Anthropological Review • Vol. 78 (2), 183–195 (2015)

ANTHROPOLOGICAL REVIEW
Available online at: https://doi.org/10.1515/anre-2015-0013

Twenty four year time trends in fats and cholesterol intake by adolescents. Warsaw Adolescents Study

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ABSTRACT: The objective of this study was to determine time trends (1982–2006) in total fat intake and changes in fatty acid structure intake in adolescents from Warsaw in view of increasing prevalence of obesity. Data come from four successive surveys randomly selected samples of adolescents (aged 11–15 years old), from Warsaw region. In total 9747 pupils have been examined, with response rate varying from 55% to 87% depending on year. Surveys were done always in the spring season of the year. Food intake was assessed by using 24 hours recall method of consumption by the pupils all products, including enriched, dishes and beverages as well as diet supplements, in the last 24 hours preceding the examination. The content of energy and nutrients was calculated by means of own computer softwares (DIET 2 and 4), taking into account successive revisions of the tables of food composition and nutritional values, as well as current Polish DRI. A significant decreasing trend was found in intake of total fat, of saturated fatty acids (SFA) and cholesterol. The percentage of energy from total fat, also decreased both in boys (to 35,1%) and girls (to 33,7%), what failed to reach the desired level below 30% of energy from fat which is recommended. Also significant decrease of SFA consumption was not satisfactory enough to approach the values <10% of energy recommended as was from 13% to 15%. Decreasing trends in fat intake was not in accordance with the trend in obesity prevalence in the adolescents as average BMI is going up. To stabilize the health-oriented changes especially in the diets of adolescents, further activity is desired from professionals working with prevention of adolescents obesity.

KEY WORDS: adolescents, fatty acids, fat intake, BMI, trends

Original article: May 29, 2015; Accepted for publication: June 4, 2015
DOI: 10.1515/anre-2015-0013

Introduction

In view of increasing prevalence of obesity and the risk of development of many chronic diseases in ever younger age groups, it is recommended to limit fat consumption, also by children and adolescents. These recommendations have been reflected in the Polish Dietary Reference Intake (DRI), both in nutrition goals and in guidelines for the Polish population (Jarosz and Bułhak–Jachymczyk 2008).

Such recommendations are based on many years of observations of the relationship between fat consumption and the risk of development of cardiovascular diseases, some malignancies, atherosclerosis, arterial hypertension and overweight or obesity (Kuller 1997). There is a large body of evidence in the literature proving that fat diet plays a significant role in the development and treatment of obesity (Bray and Popkin 1998). Equally numerous reports question those statements. In spite of many benefits resulting from energy balance controlling through application of low-fat diets, numerous authors at present begin to accept the conclusion that not only fat diet but also the level of everyday physical activity have a decisive effect on the occurrence of a positive energy balance, leading to obesity development (Jequier 2001; Remer et al. 2002).

Furthermore, fat consumption is ascribed a new role in body mass regulation through the postprandial thermogenic effect, since the increase of energy expenditure after fat consumption is lower (2-3%) compared with the effect associated with carbohydrate intake (6-8%). These differences result from the fact that the energy cost of storage of fatty acids in the form of fat is lower than that of storage of glucose and glycogen (Jequier 2001).

Willet (1998), based on the analyses performed of the results of many interpopulation studies, came also to the conclusion that diet fat is not the main cause of obesity, since in many countries, including the USA, a significant drop has been noted in energy intake from fat with simultaneous increase of obesity (Willet 1998).

High-fat diet consumed by children and adolescents, as it is believed, also is not the most important cause of the increase of obesity prevalence (Jequier 2001; Magarey et al. 2001; Remer et al. 2002).

