

## SECTION – VARIA

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## CONSUMING SELECTED GROUPS OF PRODUCTS AMONG POLISH AND SPANISH PHYSICAL EDUCATION STUDENTS WITHIN THE CONTEXT OF THE ASSUMPTIONS PROPOSED BY THE MEDITERRANEAN DIET

**Authors' contribution:**

- A. Study design/planning
- B. Data collection/entry
- C. Data analysis/statistics
- D. Data interpretation
- E. Preparation of manuscript
- F. Literature analysis/search
- G. Funds collection

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**Keywords:** food consumption, physical education students, geographical and cultural determinants of food choices

**Abstract:**

**Introduction:** Nutritional behaviour is determined by individual and environmental factors.

**Aim:** The aim of the study was to analyse the frequency of consuming selected groups of food products within the context of the recommendations proposed by the Mediterranean diet model, depending on the country of residence: Polish vs. Spanish physical education students.

**Material and methods:** Research was carried out among 219 Polish and 280 Spanish students, using the standardised KOMPAN questionnaire. In the statistical analysis, the chi-square test was used, at the  $\alpha=0.05$  level of statistical significance.

**Results:** Nutritional mistakes of the general population were related to the low frequency of consuming: fruit, vegetables, wholemeal bread and other whole grains, fermented dairy products and vegetable oils, and the relatively frequent consumption of red meat, processed meat products and confectionery. Among the Polish students, significantly more frequent consumption of some products recommended in the Mediterranean diet (fruit, vegetables and wholegrain cereal products) as well as poultry meat was noted, but also more frequent consumption of sweets and confectionery products ( $p<0.001$ ). The Spanish students significantly more often consumed the recommended dishes with legume seeds and sea fish ( $p<0.001$ ), but also non-recommended products - red meat and fast food ( $p<0.01$ ).

**Conclusions:** Among Polish and Spanish physical education students, the assumptions of the Mediterranean diet were implemented to a limit extent, while depending on the country of residence, their differentiation was demonstrated.

## Introduction

A rational diet, taking individual characteristics such as age, sex, level of physical activity and physiological condition into account, is one of the important factors in maintaining health and preventing chronic illness, including those related to metabolic, cardiovascular and cancerous diseases. A proper nutritional model requires a varied and balanced diet, including foods with high nutritional density (vegetables and fruits, whole grain cereal products, dairy products with reduced fat content, sea fish, vegetable oils and nuts), with a reduction of refined grain products, red meat, processed meat products, animal fats and confectionery, sweetened beverages and fast food products [1]. The rational model of nutrition, as an important determinant of health, is illustrated by food pyramids, including the Polish Pyramid of Physical Activity and Healthy Nutrition from 2016 and the Spanish Strategy for Nutrition, Physical Activity and the Prevention of Obesity from 2008 [2].

One of the healthiest nutritional models is the Mediterranean diet, which is mainly based on plant products: vegetables, fruits, low-mill grains, legumes, olive oil, nuts and seeds. The traditional Mediterranean diet involves moderate consumption of dairy products (yoghurts and cheeses), sea fish and white meat as well as red wine with meals, and limited consumption of meat and animal fats as well as salty and sweet snacks. However, it should be noted that the Mediterranean diet has many variants. It is characterised by high health values, related to e.g. a high supply of antioxidants (vitamins C, E, carotenoids and polyphenols), dietary fibre and unsaturated (including monounsaturated) fatty acids, with a limited supply of saturated fatty acids, cholesterol and trans isomers. In this context, the Mediterranean diet is an important factor in the prevention of chronic diseases, including metabolic syndrome (obesity, disorders of carbohydrate and lipid metabolism) and its complications, as well as neoplastic diseases [3-11].

A group having special nutritional needs are people representing increased physical activity, including athletes [12] and students of physical education, who are characterised by a significantly higher level of physical activity than students of other faculties [13-15]. The interest in this population group is also related to the role of physical education students (future teachers) in the implementation of school health education [16]. In research, it has been confirmed that the intensification of pro-health attitudes among teachers increases the effectiveness of educational interactions, including promoting a healthy lifestyle and rational nutrition [17].

