Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Effects of Ramadan Intermittent Fasting on Physiological Responses and Match- Related Performance in Young Tennis Players

Mounir Landolsi

mounir.landolsi@famso.u-sousse.tn

University of Sousse

Nadia Lakdhar

Manouba University

Jabeur Methnani

University of Sousse

hakim Aissa

University of Sousse

Faysal Zarrouk

Manouba University

Monia Zaouali

University of Sousse

Ezdine Bouhlel

Manouba University

Research Article

Keywords: Ramadan intermittent fasting, Tennis performance, serve performance, heart rate, Young athletes

Posted Date: May 28th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9616598/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Ramadan intermittent fasting (RIF) presents a significant challenge for athletes, often resulting in reduced dietary intake and dehydration, which can cause increased physiological stress. While RIF's effects on various sports are documented, specific research on tennis-specific technical and physical performance in young, trained athletes remains limited. This study aimed to examine the effects of Ramadan intermittent fasting on physiological responses and tennis-specific performance during a simulated match in young trained players.

Methods

Fifteen trained male tennis players (17 ± 2.4 years) completed a simulated two-set match before Ramadan (CON) and during mid-Ramadan (RIF). Countermovement jump (CMJ), serve performance (velocity, precision, and success rate), and physiological variables (glycemia, heart rate, body temperature, urine specific gravity [USG], and rating of perceived exertion [RPE]) were assessed at baseline, after Set 1, and after Set 2. Dietary intake was recorded under both conditions.

Results

Energy intake (− 14.4%, $p = 0.001$) and fluid intake (− 7.9%, $p = 0.001$) were significantly reduced during RIF. Body temperature and USG were higher during RIF ($p < 0.05$), while baseline glycemia was lower ($p = 0.003$). CMJ performance was slightly reduced after Set 1 ($p = 0.031$), with no differences at baseline or after Set 2. No significant differences were observed in serve velocity, precision, or success rate.

Conclusion

Despite significant alterations in nutritional intake, hydration status, and physiological responses, RIF had no significant impact on tennis-specific performance. These findings suggest that young trained players can maintain performance during fasting, likely through compensatory mechanisms.

Highlights

• Significant reductions in daily energy (− 14.4%) and fluid intake (− 7.9%) occur during Ramadan intermittent fasting (RIF).

• Physiological changes include higher body temperature and urine specific gravity, alongside lower baseline glycemia.

• Tennis-specific performance, including serve velocity and precision, remains stable despite nutritional challenges.

• Physical power (CMJ) remains largely unaffected, demonstrating high performance resilience despite fasting.

• Young tennis players sustain technical performance during the fasting period, likely due to physiological adaptation to Ramadan fasting.

Background

Tennis is a high-intensity intermittent sport requiring repeated accelerations, decelerations, changes of direction, and explosive actions. Performance depends on a complex interaction between physical, technical, and cognitive abilities. Ramadan intermittent fasting (RIF) induces marked alterations in dietary intake, hydration status, sleep patterns, and training routines. These changes may affect physiological function and, consequently, physical and technical performance (1).

Previous studies investigating the effects of Ramadan fasting on athletic performance have reported contrasted findings. While some studies have shown impairments in physical or technical performance (2), others have reported no significant effects, particularly in trained athletes (1, 3).

In addition, most studies have focused on general physical performance, with limited data available on sport-specific technical skills under match conditions (3, 4). It has been proposed that lifestyle changes during Ramadan fasting potentially impact physical aptitude and result in decreased performance levels, including reduced speed, power, and shot accuracy (2). The day dietary restriction can potentially lead to caloric deficit and dehydration (1, 5, 6), impairing physical and cognitive performance (4, 7). Furthermore, these changes could disrupt the athletes' sleep-wake cycle (8), resulting in alterations in their circadian rhythm, which can cause reduced alertness (9–11), and physical performance (12).

In tennis, the ability to maintain physical and technical performance during prolonged match play is critical. Under fasting conditions, the combination of metabolic constraints and match-induced fatigue may exacerbate performance decrements (13).

Therefore, this study aimed to examine the effects of Ramadan intermittent fasting on physiological responses and tennis-specific performance during a simulated match in young trained players. It was hypothesized that fasting would impair performance as match-induced fatigue develops.

