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Body Mass Index of Children 5-8 Years Old in Kosovo, Indication of Transport Way and School-Home Distance

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Abstract: Changes in life style in the last decades in Kosovo have shown an effect in many aspects in the social life of children by spending more time in playing inside house computer game, low level of physical activities which may increase the prevalence for diabetes and anthropometric changes. Transport to school, distance, academic class that pupil are attending, geographically position where pupil live and gender my affect the Body Mass Index (BMI) of the pupil. Therefore, the objective of this study is to assess whether there is a statistically significant correlation between the body mass index and several indicators (life style and gender) for primary school children with ages ranging from 5-8 in five geographically distributed, different cities in Kosovo. Results showed a difference among the mean BMI and gender groups with $p<0.005$ but there was no difference between age groups. No correlation was found between BMI and neither the way of transport nor school-home distance. BMI was reported to be effected from several factors like socioeconomic one which in the present study during the measurement are neglected or try to standardize. The resulting data is important since, it represents first study of this kind in Kosovo which can later be re-used in prevalence studies.

Key words: BMI, children, transport, distance, Kosovo, prevalence studies

INTRODUCTION

The prevalence of childhood obesity has shown a significant increase in the last two decades in several Western countries. Obesity is recognized as a major health, since, 1998 in both developed and in some developing countries by the World Health Organization (WHO., 1998). In UK, the prevalence of overweight increased from 14.7-23.6% within nearly 10 years (from 1989-1998) and the obesity prevalence increased from 5.4-9.2% within the same time period. Similarly in Germany, the overweight prevalence for boys increased from 10-16.3% and for girls from 11.7-20.7% between 1975 and 1995, respectively (Rolland-Cachera *et al*., 2002). The obesity prevalence in children 14 years old and adolescent in developing neighboring countries like Albania is reported to be near 14% (Kola *et al*., 2014) while in Serbia the obesity prevalence is 5% in an adolescent 15-18 years old (Rakic *et al*., 2011). Now a days in Europe 1 of 20 adolescents is obese while 1 of 6 children is overweight (Aguilar *et al*., 2012). In other parts of the world, Japanese scientists conducted a 2 years research on the obesity at the children aged 10-13 where they reported an increase in the overweight prevalence from 6.6-10.0% (Okuda *et al*., 2010). All similar other studies point to an increase in the prevalence of both overweight and obesity, the major cause being commonly attributed to the dietary habits and low physical activity during the day for children.

BMI is considered to be a sensitive method to conclude for underweight, normal weight, overweight and obese children (Al-Mohaimeed *et al*., 2015). Obesity in children and adolescents increase the risk for several health disorders like dyslipidemia, high blood pressure and sleep breathing disorders. A correlation between Body Mass Index (BMI) and higher blood pressure was verified from the study by Hu *et al*. (2016) where they further noted that this correlation holds during both childhood and adolescence. In the study Eyck *et al*. (2017), 32.3% of the obese and overweight participant children have shown problem with obstructive sleep apnea which is a sleep breathing problem caused by total or partial obstructions of the upper airway.

The economic consequence of obesity in the United States was reported to be near $147 billon in 2008 and the predicted prevalence to be near 51% in 2030. A number of changes in health services in schools as well as dietary habits and activity routines of students resulted in decreasing obesity trends (Lohrmann *et al*., 2014). In another study, socio-cognitive and socio-economic status factors are studied as an indication to BMI for children and adolescents between 6-18 years old. They reported

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these two factors are significant in development of a high BMI and risk of overweight and obesity in children and adolescents (O'Dea and Wilson, 2006). Another study reported that obese children in developed countries commonly belonged to the deprived groups and with inequalities of socio economic status, yet, the age and gender did not show a considerable significance correlation with BMI (White *et al*., 2016).

The dietary habits and daily organized life during the current decades changed remarkably in Kosovo. Two decades before the war in 1999, all the economy was based on small family agriculture business and most of the meals were eaten inside the house, after the war more economy business were open and accesses to fast foods were much easier. Until now there was less to no study related to the effect on BMI or in any anthropometric characteristics and factors on life and the health of the population. In the light of this,the current study is a step to start controlling and giving a statistical conclusion about the circumstances and the condition that are affecting the life of the people, especially for children. This study aimed to explore the BMI changes in the children ages 5-8 years old and effects of distance and the way of transport in their BMI. Noting the absence of any previous data for comparison, the current study aims to be a starting stone for noting any change in measures related to overweight and obesity in children and to make people aware of the risk of the obesity in children. For the present study, socio-economic status and socio-cognitive could not be included in the study as factors because the school did not have any information registered for the socio-economic status of the parents of children.

