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COMPARISON OF EATING HABITS ON THE BASIS OF SINGLE AND TRIPLE DIETARY INTERVIEWS

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The aim of this work was to compare the results of an evaluation of the eating habits of young people on the basis of single and triple dietary interviews.

The research included 95 pupils from secondary schools, aged 13.1 years ±0.04. The nutrient intake was estimated by the 24-h recall method. A triple dietary interview was carried out with each of the persons. The daily nutrient intake and the mean intake for three days were determined and, allowing for losses, compared with the recommended daily intakes on the safe level. The population percentage was calculated for four intake ranges (<66.6% of the RDA; 66.6÷89.9% of the RDA; 90÷110% of the RDA; >110% of the RDA). The variation in the intake estimation was expressed in % as the index $(x_n - x_{śr})100/x_{śr}$ and determined by calculating the Pearson's linear correlation coefficient. The population distribution in the consumption ranges was compared by means of the chi^2 test.

The variation in the nutrient intake estimation on the basis of a single dietary interview varied from -15% to +30% in girls and from -15% to +16% in boys. The correlation between the dietary recommended allowances in a triple interview (calculated as the mean for three days) and the values from single interviews varied from 0.49 to 0.91 in the first interview; from 0.61 to 0.90 in the second interview, and from 0.43 to 0.80 in the third interview. The population distributions in intake ranges did not differ significantly ($p \geq 0.818$). The percentage of people classified correctly to particular intake ranges in single interviews, in comparison with the classification carried out for the triple interview, varied from 44.2% to 85.3% of the population. The percentage of people classified incorrectly to the lower class ranged from 10.5% to 45.3%, and to the higher class – from 3.2% to 29.5%. With the exception of calcium, in all incompatible classification cases in single interviews the displacement of individual cases to the lower class, in comparison to the triple interview, was stated.

A high correlation between single and triple dietary interviews in nutrient intake evaluation, and the lack of differences in the population distribution in intake ranges confirms the possibility of using the 24-h recall method in a single repetition for determining the eating habits of young people. In single interviews, in comparison with the triple interview, people were more often classified to a too low intake range than to a too high one. This indicates higher probability of obtaining unsatisfactory results as for the eating habits evaluation – lower on the basis of a single interview than a triple interview.

INTRODUCTION

The 24-h recall method has recently appeared in scientific literature for two main reasons. It is one of the most commonly used methods in short- and medium-term research on the eating habits of different groups of people [Duda *et al.*, 1998; Mensink *et al.*, 2001; Persson *et al.*, 2001; Przysławski *et al.*, 1998; Szponar & Rychlik, 1996a, b; Wądołowska *et al.*, 2001], despite some doubts concerning its accuracy, the degree of compatibility between estimated and actual food intake, and the influence of the so-called "unreliable" respondents on the results [Gibson, 1990; Hill & Davies, 2001; Johansson *et al.*, 1998; Macdiarmid & Blundell, 1998]. However, its unquestionable advantages, like for example low costs and relative simplicity, gain meaning especially in the case of strict observance of the procedure principles during the dietary interview [Charzewska, 1994; Charzewska *et al.*, 1997; Gibson, 1990]. Therefore, in the eating habit evaluation it is a method of choice. The other reason is the application of the 24-h recall method for validation when verifying the credibility of information on food consumption, obtained with the help of different questionnaires of food intake frequency [Hill & Davies, 2001; Kroke *et al.*, 1999; Mensink *et al.*, 2001; Wądołowska *et al.*, 2002]. In this case, the interview is repeated with the same respondent many times: twice to 12 times, which increases the estimation precision of habitual consumption estimation for individual persons [Gibson, 1990; Kroke *et al.*, 1999; Persson *et al.*, 2001].

The multiple usage of the 24-h recall method is very burdensome for respondents, and frequent research participation refusals decrease the possibility of conducting representative research. Therefore, in all cases when the researcher does not care about a particularly accurate evaluation of food intake by individual persons, but is interested in the consumption in a group – the dietary interview is carried out only once, on an increased-size sample [Gibson, 1990]. On the other hand, the examination of the correla-

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tion between food intake and the health/disease state requires result verification by statistical methods, applying *e.g.* regression models [Gibson, 1990; Paeratakul *et al.*, 1998]. In such cases, credible information about nutrient intake by individual persons is essential. For these reasons it seems that the knowledge of the precision of a single interview concerning the last 24-h intake is particularly crucial. However, very few works are currently being conducted on this topic [Paeratakul *et al.*, 1998; Persson *et al.*, 2001], and basic information comes mainly from textbooks, monographs and review works [Dwyer, 1988; Gibson, 1990; Gronowska-Senger, 2000; Hill & Davies, 2001]. Also, a few papers only concern children and youth, including the Caucasian ethnic group [Hill & Davies, 2001].