Material and methods

Study design

A repeated-measures crossover design was used. All participants completed two experimental conditions: before Ramadan (CON) and during mid-Ramadan (R-2). Each athlete performed a Tennis

match, consisting of 2 sets, separated by a recovery time of 4–5 min, under the two mentioned conditions (11) (Fig. 1). All experiments took place around 15:30 – 17:00 h corresponding to about 12 hours of fasting during RIF. Measurements were performed at baseline, after Set 1, and after Set 2.

Participants

Fifteen trained male tennis players (17 ± 2.4 years; body mass 66.4 ± 11.3 kg) participated in the study. All players had at least 10 years of training experience and were regularly competing at national level. All participants were accustomed to Ramadan fasting and had been fulfilling this annual religious obligation for at least three years prior to this study.

During the experimental period, the players trained 5–6 sessions per week, totaling about 10–15 hours. This included four to six 2-hour training sessions focusing on technical and tactical skills, match simulation, and two 1.5-hour sessions of muscle strengthening and resistance-type work (high-intensity interval training, HIT). In the 24 hours preceding the experimental trials, the usual training load was reduced to avoid a state of fatigue during the experimentation. During the study year, the daily fasting period lasted approximately 16 hours and 30 minutes (∼03:00–3:35 am to ∼19:30 – 19:50 pm).

Measured parameters

During the first visit, anthropometric measurements were performed (body mass, height, body fat mass). During the second visit, the players provided a urine sample to evaluate the urine specific gravity, using the Cybow 10 model (Cybow10, Gimhae-si, Gyeongsangnam-do, South Korea), and were then weighted wearing only shorts to determine pre-match body mass. After weighting body mass of the participant, using an accurate scale (Beurer, Ulm, Germany), capillary blood samples were taken from the players' fingertips to determine fasting blood glucose using the Accu-chek Active device (Burgess Hill, United Kingdom). Resting heart rate (Polar 850, Kempele, Finland), perceived exertion (14), and body temperature (Beurer FT85, Ulm, Germany) were also recorded at rest. Next, the players went through a standard warm-up of 15 min, consisting of 3 min of dynamic stretching, 5 min of moderate running, 5 maximal 10-meter sprints, and then 5 min of tennis ball exchanges. After the warm-up, performance evaluation of the countermovement jump (CMJ) and the serve (in terms of speed, precision, and success rate) was conducted at baseline (before the simulated match that lasted approximately one hour (2 sets of approximately 30 minutes each). At the end of set 1 (mid-match) and at the end of set 2 (end of match), body mass, CMJ performance, and service parameters (speed, precision, and success rate) were measured (Fig. 2).

Capillary blood samples were taken again at the end of set 2 (end of match) to determine blood glucose levels prior to the evaluation of jump and tennis service performances.

Heart rate (HR) was recorded throughout the match using a heart rate monitor (RS400, Kempele, Finland). Perceived exertion (RPE) was assessed using the Borg scale, ranging from 0–10 before the

match and at the end of set 2. Body temperature was measured at rest before the match and at the end of the match (Fig. 1).

Water intake was allowed ad libitum during the control period (C), but not during the Ramadan fasting period (R).

Dietary intake

Dietary intake was recorded during a non-fasting period (control), and at the second week of Ramadan fasting (R-2) (Table 1). During fasting, the players consumed their pre-dawn meal (sahur) between 2:00 and 3:00 am.

Table 1
Mean values (± SD) of daily dietary intake before Ramadan (C), and during mi- Ramadan period (R-2).

Energy (Kcal/d)	**Control (C)**	**Ramadan (R-2)**	***p* value**	**Cohen's *d***
	2665.13 ± 240.22	**2280.80 ± 277.40**	**0.001**	**1.15**
Energy (MJ/d)	11.19 ± 1.00	9.57 ± 1.17	0.001	1.15
Carbohydrates (g/d)	290.07 ± 38.84	236.47 ± 33.98	0.001	1.07
CHO (% of energy)	44.85 ± 5.26	41.57 ± 4.12	0.039	0.59
Protein (g/d)	107.77 ± 19.41	94.34 ± 15.04	0.030	0.62
Protein (% of energy)	17.63 ± 4.28	16.63 ± 2.49	0.479	0.19
Total fat (g/d)	111.85 ± 23.68	100.73 ± 18.33	0.112	0.44
Total fat (% of energy)	34.99 ± 6.48	39.51 ± 3.93	0.023	-0.66
Fluid intake (l)	3.8 ± 0.4	3.5 ± 0.3	0.001	1.10

Post-hoc significant difference between control and Ramadan periods ($p < 0.05$).

