ASSESSMENT OF ANTHROPOMETRIC AND NUTRITIONAL STATUS OF BULGARIAN YOUTH ROWERS

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ABSTRACT
Introduction: Nutritional intake plays a general role in athletic performance in rowing. Suboptimal nutrition among adolescent rowers can negatively impact growth and development, athletic performance, and the development of professional athletes. Previous research has shown that suboptimal carbohydrate and/or protein intake is a common problem in rowing.
The present study aimed to assess the nutritional status of young rowers and compare it with current recommendations.
Methodology: Participants' dietary intake was assessed using a seven-day food diary, including training and recovery days. Body composition was measured with Tanita BC-418. Based on this information, the following factors were assessed: daily nutritional intake, body mass index, nutritional status, and physical activity. Microsoft Excel software was used to calculate the mean values and standard deviations.
Results: Of the initial 23 participants, 18 completed the study fully (girls, n = 9; boys, n = 9, with a mean age of 15.4 ± 1.55 years). Boys consumed 111 ± 38 g/24h (1.7 ± 0.5 g/kg/24h) of proteins, 382 ± 98 g/24h (5.7 ± 2.5 g/kg/24h) of carbohydrates, and 96 ± 40 g/24h (1.5 ± 0.5 g/kg/24h) of fats. Girls consumed 69 ± 18 g/24h (1.2 ± 0.4 g/kg/24h) of proteins, 230 ± 54 g/24h (3.9 ± 1.2 g/kg/24h) of carbohydrates, and 55± 18 g/24h (0.9 ± 0.3 g/kg/24h) of fats. Daily nutritional intake is 2832 ± 1183 kcal/24h for boys and 1710 ± 312 kcal/24h for girls.
Conclusions: Girls` protein and carbohydrate daily intake is less than recommended.

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INTRODUCTION

Rowing requires great power and strength endurance, and uses both long-term (aerobic) energy systems and short-term (anaerobic) energy systems. The race is a near-maximal effort lasting between 5.5 and 7 minutes per 2000 m, depending on the class of the boat and the level of the race.

Rowing is a sport where commitment to training often begins in adolescence. Given the high energy demands, adolescent rowers must match their nutritional intake to the intensity and duration of exercise to optimize performance and recovery (Desbrow et al., 2014). In contrast to adults, a teenager's diet must provide nutrients for growth. In addition to training, children have increased nutritional needs to support intensive growth, development, and maturation (Brown, 2019). Inadequate nutritional intake during this critical developmental stage can have detrimental effects on normal adolescent development (Brown, 2019). Therefore, a nutritional assessment is needed to identify dietary inconsistencies, allowing for the establishment of nutritional education, especially for young athletes, to ensure adequate intake of protein, carbohydrates, and fats.

Adolescents – both boys and girls – are at high risk of developing eating disorders and low energy availability (LEA). Disordered eating and eating disorders are common in those doing sport at a high level (*8 Healthy Eating Habits for Teenage Rowers*, 2014).

Some overweight teenagers can choose rowing as an effective weight loss option because it offers a full-body workout that burns a significant number of calories and engages multiple muscle groups. Rowing combines both cardiovascular and strength training, which can help increase your resting metabolic rate and build lean muscle mass, both of which contribute to weight loss.

Aim and objectives

The primary aim of this study is to explore and analyze the nutritional intake of Bulgarian youth rowers aged 14-18 years.

Objectives – to determine body composition and macronutrient intake, and compare with the phys-

iological norms of nutrition of the Bulgarian population and sports nutrition guidelines for young athletes.

METHODOLOGY

Participants

Twenty-three youth rowers participated in the study. 18 of them (girls $n = 9$ and boys $n = 9$, with mean age 15.4 ± 1.55 years) fully completed the study. The research group averaged 7.7 ± 2.3 workouts per week.

Measures

Participants' dietary intake was assessed using a seven-day food diary, including training and recovery days. Body composition was measured with Tanita BC-418. Height was measured to the nearest 0.5 cm. Based on this information, the following factors were assessed: Daily Calorie Needs (DCN) (Harris & Benedict, 1918; Pavlidou et al., 2023), Daily Nutritional Intake (DNI), Macronutrients intake, Body Mass Index (BMI = kg/m^2, Table 1), %Body fat (%BF), and Physical activity. Nutritional status was assessed through anthropometric indicators based on measured height and weight. Body Mass Index (BMI = kg/m^2, Table 1) was used.