The aim of this work was to compare the results of an evaluation of the eating habits of young people on the basis of single and triple dietary interviews.

MATERIALS AND METHODS

The research included 95 pupils aged 13.1±0.04 from four classes at two secondary schools located in Olsztyn and Barczewo. The pupils examined were selected randomly in a two-stage procedure, first schools, and then classes, two at each school. The research included all pupils from the four classes, who were present at school during the examination. The basic anthropometrical parameters of the pupils examined are presented in Table 1.

The evaluation of their consumption habits was carried out by the multi-24-h recall method [Charzewska *et al.*, 1997], using the "Album of products with a different size of portions" [Szczygłowa *et al.*, 1991]. The dietary interview was conducted with each of the pupils on three consecutive days. Daily nutrient intake was determined on the basis of tables showing the composition and nutritional value of products [Kunachowicz *et al.*, 1998]. Then the mean con-

TABLE 1. The basic anthropometrical parameters of the youth examined.

Parameter	Girls N=51				Boys N=44			
	x	SEM	min	max	x	SEM	min	max
Age (years)	13.0	0.03	12.0	14.0	13.2	0.07	13.0	15.0
Height (cm)	158.5	0.95	145.0	177.5	160.9	1.03	146.0	175.5
Body mass (kg)	51.0	1.71	32.5	99.3	49.8	1.49	36.3	84.0
BMI (kg/m^2)	20.2	0.52	13.8	31.5	19.2	0.44	13.9	29.0

TABLE 2. The nutritional value of girls and boys food rations and its variation in single and triple interview (mean of 3 days) and comparison to the recommended daily intake.

Nutrient	Intake										Percent of RDA's in triple interview (%)					
	Girls (N=51)					Boys (N=44)										
	Triple interview		Variation (%) $(x_n - x_{\text{śr}})100/x_{\text{śr}}$			Triple interview		Variation (%) $(x_n - x_{\text{śr}})100/x_{\text{śr}}$			Girls (N=51)		Boys (N=44)		Total population (N=95)	
	$x_{\text{śr}}$	SEM	1 day	2 day	3 day	$x_{\text{śr}}$	SEM	1 day	2 day	3 day	$x_{\text{śr}}$	SEM	$x_{\text{śr}}$	SEM	$x_{\text{śr}}$	SEM
Energy (kcal)	2443	107.0	0.0	4.7	-4.7	3472	179.1	9.7	-0.1	-9.6	95.6	4.19	120.2	6.20	107.0	3.84
Total protein (g)	77.5	3.27	-2.2	6.8	-4.6	109.1	5.91	8.6	4.5	-13.1	139.5	5.89	178.5	9.67	157.6	5.81
Animal protein (g)	44.1	2.19	-6.3	9.0	-2.7	60.9	3.94	7.4	7.0	-14.4	–	–	–	–	–	–
Fat (g)	89.6	4.56	-2.5	5.0	-2.5	130.7	7.91	8.1	0.7	-8.8	113.6	5.78	143.5	8.68	127.4	5.28
Carbohydrates (g)	355	15.7	2.9	3.4	-6.3	496	26.1	10.6	-1.3	-9.3	–	–		–	–	–
Fiber (g)	25.5	1.12	1.4	5.0	-6.5	35.1	1.96	9.0	2.2	-11.1	85.0	3.72	116.9	6.53	99.8	3.96
Cholesterol (mg)	378	28.2	-15.0	29.5	-14.5	469	34.4	15.8	-6.1	-9.7	113.5	8.46	140.7	10.33	126.1	6.71
SFA (g)	31.4	1.89	-1.0	2.5	-1.5	46.8	3.28	11.8	-0.7	-11.1	–	–		–	–	–
MUFA (g)	33.3	1.83	-0.7	3.3	-2.6	48.5	3.10	10.4	-0.3	-10.1	–	–		–	–	–
PUFA (g)	17.1	1.00	-4.1	10.9	-6.8	24.2	1.82	-0.5	6.3	-5.9	220.5	12.83	272.3	20.42	244.5	11.94
Ca (mg)	691	49.3	-5.3	-3.8	9.2	826	70.7	11.1	2.3	-13.4	56.5	4.03	67.6	5.78	61.6	3.47
P (mg)	1296	58.7	-3.0	5.4	-2.4	1782	100.6	9.2	2.7	-11.9	145.8	6.60	200.5	11.32	171.1	6.90
Mg (mg)	310	14.4	-1.8	6.3	-4.6	414	22.0	8.3	2.1	-10.4	99.5	4.62	133.2	7.09	115.1	4.44
Fe (mg)	12.0	0.50	-1.3	8.6	-7.3	16.6	0.98	9.1	2.1	-11.2	71.7	3.01	124.4	7.36	96.1	4.63
Zn (mg)	11.1	0.47	1.5	5.5	-6.9	15.6	0.87	8.4	3.8	-12.2	100.1	4.26	100.3	5.62	100.2	3.45
Cu (mg)	1.27	0.056	-2.6	8.5	-5.9	1.68	0.093	8.5	1.7	-10.2	76.3	3.37	100.9	5.56	87.7	3.38
K (mg)	3387	136.3	-1.8	9.3	-7.5	4565	250.7	8.6	2.5	-11.1	121.9	4.91	164.3	9.03	141.6	5.37
Vitamin A (ug)	1145	84.9	-6.9	10.7	-3.8	1744	310.3	3.6	4.6	-8.1	143.1	10.61	186.8	33.25	163.4	16.47
Vitamin E (mg)	14.1	0.83	-5.3	8.4	-3.0	19.4	1.53	-0.3	0.9	-0.6	159.2	9.34	174.4	13.79	166.2	8.12
Vitamin B_1 (mg)	1.61	0.066	5.9	3.0	-8.8	2.47	0.156	11.5	0.6	-12.1	99.0	4.08	131.8	8.32	114.2	4.72
Vitamin B_2 (mg)	1.63	0.081	-7.4	11.3	-3.9	2.09	0.139	12.0	0.0	-12.1	77.1	3.85	98.7	6.58	87.1	3.83
Vitamin PP (mg)	15.4	0.67	0.4	10.4	-10.8	23.1	1.44	6.0	3.8	-9.8	76.9	3.33	104.0	6.4	89.4	3.74
Vitamin B_6 (mg)	2.18	0.095	-1.6	10.5	-8.9	3.07	0.171	8.4	2.3	-10.7	130.9	5.69	153.4	8.57	141.4	5.12
Vitamin C (mg)	115.2	7.94	-4.0	5.9	-1.8	116.2	8.99	12.1	1.1	-13.2	86.4	5.96	87.2	6.75	86.7	4.45