Fats not only provide an undesirable energy excess in the diets of adolescents but also, through the effects of individual fatty acids, participate in many metabolic processes. They influence myocardial function, participate in blood clotting processes and metabolism of lipoproteins, are components of cell membranes and a source of fat-soluble vitamins. The properties of individual fatty acids are diverse. The sources of energy include first of all saturated fatty acids (SFA), which are stored in the fatty tissue, and, when consumed in excess, cause an increase of atherogenic lipoprotein (LDL) concentration and an increase of blood coagulability and arterial pressure. On the other hand, a desirable group of fatty acids include the polyunsaturated fatty acids (PUFA) n-6 and particularly n-3, which in the youngest age groups ensure normal development of cognitive functions and vision and, at every age, exert a protective effect on the circulatory system, cardiac function and blood pressure, reduce the risk of arrhythmia and inhibit inflammatory processes. In view of their functions in many metabolic processes,

PUFA belong to the essential diet components, particularly at developmental age. The desirable fats in diet include also monounsaturated fatty acids (MUFA). Controversial views in literature are the cause of a need of elucidation of the role of dietary consumption of fat on population level and its association with a prevalence of obesity particularly in children or adolescents.

Aim of the study

An analysis of the occurrence of trends in total fat intake or cholesterol and changes in fatty acid structure intake in adolescents from Warsaw over a period of 24 years, was accepted as the aim of the study.

Materials and methods

In the years 1982–2006 four consecutive studies were carried out in youths aged from 11 to 15 years from randomly selected schools in Warsaw. The studies were carried out always in the same season, (in Spring from April through June) and always in the same schools. In all, 9747 pupils were studied, the mean response rate was 80.9% (Table 1).

The consumption of all products by the pupils, including enriched products and beverages as well as diet supplements was assessed by using 24 hours recall method of consumption in the last 24 hours preceding the examination, according to the recommended method (Cameron and Staveren 1988; Gibson 2005). The interviews were performed individually with each pupil by specialists in nutrition using the "Album of products and dishes of diversified size of portions" (Szponar et al. 1982, 2000). The content of energy and nutrients was calculated by means of own computer programmes, taking into account successive revisions of the tables of composition and nutritional values as well as the Polish DRI. The recently developed software contains new tables of composition and nutritional values and the revised (Kunachowicz et al. 2005).

In each of the programmes, losses of the nutrients were taken into account, resulting from the technology used for preparation of the products and dishes for consumption.

Anthropometric measurements were taken in agreement with proper methods (Weiner and Lourie 1969; WHO, Physical Status 1995) by staff of anthropologists. In this study, only Body mass index (BMI=kg/m^2) was analyzed, as trends in obesity with use of IOTF classification were published earlier (Charzewska et al. 2009; Charzewska and Chabros 2010).

Changes the mean daily intake of total fat, fatty acids, cholesterol and BMI in successive surveys, in 5 age groups, separately for girls and boys, were calculated with use of linear regression models. Normal distribution of analysed parameters were checked by Shapiro-Wilk test.

Table 1. Numbers of examined adolescents from Warsaw, in particular years of surveys and response rate

Years of surveys	Randomly selected	Examined	Response rate %
1982–1985	5431	4750	87.5
1988–1991	3205	2807	87.6
1999–2000	1526	1136	74.4
2005–2006	1884	1054	55.9
Total	12046	9747	80.9

As level of significance was accepted 5%. Analyses were done with use of Stata v.10 programme.

Results

Changes of the mean total fat intake by adolescents

During 24 years between the first and the last study a significant decreasing trend was found ($p<0.001$) in total fat content in the diets of adolescents of either sex (Table 2). Average daily intake over that time decreased in boys, depending on age group, from 0,68 g to 1,17 g per year, what makes drop from 16 to 28 g by 24 years period. In girls decrease by year was equal from 0,97 g to 1,28 g what did total decrease from 23 to 31 g in 24 years time.

In Table 3 the changes in fat content per 1000 kcal are shown, which standardized total fat intake per energy intake during 24 year. Such calculated average daily intake of total fat per 1000 kcal by children (per 1000 kcal = fat density) decrease from 1.1 g to 5.0 g/1000 kcal. Changes were significant ($p<0.01$), with the exception of 15-year-old boys ($p>0.1$).