Simulated Tennis Match

The players were matched based on their skill level. Each player faced the same opponent during the match in both control (C) and fasting period (R-2). The match was played according to the official rules of the International Tennis Federation, and was composed by two sets. The duration of each set was 35 ± 5 min, with a rest period of 4–5 min between each set. The choice of duration was based on the average set duration observed in singles U-18 players (15).

For the assessment of technical skills, the player performed four serves at the beginning, post-set 1, and post-set 2 (Fig. 2). The players used their own tennis rackets for all their matches. All matches were

played outdoors on a hard surface or "quick" court, where the ambient temperature was between 20—26°C and the relative humidity was 60—66%.

Evaluation of Tennis Service Performance

The serve is considered as one of the most important technical moves in tennis. According to experts, the tennis serve is important because it starts the point. It is the only shot where the player does not depend on the opponent and has full responsibility for the success or failure of the serve. It requires qualities such as muscular power, coordination, flexibility, and considerable technical skills, including precision and the type of serve (flat or with spin: slice, topspin). According to specialists, flat serve often allows for high ball speeds.

We placed 4 targets: two near the T of the court, one at the right square of the T of the court, and one at the left square of the T, and 2 targets, placed at the end of the square (right and left, Fig. 2).

The player performed 4 attempts. He served twice alternately into the left box and twice into the right box, starting respectively from the right and left sides of the court, aiming for a target (red flat triangles) one located near the T of the service box, and the other close to the singles sideline (Fig. 2).

Three criteria were used to assess service performance: i) precision (in cm), ii) ball speed (in km/h), and iii) success rate (%). The distance of the ball impact from the target represents the subject's precision level measured in cm. Ball speed was measured by Stalker Pro IIs radar gun (Applied Concepts Inc., USA). The success rate is the percentage of successful for the 4 serves realized by the player. In addition, we recorded the percentage of successful first serves, which is considered as an important indicator of a player's physical fitness and aptitude (16). The investigator was placed in front holding the radar, in the other side of the serving player near the baseline (central mark) of the hard court to measure serves speed.

Statistical Analyses

Statistical analyses were realized using the SPSS software version 23 (Chicago, IL, USA). Data were reported as mean ± SD. All data was checked for normality of distribution, and if not normally distributed, the non-parametric statically analysis was used.

Differences in normally distributed measures between control period and Ramadan fast were determined using the paired Student’s t-test. Data with continuous time component was determined using 2-way ANOVA with repeated measures (condition: control and Ramadan; time: baseline, after Set 1, and after Set 2). If a significant main effect was found, post-hoc t-test was used using the Bonferroni correction. In addition, effect size (*d*) was used to determine the practical meaningfulness of the differences. The magnitude of the effects size was classified as trivial (< 0.2), small (> 0.2—0.6), moderate (> 0.6—1.2), large (> 1.2—2.0) and very large (> 2.0—4.0) (17). The level of statistical significance was set at $p < 0.05$.

Results

Dietary intake

Dietary intake decreased significantly during mid-Ramadan (R-2) compared to control (C) (− 14.4%, p = 0.001, d = 1.15), indicating a large effect size. This reduction was primarily driven by a significant decrease in carbohydrate intake both in absolute terms (− 18.5%, p = 0.001, d = 1.07) and relative contribution to total energy (p = 0.039, d = 0.59). Protein intake also declined moderately (− 12.5%, p = 0.030, d = 0.62), although its relative contribution to energy remained unchanged. Interestingly, while absolute fat intake did not significantly change (p = 0.112), its relative contribution increased significantly (+ 4.5%, p = 0.023, d = − 0.66), suggesting a shift toward a more lipid-dominant diet during Ramadan. Fluid intake was significantly reduced (− 7.9%, p = 0.001, d = 1.10), with a large effect size (Table 1).

However, we found that Ramadan fasting has no significant effect on body mass and fat mass in our young tennis players.

Physiological responses

Body temperature was significantly higher during Ramadan after Set 1 (p = 0.011, d = − 0.80) and Set 2 (p = 0.030, d = − 0.98), with large effect sizes. Baseline glycemia was significantly lower during Ramadan (p = 0.003, d = 0.93), but no differences were observed post-set. Urine specific gravity (USG) was significantly higher after Set 1 during Ramadan (p = 0.019, d = − 0.92), indicating increased dehydration. Baseline heart rate was significantly higher during Ramadan (p = 0.027, d = − 0.63), while no differences were observed after Set 1 or Set 2. We found no significant differences in RPE after Set 1 or Set 2 (Table 2).