Table 1. *BMI scale for children (WHO 2007).*

	Boys			Girls		
Age (years)	Underweight if BMI is below	Overweight if BMI is above	Obese if BMI is above	Underweight if BMI is below	Overweight if BMI is above	Obese if BMI is above
14	16.3	21.9	24.8	16.2	22.4	26.0
15	16.8	22.6	25.6	16.7	23.1	26.8
16	17.4	23.4	26.4	17.2	23.7	27.5
17	18.0	24.2	27.2	17.6	24.3	28.2
18	18.6	24.9	27.9	17.9	24.8	28.7

Statistical analysis

Microsoft Excel software was used to calculate the mean values and standard deviations.

RESULTS

Table 2 presents information on the anthropometric indicators and nutritional status of participants who fully completed the study ($n = 18$).

According to average BMI, boys are of normal body weight and, as can be seen in Table 3, only one of them is underweight.

Table 2. *Participant anthropometric information (Mean±SD).*

	Age (years)	Height (cm)	Bodyweight (kg)	BMI (kg/m$_2$)	%BF
Boys ($n = 9$)	15.8 ± 1.56	178.4 ± 5.8	65.2 ± 10.0	20.4 ± 2.2	8.1 ± 3.1
Girls ($n = 9$)	15.0 ± 1.5	165.6 ± 6.2	58.5 ± 7.6	22.5 ± 3.6	25.1 ± 6.3

The female average BMI is also within the normal range. Looking at the female group in more detail, one of them is actually overweight, and one is obese (Table 3).

By average %BF, boys are below the norm, and girls are on the upper limit of the norm (Marques-Vidal et al., 2008).

In addition to the DCN, the DEI was also compared with the Daily Energy Needs (DEN) recommended in the Physiological Norms for Nutrition of the Bulgarian Population (2018). In boys, the difference between the theoretically calculated and recommended values (DCN vs. DEN) is less than 100 kcal (Table 4). DEI is 6% below the DCN and 9% below the DEN.

Table 3. *BMI distribution.*

BMI	Number of boys	Number of girls
Under-weight	1	0
Normal weight	8	7
Over-weight	0	1
Obese	0	1

The Daily Energy Intake (DEI) determined from food diaries, filled in by the participants, is presented (Table 4). The obtained values were compared with Daily Calorie Needs (DCN), theoretically calculated based on anthropometric indicators and the number of training sessions per week.

For girls, the difference between DCN and DEN is 30 kcal. Comparing their DEI with DCN and DEN, it is seen that the female reported a serious calorie deficit of around 700 kcal.

Table 4. *Comparison of DEI with calculated DCN and recommended DEN (Mean ± SD).*

	DCN (kcal/24h)	DEN (kcal/24h)	DEI (kcal/24h)
Boys (n = 9)	3015 ±470	3108 ±172	2832 ±1183
Girls (n = 9)	2436 ±352	2467 ±14	1692 ±312

Table 5. *Daily macronutrient intake (Mean±SD).*

	Proteins (g/kg)	CHO (g/kg)	Fats (g/kg)	Proteins (g)	CHO (g)	Fats (g)
Boys (n=9)	1.7 ±0.5	5.7 ±2.5	1.5 ±0.5	111 ±38	382 ±198	96 ±40
Girls (n=9)	1.2 ±0.4	3.9 ±1.2	0.9 ±0.3	69 ±18	230 ±54	55 ±18

