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ORIGINAL ARTICLE

ANALYSIS OF THE CHOICE OF FOOD PRODUCTS AND THE ENERGY VALUE OF DIETS OF FEMALE MIDDLE- AND LONG- DISTANCE RUNNERS, DEPENDING ON THE SELF-ASSESSMENT OF THEIR NUTRITIONAL HABITS

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ABSTRACT

Background. Properly balanced diet is especially important in the case of young athletes, as it influences not only their physical development, but also influences results obtained during trainings and competitions.

Objective. The aim of the study was to assess the choice of food products and the energy value of diets of female middle- and long-distance runners, depending on the self-assessment of their nutritional habits.

Material and methods. The study was conducted in the group of 40 female middle- and long-distance runners, aged 15-25, who declared average diet (n=15, 37.5%) or outstanding diet (n=25, 62.5%). Participants conducted three-day dietary record of the consumed dishes and drunk beverages, that was based on the self-reported data. The choice of products, the energy value of diets as well as macronutrients intake were compared depending on the self-assessment of the nutritional habits.

Results. Runners declaring outstanding diet were characterized by significantly lower intake of dairy beverages, than runners declaring average diet (p=0.0459), but simultaneously, by higher intake of mushrooms (p=0.0453). No difference of energy value of diets was stated between groups of runners depending on the self-assessment of their nutritional habits. Runners declaring outstanding diet were characterized by significantly lower intake of lactose, than runners declaring average diet (p=0.0119), but simultaneously, by higher intake of cholesterol (p=0.0307).

Conclusions. The female middle- and long-distance runners analysed in the presented study do not assess the quality of their diet reliably, so they probably do not have the sufficient nutritional knowledge. There is a need to implement nutritional education among professional runners and their coaches, in order to improve the quality of diet of professional runners and, as a results maybe also to improve their sport results.

Key words: *female runners, young women, diet, energy value, choice of food products*

STRESZCZENIE

Wprowadzenie. Prawidłowo zbilansowana dieta jest szczególnie istotna w przypadku młodych sportowców, jako że wpływa nie tylko na ich rozwój fizyczny, ale także na ich wyniki osiągane na treningach, czy zawodach.

Cel. Celem badań była analiza wyboru produktów spożywczych oraz wartości energetycznej diety młodych biegaczek średnio- i długodystansowych, w zależności od ich samooceny sposobu żywienia.

Materiał i metody. Badanie przeprowadzono w grupie 40 biegaczek średnio- i długodystansowych, w wieku 15-25 lat, które deklarowały przeciętny sposób żywienia (n=15, 37,5%) lub dobry sposób żywienia (n=25, 62,5%). Uczestniczki wykonały 3-dniowe bieżące notowanie spożycia. Dobór produktów, wartość energetyczna diety oraz spożycie makroskładników zostały porównane w grupach zależnych od samooceny sposobu żywienia.

Wyniki. Biegaczki deklarujące dobry sposób żywienia charakteryzowały się istotnie niższym spożyciem napojów mlecznych, niż te deklarujące przeciętny sposób żywienia (p=0,0459), ale równocześnie charakteryzowały się wyższym spożyciem grzybów (p=0,0453). Między porównywanymi grupami zależnymi od samooceny sposobu żywienia nie obserwowano różnic wartości energetycznej diety. Biegaczki deklarujące dobry sposób żywienia charakteryzowały się istotnie niższym spożyciem laktozy, niż te deklarujące przeciętny sposób żywienia (p=0,0119), ale równocześnie charakteryzowały się wyższym spożyciem cholesterolu (p=0,0307).

Wnioski. Biegaczki średnio- i długo-dystansowe z analizowanej grupy nie oceniają jakości swojej diety w sposób rzetelny, co sugeruje, że prawdopodobnie nie mają one dostatecznej wiedzy żywieniowej. Istnieje zatem potrzeba edukacji żywieniowej wśród profesjonalnych biegaczy i ich trenerów, która miałaby na celu poprawę jakości diet tych biegaczy, co w konsekwencji może także wpłynąć na poprawę ich wyników sportowych.

Słowa kluczowe: *biegaczki, młode kobiety, dieta, spożycie, wartość energetyczna, wybór produktów spożywczych*

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INTRODUCTION

Properly balanced diet is especially important in the case of young athletes [27]. It influences not only their physical development, but also results obtained during trainings and competitions [33]. It is indicated, that the choice of products consumed in specific meals may be crucial, as meals being high in fat may cause the delay of gastric emptying and, as a result may contribute to worse sport performance [11]. Moreover, in the case of the morning trainings, it is necessary to plan the early-morning snack before it and a regular breakfast after – in order to provide sufficient energy and carbohydrates intake [21].