Table 2
Metabolic parameters at baseline (pre-match), after Set 1, and after Set 2 in control (C) and mi-Ramadan fast (R-2) period (n = 15).

	Control (C)	Ramadan (R-2)	*p* value	Cohen's *d*
Body mass (kg)				
Baseline	66.4 ± 11.3	66 ± 11	0.926	-0.007
After Set 1	65.5 ± 11.2	65.4 ± 11.1	0.983	-0.001
After Set 2	65.3 ± 11.2	65.2 ± 11.2	0.830	0.018
Body temperature (°C)				
Baseline	37.1 ± 0.5	37. 0 ± 0.4	0.454	0.243
After Set 1	36.7 ± 0.3	36.9 ± 0.3	0.011	-0.802
After Set 2	36.7 ± 0.2	36.9 ± 0.2	0.030	-0.984
Glycemia (g/L)				
Baseline	0.93 ± 0.1	0.83 ± 0.1	0.003	0.928
After Set 2	0.86 ± 0.1	0.9 ± 0.1	0.520	-0.137
Urine specific gravity				
Baseline	1.024 ± 0.006	1.024 ± 0.006	0.869	0.053
After Set 1	1.024 ± 0.004	1.028 ± 0.004	0.019	-0.924
After Set 2	1.029 ± 0.004	1.030 ± 0.001	0.189	-0.377
Heart rate (bpm)				
Baseline	66 ± 11	73 ± 11	0.027	-0.630
After Set 1	161 ± 16	155 ± 17	0.215	0.365
After Set 2	163 ± 15	159 ± 14	0.248	0.299
RPE (AU)				
Baseline (rest)	0	0	–	–
After Set 1	4.5 ± 1.3	4.5 ± 1.5	0.364	-0.188
After Set 2	5 ± 1.2	5.5 ± 2	0.320	-0.271

Post-hoc significant difference between control and Ramadan periods ($p < 0.05$).

Performance outcomes

Countermovement jump (CMJ) performance was slightly but significantly reduced during Ramadan after Set 1 ($p = 0.031$), although the effect size was trivial ($d = 0.247$). No significant differences were observed at baseline or after Set 2.

For the serve, we found no significant differences in mean or peak ball velocity across all time points ($p > 0.05$), with consistently small effect sizes. In addition, serve precision and success rate showed no statistically significant differences; however, moderate negative effect sizes (− 0.40 to − 0.50) consistently favored the control condition (Table 3).

Table 3
Performance parameters of CMJ and Tennis serve at baseline (pre-match), after Set 1, and after Set 2 in control (C) and mi-Ramadan fast (R-2) periods (*n* = 15).

	Control (C)	**Ramadan (R-2)**	***p* value**	**Cohen's *d***
CMJ (cm)				
Baseline	28.4 ± 4.9	27.7 ± 5.0	0.162	0.156
After Set 1	30.9 ± 4.9	29.7 ± 4.8	0.031	0.247
After Set 2	30.3 ± 5.2	29.5 ± 4.5	0.204	0.163
Serve				
Mean Ball velocity (Km/h)				
Baseline	126.5 ± 10.4	124.1 ± 12.9	0.075	0.451
After Set 1	128.2 ± 10.5	127 ± 11.4	0.578	0.206
After Set 2	126.3 ± 12.5	126.7 ± 11.3	0.913	0.032
Peak Ball velocity (km/h)				
Baseline	137.4 ± 12.4	134.6 ± 14.4	0.250	0.287
After Set 1	138 ± 11.7	136.9 ± 9.5	0.649	0.152
After Set 2	135.3 ± 13.1	138.9 ± 11.1	0.566	-0.154
Precision (m)				
Baseline	2.3 ± 1.0	2.7 ± 1.2	0.135	-0.461
After Set 1	2.1 ± 1.3	2.7 ± 2.4	0.228	-0.437
After Set 2	2.4 ± 1.4	2.8 ± 1.2	0.334	-0.402
Successful rate (%)				
Baseline	41.7 ± 18.1	40 ± 22.8	0.533	-0.236
After Set 1	35 ± 20.7	46.7 ± 30.9	0.225	-0.426
After Set 2	36.7 ± 28.8	45 ± 30.6	0.227	-0.509
Successful rate 1st serve (%)				
Baseline	46.6 ± 51.64	46.6 ± 51.64	1	0.00
After set 1	20 ± 41.40	40 ± 50.70	0.189	0.43
After set 2	46.6 ± 51.64	40 ± 50.70	0.719	-0.13

Post-hoc significant difference between control and R-2 period ($p < 0.05$).

