RELATION OF SOME ANTHROPOMETRIC PARAMETERS OF CHILDREN AGED 13–16 YEARS WITH THEIR EATING HABITS AND PHYSICAL ACTIVITY

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ABSTRACT

People's lifespan is increasing. Therefore, it is necessary to keep the high quality of life. Healthy lifestyle is related to healthy food and must include some physical activities. The aim of the study was to analyse how students' (aged 13–16 years) eating habits and physical activity are related to the height-weight classes. They were administered a questionnaire that asked for information about the frequency of eating different food groups. Based on the 5 SD height-weight classification devised by the Centre for Physical Anthropology at the University of Tartu, the subjects were divided into five classes. Boys were more often overweight than girls. Most of the normal-weight boys and girls in the present study ate breakfast and had a school lunch. Their diet was sufficiently healthy, but included too many sweets and beverages with sugar. According to the height-weight classification, the group of leptomorphs was the largest – 27.8% of girls and 29.6% of boys. Pycnomorphs and large respondents did not like to eat in the morning but ate extra food at school. Although pycnomorphs were heavy, they were physically more active than others.

Keywords: height-weight classification, eating habits, physical activity

INTRODUCTION

Nowadays, people's lifespan is increasing, and therefore knowledge of healthy lifestyle needs to be brought to younger persons. Young people aged between 11 and 15 years face many physical, emotional and social changes. These years may influence their health and development of health-related behaviour [4].

Health behaviour in school-aged children (HBSC), a WHO collaborative cross-national study, collects data on 11-, 13- and 15-year-old boys' and girls' health and well-being, social environments and health behaviour in every four years [4]. Boys tend to be more overweight than girls, and the number of overweight children is growing after each following study. 11-year-old children were more overweight than 15-year-olds [1].

Overweight and obesity carry serious health consequences that can last into adulthood [21], including metabolic disturbances that increase the risk of cardiovascular diseases and diabetes [11, 15, 20]. HBSC findings indicate that overweight young people are more likely to skip breakfast and are physically less active [10, 16]. Overweight and obesity have become more prevalent in industrialized countries [19], and concern about body weight and dissatisfaction with it have increased [2]. Girls are particularly conscious of their bodies [4].

In the HBCS 2009/2010 study [4], 41% of 13-year-old Estonian girls and 32% boys of the same age thought that they were too fat. With these numbers, Estonia was in the 9th place among 41 countries. Among the 15-year-olds, the same percentages were 39% (girls) and 21% (boys), and the place among the countries was the 24th. Estonian 15-year-old girls were similar to Latvians and Lithuanians. The Baltic countries had smaller values than the Scandinavian and Western European countries but higher numbers than Russia and the Eastern European countries. Boys also reported themselves as "too fat". These percentages were similar in the Baltic countries, Russia and the Eastern European countries but lower than in the Scandinavian and Western European countries. 13% of 13-year-old and 19% of 15-year-old girls were on diet or did something else to lose weight, but boys' percentage was lower, accordingly 8% and 9%.

In the HBCS study [1], the children's weight and height values were self-reported. To evaluate the overweight, the body mass index (BMI) was calculated. Children's BMI changes with age, falling during the preschool years and then rising again during adolescence. For this reason, child BMI needs to use age-related reference curves, which have been produced for a number of countries [17]. These curves give specific cut-off points for BMI in childhood and children can be divided as underweight, normal-weight and overweight [3, 8]. Danubio et al [5] have observed that BMI calculated from self-reported and measured parameters does not statistically differ. Respondents underreport their weight by 2–4 kg and overreport their height by 2–3 cm. The researchers

believe that self-reported data should be corrected before analysis. Drake et al [6] also found that BMI based on self-reported data was normally underestimated by girls and overweight or obese adolescents. In the Estonian HBCS study [1], it was observed that in the case of measured parameters the number of overweight children was 4% larger.

Kaarma et al [12] have found that BMI is not correlated with body height but is correlated with indicators of body fat content and also with body weight. Therefore, it cannot replace the analysis of different body types [18]. BMI is a whole body characteristic and not only related to body fat content. For classification of body measurements, height and weight are more preferable. BMI is a valuable addition to height-weight classes [12].

