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ANALYSIS OF THE NUTRITIONAL VALUE OF DIETS OF YOUTH FOLLOWING VARIOUS FOOD PATTERNS. PART I – FOOD PATTERNS OF BOYS

Anna Waluś[1], Lidia Wądołowska[2], Roman Cichon[1,2], Tomasz Długosz[3]

[1]Chair and Department of Nutrition and Dietetics, Nicolaus Copernicus University, Collegium Medicum, Bydgoszcz; [2]Department of Human Nutrition, University of Warmia and Mazury, Olsztyn; [3]"Apteka przy Jurasza", Bydgoszcz

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This study analyses the nutritional value of diets consumed by boys with two different food patterns, expressed as a different frequency of consuming pork and poultry or snacks, sweets and sweet drinks. Two hundred and fifty-three boys aged 15-18 years from secondary schools of various types situated in the Suwałki region and in the city of Olsztyn were included in the study. The factor analysis was applied to data on the frequency of consuming 21 products, which resulted in identifying 8 food patterns typical of young people. Two selected food patterns were further analysed: pork plus poultry (pattern III) and snacks, sweets and sweet drinks (pattern IV). When the frequency of consuming pork and poultry was low, the boys' diet had a high nutritional value, but at the same time, cholesterol, protein and fat contents were too high. The results indicate that a low frequency of pork and poultry consumption resulted in a more varied diet, containing products of both plant and animal origin. An increase in the frequency of snacks, sweets and sweet drinks consumption resulted in higher amounts of consumed vitamins and minerals; however, it also resulted in consuming excessive amounts of protein, fat and energy.

INTRODUCTION

Nutrition is a complex process involving numerous co-existing and interlinked features, which together make up certain food patterns [Gronowska-Senger, 2005; Hu, 2003; Fung *et al*., 2001; Newby *et al*., 2004a]. This justifies the need to apply a comprehensive approach to assessing food consumption and to perform multifactor analyses. Such analyses can be performed with the use of multidimensional statistical methods, *e.g.* cluster and/or factor analysis [Hoffmann *et al*., 2004].

The factor analysis aims at reducing the number of input variables and lets one isolate and identify the main factors, made up of concurrent and the most significant features [StatSoft, 2000]. It has been successfully applied in numerous studies [Hu, 2003; Newby *et al*., 2004a, b; Fung *et al*., 2001; Hu *et al*., 2000; Lopez-Garcia *et al.* 2004; Ostrowska, 1999]. Factor analysis has also been found to yield comparable results to those obtained with cluster analysis of blood lipid indexes [Newby *et al*., 2004b], which confirms its usability in analysing human nutritional behaviour.

Analysing the many features which combine to create certain food patterns precisely determines the relationship between nutrition and health. It has been found that long-term nutrition based on incorrect food patterns may adversely affect one's health and increase the risk of nutrition-based diseases [WHO, 2003; Augustyniak & Brzozowska, 2002; Bao *et al*., 1997; Dietz, 1998]. The team of Fung *et al.* [2001] showed that consuming high amounts of fruit, vegetable, wholemeal cereal products and poultry was positively correlated with the biomarker's profile. Conversely, consuming high amounts of red meat, high-fat dairy products and refined cereal products was correlated with a negative profile of biomarker of cardiovascular diseases. It has been shown that high consumption of low-fat dairy products and high fibre foods may result in lower annual body weight increases in women and lower increases in waist circumference in both sexes [Newby *et al.,* 2004a]. In a Polish study four food patterns were found, three of which were negative, as they were associated with consuming (i) high fat meat products and chips, (ii) high fat dairy products and (iii) snacks and sweets [Ostrowska, 1999]. The fourth pattern involved consumption of juices, fruits and salads and was the only one to be consistent with the principles of a healthy lifestyle.

The available literature does not contain information about the nutritional value of diets followed by people with characteristic food patterns, which might indicate potential benefits or threats to their health. This study aimed at verifying the hypothesis that food patterns followed by young people result in various nutritional value of their diets, and the undesired ones are ill-balanced and/or have low nutritional value.

MATERIALS AND METHODS

The study was conducted in autumn 2002 and 2003 and covered 567 people aged 15 to 18 (average 16.1±0.44). The study sample consisted of various secondary school students. It was assumed that the numbers of students who live in the country, in small towns and in the big city of a rural

Author's address for correspondence: dr inż. Anna Waluś, Chair and Department of Nutrition and Dietetics, Nicolaus Copernicus University, Collegium Medicum, ul. Dębowa 3, 85-626 Bydgoszcz, Poland; tel.: (48 52) 585 25 89; e-mail: anna.walus@wp.pl

TABLE 1. The frequency of consuming 21 products by boys in quintiles of frequency of pork and poultry consumption.

