# THE DYNAMIC OF EXCESS WEIGHT AT PUBERTY IN ADOLESCENTS AND YOUTHS FROM URBAN AREAS

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**Abstract**
*This research was aimed at emphasizing the incidence of excess weight for the studied population segment as well as the degree to which lifestyle can influence its frequency. As a premise of this research, we consider that the practice of physical exercises during formal and non-formal activities can influence the frequency of excess weight in adolescents and youth at puberty from urban areas.*
*The data regarding the practice of physical exercises during physical education classes and leisure time activities was acquired after conducting a questionnaire-based study on 757 gymnasium students and 825 high school students from Braşov municipality. The results showed that 85% of the respondents are practicing formal physical activities while 65% are practicing leisure time activities.*
*In order to emphasize the excess weight dynamic for this population segment, we conducted specific measurements of height and weight in the same students.*
*The frequency of excess weight in boys shows a rising trend from 4-6% to 20-25% during puberty while during adolescence the increase is from 21% at 15 years to 31% at 18 years. For individuals with excess weight and obesity a significant reduction at the onset of adolescence could be observed, over 50% of all individuals showing a normal BMI, except for the 12 year old segment.*
*A similar trend could be observed in girls, the proportion of underweight girls rising significantly from 5.83% at 11 years to 25.93% at 18 years, while the proportion of excess weight girls decreases from 17.09 at 15 years to 14.82 at 18 years. By correlating the data regarding the practice of physical activities with the excess weight dynamic, it was found that the number of overweight and obese individuals is not decreasing although over 85% of all students were involved in physical activities.*
*The development of programmes for youths at puberty and adolescence, intended to raise awareness of both teachers and health specialists about the effects of unhealthy lifestyles on the growth and development processes, appears to be an imperative necessity.*
**Key words:** *dynamic, excess weight, puberty, adolescence, lifestyle, students*

Excess weight can be regarded as a consequence of interaction between environmental factors and the individual's genetic substrate [7]. The occurrence risk of excess weight increases if the energy consumption decreases in comparison with the energy intake [1].
In terms of anthropometry, obesity can be described as *the weight surplus that exceeds the ideal weight by 20% [8]*.
Obesity is frequently known as excess weight because the overweight degree is associated with its risks and direct measurements on the adipose tissue are expensive [9].
Geographic area, socio-economic status, the individual's lifestyle and eating habits are factors that influence the incidence of excess weight [2].
The causes of an increased incidence of excess weight are not yet fully elucidated. These can include among others several factors such as: genetic, metabolic, psychological, sociocultural, neuroendocrinologic, sedentarism, medication, excessive eating [5].
The ***research hypothesis*** assumes that the organism growth and development indicators of the youths at puberty and adolescence can be influenced by the individual's lifestyle.
The ***research aim*** is to emphasize the incidence of excess weight for this population segment as well as the degree to which lifestyle can influence its frequency.
In order to emphasize the excess weight dynamic in youths at puberty and adolescence, we conducted *a set of anthropometric measurements* and the obtained data were correlated with the Body Mass Index (BMI).

## INTRODUCTION

Excess weight in youths at puberty is a major problem in the European Union. According to a study conducted in 2008 through 2009, the proportion of persons from this population sample with excess weight lays between 8 and 25%, the higher values corresponding with data obtained from the UK and Malta.
The youths' diet during this period is intended to provide the maintenance ration, the ration for physical and intellectual effort sustainment and the ration necessary for organism growth and development [3, 11].

The practice of physical exercises performed by the youths plays a very important role in the processes of organism growth and development. Parental influence aimed at encouraging the youths' involvement in their favourite physical exercises leads to a long term preservation of good physical and mental condition [4].

The WHO recommendations regarding the practice of physical exercises for health purposes are based on the fact that physical activity is extremely beneficial to this age segment since it contributes to the development of the bone and muscle system, the cardiovascular, respiratory and neuromuscular systems as well as to maintaining a normal body weight [8, 14, 15].

For this age group the recommendations provide at least 60 minutes of physical activity, three times per week, while additional activities are regarded as very beneficial [13].

The involvement of schools and communities is also extremely important since these can actively promote a healthy lifestyle [10]. These can encourage the practice of physical education, also during class breaks, within the curricular framework, with the contribution of qualified teachers [12]. The cooperation with the local community, regarding the organization of leisure time activities as well as the parents' systematic involvement in the practice of physical exercises, can contribute to an increased participation of youths in these activities [13, 14].

The research was conducted in October-November with youths at puberty and in September-October with adolescents using a representative sample of students.

