

NUTRITIONAL PATERNS OF CHILDREN INVOLVED IN FOUR DIFFERENT SPORTS: SKI, GYMNASTICS, FOOTBALL, AND BASKETBALL

DOI: <https://doi.org/10.46733/PESH2090189dz>

(Original scientific paper)

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Abstract

Proper nutrition is very important for children in order to support their normal growth and development. For children involved in sports, it is even more important as it has also to ensure energy demands of training and competition. Different sports have different energy demands, so the aim of the present study was to evaluate the usual diet of children involved in ski, gymnastics, football and basketball. Fifty-eight subjects (age 14 ± 4.5 years, height 160 ± 18.1 cm, weight 52 ± 16.1 kg) participated in this investigation. For determination of their body mass, body composition IOI353 Body Analyser was used and food intake was evaluated using short food frequency questionnaire adapted for Bulgarian food. Results showed that gymnasts obtained less energy from food (1755 ± 794 kcal/day), followed by skiers (1846 ± 544 kcal/day), football players (2008 ± 834 kcal/day), and basketball players (2204 ± 624 kcal). In all diets carbohydrates are the predominant macronutrient (66 %, 59 %, 63 %, and 63 % of energy from food for gymnasts, skiers, basketball and football players, respectively). Energy from fat is lower in gymnasts' diet (only about 17 %) as compared with diets of other athletes (22 %, 22 %, and 21 % for skiers, basketball and football players, respectively). The main conclusion from the analysis of the athletes' nutrition was that energy requirements for practicing the respective sport are much higher than energy intake from food for most of them. All participants in the study received detailed explanation about their results and guidelines for proper changes in their nutritional plans.

Key Words: *adolescent nutrition, food frequency questionnaire, energy intake*

Introduction

Proper nutrition is crucial for child and adolescent athletes to maintain growth and development and to achieve optimal results in sports. Usually in Bulgaria parents of the adolescent athletes take care of their diets. Traditional Bulgarian foods are good for providing all necessary macro- and micronutrients, but usually children are so busy and don't have time to eat normal food, so the main meals are "fast/junk" food.

Assessing the energy requirements and energy intake of young athletes is very important and specialist of sport nutrition should work with them and their parents and coaches to ensure their proper nutrition.

Sport nutrition enhances athletic performance by decreasing fatigue and the risk of disease and injury; it also enables athletes to optimize training and recover faster (Hoch, et al., 2008). It is very important to balance the energy expenditure with the energy intake in order to prevent the energy deficit or excess.

There are different methods for evaluation of total energy expenditure (TEE). The prediction equations are the most used method as it is very easy. They were derived from the studies of total energy expenditure for different age group and there are various mathematical models (e. g. linear, multiple, polynomial, etc.) that account age and/or body weight as a predictors of TEE (FAO/WHO/UNU, 2001).

The most commonly used methods for measuring dietary intakes are based on current and past dietary intakes (Burke & Deakin, 2015). The problem nowadays is that few people still use freely English, and most platforms work in English. There are still people who have difficulty coping with new technologies. Another point is that these researches are time consuming when a large group of people is included.

The other way to study nutrition is via questionnaires based on past meals (Mulligan, et al., 2014; Uenish, et al., 2008; Foster, 2014; Neelakantan, et al., 2016). They cover longer periods of time and usually refer to the characteristics of a person's diet and can give a more complete picture of his diet. Various

questionnaires have been developed that aim to determine different nutrition parameters in a given population. They are validated specifically for this population and do not work for all people. Typically, questionnaires contain questions about typical foods in the given country and in the given population group.

The aim of the study was to evaluate the usual diet of children involved in alpine ski, gymnastics, football and basketball and to give them some recommendation in order to improve their nutrition.