Products	Consumption frequency (times/day)						
	Total	Quintiles of frequency of pork and poultry consumption					
		Q1 (lowest)	Q2	Q3	Q4	Q5 (highest)	p of the trend
	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD	
Beef	0.16±0.212	0.06±0.068	0.12±0.087	0.14±0.148	0.20±0.235	0.27±0.323	0.002
Beer	0.06±0.120	0.07±0.138	0.08±0.135	0.05±0.103	0.07±0.127	0.04±0.099	NS
Butter	1.93±1.017	1.88±1.149	1.95±1.157	1.89±0.926	1.90±0.988	2.02±0.914	NS
Chips and other hot snacks	0.17±0.198	0.14±0.163	0.23±0.219	0.12±0.119	0.17±0.183	0.20±0.260	NS
Crisps and other salted snacks	0.39±0.529	0.34±0.300	0.49±0.690	0.29±0.360	0.39±0.609	0.43±0.543	NS
Fish	0.14±0.162	0.21±0.166	0.14±0.165	0.12±0.125	0.11±0.103	0.15±0.225	NS
Fruit	1.01±0.846	1.18±0.823	1.27±1.019	0.84±0.739	0.83±0.743	1.00±0.841	NS
Fruit juices	0.61±0.691	0.63±0.723	0.62±0.763	0.45±0.371	0.70±0.790	0.64±0.732	NS
Legumes	0.16±0.243	0.15±0.190	0.12±0.126	0.11±0.121	0.13±0.145	0.27±0.441	NS
Margarine	0.44±0.814	0.34±0.753	0.59±1.025	0.43±0.842	0.44±0.787	0.40±0.623	NS
Milk	0.99±0.852	1.17±1.000	0.90±0.888	0.90±0.591	0.86±0.761	1.17±0.986	NS
Pork*	0.47±0.518	0.11±0.086	0.18±0.099	0.44±0.290	0.44±0.202	1.09±0.784	0.033
Poultry*	0.45±0.361	0.18±0.136	0.26±0.165	0.34±0.235	0.57±0.182	0.81±0.508	0.007
Raw vegetables	0.57±0.547	0.82±0.823	0.62±0.587	0.53±0.439	0.41±0.353	0.54±0.452	NS
Sweet drinks	0.84±0.814	1.07±1.102	0.92±0.891	0.88±0.813	0.77±0.649	0.64±0.576	0.002
Sweets	0.79±0.663	0.84±0.706	0.75±0.823	0.70±0.575	0.77±0.449	0.88±0.750	NS
Vegetable juices	0.35±0.488	0.42±0.689	0.34±0.529	0.27±0.332	0.34±0.334	0.41±0.541	NS
Vodka	0.01±0.028	0.01±0.034	0.01±0.031	0.01±0.008	0.01±0.029	0.01±0.031	NS
Wholemeal bread	0.51±0.705	0.30±0.666	0.51±0.694	0.57±0.840	0.47±0.570	0.66±0.711	NS
Wine	0.02±0.059	0.01±0.034	0.03±0.087	0.01±0.009	0.02±0.081	0.02±0.042	NS
Yoghurt	0.51±0.572	0.67±0.804	0.49±0.572	0.48±0.409	0.42±0.407	0.55±0.645	NS

* the products which make up food pattern III, p – level of significance, NS – statistically insignificant differences

region without much industry, were similar. The study was conducted in Olsztyn and in selected towns of the Suwałki region, which were typical of the north-eastern Poland when taking into consideration low industrial development. The small towns in the region included Suwałki and Sejny and the villages were Przerośl and Dowspuda. The study group was selected by two-phase sampling; 2-3 secondary schools were selected in each of the sites and 2-3 classes in each of the schools.

The basic information characterising each group was gathered in individual interviews; this included gender, date of birth and selected socio-economic features. The individuals who provided incredible information about their eating habits, according to the criterion provided by Goldberg *et al.* [1991] were excluded from the study. After excluding 22 boys and 114 girls, the information provided by 431 people was further analysed.

The frequency of food consumption was measured with the use of a specially devised questionnaire with closed questions [Wądołowska & Cichon, 1995]. The frequency of the consumption of 21 groups of products (Appendix 1) was examined; this was described in a 7-point scale as: (1) never, (2) 1-3 times a month, (3) 1-2 times a week, (4) 3-4 times a week, (5) 5-6 times a week, (6) 1-2 times a day, (7) 3 or more times a day.