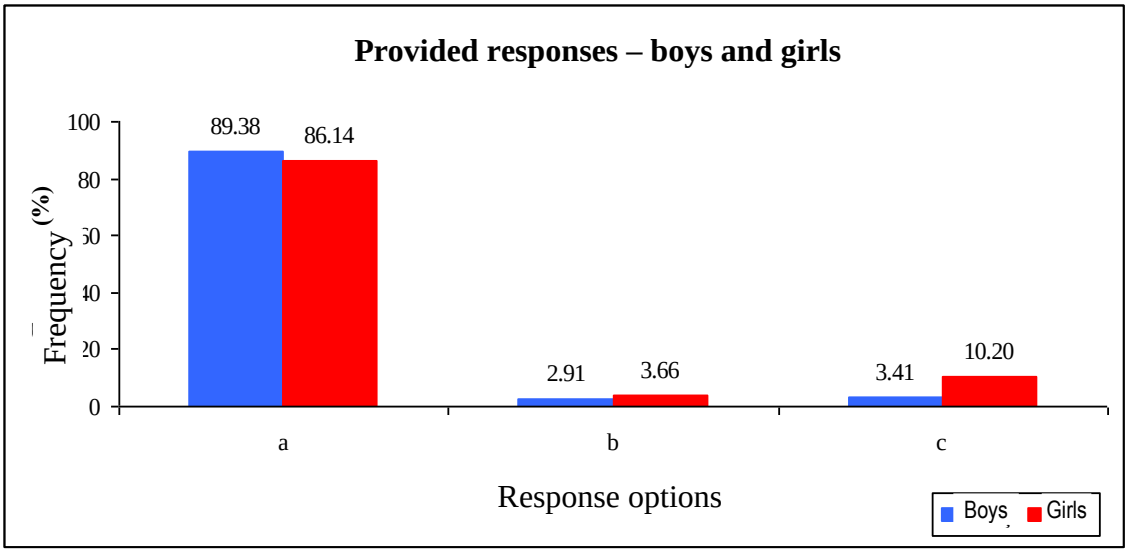
The data relating to the practice of formal and non formal activities was obtained by conducting a questionnaire-based study on a number of 1577 students, out of which 825 high school and 757 the gymnasium students.

With regard to girls, over 85% of them participated in physical education and sports classes, 10% were medically exempted and around 5% never participated in these classes, yet without being medically exempted. With regard to boys, almost 90% of them participated in physical education and sports classes, 4% were medically exempted and 3% never participated in sports classes while 9% of these provided no response to this question (Table 1 and Graph 1).

**Table 1**

| Response options | | a | b | c |
|---|---|---|---|---|
| Frequency (%) | boys | 89.38 | 2.91 | 3.41 |
| | girls | 86.14 | 3.66 | 10.20 |

**Graph 1**

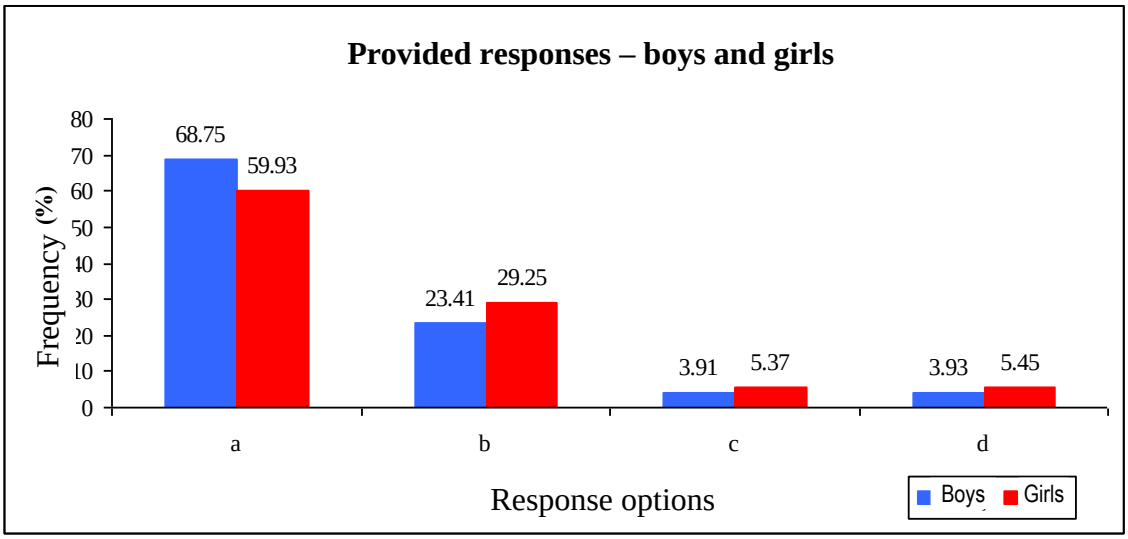



Almost 60% of the girls practice physical activities every day, 30% practice physical exercises every week, 5% every month, and 6% never practice physical activities after school. With regard to boys, 70% practice physical activities every day, 25% practice physical exercises every week, after school, 4% every month, and <5% never practice any physical activities (Table 2 and Graph 2).