In the case of male athletes no risk of insufficient intake is commonly stated [10], but in the case of women, the intake is often too low [18]. It is associated with higher intake in the case of male, than in the case of female, that results *inter alia* from decreased consumption due to desire to lose weight, that is common in the case of female athletes [17]. It is observed even in the case of teen athletes, as dietary restrictions are more common in the case of girl athletes, than boy athletes [7], while girl athletes are characterized by worse nutritional habits than boys [31] and they are indicated as a risk group of eating disorders development [28].

On the one hand, low intake observed in the female athletes is associated with common under-reporting [6]. However, on the other hand, even if energy value of diet is on the recommended level, the diet is often not properly balanced and the intake of micronutrients is too low [8, 15]. Common supplements applying causes, that the symptoms of deficiencies are not observed [3], but in Poland supplements are applied mainly by male athletes [14]. However, the excessive use of supplements is other problem in the nutrition of athletes, as they apply supplements without consultation with a sport nutrition specialist and without understanding the possible risk of too high intake of nutrients [22].

Taking into account the insufficient nutritional knowledge, the need of education is commonly emphasized [26], as it may allow to obtain the positive dietary changes [1]. However, unless the athletes are aware of the need for the diet improvement, as they perceive their nutritional habits as satisfying, the education may not be sufficient.

The aim of the study was to assess the choice of food products and the energy value of diets of female middle- and long-distance runners, depending on the self-assessment of their nutritional habits.

MATERIAL AND METHODS

The study was conducted according to the guidelines laid down in the Declaration of Helsinki and it was approved by the Bioethical Commission of the National Food and Nutrition Institute in Warsaw (No. 0701/2015). The invitation to participate in the study, as well as information about inclusion criteria were distributed among young female middle- and long-distance runners, practicing in 20 Polish sport running clubs. The middle- and long-distance runners were not divided into two groups, due to the fact, that because of the characteristics of the training, female athletes in Poland participate both in middle- and long-distance running competitions.

Inclusion criteria were: women, taking part in the national middle- and long-distance running competitions, not being pregnant and during lactation, without any chronic diseases diagnosed, written informed consent to participate. The number of 40 individuals, aged 15-25 years, that were meeting the inclusion criteria, volunteered to participate in the study.

Participants were asked to fill out the questionnaire, answering questions associated with *inter alia* their training and self-assessment of their nutritional habits. They were able to indicate, that their diet is: extremely outstanding (very good nutritional habits), outstanding (good nutritional habits), average (neither good nor bad nutritional habits), unsatisfactory (bad nutritional habits), extremely unsatisfactory (very bad nutritional habits). In the analysed group of 40 athletes, 15 (37.5%) declared average diet and 25 (62.5%) declared outstanding diet. The declared self-assessment of their nutritional habits was the basis of the further analysis.

Participants conducted three-day dietary record of the consumed dishes and drunk beverages, that was based on the self-reported data. The record was to be conducted, using a structured format, during three typical random not following days (2 weekdays and 1 weekend day). To provide reliable estimates of food intake, the additional questions about name of the meal, time and location of consumption, meal ingredients and weight of serving (while weighted using kitchen scale) or size of serving (while estimated using standard household measures) was placed in the structured format, as is commonly applied [25]. Participants were instructed on the principles of conducting the dietary record, as well as on the necessity of accurate and scrupulous recording of all food products consumed and beverages drunk. Afterwards, the serving sizes were verified by a dietitian using the Polish food model booklet [32].

The typical daily energy and nutritional value of diets were assessed using the Polish dietician software "Dietetyk 2" (National Food and Nutrition Institute, 2001) and the Polish base of the nutritional value of the products [20]. The typical daily intake of food products were calculated, while the following groups were taken into account: dairy products (dairy beverages, cottage cheese, rennet cheese), eggs, meat and meat products, fish products, fats (butter, cream, oils, margarine), plant products (vegetables, legumes, fruits, potatoes), bread and other cereals, sugar, jam and honey, beverages (tea, coffee, alcoholic beverages, sweetened beverages), nuts

and seeds, mushrooms, sweets (chocolate sweets, cakes and cookies).