Eating habits were assessed quantitatively based on the information concerning foods eaten during a 24-hour period (24-h recall) [Charzewska *et al*., 1997; Szponar *et al.,* 2000]. Such interviews were conducted once with each of the respondents, using the "Album of photographs of food products and dishes" [Szponar *et al*., 2000]. The interviews were conducted on each day of the week, maintaining a proportion between the interviews conducted on weekdays and at weekends. The energy and nutritional values of the diets were calculated with MS Access 7.0, containing a database of nutritional values of foods [Kunachowicz *et al*., 1998; Nadolna *et al*., 1994]. The calculated amounts of energy and nutrients were reduced by the technological and culinary losses, which for various components were as follows: vitamin B_1 – 20%, vitamin B_2 – 15%, vitamin A – 25%, vitamin C – 55%, and for the other components – 10%. The energy and nutrient content in the diet was then compared to safe level of dietary standards (Dietary Reference Intake – DRI) for young people from the relevant age groups with a low level of physical activity [Ziemlański *et al*., 1994], and for cholesterol and dietary fibre – with nutrition prevention recommendations [WHO, 1990]. The lower recommended limit value of 27 g was adopted for dietary fibre and the upper one for cholesterol – 300 mg.

Eight characteristic food patterns followed by young people were identified with the use of factor analysis. Twenty-one characteristics concerning the frequency of food con-

TABLE 2. Energy and nutritional value of the diets of boys in quintiles of frequency of pork and poultry consumption.

Nutrient	Total		Quintiles										p of the trend
			Q1 (lowest)		Q2		Q3		Q4		Q5 (highest)		
	$\overline{X}$±SD	DRI, %	$\overline{X}$±SD	DRI, %	$\overline{X}$±SD	DRI, %	$\overline{X}$±SD	DRI, %	$\overline{X}$±SD	DRI, %	$\overline{X}$±SD	DRI, %	
Energy (kcal)	2653±1235	99.1	3175±1852	117.8	2969±1335	110.7	2490±1005	93.5	2517±954	93.9	2235±931	84.0	0.009
Total protein (g)	86.2±41.7	121.4	100.5±58.6	140.0	95.6±42.5	134.2	78.9±33.9	111.9	85.1±37.0	119.7	71.3±33.7	101.9	0.030
Animal protein (g)	52.7±31.1	-	59.6±40.4	-	58.1±30.7	-	47.1±26.1	-	52.9±29.1	-	43.8±28.1	-	0.066
Fat (g)	111.7±63.8	113.8	132.8±82.3	134.4	125.1±69.6	127.2	104.2±53.9	106.9	104.0±54.0	105.7	95.6±60.5	98.2	0.011
Cholesterol* (mg)	490±376	163.5	552±405	184.0	516±334	172.0	500±501	166.7	470±331	156.6	431±293	143.8	0.001
Carbohydrates (g)	346±159	91.7	419±249	110.4	387±173	102.4	329±133.3	87.6	329±119	87.1	289±92	77.0	0.006
Fibre* (g)	22.5±11.7	83.4	28.0±17.6	103.8	25.2±12.0	93.2	22.2±11.9	82.3	20.4±7.6	75.4	18.0±7.2	66.8	0.001
Ca (mg)	721±589	65.5	1000±851	90.9	757±565	68.9	657±386	59.8	697±644	63.4	546±416	49.6	0.033
P (mg)	1374±676	171.8	1630±1000	203.7	1541±697	192.7	1252±530	156.4	1320±557	165.0	1174±559	146.7	0.026
Mg (mg)	300±159	87.1	350±238	100.3	348±171	100.9	267±120	78.4	288±101	83.5	266±153	77.6	0.065
Fe (mg)	12.6±7.1	105.2	15.0±10.3	125.2	14.6±8.1	121.4	11.8±5.8	97.9	11.5±5.5	95.8	11.0±5.8	91.8	0.019
Zn (mg)	11.6±5.8	82.6	13.6±8.3	96.9	12.8±5.1	91.5	10.8±5.3	76.9	10.8±4.5	77.3	10.1±5.5	72.0	0.014
Cu (mg)	1.18±0.70	67.6	1.42±0.94	81.3	1.43±1.04	81.9	1.06±0.49	60.7	1.08±0.38	61.8	1.00±0.45	57.0	0.038
K (mg)	2989±1461	119.6	3458±2023	138.3	3469±1639	138.8	2774±1189	111.0	2857±1027	114.3	2505±1323	100.2	0.026
Vitamin A (μg)	1183±2620	169.0	1589±3430	227.0	1590±3448	227.2	817±746	116.8	1036±2169	148.1	1094±2983	156.4	NS
Vitamin E (mg)	11.46±13.68	114.6	14.20±10.72	142.0	15.13±27.30	151.3	9.81±6.21	98.1	10.24±8.04	102.4	8.52±4.96	85.2	0.046
Vitamin B_1 (mg)	1.49±0.99	99.1	1.60±1.02	107.0	1.76±1.17	117.6	1.36±0.82	90.7	1.36±0.74	90.3	1.21±0.99	80.8	0.067
Vitamin B_2 (mg)	1.64±0.95	82.4	1.84±1.18	92.2	1.81±0.99	91.0	1.53±0.61	77.0	1.52±0.79	76.1	1.52±1.19	76.9	0.044
Vitamin PP (mg)	16.6±11.1	76.1	17.7±11.8	80.7	19.5±12.6	89.0	14.5±9.3	66.6	17.5±10.6	80.1	13.5±10.6	61.9	NS
Vitamin B_6(mg)	2.02±1.10	93.1	2.28±1.37	103.9	2.34±1.29	107.6	1.84±0.96	85.0	1.95±0.83	90.1	1.71±1.02	79.6	0.050
Vitamin C (mg)	40.6±42.3	67.7	54.7±55.0	91.1	53.2±56.0	88.7	34.7±26.2	57.8	34.7±33.7	57.8	28.8±33.2	47.9	0.019
SFA (g)	42.7±24.3	-	50.0±33.4	-	46.2±23.8	-	41.5±24.2	-	41.1±18.3	-	37.9±23.9	-	0.005
MUFA (g)	45.9±30.8	-	53.4±34.1	-	52.9±40.8	-	42.6±23.3	-	41.3±25.4	-	38.8±28.1	-	0.016
PUFA (g)	14.0±11.4	156.8	19.1±17.3	212.3	16.4±13.0	183.3	11.7±6.9	131.3	12.6±9.9	140.4	10.5±6.2	118.7	0.024

