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SUMMARY OF THE DOCTORAL THESIS

The influence of socio-cultural factors on the growth and development of adolescents from Romania- anthropological aspects

Scientific coordinator:

Cristiana Glavce, PhD, CS. I

Member of the Academy of Medical Sciences

Doctoral student:

Iusein Ervin

Bucharest

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Table of contents

1.Introduction.....	2
2.General characteristics of the research.....	3
3.The analysis of the anthropometric data.....	4
4.The analysis of the data from the questionnaire.....	13
5. Multifactorial correspondence analysis (MCA).....	23
6.Conclusions.....	24
7.Bibliography.....	25

1.Introduction

Adolescence is defined as the period during the lifetime of the individual between the age of puberty and that of the adult, when a gradual maturation of physical and psychological functions occurs. The word „adolescence” derives from the latin “*adolescere*”, which means “to grow”. World Health Organization defines the adolescent as any individual between 10 and 19 years of age.

Due to the relatively large amount of time, as well as the changes occurring during this period, the age of adolescence is divided into three successive stages, each of these showing particular characteristics of development as well as typical experiences:

- 1) *Early adolescence*- is the first stage of adolescence when the growth spurt occurs, as well as puberty and all the biological changes that transform the body of a child into the one of an adult.
- 2) *Late adolescence*- during this stage, the pubertal changes no more dominates the experience of the adolescent. Alternatively, individuals feel the need to discover by making use of abstract thinking in order to question their own values as well as those of the society they belong to.
- 3) *Emerging adulthood*- is the third stage introduced Jeffrey Arnett in 2000 and defined as the period between adolescence and adulthood (between 18 and 25 years of age). This period is defined through low demographic predictability as well as many opportunities for exploring own identity (Arnett, 2000).

A complete definition of adolescence needs to take into account the whole spectrum of biological, psychological and social changes that take place within a predefined cultural setting. It is because of this reason, the study of adolescence requires a multidisciplinary, holistic approach specific to the anthropological research, from the viewpoint of the bio-psycho-social triad. The bio-psycho-social model and the systems theory provides such a setting necessary for a multidisciplinary approach to this complex phenomena.

Therefore, in the research of adolescence, we can identify three dimensions: the biological dimension, which encompasses the whole of the biological, morphological and physiological changes triggered by puberty, and which transform the body of the child into the one of an adult that is fully grown physically and sexually; the psychological dimension, which encompasses the whole of the psychological and emotional changes, as well as the development of the cognitive and intellectual capacities, of personality traits as well as the sense of own identity; the socio-cultural dimension which emphasizes the social relations that adolescents

take part in, and which have a vital role in their development (family, the group of friends, school, the socio-economic status etc.) as well as the cultural setting in which they grow and develop.

In a contextual like approach analysis, Urie Bronfenbrenner, identifies a few layers of the environment in which an individual develops, the so-called bioecological theory. Each one of these, is not regarded as a static aspect of the physical environment, but rather involves the subject in a dynamic process of exchange. In their greatest majority, these activities imply interpersonal relations, what we do and say when we are in the company of others. At the same time, it implies assuming a role according to the type of relation (Bronfenbrenner, 1990).

The first level of influence of the social environment on the adolescent is the immediate level, the so-called microsystem. This includes different systems in which the adolescent spends his/her daily time: family, group of friends, school, work (if it exists) etc. The second level is the so-called mesosystem, where one can observe the influence of different types of relations among the microsystem, on the adolescent. The mesosystem includes the school-family or school-group of friends types of relations.

In addition to these, the adolescents could also be influenced by the environments in which they are not physically present, but which have an effect over the immediate environment in which they develop. This is the so-called exosystem. One example of this kind could be the working conditions or the salary of the parents. 3

The macrosystem represents the superior level that is found at the greatest distance from the daily experience of the adolescent, whose influence must not be neglected. Finally, the cronosystem refers to the circumstances existing at one particular historical moment in a given culture, and in which the life experience of the adolescent crystallizes, in a particular context.

2. General characteristics of the research

The current research related to this doctoral thesis, aims to evaluate the influence of current socio-economic and cultural factors on the growth and development of Romanian adolescents, using the comparative method between two geographical distinct areas with different characteristics, as well as using the historical perspective in order to illustrate the changes occurring during the latest period of time.

The current study, designed from the perspective bio-psycho-social model, aimed to understand the degree in which current socio-economic differences, opportunity and education differences etc., have an impact on the growth and development of adolescents from Romania.

Taking into account the existence of some major differences between different regions in Romania two adolescent cohorts from Bucharest and Iasi had been established. This mixed-

longitudinal study had taken place for three years (between 2014-2017) on 376 subjects, adolescents of both sexes.

Adolescents in Bucharest come from families with high incomes and socio-economic status (over 5,000 RON), as well as with parents mostly graduates of higher education. These are students in a private high school where a school fee is charged. The great majority of teenagers in Iasi county come from the villages around the city of Iasi and study in a state high school (no tuition), some of them being accommodated in the high school's dormitory (approx. 40%). Their families are characterized by a low socio-economic profile, with low incomes (between 1000 and 3000 RON). At the same time, the parents are mostly graduates of high school or middle school.

In order to study the evolution of growth and development of adolescents during the 14-18 age interval, anthropometrical measures had been performed once a year, on the subjects involved in the research. The measured anthropometrical indexes are as follows: height, weight, BMI index, sitting height, leg length, torax circumference, hips circumference and arm circumference.

Together with these measurements, the adolescents from the two cohorts have filled two questionnaires (an anthropological questionnaire as well as a standardized one that included a dietary diversity index, the Kidmed index, an index of sedentarity and the body discrepancy index) during the first and last year of study in order to investigate aspects related to the family structure, nutrition habits, level of physical activity, sleep patterns, body image etc.

Objectives: The present study aimed to highlight the fact that the socio-economic differences currently existing (opportunities, education, etc.) have an impact on the growth and development of adolescents in Romania. Also, the evolution of the "secular-trend" phenomenon in relation to the different socio-economic levels was followed.

Another objective is to assess the need to implement a strategy to improve the quality of these socio-economic factors with an impact on adolescents (depending on the conclusions of the data analysis obtained in the two regions of Romania).

3.The analysis of the anthropometric data

The statistical analysis indicates the data are normally distributed for each variable, with the exception of the body fat variable and the body fat/weight derived index. At the same time, regarding the Pearson coefficient of correlation, this has values close to 1, as a measure of the high intensity in relation with the level of variability between specific directly measured

variables or the ones that are derived. Some values slightly go into the negative territory, like the correlation coefficient between height and BMI index.

At the same time, significant differences had been identified after the grouping of data based on the city, gender and age. Therefore, data resulting from the measurements on adolescents from Bucharest tend to be more homogenous and compact in comparison to those on adolescents from Iasi, indicating a lower level of variability with regards the growth characteristics. Grouped by gender, data indicates clear growth and development differences between boys and girls, while, grouped according age the cloud of points tends to follow a predictable evolution.