Material & methods

Subjects

Fifty-eight subjects involved in four different sports participated in the study: 9 alpine skiers (age 13.6 ± 1.3 years, height 163.3 ± 7.6 cm, weight 55.3 ± 12.03 kg), 23 gymnasts (age 13.1 ± 6.7 years, height 145.0 ± 16.7 cm, weight 41.0 ± 16.1 kg), 10 football players (age 13.4 ± 0.5 years, height 166.9 ± 9.7 cm, weight 54.4 ± 8.2 kg), and 16 basketball players (age 15.4 ± 1.2 years, height 176.3 ± 7.8 cm, weight 64.4 ± 10.8 kg). It was conducted at the end of 2019. Prior to the study, participants were asked to refrain from physical exercise, food, and fluid intake. Parent of each participant in the study signed a declaration of informed consent and the study was approved by the Scientific Research Committee of South-West University "Neofit Rilski". The subjects came once at the Center for Functional Studies in Sport and Kinesitherapy of South-West University "Neofit Rilski" - Blagoevgrad, where the anthropometric measurements were made.

Determination of body composition was done with Body Composition Analyzer, model IoI 353. The participants in the study were wearing the lightest possible clothes and took off socks before the measurement. From the obtained results we used Body Mass Index (BMI) and Soft Lean Mass (SLM) or muscle mass.

Determination of total energy expenditure was made by prediction equations. For adolescent athletes the quadratic regression equations were used for prediction of TEE/day from body weight (Torun, 2005):

$$\text{Boys: TEE(kcal/day)} = 310.2 + 63.3 \cdot \text{kg} - 0.263 \cdot \text{kg}^2$$

$$\text{Girls: TEE(kcal/day)} = 263.4 + 65.5 \cdot \text{kg} - 0.454 \cdot \text{kg}^2$$

Determination of the energy value of usual diet of the subjects was done through a simple food frequency questionnaire (FFQ) (Kirkova, et al., 2019), prepared and validated for the conditions in Bulgaria. Each person fills in a pre-encoded questionnaire that automatically calculates the total amount of kilocalories that a person normally consumes and the amount of carbohydrates, proteins and fats normally found in his menu.

Data analysis

For data processing and analysis Excel and GraphPad Prism (Ver 3.0) were used. A spreadsheet was prepared in Excel to calculate the food questionnaire results. Formulas that calculate total energy intake with food, protein, carbohydrate, and fat were introduced. The mean values and standard deviations of all variables were calculated by descriptive statistics. Experimental data were presented in two ways: - as mean \pm SD; and - as individual values for each subject. For the statistical analysis of the results (One-way ANOVA, Kruskal-Wallis test, Dunn's multiple comparison test), for figure generation the Graph Pad Prism statistical software and Excel were used.

Results

Fifty-eight adolescent athletes involved in four different sports participated in this study. Their anthropometric data was presented in table 1 as a mean values and standard deviations in the groups.

Table 1. Anthropometric data of the participants of the study

Sport	Alpine ski	Gymnastics	Football	Basketball
Number	9	23	10	16
Age	13.6 \pm 1.3	13.1 \pm 6.7	13.4 \pm 0.5	15.4 \pm 1.2
Height	163.3 \pm 7.6	145.0 \pm 16.7	166.9 \pm 9.7	176.3 \pm 7.8
Weight	55.3 \pm 12.0	41.0 \pm 16.1	54.4 \pm 8.2	64.4 \pm 10.8
BMI*	20.1 \pm 2.8	18.6 \pm 3.3	19.5 \pm 2.4	20.6 \pm 2.5

*BMI – body mass index

There is a statistically significant difference in the height of gymnasts compared to all other sports (ski – $p < 0.05$; football – $p < 0.01$; basketball – $p < 0.001$). A similar difference was observed in the weight of the gymnasts (ski – $p < 0.05$; football – $p < 0.05$; basketball – $p < 0.001$). BMI differed statistically only in the groups of gymnasts and basketball players ($p < 0.001$). There was no statistically significant difference between the other groups.

Mean values and standard deviations of total energy expenditure obtained by quadratic regression equations were presented in table 2, as well as the mean values of total energy intake, protein, carbohydrate, and fat intake determined with questionnaire.

Table 2. Total energy expenditure and intake of energy and macronutrients from food.

Sport	TEE, kcal/day		TEI, kcal/day		Protein, g/day		Carbohydrates, g/day		Fat, g/day	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Alpine ski	2778	380	1846	544	81.1	22.4	294	112.4	44.5	13.7
Gymnastics	2178	550	1755	794	77.1	26.9	319.4	183	31.7	10.1
Football	2959	286	2008	834	85	29.7	324.1	177.8	48.9	18.8
Basketball	3266	298	2204	624	90.8	28.9	379.7	123.4	59.8	17.3

TEE – total energy expenditure, TEI – total energy intake.

