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Composition and structure of the menu for top level young athletes involved in Handball

Compoziţia şi alcătuirea meniului pentru tinerii jucători de handbal

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Abstract

Background. Menu planning is an important element of sports performance in order to enhance an athlete's recovery process during daily training.

Aims. Establishing a relationship between food consumption, body weight and specific activity of athletes in the sport practiced.

Methods. A transversal epidemiological study was conducted during January-February 2015 in order to identify food consumption in a group of athletes. Thereby, 57 female athletes, with a mean age of 14.4±1.78 years, with specific handball practice, were included in the study. The data was obtained by applying a 17-item questionnaire.

Results. A statistically significant association (p=0.0002) between decreased levels of nutrition practice (3.35±0.84) and age (r=-0.471, 95% CI =-0.653 to -0.237) was obtained. The female athletes described the intensity of the effort carried out over a week, as a physical perception, high values on days 2, 5 and 6 during the training week, representing Tuesdays (2.46±0.76), Fridays (2.07±1.34), and Saturdays (2.08±1.31) being identified. At the same time, total exercise length (300±20 minutes/week) was directly proportional to the perception of effort, the effort perception index increasing with the increase of the total length of training.

Conclusions. The identified results influence the effort in energy terms, through strength, total activity time and intensity. If these parameters are not found on an average level during the effort, the typical sports practice will be adversely affected, relating directly to energy deficiencies. Establishing a comprehensive program of nutritional education for athletes and parents, through suggestions in various important periods during the season, is still a basic objective.

Key words: breakfast, intensity, carbohydrate, meal, handball.

Rezumat

Premize. Planificarea meniului reprezintă un element important al activității sportive de performanță în îmbunătățirea procesului de recuperare a sportivilor.

Obiective. Relaționarea consumului alimentar, a greutății corporale a sportivilor și activitatea specifică din cadrul sportului practicat.

Metode. A fost inițiat un studiu transversal epidemiologic, spre identificarea consumului alimentar în cadrul unui grup de 57 de sportive, cu practică specifică în handbal, prin aplicarea unui chestionar de 17 întrebări. Studiul a fost desfășurat în perioada ianuarie-februarie 2015, în Târgu Mureș, România. 57 sportive, membre ale echipei de handbal, cu vârsta medie 14.4±1.78, au fost incluse în studiu.

Rezultate. S-au obținut asocieri semnificativ statistice (p=0.0002) între scăderea nivelului de practică nutrițională (3.35±0.84), și înaintarea în vârstă (r=-0.471, CI95%=-0.653 to -0.237). Sportivele au descris intensitatea efortului desfășurat pe parcursul unei săptămâni, sub forma percepției fizice asupra efortului, identificându-se valori crescute pe ziua a 2-a, respectiv ziua a 5-a, și a 6-a de pregătire din cadrul săptămânii, reprezentând zilele de marți (2.46±0.76), vineri (2.07±1.34), și sâmbătă (2.08±1.31). Totodată, durata efortului (300±20 minute/săptămână) a fost direct proporțională cu percepția efortului, raportându-se creșterea indicelui de percepție al efortului, prin creșterea duratei totale de acțiune.

Concluzii. Rezultatele identificate influențează efortul, din punct de vedere energetic, prin rezistență, durată și intensitate de lucru. Dacă acești parametri nu se regăsesc la un nivel mediu pe parcursul efortului, practica sportivă tipică va fi afectată negativ, date care se concretizează și pe baza deficiențelor energetice. Stabilirea unui program complex de alimentare, educarea sportivilor, cât și a părinților, prin sugestii și preparate optime în diferite perioade importante ale sezonului competițional, reprezintă un obiectiv de bază în continuare.

Cuvinte cheie: mic dejun, intensitate, carbohidraţi, masă principală, handbal.

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Introduction

Food preferences and the objective of energy distribution during the day can influence sports activities through the implemented menu structure (Grandjean, 1997). Creating a menu will take into account daily activity periodization, such that the structure of food consumption and implementation will be carried out according to the training performed. The data is complemented through the importance of the energy/nutritional balance during a period in which growth and body development is the most important objective of the young athlete (Garrido et al., 2007).