In order to identify whether these differences are statistically significant we made a series of comparisons between the arithmetic averages of these grouped variables by using the ANOVA procedure (in order to identify whether there are overall differences between the groupings based on different categories) and the statistical t-student test.

According to the student's t test, at a p-value measured at 95% confidence level, statistically significant differences had been identified between the averages of variables grouped based on locality and gender for the following variables: height, weight, BMI, sitting height, leg length, thorax circumference, hip circumference as well as for some of the derived indexes.

According to the results from ANOVA procedure, for the group according to locality, there are statistically significant differences between the means of the majority of variables, regardless whether they are direct measurements or derived indexes. At the same time, for some specific variables, we can observe significant differences between their means with regards the grouping based on gender.

Total height represents an important indicator for general health as well as the nutritional status, both at individual as well as at the population level. Starting with puberty, a rapid gain in height is observed for both genders, reaching a maximum after approximately three years from the onset of puberty.

With regards the current research, the first measurement of the subjects took place at the age of 15. Data analysis identified the fact that the total growth in height in boys is more accelerated during the first two years of study, the acceleration slowing down significantly between the 17-18 age interval. The same phenomenon could be observed in the case of the girls, with the exception that the growth in height at the same age intervals is more reduced in comparison with boys, taking into account the fact that girls reach their adulthood with approximately two years earlier.

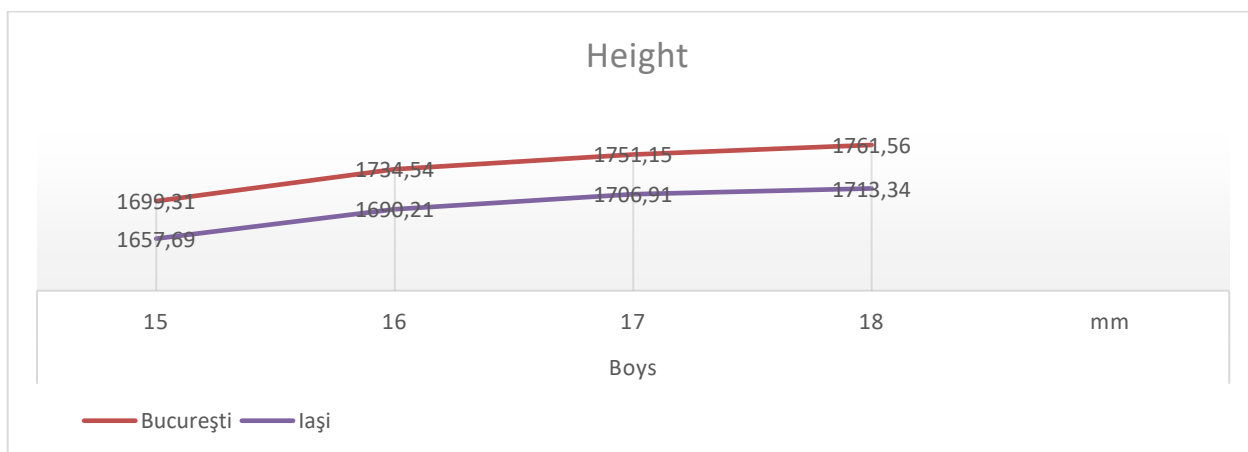


Figure 1. The evolution of height mean during the three years in boys from Bucharest and Iasi

As it can be seen in figure 1, the boys from Bucharest have higher height means compared to those from Iasi for all the age groups, the greatest difference between cohorts being observed at the age of 18. Regarding the girls, the ones from Iasi will have total height means larger than those from Bucharest for all age groups. When 18 years old, the adolescent girls from both cohorts, have a very close mean height, even though, overall, there is a delay in growth of those from Bucharest (figure 2).

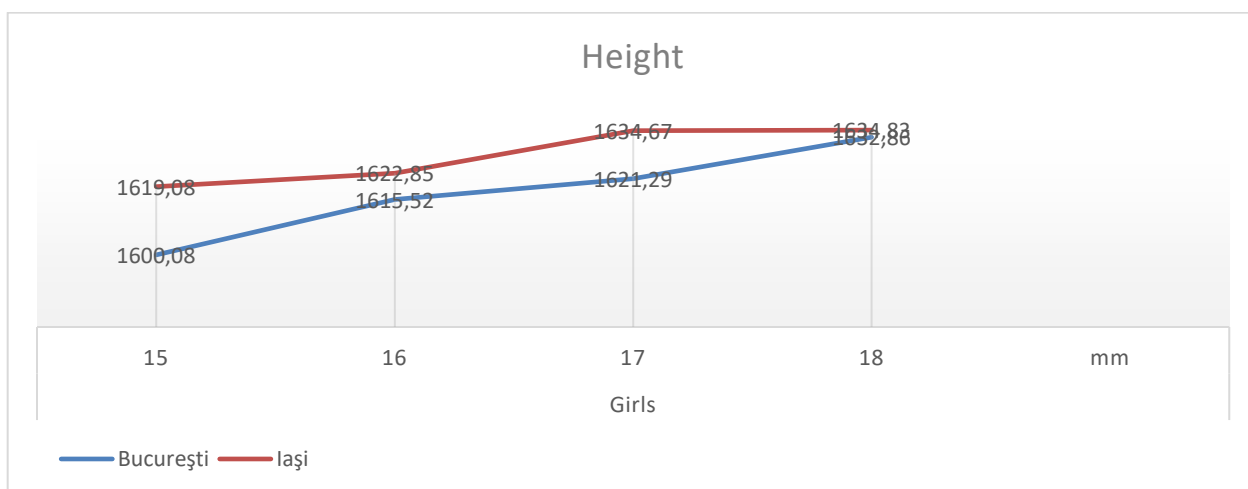


Figure 2. The evolution of height mean during the three years in girls from Bucharest and Iasi

At the same time, in all individuals, regardless the gender and locality, the acceleration of growth in height is higher at the 14.6-16.5 age interval. The acceleration decreases significantly during the next year. In comparison to boys, the acceleration of growth in girls is lower at all age groups, considering that they come to the end of their growth period with approximatively two years earlier.

The comparison of the height means of the current research with those from 2005 indicate a decrease of the maximum value as well as for the mean for this parameter, that took place during the last decade in both genders, for the cohort from Bucharest (table 1). Instead, we can observe an increase of the minimum values, a fact that indicates a reduction in the number of small stature individuals.