The decreasing trend in the content of total fat and fat calculated for 1000 kcal in the diets of adolescents is reflected in the percentage of energy derived from fat

Table 2. Total fats (g) content in diets of adolescent boys and girls from Warsaw schools in 1982–2006

Years of survey	Age (years)				
	11	12	13	14	15
	Total fats (g/d) content				
	X±SD	X±SD	X±SD	X±SD	X±SD
Boys					
1982–1985	102±42	108±44	117±47	123±52	123±54
1988–1991	104±46	106±44	110±49	129±63	147±59
1999–2000	79±31	91±43	99±44	110±49,0	122±65
2005–2006	77±32	86±45	100±50	104±50	104±48
Mean annual change	–1.17	–0.97	–0.87	–0.84	–0.68
95% CI	(–1.52;–0.82)	(–1.33;–0.62)	(–1.24;–0.50)	(–1.25;–0.43)	(–1.17;–0.20)
p	<0.001	<0.001	<0.001	<0.001	<0.006
Total changes (g)	–28	–23	–21	–20	–16
Girls					
1982–1985	94±40	93±39	98±44	93±40	93±48
1988–1991	90±40	92±41	95±47	101±47	95±44
1999–2000	76±31	75±33	76±34	76±40	73±46
2005–2006	68±30	69±32	80±37	68±32	64±31
Mean annual change	–1.09	–1.00	–0.97	–1.10	–1.28
95% CI	(–1.40;–0.78)	(–1.32;–0.69)	(–1.31;–0.63)	(–1.42;–0.79)	(–1.65;–0.92)
p	<0.001	<0.001	<0.001	<0.001	<0.001
Total changes (g)	–26	–24	–23	–26	–31

95%CI = 95% confidence interval
p= level of significance

Table 3. Total fats content adjusted to 1000 kcal (g/1000 kcal), in diets of boys and girls from Warsaw schools in 1982–2006

Years of surveys	Age (years)				
	11	12	13	14	15
	Total fats content adjusted to 1000 kcal (g/1000 kcal/d)				
	X±SD	X±SD	X±SD	X±SD	X±SD
	Boys				
1982–1985	40±8	40±8	41±7	41±8	40±7
1988–1991	42±8	41±8	40±8	42±9	42±8
1999–2000	37±8	39±9	38±8	38±8	39±9
2005–2006	37±9	38±9	39±8	40±8	39±10
Mean annual change	–0.12	–0.10	–0.10	–0.09	0.05
95% CI	(–0.19;–0.05)	(–0.16;–0.04)	(–0.16;–0.04)	(–0.15;–0.03)	– (NS)
p	<0.01	<0.01	<0.01	<0.01	>0.1
Total changes (g/1000 kcal)	–2.9	–2.4	–2.5	–2.2	–1.1
	Girls				
1982–1985	39±7	40±7	40±8	41±8	40±8
1988–1991	40±8	40±8	41±8	41±9	41±7
1999–2000	37±9	36±8	36±9	37±9	35±9
2005–2006	37±8	37±8	38±8	38±9	37±9
Mean annual change	–0.10	–0.16	–0.12	–0.13	–0.21
95% CI	(–0.16;–0.04)	(–0.22;–0.09)	(–0.19;–0.06)	(–0.20;–0.07)	(–0.28;–0.14)
p	<0.01	<0.01	<0.01	<0.01	<0.01
Total changes (g/1000 kcal)	–2.3	–3.7	–3.0	–3.2	–5.0

95%CI = 95% confidence interval
p= level of significance
NS= not significant

(Fig. 1). The percentage of energy from fat (E F%) during over 24 years of observation of the diets of adolescents, in spite of some fluctuations depending on the year of study, decreased both in boys and girls. After the year 2000 a reverse of the trend could be seen in both sexes, about 1% increase of energy from fat (0.7% in boys and 1.0% in girls) but that increase failed to equal the percentages of energy from fat found in 1980s and 1990s. The lowest percentage of energy from fat occurred in the years 1999/2000, reaching 34.4% in boys and 32.7% in girls.

