Original Article

Evaluation of young elite soccer players food intake on match day and highest training load days

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ABSTRACT

It is crucial to ensure an adequate nutritional support for young soccer players under high physical stress situations, including match days and high training load days. Therefore, this study aimed to investigate the dietary intake of young male soccer players from a Portuguese first league soccer club, both on match day and on the highest training load day of the week. All players recorded their ingestion at these moments for 3 consecutive weeks, by completing a food diary and making a photographic record. On match day, the intake of carbohydrates (5.2 ± 0.6 g.kg^{-1}. d^{-1}), proteins (2.1 ± 0.2 g.kg^{-1}. d^{-1}), and fats (1.0 ± 0.2 g.kg^{-1}. d^{-1}) represented 55.1 ± 5.0 %, 22.3 ± 1.52 %, and 23.9 ± 5.1%, respectively, of the average daily energy intake. Regarding the highest training load day, the intake of carbohydrates (5.2 ± 0.9 g.kg^{-1}. d^{-1}), proteins (2.0 ± 0.3 g.kg^{-1}. d^{-1}), and fats (1.0 ± 0.3 g.kg^{-1}. d^{-1}) represented 54.8 ± 5.3 %, 21.8 ± 1.8 %, and 24.6 ± 4.6 %, respectively. There were no statistically significant differences between intakes during match day and on the highest training load day, for all the variables analyzed, except for percentage of fat intake (Energy intake p = 0.873; Protein p = 0.335; Carbohydrates p = 0.814; Fat p=0,000). The results obtained are in line with previous research and reveal that energy and carbohydrate intake are below the recommendations for this population. **Key words:** ENERGY INTAKE ASSESSMENT, FOOD DIARIES, ADOLESCENT SOCCER PLAYERS.

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INTRODUCTION

Soccer is a strength and power-contact sport, involving high-intensity activity in training and competition. During a match, professional youth soccer players may cover distances that are comparable to their adult counterparts (Russel and Pennock, 2011; Ruiz *et al.*, 2005) - around 10-13km (Bangsbo *et al.*, 2006). However, it is important to consider that the demands of different players depend on a number of factors (e.g. their field positions) and can be further complicated by the unpredictable pattern of activities that match-play requires (García-Rovés *et al.*, 2014; Bangsbo *et al.*, 2006; Teixeira *et al.,* 2014; Desbrow *et al.*, 2014; Russel and Pennock, 2011).

Besides training, diet is a very important factor with influence on athletic performance (Ruiz *et al.* 2005). Furthermore, growth and development of young athletes significantly increase daily nutritional needs (Desbrow *et al.*, 2014; Meyer *et al.*, 2007; Purcell, 2013; Russel and Pennock, 2011).

Currently, there is not much data about the specific needs of young soccer players, only general recommendations based on adults. Studies that have focused their findings on young soccer players observed suboptimal nutritional intakes, particularly in what concerns to total energy intake and the distribution of macronutrients (Caccialanza *et al.*, 2007; Iglesias-Gutiérrez *et al.*, 2005; Russel and Pennock, 2011; Galanti *et al.*, 2015; Ruiz *et al.*, 2005; Briggs *et al.*, 2015). This can compromise an athlete's physical performance and physiological development, thus highlighting the need to improve nutritional practices of young soccer players.

Therefore, the aim of this study was to investigate the dietary intake of academy level soccer players from a Portuguese first league soccer club on match day (MD) and on the highest training load day (HTLD) during 3 consecutive weeks of the final phase of a competitive season. Based upon the findings of previous authors, it was hypothesized that the dietary intake of the sampled soccer players would be inadequate to meet recommended values.

MATERIAL AND METHODS

Participants

Ten male young soccer players (age: 15.8 ± 0.4 years, body mass: 70.4 ± 3.3 kg, stature: 1.77 ± 0.05m, body mass index: 22.4 ± 0.8 $kg.m^{-2}$) who played in the highest national division of their age group, participated in this study. All participants had regularly been involved in the training and competitive schedule of the team since the beginning of the season. Each microcycle consisted of four training days, a MD and two non-training recovery days within the week. All training sessions had the approximate duration of 80 minutes. The HTLD had a higher training volume comparing with the other training sessions. Before any form of participation, permission was conceded from the head coach of the team and from the School Ethics Committee.