Within the context of increased physical activity among physical education students and their educational profile, oriented towards physical and health cul-

ture and preparation for their future professional role of health educators of children and adolescents, assuming the geographical and cultural differentiation of eating behaviours, research was undertaken with regard to the food choices of Polish and Spanish physical education students. The aim of the study was to analyse the frequency of consuming selected groups of food products within the context of the recommendations proposed by the Mediterranean diet model and depending on the country of origin: Polish vs. Spanish physical education students.

## Materials and methods

Research was carried out 2017-2019 among 499 physical education students, aged 18 to 35 ( $21.65 \pm 2.42$ ), in the second and third years of B.A. studies (bachelor's degree). The study included 219 Polish students (University of Physical Education in Kraków,  $n=135$  and University of Physical Education in Wrocław,  $n=84$ ) and 280 Spanish students (University of Murcia, Faculty of Sports Sciences,  $n=127$  and University of Granada, Faculty of Sports Sciences,  $n=153$ ).

In the study, a standardised questionnaire was used to study the views and eating habits of individuals aged 16 to 65 (Kom-PAN), developed by the Human Nutrition Science Committee of the Polish Academy of Sciences, with regard to the part concerning the frequency consuming selected food groups. This frequency was assessed on an ordinal scale: never (1), 1-3 times a month (2), once a week (3), several times a week (4), once a day (5), several times a day (6) [18].

The IBM SPSS 21 program and the J.T. Newsom's macro were used for statistical calculations. Differentiation regarding the frequency of consuming food products depending on the country of students' residence was assessed using the chi-square test ( $\chi^2$ ), along with multiple comparisons for proportions that were marked in the percentage tables with the letters a and b, assuming the statistical significance level of  $\alpha=0.05$ .

## Results

The surveyed physical education students consumed vegetables and fruit several times a week (approx. 35%), wholemeal bread 1-3 times a month (approx. 30%), and other whole grain cereal products and legume seeds several times a week (approx. 30%). Polish students, in a significantly greater percentage than those Spanish, consumed vegetables daily ( $p<0.001$ ), and fruit several times a week ( $p<0.001$ ). Spanish students ate wholemeal bread significantly more often, i.e. 1-3 times a month, while Polish students consumed this product several times a week ( $p<0.001$ ). Similar trends

applied to other whole grain cereal products ( $p=0.004$ ). Dishes prepared with legumes were significantly more often consumed by Polish students sporadically, while among Spanish students, several times a week and every day ( $p<0.001$ ) (Tab. 1).

The examined students consumed fermented dairy products, usually several times a week (approx. 37%), similarly to dishes from red meat (approx. 32%), cold-cuts (approx. 42%), dishes prepared from white meat (approx. 50%) and vegetable oils (about 34%). On the other hand, meals from sea fish were eaten once

a week (approx. 35%). Polish students consumed fermented dairy products several times a week and significantly more often than Spanish students ( $p<0.001$ ). Red meat dishes were consumed by Polish students (3 times a month) at a greater frequency than Spanish students, i.e. once a day ( $p<0.002$ ). Dishes from white meat were consumed by Spanish students more often, i.e. once a week, while by Polish students, several times a week ( $p<0.001$ ). Spanish students more often included sea fish in their meals (several times a week), while among Polish students, this rate was 1-3 times

**Table 1.** Frequency of consuming vegetables, fruit, wholegrain products and legume seeds among Polish and Spanish physical education students (percentage of respondents)