The main element of influence in sport performance is represented by the athletes' training program, through the periodization that is imposed during the season. Thus, secondary factors involved in energy recovery, such as macronutrients/micronutrients and liquids, will insure the athlete's recovery process, favoring physical development (Millard-Stafford et al., 2005). Providing balanced meals (energy/ nutrients) represents a basic element of sport nutrition. In order to achieve the energy requirements, training information such as duration, intensity, and objective of the activity will be used to change the food quantities and to establish the dominant macronutrient of the meal (Millard-Stafford et al., 2008). Carbohydrates represent the energy form that will be consumed to a greater extent (50-60%) during the day, along with proteins (15-20%) and lipids (15-20%) (Hinton et al., 2004). Such values tend to change depending on the activity performed by the individual. However, a small number of studies have highlighted the menu structure in relation to the work performed by athletes. Moreover, the selected population requires special attention for food variation due to the average age of the study group.

Hypothesis

Correct training periodization combined with an optimal diet adaptation during the physical development period, between 12-15 years of age, will form the basis of high performance in athletes. Improving adaptation, along with technical/tactical development, according to age, can generate a complex of motor skills in achieving optimal basic/specific training during the season.

Material and method

Research protocol

A transversal epidemiological qualitative study was conducted after obtaining the approval of the sports club Ethics Committee and the consent of the subjects (or their legal guardians) for participation in the study, a confidentiality agreement being also required. Throughout this study, we monitored the daily menu structure and its variation based on effort perception.

a) Period and place of the research

This paper was carried out during January-February 2015, in the athletes' training center in Târgu Mureş, Romania.

b) Subjects and groups

A total of 57 female athletes, with a mean age of 14.4±1.78 years, members of the handball team, with specific competitive national and international activities, were included in the study.

c) Tests applied

Data extraction was performed using a 17-item questionnaire with multiple choice answers. The main objective of the survey was to identify the eating habits of the athletes (food consumption and food knowledge), and secondarily, to correlate them with daily training activities. Thus, training activity was characterized through effort perception reported on a scale from 1 to 3, with values between 1 representing minimum effort difficulty, and 3, representing maximum effort difficulty. At the same time, the total number of training days during a week was reported by athletes, along with the total time spent in effort during each workout (number of days/ minutes). In terms of nutritional practice, during data extraction we included aspects of food consumption characterization, such as meals eaten throughout the day, percentage of energy distributed for each of the meals scheduled throughout the day (%), food consumed (g), and moments of ingestion (serving time during the day). The data regarding the athletes' training seasons, including total activity time and effort intensity, were communicated by the athletes, and approved by coaches.

d) Statistical processing

Statistical evaluation was performed using GraphPad Prism 5.0 software. The statistical indicators used were standard deviation (SD), standard error (SE), average value (mean), and coefficient of variation (CV). Pearson correlations were used to determine the association between two indicators; the confidence interval used in data analysis was 95%. The level of significance $p<0.05$ was considered statistically significant, while data exposure was performed through mean value and standard deviation (mean±SD).

Results

The athletes' weight and BMI showed values within normal limits, as well as underweight and overweight values. Thus, the average weight was 56.18±9.68 kg, with a minimum value of 36 kg, and a maximum value of 75 kg. The body mass index (BMI) indicated a minimum value of 15.20, and a maximum value of 25.5, while the average measured data was 20.78±2.19. The mean age of the subjects was 14.4±1.78 years, with range values between 13 and 15 years.

During the first phase, the subjects' nutritional practice was characterized based on a scale from 1 to 5 (1 – low level, 5 - high level). The results showed that 57.1% of athletes reported an average level of nutritional knowledge. Statistically significant associations ($p=0.0002$) were obtained between decreased nutritional practice levels (3.35±0.84) and increasing age ($r=-0.471$, 95% CI=-0.653 to -0.237). However, the body mass index of the athletes (20.78 ± 2.19) was reported to be within normal limits in association with appropriate nutritional practice, while decreased nutritional practice levels were significantly associated ($p=0.03$) with an inappropriate weight gain in relation to age and height ($r=-0.286$, 95% CI=-0.51 to -0.024).