Procedures

Dietary intake was assessed throughout the months of May and June in the final phase of the competitive season using food diaries and photographic records that were similar in terms of required information and measurement units to those previously published (Magkos and Yannakoulia, 2003; Martin *et al.*, 2014; Caccialanza *et al.*, 2007). Prior to the study, a lecture was given to the players and the team's technical staff by the lead investigator with an explanation of the procedure. Athletes were asked to photograph everything they ingested in the evaluated days. The procedure was to shoot the food ingested in all the meals throughout the day, at the beginning and at the end of the meal. To have a better perception of the quantities of the

meals, all athletes had to use a given pencil (with known dimensions) next to the plate, to serve as a scale of measurement. To ensure the accuracy of data, all participants received a food diary they had to complete with the help of the photographs taken to avoid under-reporting. Information concerning time of day, food description (including cooking methods and brand names), amount prepared, amount remaining, volume and type of fluid consumed was recorded. Players were asked to keep this procedure for 3 consecutive weeks (in each week, the HTLD and the MD were evaluated). There were 3 moments of evaluation (each moment representing one training session and one match) because it was suggested to be the ideal time-period associated with valid nutritional information (Ma *et al.*, 2009). To ensure the consistency of the collected data, no intervention was made during the study to avoid influencing the players' diets. Due to lack of cooperation of some athletes, it was only possible to obtain valid data from two out of the three original assessment moments. After the collection of the food diaries and photographs (received via e-mail or *Whatsapp*®) data were carefully reviewed and each player attended a quick interview with the authors to clarify any ambiguous information. Software available at the University was used to analyze the diet records and the photographs (*Microdiet*® version 1.2, 2001) together with the Portuguese Table of Foods Composition (first edition, 2007). A single researcher performed all dietary analyses to ensure consistency and avoid potential variation in the interpretation of dietary records. Data comparisons where made with published recommended values.

Analyses

Statistical analyses were performed using SPSS software (Version 22.0). Data were normally distributed so descriptive statistics are presented as mean ± *SD* and the level of statistical significance was set at $p \leq 0.05$. The average for total energy intake (kcal) and macronutrients (% total energy intake, g, g/kg) of each assessment moment was determined for each participant. A paired samples t-test was used to determine whether there were statistically significant differences between the ingestion on MD and HTLD for all analyzed variables and one-sample t-test to evaluate statistical significance between these two moments and the recommendations, for the same variables.

RESULTS

The average daily energy intake was 2667 ± 170 kcal for MD and 2646 ± 415 kcal for the HTLD. The daily average macronutrient intake and reference values (considered as recommendations) for both moments are summarized in Table 1 and 2. There were no statistically significant differences between the ingestion on MD and on the HTLD, for all the variables analyzed, except for fats (Energy intake p = 0.873; Protein p = 0.335; Carbohydrates p = 0.814; Fats p = 0,000).

Regarding the comparison with recommendations, the energy intake was below the recommended values (p = 0.000) both on HTLD and on MD. Concerning carbohydrate intake, only one athlete had a daily ingestion within recommendations in HTLD (p = 0.002). In MD, all athletes registered an ingestion below the minimum recommended value (p = 0.014). Regarding protein intake, in HTLD only one athlete was within the recommended range, while the others were all above (p = 0.002), similar to what was verified in MD (p = 0.000).

Table 1. Daily energy and macronutrients intake on intensive training day

Macronutrients	Mean	Range	RV (Reference Value)/ Recommendations
Energy Intake			
Kcal	2646	2043-3234	3676 [a]
kcal/kg weight	37.6	29.3-46	52-53
Proteins			
g	143	113-173	-
g/kg weight	2	1.6-2.4	1.4-1.7 [b]
% energy intake	21.8	18.8-24.4	-
Carbohydrate			
g	363	240-457	-
g/kg weight	5.2	3.4-6.5	6-10 [c]
% energy intake	54.8	47-62.2	-
Fats			
g	73	48-106	-
g/kg weight	1	0.7-1.5	-
% energy intake	24.6	16.8-31.4	20-35 [d]

[a] Recommended values taken from: Torun, B., 2005.

[b] Recommended values taken from: Boisseau et al., 2002.

[c] Recommended values taken from: Desbrow et al., 2014.

[d] Recommended values taken from: NHMRC & NZMH., 2006.