Products	Frequency	Total	Poland	Spain	$\chi^2$ and $p$
Vegetables	Never	8.4	1.8 <sub>a</sub>	13.6 <sub>b</sub>	$\chi^2(5) = 67.23$ $p < 0.001$
	1-3 times a month	7.6	1.4 <sub>a</sub>	12.5 <sub>b</sub>	
	Once a week	11.6	6.8 <sub>a</sub>	15.4 <sub>b</sub>	
	Several times a week	35.9	41.1 <sub>a</sub>	31.8 <sub>b</sub>	
	Once a day	19.0	25.1 <sub>a</sub>	14.3 <sub>b</sub>	
	Several times a day	17.4	23.7 <sub>a</sub>	12.5 <sub>b</sub>	
Fruit	Never	10.6	0.5 <sub>a</sub>	18.6 <sub>b</sub>	$\chi^2(5) = 51.78$ $p < 0.001$
	1-3 times a month	5.6	3.7 <sub>a</sub>	7.1 <sub>a</sub>	
	Once a week	11.0	10.5 <sub>a</sub>	11.4 <sub>a</sub>	
	Several times a week	35.1	44.3 <sub>a</sub>	27.9 <sub>b</sub>	
	Once a day	19.6	22.4 <sub>a</sub>	17.5 <sub>a</sub>	
	Several times a day	18.0	18.7 <sub>a</sub>	17.5 <sub>a</sub>	
Wholemeal bread	Never	10.0	7.3 <sub>a</sub>	12.1 <sub>a</sub>	$\chi^2(5) = 38.57$ $p < 0.001$
	1-3 times a month	30.5	18.3 <sub>a</sub>	40.0 <sub>b</sub>	
	Once a week	13.6	17.8 <sub>a</sub>	10.4 <sub>b</sub>	
	Several times a week	27.5	36.1 <sub>a</sub>	20.7 <sub>b</sub>	
	Once a day	12.2	13.2 <sub>a</sub>	11.4 <sub>a</sub>	
	Several times a day	6.2	7.3 <sub>a</sub>	5.4 <sub>a</sub>	
Other wholegrain products (groats, oatmeal, wholegrain pasta)	Never	5.8	3.2 <sub>a</sub>	7.9 <sub>b</sub>	$\chi^2(5) = 17.32$ $p = 0.004$
	1-3 times a month	25.9	19.2 <sub>a</sub>	31.1 <sub>b</sub>	
	Once a week	22.2	25.1 <sub>a</sub>	20.0 <sub>a</sub>	
	Several times a week	31.5	36.5 <sub>a</sub>	27.5 <sub>b</sub>	
	Once a day	12.8	14.6 <sub>a</sub>	1.4 <sub>a</sub>	
	Several times a day	1.8	1.4 <sub>a</sub>	2.1 <sub>a</sub>	
Legume seeds	Never	9.6	10.0 <sub>a</sub>	9.3 <sub>a</sub>	$\chi^2(5) = 52.83$ $p < 0.001$
	1-3 times a month	23.6	36.5 <sub>a</sub>	13.6 <sub>b</sub>	
	Once a week	28.3	29.2 <sub>a</sub>	27.5 <sub>a</sub>	
	Several times a week	30.3	21.5 <sub>a</sub>	37.1 <sub>b</sub>	
	Once a day	6.4	2.7 <sub>a</sub>	9.3 <sub>b</sub>	
	Several times a day	1.8	0.0 <sub>a</sub>	3.2 <sub>b</sub>	

Statistically significant differences in proportions between columns were marked with letters in the subscript (a and b)

a month ( $p < 0.001$ ). Vegetable oils were consumed by Spanish students several times a day, and among Polish students, 1-3 times a month and during every week ( $p < 0.001$ ) (Tab. 2).

The study participants consumed fast food as well as sweets and confectionery products usually 1-3 times a month (approx. 50% and approx. 31%). Spanish students consumed a significantly greater percentage of

**Table 2.** Frequency of consuming fermented dairy products, meat and fish dishes, processed meat products and vegetable oils among Polish and Spanish physical education students (percentage of respondents)