* compared to nutritional prevention recommendations, SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids. $\overline{X}$ – mean value, SD – standard deviation, DRI – dietary reference intake, p – level of significance, NS – insignificant differences

TABLE 3. The frequency of consuming 21 products by boys in quintiles of frequency of snacks, sweets and sweet drinks consumption.

Products	Consumption frequency (times/day)						
	Total	Quintiles of frequency of snacks, sweets and sweet drinks consumption					
		Q1 (lowest)	Q2	Q3	Q4	Q5 (highest)	p of the trend
	x̄±SD	x̄±SD	x̄±SD	X̄±SD	x̄±SD	x̄±SD	
Beef	0.16±0.212	0.08±0.075	0.09±0.097	0.14±0.123	0.22±0.201	0.26±0.344	0.005
Beer	0.06±0.120	0.07±0.136	0.04±0.104	0.03±0.061	0.05±0.107	0.10±0.160	NS
Butter	1.93±1.017	1.47±0.899	1.63±0.887	1.92±0.958	2.25±1.036	2.24±1.066	0.006
Chips and other hot snacks*	0.17±0.198	0.07±0.042	0.09±0.079	0.12±0.070	0.20±0.168	0.35±0.302	0.023
Crisps and other salted snacks*	0.39±0.529	0.14±0.126	0.17±0.164	0.19±0.141	0.32±0.214	1.02±0.813	0.093
Fish	0.14±0.162	0.14±0.139	0.14±0.132	0.12±0.116	0.15±0.128	0.17±0.248	NS
Fruit	1.01±0.846	1.10±0.902	0.81±0.522	0.69±0.598	0.85±0.678	1.57±1.087	NS
Fruit juices	0.61±0.691	0.55±0.669	0.42±0.476	0.52±0.602	0.62±0.770	0.90±0.794	NS
Legumes	0.16±0.243	0.17±0.188	0.15±0.146	0.15±0.173	0.13±0.155	0.17±0.417	NS
Margarine	0.44±0.814	0.29±0.551	0.27±0.434	0.25±0.451	0.45±0.868	0.89±1.212	0.096
Milk	0.99±0.852	1.15±0.905	0.94±0.842	0.84±0.691	0.81±0.741	1.24±0.996	NS
Pork	0.47±0.518	0.62±0.723	0.48±0.375	0.49±0.476	0.36±0.331	0.41±0.599	0.056
Poultry	0.45±0.361	0.37±0.307	0.39±0.290	0.51±0.276	0.42±0.298	0.52±0.529	NS
Raw vegetables	0.57±0.547	0.53±0.406	0.58±0.497	0.55±0.421	0.52±0.638	0.65±0.691	NS
Sweet drinks*	0.84±0.814	0.27±0.217	0.54±0.335	0.57±0.255	0.96±0.861	1.71±0.988	0.021
Sweets*	0.79±0.663	0.37±0.226	0.52±0.280	0.65±0.272	0.74±0.422	1.51±0.959	0.042
Vegetable juices	0.35±0.488	0.29±0.312	0.27±0.302	0.36±0.319	0.36±0.625	0.46±0.677	0.032
Vodka	0.01±0.028	0.01±0.033	0.00±0.008	0.01±0.008	0.01±0.008	0.02±0.048	NS
Wholemeal bread	0.51±0.705	0.38±0.551	0.44±0.574	0.48±0.538	0.47±0.646	0.73±1.016	0.062
Wine	0.02±0.059	0.01±0.033	0.01±0.032	0.01±0.008	0.01±0.031	0.04±0.113	NS
Yogurt	0.51±0.572	0.50±0.671	0.31±0.264	0.36±0.280	0.56±0.645	0.80±0.698	NS