sumption for three days was determined and, allowing for losses, compared with the recommended daily intake [Ziemlański *et al.*, 1994]. The losses amounted to: 25% – vitamin A, 20% – vitamin B_1, 15% – vitamin B_2, 55% – vitamin C, and 10% for the other nutrients. Cholesterol and fiber consumption was compared with the dietary prophylaxis recommendations, assuming 27 g and 300 mg, respectively, as reference standards [WHO, 1990]. Only those pupils for whom complete dietary history data for three days were gathered were included in the research.

The results are presented as mean values and standard deviations of the mean (x±SEM) for consumption on each day (x_1, x_2, x_3) and for the mean consumption on three days ($x_{śr}$). The variation in the consumption evaluation was expressed in % as the index $(x_n\text{-}x_{śr})100/x_{śr}$ and determined by calculating the Pearson's linear correlation coefficient. The population percentage was calculated for four consumption ranges (<66.6% of the norm; 66.6÷89.9% of the norm; 90÷110% of the norm; >110% of the norm). The population distribution in the consumption ranges was compared by means of the chi^2 test. Statistical analysis was made with the use of the computer program STATISTICA v.6.0 PL, at a significance level of $p \leq 0.05$.

RESULTS

The nutritional value of the boys' daily food rations, calculated as a mean for three days for many nutrients was within the recommended daily intakes or higher (Table 2). Among girls, a too low consumption level was revealed for calcium (56.5% of the RDA), iron (71.7% of the RDA), copper (76.3% of the RDA), vitamin B_2 (77.1% of the RDA), vitamin PP (76.9% of the RDA), vitamin C (86.4% of the RDA), and fiber (25.5 g/day), and among boys – only for calcium (67.6% of the RDA) and vitamin C (87.2% of the RDA). The biggest variance in the nutrient intake evaluation on the basis of a single nutritional interview was revealed for cholesterol: it varied from -15% to +30% among girls and from -10% to +16% among boys, and for the other nutrients accordingly from -11% to +11% and from -15% to +12% (Table 2). The correlation coefficient between the dietary recommended level realization in a triple interview and the values from single interviews varied from 0.49 to 0.91 in the first interview; from 0.61 to 0.90 in the second interview, and from 0.43 to 0.80 in the third interview (Table 3).

The population distributions in the separate intake ranges on consecutive days of the single interview did not differ significantly from the population distribution for the triple interview ($p \geq 0.818$, Table 4).