Correct daily food intake distribution estimated by the subjects indicated that 17.9% of the group distributed the

correct proportion of energy consumption (during the day - %) for breakfast (value considered normal: 30%), while 32% had a correct proportion, in quantitative terms, during the first snack of the day. However, lunch was consumed in the right quantitative proportion by 21.4% (value considered normal: 40%), the second snack of the day was properly consumed by 7.1% (value considered normal: 10%) and dinner by 32.1% (value considered normal: 20%) (Fig. 1). Individual data evidenced statistically significant correlations between the percentage of energy distributed during the first meal of the day (21.38±13.30%) and nutritional practice reported by the subjects (3.35±0.84), showing an increase in the percentage of energy distributed for breakfast (21.38±13.30%) in association with increased nutritional practice characterization. However, the increasing age of athletes (14.4±1.78 years) was correlated with an improvement of energy intake during breakfast, but without statistical significance (p=0.0537).

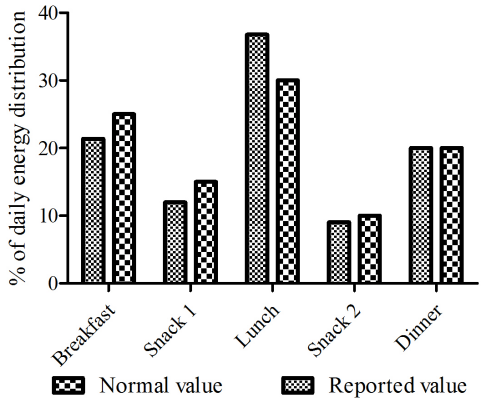

Fig. 1 – Data regarding the distributed energy value and the ideal value in the study group.

Furthermore, food consumption justified through these data indicates differences in the daily energy intake based on physical progress and intensity of the effort. As a result, female athletes described the intensity of the effort carried out over a week, as physical perception; high values on days 2, 5 and 6 of the training week, i.e., Tuesday (2.46±0.76), Friday (2.07±1.34), and Saturday (2.08±1.31), were identified. At the same time, total exercise duration (300±20 minutes/week) was directly proportional to the perception of the effort, indicating a growth of the effort perception index by an increase in the total duration of training. Despite these results, the coach did not report any changes in the volume or intensity of the effort during the training period.

In association with effort, daily food consumption indicated differences in terms of quantity/quality. Four distinct days, during which athletes reported an increased level of effort, suggested changes in food consumption (Table I).

As a consequence of food intake changes as a result of the effort, we identified an energy restriction and/or modification of the dominant macronutrient, represented by complex carbohydrates, at the expense of inadequate food choices in terms of nutrition (intake of simple carbohydrates or foods with a high amount of fat) (Table II).

These data show that different structures for daily food consumption may influence the quality/quantity of the food, which can indicate the athletes' inability to achieve their nutritional goal (Table III).