14-15 years	Min	Max	Mean	SD	CV%	14-15 years	Min	Max	Mean	SD	CV%
M						F					
2005	1510	1890	1703.1	74.8	4.3	2005	1500	1790	1644.9	57.9	4.4
2014	1600	1848	1699.3	65.6	4.1	2014	1557	1645	1610	19.38	5.5
18 years	Min	Max	Mean	SD	CV%	18 years	Min	Max	Mean	SD	CV%
2005	1700	1920	1800.6	60.3	3.3	2005	1540	1850	1681.1	65.8	3.9
2017	1630	1898	1747.5	62.4	5.3	2017	1549	1872	1641.8	45.9	5.8

Table 1. A comparison between the heights at two age groups- data from the 2005 study (Popescu-Spineni) with present data finalized in 2017- adolescents from Bucharest, males and females

Also, the comparison of the averages of the height with the reference ones of the WHO reveals the fact that the adolescents of both sexes, from the two localities, register values very close to the international ones, at all the studied age groups, indicating a slowing of the secular phenomenon. The boys from Iași are the only category that registers lower average values in all age groups compared to those of the WHO.

Together with the height, weight represents another valuable cantitative index in science of auxology. This parameter is also used as a criteria to evaluate the general health as well as in the clinical studies related to underweight, overweight and obesity. Among those, especially overweight and obesity are known to be risc factors regarding cardio-vascular disease, hypertension, diabetis and others at the age of adulthood, while the underweight status could be an indicator of malnutrition.

With regards this parameter, the boys from Bucharest show weight means higher than those from Iasi at all age groups, the greatest difference between cohorts being observed at 18 years of age (approximatively 7 kg). At the same time, we notice a higher level of variation regarding weight in adolescents from Bucharest compared to those from Iasi.

The girls from Bucharest show weight means larger than those from Iasi, as well, with the exception of the 14.6-15.5 age interval, when the ones from Iasi are ahead. The greatest difference between the two girl cohorts is seen again at 18 years of age. The gain in weight is more accelerated in girls from Bucharest, while in the ones from Iasi there is a higher level of stability regarding this parameter.

The BMI (Quetelet) index integrates the height and weight, being one of the most utilized indicators in clinical studies. In the current longitudinal study, the BMI values for each individual had been calculated and reported automatically by the professional scale used for anthropometrical measurements.

The analysis of the data reveals that the average values of BMI registered are higher in the case of boys from Bucharest than in Iași in all age groups, although the differences are not significant. In the case of girls, the average BMI values are very appropriate in the age range 14.6-16.5 years, and then the adolescents in Bucharest will register higher average values for this parameter in the other age groups, without these differences being statistically significant. As it can be seen in table 2, there is a slightly higher percentage of underweight male adolescents in Iasi compared to underweight adolescents in Bucharest. Instead, the percentage of normal-weight and overweight boys is approximately equal between the two groups.

BMI	15 years			16 years			17 years			18 years		
	IASI	BUC	p value	IASI	BUC	p value	IASI	BUC	p value	IASI	BUC	p value
Underweight/Risk %	8.1	6.9	NS	10.2	6.8	S*	8.3	6.4	NS	8.42	6.1	NS
Normal weight %	83	84.7	NS	81.6	84.8	NS	83	85.3	NS	83.1	85.8	NS
Overweight/Obesity %	8.9	8.4	NS	8.6	8.4	NS	8.7	8.3	NS	8.4	8.1	NS

Table 2. The distribution of boys from Iași and Bucharest according to the BMI value on three categories and age (percentages)

Regarding the female gender (table 3), there is an almost double percentage of underweight adolescents in Iași compared to those in Bucharest at the age interval of 14.6-15.5 years, later this difference is reduced at the age of 18 years. As in the case of boys, the percentage of normal-weight and overweight girls is approximately equal between the two groups.

BMI	15 years			16 years			17 years			18 years		
	IASI	BUC	p value	IASI	BUC	p value	IASI	BUC	p value	IASI	BUC	p value
Underweight/Risk %	22.1	10.1	S*	17	9.5	S*	18.2	8.7	S*	12.1	8.6	NS
Normal weight %	71.1	82.9	NS	75.8	83.3	NS	74.8	83.8	NS	81.2	84.3	NS
Overweight/ Obesity %	6.8	7.0	NS	7.2	7.2	NS	7	7.5	NS	6.7	7.1	NS

Table 3. The distribution of girls from Iași and Bucharest according to the BMI value on three categories and age (percentages)

Overall, there is a higher percentage of overweight male adolescents compared to girls, with a higher tendency to remain stable in BMI groups compared to adolescent girls, where these percentages are lower, especially for those from Iasi, during the three years of study. This indicates the existence of a greater degree of variability during the three years, in the case of females.

The comparative analysis of the data between 2011-2017 reveals the fact that there is a reduction in the percentage of underweight and overweight boys from Iași, the differences being constant in all age groups. At the same time, the percentage of underweight girls from Iasi increases, the difference being significantly reduced at 18 years. Instead, there is a decrease in the percentage of overweight girls, as in the case of boys, which is an indicator of an improvement taking place during the last decade.

Also, between 2010-2017 there is a decrease in the percentage of overweight Bucharest boys, while the percentage of underweight people remains relatively constant. In the case of girls from Bucharest, there is a higher percentage of underweight at the age of 14.6-15.5 years, after which the differences are significantly reduced to 18 years. Thus, the percentage of overweight girls remains constant across the three years of research.

Another parameter measured in this longitudinal study is the fat mass and its evolution during the growth and development of adolescents. The related analysis of the data indicates that the average values of fat mass are higher in Bucharest adolescents of both sexes compared to Iasi. Overall, girls have higher values than boys for this parameter, especially at the age of 18, a phenomenon specific to sexual dimorphism.

The length of the leg was obtained by subtracting the sitting height measured from the total height. This parameter can then be used in relation to the total height, sitting height or other parameters in order to establish the proportions of the body.

The results of related research indicate the existence of a positive correlation between the leg length and favorable socio-economic conditions, this aspect being part of the “secular trend” phenomenon. In contrast, poor childhood health conditions, inadequate nutrition or an unfavorable family environment are known as factors with a negative effect on leg length.

Thus, the average values of the leg length are higher in Bucharest boys in all age groups, the biggest difference being registered at 15-16 years. The highest increase is recorded between 15 and 16 years for both groups, subsequently, the growth of the leg slowing down to 18 years. On the other hand, in the case of adolescents, Girls in Iași register an average of the leg length slightly higher than in Bucharest, at all age categories. As in the case of boys, the process of growing of the leg in girls reaches a plateau with the age of 17 years, however, adding about 2 cm to 18 years, in adolescents in both groups. The differences between the values of the

recorded averages are smaller in the case of girls compared to boys at all ages, as they are not statistically significant.

Overall, boys will have a higher average for the leg length compared to girls in all age groups, the increase in this parameter being more pronounced in males at this age.

Comparative analysis of leg length by income (chi-square test with Yates correction) shows that, although the differences are not statistically significant in any of the genders or age groups, the average length is higher in adolescents from families with incomes over 2000 RON. This trend suggests the existence of an influence of income on this parameter. The analysis in this case was performed only for adolescents in Iasi, as here there is a higher distribution of family income that allows a comparison.

In addition to leg length, sitting height and the various ratios derived from them, are other parameters used in auxological studies to determine the peculiarities of growth and development of individuals, these values are also used to identify risk factors for the history of various diseases (overweight-obesity, cardiovascular disease, diabetes, etc.), morbidity and mortality in adults.