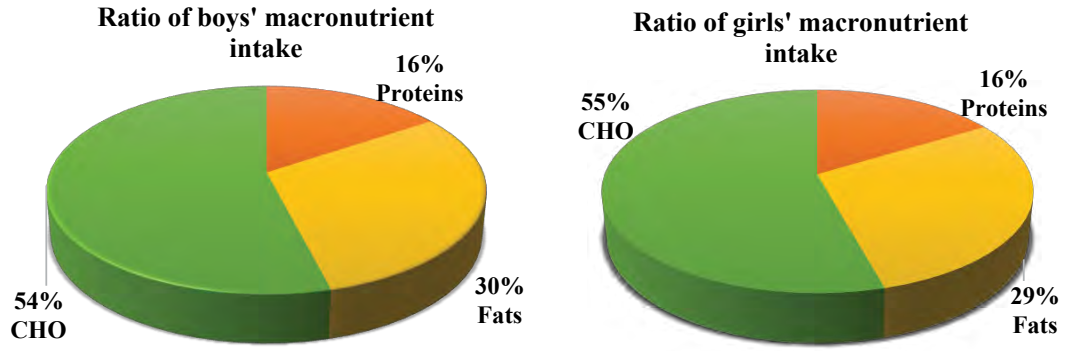

Figure 1. *Macronutrient ratio of energy intake.*

Figure 1 presents the energy ratios of consumed with the food macronutrients. The values for boys and girls are almost identical and correspond to the recommended medium-carbohydrate diet: Proteins/fats/carbohydrates = 15% / 30% / 55% (Institute of Medicine of the National Academies, 2002).

DISCUSSION

BMI-based nutritional status was assessed by WHO (World Health Organization) criteria used for the determination of overweight and obesity, age, and gender differentiation based on a reference population (Cole et al., 2000) were applied.

Analysis of the BMI data of respondents in this study shows that most of them have a normal body weight (15 of 18). There is one boy who is underweight, one girl who is overweight, and one who is obese. The body fat percentage in the same girls is above 30%.

In the male group, Daily Energy Intake is very close to the theoretically calculated DCN (6% less) and to the recommended DEN (9% less).

The consumed macronutrients are within the recommended values in terms of quantity and ratio (Table 5 and Figure 1).

Intake of 1.7 g/kg protein (Table 5) is within the acceptable range of recommended 1.3-1.8 g/kg (Desbrow et al., 2014). Looking at the individual values of the subjects, in 2 out of 9, the protein intake was below the recommended amount. Carbohydrates are also within the recommended amount (between 5 and 7 g/kg) (Desbrow et al., 2014), with an average value of 6.5 g/kg (Table 5). Here, three out of nine participants consumed amounts below the recommended levels.

The average dietary fat intake of 1.5 g/kg also met the recommended amount, equivalent to 30-35%

of energy intake (Hannon et al., 2020). Only 2 out of 9 reported consuming less than the required amount of fat.

In the female group, the ratio of macronutrients consumed with food is within the recommended range for a medium-carbohydrate diet (Figure 1).

In terms of quantity, the situation is much different from that of the boys. Girls reported a DEI with a serious calorie deficiency of about 700 kcal (Table 4). Only one girl reported that she had consumed the necessary amount of food to cover her daily energy needs.

The amount of consumed protein is 1.2 g/kg (Table 5). Four out of nine girls consumed amounts within the recommended range of 1.3-1.8 g/kg.

Desbrow et al. state that male endurance athletes require 1.6–1.8 g/kg for optimal protein and/or amino acid homeostasis, with young women requiring approximately 25% lower intakes due to estrogen-mediated decreases in amino acid oxidation (Desbrow et al., 2019). If that is correct, 1.2 g/kg protein intake should be sufficient, but 4 of the 9 girls report consuming proteins less than 1 g/kg.

A 3.9 g/kg carbohydrate intake is below the recommended range of 5-7 g/kg (Desbrow et al., 2014). Only 2 out of 9 girls consume between 5 and 7 g/kg of carbohydrate.

An amount of around 0.9 g/kg fat is not enough to meet daily energy needs. Six out of nine girls consume less than 1 g/kg of fat.

In a similar, more detailed study of young rowers in New Zealand, the authors reported similar trends. Girls consumed less protein, although the difference was not statistically significant. A large proportion of the participants consumed carbohydrates below the recommended amounts (Watts et al., 2024). In our study, 10 of 18 participants consumed not enough carbohydrates.

The identified calorie deficit in the female group may be due to:

- Intentionally imposed deficit, aimed at reducing body weight and body fat;
- Intentional omission in completing the food diary.

A prolonged period of deficiency exceeding 500 kcal at this amount and ratio of macronutrients would lead to loss of muscle mass (Perriello, 2001), overtraining, injuries (Close et al., 2019), and interruption of the menstrual cycle (Amoruso et al., 2024), among other adverse effects.

CONCLUSIONS

In this study, it was found that girls consumed less protein than boys.

10 out of 18 participants consumed less than the recommended amount of carbohydrates.

The ratio of consumed macronutrients corresponds to the recommended for a medium-carbohydrate diet, but a calorie deficit of 700 kcal was found in the female group.

Interpreting the science and application of the current energy and macronutrient recommendations into practice through the implementation of nutrition education is essential for normal growth, development, and the success of young athletes.

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