The percentage of the population classified correctly to the intake ranges in single interviews, in comparison with the classification carried out for the triple interview, varied from 44.2% to 85.3% of the population. The percentage of the population classified incorrectly to the lower class ranged from 10.5% to 45.3%, and to the higher class – from 3.2% to 29.5%. Only in the case of calcium was the classification incompatible in single interviews, compared with the triple interview, as a higher percentage of people was classified to a too high than to a too low class (day 1: 23.2% *vs.* 10.5%; day 3: 26.3% *vs.* 14.7%, Table 4). In the other cases of incompatible classification in single interviews a displacement of individual cases to the lower class, in comparison with the classification in the triple interview, was stated (Table 4). This kind of incompatible classification was revealed for energy (day 3), protein (day 1, 3), fat (day 2, 3), cholesterol (day 1, 3), PUFA (day 1,3), fiber (day 3), phosphorus (day 3), magnesium (day 3), iron (day 3), zinc (day 3), copper (day 3), potassium (day 3), vitamin A (day 1, 3), vitamin E (day 1, 3), vitamin B_1 (day 3), vitamin B_2 (day 3), vitamin PP (day 3), vitamin B_6 (day 1, 3), and vitamin C (day 3). Taking into account all intake ranges, seven incompatible classifications were noted on the first day, one on the second day and 20 on the third day (Table 5).

TABLE 3. The breakdown of correlation coefficients between triple (mean of 3 days) and single nutritional interview for recommended daily intake realization in total population (N=95).

Nutrient	Single dietary interview in consecutive days		
	1 day	2 day	3 day
Energy	0.83	0.83	0.78
Protein	0.78	0.81	0.76
Fat	0.75	0.76	0.79
Cholesterol	0.49 p<0.001	0.69	0.74
PUFA	0.68	0.72	0.75
Fiber	0.83	0.79	0.74
Ca	0.86	0.76	0.76
P	0.85	0.82	0.80
Mg	0.85	0.79	0.73
Fe	0.85	0.86	0.77
Zn	0.75	0.76	0.77
Cu	0.83	0.81	0.73
K	0.84	0.64	0.70
Vitamin A	0.91	0.90	0.43 p<0.001
Vitamin E	0.66	0.72	0.76
Vitamin B_1	0.70	0.79	0.74
Vitamin B	20.8	50.8	10.73
Vitamin PP	0.77	0.74	0.71
Vitamin B_6	0.79	0.61	0.71
Vitamin C	0.79	0.63	0.62

DISCUSSION

According to the results of the triple interview, the young people examined were characterized by average energy and nutrient intake. The boys from Olsztyn and Barczewo, compared with 13-year-old boys from the area of whole Poland included in the research by Szponar and Rychlik [1996a], consumed more energy (120.2% of the RDA *vs.* 98.2% of the RDA), but at the same time they were characterized by higher body mass (49.8 kg *vs.* 44.9 kg), height (160.9 cm *vs.* 155.0 cm) and the BMI (19.2 kg/m^2 *vs.* 18.5 kg/m^2). Their average anthropometrical parameters corresponded with the body measurements of 14-year-old boys [Szponar & Rychlik, 1996a]. On the other hand, the girls examined, in comparison with 13-year-old girls [Szponar & Rychlik, 1996b], consumed slightly smaller amounts of energy (95.6% of the RDA *vs.* 99.9% of the RDA), although their body measurements, like in the case of boys, were higher (height: 158.5 cm *vs.* 156.2 cm; body mass: 51.0 kg *vs.* 44.4 kg; BMI: 20.2 kg/m^2 *vs.* 18.1 kg/m^2).

TABLE 4. The comparison of total population distribution (N=95) in the intake ranges in triple (mean of 3 days) and single interview.