**Table 2**

| Response options | | a | b | c | d |
|---|---|---|---|---|---|
| Frequency (%) | Boys | 68.75 | 23.41 | 3.91 | 3.93 |
| | Girls | 59.93 | 29.25 | 5.37 | 5.45 |

**Graph 2**




To emphasize the rate of organism growth and development as well as the excess weight dynamic, we conducted measurements of the height and weight indicators in order to determine excess weight levels in the same students (Table 3 and 4).

**Table 3 [18].** Values of somatic indicators measured in girls aged 11-18

| Age (yrs) | Number of students | measured indicator | Ma | σ | C.v. (%) | W | ±m | Extreme values | | Frequency(%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | upper | lower | Under average | above average |
| 11 | 103 | height (cm) | 148.95 | 8.17 | 5.48 | 41 | 0.81 | 129 | 170 | 42.72 | 57.28 |
| 12 | 93 | | 156.27 | 7.06 | 4.52 | 35 | 0.74 | 140 | 175 | 41.94 | 58.06 |
| 13 | 94 | | 158.49 | 7.04 | 4.44 | 35 | 0.73 | 141 | 176 | 48.94 | 52.06 |
| 14 | 75 | | 161.44 | 5.61 | 3.48 | 27 | 3.48 | 146 | 173 | 48.00 | 52.00 |
| 15 | 117 | | 161.02 | 0.08 | 5.07 | 0.41 | 0.01 | 1.82 | 1.41 | 47.86 | 52.14 |
| 16 | 107 | | 162.38 | 0.08 | 4.17 | 0.34 | 0.01 | 1.83 | 1.49 | 44.86 | 55.14 |
| 17 | 139 | | 162.88 | 0.07 | 4.53 | 0.37 | 0.01 | 1.86 | 1.49 | 50.36 | 49.64 |
| 18 | 108 | | 162.21 | 0.07 | 4.56 | 0.38 | 0.01 | 1.8 | 1.41 | 50.00 | 50.00 |
| 11 | 103 | weight (kg) | 44.04 | 11.95 | 27.14 | 60 | 1.18 | 29 | 87 | 56.31 | 43.69 |
| 12 | 93 | | 51.96 | 14.52 | 27.94 | 72 | 1.51 | 31 | 103 | 49.46 | 50.54 |
| 13 | 94 | | 51.07 | 9.66 | 18.91 | 48 | 1 | 32 | 80 | 53.19 | 46.81 |
| 14 | 75 | | 55.71 | 9.15 | 16.42 | 44 | 1.06 | 34 | 78 | 53.33 | 46.67 |
| 15 | 117 | | 52.89 | 11.16 | 21.09 | 56 | 1.04 | 85 | 29 | 47.00 | 53.00 |
| 16 | 107 | | 54.12 | 10.76 | 19.88 | 54 | 1.05 | 91 | 37 | 57.00 | 43.00 |
| 17 | 139 | | 53.76 | 10.96 | 20.38 | 55 | 0.93 | 96 | 41 | 54.68 | 45.32 |
| 18 | 108 | | 55.40 | 11.92 | 21.52 | 62 | 1.15 | 91 | 29 | 61.11 | 38.89 |
| 11 | 103 | BMI ($kg/m^2$) | 19.70 | 4.5 | 22.82 | 22.57 | 0.45 | 13.23 | 35.8 | 62.14 | 37.86 |
| 12 | 93 | | 21.24 | 5.1 | 23.99 | 25.28 | 0.53 | 14.03 | 39.31 | 43.01 | 56.99 |
| 13 | 94 | | 20.26 | 3.05 | 15.06 | 15.16 | 0.32 | 14.61 | 29.77 | 52.13 | 47.87 |
| 14 | 75 | | 21.33 | 3.39 | 15.89 | 16.3 | 0.39 | 14.16 | 30.46 | 52.00 | 48.00 |
| 15 | 117 | | 20.40 | 3.79 | 18.55 | 19 | 0.35 | 32.59 | 13.59 | 53.00 | 47.00 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **16** | **107** | | 20.49 | 3.65 | 17.81 | 18.31 | 0.35 | 33.63 | 15.31 | 57.94 | 42.06 |
| **17** | **139** | | 20.27 | 3.21 | 15.84 | 16.12 | 0.27 | 31.06 | 14.93 | 56.12 | 43.88 |
| **18** | **108** | | 20.97 | 3.53 | 16.82 | 18.34 | 0.34 | 32.83 | 14.48 | 59.26 | 40.74 |
| **11** | **103** | **Percentile (%)** | 50 | 19.73 | 39.45 | 99.02 | 1.95 | 99.51 | 0.49 | 48.54 | 51.46 |
| **12** | **93** | | 50 | 19.94 | 39.89 | 98.92 | 2.08 | 99.46 | 0.54 | 48.38 | 51.62 |
| **13** | **94** | | 50 | 19.91 | 39.81 | 98.94 | 2.07 | 99.47 | 0.53 | 50.00 | 50.00 |
| **14** | **75** | | 50 | 20.51 | 41.02 | 98.66 | 2.39 | 99.33 | 0.67 | 49.33 | 50.67 |
| **15** | **117** | | 50 | 19.75 | 39.5 | 99.15 | 1.83 | 99.57 | 0.43 | 49.57 | 50.43 |
| **16** | **107** | | 50 | 19.73 | 39.47 | 99.07 | 1.92 | 99.53 | 0.47 | 49.53 | 50.47 |
| **17** | **139** | | 50 | 19.78 | 39.55 | 99.28 | 1.68 | 99.64 | 0.36 | 49.64 | 50.36 |
| **18** | **108** | | 50 | 19.05 | 38.11 | 99.07 | 1.84 | 99.54 | 0.46 | 50.00 | 50.00 |
| **11** | **103** | **Excess weight (%)** | 9.77 | 2.02 | 20.65 | 10.13 | 0.2 | 16.93 | 6.8 | 59.22 | 40.78 |
| **12** | **93** | | 10.05 | 2.28 | 22.67 | 11.3 | 0.24 | 18.11 | 6.81 | 69.15 | 30.85 |
| **13** | **94** | | 9.48 | 1.34 | 14.09 | 6.64 | 0.14 | 13.69 | 7.05 | 51.07 | 47.87 |
| **14** | **75** | | 9.84 | 1.54 | 15.66 | 7.42 | 0.86 | 14.12 | 6.7 | 52.00 | 48.00 |
| **15** | **117** | | 9.46 | 1.80 | 19.00 | 9.02 | 0.17 | 15.02 | 6 | 55.55 | 44.45 |
| **16** | **107** | | 9.45 | 1.69 | 17.83 | 8.46 | 0.16 | 15.37 | 6.91 | 57.94 | 42.06 |
| **17** | **139** | | 9.37 | 1.55 | 16.49 | 7.76 | 0.13 | 14.43 | 6.67 | 56.83 | 43.17 |
| **18** | **108** | | 9.72 | 1.51 | 15.57 | 7.87 | 0.15 | 14.96 | 7.09 | 60.75 | 39.25 |