The obtained data are presented as means ± standard deviations (SD) with minimum, maximum and median values. The normality of distribution was verified using the *Shapiro-Wilk* test. To compare the intake between groups declaring various self-assessment of their nutritional habits, the t-*Student* test (for parametric distribution) and U *Mann-Whitney* test (for non-parametric distribution) were applied. The level of significance $p \leq 0.05$ was accepted, while the level of significance $p \leq 0.1$ was indicated as close to statistical signifficance. The statistical analysis was carried out using the Statistica software version 8.0 (StatSoft Inc).

RESULTS

The body mass of the recruited female individuals was 53.54 ± 5.90 kg (34-67 kg) and their Body Mass Index (BMI) was 19.44 ± 1.33 kg/ m^2 (16.55-21.67 kg/m^2), while 25% of individuals was characterized by BMI lower than 18.5 kg/m^2, and BMI was higher than 25 kg/m^2 for none of the recruited female middle- and long-distance runner.

Runner declared, that they have trainings 5-7 times a week, while 10% declared 5 times a week, 40% – 6 times a week, and 50% – 7 times a week. The typical training duration in the analysed group was 2 hours. The recruited female middle- and long-distance runners practiced running for 3-12 years, while mean duration of practicing running was 5.78 ± 2.31 years.

The daily intakes of products in diets of female runners characterized by various self-assessment of their nutritional habits are presented in Table 1. The comparison of choices of products revealed, that runners declaring outstanding diet were characterized by significantly lower intake of dairy beverages, than runners declaring average diet (p=0.0459), but simultaneously, by higher intake of mushrooms (p=0.0453).

The intakes of products in diets of female runners characterized by various self-assessment of their nutritional habits, recalculated per 1000 kcal of diet, are presented in Table 2. The comparison of choices of products revealed, similarly as for daily intakes, higher intake of mushrooms (p=0.0454) in diets of runners declaring outstanding diet, than for runners declaring average diet. However, the previously observed difference of dairy beverages intake was only close to statistical significance (p=0.0645).

The energy values of diets and macronutrients daily intakes in diets of female runners characterized by various self-assessment of their nutritional habits are presented in Table 3. No difference of energy value of diets was observed. The comparison of daily intake revealed, that runners declaring outstanding diet were characterized by significantly lower intake of lactose, than runners declaring average diet (p=0.0119), but simultaneously, by higher intake of cholesterol (p=0.0307).

The macronutrients intakes in diets of female runners characterized by various self-assessment of their nutritional habits, recalculated per 1000 kcal of diet, are presented in Table 4. The comparison of daily intake revealed, similarly as for daily intakes, lower intake of lactose (p=0.0204) in diets of runners declaring outstanding diet, than for runners declaring average diet. However, the previously observed difference of cholesterol intake was only close to statistical significance (p=0.0883).

DISCUSSION

The lack of nutritional knowledge is commonly indicated for athletes. However, especially important is the fact, that insufficient nutritional knowledge may be accompanied by insufficient nutritional intake. In the systematic review of *Heaney* et al. [16], it was indicated, that there may be a positive correlation between nutritional knowledge and dietary intake, but due to the lack of valid instruments to assess the knowledge, it is hard to conclude.

In this own study, the nutritional knowledge was not assessed directly, but the fact that respondents were asked to conduct self-assessment of their diet, allows to interpret if their nutritional knowledge is sufficient, or not. It must be supposed, that individuals declaring good nutritional habits are characterized by better nutritional value of diet, than others, and only in such situation it may be interpreted, that their nutritional knowledge is sufficient and self-assessment of dietary habits is reliable. It results from the fact, that in general, the association between nutritional knowledge, dietary habits and self-assessment of them is expected [19].

The association was observed in the study of *Hoogenboom* et al. [18] in the group of female collegiate swimmers, that in the simple true/ false test of nutritional knowledge scored 72%, while simultaneously majority of analysed group (96%) did not meet the recommended intake of macronutrients. It should be indicated, that while the simple true/ false test is applied, the assessed knowledge may be overestimated, due to the possibility of guessing among two potentially correct answers, so the conclusion, that swimmers did not know 28% of important nutritional information [18] may had been underestimated. Similarly, in the Polish study conducted in a group of teen athletes, it was observed, that a number of respondents was characterized by low level of nutritional knowledge, while the simple true/ false test was applied to assess, and low level of nutritional knowledge was related to the improper nutritional behaviors [13].