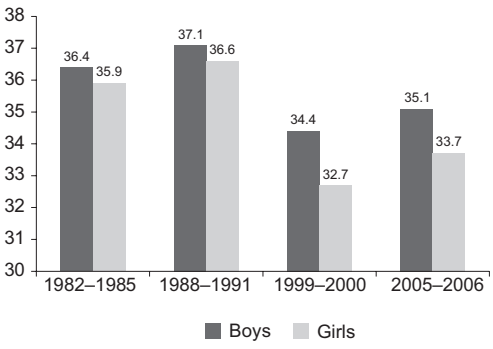

Fig.1. Percentage of energy from fats (%EF) in diet of adolescents from arsaw schools in 1982–2006 years

Structure changes of fatty acids intake

In the analysed period of 18 years some changes also occurred in the structure of fatty acids consumed by adolescents. As shown in Table 4, in all age groups a significant drop of saturated fatty acids (SFA) intake occurred in the diets of adolescents ($p<0,01$), which reached from 0.562 to 1.516 g SFA yearly, what means total decrease of saturated fatty acids from 10 g to 27 g SFA during 18 years.

On the other hand, the content of polyunsaturated fatty acids (PUFA) underwent a statistically insignificant reduction ($p>0.1$), what possibly could have been associated with a reduction of total fat intake (Table 5).

In spite of beneficial changes in the structure of fatty acids and the observed decreasing trends, the percentage of energy from saturated fats still remained too high in relation to the recommendations in force (<10% energy), since in the years of the last studies it was from 13% to 15% in boys and from 13% to 14% in girls (Table 6). The complementary increase of energy from polyunsaturated fatty acids was slight, failing to exceed 1% and remaining lower than recommended 6-10% of energy.

Changes of cholesterol content in the diets of adolescents

Table 7 demonstrates that during 18 years of observation (since the information on cholesterol content have been given in polish tables of composition and nutritional value), a systematic drop of cholesterol daily intake with diet of ado-

Table 4. Saturated fatty acids (g) in diets of adolescents from Warsaw in years 1988–2006

Years of surveys	Age (years)				
	11	12	13	14	15
	Saturated fatty acids (g/d)				
	X±SD	X±SD	X±SD	X±SD	X±SD
	Boys				
1988–1991	45±21	46±20	49±23	56±29	65±30
1999–2000	31±15	36±18	39±18	44±24	48±29
2005–2006	30±14	33±18	41±20	41±21	40±22
Mean annual change	–0.989	–0.826	–0.562	–0.944	–1.516
95% CI	(–1.236;–0.742)	(–1.065;–0.586)	(–0.818;–0.305)	(–1.249;–0.639)	(–1.873;–1.158)
p	<0.01	<0.01	<0.01	<0.01	<0.01
Total changes (g)	–18	–15	–10	–17	–27
	Girls				
1988–1991	39±18	40±19	41±20	43±21	41±19
1999–2000	31±14	31±14	31±15	30±17	28±19
2005–2006	28±14	28±13	31±14	26±14	25±13
Mean annual change	–0.700	–0.740	–0.620	–1.050	–0.990
95% CI	(–0.91;–0.49)	(–0.95;–0.53)	(–0.84;–0.41)	(–1.28;–0.83)	(–1.21;–0.77)
p	<0.01	<0.01	<0.01	<0.01	<0.01
Total changes (g)	–13	–13	–11	–19	–18

95%CI = 95% confidence interval
p= level of significance

Table 5. Polyunsaturated fatty acids (g) in diets of adolescents from Warsaw in years 1988–2006