**Table 4 [18].**Values of somatic indicators measured in boys aged 11-18

| **Age (yrs)** | **Number of students** | **measured indicator** | **Ma** | **σ** | **C.v. (%)** | **W** | **±m** | **Extreme values** | | **Frequency (%)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **upper** | **lower** | **Under average** | **Above average** |
| **11** | **108** | **height (cm)** | 147.19 | 7.77 | 5.27 | 39 | 0.75 | 130 | 169 | 45.37 | 54.63 |
| **12** | **91** | | 154.55 | 8.08 | 5.23 | 40 | 0.85 | 139 | 179 | 49.45 | 50.54 |
| **13** | **94** | | 160.53 | 7.24 | 4.51 | 36 | 0.75 | 142 | 178 | 40.43 | 59.57 |
| **14** | **99** | | 167.18 | 8.18 | 4.90 | 41 | 0.83 | 144 | 185 | 42.42 | 57.58 |
| **15** | **99** | | 171.60 | 0.07 | 4.25 | 0.36 | 0.01 | 1.90 | 1.53 | 46.46 | 53.54 |
| **16** | **74** | | 175.76 | 0.06 | 3.32 | 0.28 | 0.01 | 189 | 1.61 | 47.30 | 52.70 |
| **17** | **76** | | 175.71 | 0.06 | 3.60 | 0.31 | 0.01 | 1.91 | 1.61 | 56.58 | 43.42 |
| **18** | **100** | | 177.05 | 0.06 | 3.21 | 0.28 | 0.01 | 1.90 | 1.61 | 41.00 | 59.00 |
| **11** | **108** | **weight (kg)** | 42.49 | 10.16 | 23.91 | 51 | 0.98 | 25 | 76 | 56.48 | 43.52 |
| **12** | **91** | | 50.11 | 12.73 | 25.40 | 63 | 1.34 | 31 | 94 | 53.85 | 46.15 |
| **13** | **94** | | 52.67 | 12.07 | 22.92 | 60 | 22.92 | 35 | 95 | 56.38 | 43.62 |
| **14** | **99** | | 60.31 | 17.17 | 28.46 | 86 | 1.74 | 34 | 120 | 51.51 | 48.49 |
| **15** | **99** | | 59.16 | 14.57 | 24.63 | 73 | 1.47 | 113 | 40 | 62.63 | 37.37 |
| **16** | **74** | | 63.00 | 9.58 | 15.21 | 46 | 1.12 | 92 | 46 | 54.05 | 45.95 |
| **17** | **76** | | 64.74 | 13.07 | 20.19 | 63 | 1.51 | 107 | 44 | 56.58 | 43.42 |
| **18** | **100** | | 65.92 | 14.94 | 22.66 | 75 | 1.50 | 115 | 40 | 56.00 | 44.00 |
| **11** | **108** | **BMI ($kg/m^2$)** | 19.33 | 3.09 | 15.99 | 15.52 | 0.30 | 13.36 | 28.88 | 57.41 | 42.59 |
| **12** | **91** | | 20.89 | 4.16 | 19.91 | 20.59 | 0.44 | 13.96 | 34.55 | 57.14 | 42.86 |
| **13** | **94** | | 20.28 | 4.005 | 19.95 | 20.11 | 0.42 | 14.81 | 34.92 | 59.57 | 40.42 |
| **14** | **99** | | 21.49 | 5.03 | 23.43 | 25.22 | 0.51 | 14.91 | 40.13 | 59.59 | 40.41 |
| **15** | **99** | | 19.95 | 3.77 | 18.90 | 18.89 | 0.38 | 33.08 | 14.19 | 63.64 | 36.36 |
| **16** | **74** | | 20.35 | 3.22 | 15.81 | 15.45 | 0.38 | 31.46 | 16.01 | 64.86 | 35.14 |
| **17** | **76** | | 20.95 | 3.47 | 16.58 | 16.74 | 0.4 | 32.66 | 15.92 | 60.53 | 39.47 |
| **18** | **100** | | 20.98 | 3.68 | 17.52 | 18.45 | 0.37 | 32.72 | 14.26 | 53.00 | 47.00 |