* the products which make up food pattern IV, p – level of significance, NS – statistically insignificant differences

sumption were taken as input variables in the factor analysis [Hu *et al*., 1999; StatSoft, 2000]. The patterns were assigned names according to the properties of the input variables and the values of the factor load between an input variable and the food pattern. It was established that the name of a pattern was created from those variables for which the values of factor loads were high and positive, *i.e.* (0.5 [Waluś *et al*., 2006; Newby *et al*., 2004a; StatSoft, 2000]. The procedure was described in detail in a previous paper [Waluś *et al*., 2006].

Further analysis was conducted only in the group of 253 boys. Two characteristic food patterns for young people were selected, taking into account their effect on the nutritional and energy value of their diet. These included: pork and poultry (food patterns III) and snacks, sweets and sweet drinks (food patterns IV). The quintile ranges of the frequency of consumption of the products which together make up the common food pattern were established for both food patterns (Q1, Q2, Q3, Q4 and Q5). Then, in each quintile, the mean frequency of consuming each product (times/day) and mean energy and nutritional values were calculated. For each food pattern, the trends of the food consumption frequency and its energy and nutritional value in the quintiles of food consumption frequency were analysed with a linear regression analysis, establishing the level of significance for a trend. The statistical analysis was conducted with the use of Statistica PL v.7.1.

RESULTS

A significant increase in the frequency of consuming foods which made up the common food pattern (*i.e.* pork and poultry) was observed in the subsequent quintiles of food consumption. In Q5 as compared to Q1, the frequency of pork consumption was 10 times higher (p=0.033), and that of poultry was 4 times higher (p=0.007; Table 1). Furthermore, the increase in pork and poultry consumption frequency was accompanied by a significant increase in beef consumption and a decrease in the frequency of consuming sweet drinks, although the products did not make up a food pattern.

An increase in the frequency of pork and poultry consuming was accompanied by a significant decrease ($p<0.05$) in the energy and nutritional value of the boys' diet, which was shown for all nutrients except for vitamin A and vitamin PP (Table 2). A decreasing tendency for animal protein and magnesium was also shown ($p<0.1$). The diets of the boys from the first and second quintiles of pork and poultry consumption were better balanced and met recommendations (from 90% DRI to 110% DRI or nutrition prevention recommendations) concerning: carbohydrates, fibre, calcium, magnesium, iron, zinc, potassium, vitamin E, vitamin B_1, vitamin B_2, vitamin PP and vitamin C (Table 2). The diets of the boys from the third, fourth and fifth quintile of pork and

TABLE 4. Energy and nutritional value of diets of boys in quintiles of frequency of snacks, sweets and sweet drinks consumption.