Discussion

The present study investigated the effects of Ramadan intermittent fasting (RIF) on dietary intake, physiological responses, and tennis-specific performance. The main findings indicate that RIF significantly altered energy intake, hydration status, and physiological responses, while having minimal impact on tennis-specific performance. Specifically, despite reduced energy and fluid intake and increased physiological strain, CMJ performance and serve characteristics were preserved.

Dietary Intake and Physiological Responses

RIF was associated with a significant reduction in total energy intake, primarily driven by decreased carbohydrate consumption, along with reduced fluid intake. These findings are consistent with previous literature reporting altered nutritional patterns during Ramadan (4).

From a physiological perspective, these nutritional changes were accompanied by increased body temperature and urine specific gravity, indicating elevated thermoregulatory strain and dehydration. In addition, baseline glycemia was reduced, suggesting an altered metabolic state at rest. The higher baseline heart rate observed during RIF further supports increased physiological stress related to dehydration (5).

Together, these findings indicate that Ramadan fasting imposes a combined metabolic and hydration-related constraint, which would typically be expected to impair exercise performance, particularly in high-intensity intermittent sports such as tennis.

Previous literature has consistently reported that dehydration impairs thermoregulation and increases cardiovascular stress, particularly in warm environments (5, 6). During Ramadan, this effect was exacerbated by the inability to rehydrate during the match, thereby amplifying thermal load. Such physiological strain could influence fatigue development and recovery kinetics. The higher baseline heart rate observed during Ramadan fasting could be explained by this state of dehydration (5).

Performance Outcomes and Compensatory Mechanisms

Despite these physiological constraints, tennis performance was maintained. CMJ performance showed only a transient decrease after Set 1, while serve velocity, and precision, and also success rate were not significantly affected. This relative dissociation between physiological strain and preserved performance suggests the presence of effective compensatory mechanisms. These may include pacing strategies, improved neuromuscular efficiency, and motivational factors that allow our young tennis players to maintain these performances despite reduced substrate availability and hydration status. Further, the absence of marked performance decrements indicates that performance outcomes during RIF are not solely determined by metabolic or hydration status, but rather reflects integrated physiological and behavioral adaptations.

The reduction in total energy intake and carbohydrate intake was also observed in other studies during Ramadan (4, 7). This is consistent with recent systematic review showing that RIF commonly leads to reduced caloric intake and altered macronutrient distribution, particularly decreased carbohydrate availability (18). Given the major role of carbohydrates in high-intensity intermittent exercises, such reductions are expected to impact muscle glycogen stores, a key determinant of high-intensity tasks. Mechanistically, glycogen depletion during fasting has been associated with reduced power output, increased fatigue, and altered metabolic responses during exercise (19). However, in the present study, the limited impact on performance suggests that glycogen depletion may not have reached a critical threshold or that players effectively compensated through behavioral and pacing strategies. In parallel, fluid intake decreased significantly, accompanied by increased urine specific gravity, confirming a state of mild dehydration (5, 6). This is in line with established evidence that fluid restriction during fasting hours compromises hydration status and may impair performances, even at relatively low levels (∼2% body mass loss)(6). Despite these marked physiological perturbations, tennis performance remained largely unaffected. Neither mean nor peak serve velocities were significantly altered, and CMJ performance exhibited only a transient decrement.

This apparent dissociation is consistent with recent reviews indicating that the impact of Ramadan fasting on performance is generally modest, particularly in sports involving short-duration, high-intensity efforts such as tennis (18). Similarly, a recent review suggests that anaerobic performance and strength are relatively preserved, when athletes maintain adequate nutrition and training load (20). Several mechanisms may explain this; athletes may regulate intensity to avoid premature fatigue, motivation could mitigate physiological constraints, and/or efficient motor unit recruitment may help sustain force production despite reduced substrate availability.

Practical Implications

From an applied perspective, these findings suggest that young trained tennis players can maintain performance during Ramadan fasting despite physiological strain. However, practitioners should implement strategies to minimize potential negative effects, including optimizing carbohydrate intake during non-fasting hours, ensuring adequate hydration between Iftar and Suhoor, and adjusting training schedules to reduce thermal and metabolic stress.