Table 1. Comparison of the choice of products in diets of female runners characterized by various self-assessment of their nutritional habits – the daily intakes presented for groups [g]

	Runners declaring average diet; n=15		Runners declaring outstanding diet; n=25		p-value**
	Mean±SD	Median (min.- max.)	Mean±SD	Median (min.- max.)	
Dairy beverages	270.0±93.1	250.0 (100.0-450.0)	192.0±127.0	200.0 (0.0-450.0)	0.0459
Cottage cheese	29.3±33.3	30.0* (0.0-100.0)	33.0±34.2	30.0* (0.0-100.0)	0.7915
Rennet cheese	15.3±15.2	15.0* (0.0-45.0)	15.6±12.4	20.0* (0.0-35.0)	0.9313
Eggs	16.1±22.0	0.0* (0.0-60.0)	24.8±25.8	20.0* (0.0-80.0)	0.1863
Meat	86.7±45.5	90.0 (0.0-160.0)	105.8±35.0	110.0 (40.0-180.0)	0.1431
Meat products	29.0±17.9	30.0 (0.0-60.0)	31.2±13.0	30.0* (15.0-60.0)	0.7326
Fish products	22.7±32.2	0.0* (0.0-90.0)	19.8±26.0	0.0* (0.0-80.0)	0.9876
Butter	2.5±4.5	0.0* (0.0-15.0)	4.2±5.6	0.0* (0.0-15.0)	0.4790
Cream	7.0±12.9	0.0* (0.0-45.0)	7.0±9.0	0.0* (0.0-25.0)	0.5910
Vegetables	247.3±86.7	260.0 (100.0-400.0)	229.4±75.4	220.0 (90.0-380.0)	0.4955
Legumes	10.7±23.7	0.0* (0.0-80.0)	12.2±16.8	0.0* (0.0-50.0)	0.3218
Fruits	305.0±135.1	265.0 (80.0-550.0)	286.0±80.0	295.0 (60.0-410.0)	0.5784
Potatoes	36.7±59.8	0.0* (0.0-150.0)	47.2±53.0	40.0* (0.0-190.0)	0.2754
Bread	108.0±64.3	100.0 (0.0-200.0)	117.4±50.7	120.0 (0.0-210.0)	0.6110
Other cereals	144.7±67.8	150.0 (40.0-250.0)	120.6±55.6	110.0* (40.0-210.0)	0.3070
Oils	5.5±5.0	5.0 (0.0-15.0)	6.6±4.4	6.0* (0.0-20.0)	0.4892
Margarine	2.3±3.5	0.0* (0.0-10.0)	2.2±3.6	0.0* (0.0-10.0)	0.9063
Sugar	3.7±5.8	0.0* (0.0-15.0)	5.1±6.0	5.0* (0.0-20.0)	0.3893
Jam and honney	11.0±15.3	0.0* (0.0-45.0)	12.4±11.3	10.0* (0.0-40.0)	0.3590
Tea	466.7±230.4	300.0* (200.0-750.0)	442.0±280.9	500.0* (0.0-750.0)	0.7210
Coffee	146.7±179.7	100.0* (0.0-500.0)	162.0±170.9	200.0* (0.0-500.0)	0.8252
Alcoholic beverages	0.0±0.0	0.0* (0.0-0.0)	16.6±46.9	0.0* (0.0-165.0)	0.1784
Sweetened beverages	186.7±184.6	150.0* (0.0-500.0)	182.0±199.9	200.0* (0.0-500.0)	0.9069
Nuts and seeds	10.7±14.4	0.0* (0.0-40.0)	7.0±8.8	7.0* (0.0-30.0)	0.9522
Mushrooms	0.0	0.0* (0.0-0.0)	6.0±9.4	0.0* (0.0-25.0)	0.0453
Chocolate sweets	24.0±29.4	0.0* (0.0-100.0)	25.6±17.9	30.0 (0.0-55.0)	0.4265
Cakes and cookies	43.0±41.0	50.0* (0.0-100.0)	38.8±33.8	35.0* (0.0-115.0)	0.7975

*- non-parametric distribution (verified using *Shapiro-Wilk* test; $p \leq 0.05$)

** - compared using t-*Student* test (parametric distribution) or U *Mann-Whitney* test (non-parametric distribution)

In the study of *Frederick & Hawkins* [12] conducted in groups of women characterized by various physical activity level – college-aged dancers, members of a college track team, nonathletic college women and postmenopausal women, it was stated, that the number of servings of high-calcium food products consumed was significantly correlated with nutritional knowledge level, as well as with attitude scores. However, in the same study it was indicated, that nutritional knowledge level and attitude scores were not correlated [12]. It may explain the fact, that in some studies the nutritional knowledge and nutritional intake are not associated, as it may result from the influence of attitude on the nutritional intake, that in some groups may be stronger, than the influence of nutritional knowledge.