The Centre for Physical Anthropology at the University of Tartu has introduced a height-weight classification which consists of five classes: small – small height, small weight; medium – medium height, medium weight; large – big height, big weight; pycnomorphs – big weight, small height; leptomorphs – small weight, big height [13].

There are no universal methods for comparing a person's body build and the amount of food consumed. Peterson et al [18] have revealed that anthropometric data show statistically significant correlation with nutrition. Therefore, the body composition is related to the amount of consumed food. For example, the consumption of energy and main nutrients in the class of pycnomorphs is lower than in the class of leptomorphs in total amount as well as per 1 kg of body weight. In the class of pycnomorphs, body fat content is significantly higher and body density significantly lower than in the class of leptomorphs.

It is informative to find some relations with different height-weight classifications and respondents' behaviour. For that purpose a classification with BMI cut-off points and the height-weight SD classification were used.

MATERIAL AND METHODS

All the subjects had participated in the studies of healthy eating habits and physical activity among the students from two Pärnu schools [7, 14]. The data were collected in an unidentifiable form; no sensitive personal data were recorded. Anonymous, specially designed questionnaires were used to collect the following information: personal details, eating habits during the day, understanding about healthy food, favourite food, frequency of eating some food,

type and frequency of sport activities. The questionnaires were administered in the 2012/2013 academic year to the students (aged 13–16 years) in Pärnu Rääma Basic School and Pärnu Russian Secondary School. The participation in the research was voluntary. The students' height and weight were not measured *in situ*; these data were self-reported.

The body mass index (BMI) was calculated using the following standard equation: BMI (kg/m^2) = weight (kg) / height (m^2). By the BMI, children at the age of 13–16 years can be divided as underweight, normal-weight and over-weight. Underweight criteria by Grünberg et al [8] and overweight criteria by Cole et al [3] are presented in Table 1.

Table 1. Cut-off points for BMI for underweight and overweight by gender and age

Age, years	Underweight, kg/m²		Overweight, kg/m²	
	Boys	**Girls**	**Boys**	**Girls**
13	15.5	15.3	21.9	22.6
14	16.1	16.1	22.6	23.3
15	16.7	17.0	23.3	23.9
16	17.1	17.6	23.9	24.4

Statistical analysis was performed using the SPSS program. First, the mean values ($\bar{x}$, standard deviations (SD) and minimum and maximum values of all anthropometric values were found. Based on the means and standard deviations of height and weight, the students were divided in five classes using the height-weight SD classification, which was introduced by the Centre for Physical Anthropology at the University of Tartu [18].

RESULTS AND DISCUSSION

The age of respondents varied from 13 to 16 years. The total number of participants was 142 – 71 girls and 71 boys. The means and standard deviations of height and weight by gender and age are shown in Table 2.

Table 2. Respondent's weight and height statistics by gender and age

Age, years	Female								Male							
	Weight, kg		Height, cm		BMI, kg/m²		N		Weight, kg		Height, cm		BMI, kg/m²		N
	Mean	SD	Mean	SD	Mean	SD			Mean	SD	Mean	SD	Mean	SD	
13	51.3	7.5	162.0	5.1	19.6	2.8	18		56.1	13.2	164.6	8.6	20.6	4.0	16
14	56.6	11.7	164.9	4.9	21.2	4.4	25		65.7	14.2	175.3	11.0	21.3	3.7	22
15	57.3	9.4	168.8	6.2	19.9	2.3	23		69.2	12.9	177.8	6.2	21.9	3.8	22
16	63.0	15.0	169.2	5.2	21.9	4.2	5		69.0	12.4	179.3	8.5	21.4	3.3	11
Total	56.0	10.5	165.8	6.0	20.5	3.5	71		65.1	14.0	174.3	10.2	21.3	3.7	71