As for the boys from Bucharest, they register the higher average value of sitting height compared to the boys from Iași in all age groups, while for girls the values increase for those from Bucharest with the age of 16 years. In both sexes and localities, overweight subjects register slightly higher values of this parameter.

10

From the analyzed data on leg length and sitting height we can conclude that there are typological differences between the two groups, more obvious in females - in adolescents in Bucharest, the increase seems to be more pronounced on the trunk, while in adolescents in Iasi, it takes place, more accentuated, on the lower limb.

From the point of view of the sitting-weight-weight relationship, although the differences are not statistically significant, we can identify an influence of weight on this parameter, an aspect that is in consensus with the literature. Also, the comparison between the mean values of sitting height of underweight subjects with those of overweight subjects indicates the same trend: sitting height is generally higher in overweight individuals for both localities and both sexes. The only exception is registered among teenagers in Iași, at the age of 15.

The comparison of the sitting height averages resulting from the present research with those of 2005 reveals a decrease of the average of this parameter that took place in the last decade in the group from Bucharest. The differences between the two years are greater in the case of male adolescents, both in the age group of 14-15 years and at 18 years olds. In the case

of girls, the difference between the averages is greater at the age of 14-15, while, at 18 it will no longer be significant.

Both boys and girls in Bucharest show higher average values regarding the chest circumference compared to boys, respectively girls from Iași in all age groups. Overall, the chest circumference is larger in boys compared to girls, a specific aspect of sexual dimorphism. The differences between the sexes regarding this parameter at 18 years are approx. 5-6 cm. Also, both boys and girls from Bucharest show higher average values regarding the hip circumference compared to boys, respectively girls from Iași in all age groups. Overall, the hip circumference is larger in girls compared to boys. This is another aspect specific to sexual dimorphism, which is in line with the literature.

According to WHO, a value of this ratio less than or equal to 0.9 for males, respectively less than or equal to 0.85 for females, indicates a good state of health. Values higher than those indicated for each sex can give indications of the occurrence of various dysfunctions or diseases in adulthood.

In the case of males, the highest percentages of adolescents with CT / CS ratio values above 0.9 are recorded in overweight individuals, in all age categories, for both localities (table 4). In the case of subject with normal weight, there are the fewest cases with ratio values above 0.9, at all ages. Also, although the differences are not statistically significant in any age group, we notice that the percentages are slightly higher in adolescents from Iasi compared to those in Bucharest, which suggests that the former are exposed to a higher risk of incidence of certain diseases.

TC/HC > 0.90 Males	15 years			16 years			17 years			18 years		
	uW	NW	OW	uW	NW	OW	uW	NW	OW	uW	NW	OW
BUCURESTI	15.2	5.5	20.3	17.1	5.3	20	16.7	5.8	20.5	16.1	5.5	20.5
IASI	20.1	7.4	28.8	19.5	7	27.5	19.3	7.2	29.7	19	7.1	28.6

Table 4. The distribution of male adolescents with TC/HC values above 0.90, based on age groups, localities and weight category (percentages)

In the case of females, we also notice that the highest percentage values for the TC /HC ratio are registered in overweight adolescents in all age categories, for both localities (table 5). Normal-weight girls are the ones with the lowest ratio values above 0.85. It should also be noted that the percentage differences between underweight and overweight adolescents in this ratio are smaller compared to males, suggesting a greater influence of BMI on the TC/HC ratio in girls.

TC/HC > 0.85 Females	15 years			16 years			17 years			18 years		
	sP	NP	SP	sP	NP	SP	sP	NP	SP	sP	NP	SP
BUCURESTI	18.4	6.2	19.4	19.3	6.6	19.7	18.8	6.2	19.1	18	5.8	18.7
IASI	20.3	5.7	19	20.1	5.7	19.4	19.5	5.5	19	19.5	5.3	18.4

Table 5. The distribution of female adolescents with TC/HC values above 0.90, based on age groups, localities and weight category (percentages)

At the same time, although the differences are not statistically significant between localities in any age group, adolescents from Iași have lower values of the TC/HC ratio that exceed the critical threshold of 0.85 compared to Bucharest (except for underweight girls at the ages of 15 and 16). This fact suggests that, unlike boys, in the case of girls, those from Bucharest are slightly more prone to certain diseases.

The value obtained by measuring the circumference of the arm can be commonly used to determine possible energy deficiencies, while also being a useful screening tool for obesity in children and adolescents. Sometimes this indicator is also used for the purpose of predicting BMI weight categories. In the case of the present research, the circumference of the arm was measured with the help of a centimeter standing, at the level of the relaxed arm, which is in extension.

The analysis of the evolution of the average arm circumference in male adolescents reveals that, in all age groups, boys in Bucharest register a higher average compared to those in Iasi, although the differences are not statistically significant. The largest difference is recorded at the age of 15 years (approx. 3 cm), and then the difference remains constant until 18 years (approx. 2 cm).

In the case of adolescent girls, we notice that the average values of arm circumference are higher in the group in Bucharest than in Iasi, in all age groups, although the differences are smaller compared to those of boys (approx. 1cm). There are no statistically significant differences in adolescent girls either.

The higher values of the average arm circumference obtained in the group in Bucharest compared to the one in Iasi, for both sexes, in all age groups, can be explained by the habits, respectively the preferences of adolescents regarding the type of physical activity performed. First of all, the analysis of the related questions in the questionnaire shows that a significantly higher percentage of Bucharest adolescents perform several hours of sports outside the school program, especially at the age of 18 (2017).

Also, especially in the case of Bucharest boys, the type of physical activity preferred outside of school is the one performed in the fitness room (over 60%), while for the teenagers

from Iași, football is in the top of preferences. The average circumference of the larger arm in Bucharest represents the effect of the longer period of time spent by them lifting weights and, thus, performing specific physical activities that have the effect of increasing muscle mass.

4. The analysis of data from the questionnaire

The great majority of girls in Bucharest had menarche earlier than those in Iași. A small percentage had menarche at the age of 10, while in adolescents in Iași menarche is registered at the earliest at the age of 11. The highest percentage for both localities is around the age of 12, although higher in proportion for Bucharest residents. The average age of menarche is in line with the secular trend phenomenon registered both in most European countries, as well as in Romania.

The average age of menarche in Romania was 12.6 years in 2008, and 12.7 for Bucharest in 2007. In the case of our research, the average age of the menarche for the group from Bucharest is 12.2 years, while the average age for the group from Iași is 12.5 years. The differences recorded are not statistically significant compared to these data. We can observe, however, a decrease in the average age of menarche in girls in Bucharest compared to 2007.

After the age of 12, there is a decrease, more pronounced for adolescent girls in Bucharest, of the number of individuals, while at 14 years of age, only 4.40% of Bucharest subjects had their first menstruation. In the case of adolescent girls in Iași the percentage is still high (16.30%).

