

This article was downloaded by: [Loughborough University]

On: 15 December 2008

Access details: Access Details: [subscription number 788992146]

Publisher Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Journal of Sports Sciences

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713721847>

### Influence of Ramadan fasting on physiological and performance variables in football players: Summary of the F-MARC 2006 Ramadan fasting study

Yacine Zerguini <sup>a</sup>; Jiri Dvorak <sup>b</sup>; Ronald J. Maughan <sup>c</sup>; John B. Leiper <sup>c</sup>; Zakia Bartagi <sup>d</sup>; Donald T. Kirkendall <sup>b</sup>; Masoud Al-Riyami <sup>e</sup>; Astrid Junge <sup>b</sup>

<sup>a</sup> Centre d'Evaluation et d'Expertise en Medecine du Sport, Algiers, Algeria <sup>b</sup> Schulthess Clinic and FIFA-Medical Assessment and Research Centre (F-MARC), Zurich, Switzerland <sup>c</sup> School of Sport and Exercise Sciences, Loughborough University, Loughborough, UK <sup>d</sup> National Center for Medicine and Scientific Research in Sport, Tunis, Tunisia <sup>e</sup> Orthopaedic Sports Medicine Unit, Khoula Hospital, Muscat, Oman

Online Publication Date: 01 December 2008

**To cite this Article** Zerguini, Yacine, Dvorak, Jiri, Maughan, Ronald J., Leiper, John B., Bartagi, Zakia, Kirkendall, Donald T., Al-Riyami, Masoud and Junge, Astrid(2008)'Influence of Ramadan fasting on physiological and performance variables in football players: Summary of the F-MARC 2006 Ramadan fasting study',*Journal of Sports Sciences*,26:1,S3 — S6

**To link to this Article:** DOI: 10.1080/02640410802614944

**URL:** <http://dx.doi.org/10.1080/02640410802614944>

## PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

## **Influence of Ramadan fasting on physiological and performance variables in football players: Summary of the F-MARC 2006 Ramadan fasting study**

YACINE ZERGUINI<sup>1</sup>, JIRI DVORAK<sup>2</sup>, RONALD J. MAUGHAN<sup>3</sup>, JOHN B. LEIPER<sup>3</sup>, ZAKIA BARTAGI<sup>4</sup>, DONALD T. KIRKENDALL<sup>2</sup>, MASOUD AL-RIYAMI<sup>5</sup>, & ASTRID JUNGE<sup>2</sup>

<sup>1</sup>Centre d'Evaluation et d'Expertise en Medecine du Sport, Algiers, Algeria, <sup>2</sup>Schulthess Clinic and FIFA – Medical Assessment and Research Centre (F-MARC), Zurich, Switzerland, <sup>3</sup>School of Sport and Exercise Sciences, Loughborough University, Loughborough, UK, <sup>4</sup>National Center for Medicine and Scientific Research in Sport, Tunis, Tunisia, <sup>5</sup>Orthopaedic Sports Medicine Unit, Khoula Hospital, Muscat, Oman

### **Abstract**

The timing of food and liquid intake depends on the times of sunset and sunrise during the month of Ramadan. The current body of knowledge presents contradicting results as to the effect of Ramadan fasting on body mass, body composition and metabolic changes. The main objective of the present investigation was to gain additional information and scientific data in conformity with the philosophical background of Islam to allow optimisation of the daily training and dietary regimen in relation to the mental and physical performance of football players. The four teams, along with their coaches and trainers, attended a residential training camp at training centre 3 weeks before the start of Ramadan and throughout the study. Energy intake was relatively stable in the fasting group, but there was a small, albeit significant, decrease of approximately 0.7 kg in body mass. Water intake increased on average by 1.3 l/day in line with the greater energy intake in the non-fasting group in Ramadan. Daily sodium intake fell during Ramadan in the fasting players but increased slightly in the non-fasting group. Fasting players trained on average 11 h after their last food and drink, and reported that they felt slightly less ready to train during the Ramadan fast. None of the assessed performance variables was negatively affected by fasting while nearly all variables showed significant improvement at the third test session, indicating a training effect. Heart rate measurements in one training session during the third week of Ramadan appeared to suggest that the training load during training was marginally greater for the fasting than for the non-fasting players. However, the overall exercise load measures indicated that there was no biologically significant difference between the fasting and non-fasting groups.