BMI – body mass index, SD – standard deviation, N – number of respondents

In the HBSC study [4], 13% of girls and 18% of boys among 13-year-old Estonian respondents reported that they were overweight or obese according to BMI. Among the 15-year-olds, these numbers were 9% and 16% accordingly. In the present study, the 13-year-old girls' percentage was lower, but that of boys' of the same age – much higher. For 15-year-old girls, overweight or obese respondents' percentage was same as in the HBSC study, but the percentage for boys of the same age was significantly higher (Figure 1). Comparing the findings with a 1997–1999 study [9], we found that 15-year-old girls' mean BMI was lower than in the previous study. 15-year-old boys' BMI was 20.2 kg/m² in the previous study but had increased 8.4% in this study (Table 2).
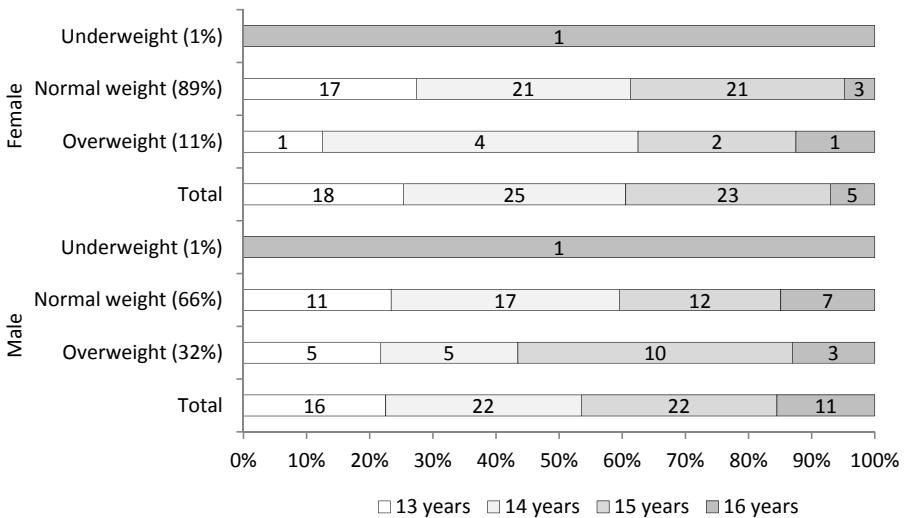
Figure 1. Respondents' gender and weight classification distribution by Grünberg et al [8] (underweight) and Cole et al [3] (overweight)

As the HBCS 2009/2010 study [4] findings show, the prevalence of overweight and obesity varies across regions. No clear age pattern has been identified, but gender differences are apparent. In most countries, boys tend to be more overweight than girls. Reasons for that might include that girls' eating habits are healthier, boys eat more fast foods [22], and parents are less likely to encourage boys to control their weight.

Eating habits of Pärnu school students are given in the Table 3. Based on the available data, only normal and overweight respondents were compared. There were only two underweight respondents, and their data were not used. Only

normal-weight students' answers could be analysed by age, as there were not enough underweight or overweight respondents for comparison.

Table 3. 13–16 years students who answered "yes" to various behaviour questions

Respondents' behaviour	Female		Male	
	Normal weight (N=63)	Overweight (N=8)	Normal weight (N=47)	Overweight (N=23)
Breakfast consumption	92%	75%	98%	78%
Importance of breakfast	87%	63%	91%	74%
Eating school lunch	73%	88%	87%	74%
Is school lunch healthy?	67%	50%	79%	70%
Eating snacks in school	49%	50%	36%	43%
Info about healthy diet comes from				
school	13%	13%	32%	9%
parents	33%	38%	38%	22%
the Internet	30%	25%	17%	22%
magazines	13%	25%	13%	9%
Engaged in sports	70%	75%	85%	87%

