

THE RELATION BETWEEN SELECTED HEALTH BEHAVIOUR AND BODY MASS INDEX AMONGST ADOLESCENTS LIVING IN URBAN AND RURAL AREAS IN SOUTH-WESTERN POLAND

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ABSTRACT

Background. Changes to the body and its proportions, especially body mass, are frequently and critically assessed by the young according to peer pressure and opinions prevalent in their living and home surroundings, as well as through role models created by the media; particularly those promoting fashions for having a slim figures. The desire to achieve this ideal, is thus responsible for adolescents undertaking a variety of actions/behaviour to regulate their body weight.

Objective. To compare healthy lifestyle behaviour in secondary school pupils living in towns and the countryside who have variable weights and heights associated with a self-assessment of body mass.

Material and Methods. Subjects were $n=1,279$ pupils aged 13-15 years, attending secondary school. Those from the countryside environments were $n=273$ (136 boys and 137 girls), whilst those from urban areas, (towns) were $n=1,006$ (512 boys and 494 girls). Both weights and heights were measured and the Body Mass Index (BMI) determined. Threshold values for overweight, obesity and underweight, were used to assign BMI groups according to the procedure of *Cole et al.* Perceptions on how subjects assessed their body weight and remedial actions so arising, were surveyed using the Youth Risk Behaviour Survey (YRBS) questionnaire. The relationships between the factors studied were subjected to log-linear analysis and their significance evaluated by Chi^2 test using a significance level of $p \leq 0.05$.

Results. No significant differences were found in the observed frequencies of overweight, obesity and underweight groups between students from the different environments studied. Pupils having a normal body mass constituted 68.9% of total subjects. There were also no differences seen in body weight perception between the various environments. Approximately 70% of subjects properly assessed their own body mass, however the methods of its assessment differed between boys and girls. The main ways adopted for regulating body mass was found to be exercise and diet in both student groups. Significantly more girl pupils living in towns, (54.9%) did physical exercises, aimed at weight reduction, compared to those living in the countryside (43.8%).

Conclusions. Only small differences in observed frequencies of height-weight were seen between urban and rural dwelling pupils; the same being true for lifestyle behaviour in controlling weight. Irrespective of residence, two thirds of pupils, aged 13-16 years, correctly assessed their own body mass. In children and adolescents, improving self-awareness of body proportions can be achieved through educating on what the significance of having a healthy BMI is, effective ways of its estimation and safe methods for regulation.

Key words: *adolescents, BMI, self-assessment of body mass, weight control behaviours*

STRESZCZENIE

Wprowadzenie. Zmieniające się proporcje ciała a zwłaszcza masa ciała, często poddawane są przez młodzież ocenie, na którą ma wpływ opinia najbliższego środowiska oraz wzorce kreowane przez środki masowego przekazu promujące modę na szczupłą sylwetkę. Chęć osiągnięcia wzorcowej sylwetki skłania do podejmowania przez młodzież działań ukierunkowanych na regulację masy ciała.

Cel. Celem badań było porównanie zachowań zdrowotnych związanych z postrzeganiem własnej masy ciała uczniów miejskich i wiejskich gimnazjów o zróżnicowanych proporcjach wagowo-wzrostowych.

Materiał i metody. Materiał obejmował dane pomiarowe i ankietowe 1279 uczniów w wieku 13-16 lat, z dwóch różnych środowisk: wiejskiego (273 uczniów – 136 chłopców i 137 dziewcząt) i miejskiego (1006 osób – 512 chłopców i 494 dziewcząt). U młodzieży zmierzono wysokość i masę ciała, wyliczono wskaźnik BMI. Wartości graniczne dla nadwagi, otyłości oraz niedowagi posłużyły do wyznaczenia grup BMI. Z kwestionariusza Youth Risk Behavior Survey (YRBS) uzyskano informacje o ocenie własnej masy ciała oraz działaniach podejmowanych w celu jej zmiany. Do ustalenia związków

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pomiędzy analizowanymi czynnikami, wykorzystano analizę log-liniową. Istotność statystyczną otrzymanych zależności oceniano testem χ^2 na poziomie istotności $p \leq 0,05$.