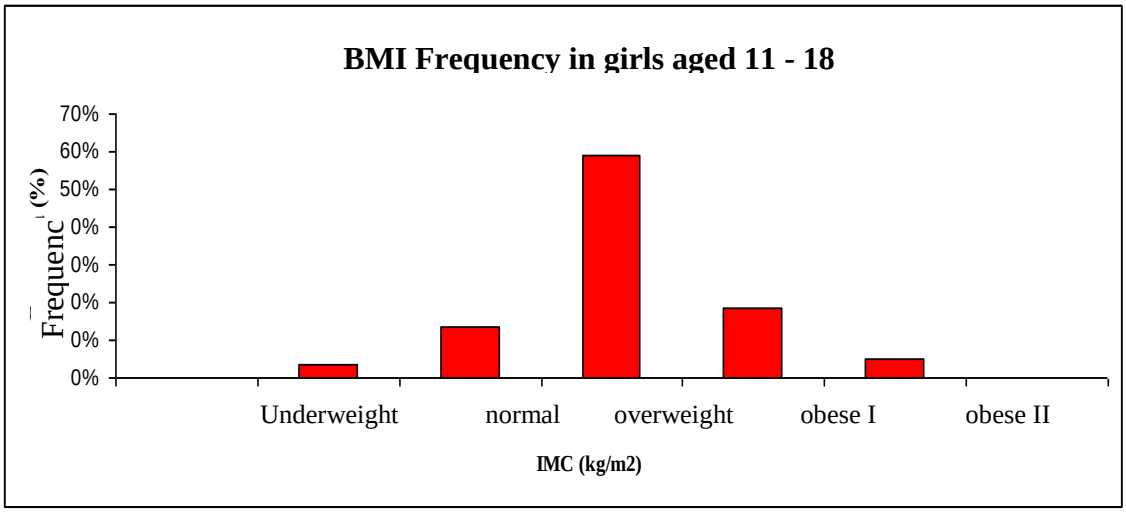
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **11** | **108** | **Percentile (%)** | 50 | 19.74 | 39.47 | 99.08 | 1.91 | 99.54 | 0.46 | 50.00 | 50.00 |
| **12** | **91** | | 50 | 19.98 | 39.96 | 98.9 | 2.11 | 99.45 | 0.55 | 50.55 | 49.45 |
| **13** | **94** | | 50 | 19.91 | 39.81 | 98.94 | 2.07 | 99.47 | 0.53 | 50.00 | 50.00 |
| **14** | **99** | | 50 | 19.76 | 2 | 39.51 | 98.98 | 99.49 | 0.51 | 49.5 | 49.49 |
| **15** | **99** | | 50.00 | 19.76 | 39.52 | 98.99 | 2.00 | 99.49 | 0.51 | 49.49 | 50.51 |
| **16** | **74** | | 50.00 | 20.55 | 41.10 | 98.65 | 2.36 | 99.32 | 0.68 | 50.00 | 50.00 |
| **17** | **76** | | 50.00 | 20.47 | 40.95 | 98.68 | 2.36 | 99.34 | 0.66 | 50.00 | 50.00 |
| **18** | **100** | | 50.00 | 19.72 | 39.44 | 99.00 | 1.98 | 99.50 | 0.50 | 50.00 | 50.00 |
| **11** | **108** | **Excess weight (%)** | 9.67 | 1.40 | 14.18 | 7.03 | 0.28 | 14.32 | 7.29 | 58.33 | 41.67 |
| **12** | **91** | | 9.95 | 1.97 | 19.76 | 9.73 | 0.21 | 16.59 | 6.86 | 50.55 | 49.45 |
| **13** | **94** | | 9.43 | 1.80 | 19.07 | 8.94 | 0.19 | 15.92 | 6.98 | 63.83 | 36.17 |
| **14** | **99** | | 9.75 | 2.14 | 21.94 | 10.71 | 0.22 | 17.92 | 7.21 | 61.62 | 38.38 |
| **15** | **99** | | 8.96 | 1.70 | 18.97 | 8.51 | 0.17 | 14.80 | 6.29 | 64.65 | 35.35 |
| **16** | **74** | | 9.08 | 1.44 | 15.84 | 6.90 | 0.17 | 14.10 | 7.20 | 66.21 | 33.78 |
| **17** | **76** | | 9.37 | 1.51 | 16.14 | 7.28 | 0.17 | 14.46 | 7.18 | 60.53 | 39.47 |
| **18** | **100** | | 9.37 | 1.58 | 16.89 | 7.94 | 0.16 | 14.42 | 6.48 | 53.00 | 47.00 |