Limitations

The relatively small sample size (n = 15) may limit statistical power, particularly for technical performance variables. Additionally, dietary intake was assessed under free-living conditions, introducing potential reporting bias. Finally, sleep patterns and circadian rhythm alterations (known to be significantly affected during Ramadan) were not controlled and may have contributed to the observed responses.

Conclusion

Ramadan intermittent fasting induces significant alterations in dietary intake, hydration status, and physiological responses in young tennis players. However, these changes have no significant impact on tennis-specific performance. These findings indicate that trained athletes can maintain performance under fasting conditions, although appropriate nutritional and hydration strategies remain essential to mitigate physiological strain.

Abbreviations

RIF Ramadan intermittent fasting

CMJ Countermovement jump

USG urine specific gravity

RPE rating of perceived exertion

CON before Ramadan

R-2 mid-Ramadan

HR Heart rate

HIT high-intensity interval training

BMP Baseline measured parameters

AW-up MP After Warm-up measured parameters

PRMP Passive recovery measured parameters

AS2MP After S2 measured parameters

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and was approved by the local ethics committee of the University of Sousse (CEFMS_0149_2025). Written informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable

Conflicts of interest

The authors declare no conflict of interest

Author details

[1]Research Laboratory (LR19ES09), Exercise Physiology and Pathophysiology: From Integrated to Molecular - Biology, Medicine, and Health Faculty of Medicine of Sousse, University of Sousse, Sousse, Tunisia.

[2]Higher Institute of Sport and Physical Education of Ksar Saïd, University of Manouba, Tunis, Tunisia

Funding

This research did not receive any specific funding from public, commercial or not-for-profit funding bodies.

Author Contribution

ML, NL, and EB, contributed to the study's conception, design, interpretation of the results, writing (original draft, review, and editing). ML, NL, JM, HA, FZ, and EB, participated in the experimental study, in data acquisition and analysis. EB, and MZ, were involved in conceptualization, supervision, critical – review and editing, project administration, funding acquisition. All authors reviewed and approved the final version and gave their consent for submission.

Acknowledgement

We would like to thank the club manager, coaches and all participants who volunteered for this study. The authors acknowledge also the use of an AI-assisted language refinement tool, which contributed to improving the English writing of the manuscript. The conceptual framework, experimental design, data analysis, and interpretation were entirely developed by the authors.

Data availability

The data used in the current study are available from the corresponding author upon reasonable request.

References

1. Bouhlel H, Shephard RJ, Gmada N, Aouichaoui C, Peres G, Tabka Z, et al. Effect of Ramadan observance on maximal muscular performance of trained men. Clin J Sport Med. 2013;23(3):222–7. 10.1097/JSM.0b013e318275d213.