Wyniki. W badaniach nie stwierdzono istotnych różnic w częstości występowania nadwagi, otyłości oraz niedowagi między uczniami zamieszkującymi odmienne środowiska. Osoby z właściwą masą ciała stanowiły 68,9% badanych. Nie odnotowano różnic międzyśrodkowowych w samoocenie masy ciała. Około 70% badanych właściwie oceniało własną masę ciała, lecz chłopców i dziewczęta różnił sposób jej oceny. Ćwiczenia fizyczne i dieta w obu badanych środowiskach były wskazywane jako główne metody regulacji proporcji wagowo-wzrostowych. Badania dowiodły, że dziewczęta szkół miejskich (54,9%) istotnie częściej w porównaniu do rówieśniczek ze szkół wiejskich (43,8%) wykonywały ćwiczenia fizyczne ukierunkowane na regulację masy ciała.

Wnioski. Zaobserwowano niewielkie różnice między środowiskami – miejskim i wiejskim – pod względem proporcji wagowo-wzrostowych oraz zachowań zdrowotnych związanych z masą ciała. Niezależnie od miejsca zamieszkania, dwóch na trzech uczniów w wieku 13-16 lat prawidłowo oceniało własną masę ciała. Poprawę świadomości wśród dzieci i młodzieży w zakresie własnych proporcji ciała, można dokonać poprzez edukację znaczenia prawidłowej masy ciała dla zdrowia, sposobów jej oceny oraz skutecznych i bezpiecznych metod jej regulacji.

Słowa kluczowe: okres pokwitania, BMI, samoocena masy ciała, zachowania zdrowotne

INTRODUCTION

Obesity and overweight is particularly prevalent amongst adolescents [17, 19]. Data from the World Health Organisation (WHO) on Western Europe demonstrate that child obesity rates have risen from 10% in the 1980s to around 20% a decade later [24]. One of the chief culprits for these observations, being an increased consumption of high calorie foodstuffs coupled with low physical activity, so leading to rapid increases in body mass [7, 12, 20].

Notwithstanding obesity and overweight, the desire to have an ideal body figure is also widespread amongst adolescents. Together with other factors, this is related to having an image created by the media of a slim body being attractive and indispensable for a successful life. This 'mandatory' canon of beauty regarding the human body, results in various remedial actions being undertaken for losing weight that can often pose a health risk. This phenomenon is becoming more frequent in children of schoolage and also doesn't necessarily apply to those who are overweight [6, 15, 23, 25]. Studies indicate that young women, more often than men, take up unhealthy methods for losing weight [9, 26]. Data on Polish adolescents, from a 2006 international study, 'Health Behaviour in Schoolaged Children' (HBSC) indicate that 20% girls, aged 13-15 years with an appropriate body mass, still try and lose weight [15]. This trend rises to 25%, in older girls aged 16-18 years [25]. In addition, the same can be seen in subjects with a low body mass [23].

The most common reason for slimming is an inappropriate perception of one's body mass, where this dissatisfaction and actions thereof, bear a greater health risk than that arising from the actual body mass itself [1, 14]. Using dieting and other methods for weight loss can, during the formative years, constitute health risk behaviour as children and adolescents constitute a

population group most vulnerable to the negative effects arising from nutritional/dietary mistakes [2, 3]. Socio-economic factors, particularly place of residence, have also been shown to be involved [8].

The study aims were therefore to compare lifestyle behaviour, regarding perception and self-assessment of body mass, between urban and rural dwelling school pupils with various body weights-heights.

