

**ALIMENTATION REGIME *VERSUS* THE STATURE-WEIGHT RATIO
IN 12 AND 13 YEAR-OLD TEENAGERS FROM THE IAȘI CITY**

**ANGELA SIMALCSIK, ROBERT-DANIEL SIMALCSIK,
CĂTĂLIN-GEORGE FEDOR and VASILICA-MONICA GROZA**

It is by now a well-known assertion that, during childhood and adolescence, a certain life style of each of us – involving food habits, which will decisively influence the following stages of somatic development – is settled. The prevalence of obesity among children and adolescents represents one of the main problems the modern society has to face, especially in the developed countries, in which obesity and over-weight affect about 30% of the whole population with ages between 2 and 17 years.

The present study attempts at evidencing whether the excedent or deficit of the real food regime – comparatively with an optimum consumption – is also reflected in the stature-weight ratio (as the literature of the fields reflects on teenagers' trophicity). The experiments, made on a group of 210 adolescents (84 boys and 126 girls) with ages of 12 and 13 years, all from the Iași city, started from the idea that the food regime influences the constitution of the subjects and explains the clinical image of the adolescent population. Consequently, the daily average individual value of caloric consumption is around 2055.14 calories in boys, and around 1895 calories, respectively, in girls, values with 33–34% lower for the masculine sex and 25–28% for the feminine one, comparatively with the daily average necessary values recommended by the Ministry of Public Health (Disposition no 1563/2008) for the 11–14 year old category of age. Out of the three main categories of trophins, proteins show the highest deficit, while lipids – on the contrary – are in excess. The highest deviation is registered for glucides, appearing in both sexes, which explains the caloric deficit of the whole batch under study. As to the stature-weight ratio, expressed by B.M.I., the batch here analyzed is about 69% ponderally normal.

Key words: adolescent, nutrition, growth, development, Quetelet.

1. INTRODUCTION

Adolescence – the transition period from childhood to maturity – is manifesting as early as the first signs of development in the secondary sexual characters, being marked by a rapid physical development and important metabolic modifications, *i.e.*, the child becomes mature from both biological and neuro-behavioral points of view, its aspect being more and more similar to that of an adult.

As a transition period from childhood to adult life, adolescence is characterized by increased nutritional demands, representing the ontogenetic stage in which 15–25% of stature increase and 45% of the bony mass occurs, which means a 50% increase of calcium requirements [2, 4].

In the first 8 decades of the XXth century, the health condition of the teenagers did not represent a major concern for researchers, the general belief being that such a group of age is less exposed to maladies, comparatively with children and aged people. Indeed, generally, adolescence is described as a period characterized by a good health condition, especially infection and chronic diseases being absent. In spite of this, it is nevertheless unanimously accepted the idea that “teenagers are extremely vulnerable to major social and economic changes, the cumulative action of such factors being reflected, firstly, in an altered general health condition. Adolescence is a challenge for nutrition, even if the vulnerability of the organism confronted with a deficitary alimentation regime is not as high as in the preceding ontogenetic stages [7, 10].

The adolescent of today is equally confronted with subnutrition and malnutrition, and with obesity. The life style and the alimentary regime, along with the psycho-social factors influencing them, are of special importance for an adequate nutrition. There are several motives that explain the alimentary vulnerability of adolescence. The nutritive requirements are higher, as a result of the accelerated growing and development processes, of the deeply rooted food habits and life style acquired in this period, while the susceptibility of the teenagers to the influences of the surrounding environment is extremely high. An inadequate nutrition during adolescence may retard the processes of growth and sexual maturation; even if the generally accepted idea was that they are rather the consequences of chronic malnutrition during childhood. Inadequate nutrition may affect the health condition of the teenagers and may expose them to several chronic diseases, such as: cardiovascular maladies, diabetes, maladies of the digestive apparatus, orthopedical problems, breathing maladies, etc. Apart from these, modifications at psychological level – such as lack of self-confidence, social isolation, low school performances – may also appear [1, 6].

Nowadays, obesity represents one of the plagues of the modern society, especially obesity installed during childhood and adolescence. It became a worldwide pandemy, now viewed as the main problem of public health, once it is increasingly and alarmingly installing in most of the socially and economically developed countries, and even in the developing countries, now facing a nutritional tendency, and quite surprisingly – in the poor countries, characterized by an insecure alimentary situation [7].