After measurements performed on girls aged 11-18, it could be observed that the BMI values, as well as their frequency, show that 58.97% of the girls have a normal BMI, 17.23% are underweight, 18.54% are overweight, and 5.26% are obese (Table 5, Graph 3).

**Table 5**

| **CLASSIFICATION** | | **FREQUENCY (%)** |
|---|---|---|
| **Underweight** | **severe** | 0.24 |
| | **moderate** | 3.35 |
| | **low** | 13.64 |
| **Normal** | | 58.97 |
| **Overweight** | | 18.54 |
| **Obesity** | **I$^{st}$ group** | 5.02 |
| | **II$^{nd}$ group** | 0.24 |

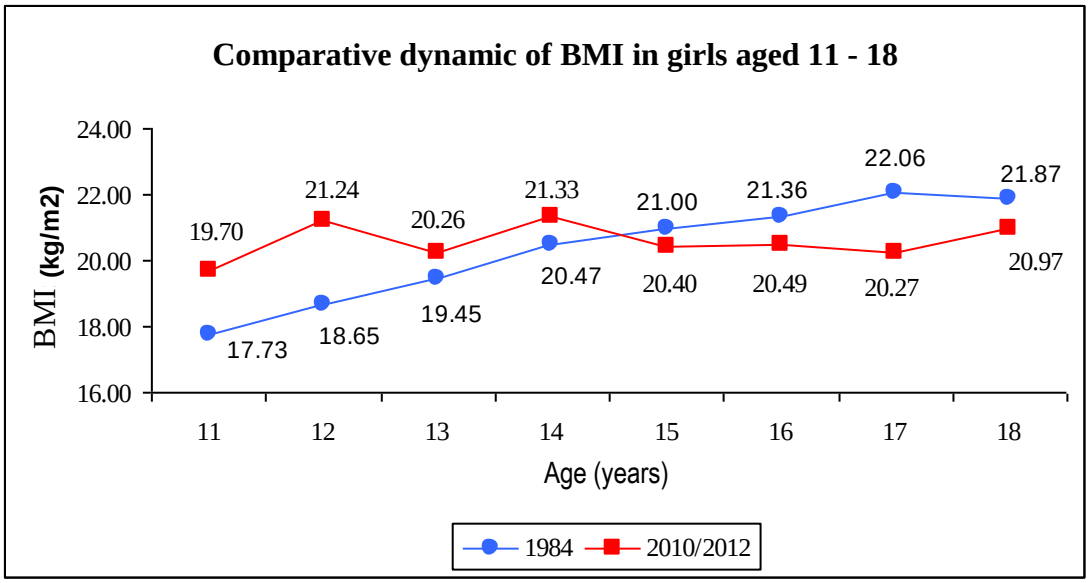
**Graph 3**




With regard to the comparative dynamic of the BMI (Graph 4), according to researches conducted in 1984 and 2010/2012, it can be observed that in 1984 the excess weight dynamic rises by 4.14% from 11 to 18

years, 1.40 kg/m$^2$ more, while according to the 2010/2012 research an increase of only 1.27% was observed.