MATERIAL AND METHODS

Subjects were 1279 pupils, aged 13-16 years, living in towns or the countryside in the copper basin of south-western Poland. Data consisted of weight and height measurements taken and questionnaire replies. Urban dweller subjects were selected from four High Schools in Legnica (512 boys and 494 girls). The actual choice of schools, reflected the average socio-economic mix of the town's residents. Only pupils living in the town itself were studied. The rural sample consisted of 273 pupils, (136 boys and 137 girls) attending three High Schools from the Lower Silesian region. The subject's age was recorded as that being exactly at the time of study, (in decimal places). This served to allocate pupils into their appropriate age groups, defined by a whole number average (eg. the 13 year group consisted of pupils aged within the range 12.5 to 13.49 years).

Measurements of basic somatic parameters were undertaken in the test subjects. Anthropometry was used to measure height (precision of 0.1 cm) and subjects were weighed on an electronic balance to obtain the body mass (precision 0.1 kg). The BMI could thus be calculated with values then assigned to various categories including those of being underweight, overweight and obese according to the criteria proposed by *Cole et al* [4, 5]. Six pupil categories were initially defined by various weights-heights for the presented study;

1. Three groups of subjects having unadvisable thinness (thinness grades 1, 2 and 3 ie. respectively; slightly, moderate and substantial).
2. One subject group of normal weight.
3. Two subject groups of overweight and obesity.

Due to their being only a few subjects falling into the very thin and obese categories, a reclassification into just 3 BMI groups was made to allow a valid analysis of factors to be performed. These were:

1. Underweight ; subjects with thinness grades 1, 2 and 3.
2. Normal weight; subjects within borderline limits of thinness grade 1 and overweight.
3. Overweight; obese and overweight subjects.

The YRBS questionnaire yielded information about the self-assessment of body mass and on actions undertaken to alter this. The questionnaire asked the following:

1. How do you describe your weight?
(answer: A. Very underweight, B. Slightly underweight, C. About the right weight, D. Slightly overweight, E. Very overweight)
2. Have you ever exercised to lose weight or to keep from gaining weight?
Indicated in the figure and tables: exercise
3. Have you ever eaten less food, fewer calories, or foods low in fat to lose weight or to keep from gaining weight?
Indicated in the figure and tables: diet
4. Have you ever gone without eating for 24 hours or more (also called fasting) to lose weight or to keep from gaining weight?
Indicated in the figure and tables: starvation
5. Have you ever taken any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight? (Do not include meal replacement products such as Slim Fast.)
Indicated in the figure and tables: losing weight medicine
6. Have you ever vomited or taken laxatives to lose weight or to keep from gaining weight?
Indicated in the figure and tables: vomiting

In order to analyse the factors from the self-assessment of body mass in question 1, three groupings were created: 1. underweight (slightly and very underweight) 2. normal weight (about the right weight), 3. overweight (slightly and very overweight).

A log-linear analysis was used to determine the relationships between behaviour concerned with controlling body mass, the environment, gender and body proportions, (ie. both measured BMI and self-assessed body mass). Statistical significance between variables was calculated by Chi² adopting a p≤0.5 significance level.

RESULTS

Figure 1 shows the studied group divided according to gender, place of residence and BMI category. There were no significant differences in weight-height body proportions between subjects living in towns or the countryside (ie. different environments).

Pupils with normal body mass constituted two-thirds of the total. The observed frequency of girls with an abnormally high BMI was similar in both urban and rural settings; respectively 21.1 and 20.4%. Overweight was seen in 18.2% urban dwelling girl pupils and 15.3% in those living in the countryside; the corresponding values for obese girls were respectively 2.8 and 5.1%. More boy pupils living in towns, however had an overweight body mass (25.6%) compared to those from rural areas (20.6%), whereas for obesity, similar frequencies were observed; respectively 5.5 and 5.9%.

Underweight subjects constituted around 8.4% of the study total. The group where this was most prevalent were girls, (almost 10%) of which the largest proportion were pupils with Grade 1 thinness (town and rural dwellers respectively being; 7.3% and 9.5%). Girls with grade 2 thinness more often came from the town than country. Extreme forms of being underweight, classified as grade 3 thinness was only seen in 0.6% of female pupils from towns. Amongst boys living in towns, 7.8% demonstrated grade 1 thinness relative to 5.2% living in the countryside. Those boys with grade 2 thinness were similar in both places of residence however, like for girls, boys falling into the grade 3 category of thinness only lived in towns.