By the HBSC 2009/2010 study [4], 60% of 13-year-old girls (in the present study – 89%) and 64% of boys (present study – 100%) eat breakfast. From 15-year-old girls, 58% preferred to eat in the morning (present study 89%) and from boys 68% (present study 96%). In the present study, normal-weight boys and girls ate breakfast more often than overweight respondents, considering it the most important meal in the day. Frequency of eating breakfast increased with the girls' age. For boys, it also increased with age up to 100% at the age of 15 years but then decreased to 86%. Breakfast was more important for younger girls whose acceptance rate was over 80%, but in the 16-year-old girls, it was only 66%. Younger boys also accepted the importance of eating breakfast, but only 75% of 15-year-old boys agreed to it. The respondents generally ate sandwiches for breakfast (Figure 2), and the boys did it more often. In the second place, there were dry cereals. Overweight girls did not like to eat porridge in the morning. They ate more yoghurt and dry cereals than sandwiches.
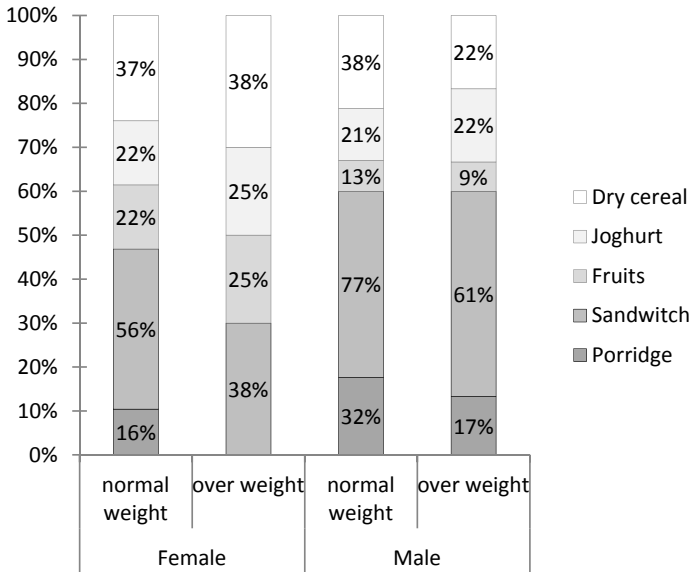
Figure 2. Student's preferences for breakfast

Most respondents ate lunch in school, and more than half considered it healthy (Table 3). Not eating school lunch was more common in young students because it tastes differently from home food. Both genders evaluated school food as satisfactory. Overweight girls and normal-weight boys evaluated lunch somewhat better, but the difference was not statistically relevant. Half of the girls ate snacks in school, but less than half of the boys did. According to the instructions [23], children and adolescent should eat four times per day: breakfast, lunch, afternoon snack and dinner.

Information about healthy diet was given by parents or could be found on the internet. Girls liked to use more internet information. Overweight girls got information mostly from parents, and normal-weight boys were more active in getting information than overweight boys.

Boys practised sports more often than girls did, and overweight students were physically more active by a few per cent than normal-weight children (Table 3). Girls practised sports 1–2 or 3–4 times in week (25%), but boys mostly 3–4 times per week (32%). Overweight boys were physically more active (43%) than normal-weight boys. More boys trained every day (27%) than girls (8%) did. After school, 21% of normal-weight girls took a walk, which lasted for 28.3 minutes on the average. From overweight girls, 50% took a walk, but it lasted for only 6.3 minutes. 43% of boys also liked walking after school;

overweight boys did it for 42.6 minutes and normal-weight boys for 26.5 minutes. Girls spent 1–2 hours on sedentary activities daily (19% of normal-weight girls, 38% of overweight girls). Normal-weight boys spent 3–4 hours on that (19%) and overweight boys 1–2 hours (26%). This means that the subjects of the study were physically active enough every day. According to the instructions [23], all adolescents should be physically active at least one hour every day.

Analysis of consumption frequency of different foods by normal-weight boys and girls is given in Figure 3. Normal-weight boys consumed rye bread, milk and fruits every day. Girls used more fruits, juice and milk products every day. Boys ate more pasta, fish and sausage once a week, but girls liked more pasta, meat and vegetables. Chips and nuts were eaten rarely by both boys and girls.

The daily diet must contain a lot of different minerals and vitamins. Fruit and vegetables also contain fibre that is useful for digestion [1]. Children like to eat fruit, but more boys than girls ate vegetables every day. Milk contains proteins, calcium, phosphorus, potassium, magnesium and vitamins A, B and D. Milk is useful for bones, fingernails and hair [1]. More than half of normal-weight respondents liked to drink milk every day, and boys liked it more. Fish contains useful fatty acids and vitamin D, and dieticians suggest eating fish twice a week [1]. In the present study, 67% of boys and 55% of girls ate fish at least once a week. Sweets and beverages with sugar contain a lot of extra energy. Overusing them by children may result in obesity [1]. In the present study, half of the respondents used sweets and beverages with sugar every day. Boys had higher frequency values than girls did. Long-time overuse of energy may raise the body weight of children who are now in normal weight. Chips should not be eaten more often than once a month because they contain too much fat and salt [1]. That suggestion was followed by half of the boys and girls.