Table III

Summary of the dietary intake in the study group

Food	Daily (%)	2-3 servings per day (%)	1 serving per day (%)	Rarely (%)	Never (%)
Milk	33.9	35.7	14.3	12.5	3.6
Yogurt	30.4	33.9	12.5	10.7	12.5
Sour cream	3.6	33.9	23.2	35.7	1.8
Kefir	0.0	8.9	7.1	41.1	42.9
Cheese	10.7	35.7	8.9	42.9	1.8
Cottage cheese	3.6	17.9	12.5	42.9	23.2
Butter	44.6	17.9	10.7	19.6	7.1
Melted cheese	16.1	28.6	12.5	39.3	3.6
Beef meat	0.0	10.7	19.6	51.8	17.9
Pork	0.0	17.9	28.6	51.8	17.9
Chicken meat	12.5	55.4	23.2	7.1	1.8
Fish	0.0	10.7	14.3	55.4	19.6
Cold cuts	51.8	35.7	5.4	7.1	0.0
Bacon	0.0	5.4	10.7	46.4	37.5
Sausage	0.0	12.5	26.8	50	10.7
Pate	0.0	12.5	26.8	50.0	10.7
Eggs	1.8	32.1	48.2	17.9	0.0
White bread	67.9	10.7	3.6	14.3	3.6
Wholemeal bread	17.9	17.9	7.1	41.1	16.1
Pasta	0.0	14.3	37.5	44.6	3.6
Confectionery, baked products	7.1	55.4	25	12.5	0.0
Rice	0.0	14.3	33.9	44.6	7.1
Walnuts	1.8	12.5	12.5	62.5	10.7
Sunflower seeds	0.0	10.7	21.4	60.7	7.1
Flaxseed	1.8	7.1	1.8	19.6	69.6
Pistachio	1.8	5.4	16.1	58.9	17.9
Chocolate	55.4	25.0	14.3	5.4	0.0
Chips	1.8	19.6	33.9	42.9	1.8
Crackers	7.1	16.1	35.7	41.1	0.0
Popcorn	1.8	10.7	35.7	51.8	0.0
Sunflower oil	3.6	30.4	19.6	33.9	12.5
Olive oil	3.6	17.9	19.6	37.5	21.4
Palm oil	1.8	1.8	3.6	19.6	73.2
Margarine	7.1	25.0	5.4	23.2	39.3
Natural fruit and vegetable juices	19.6	30.4	25.0	21.4	3.6
Sodas	5.4	17.9	28.6	42.9	5.4
Coffee	0.0	0.0	1.8	16.1	82.1
Apples, pears, bananas	62.5	35.7	1.8	0.0	0.0
Citrus	50.0	32.1	1.8	0.0	0.0
Pineapple, kiwi	8.9	23.2	30.4	35.7	1.8
Grapes	5.4	17.9	25	50	1.8
Peaches, apricots, nectarines	10.7	21.4	21.4	44.6	1.8

Statistically significant associations were obtained between the effort performed and increased snack servings and decreased intake during the last meal of the day (dinner), respectively. At the same time, significant values were obtained between physical activity and decreasing the ratio of calories consumed during breakfast, while simultaneously increasing the energy value of the first snacks served during the day (Table IV).

The level of nutritional knowledge of the subjects was not influenced by exercise length (p=0.486, r=-0.094, 95% CI=-0.349 to 0.172), but sports practice was a significant factor influencing the improvement in nutritional knowledge (p=0.022, r=0.304, 95% CI=0.045 to 0.525).

Table I
Differences between effort perception and food consumption

Days of the week	Effort perception (index 1 to 3)	Snack consumption rate (%)	p	r	95% confidence interval	
					Lower	Upper
I	1.69±1.26	93.3	0.7332	0.04657	-0.2191	0.3058
II	2.46±0.76	58.5	*0.0011	0.4253	0.1828	0.6190
III	1.87±1.38	85	0.9786	0.003661	-0.2596	0.2664
IV	1.66±1.44	31.7	*0.0032	0.0315	0.0291	0.0362
V	2.07±1.34	51.2	*0.040	0.0395	0.0364	0.0432
VI	2.08±1.31	45	*0.0042	0.2120	0.2074	0.5398

Table II
Statistical significance regarding nutritional intake

Parameter 1	Parameter 2	P	r	95% confidence interval		Median
				Lower	Upper	
Age	Nutritional practice	0.0002	-0.4709	-0.6530	-0.2374	13 3
BMI		0.0329	-0.2856	-0.5102	-0.02443	20.75 3
Energy distribution during breakfast		0.0216	-0.3065	-0.5270	-0.04737	20 3
	Age	0.0537	0.2592	-0.004018	0.4889	20 13
Effort perception	Weekly exercise duration	0.0001	-0.2698	-0.2365	-0.4612	3 300

Table IV
Menu structure in direct relation to the perception of effort

Meals served	Frequency				Caloric/energy value (%)			
	p	R	95% confidence interval		p	r	95% confidence interval	
			Min	Max			Min	Max
Breakfast	0.466	-0.099	-0.353	0.168	0.018	-0.314	-0.533	-0.056
Snack 1	0.048	0.264	0.001	0.493	0.0009	0.430	0.188	0.622
Lunch	0.665	0.665	-0.207	0.317	0.472	-0.097	-0.351	0.169
Snack 2	0.427	0.108	-0.159	0.360	0.701	0.052	-0.213	0.311
Dinner	0.039	-0.275	-0.502	-0.013	0.574	0.076	-0.190	0.333