Self-assessment of body mass, and thus BMI categories, were found to independent of both the two area categories the subjects lived in. Approximately 70% of subjects living in both environments, correctly estimated their own weight-height body proportions - as shown in Figure 2. Girls living both in towns or the countryside, used more different ways for assessing body mass compared to boys living at these same locations.

Amongst overweight and obese pupils living in rural areas, 92% correctly estimated their body mass and hence BMI, however in underweight girls only 50% recognised this as being so (Figure 2). Nearly 70% of those girls attending schools in towns, correctly assessed their body proportions according to the BMI categories of underweight, normal or overweight.

Figure 2 shows the combined underweight gradings of 1, 2 and 3 thinness groupings together with overweight subjects, including the obese, thus creating a wide range of BMI categories. Boys coming from both the aforementioned environments assessed their weight-height body proportions in similar ways, (Figure 2). However, compared to girls, overweight boys (by BMI

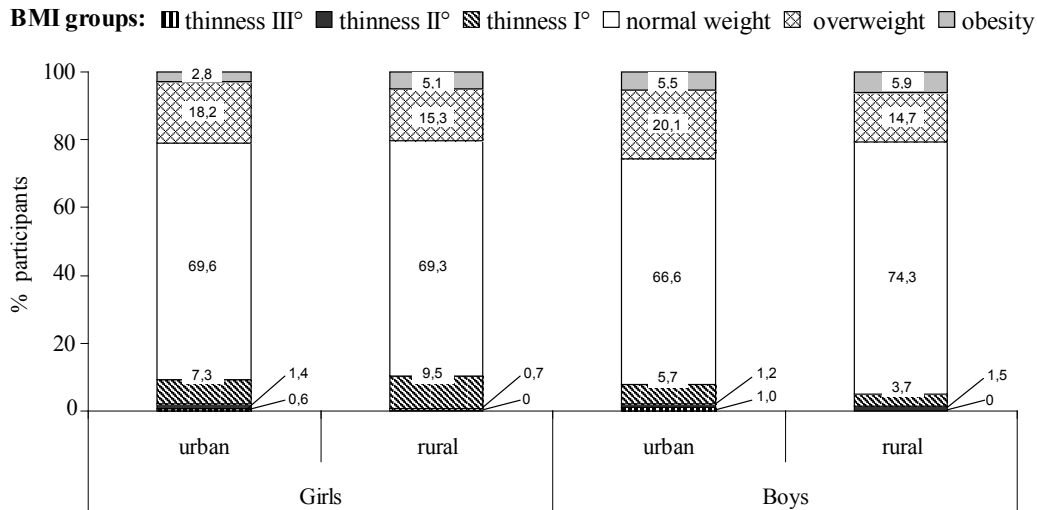


Figure 1. Structure of studied groups by BMI categories

classification) were noticeably more able to estimate their correct body mass; pupils from towns at 35% and countryside at 50%.

The different ways of losing weight, and how often they were adopted are shown in Table 1. In both town and countryside dwellers, pupils predominantly chose low-calorie diets and physical exercise. Almost half the total subjects opted for the latter in order to lose weight, whilst girls living in towns also more frequently chose this way (Figure 3).

Furthermore, regulating weight through dietary means was observed to be related to gender. One in three girl pupils chose diet for controlling weight compared to only one in five boys. Subjects that either used slimming products or provoked vomiting as a means of such weight control only formed a small proportion; not exceeding 2.5% (Table 1, Figure 3). The largest number of subjects that decided to lose weight by not eating foodstuffs (ie. by adopting a starvation diet) was seen in pupils living in towns, (6.3%).