Nutrient	Total		Quintiles										p of the trend
			Q1 (lowest)		Q2		Q3		Q4		Q5 (highest)		
	x̄±SD	DRI, %	x̄±SD	DRI, %	x̄±SD	DRI, %	x̄±SD	DRI, %	x̄±SD	DRI, %	x̄±SD	DRI, %	
Energy (kcal)	2653±1235	99.1	2337±1029	87.4	2526±1406	94.9	2186±870	81.8	2872±1270	107.6	3237±1361	120.0	NS
Total protein (g)	86.2±41.7	121.4	67.7±29.4	95.9	83.9±43.5	119.6	70.5±32.9	99.1	96.2±45.7	136.2	105.3±43.6	146.5	0.066
Animal protein (g)	52.7±31.1	-	37.9±20.9	-	49.1±30.09	-	42.8±24.8	-	61.3±36.1	-	65.2±31.9	-	0.037
Fat (g)	111.7±63.8	113.8	105.0±74.3	107.1	100.1±61.6	102.6	88.9±47.4	90.8	120.5±64.2	123.4	138.0±65.4	139.6	NS
Cholesterol* (mg)	490±376	163.5	467±354	155.6	446±406	148.5	443±325	147.6	589±461	196.5	501±326	167.0	NS
Carbohydrates (g)	346±159	91.7	300±95	79.7	343±197	91.1	293±111	77.7	372±166	98.8	416±181	109.6	NS
Fiber* (g)	22.5±11.7	83.4	21.6±8.6	79.9	22.2±14.7	82.2	18.3±8.6	67.7	24.2±12.5	89.8	25.7±12.6	95.3	NS
Ca (mg)	721±589	65.5	539±357	49.0	634±513	57.6	581±351	52.8	794±652	72.1	996±814	90.5	0.034
P (mg)	1374±676	171.8	1119±557	139.9	1330±687	166.3	1127±471	140.9	1523±739	190.4	1688±752	211.0	0.071
Mg (mg)	300±159	87.1	264±142	76.8	297±182	87.5	254±103	73.8	314±149	91.2	367±192	105.1	NS
Fe (mg)	12.6±7.1	105.2	10.9±4.9	91.1	12.6±8.9	104.8	10.9±7.7	90.8	13.8±7.0	115.1	14.5±6.4	121.1	0.097
Zn (mg)	11.6±5.8	82.6	9.58±4.13	68.5	11.1±6.4	79.4	9.4±4.5	66.9	13.2±6.5	94.4	13.7±6.0	98.1	0.092
Cu (mg)	1.18±0.70	67.6	1.11±1.03	63.7	1.21±0.81	68.9	1.00±0.51	57.2	1.22±0.54	69.6	1.37±0.60	78.3	NS
K (mg)	2989±1461	119.6	2657±1356	106.3	2889±1569	115.5	2603±1058	104.1	3133±1576	125.3	3554±1602	142.2	0.084
Vitamin A (μg)	1183±2620	169.0	747±543	106.8	1246±3248	178.0	1572±4090	224.5	1293±2308	184.7	1056±1506	150.8	NS
Vitamin E (mg)	11.46±13.68	114.6	14.04±29.23	140.4	9.72±8.41	97.2	9.18±8.23	91.8	10.78±6.81	107.8	13.50±7.44	135.0	NS
Vitamin B_1 (mg)	1.49±0.99	99.1	1.16±0.64	77.3	1.42±0.97	94.5	1.13±0.77	75.4	1.73±1.13	115.1	1.74±1.02	116.1	NS
Vitamin B_2 (mg)	1.64±0.95	82.4	1.31±0.48	66.0	1.59±1.01	80.3	1.51±1.32	76.1	1.82±0.90	91.8	1.84±0.80	92.3	0.028
Vitamin PP (mg)	16.6±11.1	76.1	12.9±9.1	59.4	16.5±11.5	76.1	14.8±11.1	67.5	18.1±12.2	82.9	19.3±10.3	87.9	0.042
Vitamin B_6(mg)	2.02±1.10	93.1	1.70±0.99	78.6	1.97±1.09	92.0	1.73±0.90	79.4	2.17±1.27	100.1	2.40±1.12	109.4	0.067
Vitamin C (mg)	40.6±42.3	67.7	37.5±28.9	62.5	37.4±49.2	62.3	33.9±26.8	56.6	38.0±33.2	63.4	53.5±60.5	89.1	NS
SFA (g)	42.7±24.3	-	37.6±21.7	-	38.7±22.3	-	34.8±14.6	-	48.5±28.7	-	53.6±28.5	-	0.086
MUFA (g)	45.9±30.8	-	46.2±46.6	-	39.9±26.5	-	36.2±24.4	-	48.4±26.8	-	55.1±25.9	-	NS
PUFA (g)	14.0±11.4	156.8	12.5±9.6	139.2	12.9±13.3	145.3	10.7±9.7	119.8	14.2±10.8	158.8	18.2±11.9	202.2	NS

* compared to nutritional prevention recommendations, SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids. x̄ – mean value, SD – standard deviation, DRI – dietary reference intake, p – level of significance, NS – insignificant difference

poultry consumption frequency were worse-balanced and did not meet the recommendations (below 90% DRI). This was found mainly for calcium, copper, vitamin PP and vitamin C. At the same time, the consumption which was compliant with the recommendations for the energy values was observed for the boys in quintile three and four, for proteins for the boys in quintile five, and for fats for the boys in quintile three, four and five (Table 2).