Discussions

Distribution of macronutrients through macronutrient balance is highlighted in many papers (Erdman et al., 2013; Burke et al., 2006). Thus, the distribution of the total energy value in the three main meals of the day is now a suggestive factor in order to characterize the nutritional practice of athletes. Various papers have highlighted the lack of breakfast consumption in young athletes (Cheong et al., 2003; Weimann, 2014). The lack of breakfast along with physical effort may result in the athlete's failure to achieve daily energy requirements as a result of overnight fast (10±2 hours) (Ormsbee et al., 2014). Thus, the body will get a deficiency of glycogen in the liver, with a degradation of about 80% of glycogen deposits (Rothman et al., 1991). The implication of the subject in breakfast serving will continue to influence the work that will take place during the day. An association of such behavior with an unbalanced body mass is commonly seen (Jakubowicz et al., 2013). Lunch, as well as dinner, is most often modified according to the training schedule of the athlete. Overall recovery time plays an important role in establishing dietary intake (Beelen et al., 2010). Various studies report the effect of simple carbohydrates post-exercise, due to increased GI and glycemic variation during the athletes' recovery phase (Wong et al., 2009). However, the consumption of whey and casein protein products is mentioned in the post-exercise period (Wilborn et al., 2013).

Macronutrient distribution of the total energy value throughout the day will take into account the period of the athlete's calendar. However, the overall recovery time will dictate the final form of the nutrition program. Thus, it is possible to identify differences in the structure of food intake during recovery if the total time is more than 8 hours or less than 8 hours (Burke et al., 2006). If the overall recovery time exceeds 8 hours, post-exercise intervention (main period) may be deferred, provided that the first main meal is served within maximum 60 minutes after exercise. If the recovery time falls below 8 hours post-exercise, food consumption (main period) is required. Post-exercise consumption is achieved by rapid and simple carbohydrates due to energy absorption in a catabolic period, characterized by body substrate degradation. Protein extracts, post-exercise, are used due to the plastic effect that will manifest in the body. The literature reports the effect of carbohydrates in combination with proteins after completion of exercise (Koopman et al., 2005). Moreover, in metabolic terms, protein absorption post-

exercise will be improved by ensuring a minimum amount of carbohydrates.

From a practical standpoint, changes in food consumption over a week are induced either through an increase in quantitative terms on the last day of training in the week, or by a decrease in food consumption, or a distribution of the snacks during the period in which athletes may report fatigue associated with loss of appetite – which is dictated by the exercise performed and the lack of recovery in the study group. The athletes' practice is often characterized by a high amount of protein during the main meals. This is complemented by additional consumption of sport products, ensuring a maximum quantity that will be exceeded in g/kg (Hoffman et al., 2004). Thus, the possibility that athletes will focus on the main energy source of the body, carbohydrates, complemented by protein, for body recovery by increasing the synthesis of muscle protein and improving adaptation to exercise, along with lipid intake, for meeting the final energy needs, is a certainty at this time in order to enhance the sport nutrition aspect in young athletes (Purcell et al., 2013; Meyer et al., 2007; Jeukendrup et al., 2011; Smith et al., 2015).

Conclusions

1. The main physical activity along with inadequate food intake during the main meals can suggest a number of changes in the athletes' daily nutrition.

2. The subjects included in this study showed a lack of appropriate nutrition practice during the main meals of the day.

3. As a result, the athletes reported a severe fatigue state as they advanced in weekly training, although the training form was linear during the mentioned period.

4. Establishing a comprehensive food education program for athletes and parents, through suggestions in various important periods during the season, represents a basic objective.

5. At the same time, improving nutritional knowledge will be important in a direct connection with nutritional practice, as shown in the study.

Conflicts of interest

There are no conflicts of interest concerning the results or methodology of the study.

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