In the presented own study, the nutritional knowledge of middle- and long-distance female runners must be assessed as insufficient. The self-assessed level of their nutritional habits was not reliable, as both choice of products in diets and nutritional value of diets were similar in the sub-groups of runners declaring outstanding diet and declaring average diet. Taking it into account, it must be concluded, that either runners declaring outstanding diet overestimated their nutritional habits, or runners declaring average diet underestimated their nutritional habits.

Among the studies indicating, that the risk of diet-related deficits may be independent from the nutritional knowledge, there is a study conducted in the group of young female athletes, assessed as susceptible and not susceptible to the Female Athlete Triad Syndrome (disordered eating, amenorrhea and osteoporosis combined observed in young female athletes due to dietary restrictions), in which the similar level of nutritional knowledge was observed [29]. The presented results indicate, that the nutritional education would be not enough to reduce the risk of Female Athlete Triad Syndrome, as the risk of the syndrome is independent from the nutritional knowledge. The results of own study indicate also, that declared nutritional knowledge or

Table 2. Comparison of the choice of products in diets of female runners characterized by various self-assessment of their nutritional habits, while recalculated per 1000 kcal of diet – the intakes per 1000 kcal presented for groups [g/ 1000 kcal]

	Runners declaring average diet; n=15		Runners declaring outstanding diet; n=25		p-value**
	Mean±SD	Median (min.-max.)	Mean±SD	Median (min.-max.)	
Dairy beverages	142.9±65.3	127.2 (44.7-298.3)	101.2±67.8	91.5 (0.0-229.8)	0.0645
Cottage cheese	15.4±17.9	14.9* (0.0-56.9)	17.5±18.2	16.2* (90.0-53.3)	0.7807
Rennet cheese	8.2±8.7	6.0* (0.0-25.0)	8.1±6.5	10.7* (0.0-18.5)	0.8416
Eggs	7.2±11.0	0.0* (0.0-35.5)	13.0±13.1	11.2* (0.0-42.7)	0.1553
Meat	45.8±29.8	40.2 (0.0-119.3)	55.3±19.1	59.3 (16.1-96.0)	0.2273
Meat products	14.6±8.7	13.2 (0.0-32.4)	16.6±8.3	13.7* (8.1-42.2)	0.7568
Fish products	11.2±16.2	0.0* (0.0-44.6)	10.5±14.4	0.0* (0.0-56.3)	0.9012
Butter	1.3±2.3	0.0* (0.0-6.6)	2.2±2.9	0.0* (0.0-7.9)	0.4999
Cream	3.8±7.2	0.0* (0.0-25.6)	3.5±4.6	0.0* (0.0-13.4)	0.6587
Vegetables	126.3±45.5	133.6 (43.6-240.5)	119.4±38.4	112.0 (41.3-193.3)	0.6102
Legumes	4.74±10.51	0.0* (0.0-35.2)	6.5±9.2	0.0* (0.0-28.1)	0.3828
Fruits	156.5±71.8	156.9 (44.4-285.9)	148.2±40.2	147.0 (32.1-210.4)	0.6394
Potatoes	19.6±31.9	0.0* (0.0-85.4)	24.2±27.8	20.2* (0.0-101.4)	0.3244
Bread	58.7±40.5	59.2 (0.0-134.2)	59.8±24.8	57.8 (0.0-101.5)	0.9119
Other cereals	78.1±42.2	87.1 (15.9-143.3)	64.3±33.3	55.5 (20.4-147.7)	0.2592
Oils	2.8±3.0	2.1* (0.0-11.2)	3.6±2.8	3.2* (0.0-14.1)	0.3538
Margarine	1.3±1.9	0.0* (0.0-5.1)	1.1±1.9	0.0* (0.0-5.4)	0.8667
Sugar	2.1±3.6	0.0* (0.0-11.2)	2.7±3.2	2.3* (0.0-10.5)	0.4264
Jam and honney	5.6±7.7	0.0* (0.0-23.1)	6.5±6.1	5.0* (0.0-21.1)	0.4240
Tea	241.9±123.2	214.6 (79.6-435.7)	229.6±149.4	255.2 (0.0-450.9)	0.7896
Coffee	76.1±91.8	59.2* (0.0-277.3)	81.3±86.6	96.4* (0.0-262.6)	0.7807
Alcoholic beverages	0.0±0.0	0.0* (0.0-0.0)	8.2±23.2	0.0* (0.0-84.2)	0.1784
Sweetened beverages	95.3±89.9	84.8* (0.0-269.7)	98.5±111.7	96.4* (0.0-292.4)	0.9768
Nuts and seeds	6.0±8.0	0.0* (0.0-19.8)	3.6±4.7	3.4* (0.0-17.2)	0.9168
Mushrooms	0.0±0.0	0.0* (0.0-0.0)	2.1±4.2	0.0* (0.0-13.5)	0.0454
Chocolate sweets	11.3±13.1	11.0* (0.0-39.8)	13.6±9.7	14.1 (0.0-29.2)	0.3013
Cakes and cookies	24.3±24.9	22.0* (0.0-67.1)	19.9±17.0	18.5* (0.0-61.4)	0.7330