The 5 SD height-weight classification [18] was used to divide the respondent's height and weight into the three classes and then five SD classes were formed (Table 4). In the present study, the percentage of leptomorphs was the highest in both genders – 27.8% of girls and 29.6% of boys. The percentage of pycnomorphs was the lowest – 13.9% of girls and 12.7% of boys.

Normal weight girls, n = 31

Normal weight boys, n = 22
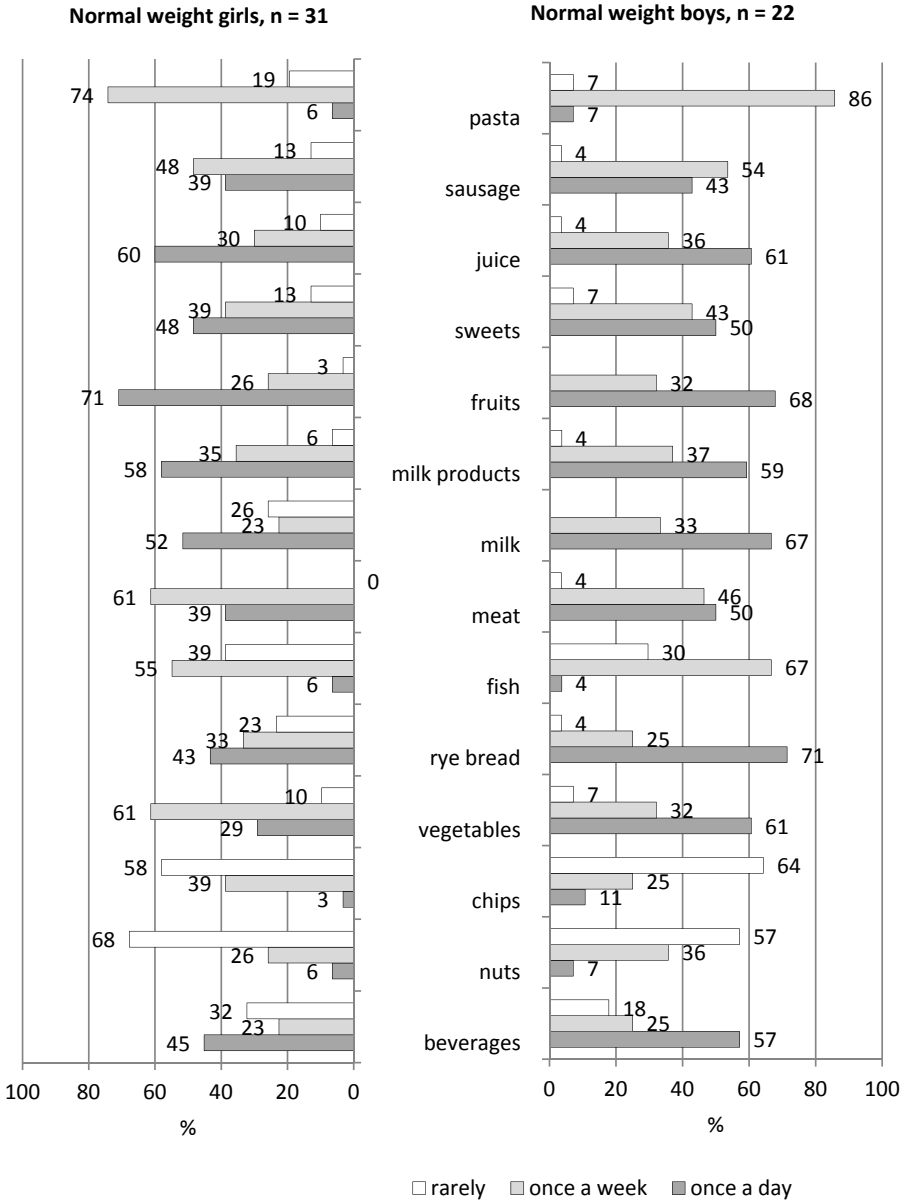
Figure 3. Consumption frequency (%) of different foods by normal-weight boys and girls