Years of surveys	Age (years)				
	11	12	13	14	15
	Polyunsaturated fatty acids (g/d)				
	X±SD	X±SD	X±SD	X±SD	X±SD
	Boys				
1988–1991	12±11	11±9	12±10	15±15	17±13
1999–2000	10±5	12±9	13±8	14±8	17±12
2005–2006	11±6	12±9	12±8	14±9	14±8
Mean annual change 95% CI	–(NS)	–(NS)	–(NS)	–(NS)	–0.15 (–0.31; 0.002)
p	0.077	>0.1	>0.1	>0.1	0.053
Total changes (g)	–2	0.5	1.0	–1.5	–3.0
	Girls				
1988–1991	10±8	10±9	11±11	12±10	12±10
1999–2000	10±5	10±7	10±7	11±7	11±8
2005–2006	8±5	9±6	11±7	10±6	9±6
Mean annual change 95% CI	–(NS)	–(NS)	–(NS)	–0.14 (0.24; –0.03)	–0.16 (–0.27; –0.05)
p	0.08	>0.1	>0.1	0.010	0.004
Total changes (g)	–1.0	–1.0	–1.0	–2.5	–3.0

95%CI = 95% confidence interval
p= level of significance
NS=not significant

lescents could be seen and the drop was particularly dramatic in the years 1988-2000. In all age groups the reduction of cholesterol content in the diets of adolescents had the nature of a significant decreasing trend ($p < 0.01$), which could be estimated as an average decrease by 12 to 18 mg yearly, what makes total drop from 219 mg to 332 mg of daily intake during 18 years period.

BMI changes

In spite of a significant decrease of fat content in the diets of adolescents a reverse trend could be seen in the mean BMI value (Fig. 2) since in all analysed age groups an increase of the mean value of that index was found during 35 years of observation since 1971 to 2005/6, however increase was not significant in every group of age and sex.

Discussion

Changes in total fat intake

The analysis of 24-year trends in fat intake by adolescents in Warsaw demonstrated a statistically significant decreasing trend. The diet density in respect

Table 6. Percentage of energy (%E) from saturated, monounsaturated and polyunsaturated fats in diets of adolescent boys and girls, from Warsaw schools in 1988–2006 years

	Years of survey	Age (years)				
		11	12	13	14	15
Boys				Saturated		
	1988–1991	16	16	16	17	17
	1999–2000	13	14	14	14	14
	2005–2006	13	13	15	14	14
				Monounsaturated		
	1988–1991	17	16	16	17	17
	1999–2000	14	14	14	14	15
	2005–2006	14	14	14	15	15
				Polyunsaturated		
	1988–1991	4	4	4	4	4
	1999–2000	4	5	5	4	5
	2005–2006	5	5	4	5	5
Girls				Saturated		
	1988–1991	16	16	16	16	16
	1999–2000	14	14	14	13	13
	2005–2006	14	13	14	13	13
				Monounsaturated		
	1988–1991	16	16	16	17	17
	1999–2000	13	13	13	13	13
	2005–2006	13	13	14	14	13
				Polyunsaturated		
	1988–1991	4	4	4	5	5
	1999–2000	4	4	4	5	5
	2005–2006	4	4	5	5	5

of fat content calculated for 1000 kcal also decreased. In consequence, a reduction occurred of the percentage of energy derived from fat. The lowest percentage (EF%- percent energy from fat) was found in the study in the years 1999/2000; it reached 34.4% in boys and 32.7% in girls. An increase of the energy value from fat in the last study (2005/2006) in adolescents in Warsaw to 35.1% in boys and 33.7% in girls, means that these percentages failed to reach the desired level below 30 % of energy from fat which is recommended (for general population) and below 35 % for children in nutritional goals (Jarosz and Bułhak–Jachymczyk 2008).

