Evaluation of the Diet of Crossfit Participants in a Crossfit Affiliate Box in Sofia, Bulgaria

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Abstract: *The mix of proteins, carbohydrates, and fats properly can maintain good energy level and fast removal of metabolic products. We present the evaluation of the men and women participants diet in a CrossFit affiliate box in Bulgaria. We compare it with the recommendations for high-intensity training. The data were obtained from a questionnaire for nutrition. Energy intake and carbohydrate consumption values were lower than recommended for exercises with high-intensity. The lower carbohydrate intake negatively influences the energy intake but has with no significant risk for the efficient energy provision of the long-term recovery processes.*

Keywords: CrossFit nutrition, energy intake, energy needs, recommendation
Ключови думи: кросфит хранене, прием на енергия, енергийни нужди, пропоръки

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INTRODUCTION

CrossFit training sessions include sets of exercises with various ways of execution, aimed at the development of a number of motor qualities. Like in most sports, when practising CrossFit one should combine proteins, carbohydrates, and fats properly so that one can maintain good energy level, positive nitrogen balance, and fast removal of metabolic products[1].

The CrossFit founder recommends high protein consumption – about 30 % of the daily calory intake, and its weight values should range from 1.5 to 2 - 2.2 g/kg. The fat consumption should cover 30 % of the daily energy needs, and carbohydrate consumption – about 40 % of the daily calory intake[2]. This percentage of nutrients is based on Zone Diet[3] which, according to Glassman, is a healthy way of optimal nutrient combination for a lasting loss of body fat[4].

McArdle et.al. recommend that people practicing high-intensity sports should have a diet based on 50-75 % carbohydrates, 20-30 % proteins, and 30-45 % fat[5].

The specialists in the field of sports nutrition recommend a protein consumption of 1.4–2.0 g/kg for high-intensity sports[6]; the recommendations of American College of Sports Medicine

(ACSM) for this kind of intensity training are 1.2–2.0 g/kg[7]. ACSM recommends that athletes have carbohydrate consumption equal to 3-12 g/kg depending on the intensity of their training sessions, their duration and weekly frequency. Fat consumption should provide as much as 20 %–35 % of the total energy intake[8].

AIM

The aim of this research was to evaluate the diet of men and women practicing CrossFit and to compare it with the recommendations for high-intensity training.

STUDY DESIGN: Prospective Face-to-face questionnaire and online electronic questionnaire.

METHODS

Participants

The research was done among 43 participants: 26 men and 17 women (age 31.7 ± 6.4 and 35.8 ± 6.4 years, respectively) who practice CrossFit in a CrossFit affiliate box located in Sofia, Bulgaria. We selected and processed statistically only the answers of those who filled in the questionnaire properly. The sports characteristics of the participants are presented in Table 1.

NUTRITION ASSESSMENT

The participants filled in a nutrition questionnaire used with different subjects previously[9]. The test included questions about the participants' age, height and weight, sports experience, number of training sessions per week and their duration. There were 27 questions about the weekly consumption of main food products measured in gr, ml, or number, as well as questions about the information sources used for making a diet. On the basis of the answers provided, we calculated the daily intake of proteins, carbohydrates and fat (g/kg), their relative intake (g/kg/day), and their relative share in providing the energy (%). The energy intake (EI) was calculated on the basis of the energy contents of the main food products included in the questionnaire.

The metabolism was calculated with the formulas of Harris-Benedict (BMR kcal/day), the energy needs (EN) - kcal/kg/day with the formula: BMR kcal/day x (1.2+0.08 x session of training)[10].

We used the National Nutrient Database for Standard Reference Release 28, United States Department of Agriculture, Agricultural Research Service as a reference source as regards the energy content of the main food products included in the questionnaire.

All participants in the study gave their written informed consent.

