Palestrica of the third millennium – Civilization and Sport
Vol. 19, no. 3, July-September 2018, 176–180

Menu structure for children and youth swimmers during micro-cycle training

Particularităţi alimentare la cadeţii înotători pe parcursul unui microciclu de pregătire

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Abstract

Background. Menu structure is an important element in swimmers' specific activity in order to maintain an optimal physical development pattern and to facilitate the recovery process between training sessions.

Aims. The aim of the study was to identify swimmers' nutritional knowledge and to establish a relationship between food ingestion and specific physical activity.

Methods. A cross sectional study was conducted in Târgu Mureş, Romania, between 19th of March and 20th of July 2018, on a sample of 24 athletes consisting of 11 female and 13 male swimmers enrolled in national competitions. In order to determine swimmers' food intake and preferences we applied a 19-item questionnaire and a 5 day food diary.

Results. Statistically significant differences were recorded regarding the increased intake of processed meat foods (p=0.014, r=0.4947, CI=0.1014 to 0.7542) and sweets (p=0.0425, r=-0.4173, CI=-0.7088 to 0.003916) both at breakfast and during lunch. Also, the results showed an increase of refined products and sweets consumption in snacks during a day (p=0.0305, r=0.4422, CI=0.03446 to 0.7237). At the same time, significant statistical associations were identified between the athletes' age and fruit intake both before (p=0.0207, r=0.4693, CI=0.06862 to 0.7396) and after the training session (p=0.007, r=0.5356, CI=0.1562 to 0.7773).

Conclusions. The obtained results will influence physical activity in energy terms, providing a higher training session difficulty due to an inappropriate food intake before the practice and an increased fatigue level reported by the athletes. Establishing a nutritional scheme for the athletes during different training phases of the season is required.

Keywords: swimming, food intake, food preferences, age

Rezumat

Premize. Structura planificării alimentare reprezintă un element important în activitatea sportivă specifică în vederea dezvoltării fizice optime şi pentru facilitarea procesului de refacere fizică între şedinţele de pregătire.

Obiective. S-a urmărit identificarea cunoştinţelor nutriţionale în rândul înotătorilor, stabilindu-se o relaţie între aportul alimentar şi activitatea sportivă specifică.

Metode. S-a desfăşurat un studiu transversal observaţional, în Târgu Mureş, România, în perioada 19 martie – 20 iulie 2018, pe un eşantion format din 11 subiecţi de gen feminin şi 13 subiecţi de sex masculin, activând în competiţii la nivel naţional. În vederea determinării aportului şi preferinţelor alimentare, am aplicat un chestionar format din 19 întrebări şi un jurnal alimentar desfăşurat pe parcursul a 5 zile.

Rezultate. Au fost identificate diferenţe semnificative din punct de vedere statistic între vârsta înotătorilor şi consumul crescut de produse procesate de origine animală (p=0.014, r=0.4947, CI=0.1014 to 0.7542) şi consumul de dulciuri (p=0.0425, r=-0.4173, CI=-0.7088 to 0.003916) atât în cadrul micului dejun, cât şi la prânz. S-a constatat o creştere a consumului în rândul produselor rafinate şi al dulciurilor în cadrul gustărilor (p=0.0305, r=0.4422, CI=0.03446 to 0.7237). Au fost identificate asocieri semnificative din punct de vedere statistic între vârsta sportivilor şi consumul de fructe, atât înainte (p=0.0207, r=0.4693, CI=0.06862 to 0.7396), cât şi după finalizarea şedinţei de pregătire (p=0.007, r=0.5356, CI=0.1562 to 0.7773).

Concluzii. Activitatea fizică este influenţată din punct de vedere energetic prin creşterea percepţiei gradului de dificultate a şedinţei de pregătire din cauza unui aport alimentar inadecvat înaintea efortului fizic. Necesitatea dezvoltării unui plan alimentar în rândul sportivilor pe parcursul diferitelor perioade de pregătire din cadrul unui sezon este confirmată prin rezultate.