It is also worth noting that the EF% values in Warsaw were lower compared with 36.8% - 36.9% observed in the German youth in the DONALD study (Alexy et al. 2002) and with the Belgian youth aged 10-12 years, in whom the EF% values were 40.4% and 39.5% respectively (Guillaume et al. 1998). The Polish values were similar to those found in Australian youth, which were 34.8% in 11-year-old boys and 35.9% in 11-year-old girls, being lower in the 15-year age group, 33.2% and 34.4%, respective-

Table 7. Cholesterol (mg) content in diets of boys and girls form Warsaw schools in 1988–2006 years

Years of surveys	Age (years)				
	11	12	13	14	15
	Cholesterol (mg/d) content				
	X±SD	X±SD	X±SD	X±SD	X±SD
	Boys				
1988–1991	458±265	479±311	489±278	554±312	574±322
1999–2000	208±133	242±133	263±139	315±186	327±204
2005–2006	236±134	225±140	262±171	297±205	281±158
Mean annual change	–16.01	–16.96	–15.23	–16.50	–18.43
95% CI	(–18.96;– 13.06)	(20.18;–13.75)	(–18.06;–12.4)	(–19.62);–13.38)	(–21.84;–15.02)
p	<0.01	<0.01	<0.01	<0.01	<0.01
Total change (mg)	– 288	– 305	– 274	– 297	– 332
	Girls				
1988–1991	429±275	383±215	429±301	448±285	409±250
1999–2000	248±143	202±125	214±130	216±141	186±131
2005–2006	191±118	202±129	207±130	203±120	186±123
Mean annual change	–14.60	–12.15	–14.50	–15.68	–14.54
95% CI	(–17.39;–11.80)	(–14.48;–9.82)	(–17.41;11.59)	(–18.34;–13.01)	(–17.06;12.01)
p	<0.01	<0.01	<0.01	<0.01	<0.01
Total change (mg)	– 263	– 219	– 261	– 282	– 262

95%CI = 95% confidence interval
p= level of significance

ly (Magarey et al. 2001). In the USA, similarly as in the Warsaw youth, also a decreasing trend was found of the percentage of energy derived from fat, and in the recent NHANES III study the EF% values were 33.4% in boys and 33.6% in girls (Troiano et al. 2000).

Changes in fatty acids structure intake

A large body of scientific evidence from observational and interventional studies is available in literature indicating that animal fats containing mainly saturated fatty acids (SFA) cause an increase of total cholesterol concentration in serum, increase in LDL fraction, cause hypercoagulability, insulin resistance, epithelial dysfunction and inflammatory conditions. Evidence is also available that substitution of SFA for polyunsaturated fatty acid (PUFA) may reverse those reactions (Mozaffarian et al. 2010). Because of that, the interest in diet fat intake is currently focused on the analysis of the structure of consumed fatty acids.

In the Warsaw adolescents examined in our study not only a reduction of total fat content in diets was observed over the 24 years, but also a significant decrease of SFA consumption was found. It was not high or satisfactory enough to approach the values <10% of energy recommended in current nutritional goals. In recent years that percentage in Warsaw adolescents was from 13% to 15%. On the other hand, the proportion of energy from the desired polyunsaturated fatty acids (PUFA) increased over the period of over 20 years by about 1% but in that case the values recommend-