In subsequent quintiles of the frequencies of consuming foods which make up pattern IV, a significant increase in chips and other hot snacks, sweets and sweet drinks consumption frequency was observed; a growing tendency in crisps and other salted snacks consumption frequency was also shown (p=0.093). In quintile five, as compared to quintile one, the frequency of chips and other hot snacks consumption was 5 times higher, sweets – 4 times higher, sweet drinks – 6 times higher and crisps and other salted snacks – 7 times higher (Table 3). Also, an increase in the frequency of consuming snacks, sweets and sweet drinks was accompanied by a significant increase in the frequency of consuming beef, vegetable juices and butter, although the products did not make up a food pattern. A growing tendency was observed for margarine and wholemeal bread, and a decreasing tendency – for pork consumption frequency (Table 3).

An increase in the frequency of consuming snacks, sweets and sweet drinks was linked to a significant increase in the consumption of calcium, vitamin B_2, vitamin PP and animal proteins (Table 4). The diets of the boys from quintile four and five of snacks, sweets and sweet drinks consumption frequencies had a higher nutritional values and were better-compliant with the recommendations (from 90% DRI to 110% DRI or nutrition prevention recommendations) for the following nutrients: carbohydrates, fibre, magnesium, iron, zinc, potassium, vitamin E, vitamin B_1, vitamin B_2 and vitamin B_6. The diets of boys from quintile one, two and three of snacks, sweets and sweet drinks consumption frequency had a lower nutritional value (below 90% DRI). This concerned mainly the intake of calcium, zinc, copper, vitamin PP and vitamin C (Table 4).

DISCUSSION

It has been shown in this study that a low frequency of pork and poultry consumption resulted in a better balanced diet for boys in relation to most vitamins and minerals as well as for carbohydrates and fibre. An increase in the frequency of consuming pork and poultry resulted in the positive decreasing of fat and energy consumption, while at the same time bringing about an adverse decrease in vitamin and mineral consumption. The results indicate that both the lower quintiles of pork and poultry consumption corresponded to a varied diet containing both animal and plant products. Thanks to the consumption of these products, the boys' diet was balanced and contained the right amounts of carbohydrates, fibre, vitamins and minerals, but also excessive amounts of cholesterol, proteins and fats. It could be argued that a lower frequency of pork and poultry consumption favoured their being replaced by other products, which caused an improvement in the nutritional value of the boys' diet. An increase in the frequency of consuming pork and poultry was probably caused by a decrease in the diet's variety, which reduced the energy and nutritional value of the boys' diets in the upper quintiles of pork and poultry consumption frequencies. It may be assumed that an increase in the frequency of consuming pork and poultry influenced an increase of the amounts of these items insignificantly and finally it did not increase energy, total protein, fat and cholesterol intake, even though pork is their source. Because of this simultaneous decrease of boys' diet variety along with an increase of the frequency of consuming pork and poultry had important influence on decreasing energy and nutrient value of the boys' diet. These results are consistent with the research hypothesis put forward in other studies and documented by indicating relations between consuming food of high nutritional value and health. According to the available research results, the people who excluded or cut down on meat, dairy products and sweets, consumed more vegetables, fruit and wholemeal bread, which reduced the risk of diet-related diseases, such as obesity and cardiovascular diseases [Martinez-Gonzalez & Sanchez-Villegas, 2004; Ostrowska, 2004].

It has been shown that an increase in the frequency of consuming snacks, sweets and sweet drinks favoured a better diet balance in relation to most vitamins and minerals, carbohydrates and dietary fibre. A low frequency of consuming snacks, sweets and sweet drinks resulted in decreasing the nutritional value of the boys' diet, mainly in vitamins and minerals. An increase in the nutritional value of the boys' diet in the upper frequencies of consuming snacks, sweets and sweet drinks may have resulted from the concurrent increase in the frequency of consuming of vegetable juices, beef and butter, as well as the tendency to consume more wholemeal bread. Such products are good sources of vitamins and minerals as well as well balanced proteins and easily absorbable fats; consequently, an increase in their consumption, observed in subsequent quintiles, may account for the increase in the nutritional value of the boys' diet. In addition, the changes may have been the result of an increased frequency of consuming snacks, sweets and sweet drinks, but in smaller amounts. As has been shown in earlier studies, potentially undesired eating habits may be linked to the appropriate quality of a diet. Such observations were related to eating small amounts of food between bigger meals. It has been shown that this can supplement the low nutritional value of young people's diets and favour its right balance, particularly in individuals who consume insufficient amounts of food in the meals [Wądołowska *et al.*, 2001]. Among the negative outcome of high frequencies of consuming snacks, sweets and sweet drinks was a high content of proteins and fats, which resulted in energy values in excess of the recommendations. This indicates the adverse aspects of more frequent consumption of snacks, sweets and sweet drinks, despite their positive effect on vitamins and minerals content in the boys' diet.