Cuvinte cheie: înot, aport alimentar, preferinţe alimentare, vârstă

Received: 2018, July 2; *Accepted for publication:* 2018, July 20
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https://doi.org/10.26659/pm3.2018.19.3.176

Introduction

Nutritional background is an effective factor regarding adolescent swimmers' physical activity and development. Alongside the nutritional scheme, different parameters such as the daily training schedule, training period and intensity of physical effort will dictate swimmers' evolution (Papadopoulou et al., 2002; Mujika et al., 2014).

Nutritional support for competitive swimming will represent a critical element of the athlete's preparation in order to meet daily energy and nutrient demands as a result of the specific sporting activity. Thus, swimmers' schedule requires rigorous training and practice in order to develop biomechanical and physiological skills specific to aquatic sports (Pyne et al., 2014). Swimming is a sport that aims to develop both the aerobic and anaerobic capacity in order to increase strength and technical efficiency in athletes. Therefore, physical performance can be optimized with an adequate meal plan that includes a proper macronutrient distribution, as well as with a hydration plan and periodization of supplements (Domínguez et al., 2017). Moreover, these features can provide a favorable impact on swimmers' performances as described by Stellingwerff et al. (2014). However, adolescent and youth swimmers are advised to adapt their food intake towards a well-planned menu in order to enhance training performance. Sufficient energy will have to be provided through food intake, otherwise swimmers might develop energetic and micronutrient deficiencies during growth and development periods (Shaw et al., 2014).

Swimmers' food intake will be fulfilled according to the macro-cycle training periodization. Food ingestion will be adapted to every training period requirement (Shaw et al., 2014; Pyne et al., 2014).

Particularly, swimmers are advised to adapt their menu according to the training and the physical effort structure (Trakman et al., 2016). A dense nutrient food intake will fulfill both the athletes' quality and quantity nutritional requirements. As a result, the composition and the structure of the menu will overcome swimmers' energy requirements in both physical development phases, having a direct impact on the general physical activity (Shaw et al., 2014).

Hypothesis

Based on our hypothesis, negative nutritional habits can affect sports performance. Our main objective is to identify the nutritional knowledge of swimmers with active participation in national competitions in order to assess a relationship between nutrition practice, knowledge and effort perception.

Material and methods

Research protocol

A cross-sectional study was conducted after obtaining the written consent of the legal tutors of the subjects.

a) Period and place of the research

The study was conducted in Târgu Mureş, Romania, between March-May 2018.

b) Subjects and groups

The study group was formed by 24 subjects, of which 11 females and 13 males. Both groups were active participants in regional and national competitions. Data usage was obtained by written approvals of the legal guardians of the subjects.

c) Tests applied

The analyses were performed during the general training cycle of the swimmers. The inclusion criteria were: healthy subject who signed up for the swimming club, with a reported age between 7 and 14 years. The athletes who did not participate in at least 3 swimming practices during the analysis week were excluded.

Food questionnaire development

Data extraction was conducted through a 19-item multiple choice questionnaire. Also, a food diary was completed by athletes in order to identify food ingestion over a 5 day period. The main purpose of the questionnaire was to identify swimmers' food intake and preferences. Through the food diary we followed the predominant food choices of the swimmers according to the daily training schedule. Within the food questionnaire, data regarding the number of meals and snacks, along with liquid ingestion were incorporated. Pre- and post-training information about food intake and food content was extracted.

Physical exercise data monitoring

Exercise activity, such as daily training session difficulty and physical stress level, was individually reported. A characterization scale was used, by applying values between 1, which represented the minimum effort difficulty, and 5, which represented the maximum effort difficulty, in order to characterize physical effort. The data regarding swimmers' training sessions, including total effort time (minutes) and total swim distance (meters), were monitored as well.

Anthropometric analysis

Through anthropometric measurements we identified the athletes' height (m), determining weight (kg) and the body mass index (BMI) using an Omron BF511 (Kyoto, Japan) body composition scale.

d) Statistical processing

The statistical analyses were performed using GraphPad Prism 6.0 software. We used mean values, median values and standard deviations to describe our data. Data normalization was done with the D'Agostino-Pearson normality test. We used the Spearman rank correlation test and Wilcoxon matched pairs test to analyze a possible association between two items or a difference in evolution. The confidence test was set at 95%, so a p value lower than 0.05 was considered significant.