In the present study, biochemical, nutritional, subjective well-being and performance variables were not adversely affected in young male football players who followed Ramadan fasting in a controlled training camp environment. Physical performance generally improved, but match performance was not measured. We recommend that players should ensure adequate sleep and good nutrition during Ramadan to preserve football performance and general health.

**Keywords:** *Ramadan, soccer, nutrition, performance*

### **Introduction**

Islam is a monotheistic religion based upon the Koran, which is a divine message delivered by Mohammad, the messenger of God. The original aims or objectives of the fasting period during Ramadan are physical and mental regeneration combined with intensified praying during each day of the month. The ritual of fasting (sawm) during the month of Ramadan is the fourth pillar of the five that make up the Islamic faith. The timing of food and

liquid intake depends on the times of sunset and sunrise. The observance of Ramadan varies in different countries and cultures, but for many Muslims the time between the morning prayers and the midday prayer is used for regular activities. The afternoon time allows for light intellectual and physical activities including sports and exercise such as football.

Football as a game and means of physical exercise is the most popular leisure activity in many Muslim countries, but it has become important at the highest

competitive level as well. As the month of Ramadan shifts from year to year, some individual players within the professional clubs and in National teams have to play high profile matches during the fasting period of Ramadan. The combined effects of food and fluid restriction and of changes in the eating and sleeping patterns are therefore of importance to Muslim players who train and compete throughout Ramadan. The current body of knowledge presents contradicting results as to the effect of Ramadan fasting on body mass, body composition and metabolic changes. These data are generally based on studies of rather small groups of healthy volunteers. As sports continue to be scheduled, an understanding of the effects of Ramadan on Muslim athletes is warranted.

In a previous F-MARC Study, Algerian professional football players (55 men) were studied (Zerguini, Kirkendall, Junge, & Dvorak, 2007). Field tests of physical and football performance were completed before, at the end and 2 weeks after Ramadan in 2004. Players were questioned on sleeping habits and personal perception of training and match performance. Performance declined significantly for speed, agility, dribbling speed and endurance, and most stayed low after the end of Ramadan. Nearly 70% of the players thought that their training and performance were adversely affected during the fast. Similar findings were shown for a team of adolescents playing in a first division Israeli youth league during Ramadan (Meckel, Ismaeel, & Eliakim, 2008). The phase shift of food intake and disruption of sleep patterns therefore appeared to affect actual and perceived physical performance in these players. In both the Algerian and Israeli studies, the players were living in their homes and were therefore following the eating and sleeping habits of their families. Islamic athletes need to explore strategies that will maximise performance during Ramadan.

To date, no well-controlled study with adequate numbers of trained participants has compared sports performance in those who observe Ramadan and those who do not. The main objective of the present investigation was to gain additional information and scientific data in conformity with the philosophical background of Islam to allow optimisation of the daily training and dietary regimen in relation to the mental and physical performance of football players during the month of Ramadan under controlled training camp conditions.

### **Methodological design, population and environmental conditions**

The study was carried out in Tunis, Tunisia, in 2006, when Ramadan started on the 23rd of

September and finished on the 22nd of October. Weather conditions at the time of the study were generally warm and humid: the average temperature was 26°C, with a daily average minimum temperature of 18°C and an average maximum temperature of 28°C. Average relative humidity was 72%, and total rainfall during the month was 49 mm. Players from four male Tunisian junior football teams (average age: 18 years) participated in the study. It was up to the individual players if they observed the Ramadan fast or not, and 64 players chose to observe the fast whereas 36 players did not.

The four teams, along with their coaches and trainers, attended a residential training camp at the Tunisian Football Federation's training centre 3 weeks before the start of Ramadan and throughout the study. Each team's coaches designed and ran their own training programmes for their specific squad, and the teams were involved in the programmed competitive matches. Throughout the study, all meals were prepared in the kitchens of the camp and were designed to be similar to the diets usually eaten during and outwith Ramadan.

Anthropometric data (body mass, height and skinfold measurements) were recorded 3 weeks before Ramadan, during the second and fourth weeks of Ramadan and into the third week after Ramadan. Haematological tests were performed on a 7-ml blood sample taken from each participant on each of the test days. Performance tests (30 m sprint test, Loughborough Dribbling Test, Vertical Jump Test, Agility Test, Loughborough Passing Test) and the 20 m shuttle run test ('Bleep test') were also performed on these test days. All players completed a daily questionnaire on subjective feelings and perception of training difficulty in the 3 weeks before and the 4 weeks of Ramadan. In the third week of Ramadan, water and salt balance measures were made during a training session; during this training session, heart rate was also recorded. Nutritional intake was recorded by 24-h recall three times during each phase of the study before, during and after Ramadan. Following the study, all data were analysed to compare the differences in the recorded measures for players who observed the Ramadan fast and those who did not.

