

## THE NUTRITION STATE OF STUDENTS FROM 6 TO 10 YEARS OF AGE IN THE SKOPJE REGION

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(Original scientific paper)

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### Abstract

*On a sample of 2197 respondents (1096 male respondents and 1101 female respondents), the research was carried out with the aim of determining the state of nutrition among students from 6 to 10 years of age in the Skopje region. To accomplish the research objectives, measurements of body height, weight, and calculation of the body mass index (BMI) were conducted. In each age category and gender, based on the BMI values (kg/m<sup>2</sup>) and the table (cut-off points IOTF reference), the subjects were classified into three categories: normally nourished, overnourished and obese. The processing of the data was performed with contiguous tables based on the values of the  $\chi^2$  square test and contingency coefficients, as well as testing their differences. The percentage of overnourished and obese children classified on the basis of the BMI criterion in this research is 37, 5%. The values of the  $\chi^2$  test for the entire sample of respondents ( $\chi^2 = 6.618$ ,  $p = .037$ ) indicate that there are statistically significant differences in nutrition levels between boys and girls. The percentage values show that a higher percentage of girls are classified as overweight (25.10% girls, vs. 21.50% boys) while a higher percentage of boys are classified as obese (15.70% boys, vs. 12.60% girls).*

**Key words:** *Body mass index, overweight, obesity*

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### Introduction

Obesity among children and adolescents worldwide has reached epidemic proportions. It is considered the most widespread disease among children in several countries, especially in developed ones (Reilly, 2006). Overweight and obesity in childhood and especially in adolescence, remain in adulthood. Also, it is considered a risk factor for the occurrence of cardiovascular disease, diabetes, asthma as well as some socio-psychological disorders in old age (Freedman et al., 2007; Reilly et al., 2003). The results of previous research show that every fourth child aged 6-14 years is overweight (Kotani K, et al., 1997; Kain J, et al., 2002). No European country has managed to establish control over this epidemic so far. Obesity in children and adolescents, as well as other forms of the so-called "new morbidity" - violence, abuse of psychoactive substances and disorders of sexual and reproductive health, at the beginning of the 21st century became the leading causes of illness and mortality among adolescents in developed countries.

Obesity is a multifactorial problem that is conditioned by the hereditary factor, social conditions, lifestyle, eating habits, level of physical activity and differences in upbringing that exist in different environments. The level of prevalence varies significantly by geographic region (Jackson-Leach R, et al., 2006). The Republic of N. Macedonia lacks research, especially on large samples of respondents that provide information on the prevalence of overweight and obesity, as well as on their impact on the health of children and young people.

Body mass index (BMI), also known as Quetelet's index, is the ratio of body weight to height squared. In the use of this parameter in the assessment of obesity, especially in the child population, certain shortcomings have been observed, but despite this, BMI is intensively used in anthropological research, as an indicator of the state of body weight. And in the field of kinesiology research, BMI is often used as an indicator of body constitution, in relation to various indicators of kinesiological activities.

According to the presented research as well as the fact that the period of the young adolescent age is particularly exposed to intense changes in the hormonal status, the basic problem of this research is the level of health-fitness among adolescents of Macedonian nationality with different body weight status,

categorized according to the size of the BMI. The purpose of the research is to determine the state of nutrition among students from 6 to 10 years of age in the Skopje region.

## Methods of work

### *Sample of respondents*

The research was carried out on a sample of 2197 respondents, drawn randomly from several primary schools in the Skopje region. The sample is divided into two subsamples according to gender, namely 1096 male respondents and 1101 female respondents. Each of the subsamples is also divided according to chronological age into 5 age groups spanning one calendar year. Chronological annual age is defined based on decimal years (difference between the date of measurement and the date of birth, which are transformed into a size corresponding to a division of the year into ten instead of twelve months). Based on that, 5 male age groups and 5 female age groups were formed in the span of one calendar year, namely: 6 (6-6.9), 7 (7-7.9), 8 (8-8.9), 9 (9-9.9) and 10 (10-10.9) years. Also, the five male and female age groups based on the BMI values (kg/m<sup>2</sup>) and the table (cut-off points IOTF reference) proposed by Cole and colleagues (Cole et al., 2000, 2007) are classified into three subgroups: normally fed (normal weight), overfed (overweight) and obese. Respondents are treated in accordance with the Helsinki Declaration 1961 (revision of Edinburgh 2013).

### *Anthropometric measures*

The measurement of anthropometric measures was carried out according to the recommendations of the IBP-International Biological Program (Lohman, Roche, & Martorell, 1988). The following anthropometric measures were used to assess the morphological characteristics: body height (cm), body weight (kg), and the body mass index (BMI) were calculated as well.

### *Defining the level of nutrition*

*Obesity is primarily characterized by an excessive accumulation of body fat, often assessed using the body mass index (BMI) in clinical practice. A BMI value equal to or greater than the 95th percentile for children of the same age and sex is typically indicative of obesity, whereas values in the 85th to 95th percentile range are considered indicative of overnutrition.* (Barlow, & Expert Committee, 2007).