Table 2. Daily energy and macronutrients intake on match day

Macronutrients	Mean	Range	RV (Reference Value)/ Recommendations
Energy Intake			
Kcal	2667	2256-2810	3676
kcal/kg weight	37.9	35.6-40.2	52-53
Proteins			
G	148.4	134-168	-
g/kg weight	2.1	1.8-2.4	1.4-1.7
% energy intake	22.3	20.2-24	-
Carbohydrate			
g	368	305-429	-
g/kg weight	5.2	4.4-6.1	06-oct
% energy intake	55.1	46.2-62.1	-
Fats			
g	71	54-109	-
g/kg weight	1	0.8-1.5	-
% energy intake	23.9	17.1-35	20-35

[a] Recommended values taken from: Torun, B., 2005.
[b] Recommended values taken from: Boisseau et al., 2002.
[c] Recommended values taken from: Desbrow et al., 2014.
[d] Recommended values taken from: NHMRC & NZMH., 2006.

DISCUSSION

The aim of this study was to investigate the dietary practices of young soccer players from a Portuguese first league soccer club.

The main finding of this study was that the intake of these players both on HTLD and MD was significantly below the recommendations for this type of sport regarding carbohydrates ($p = 0.002$ and $p = 0.014$, respectively) and total energy ($p = 0.000$ for both variables).

These findings were consistent with those of previous authors who analyzed the diets of players from several locations around the world and reported similar results regarding mean energy intake: 3003 kcal (Iglesias-Gutiérrez *et* al., 2005); 2844 ± 51.4 kcal (Galanti *et* al., 2015); 2560 ± 636 kcal and 2640 ± 614 kcal (Caccialanza *et al.*, 2007)]. These studies have also consistently reported that energy intake is less than optimal in most cases (Caccialanza *et al.*, 2007; Iglesias-Gutiérrez *et al.*, 2005; Russel and Pennock, 2011; Galanti *et al.*, 2015; Ruiz *et al.*, 2005; Briggs *et al.*, 2015), some with deficits of 788 kcal (Russel & Pennock, 2011) and 800 kcal (Caccialanza *et al.*, 2007). In the present study, the athletes' intake was compared with the recommended values for moderate active children (Torun, 2005) instead of an estimation of energy expenditure, which is in itself a limitation and may explain the considerably higher energy deficit observed (-1030 kcal on the HTLD and -1009 kcal on MD) and the fact that none of the athletes achieved the recommendations in both MD and HTLD (figure 1).

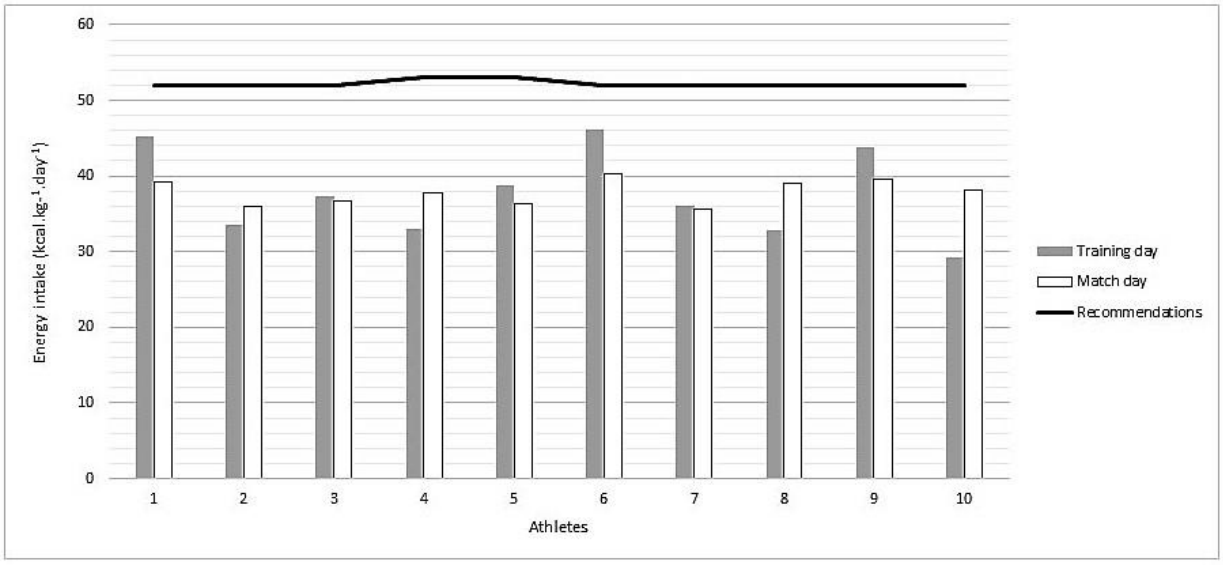

Figure 1. Energy intake in training and match day vs. recommendations

We failed to detect statistically significant differences between MD and the HTLD regarding energy intake ($p = 0.873$), protein ($p = 0.335$) and carbohydrate intake ($p = 0.814$). This is consistent with a previous study

which assessed energy balance in male adolescent academy-level soccer players across a week (with a match day and HTLD included) and showed macronutrient intake was not significantly different between days, but relatively stable across the week (Briggs *et al*., 2015).