Nutrient	Intake ranges of RDA's	Percentage of population in intake ranges in the interview (%)				Comparison of classification compability in single interviews with classification in triple interview			
		triple	single in consecutive days			Classification compatible/incompatible	Percentage of population in consecutive days of the single interview (%)		
			1 day	2 day	3 day		1 day	2 day	3 day
Energy	<66.6%	13.7	12.6	17.9	24.2				
	66.6–89.9%	16.8	24.2	18.9	21.1	incompatible – in the lower class	21.1	23.2	29.5
	90–110%	32.6	17.9	20.0	21.1	compatible	52.6	55.8	61.1
	>110%	36.8	45.3	43.2	33.7	incompatible – in the upper class	26.3	21.1	9.5
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.400	p=0.728	p=0.001
Protein	<66.6%	4.2	4.2	3.2	9.5				
	66.6–89.9%	3.2	8.4	8.4	14.7	incompatible – in the lower class	18.9	11.6	27.4
	90–110%	10.5	12.6	10.5	11.6	compatible	73.7	80.	067.4
	>110%	82.1	74.7	77.9	64.2	incompatible – in the upper class	7.4	8.4	5.3
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.020	p=0.463	p<0.001
Fat	<66.6%	8.4	17.9	16.8	18.9				
	66.6-89.9%	16.8	8.4	12.6	14.7	incompatible – in the lower class	25.3	26.3	29.5
	90-110%	14.7	20.0	14.7	16.8	compatible	58.9	58.9	61.1
	>110%	60.0	53.7	55.8	49.5	incompatible – in the upper class	15.8	14.7	9.5
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.107	p=0.049	p=0.001
Cholesterol	<66.6%	11.6	30.5	28.4	36.8				
	66.6-89.9%	24.2	14.7	8.4	20.0	incompatible – in the lower class	32.6	28.4	45.3
	90-110%	13.7	6.3	13.7	8.4	compatible	47.4	47.4	46.3
	>110%	50.5	48.4	49.5	34.7	incompatible – in the upper class	20.0	24.2	8.4
	distribution comparison		p<1.000	p<1.000	p<0.999	comparison of extreme sizes	p=0.050	p=0.512	p<0.001
PUFA	<66.6%	3.2	6.3	6.3	11.6				
	66.6-89.9%	6.3	7.4	3.2	5.3	incompatible – in the lower class	13.7	8.4	15.8
	90-110%	3.2	8.4	2.1	4.2	compatible	82.1	85.3	81.1
	>110%	87.4	77.9	88.4	78.9	incompatible – in the upper class	4.2	6.3	3.2
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.023	p=0.580	p=0.004
Fiber	<66.6%	17.9	24.2	18.9	31.6				
	66.6-89.9%	29.5	17.9	29.5	22.1	incompatible – in the lower class	20.0	22.1	28.4
	90-110%	18.9	21.1	17.9	20.0	compatible	57.9	54.7	62.1
	>110%	33.7	36.8	33.7	26.3	incompatible – in the upper class	22.1	23.2	9.5
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.723	p=0.857	p=0.001
Ca	<66.6%	63.2	62.1	67.4	60.0				
	66.6-89.9%	21.1	16.8	14.7	18.9	incompatible – in the lower class	10.5	13.7	14.7
	90-110%	8.4	5.3	6.3	7.4	compatible	66.3	71.6	58.9
	>110%	7.4	15.8	11.6	13.7	incompatible – in the upper class	23.2	14.7	26.3
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.020	p=0.844	p=0.049
P	<66.6%	3.2	5.3	3.2	8.4				
	66.6-89.9%	4.2	4.2	5.3	9.5	incompatible – in the lower class	11.6	8.4	20.0
	90-110%	10.5	9.5	12.6	10.5	compatible	82.1	84.2	74.7
	>110%	82.1	81.1	78.9	71.6	incompatible – in the upper class	6.3	7.4	5.3
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.202	p=0.799	p=0.003
Mg	<66.6%	11.6	15.8	11.6	18.9				
	66.6-89.9%	16.8	21.1	22.1	25.3	incompatible – in the lower class	21.1	17.9	32.6
	90-110%	29.5	20.0	18.9	17.9	compatible	65.3	60.0	52.6
	>110%	42.1	43.2	47.4	37.9	incompatible – in the upper class	13.7	22.1	14.7
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.180	p=0.470	p=0.004
Fe	<66.6%	22.1	27.4	24.2	36.8				
	66.6-89.9%	33.7	24.2	27.4	29.5	incompatible – in the lower class	23.2	18.9	28.4
	90-110%	16.8	9.5	16.8	8.4	compatible	47.4	52.6	64.2
	>110%	27.4	38.9	31.6	25.3	incompatible – in the upper class	29.5	28.4	7.4
	distribution comparison		p<1.000	p<1.000	p<1.000	comparison of extreme sizes	p=0.326	p=0.125	p<0.001