CONCLUSIONS

A better balanced diet in relation to most vitamins and minerals was linked to the consumption of lower amounts

of pork and poultry and to a higher frequency of consuming snacks, sweets and sweet drinks. An increase in the frequency of consuming snacks, sweets and sweet drinks resulted in a higher content of vitamins and minerals in the diets, but also caused the consumption of excessive amounts of proteins, fats and energy. Low frequencies of pork and poultry consumption resulted in a high nutritional value of the diets, but also in excessive amounts of consumed cholesterol, proteins and fat. The results indicate that low frequencies of consuming pork and poultry produced a more varied diet, containing both animal and plant products. A decrease of boys' diet variety along with an increase of the frequency of consuming pork and poultry had important influence on decreasing energy and nutrient value of boys' diet.

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APPENDIX 1

List of the food items in the 21 food groups in alphabetical order: (1) beef, excluding processed meat; (2) beer; (3) butter; (4) chips and other hot snacks, including cassarole, hamburger, pizza; (5) crisps and other salted snacks, including salted crisps, savoury stics; (6) fish; (7) fruit; (8) fruit juices; (9) legumes; (10) margarine; (11) milk, including milk beverages, milk soup; (12) pork, excluding processed meat; (13) poultry such as chicken, turkey, excluding processed meat; (14) raw vegetables; (15) sweet drinks, excluding fruit or vegetable juices; (16) sweets; (17) vegetable juices; (18) vodka; (19) wholemeal bread; (20) wine; (21) yogurt, including kefir, curds.

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ANALIZA WARTOŚCI ODŻYWCZEJ RACJI POKARMOWYCH MŁODZIEŻY O ODMIENNYCH WZORACH ŻYWIENIOWYCH. CZĘŚĆ I. WZORY ŻYWIENIOWE CHŁOPCÓW

Anna Waluś[1], Lidia Wądołowska[2], Roman Cichon[1,2], Tomasz Długosz[3]

[1]Katedra i Zakład Żywienia i Dietetyki, Collegium Medicum, Uniwersytet Mikołaja Kopernika, Bydgoszcz; [2]Katedra Żywienia Człowieka, Uniwersytet Warmińsko-Mazurski, Olsztyn; [3],,Apteka przy Jurasza", Bydgoszcz

Analizowano wartość odżywczą racji pokarmowych chłopców o dwóch odmiennych wzorach żywieniowych. Badaniami objęto 253 chłopców w wieku 15-18 lat ze szkół średnich o różnych profilach, zlokalizowanych w regionie suwalskim i w Olsztynie. Na podstawie informacji o częstości spożycia 21 produktów za pomocą analizy czynnikowej wyodrębniono 8 charakterystycznych wzorów żywieniowych młodzieży. Dalszej analizie poddano 2 wybrane wzory żywieniowe. Były to: mięso wieprzowe i drobiowe (wzór żywieniowy III) i przekąski, słodycze i słodkie napoje (wzór żywieniowy IV). Lepsze zbilansowanie diety chłopców było związane z mniejszą częstością spożycia mięsa wieprzowego i drobiowego lub większą częstością spożycia przekąsek, słodyczy i słodkich napojów (tabela 1-4). Wzrost częstości spożycia przekąsek, słodyczy i słodkich napojów sprzyjał wyższej zawartości witamin i składników mineralnych, lecz jednocześnie wpływał na wysoką zawartość białka, tłuszczu i energii na poziomie przekraczającym zalecenia. Mała częstość spożycia mięsa wieprzowego i drobiowego sprzyjała wysokiej wartości odżywczej diety chłopców, lecz jednocześnie mniej korzystnej wysokiej zawartości cholesterolu, białka i tłuszczu. Uzyskane wyniki sugerują, że mała częstość spożycia mięsa wieprzowego i drobiowego była związana z większym urozmaiceniem diety, zawierającej zarówno produkty roślinne, jak i zwierzęce. Zmniejszenie urozmaicenia diety chłopców wraz ze wzrostem częstości spożycia mięsa wieprzowego i drobiowego miało decydujący wpływ na zmniejszenie wartości energetycznej i odżywczej ich diety.