Products	Frequency	Total	Poland	Spain	$\chi^2$ and $p$
Fermented dairy products	Never	11.8	7.8 <sub>a</sub>	15.0 <sub>b</sub>	$\chi^2(5) = 29.22$ $p < 0.001$
	1-3 times a month	14.4	12.8 <sub>a</sub>	15.7 <sub>a</sub>	
	Once a week	19.2	20.1 <sub>a</sub>	18.6 <sub>a</sub>	
	Several times a week	37.1	48.4 <sub>a</sub>	28.2 <sub>b</sub>	
	Once a day	12.4	7.8 <sub>a</sub>	16.1 <sub>b</sub>	
	Several times a day	5.0	3.2 <sub>a</sub>	6.4 <sub>a</sub>	
Dishes from red meat	Never	7.8	9.1 <sub>a</sub>	6.8 <sub>a</sub>	$\chi^2(5) = 19.17$ $p = 0.002$
	1-3 times a month	23.2	28.3 <sub>a</sub>	19.3 <sub>b</sub>	
	Once a week	28.7	29.2 <sub>a</sub>	28.2 <sub>a</sub>	
	Several times a week	32.3	30.6 <sub>a</sub>	33.6 <sub>a</sub>	
	Once a day	5.8	1.8 <sub>a</sub>	8.9 <sub>b</sub>	
	Several times a day	2.2	0.9 <sub>a</sub>	3.2 <sub>a</sub>	
Processed meat products	Never	7.4	4.6 <sub>a</sub>	9.6 <sub>b</sub>	$\chi^2(5) = 8.74$ $p = 0.112$
	1-3 times a month	12.6	10.0 <sub>a</sub>	14.6 <sub>a</sub>	
	Once a week	20.4	23.7 <sub>a</sub>	17.9 <sub>a</sub>	
	Several times a week	41.7	42.9 <sub>a</sub>	40.7 <sub>a</sub>	
	Once a day	14.0	14.6 <sub>a</sub>	13.6 <sub>a</sub>	
	Several times a day	3.8	4.1 <sub>a</sub>	3.6 <sub>a</sub>	
Dishes from white meat	Never	6.6	0.9 <sub>a</sub>	11.1 <sub>b</sub>	$\chi^2(5) = 33.18$ $p < 0.001$
	1-3 times a month	6.2	5.0 <sub>a</sub>	7.1 <sub>a</sub>	
	Once a week	19.6	15.5 <sub>a</sub>	22.9 <sub>b</sub>	
	Several times a week	50.5	61.6 <sub>a</sub>	41.8 <sub>b</sub>	
	Once a day	14.4	14.6 <sub>a</sub>	14.3 <sub>a</sub>	
	Several times a day	2.6	2.3 <sub>a</sub>	2.9 <sub>a</sub>	
Dishes from fish	Never	6.8	4.1 <sub>a</sub>	8.9 <sub>b</sub>	$\chi^2(5) = 45.74$ $p < 0.001$
	1-3 times a month	24.8	36.1 <sub>a</sub>	16.1 <sub>b</sub>	
	Once a week	34.9	39.3 <sub>a</sub>	31.4 <sub>a</sub>	
	Several times a week	29.3	18.3 <sub>a</sub>	37.9 <sub>b</sub>	
	Once a day	3.2	1.8 <sub>a</sub>	4.3 <sub>a</sub>	
	Several times a day	1.0	0.5 <sub>a</sub>	1.4 <sub>a</sub>	
Vegetable oils	Never	17.0	7.8 <sub>a</sub>	24.3 <sub>b</sub>	$\chi^2(5) = 69.47$ $p < 0.001$
	1-3 times a month	9.0	13.2 <sub>a</sub>	5.7 <sub>b</sub>	
	Once a week	14.6	22.8 <sub>a</sub>	8.2 <sub>b</sub>	
	Several times a week	34.5	40.2 <sub>a</sub>	30.0 <sub>b</sub>	
	Once a day	13.6	12.3 <sub>a</sub>	14.6 <sub>a</sub>	
	Several times a day	11.2	3.7 <sub>a</sub>	17.1 <sub>b</sub>	

Statistically significant differences in proportions between columns were marked with letters in the subscript (a and b)

**Table 3.** Frequency of consuming fast food products as well as sweets and confectionery among Polish and Spanish physical education students (percentage of respondents)