To assess the possible influence of regional and cultural differences, 16 football players fasting during Ramadan were assessed with a similar methodology in Oman.

### **Energy and fluid intake**

Energy intake was relatively stable in the fasting group, but there was a small, albeit significant, decrease of ~0.7 kg in body mass during Ramadan that might have been caused by a modest level of

hypohydration. There was an increase in daily energy intake during Ramadan in the non-fasting group with a concomitant increase in body mass over the month. The fractional intake of protein increased in both groups in Ramadan, whereas the fractional contribution of carbohydrate decreased for both groups. Estimated mean daily water intake was high (about 3.8 l) in the fasting players throughout the study period, reflecting the training load and thermal stress of the environment. Water intake increased on average by 1.3 l per day in line with the greater energy intake in the non-fasting group in Ramadan. Daily sodium intake fell during Ramadan in the fasting players but increased slightly in the non-fasting group. Dietary iron decreased in the fasting and increased in the non-fasting group reflecting the difference in energy intake in both groups during Ramadan. These data suggest that Ramadan fasting had some effects on diet composition, but the effects were generally small even though the pattern of eating was very different. After Ramadan, the dietary variables reverted to the pre-Ramadan levels (Maughan, Bartagi, Zerguini, Dvorak, & Leiper, 2008).

### Blood biochemistry

Some small, but statistically significant alterations were observed in circulating concentrations of haemoglobin, ferritin, transferrin, creatinine and cortisol, but the mean values for all variables were always within the reference ranges. The minor changes observed may be explained by changes in patterns of food consumption during Ramadan and by changes in activity patterns. The results suggest that the combination of the changes in eating time and frequency during Ramadan fasting, along with the continuation of normal training load, has no important effect on metabolism (Maughan *et al.*, 2008).

### Water and salt balance

In the third week of Ramadan, water and salt balance measures were made during a training session. Body mass was recorded before and after training. Fluid intake was assessed in non-fasting players by weighing the drinks bottles before and after training, and the volume of any urine output was recorded. Sweat loss was calculated from the change in body mass after correction for the mass of fluid ingested and the volume of any urine passed. Sweat loss was significantly lower in fasting than in non-fasting players. Sweat composition was estimated from absorbent swabs applied to four skin sites for the duration of training. Sweat sodium concentration and total sweat sodium loss during training were similar in fasting players and in non-fasting players.

Sweat sodium loss was not related to estimated dietary sodium intake. These data show large individual variations in all measured parameters with relatively little difference in sweat parameters between fasting and non-fasting individuals (Shirreffs & Maughan, 2008).

### Subjective feelings

Fasting players trained on an average of 11 h after their last food and drink, and reported that they felt slightly less ready to train during the Ramadan fast. However, there was no increase in their recorded perceived effort during training or in their assessment of training difficulty compared with their ratings before Ramadan, or with that of the non-fasting group during Ramadan. The fasting group reported that they were slightly more thirsty and hungry before training during Ramadan than in the pre-Ramadan period. Before Ramadan, both groups reported that on average they slept for more than 9 h each night. The non-fasting group recorded that they had about 105 min less sleep per night during the first week of Ramadan, then they reverted back to their pre-Ramadan amount of sleep. The fasting group consistently reported having about 1 h less sleep per night throughout Ramadan, but neither group appeared to find sleep quality to have altered. Nevertheless, subjects in the fasting group reported an increase in the feeling of tiredness and a slight decrease in their ability to concentrate. The rating of alertness before training was high throughout the study in the fasting group and did not alter during Ramadan. During the 2-week-period after Ramadan, the modest changes reported by the fasting subjects reverted back to their pre-Ramadan levels (Leiper, Junge, Maughan, Zerguini, & Dvorak, 2008).

### Performance measures

None of the assessed performance variables was negatively affected by fasting whereas nearly all variables showed significant improvement at the third test session, indicating a training effect. A limited number of variables were also significant for time of day (dribbling) or in an interaction with weeks (sprinting and vertical jump). Changes in performance were most likely due to the effects of training and familiarity with the test methods. Based on these data, the changes in the timing of food intake and sleep patterns during Ramadan had little effect on objective tests of physical performance in this sample of youth football players observing Ramadan during a residential training camp setting (Kirkendall, Leiper, Zerguini, Bartagi, & Dvorak, 2008).