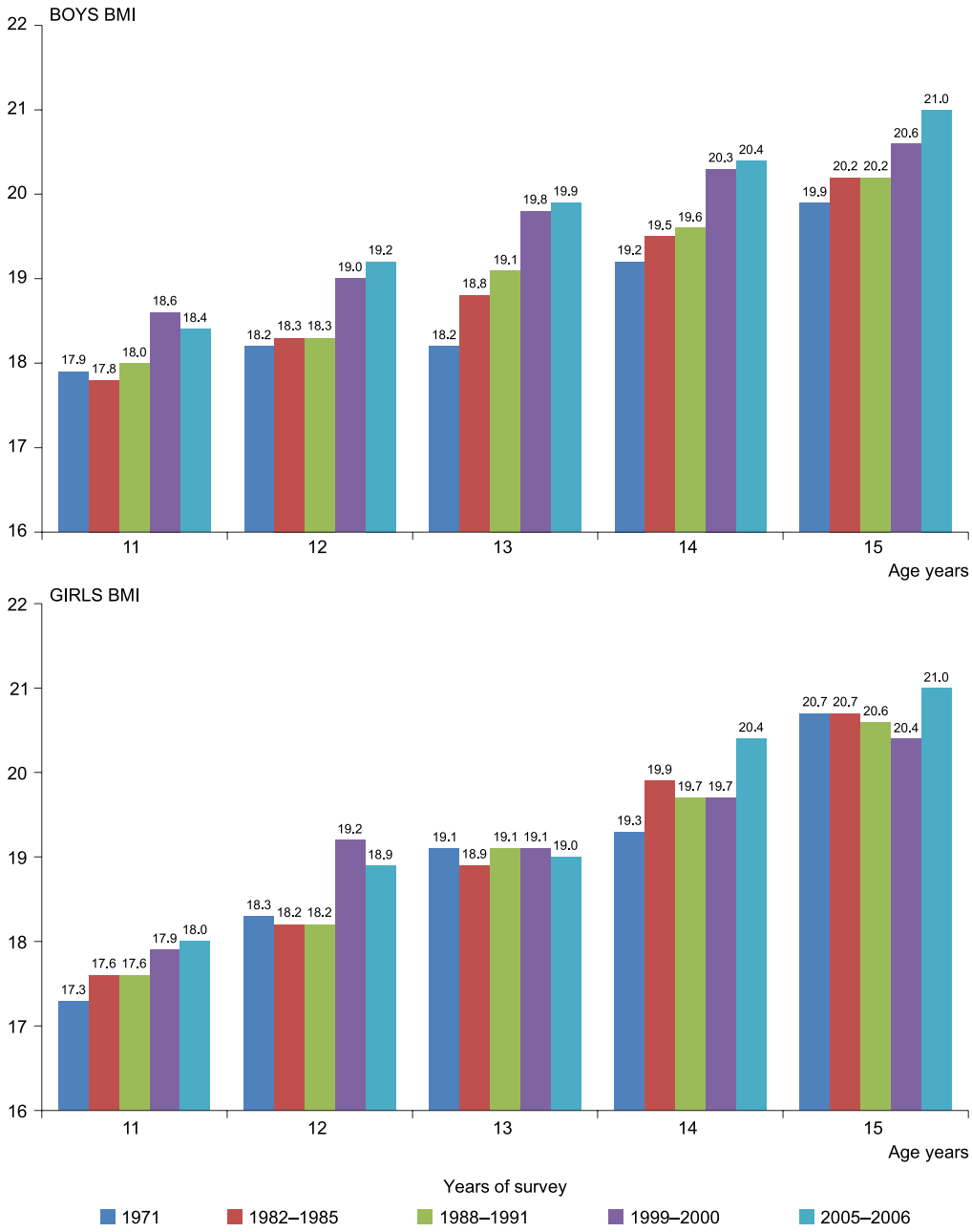

Fig. 2. Average BMI by age and consecutive years of surveys of adolescents from Warsaw, between years 1971–2005/06

ed in current nutritional goals also were not reached. Nevertheless, the changes occurring in total fat content and structure of fatty acids in Warsaw adolescents

prove that diet changes at population level at puberty age are possible.

Changes in cholesterol content in the diets of adolescents

The significant decreasing trend observed in cholesterol content in the diets of adolescents was particularly visible between the years 1988/1991 and 1999/2000. In the last stage of the studies (2005/2006) cholesterol intake both in the groups of boys and girls reached the values <300 mg recommended in the nutritional goals. Similarly, in the USA the content of cholesterol in the diet of adolescents in the III NHANES study also reached the recommended value (Troiano 2000), while in the Belgian youth the cholesterol content in diet significantly exceeded the recommended value of 300 mg daily (Guillaume et a. 1998).

The decrease of cholesterol content in the diets in Warsaw resulted mainly from a change in the structure of fats consumed by adolescents and it depended on the drop of the dietary content of animal products containing not only SFA but also cholesterol. However, it should be added that in the analysed 24 years the quality of animal products improved in respect of a reduction of their content of fat and thus also of cholesterol. Ham is an example of such changes, since in the years 1988/1991 it was a fat product, containing 70 mg of cholesterol in 100 g, while in 2005 the ham contained only 51 mg of cholesterol in 100 g (Kunachowicz et al. 2005).