The data basis on the incidence of obesity and of the century-old tendencies in adults is now rapidly developing, a rigorous system permitting to classify the adults with either deficit or excess of weight being already established, based on the stature-weight ratio. Unfortunately, such data are not available for children and adolescents, even of the World Health Organization has recorded – only in the last decades – a double frequency of the weight excess in American and Japanese children and teenagers. The latest estimates show that 13% of the American 19 year-old

teenagers are either over-weight or obese. In USA, obesity affects mainly the poor categories of people, being spread especially among American Indian, Latin-American and Afro-American populations. In South Africa, more than 30% of the black women below 15 years are obese [3, 9].

In Europe, the incidence of obesity in adults increased-between 1986 and 2006 – with 10–14%, while the United Kingdom recorded a dramatic increase of 50% between 1980–2000.

In spite of this alarming situation, no specific data are available for the category of teenagers. The number of over-weight children increases, each year, with 400,000, a figure completing that of the 14 millions of the already supraponderal people recorded only in the European Union. According to a WHO study of 2006, in the European adult population, the obesity ratio varies between 10 and 27% in men, the value recorded in women attaining up to 38% [8, 5].

2. MATERIALS AND METHOD

Evaluation of the nutritional condition by means of anthropometry and alimentary questionnaires is a highly-accessible, non-invasive and extremely useful procedure for studies devoted to the alimentation of teenagers. Obviously, the more minute investigations on micronutrients require some additional evaluation methods, apart from anthropometry and alimentary inquiries.

The anthropometric study performed by the authors on the adolescent population of the Iași district included, of course, aspects on the alimentary regime, the part they play in explaining the clinical picture of the adolescent population being well-established. The investigation was developed in several education institutions of the Iași city, namely: The National College, The “Mihai Eminescu” National College and the “Garabet Ibrăileanu” Theoretical Lyceum.

The material for the study – including 210 adolescents (boys and girls) with ages between 12 and 13 years – was collected between May–June 2009.

Anthropometric evaluation was based on measurements made on each subject in part, with specific anthropometric instruments: a spring balance (for weighing) and anthropometer (for stature). From the biometric data, the stature-weight ratio, expressed by the Quetelet index (B.M.I.), was calculated. The WHO recommends the application of the percentile method in B.M.I. analysis – here applied, too. The percentile (the hundredth part of total frequency) indicates the position occupied by a person within a reference data distribution, expressed as percent values. Percentiles are frequently employed in medical domains, as they permit a straight-forward and extremely simple interpretation [11].

Evaluation of the caloric regime and of the trophines was made with a questionnaire-type file, recording the verbal responses given on the quantity and quality of the daily consumed aliments. Consequently, alimentary inquiries had been

performed for each teenager in part, followed by calculation – on the basis of the consumed aliments – of the real daily, individual average values on the consumption of the main trophines and calories, and of their subsequent comparison with the optimum daily consumption of food, recommended as a function of age and sex. At the level of each sex and group of age (12 and 13 years, respectively), the difference between the ratio recommended by the Ministry of Public Health (Disposition no. 1563/2008) and the observed ratio being calculated. For an adolescent of masculine sex with an age between 11 and 14 years, the daily average requirement is of 3,100 calories, the possible variations induced by the characteristics of the group (such as, for example, type of physical activity) ranging between 2200 and 3700 calories. For an adolescent of feminine sex of the same age, the daily average requirement of calories is of 2600, with possible variations between 1800–3000. It goes without saying that these are recommendations of quite a general nature, applicable to adolescents making average physical efforts [10].

3. RESULTS AND DISCUSSION

Table 1 lists the daily real mean values expressing the consumption of the main trophines and of calories *versus* the optimum daily consumption, as a function of age and sex. Analysis of the data obtained show that, comparatively with the optimum average value recommended, the real mean caloric values recorded for made adolescents show a deficit of 1063.7 calories for the 12 year-old subjects, and of 1025.48 calories, respectively, for the 13 year-old ones, both figures representing, in relative values, a deficit of 34.31% and 33.08%, respectively. In the case of girls, the real mean values also show a deficit *versus* the recommended ones, which is nevertheless lower. Consequently, in the 12 year-old girls, the deficit *versus* the recommended daily outfit is of 662.8 calories while, in the 13 year-old ones, the deficit is of 745.43, *i.e.* relative values of 25.49% and 28.67%, respectively.