*- non-parametric distribution (verified using *Shapiro-Wilk* test; $p \leq 0.05$)
** - compared using t-*Student* test (parametric distribution) or U *Mann-Whitney* test (non-parametric distribution)

nutritional habits of female athletes must be also verified, in order to assess the level properly.

As the frequency of Female Athlete Triad Syndrome and of elements of Female Athlete Triad Syndrome, among female athletes, is high [24], the possibility to overcome the trend of high frequency would be of a great value. However, it must be indicated that the main reason of the syndrome is the excessive dieting [30]. It may be associated with disordered eating and, while contributes to low body mass, it may cause also oligomenorrhea or amenorrhea and low bone mineral density, as other elements of Female Athlete Triad Syndrome [2].

In the analysed group of young female runners, the body mass of majority of analysed group was proper, as only 25% of individuals was characterized by BMI lower than 18.5 kg/ m^2. However, in the case of athletes that have planned intensive trainings (2 hours each day and even 7 times a week), a high share of muscle mass may be observed and fat mass share may be low. As a result, a proper body mass of majority of analysed women does not eliminate the risk of Female Athlete Triad Syndrome.

As in the presented study, the diet of young female middle- and long-distance runners was analysed, it also must be assessed taking into account the risk of development of Female Athlete Triad Syndrome. The energy value of diet did not differ between groups of runners declaring outstanding diet and declaring average diet (while it was analysed both in kcal and kcal per kg of body mass), so it may be indicated, that in the groups compared in own study, level of satisfying energy needs was similar, while similar level of under-reporting in groups was assumed. The similar level of protein, fat and carbohydrates in diet was also observed, as it also did not differ between groups declaring outstanding diet and declaring average diet (while it was analysed both in g and g per kg of body mass).

Table 3. Comparison of the energy value and macronutrients intakes in diets of female runners characterized by various self-assessment of their nutritional habits – the daily intakes presented for groups