For a significant number of adolescent girls, we observe the influence of weight on the moment of menarche (table 6). In adolescents in Bucharest, a statistically significant high percentage of overweight girls have early menarche compared to underweight girls ($t = 1.51$, $p < 0.01$). In the adolescents from Iași, the same statistically significant difference is observed ($t = 1.58$, $p < 0.01$), for the early menarche in the two weight groups. This significant difference in both groups indicates that, for at least some adolescents, overweight is a factor that can determine the early onset of menarche.

	Early menarche			Medium menarche			Late menarche		
	uW	OW	p-value	uW	OW	p-value	uW	OW	p-value
BUCURESTI	8.4%	37.5%	S**	59.5%	55.4%	NS	32.1%	7.1%	S*
IASI	7.3%	38.5%	S**	56.7%	52.7%	NS	36%	8.8%	S*

Table 6. The distribution of girls from the two counties on the three categories of menarche, based on body weight

Again, in the case of late menarche, we also observe statistically significant differences for both localities ($t = 2.70$, $p < 0.05$ - Bucharest; $t = 2.81$, $p < 0.05$ -Iași). A significantly higher percentage of underweight adolescents will have a delayed menarche than overweight adolescents. And in the case of late menarche, we can say that the value of BMI is a factor that influences its timing, a significant percentage of underweight adolescents in both localities, with delayed menarche.

In the case of boys, the first shave is recorded at the earliest at the age of 12, with puberty occurring about two years later than in girls. The vast majority of Bucharest residents fall at the age of 14 in terms of the first shave (47.50%), while the majority of Iasi residents have their first shave at the age of 15 (60%).

At the age of 16, only 2% of the people from Iași will have their first shave during this period. Unlike girls, in the case of boys there are no statistically significant differences regarding the onset of puberty ($t = 3.24$, $p > 0.05$) but, overall, those from Bucharest seem to be slightly ahead of Iasi.

The comparison between the two sexes regarding pubertal age indicates a gap of about two years for both groups, the girls being ahead of the boys. This time difference between the sexes is also in line with the “secular trend” phenomenon. Rapid morpho-anatomical changes that occur from puberty require an additional and adequate supply of energy and protein, as well as specific micronutrients. For this reason, the recommended value of daily calorie intake is the highest in the case of an active adolescent, compared to other age groups.

According to the answers of adolescents to the questionnaires applied in 2014 and 2017, respectively, in general, there is a higher value of the food diversity index in the case of Bucharest residents compared to Iasi residents, both for girls and boys. In the case of adolescents in Bucharest, a relatively equal percentage distribution is observed in the first year (48.7% - low div. Compared to 51.3% - high div.). On the other hand, in 2017 there is a significant increase in the high diversity index, which increased to 58.7%.

In the case of adolescent girls from Iași, although the percentage of high diversity remains lower than that of Bucharest women, there is also an increase between the two years.

Regarding male adolescents, we observe, overall, a lower index of high diversity compared to girls, although this is not statistically significant. As in the case of girls, boys also see an increase in the high diversity index between 2014 and 2017, for both localities.

Thus, we can conclude that, as adolescents reach the age of 18, there is an improvement in diet in terms of food diversity. However, for both girls and boys, the low percentage of food diversity remains quite high, especially in the case of the group from Iasi, where the values are over 50%.

The lifestyle of industrially developed countries has led to the consecration of the so-called Western or American diet, a diet that consists in the prevalence of industrially processed food, semi-prepared foods and fast food, rich in sugar and saturated fats.

In opposition to the Western diet is the so-called Mediterranean diet, a diet that is currently accepted as a standard for a healthy lifestyle. It is characterized by frequent consumption of fruits, vegetables, nuts, cereals and olive oil, a moderate consumption of fish and dairy products, as well as a low intake of saturated fats and sweets.

Research shows that adherence to the Mediterranean diet is associated with increased socio-economic status. Especially young people from families with high socio-economic status have a higher tendency to adhere to this diet.

The Kidmed test, which indicates the degree of adherence to the Mediterranean diet, was included in the questionnaire applied in our research. The analysis of the answers to it highlights the degree to which adolescents in Romania adhere to the Mediterranean diet depending on the locality and time.

As it can be seen from figure 3, overall, there is no significant difference between the number of adolescents with low levels of adherence to the Mediterranean diet between Iasi and Bucharest, the percentage increasing slightly among Bucharest residents in 2017 (22%). In the case of the category with an average degree of accession with the need for improvement, the average is higher for adolescents in Iași than in Bucharest (66.01% compared to 56.06% in 2014, respectively 64.07% compared to 52.70% in 2017).

Regarding the category with a high degree of adherence to the Mediterranean diet, there is a significant difference between the two groups in the second year of study (2017, $t = 1.67$, $p < 0.05$) while in the first year there is no a significant difference (2014, $t = 1.71$, $p > 0.05$). There are also significant differences between the two years of study in both localities (Bucharest $t = 1.67$, $p < 0.05$; Iasi $t = 1.77$, $p < 0.05$).

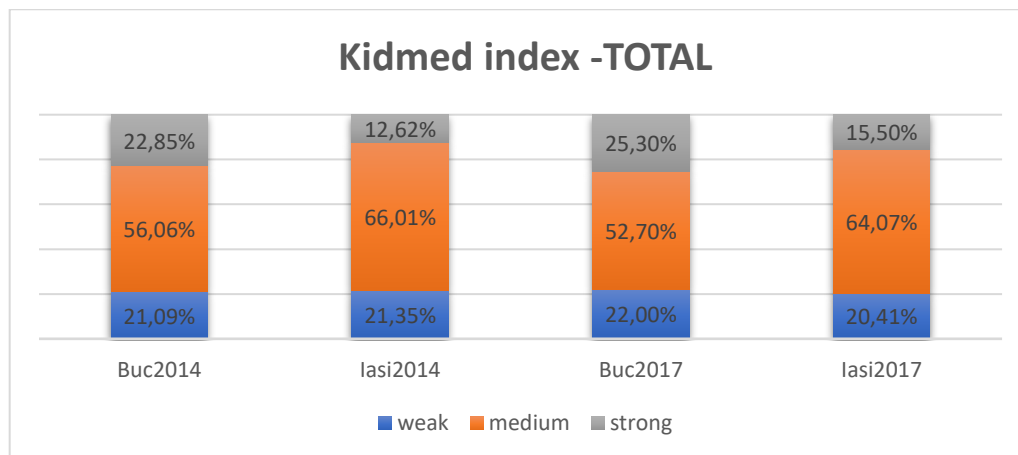


Figure 3. The evolution of the degree of adhesion to the mediterranean diet of adolescents form Bucharest and Iasi, between 2014 and 2017 (total)

Thus, overall, there is a higher average of young people in Bucharest who adopt the Mediterranean diet-22.85% in 2014, a percentage that reaches 25.30% in 2017. The percentage of teenagers from Iasi who fall into this category is lower than Bucharest residents, however, there was an increase between the two years - 12.62% in 2014, respectively 15.50% in 2017.