The weight-height body proportions, (as designated by the BMI as well as being surveyed through the self-assessment), affected the actions undertaken to influence body mass. Nevertheless, the principal impetus for these actions was afforded through self assessment of body mass, as opposed to being based on its actual value.

It was found that the small differences observed between these factors in fact arose from their strong mutual interactions. The contingency coefficients of the described dependencies are shown in Table 2. Significance was defined by $p < 0.05$.

Log-linear analysis demonstrated a significant association between using physical exercise as means of weight reduction and adopting reducing diets with gender and the self-assessment of weight-heights; the latter being very closely related to the actual BMI. There was however no effect of these factors seen on the total observed frequency of those adopting other methods of weight control, such as taking slimming products, fasting, or vomiting. The environmental area lived in

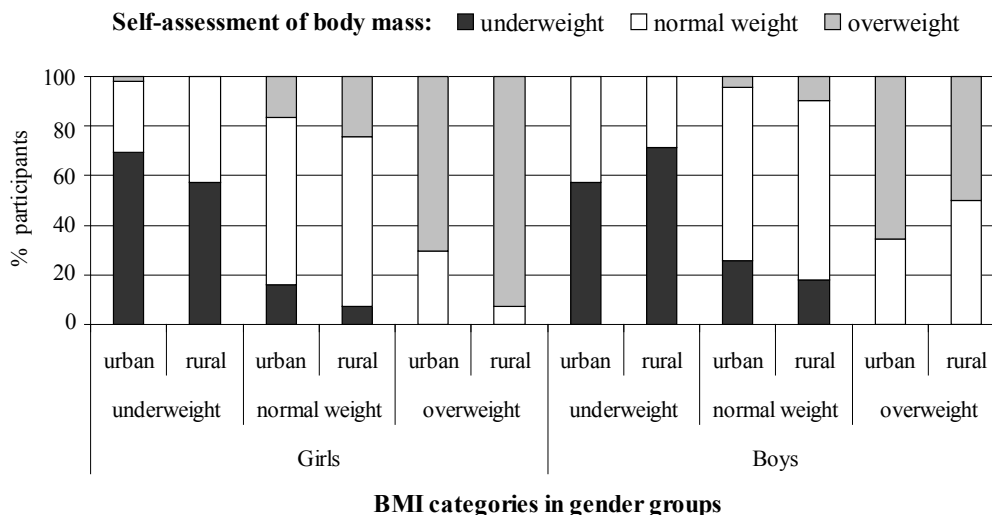


Figure 2. Conformity of self-assessment body mass with actual weigh-height proportions

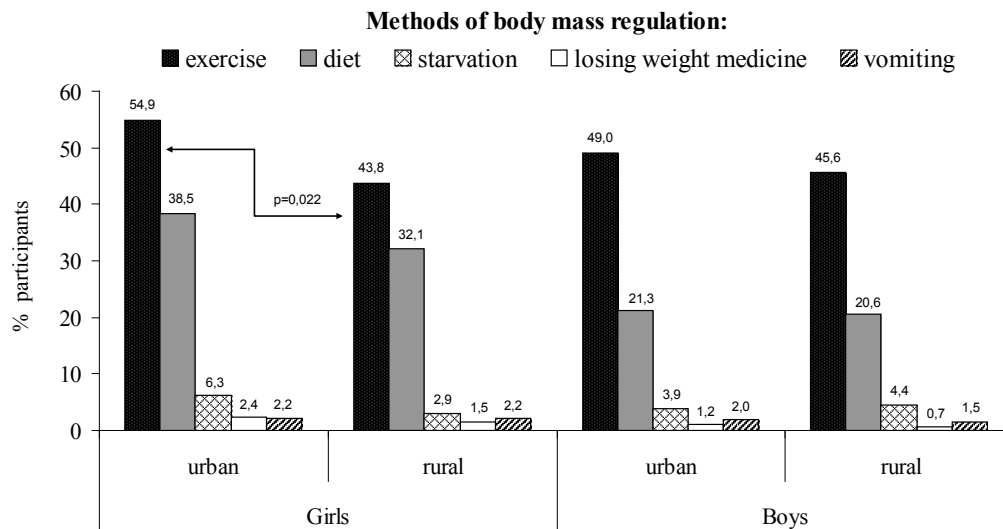


Figure 3. Diversity of actions undertaken to improve body mass regulation in individual studied groups.