2. Jackson MJ, Roche DM, Amirabdollahian F, Koehn S, Khaiyat OA. The Musculoskeletal Health Benefits of Tennis. Sports Health. 2020;12(1):80–7. 10.1177/1941738119880862.
3. Chaouachi A, Leiper JB, Chtourou H, Aziz AR, Chamari K. The effects of Ramadan intermittent fasting on athletic performance: recommendations for the maintenance of physical fitness. J Sports Sci. 2012;30(Suppl 1):S53–73. 10.1080/02640414.2012.698297.
4. Brisswalter J, Bouhlel E, Falola JM, Abbiss CR, Vallier JM, Hausswirth C. Effects of Ramadan intermittent fasting on middle-distance running performance in well-trained runners. Clin J Sport Med. 2011;21(5):422–7. 10.1097/JSM.0b013e3182293891.
5. Maughan RJ, Shirreffs SM. Hydration and performance during Ramadan. J Sports Sci. 2012;30(Suppl 1):S33–41. 10.1080/02640414.2012.688140.
6. Maughan RJ, Fallah J, Coyle EF. The effects of fasting on metabolism and performance. Br J Sports Med. 2010;44(7):490–4. 10.1136/bjsm.2010.072181.
7. Bouhlel H, Latiri I, Zarrrouk N, Bigard X, Shephard R, Tabka Z, 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. Sci Sport. 2014;29(3):131–7. 10.1016/j.scispo.2014.02.002.
8. Roky R, Herrera CP, Ahmed Q. Sleep in athletes and the effects of Ramadan. J Sports Sci. 2012;30(Suppl 1):S75–84. 10.1080/02640414.2012.693622.
9. Reilly T, Waterhouse J. Altered sleep-wake cycles and food intake: the Ramadan model. Physiol Behav. 2007;90(2–3):219–28. 10.1016/j.physbeh.2006.09.004.
10. Tian HH, Aziz AR, Png W, Wahid MF, Yeo D, Constance Png AL. Effects of fasting during ramadan month on cognitive function in muslim athletes. Asian J Sports Med. 2011;2(3):145–53. 10.5812/asjsm.34753.
11. Aloui A, Chaouachi A, Chtourou H, Wong del P, Haddad M, Chamari K, et al. Effects of Ramadan on the diurnal variations of repeated-sprint performances. Int J Sports Physiol Perform. 2013;8(3):254–62. 10.1123/ijspp.8.3.254.
12. Shephard RJ. Ramadan and sport: minimizing effects upon the observant athlete. Sports Med (Auckland NZ). 2013;43(12):1217–41. 10.1007/s40279-013-0080-7.
13. Shephard RJ. The impact of Ramadan observance upon athletic performance. Nutrients. 2012;4(6):491–505. 10.3390/nu4060491.
14. Borg GA. Psychophysical bases of perceived exertion. Med Sci Sports Exerc. 1982;14(5):377–81.
15. Zurano A, Ramón-Llín J, Guzmán JF, Martínez-Gallego R. Influence of category and sex in game structure variables in young elite tennis. Appl Sci. 2025;15(10):5496. doi.org/10.3390/app15105496.
16. Kovalchik SA, Reid M. Comparing Matchplay Characteristics and Physical Demands of Junior and Professional Tennis Athletes in the Era of Big Data. J Sports Sci Med. 2017;16(4):489–97.
17. Cohen J. A power primer. Psychol. Bull. 1992;112(1):155–9. 10.1037//0033-2909.112.1.155.
18. Ghaffar T, Ubaldi F, Valeriani F, Romano Spica V. A review of the impact of intermittent ramadan fasting on wellbeing, nutrition and physical performance in different sports. Clin Nutr ESPEN.

2025;67:585–98.
19. Özbay S, Ulupınar S, Gençoğlu C, Ouergui I, Öget F, Yılmaz HH, et al. Effects of Ramadan intermittent fasting on performance, physiological responses, and bioenergetic pathway contributions during repeated sprint exercise. Front Nutr. 2024;11:1322128. 10.3389/fnut.2024.1322128.
20. OuYang L, Du G, Chi Z, Wu Z. Impact of Ramadan Fasting on Sports Performance. J Mod Social Sci. 2025;2(2):177–82. doi.org/10.71113/JMSS.v2i2.289.

Figures

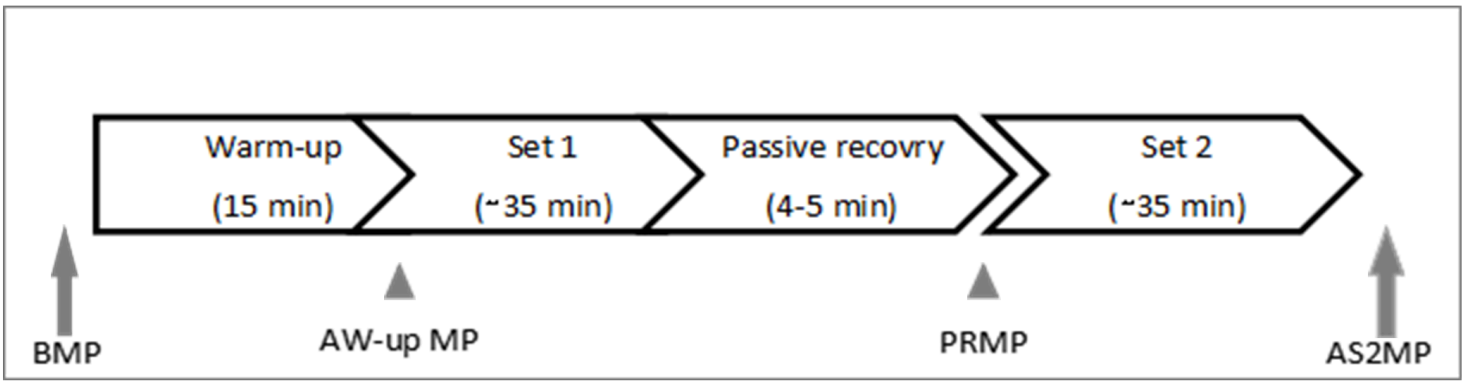


Figure 1

Schematic diagram of the experimental protocol

Note: BMP = Baseline measured parameters (Heart Rate (HR), Body Mass (BM), Body T°, Glycemia, and USG); AW-up MP = After Warm-up measured parameters (CMJ, 4 Serves, and RPE); PRMP = Passive recovery measured parameters (CMJ, 4S, and RPE); AS2MP = After S2 measured parameters (HR, BM, Body T°, Glycemia, USG, CMJ, 4S, and RPE).