MATERIALS AND METHODS

Data collection: Data used in this study consists of calculated BMI form height and weight, as well as answers to the questionnaire of the pupils from elementary school during the period from February to June 2016. Participants of the study are selected from five cities in Kosovo (Mitrovica, Gjilani, Peja, Fushe Kosove and Rahovec), some from rural regions of the cities and some from downtown schools.

Initial number of pupils enrollment in the study was 538 in the present study are included only pupil ages 5-8 years old. Consequently five participants are excluded from the study, three of them based on their age (older than 8) and two of them missed the class when measurement are done. Remaining 533 pupils, distributed in each class of the elementary schools as follows: 245 pupils from secondary class, 216 pupils from first class and 77 pupils from preparatory class. All calculations are performed using Microsoft Excel and R Software.

Table 1: Coded data for questionnaire

Codes	Gender	Transport	Distance	BMI
1	Male	Passive	Near	Underweight
2	Female	Active	Far	Normal weight
3	-	-	-	Overweight
4	-	-	-	Obese

Table 2: Grams of bun

Name of the product	Weight (g)
Bun with cheese	150
Bun with Nutella	250
Bun with sesame seed	120

The weight and height of the pupils are measured, a simple balance is used to measure weight (Tefal, 150 kg maximal) while for height is used a simple meter, than height and weight data are used to calculate the BMI (kg/m^2), resulted BMI are converted into weight categories based on diagrams for children 5-19 years old published by World Health Organization WHO. During the weight and height measurement, pupils are asked to take off their shoes and accessories. While measuring, each pupil is asked to declare their travel method and the distance from home to school. Distances until 1 km are classified as "Near the school" while those distances longer than 1 km are declared as "Far from school". All data are confirmed by the teacher of the class. Also, pupils are asked whether they came to school by car or by walking. Walking is noted as "Active transport" while transportation by car is noted as "Passive transport". A sample of questionnaire is prepared and all data are written in coded data for calculations as it is shown in Table 1. The calculated BMI value vs. age of the pupils is used to categorize in the weight category based on the charts of world and health organization for children between 5-19 years old.

The school schedule starts from 12 until 4 o'clock between these 4 h there is 15 min break during which students are offered to take a bun which is a meal offered for pupils from the municipality. The buns are offered with three options: a bun with cheese, bun with Nutella and bun with sesame seed, each day is served one type of bun weights are shown in Table 2.

Statistical analysis: Collected and calculated data are statistically analyzed, BMI in the study is considered dependent variable while as independent variables are used the way of transport and the distance between the school and their home. The differences between age group and between gender were also as a subject of the study, during these analysis non-parametric statistical method were used (Mann-Whitney U test and Kruskal-Wallis test) after our data were not normal distributed. Differences with $p \leq 0.005$ were considered to be statistically significant, all the statistical analysis were conducted in excel and R×64 3.3.3 Software.

RESULTS AND DISCUSSION

The collected data from 533 participants in the study from children 5-8 years old were calculated and convert in percentage for easy and better analyses. The data converted in percentage are shown in Table 3 for each weight category divided in age groups for two genders and in total. The second column in the table shows the number of the participants from each group while the following columns show the percentage to the weight category that each group of participants belong.

Table 4 are shown results in average BMI for each age group for male and female and also, total BMI average of age group, to make sure for any noticeable difference in BMI average between groups, moreover the data are statistically analyzed by R to check for the same correlation.

Correlation of BMI with the gender, distance and transport are analyzed by using Mann-Whitney U test for which R Software is used. While for analyzing correlation between BMI with age groups, city and the class that they attend during the examination time, Kruskal-Wallis test is used. For both tests, R Software is used to examine the correlation with 95% confidence interval (Rosner, 2010).