Nutrient	Intake ranges of RDA's	Percentage of population in intake ranges in the interview (%) triple	single in consecutive days 1 day	2 day	3 day	Comparison of classification compability in single interviews with classification in triple interview: Classification compatible/incompatible	Percentage of population in consecutive days of the single interview (%) 1 day	2 day	3 day
Zn	<66.6%	14.7	18.9	15.8	30.5				
	66.6-89.9%	30.5	26.3	26.3	23.2	incompatible – in the lower class	22.1	21.1	33.7
	90-110%	16.8	15.8	20.0	16.8	compatible	54.7	57.9	55.8
	>110%	37.9	38.9	37.9	29.5	incompatible – in the upper class	23.2	21.1	10.5
	distribuition comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.857$	$p=1.000$	$p<0.001$
Cu	<66.6%	26.3	31.6	29.5	36.8				
	66.6-89.9%	35.8	26.3	28.4	33.7	incompatible – in the lower class	22.1	15.8	27.4
	90-110%	17.9	18.9	14.7	11.6	compatible	53.7	58.9	62.1
	>110%	20.0	23.2	27.4	17.9	incompatible – in the upper class	24.2	25.3	10.5
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.732$	$p=0.107$	$p=0.003$
K	<66.6%	3.2	6.3	5.3	13.7				
	66.6-89.9%	9.5	15.8	13.7	16.8	incompatible – in the lower class	21.1	22.1	37.9
	90-110%	17.9	13.7	17.9	23.2	compatible	67.4	58.9	57.9
	>110%	69.5	64.2	63.2	46.3	incompatible – in the upper class	11.6	18.9	4.2
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.078$	$p=0.586$	$p<0.001$
Vitamin A	<66.6%	9.5	20.0	15.8	18.9				
	66.6-89.9%	11.6	12.6	13.7	18.9	incompatible – in the lower class	29.5	25.3	32.6
	90-110%	13.7	12.6	9.5	9.5	compatible	60.0	58.9	56.8
	>110%	65.3	54.7	61.1	52.6	incompatible – in the upper class	10.5	15.8	10.5
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.001$	$p=0.107$	$p<0.001$
Vitamin E	<66.6%	8.4	16.8	10.5	16.8				
	66.6-89.9%	7.4	12.6	10.5	12.6	incompatible – in the lower class	24.2	20.0	27.4
	90-110%	12.6	8.4	13.7	14.7	compatible	67.4	69.5	65.3
	>110%	71.6	62.1	65.3	55.8	incompatible – in the upper class	8.4	10.5	7.4
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.004$	$p=0.070$	$p<0.001$
Vitamin B_1	<66.6%	11.6	15.8	17.9	24.2				
	66.6-89.9%	18.9	16.8	25.3	17.9	incompatible – in the lower class	22.1	29.5	41.1
	90-110%	20.0	15.8	14.7	26.3	compatible	54.7	51.6	49.5
	>110%	49.5	51.6	42.1	31.6	incompatible – in the upper class	23.2	18.9	9.5
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.857$	$p=0.090$	$p<0.001$
Vitamin B_2	<66.6%	31.6	37.9	29.5	45.3				
	66.6-89.9%	33.7	26.3	28.4	21.1	incompatible – in the lower class	23.2	17.9	28.4
	90-110%	12.6	13.7	12.6	15.8	compatible	56.8	54.7	56.8
	>110%	22.1	22.1	29.5	17.9	incompatible – in the upper class	20.0	27.4	14.7
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.593$	$p=0.119$	$p=0.023$
Vitamin PP	<66.6%	25.3	33.7	32.6	41.1				
	66.6-89.9%	32.6	20.0	22.1	30.5	incompatible – in the lower class	25.3	20.0	37.9
	90-110%	16.8	18.9	12.6	8.4	compatible	48.4	53.7	44.2
	>110%	25.3	27.4	32.6	20.0	incompatible – in the upper class	26.3	26.3	17.9
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.875$	$p=0.305$	$p=0.002$
Vitamin B_6	<66.6%	3.2	7.4	9.5	12.6				
	66.6-89.9%	9.5	15.8	11.6	15.8	incompatible – in the lower class	25.3	21.1	33.7
	90-110%	17.9	13.7	11.6	20.0	compatible	64.2	63.2	60.0
	>110%	69.5	63.2	67.4	51.6	incompatible – in the upper class	10.5	15.8	6.3
	distribution comparison		$p<1.000$	$p<1.000$	$p<1.000$	comparison of extreme sizes	$p=0.008$	$p=0.348$	$p<0.001$
Vitamin C	<66.6%	37.9	47.4	45.3	52.6				
	66.6-89.9%	28.4	11.6	12.6	14.7	incompatible – in the lower class	18.9	25.3	30.5
	90-110%	10.5	8.4	15.8	13.7	compatible	60.0	46.3	51.6
	>110%	23.2	32.6	26.3	18.9	incompatible – in the upper class	21.1	28.4	17.9
	distribution comparison		$p<1.000$	$p<0.818$	$p<1.000$	comparison of extreme sizes	$p=0.705$	$p=0.630$	$p=0.044$

TABLE 5. Number of classifications incompatible with the intake ranges in single interviews in comparison to triple interview classification.

Classification manner	Interview in consecutive days		
	1 day	2 day	3 day
Incompatible – in the lower class	6	1	19
Incompatible – in the upper class	1*	0	1*
Incompatible – total	7	1	20

* calcium

The differences observed in food intake could partly result from the fact that Szponar and Rychlik [1996a, b] applied the tables of product composition and nutritional value of 1990 [Łoś-Kuczera, 1990], while in own research tables of 1998 were used [Kunachowicz *et al.*, 1998]. Moreover, in this work the intake was defined with the use of the 24-h recall method in triple repetitions, whereas in the research cited above [Szponar & Rychlik, 1996a, b] – in a single repetition. The eating habits of the pupils examined may be considered typical of people in Poland, *i.e.* characterized by a high intake of protein, fat and phosphorus, and a low intake of calcium, some vitamins and fiber, as well as higher deviations from the norms in the case of girls and women than in that of boys and men [Duda *et al.*, 1998; Hamułka *et al.*, 2001; Przysławski *et al.*, 1998; Pardo *et al.*, 1996; Szponar & Rychlik, 1996a, b; Wądołowska *et al.*, 2001].