STATISTICAL ANALYSIS

The statistical processing of the data was done with a software package SPSS V.23. We used statistical tests checking the normal distribution of the data (Kolmogorov-Smirnov and Shapiro-Wilk), Paired Samples Student t-Test, One Samples Student t-Test, Independent Samples Student t-Test, non-parametric test of Mann Whitney for independent samples. The data in the text and

Table 1. Characteristics of the participants

	Men (n=26)	Women (n=17)
Average sports experience (years)	3.7 ± 0.5	3.2 ± 0.9
Average training sessions per week (n)	5.1 ± 1.1	5.3 ± 0.7
Average duration of the trainings (min)	76.6 ± 15.8	63.3 ± 15.2

[1] *Sousa et al.* 2014.
[2] *Glassman* 2010: 1-115.
[3] *Stulnig* 2015: 39-41.
[4] *Glassman* 2004: 1-10.
[5] *McArdle* 2010: 82-97.
[6] *Kreider et al.* 2010: 301-305; *Jäger et al.* 2017.
[7] *ACSM* 2016: 543-568.
[8] *ACSM* 2016: 543-568.
[9] *Zaykova*, 2017: 73-82; *Zaykova, Petrov* 2017: 58-64; *Miteva, et al.* 2020: 108-116.
[10] *Harris, Benedict* 1919; *Miteva et al.* 2020: 108-116.

Table 2. The anthropometric characteristics of the participants

	Men (n=26)	Women (n=17)
Body height (m)	176.2± 5.3	168.1 ± 6.7
Body mass (kg)	78.8 ± 9.3	59.4 ± 6.1
BMI (kg/m2)	22.8 ± 1.38	21.0 ± 1.05

the tables are presented as means ± standard deviations (SD). The level of statistical significance was set at $p < 0.05$.

RESULTS

The anthropometric characteristics of the participants are presented in Table 2. BMI was calculated with the formula BMI=W/h2[11]. The values of BMI of the researched men and women (Table 2), being an indicator for the presence of body fat, were within the weight norms: 18.5 – 24.99 kg/m2[12].

Table 3 presents the mean values of the results from the nutrition test. The indicators were compared by gender, and the values for the whole sample were compared with the recommendations of ACSM[13] about Energy needs and recommended consumption of protein, carbohydrates, and fat (g/day and g/kg/day) in high-intensity training. The percentage ratio of the consumed macronutrients was compared with the lowest recommended level for this kind of load[14] because the researched individuals are not CrossFit competitors. The results were checked for statistically significant differences.

We did not find any significant difference between the total energy intake (EI) of the researched group (2469.7±903.07 kcal/day) and the calculated energy needs (EN) (2632.0±482.55 kcal/day) (sig=0.135). There was no significant difference between their relative values either: RDEN (relative daily energy needs) – 36.8 ± 2.86 kcal/kg/day and RDEI (relative daily energy intake) – 34.5 ± 11.14 kcal/kg/day, respectively (sig=0.258).

We did not find any significant difference between RDEI men (34.9±10.95 kcal/kg/day) and RDEI women (33.9±11.72 kcal/kg/day) (sig=0.769). There was a significant difference between RDEI of the researched group (34.5±11.44 kcal/kg/day) (sig=0.002) and the recommended ⊚40 kcal/kg/day[15].

The daily protein consumption of the researched men (115.2±37.16 g/day) was significantly lower (sig=0.008) than the one in the recommendations for men practicing CrossFit – 135 g/day. The daily protein consumption of the researched women (90.8±17.15 g/day) was close to the recommended values – 92 g/day, but without significant differences (sig=0.764)[16].

The average protein consumption was 1.6±0.44 g/kg/day (men), and 1.5±0.34 g/kg/day (women) and the values coincide with the recommendations for people practicing CrossFit (1.5 g/kg/day to 2-2.2 g/kg/day)[17] and the recommendations of ACSM for high-intensity loads: 1.2–2 g/kg/day[18]. We did not find any statistically significant difference in protein consumption of men and women (sig=0.574).

The consumed carbohydrates by men (4.7±1.71 g/kg/day) and by women (4.1± 1.75 g/kg/day) were less than the lowest recommended level in high-intensity training (6-10 g/kg/day)[19]. We did not find any statistically significant difference in the consumed carbohydrates by men and women (sig=0.291), but there was a significant difference between the total consumption of the researched group (4.5±1.73 g/kg/day) and the lowest recommended level (sig=0.000).