However, to analyze the data by R Software in the beginning, the excel file is converted to CSV file format, and then is loaded into the R program. A simple summary of the data is done after they are loaded in the program which are used for statistical calculation. According to the summarized data, the Mann-Whiney U test was applied to find any correlation between BMI with gender, distance, and transport. Analyzed data are shown in Table 5, correlation between BMI and gender with 95% confidence interval and resulted p-value was 0.001761 which is far <0.005 critical value which is considered to be significant. In our case, this means that there is a correlation between gender and BMI. This phenomenon can be noticed also if we check the Table 4 in which male BMI is shown to be significantly higher than female BMI. Based on Table 5 in which are shown results of analyzing the correlation between BMI and distance, results proves that there is no correlation between distance as a factor and dependent variable BMI, the p = 0.7148 was higher than the critical value which shows that distance does not have any effect in the BMI value also here confidence interval was 95%. The same test was applied to analyze indication of two manner of transport (active and passive) to BMI of children. Even though here the p-value is a little bit smaller then the pervious value, it is not smaller than 0.005 to be considered significant to correlate with BMI changes in children.

Table 3: Percentage of the underweight, normal weight, overweight and obese participants

Variables	No.	Underweight	Normal weight	Overweight	Obese
All	533	3.18	68.66	15.38	12.7
Female	259	3.08	72.97	12.74	11.19
Male	274	3.28	64.59	17.88	14.23
5 years old	16	6.25	50	18.75	25
5 years old female	8	12.5	37.5	12.5	37.5
5 years old male	8	0	62.5	25	12.5
6 years old	180	5	62.77	16.66	15.55
6 years old female	95	4.21	68.42	15.79	11.57
6 years old male	85	5.88	56.47	17.64	20
7 years old	240	1.6	72.5	15.83	10
7 years old female	107	0.93	77.57	12.14	9.34
7 years old male	133	2.25	68.42	18.79	10.52
8 years old	97	3.09	73.19	11.34	12.37
8 years old female	49	6.12	73.45	6.12	14.28
8 years old male	48	0	72.91	16.67	10.42

Table 4: Average BMI in participants divided by age and gender

Age	Female	Male	Total
5 years old	16.26	17.35	16.82
6 years old	16.51	16.87	16.68
7 years old	16.34	16.95	16.68
8 years old	16.54	17.03	16.78
Total	16.41	17.05	16.73

Table 5: Analyzed data with Mann-Whitney U test by R

BMI correlation with	Gender	Distance	Transport
W	29930	25763	22860
p-value	0.001761	0.7148	0.5496
Cl 95%	-0.8399463	-0.3200031	-0.5000090
	-0.1900027	0.4799238	0.2900179
Sample estimation difference in location	-0.5199633	0.07996412	-0.1200195

Table 6: Examination results of correlation between BMI with age, city and class

BMI correlation with	Age	City	Class
Kruskal-Wallis χ^2	0.45653	1.8348	2.7549
df	3	4	2
p-values	0.9283	7661	0.2522

*df: degree of freedom

On the other hand, group age, city and class variables have more than two levels consequently, Mann-Whitney U test cannot be used for examination of correlation between them and BMI, therefore, instead of that Kruskal-Wallis test can be used to analyze statistical correlation. Also, here for examination R Software is used for each of them and results are shown.

From Table 6 is seen that there is no correlation between BMI with age after the p-value is higher than 0.005 which means that age does not affect BMI value. After we have four age groups, from 5-8 years old the degree of freedom is df = 3. The same examination was done also for correlation of BMI with thecity, after we collect samples from five different cities the degree of freedom here is df = 4 while from calculated data p = 0.7661 which indicates that BMI is not correlated with

the cities that participants in the study live. Even though there is a financial standards difference between cities of the study, from the results, there could not be found any correlation with it, results are shown in Table 6. The school plan program is different for each level class of primary school. The first level is preparatory school which is the simplest program where children have to carry a small notebook and some light stuff. The second level is first class during which the amount of the books and notebooks that students have to carry from home to school and another way around is increased drastically. This continues to increase to the second class too. So, the work of the students is increased with academic classes. However, when collected data are examined for any correlation between the BMI and level of the class in the primary school that participants attempt, no correlation could be found after the p-value was away bigger than our critical value 0.005.