Certainly, the changes in fat content in the diets of adolescents resulted also from a constant propagation of knowledge about the negative role of excessive intake of fat of animals origin and about the need of health-oriented changes in the structure of consumed fatty acids. That propagation has been conducted by institutions appointed to disseminate the nutritional information and by existing interventional programmes counteracting the risk factors of cardiovascular diseases.

Thus, apart from changes in the nutritional habits, which contributed to the drop of both total fat and SFA and cholesterol in the diets of adolescents, the health-oriented changes were certainly associated with changes in the quality of certain products of animal origin that occurred in Poland during transformation of the political system.

Is there any relationship between the trends in dietary fat content and the prevalence of obesity in adolescents?

The analyses performed of total fat content and BMI value changes during over 20 years have demonstrated that in the Warsaw adolescents two opposing trends occurred: a decreasing one in the case of fat and increasing in the case of mean BMI values in all age groups, from 11 to 15 years of life. Previous studies have demonstrated that in the same population, using the BMI criteria and classification recommended by IOTF [International Obesity Task Force] (Cole et al. 2000) a significant increasing trend was found in the prevalence of overweight and obesity among the Warsaw adolescents. Obesity increased in boys from 1.0% in 1971 to 2.8% in the years 2005/2006 while in girls over the same period a 10-fold increase in obesity was found, from 0.3% to 3.4%. However, in spite of significant increase of obesity in Warsaw, these percentages are still lower than in peers from Scotland or England (Charzewska et al. 2009; Charzewska and Chabros 2010). It can be also add that adolescents from Warsaw, spent

after school, in average over 4.5 hours per day on passive activities without any physical effort (Charzewska and Chabros 2010).

So, the results discussed in this paper support the conclusions of authors, stating that dietary fat in children and adolescents probable is not the main cause of the increase of obesity prevalence, but the low energy expenditure associated with physically passive lifestyle of adolescents is to be blamed (Guillaume et al. 1998; Willet 1998; Jequier 2001). Remer et al. (2002) suggest that in spite of the nutritional and environmental determinants, also the genetic and/or endocrine-metabolic factors should be taken into account in obesity (Remer et al. 2002). Bray and Popkin (1998) say that dietary fat is, however, of importance in obesity development but they admit that in order to decrease the prevalence of obesity, the reduction of energy intake must be accompanied by energy expenditure (Bray and Popkin 1998). Undoubtedly, the reduction of dietary fat and SFA content found in the Warsaw adolescents, despite being not in accordance with the trends in obesity prevalence, is still a health-oriented change from the cardiologic point of view. It proves thus, that at population level, diet changes in adolescents are possible and, in consequence, the development of atherosclerosis and cardiovascular diseases can be prevented.

On the other hand, the causes of obesity development in children and adolescents are multifactorial and fat intake is one of the factors since a high-fat diet contributes significantly to a positive energy balance, particularly with increasing physical passivity of adolescents.

Conclusions

- An analysis of the occurrence of trends in nutrient intakes among Warsaw adolescents we observed a significant reduction in total fat and cholesterol intake during 24 (or 18) years between the first and last study.
- Additionally a health–oriented changes were observed in structure of fatty acids consumed by adolescents.
- In spite of a positive changes in diet of adolescents, they are not fully satisfactory as increase of polyunsaturated fatty acids (PUFA) was not sufficient enough.
- Further activity is desired to stabilize the health-oriented changes in the diets of adolescents in the form of a decreasing trend in fat content and changes in the structure of fatty acids consumed, in view of the need of controlling the risk factors of cardiovascular disease development from the earliest years of life, as well as in view of the need of further elucidation of the role of reduced fat intake in the prevention of obesity in children and adolescents.

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