### Training load

Heart rate measurements in one training session during the third week of Ramadan appeared to suggest that the training load during training was marginally greater for the fasting than for the non-fasting players. However, the overall exercise load measures indicated that there was no biologically significant difference between the fasting and non-fasting groups during the analysed training session (Leiper, Watson, Evans, & Dvorak, 2008).

### Oman study

In a satellite study in Oman (unpublished), 16 fasting players following their usual life style as during the month of Ramadan were assessed with the same methodology. The data demonstrated that the shift in food intake and the changes in sleep habits during Ramadan have varied effects on physical performance. The players' perception of training and other subjective feelings were constant over the 8 weeks and most of the performance tests were unchanged throughout the study. Performance in the endurance test was constant over the first 6 weeks and significantly improvement was seen 2 weeks after Ramadan. The football-specific tasks showed some improvements in performances during Ramadan that may have been due to training or improved familiarisation with the tasks.

### Conclusion and recommendations

Previous studies have shown decrements in performance and subjective variables during Ramadan. In the present study, biochemical, nutritional, subjective well-being and performance variables were not adversely affected in young male football players who followed Ramadan fasting in a controlled training camp environment. Physical performance generally improved, but match performance was not measured.

We recommend that players should ensure adequate sleep and good nutrition during Ramadan to preserve football performance and general health.

Sleeping and eating patterns will depend on the length of the daylight period, weather conditions and other environmental and cultural factors.

### Acknowledgements

The authors gratefully acknowledge the Fédération Internationale de Football Association (FIFA) president J. S. Blatter for funding this study. They express their gratitude to the Confédération Africaine de Football (CAF) president Issa Hayatou from Cameroon, the Asian Football Confederation (AFC) president Mohamed Bin Hammam from Qatar and the members of the FIFA Sports Medical Committee (Chairman: Dr. M. D'Hooghe) for their support. They also thank the members of the Tunisian and the Oman Football Federation for their logistic support. The authors thank the staff who helped with the data collection and the coaching staff of the teams. This study owes a considerable debt of gratitude to the young players who participated in the studies in Tunisia and Oman.

### References

- Kirkendall, D. T., Leiper, J. B., Bartagi, Z., Dvorak, J., & Zerguini, Y. (2008). The influence of Ramadan on physical performance measures in young Muslim footballers. *Journal of Sports Sciences*, 26(suppl. 3), S15–S27.
- Leiper, J. B., Junge, A., Maughan, R. J., Zerguini, Y., & Dvorak, J. (2008). Alteration of subjective feelings in football players undertaking their usual training and match schedule during the Ramadan fast. *Journal of Sports Sciences*, 26(suppl. 3), S55–S69.
- Leiper, J. B., Watson, P., Evans, G., & Dvorak, J. (2008). Intensity of a training session during Ramadan in fasting and non-fasting Tunisian youth football players. *Journal of Sports Sciences*, 26(suppl. 3), S71–S79.
- Maughan, R. J., Bartagi, Z., Dvorak, J., & Zerguini, Y. (2008). Dietary intake and body composition of football players during the holy month of Ramadan. *Journal of Sports Sciences*, 26(suppl. 3), S29–S38.
- Maughan, R. J., Leiper, J. B., Bartagi, Z., Zrifi, R., Zerguini, Y., & Dvorak, J. (2008). Effect of Ramadan fasting on some biochemical and haematological parameters in Tunisian youth soccer players undertaking their usual training and competition schedule. *Journal of Sports Sciences*, 26(suppl. 3), S39–S46.
- Meckel, Y., Ismael, A., & Eliakim, A. (2008). The effect of the Ramadan fast on physical performance and dietary habits in adolescent soccer players. *European Journal of Applied Physiology*, 102, 651–657.
- Shirreffs, S. M., & Maughan, R. J. (2008). Water and salt balance in young male football players in training during the holy month of Ramadan. *Journal of Sports Sciences*, 26(suppl. 3), S47–S54.
- Zerguini, Y., Kirkendall, D., Junge, A., & Dvorak, J. (2007). Impact of Ramadan on physical performance in professional soccer players. *British Journal of Sports Medicine*, 41, 398–400.