The correlations between the energy and nutrient intake determined in single and triple interviews by the 24-h recall method indicate a strong interdependence between the estimated values. For energy the correlation coefficients on consecutive days amounted to 0.83, 0.83 and 0.78, indicating good estimation of energy intake expressed by the norm percentage and showing the possibility of using the 24-h recall method in a single repetition for the estimation of food energy value in young people. The correlation coefficients for nutrients amounted on average to: 0.78, 0.76 and 0.73 on successive days of the interview. The lowest correlation coefficients were found in single days for cholesterol (1 day, $r=0.49$, $p<0.001$) and vitamin A (3 day, $r=0.43$, $p<0.001$). Particularly in the case of vitamin A, its high personal variance (person-to-person) is a characteristic feature of nutrition [Räsänen, 1979 after Gibson, 1990]. The standard deviation for the mean intake in the group often exceeded 100% of the mean value [Duda *et al.*, 1998; Wądołowska *et al.*, 2001]. For this vitamin a high individual deviation may also be expected, *i.e.* in the day-to-day intake (from day to day for the same person). This suggestion was confirmed by the results obtained. The results of long-term nutritional research show that high variation in vitamin A intake is usually connected with the consumption of dishes containing liver, or vegetable juices with carrot. This should be kept in mind while interpreting the results obtained with the 24-h recall method in a single interview for nutrients whose intake is characterized by a high deviation. A similar opinion was formed by Paeratakul *et al.* [1998], who analyzed errors in the creation of the regression models between intake and the BMI depending on the number of repetitions (ones-3 times) of the 24-h recall method.

Similarly as in the case of vitamin A, a wide variation of the person-to-person intake was also observed for cholesterol by some Polish authors [Pardo *et al.*, 1996; Wądołowska *et al.*, 2001]. The reason for a high deviation in cholesterol intake, both individual and personal, is first of all a different share of a given assortment of animal produce in the daily food ration. Apart from these two components (cholesterol and vitamin A), which may be considered "outlaying cases", the other nutrients were characterized by high correlation coefficients, which indicates a low day-to-day deviation. In the light of the results obtained, the 24-hour recall method in a single repetition can be considered a good method for estimating the nutritional value of daily food rations in young people.

In relation to a group, this thesis is also confirmed by the results of population distribution analysis in the intake ranges. It was not found for any of the nutrients analyzed that the 24-h recall method in a single repetition brings different results as for the eating habits of young people than a triple interview. This suggests that a single interview concerning a 24-h dietary history preceding the examination may allow to determine correctly the population percentage with adequate, too low or too high intake with reference to the relevant standards. It also enables characterising the eating habits of young people on condition that the sample size is big enough [Gibson, 1990; Persson *et al.*, 2001].

With reference to single persons, the consumption habits evaluation carried out on the basis of the 24-h recall method in a single repetition arises certain doubts. Compatibility analysis of the classification of individual persons to particular intake ranges suggests that the results gathered with the use of this method should be interpreted with care. The percentage of people classified correctly with the use of the 24-h recall method in a single repetition to the same range as in a triple repetition was high and ranged from 44.2% to 85.3% of the population. Such results should be considered satisfactory and much better than those received by Kroke *et al.* [1999]. These authors compared the way of classifying 160 adults taking part in multi-centre European research EPIC Study to nutrient intake quintiles for the FFQ (questionnaire of the food intake frequency) and the 24-h recall method in a 12-time-repetition. Correct classification by the FFQ was noted for 30.6–51.1% of the population, incorrect classification to the next quintile – for 33.6–44.0% of the population, and erroneous classification to the extreme quintile did not exceed 4.0% of the population. In the research conducted by Kroke *et al.* [1999] also the Pearson's correlation coefficients without energy adjustment were slightly lower (0.47–0.83) and remained within a narrower range than the results obtained in the present work (0.43–0.91). It would be difficult to compare the above results with own research due to certain methodological differences and different groups of people (adults – young people). However, a hypothesis may be proposed that the single 24-h recall method enables more correct classification of people to intake ranges than the food intake frequency method.

The number and way of incompatible classifications also require consideration. For 22 incorrect classifications as many as 20 were classifications to lower ranges. It means that the eating habit evaluation made on the basis of the results obtained by the 24-h recall method in a single repetition, in relation to many nutrients, showed a more frequent occurrence of too low intake among young people, compared with a triple repetition. Therefore, the consumption habits of young people evaluated with single 24-h interviews seem to be worse than they really are. The only exception to this rule was calcium. For this nutrient in two interviews out of three significantly more individuals were classified to the higher intake range than to the lower one. In contrast to the other nutrients, single 24-h recall interviews concerning calcium characterized the eating habits of pupils as better. Taking into account the great interest in calcium intake, displayed by many researchers, the results obtained question the possibility of correlating its intake by young people with the osteoporosis risk factors in the case of the 24-h recall method in a single repetition. This problem needs to be analyzed in other groups of people.