The results showed that TEE differed significantly between groups of gymnastics and football and basketball with p values < 0.01 and < 0.001 , respectively.

There were significant differences in nutritional patterns only between the groups of gymnastics and football ($p < 0.05$) and gymnastics and basketball ($p < 0.001$) (Figure 1).

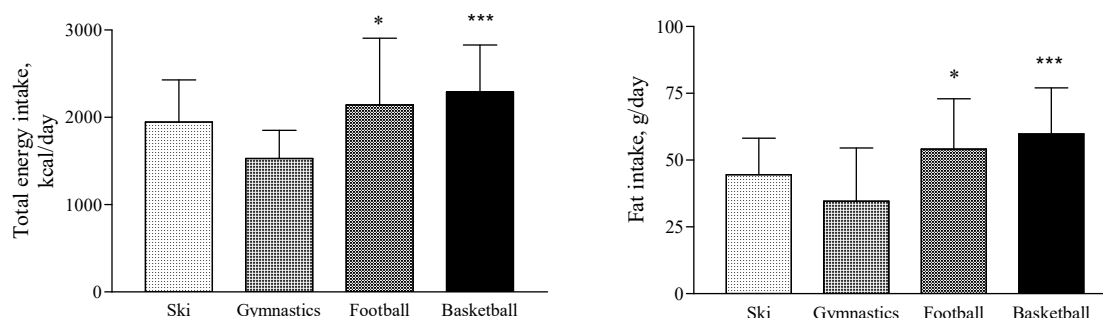


Fig. 1. Daily total energy intake and fat intake in all groups. There is statistically significant difference between gymnasts' diet and football players' diet ($p < 0.05$) and basketball players' diet ($p < 0.001$).

The ratio of energy from essential nutrients in the daily diet of athletes in different sports is presented in Figure 2.

Discussion

Different sports required different body characteristics. To be successful, a basketball player should be tall. All the subjects were tall, some comparable to elite adult basketball players (Martínez, et al., 2014; Turna & Kılınc, 2018). Other young people have the potential to achieve this height, which will be tracked over time. Not only height is important in the basketball game. Large bodies also give players an advantage, as this is a guarantee for greater power and successful fighting on the field and under the basket. A gymnast should meet certain characteristics of the body (Claessens, et al., 1999) in order to achieve good results. Over the years there have been major changes in the bodies of successful gymnasts, with the current tendency to have small bodies and small body weight (Sands, et al., 2012). Anthropometric measurements are very important in selection of young soccer player as it was shown in different studies (Gil, et al., 2007; Brahim, et al., 2013) and the data of our subjects were in the ranges reported in the literature. For alpine skiers there was no correlation between anthropometric characteristics and performance during a race, as endurance, strength, speed, flexibility and coordination, as well as psychological factors, are of greater importance (Neumayr, et al., 2003). Although every sport has its anthropometric characteristics, in

childhood, athletes differ significantly as they grow and develop at different rates. Most of the children start their sports activities with gymnastics and later move on to other sports. This is due to the fact that the gymnasts have small bodies that allow the performance of complex gymnastic exercises. The gymnastics group differed from all others by its small height and light weight. Basketball players were higher than other athletes, although this difference was not statistically significant, but it should be noted that they were on average about two years older than the rest.