**Graph 4**

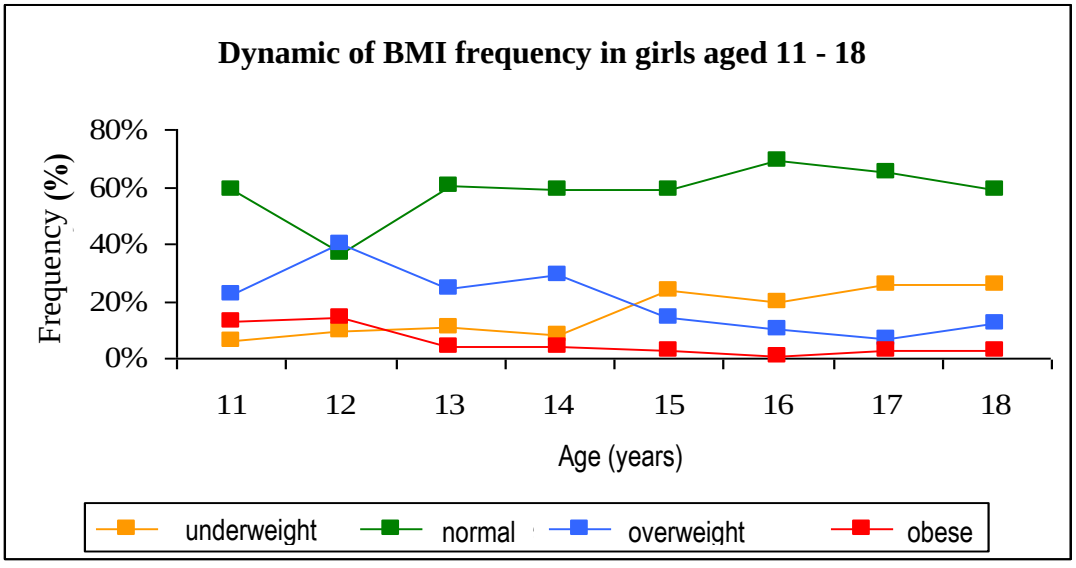



The proportion of underweight girls increases significantly during adolescence period, with a percentage between 20 and 25%. At the same time, the percentage of overweight girls decreases from 17.09% at15 years to 9.37% at 17 years and to 14.82% at 18 years (Table 6 Graph 5).

**Table 6**

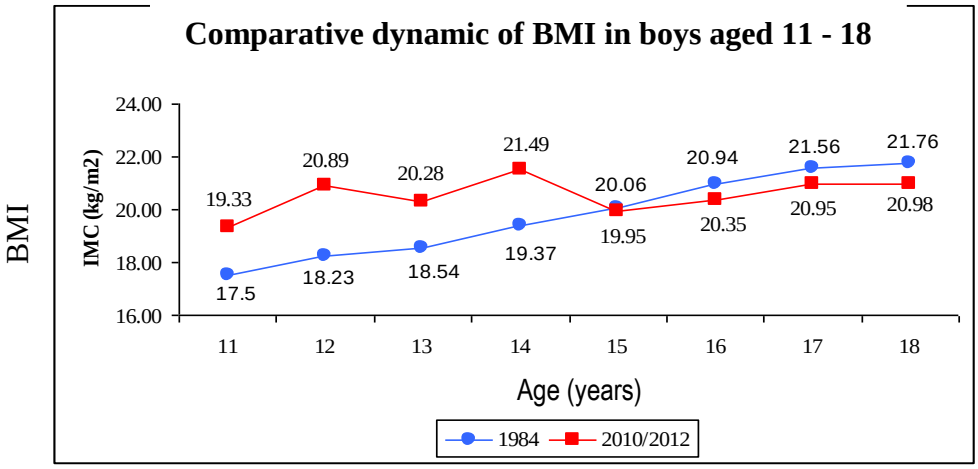
| Age (years) / BMI (kg/m$^2$) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|
| Underweight(%) | 5.83 | 9.68 | 10.64 | 8.00 | 23.93 | 19.63 | 25.90 | 25.93 |
| Normal (%) | 59.22 | 36.56 | 60.64 | 58.67 | 58.97 | 69.16 | 64.75 | 59.26 |
| Overweight(%) | 22.33 | 39.78 | 24.47 | 29.33 | 14.53 | 10.28 | 6.47 | 12.04 |
| Obese(%) | 12.62 | 13.98 | 4.26 | 4.00 | 2.56 | 0.93 | 2.88 | 2.78 |

**Graph 5**



With regard to the comparative dynamic of the BMI on the 1984-2010/2012 interval, measurements conducted on boys aged 11-18 years, results showed an increase of 1.65kg/m$^2$ according to the 2010/2012 research and 4.26kg/m$^2$ for the 1984 research (Graph 8).