Products	Frequency	Total	Poland	Spain	$\chi^2$ and $p$
Fast food	Never	9.0	12.3 <sub>a</sub>	6.4 <sub>b</sub>	$\chi^2(5) = 16.69$ $p = 0.005$
	1-3 times a month	50.1	54.8 <sub>a</sub>	46.4 <sub>a</sub>	
	Once a week	26.1	23.3 <sub>a</sub>	28.2 <sub>a</sub>	
	Several times a week	12.8	9.1 <sub>a</sub>	15.7 <sub>b</sub>	
	Once a day	1.2	0.5 <sub>a</sub>	1.8 <sub>a</sub>	
	Several times a day	0.8	0.0 <sub>a</sub>	1.4 <sub>a</sub>	
Sweets and confectionary products	Never	6.8	3.7 <sub>a</sub>	9.3 <sub>b</sub>	$\chi^2(5) = 56.28$ $p < 0.001$
	1-3 times a month	30.9	19.2 <sub>a</sub>	40.0 <sub>b</sub>	
	Once a week	23.2	21.0 <sub>a</sub>	25.0 <sub>a</sub>	
	Several times a week	28.1	37.9 <sub>a</sub>	20.4 <sub>b</sub>	
	Once a day	7.4	12.8 <sub>a</sub>	3.2 <sub>b</sub>	
	Several times a day	3.6	5.5 <sub>a</sub>	2.1 <sub>b</sub>	

Statistically significant differences in proportions between columns were marked with letters in the subscript (a and b)

fast food products, i.e. several times a week ( $p=0.005$ ). Spanish students included sweets and confectionery in their diets more sporadically than those Polish, who consumed these products at least several times a week ( $p<0.001$ ) (Tab. 3).

## Discussion

In the discussed study, a limited scale of implementing the recommendations proposed by the Mediterranean diet was indicated among Polish and Spanish physical education students and its differentiation depending on country of residence.

The revealed nutritional mistakes of all the surveyed students were particularly related to the low frequency of consuming selected products recommended in the daily diet, with potentially beneficial effects on health, including fruit (approx. 38%), vegetables (approx. 36%), wholemeal bread (approx. 18%) and other whole grain cereals (approx. 15%), fermented dairy products (approx. 17%) and vegetable oils (approx. 25%). Moreover, a low frequency of legume (approx. 38% at least several times a week) and marine fish consumption (approx. 33% at least several times a week) was. Relatively frequent preparation of dishes from red meat dishes not recommended in a healthy diet (at least a few times a week, approx. 49%), processed meat products (approx. 59%, at least several times a week), as well as sweets and confectionery (approx. 39% at least several times a week) was noted. The nutritional trends described among the surveyed students indicate deviations from the recommendations of the Mediterranean diet, the pillars of which are vegetables, fruits, low-mill grains and

olive oil. The Mediterranean diet involves the daily consumption of fruit, vegetables, whole grain cereal products, legume seeds, nuts, olive oil and dairy products (yoghurts and cheese), as well as the consumption of fish, poultry and eggs (several times a week) and, occasionally, red meat [4, 5, 7].

Insufficient consumption of fruit and vegetables may reduce the nutritional and health value of one's diet by reducing the supply of dietary fibres as well as mineral salts (K, Mg) and the antioxidant potential of the diet. Low consumption of whole grain cereal products may reduce the supply of fibre, especially insoluble fractions normalising intestinal peristalsis [1]. It has been confirmed in various studies that a diet rich in fresh fruit and vegetables, whole grains and legumes, is an effective way to meet the body's antioxidant needs [19]. Low consumption of fermented dairy products may reduce the intake of calcium and probiotic bacteria from the diet, enriching the intestinal microflora, with numerous pro-health values [20]. In other research, the positive effect of the Mediterranean diet on the intestinal microbiota has been confirmed [8]. Low consumption of vegetable oils and sea fish reduces the supply of unsaturated fatty acids, including omega 3 mono and polyunsaturated fatty acids, optimising the blood lipid profile. Relatively frequent consumption of red meat and processed meat products (cold cuts, sausages and hotdogs) may, in turn, increase the supply of saturated fatty acids and cholesterol, which in excess, have hyperlipidemic and hypertensive properties. On the other hand, frequent consumption of sweets and confectionery products may increase the supply of simple sugars and trans isomers, additionally disturbing the lipid metabolism of the body [1].