Table 1. Characterisation of undertaken methods of body mass regulation in studied groups, with respect to Body Mass Index categories

| Gender | Categories BMI | Environment | Methods of body mass regulation (n) | | | | |
|------------|----------------|-------------|-------------------------------------|------|------------|------------------------|----------|
| | | | exercise | diet | starvation | losing weight medicine | vomiting |
| Girls | underweight | urban | 9 | 8 | 2 | 0 | 0 |
| | | rural | 2 | 1 | 0 | 0 | 1 |
| | normal weight | urban | 189 | 123 | 23 | 8 | 9 |
| | | rural | 42 | 28 | 4 | 1 | 2 |
| overweight | urban | 73 | 59 | 6 | 4 | 2 | |
| | rural | 16 | 15 | 0 | 1 | 0 | |
| Boys | underweight | urban | 10 | 2 | 2 | 1 | 0 |
| | | rural | 0 | 0 | 0 | 0 | 0 |
| | normal weight | urban | 148 | 49 | 8 | 4 | 7 |
| | | rural | 46 | 18 | 5 | 1 | 2 |
| | overweight | urban | 93 | 58 | 10 | 1 | 3 |
| | | rural | 16 | 10 | 1 | 0 | 0 |

Table 2. Relationships between actual Body Mass Index (BMI) and self-assessment body mass, by the methods of body mass regulation in studied groups

| Gender | Factors | Environment | Methods of body mass regulation | | |
|--------|------------------------------|-------------|---------------------------------|-------|--|
| | | | exercise | diet | starvation. losing weight medicine. vomiting |
| Girls | BMI | urban | 0.25* | 0.22* | 0.05 |
| | | rural | 0.22* | 0.26* | 0.10 |
| | self-assessment of body mass | urban | 0.27* | 0.27* | 0.07 |
| | | rural | 0.27* | 0.27* | 0.16 |
| Boys | BMI | urban | 0.27* | 0.32* | 0.08 |
| | | rural | 0.23* | 0.21* | 0.09 |
| | self-assessment of body mass | urban | 0.28* | 0.32* | 0.05 |
| | | rural | 0.26* | 0.29* | 0.15 |

* difference statistically significant; p<0.05

only correlated significantly with choosing physical exercise. Table 3 shows results of compound and partial boundary tests of second order interactions during the fitting of a log-linear model. The interactions between the aforementioned row factors had no effect on the model specifications.

DISCUSSION

Many studies investigating the impact of environmental factors on child development have recognised the beneficial effects that living in larger social settings has on the younger generation [11, 18, 22]. In keeping with the ever increasing rise of a changing world and culture, there has been a decrease in the differences between inhabited environments. The presented study has shown minimal, and insignificant differences, between such environments, (ie. places of residence), lived in as well as between genders in terms of overweight or

Table 3. Relationships of selected factors with health behaviours of studied subjects, based on results of the log-linear analysis

