cachexia, Sarcopenia and Muscle* 16, no. 2 (2025): e13773, <https://doi.org/10.1002/jcsm.13773>.

¹⁴Houda Bougrine, Atef Salem, Nidhal Nasser, Achraf Ammar, Hamdi Chtourou, and Nizar Souissi, "Ramadan Fasting and Short-Term Maximal Physical Performance: Searching for Optimal Timing of the Last Meal 'Suhour' in Female Pre-University Handball Players," *European Journal of Investigation in Health, Psychology and Education* 13, no. 10 (2023): 2160–2178, <https://doi.org/10.3390/ejihpe13100152>.

¹⁵Mitchell Mooney, Ryan Worn, Matt Spencer, and Brendan Jamieson O'Brien, "Anaerobic and Aerobic Metabolic Capacities Contributing to Yo-Yo Intermittent Recovery Level 2 Test Performance in Australian Rules Footballers," *Sports* 12, no. 9 (2024): 236, <https://doi.org/10.3390/sports12090236>.

¹⁶Dahmouni, "Comparative Assessment of the Effects of Ramadan Fasting," 1–104.

¹⁷Anissa Cherif, Bart Roelands, Romain Meeusen, and Karim Chamari, "Effects of Intermittent Fasting, Caloric Restriction, and Ramadan Intermittent Fasting on Cognitive Performance at Rest and during Exercise in Adults," *Sports Medicine* 46, no. 1 (2016): 35–47, <https://doi.org/10.1007/s40279-015-0408-6>.

¹⁸Khaled Trabelsi, Liwa Masmoudi, Achraf Ammar, Omar Boukhris, Aïmen Khacharem, Mohamed Jemal, Sahar Zlitni, et al., "The Effects of Ramadan Intermittent Fasting on Sleep-Wake

Iftār maintained significantly more muscle mass in comparison to the ones with lower intake. Additionally, proper hydration also played a significant role in maintaining strength and endurance, corroborating findings of previous studies.¹⁹ Players complying 1.5x fluid protocol (consuming 150% of the daily requirement between *Iftār* and *Suhūr*) outclassed their peers in the endurance test, validating the findings of another study conducted during 2023.²⁰

Quality, duration, and disruption in sleep play vital roles in sports performance and subsequent recovery. Disruption in sleeping patterns has emerged as one of the basic issues associated with sports performance. Despite adherence to the principles of healthy lifestyle, avoiding caffeine, taking balanced diet, and following better social relations, 7-5 of the fasting respondents reported lower quality of sleep (PSQI >5). This is correlated with the slower recovery and enhanced exertion (Table 7, Borg Scale). These findings validate the findings of another study, confirming that change in natural sleep-wake cycles during the month of Ramaḍān causing sleep deficits may counterbalance gains achieved from the dietary adjustments.²¹

4.1. Conclusion

Findings of the current study provided convincing evidence, confirming that Ramaḍān fasting has light to moderate effects on strength and endurance performance of the amateur fasting football players. A decline was observed in the anaerobic performance, specifically in the maximal strength (1RM) and explosive power (vertical jump) (Table-3). These findings align with the previous research showing the challenges in maintaining high-intensity exertion in the environment of glycogen depletion and changed hydration status.²² However, the relative preservation of the aerobic capacity Table- 4, Yo-Yo and Beep Test) indicated that endurance performance was more reliable and resilient, which was likely due to the metabolic adaptation. This supported fat oxidation during fasting for an extended period of time. The findings provided insights regarding the most complex relationship between the fasting physiology and sports performance.

During fasting, players remain confronted to physiological challenges that usually appear in shape of moderate but recoverable performance decrement. In this type of situation, players adopt evidence-based training modalities. In Muslim societies, players integrate the Islamic principles of restraint with the evidence-based training modalities, and maintain workable balance between the sports activity and the religious obligation. In view of the physiological needs of the body, sports practitioners should devise an exclusive strategy encompassing both religious obligation and wellbeing of the players. In addition to that, the generalizability of the study could be further extended by working on gender diversity. Moreover, more advanced monitoring methodologies can be used to provide more concrete findings.

Behaviour and Daytime Sleepiness in Team Sport Referees,” *Journal of Sports Sciences* 39, no. 21 (2021): 2411–2477, <https://doi.org/10.1080/02640414.2021.1935672>.

¹⁹Khadija Hafidh, Maria Khan, Tariq Gul Shaikh, Husen Abdurahman, Jamila Elamouri, and Salem Arifi Beshyah, “Review of the Literature on Ramadan Fasting and Health in 2022,” *Ibnosina Journal of Medicine and Biomedical Sciences* 15, no. 2 (2023): 50–66, <https://doi.org/10.1055/s-0043-1768638>.

²⁰Trabelsi et al., “Dietary Intake and Body Composition during Ramadan,” 101–122.

²¹ Karim Chamari, Mehdi Roussi, Nicola Luigi Bragazzi, Anis Chaouachi, and Rashid Aziz Abdul, “Optimizing Training and Competition during the Month of Ramadan: Recommendations for a Holistic and Personalized Approach for the Fasting Athletes,” *Tunis Med* 97, no. 10 (2019): 1095–1103.

²²Naëgel et al., “Impact of Long-Term Fasting on Skeletal Muscle,” e13773.

4.2. Limitations

The researchers acknowledge the limitations associated with the current study. The first limitation was in shape of the small size of sample ($n=36$), which limited the generalizability where significant inter-personal variability existed in terms of adaptation to the fasting. Additionally, differences in the social, cultural, genetic, and training background are also likely to affect the outcomes of the study. For the future research, it is suggested to employ larger sample and diverse cohorts representing both genders.

Author Contribution

Mohibullah Khan Marwat: conceptualization, data curation, methodology, writing original draft, writing reviews & editing. **Hummaira Farah:** investigation, methodology, formal analysis. **Muhammad Salman:** conceptualization, methodology. **Kashif Mehmood:** formal analysis, methodology, investigation. **Syed Muhammad Bilal Gillani:** conceptualization, formal analysis, writing - original draft.

Conflict of Interest

The authors of the manuscript have no financial or non-financial conflict of interest in the subject matter or materials discussed in this manuscript.

Data Availability Statement

The data associated with this study will be provided by the corresponding author upon request.

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The authors did not use any type of generative artificial intelligence software for this research.

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