In further studies, nutritional disorders have been confirmed among students, including those of physical education, both in Poland [21-23], as well as in Spain [24] and Chile [25]. Nutritional errors were also described among students of other university faculties, including those from Poland [26-29] and Spain [30, 31]. The results of the authors' research correspond, for example, to the tendencies described among physical education students from Biała Podlaska, who demonstrated a low intensity of both positive and unfavourable food choices [23], which partially corresponds to the results obtained in this study. Similarly, in Chilean research, the low consumption of vegetables and dairy products was confirmed among students of physical education [25].

In the discussed research among Polish and Spanish physical education students also, statistically significant differentiation in the frequency of consuming certain product groups was also noted depending on the country of residence. Among Polish students, more frequent consumption of some products recommended in the Mediterranean diet (fruit and vegetables, whole grain cereal products) and poultry meat was shown, but at the same time, more frequent consumption of non-recommended products (sweets and confectionery) was also demonstrated, while Spanish students were significantly more likely to eat the recommended dishes made from legumes and sea fish, but also those that were not recommended (red meat, fast food products). Therefore, nutritional mistakes were confirmed, both among Polish and Spanish physical education students.

In other studies aimed at comparing the health behaviours of Polish (Gdańsk) and Spanish (Murcia) physical education students also verified the differentiation of food choices depending on the country of origin. Students from the University of Murcia consumed dairy products more often, and less frequently sweetened carbonated beverages and alcoholic drinks. In turn, students from Gdańsk consumed more vegetables [32]. The results of research among Spanish students of medical faculties showed an excessive supply of saturated fatty acids (SFA), and at the same time, a low supply of monounsaturated fatty acids (MUFA) and vitamin E, while also corresponds to the more frequent consumption of red meat by Spanish students, similarly demonstrated in the authors' research, which indicates deviations from the assumptions of the Mediterranean diet [30]. Analogously, assessment of diets among students of the University of Granada showed they were characterised by a high supply of saturated fatty acids and a low supply of dietary fibre, which also indicates deviations from the Mediterranean diet [31]. In other studies carried out on physical education students from Spain and Romania, it was shown that Spanish students followed the rules of

the Mediterranean diet more than those from Romania [24]. In further studies it was also confirmed that the diet of students from Catalonia differed from the recommendations of the Mediterranean diet, as it was characterised by low consumption of fruit (74%), vegetables (40%), whole grain products (93%), and high consumption of red meat (84%). [33]. Moreover, in another group of Spanish students, a very small scale of implementing recommendations proposed by the Mediterranean diet in terms of limiting the consumption of meat and processed meat products was demonstrated [34].

The discussed results of the authors' study allow to emphasize the predictive significance of geographical context (country of residence) in relation to the nutritional choices of physical education students from Poland and Spain. The limited scale of choices in line with the Mediterranean diet model, one of the healthiest dietary models, suggest the need for students' nutritional education in order to strengthen effectiveness concerning early prevention of chronic diseases, including obesity, type-2 diabetes, cardiovascular diseases and cancer, which are a significant issue of public health. Nutritional education of physical education students should also, in the perspective of their future professional work, contribute to shaping patterns of rational nutrition for school children and youth.

## Conclusions

1. Among Polish and Spanish physical education students, mistakes were found with regard to nutritional choices, indicating a limited implementation of the assumptions proposed by the Mediterranean diet, particularly related to the insufficient frequency of consuming fruit, vegetables, whole grains, legume seeds, fermented dairy products, sea fish, vegetable oils, and the relatively frequent consumption of dishes from red meat, processed meats, sweets and confectionery.
2. Polish and Spanish physical education students demonstrated significant differentiation in the frequency of consuming certain product groups depending on country of residence, with Polish students significantly more often consuming the recommended products (fruit and vegetables, whole grain cereals, poultry meat), but also those non-recommended (sweets and confectionery).
3. The incomplete implementation of the recommendations proposed by the Mediterranean diet, not only among Polish but also Spanish students, indicates the validity of health education (including knowledge on nutrition) among physical education students, regardless of geographical factors.

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