The mean values of the consumed fat 1.1±0.36 g/kg/day by the researched men and 1.1±0.53 g/kg/day by the researched women were slightly above the recommended highest level for high-intensity load (0.5-1.0 g/kg/day)[20]. There was no significant

[11] *Prentice, Jebb* 2001: 141-147.
[12] *Prentice, Jebb* 2001: 141-147.
[13] *ACSM* 2016: 543-568.
[14] *McArdle et al.* 2010: 82-97.
[15] *ACSM* 2016: 543-568.
[16] *Kerksick et al.* 2018.
[17] *Glassman* 2010: 1-115.
[18] *ACSM* 2016: 543-568.
[19] *ACSM* 2016: 543-568; *Burke et al.* 2011: 17-27.
[20] *ACSM* 2016: 543-568.

difference between fat consumption by the two genders (sig=0.494) and between the total fat consumption (1.1±0.43 g/kg/day/day) and the highest recommended level (sig=0,198).

The calculated energy from proteins 18.3±3.8 % was significantly lower (sig=0.003) than the lowest recommended level (20-30%) of protein consumption for high-intensity load[21] and significantly below the recommended values of 30% in CrossFit[22]. There was a very good congruence of average fat consumption 29.3±7.6 % and the recommended fat consumption for CrossFit 30 %[23], as well as the lowest level according to the recommendations for high-intensity load (30-45 %)[24] but without a significant difference (sig=0.544). The consumed carbohydrates 52.4±9.0% were within the lowest recommended level for high-intensity load (50-75 %)[25] and were significantly higher than the recommended level in CrossFit (40 %)[26]. There were no significant differences between the percentage intake of carbohydrates (sig=0.072) of the researched group and the recommended percentage[27]. As regards the percentage ratio of macronutrients taken by the researched men and women, we found a significant difference between the protein intake (sig=0.038). There were no differences in the consumed fat (sig=0.227) and carbohydrates (sig=0.058).

Table 3. Mean values of energy and macronutrients intake in CrossFit participants

	Men (n=29)	Women (n=18)	Total (n=47)	Recommendations [1,2]
Energy needs				
kcal/day	2919.1±387.26	2169.3±125.34	2632.0±482.55	
kcal/kg/day	36.3±3.13	36.2±2.46	36.8±2.86	□40 kcal/kg/day[1]
Energy intake				
kcal/day	2755.7±893.55	2008.9±726.20	2469.7±903.07	
kcal/kg/day	34.9±10.95	33.9±11.72	34.5± 11.44	□40 kcal/kg/day[1]
Protein				
g/day	115.2±37.16	90.8±17.15	105.9±33.07	
g/kg/day	1.6±0.44	1.5±0.34	1.5±0.40	1,2–2,0 g/kg/day[1]
% of energy	17.4±2.8	19.7±4.7	18.1±3.6	20-30%[2]
Fat				
g/day	84.0±31.48	78.0±30.81	77.9±31.87	
g/kg/day	1.1±0.36	1.1±0.53	1.1±0.43	0.5-1.0 g/kg/day[1]
% of energy	28.3±6.5	31.0±9.0	29.3±7.6	30–45%[2]
Carbohydrates				
g/day	368.8±132.48	244.9±106.79	321.3±136.39	
g/kg/day	4.7±1.71	4.1±1.75	4.5±1.73	6-10 g/kg/day [1]
% of energy	54.4±7.7	49.3±10.2	52.4±9.0	50–75%[2]
Animal protein (%)			54.9±17.9	
Animal fat (%)			67.4±15.7	

Legend: (ACSM, 2016)[28] – 1; (McArdle et al, 2010)[29] – 2.

[21] *McArdle et al.* 2010: 82-97.
[22] *Glassman* 2010: 1-115.
[23] *Glassman* 2010: 1-115.
[24] *McArdle et al.* 2010: 82-97.
[25] *McArdle et al.* 2010: 82-97.
[26] *Glassman* 2010: 1-115.
[27] *McArdle et al.* 2010: 82-97.
[28] *ACSM* 2016: 543-568.
[29] *McArdle et al.* 2010: 82-97.

CrossFit participants had to provide some information about the way they make their diet (**Fig.** 1). They could mark more than one correct answer. When making their diet, women consulted mostly their coach (n=9) and nutritionist (n=6). Fewer of them used Internet sources (n=4). The main source of information for the researched men was the Internet (n=10) and their coach (n=7). Another part of them made their dietary plan themselves (n=5) or used other sources (n=5).