**Graph 6**

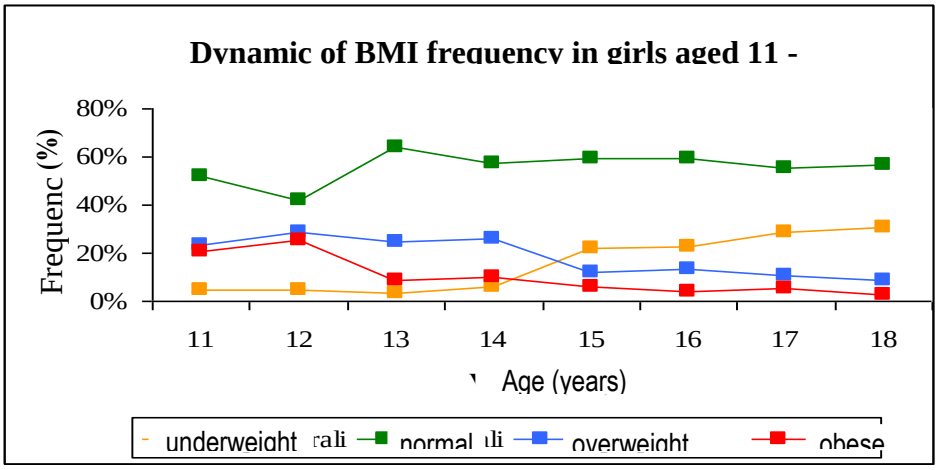



The percentage of underweight boys lies between 4 and 6% with a rising trend during adolescence of 22% at 15 years and of 31% at18 years. The percentage of overweight boys decreases significantly at the onset of adolescence. The proportion of boys with normal BMI is over 50% (Table 7 and Graph 7).

**Table 7**

| Age(years) / BMI (kg/m$^2$) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|
| underweight(%) | 4.63 | 4.40 | 3.19 | 6.06 | 22.22 | 22.97 | 28.95 | 31.00 |
| normal(%) | 51.85 | 41.76 | 63.83 | 57.58 | 59.60 | 59.46 | 55.26 | 57.00 |
| overweight(%) | 23.15 | 28.57 | 24.47 | 26.26 | 12.12 | 13.51 | 10.53 | 9.00 |
| obese(%) | 20.37 | 25.27 | 8.51 | 10.10 | 6.06 | 4.05 | 5.26 | 3.00 |

**Graph 7**




The results of the questionnaire-based study applied to a number of 1577 gymnasium and high school students, indicate that 95% of the boys are practicing formal and non formal physical activities, and live a lifestyle in accord with their age. Despite the mentioned circumstances, over 50% of all boys and 40% of all girls are affected by excess weight.

Given the circumstances of the non-confirmed research hypothesis, a null hypothesis condition was adopted according to which the influence of the lifestyle of youths from urban areas on the processes of puberty and adolescent organism growth and development was not confirmed.

From the WHO perspective, it can be concluded that the values of excess weight are higher during puberty, corresponding to the overweight stage, both in girls as well as in boys, due to the intensive processes of organism growth and development, in contrast with the adolescence period (Graph 4 and 6).

## CONCLUSIONS AND RECOMMENDATIONS

The percentage of underweight boys at puberty lies between 4 and 6% while in adolescent girls the underweight percentage is 6-10%, with a rising trend of this percentage from 21% at 15 years to 31% at 18 years. The proportion of overweight and obese individuals decreases significantly at the onset of adolescence (Table 7, Graph 7).

Excess weight at puberty in girls shows a similar trend with the analogous values measured in boys. For underweight adolescent girls, the percentage increases significantly to 23-25% while the percentage of the overweight decreases from 17.09 at 15 years to 9.37 at 17 years and 14.82 at 18 years (Table 6 Graph 5).

Non-confirmation of the research hypothesis resulted after observing that 85% of the respondents were found to practice formal and non formal physical activities yet over 50% are affected by excess weight

The absence of programmes intended to build awareness of students about the negative effects of unhealthy lifestyles on the processes of the youths' organisms growth and devlopment.

The data regarding the youths' growth and development indicators should be correlated according to environmental and social factors.

Questionnaires should not be regarded as the only research instruments to be used for determining the youths'organism growth and development indicators.

Integration of the students with excess weight must be accomplished using distinct work groups, during physical education classes, in order to reduce the underlying causes.

The involvement of schools in programmes for promoting healthy lifestyles, to create a favourable context for the students' organism growth and development.

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