Mention should be made of the fact that, in the case of girls, from both groups of age, the daily caloric consumption ranges within the limits of possible variations while, in the case of boys, they are under the minimum threshold recommended. The individual caloric consumption varies within quite large limits from one subject to another, the minimum values being of 576.5 calories in boys and of 617.54 in girls, while the maximum ones are of 4750.95 calories in boys and of 3646.2, respectively, in girls. This explains, too, the deviations from the optimum consumption, which varies within very large limits.

Out of the three main categories of trophines, for all ages and all sexes, total lipids record deviations in excess, the lowest deviation being registered in 12 year-old boys (+1.31%), while the highest one appeared in 12 year-old girls (+19.08%). Glucides are negatively deviating from the daily recommended norms, the lowest deficit being present in 12 year-old girls (–44.31%) and the highest one – in 13 year-old boys

Table 1

Average daily ratio in 12 and 13 year-old adolescents from the Iași city, *versus* the necessary average ratios recommended by the Ministry of Public Health (Disposition no 1563/2008) daily mean value recorded, daily mean outfit absolute/relative deviation

	Proteins (g)			Lipids (g)			Glucides (g)	Calories
	vegetables	animals	total	vegetables (non-saturated)	animals (saturated)	total		
boys 12 years	average daily ratio	21.31	57.34	78.65	41.26	52.64	93.90	2036.30
	necessary average ratio	54-66	52-55	106-121	25-30	58-70	83-100	3100
	possible variations depending on the characteristics of the group	34-65	41-79	75-144	21-36	50-83	71-119	2200-3700
	optimal rate (%)	40%	55%	14-16%	30%	70%	25-30%	-
	absolute deviation	-38.69	+3.84	-34.85	+13.76	-11.36	+2.40	-1063.70
relative deviation (%)	-64.48%	+7.17%	-30.70%	+50.03%	-17.75%	+1.31%	-34.31%	
boys 13 years	average daily ratio	21.66	70.80	92.46	46.01	59.42	105.43	2074.52
	necessary average ratio	54-66	52-55	106-121	25-30	58-70	83-100	3100
	possible variations depending on the characteristics of the group	34-65	41-79	75-144	21-36	50-83	71-119	2200-3700
	optimal rate (%)	40%	55%	14-16%	30%	70%	25-30%	-
	absolute deviation	-38.34	+17.30	-21.04	+18.51	-4.58	+13.93	-1025.48
relative deviation (%)	-63.90%	+32.33%	-18.53%	+67.30%	-7.16%	+15.22%	-33.08%	

girls 12 years	average daily ratio	19.56	61.05	80.61	46.21	45.48	91.69	202.98	1937.19
	necessary average ratio	40-46	49-55	89-101	20-25	50-59	70-84	349-380	2600
	possible variations depending on the characteristics of the group	25-55	34-64	61-117	11-29	37-68	49-87	241-439	1800-3000
	optimal rate (%)	45%	55%	14-16%	30%	70%	25-30%	55-60%	-
	absolute deviation	-23.44	+9.05	-14.39	+23.71	-9.02	+14.69	-161.52	-662.81
	relative deviation (%)	-54.51%	+17.40%	-15.14%	+105.38%	-16.55%	+19.08%	-44.31%	-25.49%
	average daily ratio	19.97	57.94	77.91	44.52	40.51	85.65	197.90	1854.57
	necessary average ratio	40-46	49-55	89-101	20-25	50-59	70-84	349-380	2600
	possible variations depending on the characteristics of the group	25-55	34-64	61-117	11-29	37-68	49-87	241-439	1800-3000
	optimal rate (%)	45%	55%	14-16%	30%	70%	25-30%	55-60%	-
girls 13 years	absolute deviation	-23.03	+5.94	-17.09	+22.02	-13.99	+8.65	-166.60	-745.43
	relative deviation (%)	-53.55%	+11.42%	-17.99%	+97.87%	-25.67%	+11.23%	-45.71%	-28.67%

(55.65%). Total proteins are negatively deviating, in this case the relative values being lower than those of glucides (*i.e.*, between a minimum of 15.14% in 12 year-old girls and a maximum of 30.70% in 12 year-old boys).