	Runners declaring average diet; n=15		Runners declaring outstanding diet; n=25		p-value**
	Mean±SD	Median (min.- max.)	Mean±SD	Median (min.- max.)	
Energy value [kcal]	1986.2±333.6	1945.8 (1340.8-2510.9)	1934.3±224.4	1896.1 (1421.9-2490.6)	0.5590
Energy value [kcal/ kg of body mass]	37.63±4.56	38.45 (30.05-44.07)	35.66±4.67	35.79 (25.17-47.81)	0.2009
Total protein [g]	82.4±14.6	85.4 (58.6-111.2)	84.1±14.8	83.5 (51.8-122.7)	0.7236
Total protein [g/ kg of body mass]	1.58±0.29	1.64 (0.98-1.99)	1.56±0.35	1.47 (0.88-2.48)	0.8832
Animal protein [g]	51.6±13.8	52.0 (29.2-83.0)	52.6±14.2	50.5 (24.5-84.3)	0.8377
Plant protein [g]	31.0±4.9	31.1 (22.1-40.2)	30.9±6.1	30.0 (21.0-48.5)	0.9354
Energy from protein [%]	16.5±2.8	16.2 (12.8-22.6)	17.7±5.1	16.5* (12.0-37.3)	0.5025
Total fat [g]	66.8±17.8	63.1 (44.1-94.6)	70.2±14.2	70.1 (39.5-92.7)	0.5114
Total fat [g/ kg of body mass]	1.26±0.29	1.21 (0.79-1.66)	1.29±0.25	1.26 (0.81-1.74)	0.7859
Saturated fatty acids [g]	26.8±9.2	24.6* (14.5-38.1)	25.2±7.4	25.6 (10.4-36.8)	0.5668
Monounsaturated fatty acids [g]	26.7±6.7	25.6 (17.5-36.1)	25.9±6.1	24.5 (14.5-39.4)	0.7026
Polyunsaturated fatty acids [g]	12.1±4.0	12.0 (7.1-21.8)	13.8±7.5	12.0* (5.0-43.7)	0.5388
Cholesterol [mg]	226.6±65.5	248.6 (103.4-328.9)	322.6±157.1	276.9 (105.0-666.3)	0.0307
Energy from fat [%]	29.3±3.7	29.1 (22.9-34.5)	31.1±5.7	32.3 (18.7-40.9)	0.2661
Total carbohydrates [g]	287.9±53.4	304.5 (171.4-370.3)	269.5±50.8	259.7 (138.3-363.6)	0.2841
Total carbohydrates [g/ kg of body mass]	5.43±0.68	5.44 (4.23-6.61)	4.97±0.97	4.92 (2.45-6.99)	0.1131
Sucrose [g]	58.6±20.9	60.9 (12.5-85.5)	51.0±16.2	49.0 (21.2-88.8)	0.2032
Lactose [g]	19.6±7.8	17.0* (11.5-34.3)	13.5±6.5	12.7 (3.4-30.3)	0.0119
Starch [g]	137.9±31.6	138.7 (83.3-191.9)	133.5±34.5	129.1 (76.7-211.8)	0.6890
Fiber [g]	27.0±6.3	26.9 (12.8-39.3)	26.0±4.2	25.7 (17.8-36.1)	0.5235
Energy from carbohydrates [%]	54.2±4.4	53.2 (48.3-63.5)	51.1±5.8	51.4 (40.7-63.6)	0.0923

*- non-parametric distribution (verified using *Shapiro-Wilk* test; $p \leq 0.05$)

** - compared using t-*Student* test (parametric distribution) or U *Mann-Whitney* test (non-parametric distribution)

However, among observed differences between groups, the differences of dairy beverages intake and of lactose intake must be indicated. Difference of lactose intake must be interpreted as a consequence of the difference of dairy beverages intake, but except from dairy beverages intake and lower lactose intake in the group declaring outstanding diet, the calcium deficiency risk may be also supposed.

The typical intake of dairy beverages in a group of runners declaring outstanding diet was 192±127 g and it varied from 0 g to 450 g. At the same time, in a group of runners declaring average diet, it was 270±92 g and it varied from 100 g to 450 g. It may be stated, that not only lower general dairy beverages intake was stated in a group of runners declaring outstanding diet, but also, some of them did not consume dairy beverages at all.

The intake observed in the assessed group may be compared with the recommendations for athletes practicing at least 5 hours a week, as in the assessed group of female middle- and long-distance runners such per week duration of trainings was observed. The Swiss Food Pyramid for Athletes [5] indicates, that in the case of such training duration, the basic pyramid provides enough calcium and protein, so the additional servings of milk and dairy products are not needed. However, the recommended intake according to the basic pyramid – Food Pyramid of the Swiss Society for Nutrition [34] is significantly higher, than observed in the assessed group. According to the Food Pyramid of the Swiss Society for Nutrition, 1 serving of meat, fish, eggs, cheese or other source of protein should be consumed each day and in addition, 3 servings of milk or dairy products should be consumed each day, while 1 serving counterparts 200 g of milk. In such situation, the daily intake of dairy product should at least counterpart 600 g of milk. At the same time, in the assessed group, the daily intake of both cottage cheese (median of 30 g in both groups) and rennet cheese (median of 15 g in runners declaring average diet and 20 g in runners declaring outstanding diet) was also too low to contribute to the sufficient intake of dairy products.

The main observed differences between compared groups were associated with intake of dairy beverages and cholesterol, as the intake of mushrooms is the minor issue. In the case of cholesterol, important is the fact, that the higher intake was observed in the group of runners declaring outstanding diet (323±157 mg), than in a group of runners declaring average diet (227±65 mg), while it is well known, that cholesterol intake is perceived as a factor, that may contribute to cardiovascular diseases risk [4].