Results

Through the anthropometric analysis, we identified a median of 1.39 m height (between 1.32 m and 1.61 m) and 32.7 kg body weight (between 27.2 kg and 48.2 kg). The median BMI value of swimmers was 16.95, with a minimum of 14.4 and a maximum of 20.7.

Training analysis

Physical stress, reported by subjects as fatigue, was associated with a higher swimming session difficulty ($p=0.007$, $r=0.5352$, 95%CI=0.1557 to 0.7770).

Statistical data showed significant associations between daily training sessions and different food intake ($p=0.0078$). The conducted swimming sessions lasted 90 minutes. In association with the physical effort, while the median value provided a number of 6 swimming sessions (between 4 and 10), during the micro-cycle training,

swimmers' food choices changed. The increased number of swimming sessions during a week (6) was significantly associated with an elevated intake of cereals represented by white bread (p=0.0078). However, we did not identify any associations between the median number of swimming sessions and an increased intake of pastry products, oleaginous plants or fruits, as shown in Table I.

Table I
Statistical associations regarding weekly training sessions and the studied parameters

	Weekly swimming sessions (6)				
Reported data	Bread	Pastry products	Nuts	Peanuts	Fruits
p	0.0078	0.0143	0.0294	0.0294	0.01
r	0.5297	-0.4934	-0.4448	-0.4448	-0.5148
95%CI Lower	0.1482	-0.7535	-0.7252	-0.7252	-0.7657
95%CI Upper	0.7740	-0.0997	-0.0376	-0.0376	-0.1281

Breakfast

Through the obtained results, the predominant food products consumed during breakfast were represented by "dairy products" (66.6%), "refined cereals" (66.6%) and "eggs" (41.6%). Within this meal, food products with a high processing rate such as precooked meat products (62.5%) and white bread (58.3%) were identified.

By analyzing breakfast composition, we found significant correlations between athletes' age, processed meat products intake (p=0.014) and white bread intake (p=0.0497), as shown in Table II.

Table II
Statistical correlations between athletes' age and food consumption during breakfast

	Breakfast				
Reported data	Processed meat products	Bread	Cereals	Dairy products	Eggs
p	0.014	0.0497	0.4658	0.9038	0.1747
r	0.4947	0.4048	-0.1563	-0.02605	0.2865
95%CI Lower	0.1014	-0.01107	-0.5357	-0.4354	-0.1447
95%CI Upper	0.7542	0.7013	0.2755	0.3922	0.6262

Lunch

Swimmers' food intake, during lunch, was predominantly based on soups (95.8%) and animal products such as meat (95.8%). Also, food intake was completed by vegetables such as carrots, pumpkins, broccoli, green peas and tomatoes, steamed potatoes or pasta.

Increased refined products consumption, such as sweets and simple carbohydrates (chocolate, biscuits, cakes, jams and pastry products) at the lunch meal was correlated with athletes' age (p=0.0425) according to Table III.

Table III
Statistical correlations between age and food consumption during lunch meal

	Lunch				
Reported data	Sweets/simple CHO	Steamed/ mashed potatoes	Soups	Meat	Pasta
p	0.0425	0.0455	0.3128	0.4735	0.4388
r	-0.4173	-0.4119	-0.2151	0.1536	-0.1658
95%CI Lower	-0.7088	-0.7056	-0.5777	-0.2781	-0.5426
95%CI Upper	0.0039	0.0025	0.2184	0.5337	0.2665

Snacks

Athletes' secondary food intake was predominantly represented by processed meat products (45.8%) and white bread (75%). Also, dairy products such as cheese or melted cheese (37.5%) and high saturated fat products, such as pastry (54.1%), were consumed as daily snacks. Nutritive products with a high level of unsaturated fats, such as oleaginous products including nuts, almonds or peanuts, had a low consumption percentage (4%).

Snacks intake showed a significant statistical association between the increased consumption of refined products, sweets (p=0.0305) and the increased age of swimmers (r=0.4422, 95%CI=0.03446 to 0.7237), according to Table IV.