Separate analysis of animal and vegetal proteins shows that the deviation of the animal origin ones is in excess, comparatively with the optimum norm recommended (between +7.17% and +32.33%), while deviation of the vegetal origin ones shows a deficit (between -53.55% and -64.48%), a situation valid for both boys and girls and for both groups of age. Therefore, the consumption of animal proteins is considerably higher than the consumption of vegetal proteins. The high weight of animal proteins *versus* the vegetal ones indicates a satisfactory alimentary regime during adolescence, if considering their higher biological value and the special plastic role they play in the organism of a teenager, subjected to complex biological transformations.

Analysis of the daily consumption of total lipids shows that – in absolute value – the highest consumption is recorded in 12 year-old adolescents (91.69 g) and the lowest one – in 12 year-old boys (93.90 g). Mention should be nevertheless made of the fact that the two lipid components do not deviate in the same direction. The deviation is very high for non-saturated lipids (between +50.03% and +105.38%), while the consumption of saturated lipids shows a deficit, comparatively with the optimum daily outfit of the whole batch under study, the registered deviations being of -7.16% (in 13 year-old boys) and of -25.67% (in 13 year-old girls), respectively. Consequently, the values exceeding the optimum consumption are considerably higher for non-saturated lipids, comparatively with the saturated ones. Therefore, if consumed in excess, the saturated ones show a deficit. The most alarming situation may be observed in girls, for both groups of age, namely: the 13 year-old girls consume non-saturated lipids in almost 100% higher amounts than the necessary optimum while, in the 12 year-old ones, this value exceeds 100%. A too high consumption of non-saturated lipids is explained by an alimentary regime very rich in vegetal oils. The very important lack of balance between the consumption of non-saturated and saturated lipids, along with the generally high consumption of lipids, affects unfavorably the health condition of the population. Nevertheless, a more reduced consumption of saturated lipids may be beneficial if considering that a deviation in excess represents one of the factors responsible for cardio-vascular maladies.

Calculation of the contribution of total proteins from the daily caloric ratio shows that it is slightly below the limits recommended by the literature of the field for 12–13 year-old teenagers.

As to the contribution of total lipids, comparatively with the literature data, which recommended values of 25–30% of the daily caloric ratio for the variation limits of the normal consumption, the series here under investigation evidence obviously higher values, unlike the other groups of trophines, the consumption of glucides is considerably more level-headed.

Thus, the real consumption is of 221.03 g and 192.90 g in adolescents of masculine sex of 12 and 13 years, respectively, while in girls this consumption records values of 202.98 g at the age of 12 years and of 197.90 g, respectively, in 13 year-old teenagers. Comparatively with the daily optimum consumption recommended, worth mentioning is the fact that, in all four groups of subjects, the real consumption of glucides shows a deficit, while the deviations are extremely high (between -44.31% and -55.65%).

As to the ideal caloric contribution of glucides, it should represent between 55 and 60% of the daily optimum total necessary to a 12–13 year-old teenager, a situation not met in the subjects here under investigation. The adolescents from Iași register sugar consumptions much lower than the values given in the literature. As a matter of fact, the low caloric ratio of glucides is explained both by the reduced consumption of glucides and by an unbalanced consumption of the three main categories of trophins, expressed by a very high value of lipids – the non-saturated ones, especially – comparatively with those of proteins and glucides.

Another important observation is that, out of all teenagers under analysis, those with a reduced mean caloric consumption represent about 70%, while the subjects with an excedentary mean consumption *versus* the recommended one represent about 10%.

Table 2

Variability of the Quetelet index (BMI) percentiles in 12 and 13 year-old adolescents from the Iași city

	percentiles	stature-weight ratio	12 years		13 years	
			N	%	N	%
boys	<5*	weight insufficiency	3	6.82	2	5.00
	5*–15*	risk of the weight insufficiency	4	9.09	4	10.00
	15*–85*	normality	30	68.18	28	70.00
	85*–95*	weight excess	4	9.09	4	10.00
	>95*	obesity	3	6.82	2	5.00
girls	<5*	weight insufficiency	4	5.56	3	5.56
	5*–15*	risk of the weight insufficiency	8	11.11	5	9.26
	15*–85*	normality	49	68.06	38	70.37
	85*–95*	weight excess	7	9.72	5	9.26
	>95*	obesity	4	5.56	3	5.56

Table 2, listing the percentile variability of the Quetelet index (B.M.I.) in 12–13 year-old teenagers from the Iași city, permits the deduction that some of the disequilibria calculated for the real alimentary consumption, comparatively with the optimum one, are reflected in the stature-weight ratio, as well.