In last 15 years, our society in Kosovo undergone a long and hard transition period. After the war of 1999 the Kosovo society has undergone many changes in economy, way of living and in the last 10 years there were more investments for building preliminary schools which were insufficient number for decades when children were forced to travel for kilometers from house another change eating outside the house and most of the time this is a fast food which is served near the school. The time that is spent in computers is another problem last years in a study that is done from organization save the children in Kosovo they found that 65% of respondent in the study used internet daily and 33% for 2 h per day. This is one of the reasons for physical activity reduction also the way of transport from house to school and to return back have changed, recently it is seen a trend of driving children to the school even for small distances.

Based on the results from Table 3, 68.66% of all the respondents are normal weight, only 3.18% are categorized as underweight. About 15.38% of them were categorized as overweight and obese were 12.7% of the total respondents. Two genders were represented with almost 50% of the respondents, comparing the percentage of the overweight and obese respondents of two genders, males were found to have more problem with overweight and obesity this is seen also between the group of ages 6 and 7 years old even though the percentage difference is small, this happened to indicate also the correlation of the BMI with the gender. Based on the results 60-70% of the respondents of all groups divided are normal weight. Results are not so satisfactory compared with some researches for 3-6 years old Iranian children were 83.8% of subjects were categorized with normal weight (Bafti *et al*., 2015) but the results have similarity with the Western world results in studies with children of 12 years old where they found that 72.8% of the participants are categorized to have normal weight (Pals *et al*., 2014).

From summary of the data, data percentage of the participants who declared that live near and far from the school. The 76.92% of the respondents have declared to live near the school in a diameter 1 km from school. While only 23.07% of the participants declared to live far from the school in a diameter longer than 1 km. From the examination by using the Mann-Whitney test as it is shown in Table 5, no correlation could be proved between BMI and distance. So, the distance does not show any effect of the BMI. We could not relate any weight category with the any of two distances. Going through the summary data, 78.79% of the respondents in the study are declared to walk to come to school and we register it as an active transport. While only 21.2% of the children declared to use transport by car to come to school by R Software correlation between BMI and transport way is analyzed, we could not found any effect of the transport in BMI, this was reported similarly from the study by Mytton *et al*. (2016), they could not found any effect of regular walking with reduction of BMI but increasing in walking was associated with reduction of BMI same decrease was seen when cycling to the research was used as a transport method. In contrast, a correlation between the activity of walking to the school and BMI index was reported by Rothman *et al*. (2016). By our results short walking it may not affect the obese children but it may immobilize weight gain in normal weight children after the majority of the children walk to go to school and majority of them have normal weight.

In each age groups, it is seen a potential form male children to be affected by overweight or obesity, a significant prevalence of male children to be affected by overweight and obesity more than female is reported also by Ogden *et al*. (2012). From our results shown in Table 5, a correlation between BMI with gender is found by using Mann-Whitney test. This proves that gender has an effect on BMI and weight category in children age 5-8 years old.

In this study is also attempt to found any correlation between BMI with age groups, city and academic class level that children attend by using Kruskal-Wallis test. In each of this group no correlation was found and in all of the tests p-value was higher than set critical value 0.005. Our focus was to see a correlation between BMI and cities where pupils live, since, there is a difference also in their economical standards between cities which (socioeconomic status) shown to have an indirect effect on body mass index reported by several researches (Dinsa *et al*., 2012; Fernald, 2007).

CONCLUSION

The data of height and weight of pupil from four different cities of Kosovo are used to calculate BMI which issued to categorized the participants in four

different weight categories, underweight, normal weight, overweight and obese based on the WHO chart. Statistical analysis methods are used to find if there is any correlation between the gender, age groups, city, class level, distance and transport with BMI. Statistically, from the results, there were no significant differences between the BMI mean of the age groups. Correlation between transports of the pupil from their home to the school and distance with BMI was not found. The only correlation found was between BMI and gender which was found also in other literature. This study shows the necessity for more research in this field with more parameters included to make estimations more comprehensive and more reliable. Even though some contradict results, this study is first of its kind in the Republic of Kosovo, important for the statistical conclusion for the population. These results in the future can contribute for calculating other statistical important factor as are the overweight and obesity prevalence.

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