| Examined interactions | Partial association | | Marginal association | |
|---|---------------------|---------|----------------------|---------|
| | χ^2 | p | χ^2 | p |
| Factors associated with environment: | | | | |
| BMI | 3.389 | 0.1837 | 0.694 | 0.7070 |
| self-assessment of body mass | 9.422* | 0.0090* | 3.616 | 0.1640 |
| exercise | 5.996* | 0.0143* | 4.051* | 0.0442* |
| diet | 2.462 | 0.1166 | 2.018 | 0.1555 |
| Factors associated with gender: | | | | |
| BMI | 26.469* | 0.0000* | 3.407 | 0.1821 |
| self-assessment of body mass | 29.783* | 0.0000* | 14.531* | 0.0007* |
| exercise | 0.869 | 0.3511 | 2.085 | 0.1487 |
| diet | 0.768 | 0.3810 | 1.160 | 0.2815 |
| Factors associated with Body Mass Index (BMI): | | | | |
| self-assessment of body mass | 417.705* | 0.0000* | 451.335* | 0.0000* |
| exercise | 21.746* | 0.0000* | 70.408* | 0.0000* |
| diet | 4.533 | 0.1037 | 8.953* | 0.0114* |
| Factors associated with self-assessment of body mass: | | | | |
| exercise | 36.833* | 0.0000* | 86.835* | 0.0000* |
| diet | 35.908* | 0.0000* | 110.583* | 0.0000* |
| exercise and diet | 5.365* | 0.0206* | 4.642* | 0.0312* |

* difference statistically significant; $p < 0.05$

obesity rates, together with being underweight; 70% of subjects correctly assessed their own body weight. Studies by *Kołolo* and *Woynarowska* [14] on lifestyle behaviour in adolescent schoolchildren, demonstrated that 39.5% of girls and 53.6% of boys, both aged 11-15 years, could accurately define their own weight-height body proportions, however other authors assessing BMI use centile charts. According to *Chabros* et al. [3], in order to perform any reliable and direct comparisons between population studies, a common set of criteria are required such as those published by *Cole* et al. [4,5].

The current study showed no significant effects due to the place of residence with how well self-assessment of BMI is categorised, however there were differences noted between boys and girls on the methods they used to perform this assessment. Boys whenever overweight, frequently took this as being their correct body weight, whereas underweight girls perceived this weight condition to be normal.

The reasons for differing self-assessments of body mass made between genders are mainly due to the dominating cultural ideal, which itself differs according to gender [13]. On the whole, women are apprehensive of being overweight and often consider that their body proportions are unacceptable. In both cases, this incorrect self-assessment of body mass during the formative years often leads to remedial actions being undertaken to control weight-height body proportions [14, 23].

Such actions, most commonly adopted by adolescents consist of performing physical exercise and undergoing low calorie diets, which has been confirmed by other studies [10, 16, 23]. Amongst the older of the young group of women, it is also often seen that reducing diets are taken up as well as slimming products for the purposes of weight loss [21].

It was only found that lifestyle behaviour in girls was dependent on the place of residence; girl pupils attending schools in towns more often did physical exercise compared to those from the countryside as a means of weight control. Moreover, the tendency for dieting and the decision to fast were more frequently seen in town dwellers than those from rural areas in pupils with overweight. A body weight control diet plan, as frequently used by adolescents, focuses on the need for educating pupils about its effects on the human body.

An inappropriate diet can result in metabolic dysregulation and an unbalanced nutrition may lead to developmental abnormalities [10]. Regarding the latter, uncontrolled slimming during the formative years is particularly recognised as being a health hazard [14]. In cases of normal weight-height proportions being insignificantly exceeded, without any observed rate increases, it is frequently recommended that controlling body weight can be achieved through just regular physical activity without it being necessary to limit calorific intake or dietary components [10].

It is seen that inter-disciplinary education of children and adolescents is required to improve the effectiveness of self-assessing body proportions. An abnormal perception of one's own body may be a sign/factor of developing psychology disorders thus leading to unhealthy practices for controlling body weight.

CONCLUSIONS

1. Only minor differences were observed in height-weight body proportions or activities for controlling weight between town and countryside dwellers from the copper basin of south-western region of Poland. The exception being a higher observed frequency of girls performing physical exercise that lived in towns compared to rural areas.
2. Irrespective of place of residence, two out every three subject pupils, aged 13-16, correctly self-assessed their body mass.
3. In children and adolescents, an increased awareness of one's own body proportions may be the result of being taught at school, the significance of having a correct body mass and how this can be measured, as well as effective and safe methods for weight control.

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