At the end it should be strongly indicated that all validation procedures and attempts at determining the accuracy of methods for food and nutrient intake evaluation in humans are confronted with serious obstacles. They all are burdened with some error, and the actual accuracy of these methods may never be defined, because it is impossible to repeat the observation [Block, 1982 according to Gibson, 1990]. Repeating the interview gives new information about the consumption on another day, because the day-to-day variation (intra-individual) is expressed in a short-term depiction by eating different products by the same person [Gibson, 1990]. A conclusion follows that the actual accuracy of the 24-h recall method may only be estimated, but its precise determination is not possible. However, this does not mean that work on this problem should be stopped, it only suggests the need for a more critical approach and constant improvement of intake evaluation methods in humans.

CONCLUSIONS

1. A high correlation between single and triple dietary interviews in nutrient intake evaluation, and the lack of differences in the population distribution in intake ranges confirm the possibility of using the 24-h recall method in a single repetition for determining the consumption habits of young people.

2. In single interviews, in comparison with the triple interview, people were more often classified to a too low intake class than to a too high one. This indicates higher probability of obtaining unsatisfactory results as for the consumption habit evaluation – lower on the basis of a single interview than a triple interview.

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PORÓWNANIE OCENY SPOSOBU ŻYWIENIA PRZEPROWADZONEJ NA PODSTAWIE JEDNOKROTNEGO I TRZYKROTNEGO WYWIADU ŻYWIENIOWEGO

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Celem pracy było porównanie wyników oceny sposobu żywienia młodzieży przeprowadzonej na podstawie jednokrotnego i trzykrotnego wywiadu żywieniowego.

Badaniami objęto 95 uczniów gimnazjów w wieku 13.1±0.04 lat (tab. 1). Spożycie składników odżywczych oszacowano metodą wywiadu 24-godzinnego. Z każdą z osób przeprowadzono 3-krotny wywiad żywieniowy, określając spożycie składników odżywczych w każdym dniu oraz średnie z 3 dni, które po uwzględnieniu strat porównano z normami na poziomie bezpiecznym. W utworzonych 4 zakresach spożycia (<66.6% normy; 66.6÷89.9% normy; 90÷110% normy; >110% normy) obliczono odsetek populacji. Zmienność w oszacowaniu spożycia wyrażono w % wskaźnikiem $(x_n-x_{śr})100/x_{śr}$ oraz oceniono poprzez wyznaczenie współczynników korelacji liniowej Pearsona. W porównaniu rozkładu populacji w zakresach spożycia wykorzystano test chi^2.

Zmienność w oszacowaniu spożycia składników odżywczych w oparciu o jednokrotny wywiad żywieniowy wynosiła od -15% do +30% u dziewcząt i od -15% do +16% u chłopców (tab. 2). Korelacja pomiędzy realizacją norm żywienia w wywiadzie trzykrotnym (obliczona jako średnia z 3 dni) a wartościami z wywiadów jednokrotnych wynosiła w wywiadzie 1 od 0.49 do 0.91; wywiadzie 2 od 0.61 do 0.90 i wywiadzie 3 od 0.43 do 0.80 (tab. 3). Rozkłady populacji w utworzonych zakresach spożycia nie różniły się istotnie ($p \geq 0.818$; tab. 4). Odsetek osób prawidłowo sklasyfikowanych w zakresach spożycia w wywiadach jednokrotnych w porównaniu do klasyfikacji przeprowadzonej dla wywiadu trzykrotnego wynosił od 44.2% do 85.3% populacji. Odsetek populacji sklasyfikowanej nieprawidłowo w klasie niższej wynosił od 10.5% do 45.3%, a w klasie wyższej – od 3.2% do 29.5%. Z wyjątkiem wapnia, we wszystkich przypadkach klasyfikacji niezgodnej w wywiadach jednokrotnych stwierdzono przesunięcie indywidualnych przypadków do klasy niższej w porównaniu z klasyfikacją w wywiadzie trzykrotnym (tab. 5).

Wysoka korelacja pomiędzy jednokrotnym wywiadem żywieniowym a trzykrotnym w oszacowaniu spożycia składników odżywczych oraz brak różnic w rozkładzie populacji w zakresach spożycia potwierdzają możliwość zastosowania metody wywiadu 24-godzinnego w powtórzeniu jednokrotnym w ocenie sposobu żywienia młodzieży. W wywiadach jednokrotnych w porównaniu do wywiadu trzykrotnego częściej klasyfikowano osoby do zbyt niskiej klasy spożycia niż zbyt wysokiej. Wskazuje to na większe prawdopodobieństwo uzyskiwania w ocenie sposobu żywienia wyników niezadowalających – niskich w oparciu o jednokrotny wywiad żywieniowy niż trzykrotny.