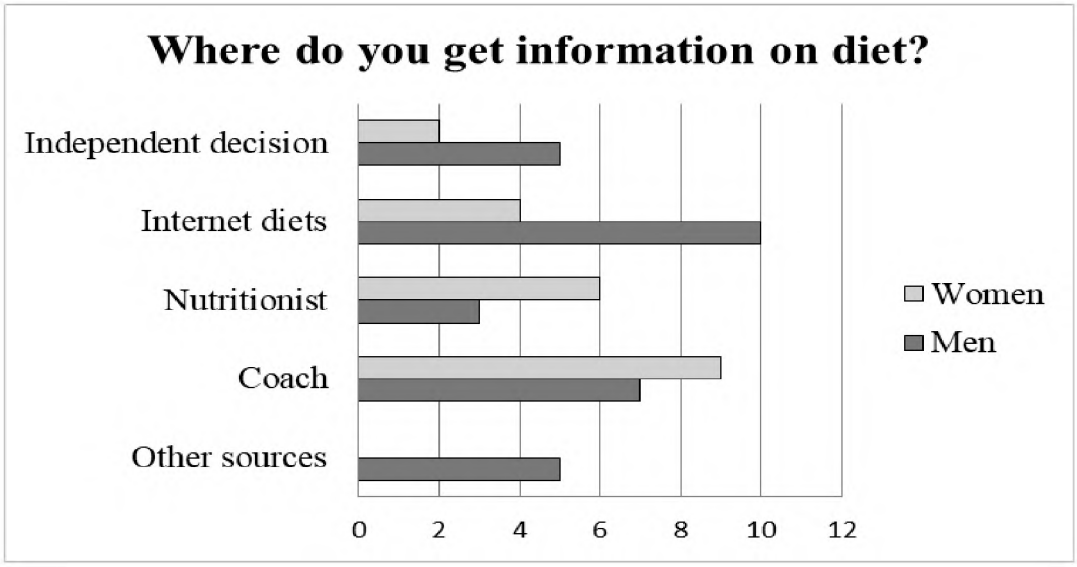

Figure 1. Sources of information on diet

DISCUSSION

CrossFit is a discipline with high requirements in terms of training session and nutrition. This sport falls into the group of high-intensity sports according to the classification of American College of Sports Medicine[30]. Nutrition is crucial for maintaining and improving training efficiency, sports achievements, and athletes' health status[31].

The assessment of the diet of the researched individuals practicing CrossFit showed lower EI compared to the recommendations for high-intensity load and calculated EN, mostly due to the lower carbohydrate intake both by men and women. The energy needed for handling loads with high intensity, 5-6 times a week, with training session duration of 1-3 hours is 600-1200 kcal/h during exercise with total energy expenditure 2500-8000 kcal/day for 50-80 kg athlete[32]. Chronic energy shortage in combination with high energy expenditure as a result of the training sessions could lead to menstrual disorders, weight loss, reduction of bone mineral density, dehydration, and other health problems among women[33]. The negative effects for men are lower testosterone levels, impaired concentrations, insulin resistance, and other health problems[34].

CrossFit is a high-intensity load with recommendations for 6-10 g/kg daily amount of carbohydrates taken[35] They are the main source of energy in anaerobic conditions. It is desirable that most of them be with low to moderate glycemic index[36]. The metabolic profile of CrossFit training sessions dominates glycogenic energy production. A sports diet which does not provide a high carbohydrate intake cannot suffice adequately the energy expenditure during a training session and will prevent the adequate recovery later[37]. The low

[30] *ACSM* 2016: 543-568.
[31] *Aerenhouts et al.* 2011: 73-82.
[32] *ACSM* 2016: 543-568.
[33] *Loveless* 2017: 301-305.
[34] *Koehler et al.* 2016: 1921-1929.
[35] *ACSM* 2016: 543-568; *Burke et al.* 2011: 17-27.
[36] *Glassman* 2010: 1-115.
[37] *Escobar* 2016: 460-470; *Burke, et al.* 2011: 17-27.

carbohydrate intake and glycogen levels will lead to loss of muscle mass because the structure protein cannot be included in the energy provision of the organism during a training session[38]. The recommendations for a higher carbohydrate intake are due to the specific for this sport high cardiorespiratory activities which are also a premise for a greater depletion of glycogen depots and high levels of glycogen in the muscles and liver[39].