Table IV
Statistical associations between swimmers' age and food consumption during snacks

	Snacks				
Reported data	Refined products	Seeds	Nuts	Fruit juices	Fruits
p	0.0305	0.9432	0.9432	0.4364	0.8831
r	0.4422	0.01536	0.01536	0.1666	0.03171
95%CI Lower	0.03446	-0.4012	-0.4012	-0.2657	-0.3874
95%CI Upper	0.7237	0.4267	0.4267	0.5432	0.4400

Dinner

Athletes' food intake during dinner was predominantly based on red and white meat (50%), white bread (66.6%) and processed meat products such as cold cuts (58.3%). Alongside those foods, dinner included butter (50%), vegetables (41.6%) and yogurts (41.6%).

Regarding athletes' dinner intake (p>0.05), we could not identify correlations between any specific products and swimmers' age (Table V).

Table V
Statistical associations between swimmers' age and dinner food intake

	Dinner				
Reported data	Meat	Pasta	Rice	Vegetables	Dairy products
p	0.1283	0.6926	0.4885	0.6225	0.9531
r	-0.3193	-0.08509	-0.1485	-0.1059	-0.01268
95%CI Lower	-0.6477	-0.4821	-0.5300	-0.4981	-0.4245
95%CI Upper	0.1091	0.3409	0.2829	0.3223	0.4035

The extracted data highlight significant statistical associations between athletes' age and food choices. Older age was associated with an increased consumption of dairy products (p=0.038), but was not correlated with a high intake of chips (p=0.0349). According to Table VI data, the conducted analyses evidenced significant statistical associations between the age of the subjects and an increased fruit intake, both before and after the training session. According to Table VII, athletes' food preferences were identified.

Table VI
Statistical associations regarding athletes' age and fruit intake

	Fruit intake	
Reported data	Before the swimming session	After the swimming session
p	0.0207	0.007
r	0.4693	0.5356
95%CI Lower	0.06862	0.1562
95% CI Upper	0.7396	0.7773

General food intake

Table VII
Food intake summary in the study group

Food	Many times/ day (%)	Daily (%)	Few times/ week (%)	Rarely/never (%)
Milk	25	45.8	25	4
Yoghurt	4	25	45	20
Fruit yoghurt	0	25	12.5	5
Kefir	4	8	12.5	75
Cheese/Melted cheese/ Cottage cheese	12.5	50	25	12.5
Butter	16.6	37.5	33	12.5
Margarine	4	8	29	58
Liver pate	4	8	33	54
Pork meat	0	16	37.5	45
Beef meat	0	8	12.5	79
Chicken meat	0	25	70	4
Sausages	0	12.5	41	45
Bacon	0	12.5	16.6	66.6
Meat based processed products	16.6	54	25	4
Fish	0	0	50	45.8
Eggs	0	20	62.5	16.6
Bread	50	37.5	12.5	0
Cereals	4	37.5	54.1	4.1
Refined cereals	4.1	33.3	45.8	16.6
Rice	0	12.5	58.3	29.1
Pasta	0	4.1	54	41
Pastry products	0	37.5	45.8	16.6
Sun flower seeds	0	4.1	37.5	58.3
Pistachio	0	0	33.3	62.5
Peanuts	0	12.5	29.1	58.3
Chips	0	0	29.1	70.8
Biscuits	0	29.1	45.8	25
Carrots/pumpkins/ potatoes/vegetables	8.3	58.3	33.3	0
Fruits	20.8	66.6	12.5	0
Oranges/bananas/ apples/kiwis	12.5	62.5	25	0
Fruit and vegetable juices	0	4.1	45.8	45.8
Popcorn	0	8.3	33.3	58.3
Nuts	0	8.3	29.1	62.5
Fried chips	0	0	58.3	41.6
Pizza	0	4.1	29.1	66.6

Daily water intake (1.25 l) was significantly associated with the swimmers' age (p=0.0089, r=0.5217, 95%CI=0.1373 to 0.7695) and also with the number of daily meals (p=0.0081, r=0.5271, 95%CI=0.1447 to 0.7725). According to the obtained results, it can be noted that athletes' liquid intake was not correlated with the anthropometric parameters (p>0.05) and the number of daily snacks (p>0.05), Table VIII.