Table 4. Comparison of the macronutrients intakes in diets of female runners characterized by various self-assessment of their nutritional habits, while recalculated per 1000 kcal of diet – the intakes per 1000 kcal presented for groups

	Runners declaring average diet; n=15		Runners declaring outstanding diet; n=25		p-value**
	Mean±SD	Median (min.- max.)	Mean±SD	Median (min.- max.)	
Total protein [g/1000 kcal]	41.9±6.9	40.3 (31.6-56.3)	43.9±8.6	41.7 (29.6-62.5)	0.4591
Animal protein [g/1000 kcal]	26.2±6.5	25.2 (15.0-39.8)	27.4±7.5	25.5 (14.0-40.1)	0.6157
Plant protein [g/1000 kcal]	15.9±3.0	15.1 (12.3-23.6)	16.0±3.2	15.6* (12.0-25.9)	0.9221
Total fat [g/1000 kcal]	33.2±4.2	33.4 (25.8-38.9)	36.5±7.9	36.6 (21.1-60.5)	0.1144
Saturated fatty acids [g/1000 kcal]	13.5±4.1	12.2 (8.4-22.3)	13.0±3.6	13.7 (5.6-19.7)	0.7354
Monounsaturated fatty acids [g/1000 kcal]	13.5±2.7	13.0 (9.8-20.3)	13.4±3.0	12.6 (7.6-21.0)	0.9882
Polyunsaturated fatty acids [g/1000 kcal]	6.1±1.5	5.8 (3.9-9.3)	7.4±5.4	5.8* (2.9-30.7)	0.6957
Cholesterol [mg/ 1000 kcal]	114.1±27.5	117.8 (53.1-147.3)	170.5±90.5	143.3* (55.1-400.6)	0.0883
Total carbohydrates [g/1000 kcal]	144.8±13.1	140.1 (127.9-166.9)	138.7±17.5	138.6 (97.3-181.7)	0.2688
Sucrose [g/1000 kcal]	29.1±9.6	30.6 (9.3-47.4)	26.4±8.3	25.5 (14.9-49.1)	0.3531
Lactose [g/ 1000 kcal]	10.0±4.2	9.2* (5.5-19.2)	7.2±3.8	6.7* (1.6-17.2)	0.0204
Starch [g/1000 kcal]	69.8±13.6	69.2 (47.4-95.1)	68.8±15.3	67.9 (42.3-107.2)	0.8553
Fiber [g/ 1000 kcal]	13.6±2.7	13.1 (9.6-19.1)	13.5±2.4	13.3 (9.4-18.1)	0.9110

*- non-parametric distribution (verified using *Shapiro-Wilk* test; $p \leq 0.05$)

** - compared using t-*Student* test (parametric distribution) or U *Mann-Whitney* test (non-parametric distribution)

As a result, it may be indicated, that group of runners declaring outstanding diet was actually characterized by not better, but worse diet, than runners declaring average diet, so the issue of worse diet accompanied by higher assessment of own diet must be emphasized. The result observed for dairy beverages are in contradiction to the previously mentioned results of the study of *Frederick & Hawkins* [12] observed for high-calcium food products, as in the compared studies the higher intake of similar groups of products was associated either with higher or with lower nutritional knowledge level.

However, the issue of the self-assessment of nutritional knowledge appears, as the assessed runners may had overestimated their actual level of knowledge. Moreover, the lower dairy beverages intake in the case of individuals assessing their own diet as outstanding may be associated with common misunderstanding of the lactose-intolerance issue and false perceiving lactose as a harmful factor, that is indicated for ages in Western countries [23]. Both indicated above potential reasons of the observed situation, emphasize the need for the nutritional education in the group of professional runners and their coaches.

Moreover, it must be indicated, that in the study of *Czaja* et al. [9], while the nutritional habits of Polish middle- and long-distance runners were analysed over ten years ago, the similar observations were indicated, as it was stated, that a diet of runners was not properly balanced and not properly planned for athletes. In the indicated study it was also concluded, that properly planned education is essential [9], but now, it must be emphasized, that ten years after, the observations are similar.

CONCLUSIONS

1. The female middle- and long-distance runners analysed in the presented study do not assess the quality of their diet reliably, so they probably do not have the sufficient nutritional knowledge.
2. There is a need to implement nutritional education among professional runners and their coaches, in order to improve the quality of diet of professional runners and, as a results maybe also to improve their sport results.

Conflict of interest

The authors declare not conflict of interest.

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