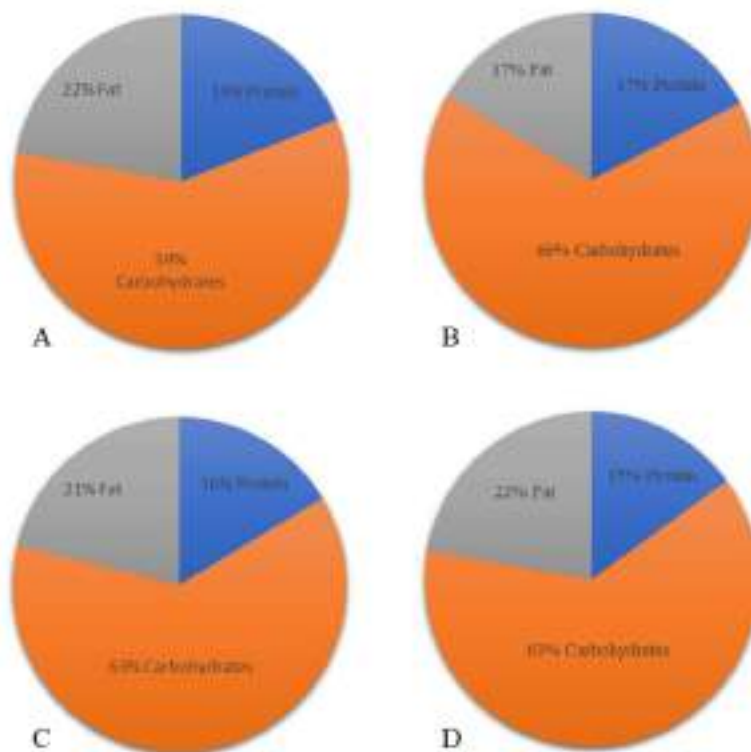


Fig. 2. Percentage of energy obtained from carbohydrates, protein and fat in the diet of different groups of athletes (A – alpine ski, B- Gymnastics, C – Football, and D – Basketball)

Energy requirements of children and adolescents are determined by their energy expenditure and the energy needs for growth. The latter consist of two components: (1) the energy deposited in growing tissues, basically as fat and protein, since carbohydrate content is insignificant; and, (2) the energy expended to synthesize those tissues (Torun, 2005). The formulas for calculating the energy expenditure contained weight. It was expected that athletes with greater weight have greater energy needs. Gymnasts were the lightest and accordingly TEE is the lowest, while basketball players had the highest TEE.

In order to provide sufficient energy for growth, development and training, it is necessary to eat the right amount of food. As could be seen in Table 2 the athletes received significantly less energy from food. We took into account the fact that, in some groups of people, especially children and adolescents, the data obtained from questionnaire was on average about 11% lower than the actual one. This was the average range of underestimation in most studies. Even with this percentage, athletes received less energy than they needed to meet their daily demands. Much of this energy they received from various soft drinks and chips, which information we got when talking to them. Often, children did not recognize these types of products as food and did not indicate them appropriately in the questionnaire. On average, one packet of chips contains about 250 kcal and soft drinks - about 150 kcal per glass. The subjects consumed them quite frequently during the day and adding these values to the results obtained from the questionnaire yielded values close to and exceeding TEE.

There were differences in energy intake between gymnastics groups and football and basketball players. Gymnasts, and especially female gymnasts, are athletes who strictly monitor their weight and often limit their food intake. Their diet also had a significantly lower fat intake than football and basketball players. Gymnasts' fat intake accounted for only 17% of all food energy, while for skiers and basketball players it

was 22% and for football players – 21%. The differences in energy intake in the groups were mostly due to the amount of fat in the food.

Although there was no statistically significant difference, the group of gymnasts consumed the most carbohydrates (66% of the energy in the food came from carbohydrates), and the group of basketball had the least amount of protein (15% of the energy in the food came from protein).

The analysis of the diet of young athletes made it possible to determine the eating patterns specific to the sport, to assess the adequacy and eating disorders and to make appropriate adjustments. Individual results of the subjects were provided to each participant, his or her parents and coaches, along with appropriate recommendations. At the request of the subject, the results of the changes made would be tracked.

Conclusions

Athletes in different sports eat differently, even in childhood. The different requirements in the respective sport affect the nutritional patterns. Gymnasts take a low calorie diet with less fat, while basketball players – a high calorie diet with a higher carbohydrate and fat content but with a lower protein content. Chips, fast food and soft drinks are a side part of their diet, but unlike children with a sedentary lifestyle, in the case of athletes, they save energy balance. Appropriate recommendations were made for changes in nutrition in the four groups of athletes participating in the study, with the aim of improving the quality of the food intake and their nutritional status.

Conflicts of interest - The author declares that she has no conflicts of interest.

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