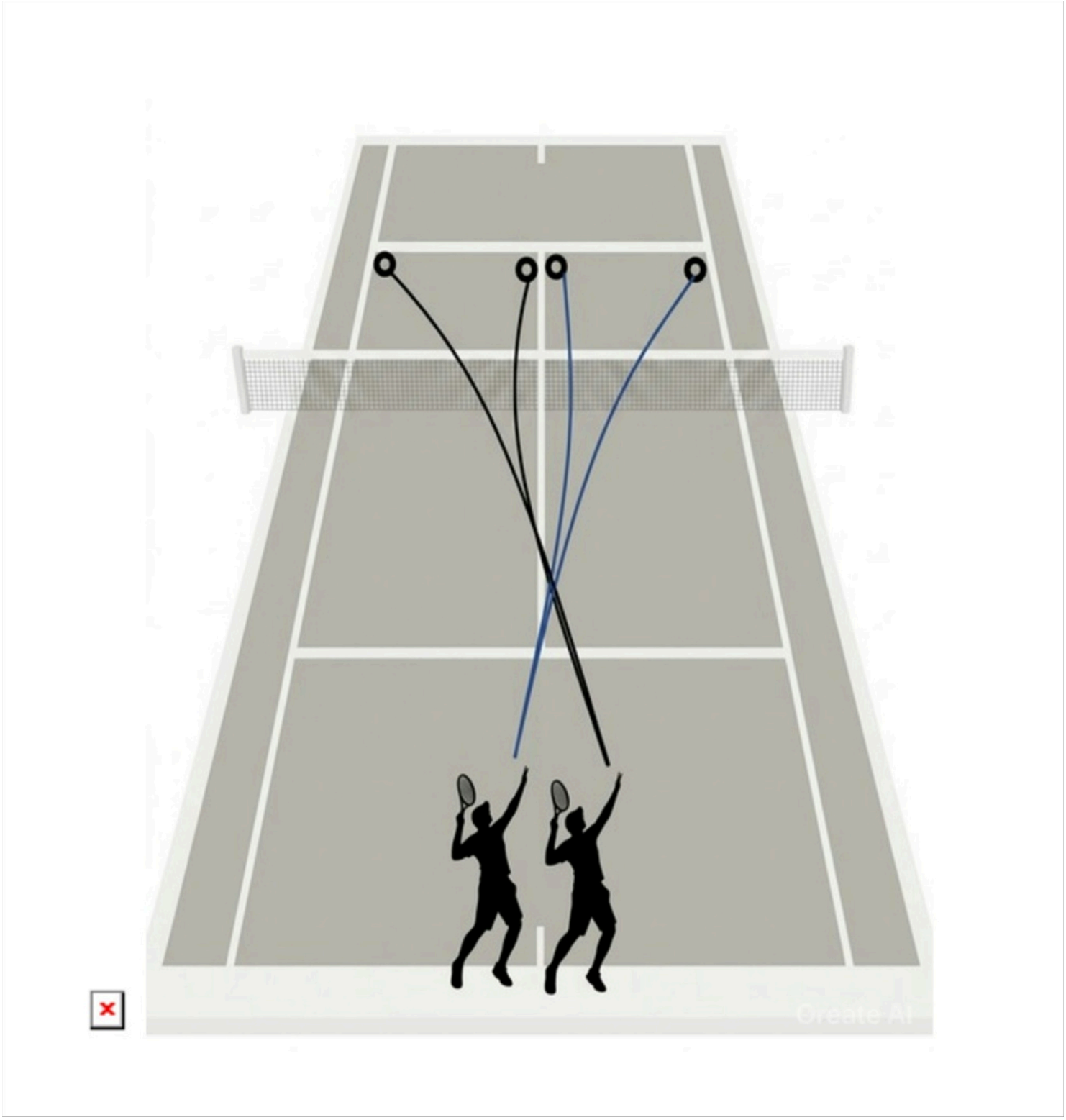


Figure 2

Placement of serve targets