Due to the relevance of carbohydrates for performance in a soccer match diets high in this macronutrient are often recommended (Bangsbo *et al*., 2006). However, most studies in youth soccer fail to show intakes that match carbohydrate recommendations (Caccialanza *et al*., 2007; Iglesias-Gutiérrez *et al*., 2005; Russel and Pennock, 2011; Galanti *et al*., 2015; Ruiz *et al*., 2005). The present study was no exception, with a mean carbohydrate intake of 5.2 ± 0.6 g/kg/d on MD and 5.2 ± 0.9 g/kg/d on the HTLD, which represented 55.1 ± 5.0 % and 54.8 ± 5.3 % of total energy intake in each respective situation. Few athletes ingested carbohydrates within recommended values. Two athletes achieved the recommendations on MD and on HTLD. All other athletes ingested an amount of carbohydrates below recommendations on both moments (6 – 10 g/kg/d) – figure 2. These findings are also consistent with previous research which shows that carbohydrate intake in this population ranges from 45% to 56% (Caccialanza *et al*., 2007; Ruiz *et al*., 2005; Iglesias-Gutiérrez *et al*., 2005; Boisseau *et al.,* 2002). Prolonged periods of energy and carbohydrate deprivation combined with the demands of training and competition and adding to the players' physiological growth needs, may impair their recovery (Bangsbo *et al*., 2006; Desbrow *et al*., 2014; Russel and Pennock, 2011), compromise their health and development and also increase the risk of injury (Petrie *et al*., 2004, Meyer *et al*., 2007, Bass & Inge, 2006).