Regarding the differences between the sexes, girls are more receptive to the adoption of the Mediterranean diet, the percentage being higher compared to boys, especially for the group in Bucharest, probably because of their higher interest in a healthy diet in relation to having a body close to current cultural standards of beauty.

The analysis of the answers to the Kidmed test reveals the existence of the habit of serving breakfast to the adolescents from both localities, in a higher percentage to the people of Bucharest; the consumption of sweets is higher in Bucharest, the percentages then decreasing at the age of 18 - these two aspects indicate a tendency to improve the quality of the diet of adolescents, with a positive impact on health.

In order to analyze the evolution over time of the Mediterranean trend of dieting in adolescents in Romania, we made a comparison between the answers to the Kidmed test obtained in 2017 with those in 2011 (Popescu-Spineni, 2011), both in Bucharest. In this way we could observe the changes that occurred over time, on the three categories regarding the degree of adherence to the Mediterranean diet in adolescents in Bucharest.

16

Thus, in total, during the last years, the proportion of adolescents with a low degree of adherence to the Mediterranean diet decreases to more than half of the previously registered value. There is also a significant improvement compared to 2011 in the proportion of young people with an optimal level of adherence to the Mediterranean diet (minimum score 8). Despite all these improvements, there is still a large proportion of adolescents (over 50%) with an average level of adherence with a need to improve their diet.

From the point of view of gender differences, there is a significant improvement in both girls ($t = 2.14$, $p < 0.05$) and boys ($t = 1.95$, $p < 0.05$). In both sexes, the percentage of young people with a maximum score of 3 (low level of adherence to the Mediterranean diet) decreases, while the percentage of those with a minimum score of 8 (optimal level of adherence to the Mediterranean diet) increases. For both girls and boys, a high proportion of average adherence with improvement needs is maintained, slightly lower in the case of adolescents. The largest percentage difference observed between the two years of research refers to breakfast, indicating another improvement in this respect, in the sense that an increasing percentage of adolescents introduce breakfast in their daily habits.

The logistic regression analysis reveals a positive dependence between the level of food quality, as shown by the data obtained from the Kidmed test, and different socio-economic

indicators (level of parental education, level of family income, number of members, etc.) for the group of teenagers from Bucharest. This dependence is observed in both sexes, both at the age of 15 years (2014) and at the age of 18 (2017).

Thus, in 2014, we observe a positive association between the quality of the diet and the level of family income in male adolescents in Bucharest (p value = 0.008, likelihood ratio = 0.0023). Also, in the case of adolescents in Bucharest, there is an association between the quality of the diet and the number of family members (p = 0.004, likelihood ratio = 0.0033). In 2017, the logistic regression analysis also indicates a positive association in the case of male adolescents with the mother's level of education (p = 0.0001, likelihood ratio = 0.057), income level (p value = 0.001, likelihood ratio = 0.028), respectively the discrepancy score of the body (p value = 0.001, likelihood ratio = 0.0108).

The existence of these positive relationships between the level of food quality and socio-economic indicators in adolescents in Bucharest, unlike those in Iasi, can be explained by the fact that their development conditions are characterized by better socio-economic conditions, as well as by belonging to families that are composed, for the most part, of a small number of members (3-4 individuals on average).

Thus, we can say that the present research illustrates an obvious tendency of association between the superior quality of the diet and the high socio-economic level. This trend is observed both in 2014 and in 2017, unlike in 2011 (Popescu-Spineni, 2011), where this relationship was not observed. The analysis of the answers regarding the habits related to nutrition reveals that the proportion of Bucharest teenagers of both sexes, who have the habit of serving meals regularly during the day, is higher compared to the percentage of people from Iași (over 50%). This percentage increases at the age of 18, while in Iași it remains constant. It is worth noting the significant number of teenagers in both groups who do not serve meals regularly.

As it can be observed from table 7, there is a strong correlation between family income and the habit of eating meals at regular hours for teenagers from Iași: in families with incomes higher than 2000 Ron, the habit of eating at regular hours tends to increase.

Do you eat regularly?	15-16 years			18 years		
	<2000 RON	>2000 RON	p value	<2000 RON	>2000 RON	p value
Boys	18.3%	56.4%	S*	20.5%	55.2%	S*
Girls	20.2%	64.3%	S**	19.7%	67%	S**

Table 7. The distribution of positive answers of adolescents from Iasi according to the family income, for two age groups

In terms of the number of meals per day, the vast majority of adolescents of both sexes and localities consume three meals a day, while a higher percentage of girls that consume two meals a day (10%), respectively a higher percentage of boys who eat four meals a day (14%). For the vast majority of teenagers, regardless of gender and location, the main meal is lunch, most declaring that they skip this meal only very rarely, followed by breakfast and dinner in the smallest proportion, the latter being on the last place. It is also worth noting that, although not the main meal of the day, teenagers in both groups do not usually skip dinner.

Despite the type of diet and related habits existing in Western countries today, the main type of food in the families of the subjects in both groups remains the traditional one, prepared at home (over 80%, higher in Iasi). In the following places are the semi-finished products and fast food, both in much lower percentages (higher for the group in Bucharest compared to the one in Iasi).

According to the answers in the questionnaire, the vast majority of adolescents, regardless of gender and locality, consider that obesity is a disease, the number of positive answers increasing in 2017, as individuals mature; the number of those who declare that they do not know, is higher in the Iași cohort in both years of study, which suggests an easier access of the adolescents from Bucharest to information.

The vast majority of adolescents, regardless of gender and location, are aware that eating habits can influence their health. However, there is a significant percentage of teenagers from Iasi who answer this question negatively compared to Bucharest residents. 18

From the analysis of the answers of the subjects from the two cohorts, to the questions regarding the incidence of diseases, it results that the prevalence of cancer and diabetes is higher in the families of individuals in Bucharest, while anemia and digestive diseases are more present in families in Iasi. The prevalence of cardiovascular disease is similar for both localities.

Regarding the diseases that adolescents of both sexes in Bucharest suffer / have suffered so far, allergies (50%) are in the first place, followed by lung diseases (21%) and others (16%). In adolescents from Iași of both sexes, the first place is occupied by digestive diseases, followed by others (22%) in boys and allergies in girls (23%). It is worth noting the high percentage of incidence of lung diseases in both groups, higher for Bucharest.

Regarding the family diseases, in the Bucharest group, diabetes and cardiovascular diseases are in the first place in approximately equal proportions, followed by cancer, while, in the Iași group, the anemias followed by cardiovascular diseases are in the first place. It is worth noting the high incidence, in both localities, of cardiovascular diseases, which occupy one of the first places worldwide too, as well as anemia in the Iasi group, which suggests the existence of possible nutritional deficiencies in children and adolescents.

Regarding the habit of reading the label before buying a product, the differences between the two lots are not significant, the distribution of answers being approximately equal. More girls tend to answer in the affirmative compared to the boys in the case of the Iași group, in Bucharest there are no differences between the sexes from this point of view.