A comparative analysis of the variation in the Quetelet index percentiles evidences that all 4 categories of the stature-weight ratio (*weight insufficiency, normality, weight excess and obesity*) have a similar distribution only when comparing the subjects of the 2 classes of age or of the two sexes, the differences recorded being negligible. Consequently, for 12 year-old adolescents of masculine sex, the prevalence of weight excess (percentiles 85–95) and obesity (>percentile 95) is of 15.91% while, for the 13 year-old ones – of 15.00%. In the case of girls, the prevalence of ponderal excess and of obesity attains values of 15.28% in the 12 year-old ones and of 14.82%, respectively, in the 13 year-old girls. Ponderal insufficiency (< percentile 5) appears in the girls from the two classes of age in 5.56% of the cases while, in boys, a 1.82% difference should be recorded between the two classes of age, the 12 year-old boys showing a slightly higher prevalence of ponderal insufficiency (of 6.82%), comparatively with the 13 year-old ones (5.00%).

Mention should be made of the fact that the highest frequency appears in normo-ponderal subjects (percentiles 5–85), attaining a value of almost 70% in the teenagers group under analysis. Global distribution of the individual values on the percentile scale shows that the frequency of normoponderals, as well as of those with deficit or excess of weight varies within very narrow limits. As to sexual dimorphism, it is extremely weak, the extreme categories (ponderal insufficiency and obesity) recording quite close values in the two sexes – which holds true for both categories of age (*i.e.*, 12 and 13 years).

4. CONCLUSIONS

Viewed globally, the teenager batch here under study evidences an important deficit, comparatively with the necessary amounts recommended by specialists – a phenomenon more obvious in the masculine sex. Out of the three categories of trophins, only total lipids record excess deviations, the other two categories – *i.e.*, total proteins and glucides – showing negative deviations from the optimum daily norms recommended by the Ministry of Health. The adolescents of Iași consume much fewer glucides than the optimal norms, which explains the caloric deficit registered.

Another important observation refers to the fact that adolescents consume more proteins of animal – and not of vegetal – origin, which is an advantage for this period, as the adolescent organism – subjected to intense growth and development – needs more energetic resources. In the case of fats, the non-saturated ones are preferred to the saturated lipids. It has been observed that the excess of non-saturated lipids is higher in the feminine sex, such a disequilibrium being unfavorable, with possible negative influences upon the general health condition. Nevertheless, the deficit of saturated lipids may be a positive fact, as a higher consumption of lipids of animal origin may favourize various cardiovascular maladies.

The conclusion is that, even if the adolescent population is about 70% normo-ponderal, it evidences both caloric deficit and trophic disequilibria. The ratio of over-ponderal people is of about 9–10%, while that of obese adolescents is around 5–6%, which permits no assertion on a possible stature-weight disequilibrium of the batch, on the contrary, 68–70% of the teenagers forming it showing a balance between stature and weight. One should nevertheless draw the attention on the disequilibria characterizing the daily nutrition of these adolescents, namely too few vegetal proteins and too few glucides, and too many non-saturated lipids.

The nutritional problems of the teenagers – be they related to sub-nutrition or to a trophic excess – are mainly the result of a dietetic disequilibrium, which may be associated to various factors, of physiological, socio-economic or psycho-social nature.

The growing processes of adolescence require additional nutritional outfits which, once neglected, expose the teenagers to various risks.

Control of the stature-weight ratio in adolescent organism, extremely important for preventing obesity and alimentary disorders, should be part of any study devoted to adolescence. As known, anthropometric evaluation detects the teenagers exposed to either sub-nutrition or obesity.

That is why, adolescents, as well as their parents, should understand that a healthy living, a balanced diet, do not assume complete elimination of certain alimentary products, but a balanced alimentary consumption, in moderate quantities and adequate ratios, which will assure a constantly good health condition. A daily alimentary menu with a positive influence on both growth and development should include balanced ratios of animal and vegetal products.

Adolescents are always open to new ideas. Many of the alimentary habits acquired during adolescence will not be changed during subsequent periods of life. More than that, with the advance of age, the personal options and choices will prevail over the ones of the family, so that it will become more and more difficult for their parents to control what child usually eats, when and where.

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Received March 4, 2010

*Iași Branch of the Romanian Academy,
Department of Anthropology
Corresponding author: angellisimal@yahoo.com;
antropologie.iasi@yahoo.com*