Table VIII
Statistical associations between daily water intake and the analyzed parameters

Daily water intake (1.25 l)					
			Anthropometric parameters		
Reported data	Age (10 years old)	Meals/day (3)	Height (1.39 m)	Weight (31.7 kg)	Snacks/ day (2)
p	0.0089	0.0081	0.1594	0.1843	0.8492
r	0.5217	0.5271	0.2965	0.2805	-0.04099
95%CI Lower	0.1373	0.1447	-0.1339	-0.1511	-0.4474
95%CI Upper	0.7695	0.7725	0.6328	0.6223	0.3795

Discussions

During physical training periods, a slight change in macronutrient distribution can be seen according to Pyne & Sharp (2014). Alongside reaching proper energy requirements, the athletes can maintain their physical activity at a top level, ensuring optimal body development. Therefore, the recovery process of swimmers will take place properly, without facing energetic issues (Pyne et al., 2014; Smith et al., 2016).

General food intake

Food intake and timing in the case of athletes will include meals and snacks distribution during daily physical activity, meeting both macro and micronutrient requirements. Young athletes, such as children and youth swimmers, will need to take care of physical development energy requirements, alongside the energy expenditure of the specific physical activity dictated by effort intensity and total training time (Unnithan et al., 2004). The hydration status of the athletes involved in competitions will be monitored in order to recover the sensitive and insensitive fluid losses and electrolyte deficiency (Petrie et al., 2004). However, swimmers will need to learn the defining elements of specific nutritional terms in order to improve physical performances. From a practical standpoint, these are defined as the choice of the proper food or dishes and timing of their ingestion during the training sessions, as well as before and after them (Purcell, 2013). Swimmers' food choices will indicate their capacity to meet the nutritional requirements in order to recover after the physical effort.

Breakfast

According to our results, swimmers' food intake at breakfast was predominantly based on processed foods such as precooked meat products (62.5%) and white bread (58.3%), dairy products (66.6%) and refined cereals (66.6%). Many scientific papers highlight the fact that consumption of high nutritional value foods such as whole grains, fruit juices and dairy products will satisfy the daily energetic requirements by achieving macronutrient balance, as stated by O'Neil et al. (2015) and O'Neil et al. (2014).

Snacks

In our study group, two daily snacks were reported by the athletes. Some similarities were mentioned by Burke et al. (2003) in a paper where athletes had three meals and two snacks during an ordinary training day. The chosen food for snacks, selected by athletes, was represented by sources higher in simple carbohydrates and lower in protein and fat, such as sports drinks and bars, similarly to Burke et al. (2003).

Lunch

Based on the obtained results, the athletes tended to consume refined products and foods rich in carbohydrates at lunch. According to the hypothesis that energy demand is predominantly overcome by refined food intake, athletes should reconsider daily food ingestion towards products with a high amount of nutrients and a low processing rate (Ward et al., 2017; Chacko et al., 2018).

Dinner

In our study group, the athletes tended to have a rich protein and carbohydrate meal at dinner. Thus, swimmers' food intake was based on animal and dairy products (milk, yoghurt, cheese) alongside vegetables. Such similarities are presented by Carlsohn et al. (2012) in a study on athletes who gained most of the macronutrients during the main meals of the day. However, even if in our study group no statistical correlations between the studied parameters

and dinner intake were identified, swimmers still need to minimize their intake of precooked meat products and white bread in order to meet the nutritional requirements and to recover after physical effort.

Conclusions

1. The daily food intake of athletes was represented by fruits (66%), vegetables (58%) and dairy products (45%). In addition to these, swimmers chose to eat different refined foods, such as meat-based processed products (54%) and pastry (37.5%).

2. According to our results, young swimmers preferred to eat refined products during daily snacks. An important element in swimmers' choices regarding highly nutritional daily food intake is represented by their age. However, older age in the case of athletes did not provide a positive background regarding nutrient dense food choices, such as whole grains, dairy products or fruits at breakfast.

3. Swimmers showed a slightly increased tendency to consume refined and processed foods, having a low daily intake of whole grains, which represents an inadequate aspect of the general physical activity.

Conflicts of interest

There are no conflicts of interest regarding the study group, methodology, results and conclusions drawn.

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