Adolescents of both sexes in Bucharest are influenced, to a large extent, in buying a product, of taste, followed by packaging and appearance. In the case of teenagers from Iași, advertising ranks first, followed by price and then taste. This trend is a proof of the fact that for teenagers from Iași, price is a much more important criterion compared to those from Bucharest, where this factor occupies one of the last places.

Physical activity is one of the most important environmental factors with an impact on normal growth and development. Therefore, the degree of influence of this factor in the growth and harmonious development of the body has been constantly in the attention of research in the field of auxological anthropology. Also, physical activity and sedentary lifestyle are of major interest for areas such as public health, medicine and educational sciences, in the context of increasing the incidence of overweight and obesity at a young age, and the negative consequences of a predominantly sedentary lifestyle on health.

The evaluation of sedentary behaviors was performed by means of the time spent in front of the TV or the number of hours spent in front of the computer. The sedentary index of the subjects included in the study indicates a relatively equal average amount of time spent in front of the computer for adolescents in both groups, regardless of sex, for 2014. In 2017 the value of this average decreases, with significant differences between boys (Bucharest adolescents males spend less time in front of the computer than Iasi).

From the point of view of weight groups, although the differences are not statistically significant, it is observed that overweight people in both groups spend more time in front of the computer.

Regarding the time spent in front of the TV, the teenagers from Iași record higher averages in both years of study, the differences being statistically significant. Therefore, in total, adolescents in Iasi record higher values of the sedentary index for both parameters compared to adolescents in Bucharest, probably due to the existence of several alternatives for spending free time with the latter.

A proportion of approximately 15% of teenagers, girls and boys in Bucharest state that they do not have time for sports outside school compared to 3% on average for Iasi. These differences are probably due to the existence of a wider range of options for spending time outside school for teenagers in Bucharest. Also, there are no respondents from Bucharest who do not do sports outside the school program due to material constraints. On the other hand, in

Iasi there is a proportion of 16%, on average, which identifies this cause for the lack of weekly sports activities.

At the age of 18, we notice a decrease in the proportion of teenagers who spent time weekly with doing sport outside of school, for both localities and sexes. The main reason for this difference compared to 2014 is the lack of time, the percentages related to this answer increasing significantly in this year of application of the questionnaire. The lack of time for allocating more sports hours outside of school this year is explained by the fact that teenagers are in their last year of high school and are forced to give priority and more time to prepare for national and entrance exams.

The increase in the share of responses to this category is an indicator of the concern of adolescents in both localities and genders on this issue. It is also observed that the proportion of individuals, girls and boys in Iași who invoke material constraints due to the lack of sports classes remains relatively constant even at the age of 18.

There are also differences between the groups studied in terms of the types of sports activities in which adolescents are involved on a regular, weekly basis. Thus, for the boys from Bucharest, the fitness room is among the preferences related to sports activities (over 60%), followed by football, swimming, running and cycling. The lowest proportion is represented by activities such as basketball, athletics and tennis. In the case of girls from Bucharest, on the first place is also the fitness room with related activities (cardio, cango-jump, etc.) followed by running, swimming, cycling and basketball and dancing, to a lesser extent.

The boys from Iași have a preference for football (average of 50%) and then basketball, to a lesser extent (28%), as the main sports activities carried out outside the school program. These are followed by activities such as running, rugby and fitness, the latter having the lowest share. In the case of girls from Iași, handball is in first place (43%), followed by athletics, running, fitness and dancing.

Following the analysis of the answers regarding the type of sports activities performed outside school, we can conclude that, in general, at adolescents in Bucharest individual activities performed in gyms and swimming pools and which require the payment of a subscription dominate, while in the case of teenagers from Iași, in the first place are the sports activities that are carried out in a team, usually in the school yard (football, handball, etc.) and which do not involve the payment of a subscription. Therefore, these answers also show differences between the two localities due to economic limitations.

Following the analysis of the adolescents' answers regarding the habits related to sleep, respectively waking up in the morning, we made an average of the hours declared by them for the summer season and for the winter period.

There are no differences in terms of schedule or number of hours of sleep, except that girls, regardless of location, sleep, on average, one hour more during the week. This homogeneity suggests the existence of a pattern of sleep habits in all adolescents, regardless of location or gender.

The answers in the questionnaire to the question on habits related to waking up in the morning indicate a relatively equal distribution between adolescents who answer in the affirmative and negative, respectively, in both years and for both sexes, regardless of locality. The differences are not statistically significant. This shows that a significant number of teenagers, regardless of their place of origin, have difficulty waking up in the morning.

In the case of the second question, regarding the existence and non-existence of the state of fatigue at the moment of waking up, a representative percentage of the adolescent girls from Bucharest declare that they feel tired in the morning, the differences being statistically significant. These significant differences are maintained in 2017. In the case of adolescent girls from Iași, the percentage of those who answer this question in the affirmative is lower than in Bucharest. Instead, the differences become statistically significant in 2017, when the proportion of those who say they feel tired in the morning increases.

Regarding the male gender, a higher percentage of Bucharest adolescents answer affirmatively to the same question, the differences between answers being statistically significant, for both years. In the case of adolescents from Iași, the significant differences are even greater, over 70% of the answers being affirmative. These differences remain significant in 2017, although they decrease during this period.

With regards the distribution by weight groups, a significantly lower percentage of overweight adolescents say that they wake up easily in the morning, regardless of gender and locality, compared to normal weight and underweight. We can therefore identify a causal relationship between overweight and sleep.

As it is well known, industrialized countries have developed an intense and strong concern for the body and the way it looks, leading to great socio-cultural pressures on individuals in order to achieve the ideal standards promoted. Often this target concerning the body image proves to be impossible to achieve.

These standards were subsequently difused to all regions of the planet, thus becoming a world standard for body aesthetics and health. There is also a correlation between individuals with high self-esteem and a higher success rate at school, in society or in personal relationships.

In order to highlight the relationship between one's own body image and the ideal image of the adolescents studied, we analyzed the body discrepancy score for underweight,

normal weight and overweight individuals, as resulted from adolescents' answers to related questions in the questionnaire.

Among the figures used in body image studies, the Stunkard figure scale for adolescents was chosen, which proved to have the highest diagnostic accuracy and is validated worldwide in specialized studies. The Stunkard figure scale consists of a number of nine figures describing the body image in ascending order of size from "very weak" (a score of 1) to "obese" (a score of 9). According to the body discrepancy score obtained, individuals were grouped into three categories: a negative score means a desire to gain weight, a score with a value of 0 or 1 represents a high degree of satisfaction with one's own body image, while a score with values above 1 means a high degree of dissatisfaction regarding this aspect.

Thus, the analysis of the discrepancy score of the body image indicates the existence of a significant percentage of underweight subjects who want to gain weight, respectively a significant percentage of overweight subjects who want to lose weight to reach the figure considered ideal. This trend is similar for teenagers from both localities. The values of the body discrepancy score are slightly lower in the case of male adolescents, which demonstrates the existence of a more active concern of girls for body image, probably against the background of stronger cultural pressures on elicited on females.