The optimal protein intake in athletes' diet is crucial for the stimulation of the synthesis of muscle proteins and respectively – muscle hypertrophy, suppression of structure protein and stimulation of other adaptive answers resulting from sports trainings[40]. The protein intake of the researched men and women, as well as the mean values for the researched group were within the recommended range: 1.2-2.0 g/kg[41]; 1.4–2.0 g/kg[42]. The protein consumption should be based on the activity, intensity, and athletes' training experience[43]. The consumption of animal protein consisting of all irreplaceable amino acids in optimal ratio was dominant among the athletes in our research. Animal proteins provide 54.9±17.9 % of the total protein consumption of our sample. Animal fats are also dominant (67.4±15.7 %) which can be explained with the high consumption of meat, fish, eggs, milk and dairy products. These food products are characterized with high biological values (Protein Digestibility Corrected Amino Acid Score) with maximum possible score of 1,0. Animal meat has a score of 0.9, compared to the values of most vegetables and fruit - 0.5 to 0.7[44].

Fat consumption of the researched athletes was congruent with the recommended intake of 30 % in CrossFit[45] and for high-intensity load[46]. The values of the consumed fat for athletes are a little higher as a percentage than the values for those not engaged in sport and it is recommended that mono non-saturated and poly non-saturated fat acids be prevalent[47].

The results from the questionnaire showed that the main sources of information about the diet of the CrossFit participants came mainly from the Internet (for men), coaches (for women), and nutritionists. Women tend to trust specialists in the area of nutrition and their coaches' competence. The role of CrossFit coaches is very important both for providing optimal training sessions and for making adequate dietary regimes appropriate for the intensity of the training sessions, their duration and frequency.

CONCLUSIONS

The mean values of the consumed proteins by the researched individuals were congruent with the recommendations for high-intensity training loads. The lower carbohydrate intake negatively influences the energy intake but has with no significant risk for the efficient energy provision of the long-term recovery processes.

[38] *Burke et al.* 2011: 17-27; *McArdle et al.* 2010: 82-97.
[39] *Escobar* 2016: 460-470.
[40] *Phillips, Loon* 2011: 29-38.
[41] *ACSM* 2016: 543-568.
[42] *Kreider et al.* 2010: 301-305; *Jäger et al.* 2017.
[43] *Glassman* 2010: 1-115.
[44] *Schaafsma* 2000: 1865-1867.
[45] *Glassman* 2010: 1-115.
[46] *McArdle et al.* 2010: 82-97.
[47] *Gleeson et al.* 2004: 115-125; *Kerksick et al.* 2018.

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Оценка на хранителния режим при занимаващи се с CrossFit в лицензирана зала в София, България

Михаил Кончев, Диляна Зайкова

Както при повечето спортове, така и практикуващите CrossFit трябва да съчетават оптимално белтъци, въглехидрати и мазнини, с цел осигуряване на енергийните нужди, поддържането на положителен азотен баланс и по-бързото отстраняване на метаболитните продукти.

Целта на настоящото изследване е да се оцени храненето при мъже и жени, практикуващи CrossFit в лицензирана CrossFit зала в София, България, и да се сравни с препоръките при високоинтензивни натоварвания.

Методи: изследването е проведено с 26 мъже (на средна възраст 30.6 г.) и 17 жени (на средна възраст 30.3 г.), които попълниха въпросник за хранене. Изчислихме дневния прием на белтъци, въглехидрати и мазнини (гр кг дневно и гр дневно), техните относителни стойности в проценти и енергийния им прием (kcal дневно). Енергийните нужди изчислихме от базовата обмяна, умножен по коефициент на физическа активност.

Резултати: Бяха изчислени следните средни консумации гр кг дневно (белтъци: мъже – 1.6±0.48, жени – 1.4±0.34; въглехидрати: мъже – 5.1±2.05, жени – 4.2±1.84; мазнини: мъже – 1.1±0.43, жени –1.2±0.52). Енергийният прием и стойностите на консумираните въглехидрати бяха по-ниски от препоръките за натоварвания с висока интензивност.

Заключение: по-ниската консумация на въглехидрати повлиява негативно енергийния прием, но без значителен риск от ефективното протичане на възстановителните процеси в дългосрочен план.