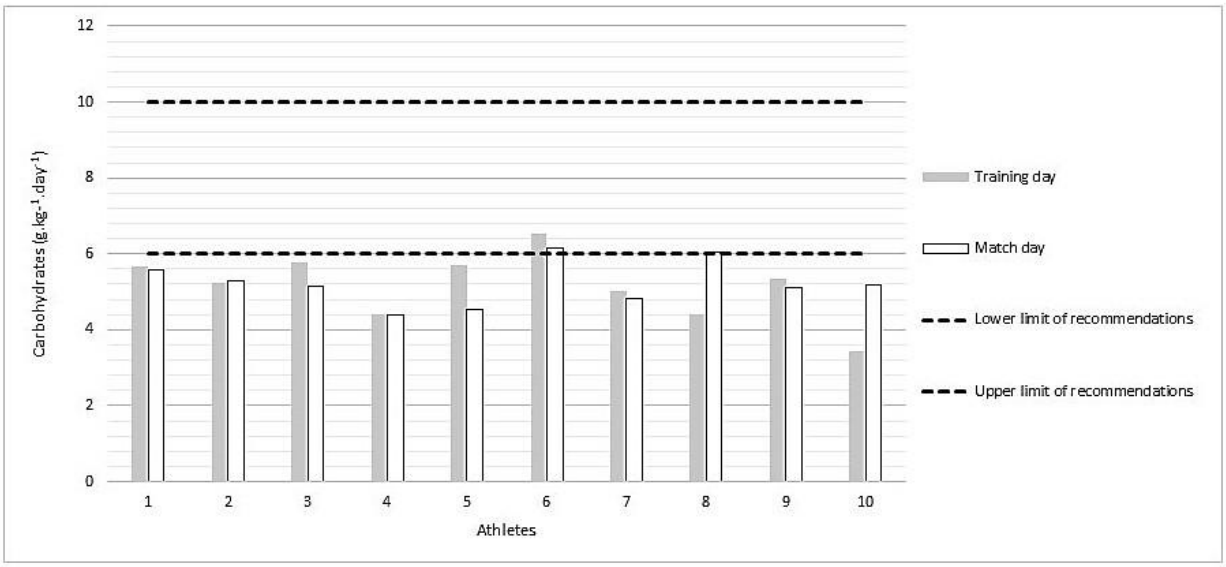

Figure 2. Carbohydrates intake in training and match day vs. recommendations

Regarding protein, athletes are encouraged to consume greater amounts of this nutrient in comparison with sedentary people (1.4 – 1.7 $g.kg^{-1}. d^{-1}$ [Boisseau *et al.,* 2002] vs ~0.8 $g.kg^{-1}. d^{-1}$ [NHMRC, & NZMH., 2006]) because of its role in the maintenance and gain of lean muscle mass after muscle-damaging exercise (Desbrow *et al*., 2014; Petri *et al*., 2004). Because specific recommendations for protein intake required for young soccer players are currently lacking, it has been recommended that they should be consistent with the same ones that exist for adults (Desbrow *et al*., 2014). The intake of protein by the players analyzed in this study was 2.1 ± 0.2 $g.kg^{-1}. d^{-1}$ for MD and 2.0 ± 0.3 $g.kg^{-1}. d^{-1}$ for the HTLD, which represents 22.3 ± 1.5% and 21.8 ± 1.8 % of mean daily energy intake. These values are in both cases significantly above

recommendations (p = 0.000 and p = 0.002, respectively for MD and HTLD) with only one athlete in HTLD being within the recommended intakes (figure 3).

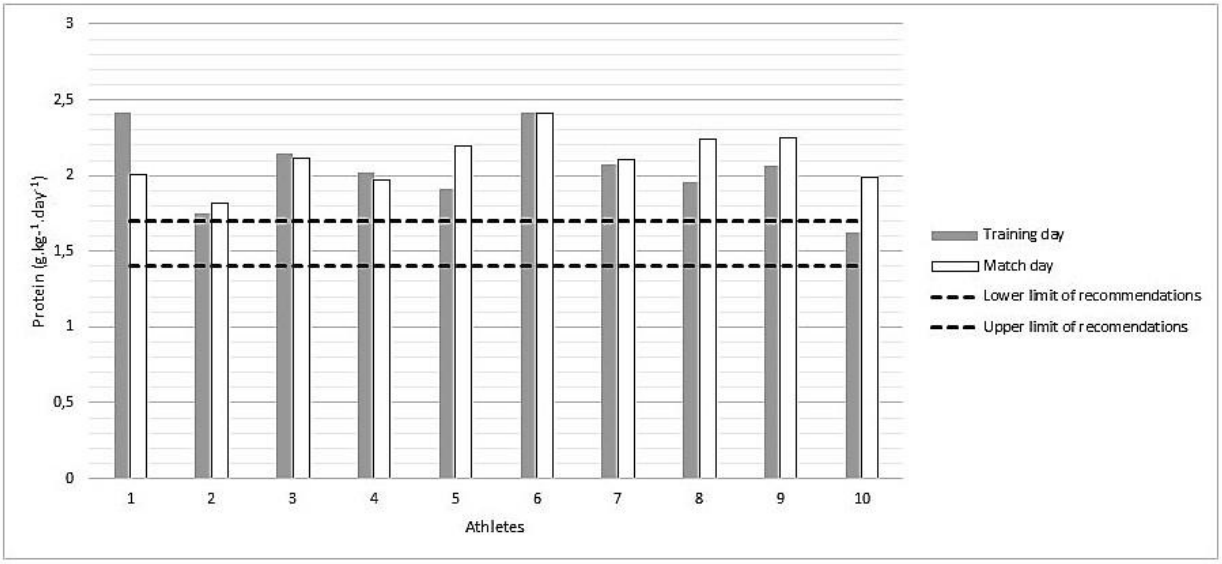

Figure 3. Protein intake in training and match day vs. recommendations

Dietary fat is a necessary component of any balanced diet, because of its involvement in biological processes and availability as an energy source (Desbrow *et al.*, 2014). In the present study, fat contribution to total energy intake represented 23.9 ± 5.1% on MD and 24.6 ± 4.6 % on HTLD, which is within recommended values (Desbrow *et al.*, 2014). This variable was the only that had a statistical significant difference between both moments (p=0.000). Two athletes were below recommendations in MD and only one athlete was below the reference values in the HTLD (figure 4). It is not usual to find such low percentages of this nutrient in young soccer players (Caccialanza *et al.*, 2007; Iglesias-Gutiérrez *et al.*, 2005; Russel and Pennock, 2011; Galanti *et al.*, 2015; Ruiz *et al.*, 2005). We speculate that "under reporting" may have occurred throughout the present study, a practice that seems very common in adolescent population (Caccialanza *et al.*, 2007; (García-Rovés *et al.,* 2014). In fact, a review of published studies using doubly labeled water to estimate energy expenditure and consequently validate self-registered energy consumption in athletes, reveals that "under-reporting" points to an underestimation of energy intake and fluid of about 18-27% (Livingstone et al., 1992; Bandini et al., 1990; Bratteby et al., 1998; Bandini et al., 1999.)