Significant differences in the body discrepancy scores demonstrate that adolescents, regardless of their place of origin, are aware of the importance of body image and the health associated with it, showing an intense concern about this issue.

Regarding the parents' perception of the ideal figure of their children, the trends are in the same register: a significant percentage of parents of underweight adolescents want them to gain weight, while a significant percentage of parents of overweight adolescents want them to lose weight. Overall, the percentages recorded are lower compared to those of adolescents, which indicates a discrepancy between the perception of adults and adolescents in terms of body image.

One of the questions in the questionnaire refers to the pressure factors that adolescents feel about their physical appearance. The answers to this question reveal the factors that influence adolescents to look in a certain way, as well as the share for each of them, according to each sex, as well as depending on the place of origin.

From the analysis of the answers regarding the factors that exert pressure to look in a certain way, in the case of adolescents, the largest share is represented by one's own person both for Bucharest and for Iași. This is to be expected, given that at this age, adolescents tend to become independent and prefer to make personal decisions. A significant percentage of

teenagers from both localities state that they do not feel pressured in any way (22.5% for Bucharest, respectively 25% for Iași). In third place is the circle of friends.

In the case of boys, we notice a greater variability in the share of responses compared to girls. Thus, in the first place is also one's own person, followed by the statement that they do not feel pressured in any way. The data analysis reveals that the circle of friends has a greater influence on boys compared to girls, given that boys mature later and are consequently more easily influenced at this age. Subsequently, the percentages for this variable decrease significantly at the age of 18 (2017).

Boys also seem to be influenced by society and the media to a greater degree than girls. In the case of teenagers from Bucharest, this factor exerts a greater pressure compared to teenagers from Iași, and the percentages will decrease significantly and become equal in 2017 (4.8% for teenagers in Bucharest, respectively 4% for those in Iași).

Regarding the pressure exerted by the parents, so that the adolescents look in a certain way, it seems to be higher in the subjects from Bucharest compared to those from Iași.

5.Multifactorial correspondence analysis (MCA)

The multifactorial analysis of the data indicates that the maximum contribution of variability is produced by the combination of answers to the questions in the questionnaire which address the following aspects: parents' level of education, family income level, incidence of diseases, nutrition issues, physical activities and pressure on teenagers to look a certain way.

Through the clustering procedure, the subjects were grouped into four clusters. Figure 4 shows the positions of the clusters in relation to dimension 1. It is observed that, in general, clusters 2 and 3 are relatively homogeneous in relation to dimension 1. Exceptions are clusters 1 and 4. Cluster 4 is represented by the observations who have a major contribution to dimension 1. An interesting observation is related to the observations captured by clusters 1 and 4, ie in cluster 1 there are exclusively teenagers from Bucharest, while in cluster 4 there are exclusively teenagers from Iași.

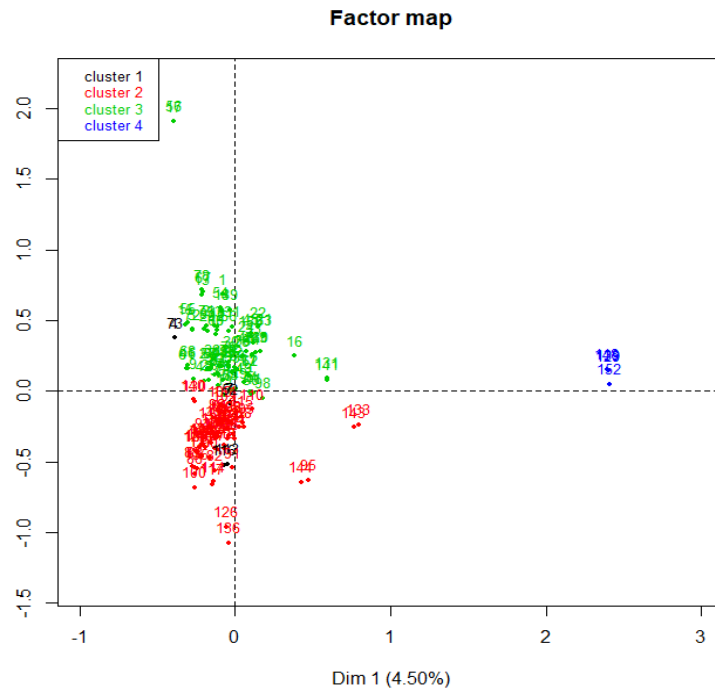


Figure 4. The four clusters in relation to dimension 1

6. Conclusion

- The existing socio-economic disparities in our country continue to generate differences in relation to the growth and development of adolescents, in the 14-18 years age range, regarding the mean height, weight, BMI value and weight distribution
- From the point of view of height, adolescents record averages very close to the WHO reference averages in all age groups studied; exceptions are male adolescents in Iasi, where the average height is below the reference values
- Socio-economic factors influence the age of menarche: a higher percentage of adolescents with better material conditions has early menarche compared to the other category, there is a correlation between BMI and menarche
- There are still phenomena specific to sexual dimorphism, regardless of locality: higher average values of fat mass and hip circumference in girls, and higher values for chest circumference in boys respectively
- Adolescents who develop in more favorable socio-economic conditions are characterized by a higher index of food diversity; a higher percentage of adherence to the Mediterranean diet, considered to be a standard for healthy eating (valid especially in girls); as well as a higher percentage regarding the habit of serving meals regularly during the day
- Adolescents who develop in more favorable socio-economic conditions have a lower sedentary index in terms of time spent in front of the computer / TV (especially at the age of

18); devotes more time to sports activities outside the school program (especially individual sport activities)

- The socio-economic context does not largely influence the type of food usually consumed within the family: home-cooked food traditionally continues to be consumed to the largest extent

- In the case of adolescents from Iași, a high prevalence of digestive diseases is observed, both in the studied subjects and in terms of the incidence in the family

- Adolescents with a good financial situation are influenced, to a large extent in the purchase of a product, by taste, followed by packaging and appearance compared to the other category where advertising comes first, followed by price and taste

- Regardless of socio-economic conditions, gender and place of origin, adolescents are aware of the importance of body image and associated health, amid current cultural pressures

- Parents' perception of the ideal figure of their own children overlaps with that of adolescents, however, there is a difference generated by the slightly lower body discrepancy scores obtained by the first

- The current existence of these discrepancies in the field of socio-economic conditions and the effect they have on adolescents indicates the need to implement strategies and programs in order to improve the quality of impact factors on young people

- The objectives of such programs shall seek for a better awareness of both adolescents and their parents from poor areas about a healthy nutrition, as well as prioritizing of available material resources in order to ensure better living conditions, and an understanding of the mechanisms of disease and obesity

- At the same time, there is a need for developing projects at regional level for a healthy nutrition, and that will enable the access of youth from disfavored areas to a diverse range of options for sports

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