Table 4. Weight and height classification by gender

| Gender | Height class | | Weight class | | | Total |
			Light	Medium	Heavy	
Female	Short	Count	16	4	1	21
		% of total	22.2%	5.6%	1.4%	29.2%
	Medium	Count	10	13	5	28
		% of total	13.9%	18.1%	6.9%	38.9%
	Tall	Count	1	9	13	23
		% of total	1.4%	12.5%	18.1%	31.9%
	Total	Count	27	26	19	72
		% of total	37.5%	36.1%	26.4%	100.0%
Male	Short	Count	13	2	1	16
		% of total	18.3%	2.8%	1.4%	22.5%
	Medium	Count	10	12	6	28
		% of total	14.1%	16.9%	8.5%	39.4%
	Tall	Count	1	10	16	27
		% of total	1.4%	14.1%	22.5%	38,0%
	Total	Count	24	24	23	71
		% of total	33.8%	33.8%	32.4%	100.0%

Small, Medium, Large, Pycnomorphs, Leptomorphs

Analysis of eating and physical activities habits by somatotypes (Table 5) revealed that pycnomorphs and large respondents ate less breakfast. Pycnomorphic girls and big boys did not value breakfast, but they mostly ate lunch in school. Small and pycnomorphic girls did not think that school lunch was healthy, and most of them (73%) ate some extra food at the school. Pycnomorphic boys thought that the food in school was healthy and did not eat extra food at school. The respondents mostly ate the main course for dinner, but pycnomorphs and leptomorphs boys also liked soup, and small boys ate sandwiches at dinner three times more than small girls. Most (85–92%) pycnomorphic and medium girls practised sports; the percentages of other groups were much lower – 53–64%. Boys were more physical active than girls, but big and leptomorphic boys were less active than others.

Table 5. Eating habits and physical activities by gender and somatotypes

Habits	Gender	Somatotype				
		Small	Medium	Large	Pycno-morphs	Lepto-morphs
Eat breakfast	Female	100%	85%	85%	82%	95%
	Male	100%	100%	81%	70%	100%
Breakfast is important	Female	88%	92%	100%	45%	89%
	Male	100%	92%	69%	80%	90%
Eat school lunch	Female	81%	69%	69%	91%	68%
	Male	69%	75%	75%	90%	100%
School lunch is healthy	Female	56%	69%	62%	45%	84%
	Male	77%	75%	63%	90%	75%
Eat snacks in school	Female	31%	46%	54%	73%	47%
	Male	31%	67%	50%	20%	25%
Preferences for dinner Soup	Female	13%	0%	31%	27%	21%
	Male	42%	42%	19%	60%	55%
Main course	Female	63%	92%	77%	91%	68%
	Male	67%	83%	75%	50%	75%
Sandwiches	Female	13%	0%	23%	18%	21%
	Male	42%	17%	19%	40%	30%
Practise sports	Female	63%	85%	92%	64%	53%
	Male	100%	92%	81%	90%	75%
Walk to and from school	Female	69%	46%	69%	45%	37%
	Male	54%	42%	50%	30%	40%
Walk to bus stop	Female	19%	38%	38%	36%	53%
	Male	15%	42%	25%	40%	50%

Somatotypes' behaviour cannot be analysed by age because these groups were too small for proper conclusions.

CONCLUSION

The analysis of school students' eating habits and physical activity in two Pärnu schools showed that their eating habits are sufficiently healthy. Boys tend to be more overweight. Most of the respondents eat in the morning and eat school lunch. They are satisfied with school food, but some of them do not like the taste. Normal-weight boys and girls eat different food groups every day, but use too many sweets and beverages with sugar. According to the height-weight classification, the largest group was leptomorphs. Pycnomorphs and large respondents do not like to eat the breakfast and eat extra food at school. Pycnomorphs are physically more active than others groups.

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