The validity of dietary recall studies has previously been questioned on the grounds that the duration of such studies may not reflect long-term nutritional practices (Magkos and Yannakoulia, 2003). However, it has previously been reported that a monitoring period of 3 to 7 days is considered reasonable to provide precise and accurate estimates of energy intake as well as protein, carbohydrate and fat intake, being the 3-4-day dietary record identified as the most commonly used approach (Magkos and Yannakoulia, 2003; Ma *et al.*, 2009).

Concerning cafeteria products, the photographic method estimates food intake by adults and children of preschool age quite precisely (Martin *et al.*, 2014; Nicklas *et al*., 2012). Validation studies regarding this method showed it can be very exact in the estimation of food intake both for groups and individuals (Martin *et al.*, 2014). These studies also show that this method can provide accurate data about the selection of food, consumed and discarded food, as well as its nutritional information (Martin *et al.*, 2014). However, photographic methods may also present limitations: athletes may forget to photograph their food, lose their

smartphones or have technical problems that can compromise data collection. Besides that, certain types of foods such as condiments, dressings and sauces may be difficult to analyze using digital imaging, although these types of foods are normally difficult to estimate using other methods too (Martin *et al.*, 2014). The simultaneous use of other forms of evaluation such as the dietary records, as occurred in the present study, may help to overcome those limitations (Martin *et al.*, 2014).

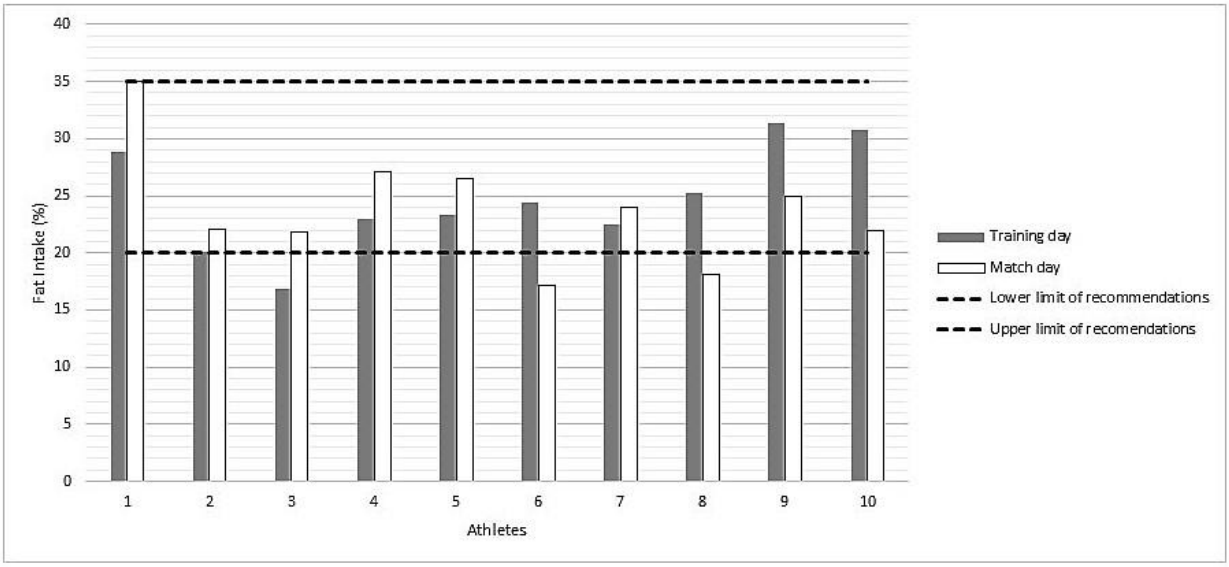

Figure 4. Fat intake in training and match day vs. recommendations

Due to the use of a free-living experimental design, this data may have an increased ecological validity. Moreover, no attempts were made to influence the dietary practices of players involved in the study.

CONCLUSION

These findings suggest that athletes' eating practices during match and highest training load days were suboptimal according to their theoretical nutritional needs. Specifically, a deficit in energy and carbohydrates intake was observed.

This study adds to the body of literature showing gaps between nutritional recommendations and intake of young elite soccer players.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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