Body mass index (eng. Body mass index – BMI) is calculated through a mathematical formula that calculates the ratio of height and mass of an individual, or more precisely represents body mass (in kg) divided by height (expressed in meters squared). That is,  $BMI = \frac{kg}{m^2}$ . In each age category and gender based on the BMI values (kg/m<sup>2</sup>) and the table (cut-off points IOTF reference) proposed by Cole and colleagues (Cole et al., 2000, 2007) the respondents are classified into three categories: normal nourished, over nourished and obese.

### *Statistical processing*

The processing of the data was carried out with contingency tables based on the values of the  $\chi^2$  square test and contingency coefficients, as well as testing their differences. Contingency tables are constructed by crossing on one side the group of respondents in each age category by gender (in rows - horizontally), numerically by frequencies (f) and percentage (%), and on the other hand the classification of respondents in each age category in three rupees according to body mass index (in columns - vertical) also by frequencies (f), and percentage (%).

## Results

Prevalence of normal weight, overweight and obesity according to gender and age groups are shown in table 1. Analysis of table 1 and examination of the  $\chi^2$  test for the entire sample of respondents ( $\chi^2 = 6.618$ ,  $p = .037$ ) indicate that there are statistically significant differences in the level of nutrition between boys and girls.

The percentage values show that a higher percentage of girls are classified as overweight (25.10% girls, against 21.50% boys) while a higher percentage of boys are classified as obese (15.70% boys, against 12.60% girls). The highest percentage of boys with a moderately elevated body mass index is in the 10th year (25.60%), while the highest percentage of boys with a high body mass index is in the 9th year (20.40%). The highest percentage of girls with a moderately elevated body mass index is in the 9th year (28.20%), while the highest percentage of girls with a high body mass index is in the 8th year (18.40%).

From the values of the  $\chi^2$  test, it can be seen that statistical differences in the level of nutrition in boys and girls were determined in the 8th year ( $\chi^2 = 10.119$ ,  $p = .006$ ), in the 9th year ( $\chi^2 = 7.565$ ,  $p = .023$ ) and the 10th year ( $\chi^2 = 8.209$ ,  $p = .016$ ). In the 6th and 7th year, no statistically significant differences were determined in the level of nutrition between boys and girls. From the percentage values (table 20), it can be seen that a greater percentage of girls at the age of 8 have a moderately elevated body mass index and a high body mass index. At the age of 9 and 10, a higher percentage of girls have a moderately elevated body mass index, while a higher percentage of boys have a high body mass index.

Table 1. Prevalence of normal weight, overweight and obesity according to gender and age groups (classification according to body mass index - BMI)

Age	Gender	Normal weight		Overweight		Obesity		Chi-Square Tests (sig)
6 years old	Boys	97	63,00%	35	22,70%	22	14,30%	
	Girls	136	68,30%	41	20,60%	22	11,10%	1,286
	<b>Total</b>	233	66,00%	76	21,50%	44	12,50%	.526
7 years old	Boys	151	68,00%	44	19,80%	27	12,20%	
	Girls	135	63,10%	53	24,80%	26	12,10%	1,603
	<b>Total</b>	286	65,60%	97	22,20%	53	12,20%	.449
8 years old	Boys	208	70,30%	49	16,60%	39	13,20%	
	Girls	143	57,20%	61	24,40%	46	18,40%	10,119
	<b>Total</b>	351	64,30%	110	20,10%	85	15,60%	<b>.006</b>
9 years old	Boys	109	54,20%	51	25,40%	41	20,40%	
	Girls	145	60,90%	67	28,20%	26	10,90%	7,565
	<b>Total</b>	254	57,90%	118	26,90%	67	15,30%	<b>.023</b>
10 years old	Boys	123	55,20%	57	25,60%	43	19,30%	
	Girls	127	63,50%	54	27,00%	19	9,50%	8,209
	<b>Total</b>	250	59,10%	111	26,20%	62	14,70%	<b>.016</b>
<b>Total</b>	Boys	688	62,80%	236	21,50%	172	15,70%	
	Girls	686	62,30%	276	25,10%	139	12,60%	6,618
	<b>Total</b>	1374	62,50%	512	23,30%	311	14,20%	<b>.037</b>

## Discussion

Obesity in childhood and youth is becoming a global epidemic and is about to reach epidemic proportions in Macedonia. The percentage of over nourished and obese children classified based on the BMI criterion in this research is 37.5%. Similar results on overnutrition and obesity have been published in various other international studies. About 33% of Baltimore school children were undernourished and obese classified according to age-specific BMI reference values (Jehn et al., 2006). Ortega et al. conducted a survey of a representative sample of Spanish adolescents ( $n=2,859$ ) and found a prevalence of overweight including obesity of 25.7% in boys and 19.1% in girls (Ortega et al., 2007). Research by Al-Nakeeb et al. indicates that over 37% of Birmingham adolescents are undernourished or obese and one in five children has a body fat percentage above 30% (Al-Nakeeb, et al., 2007). Ostojic et al. researched a sample of Serbian children aged 6-14 and determined that the prevalence of overweight, including obesity, was 38.3% in boys and 40.4% in girls (Ostojic et al., 2011).

Overweight and obesity among young people is most prevalent in southern European countries (Greece, Italy, Malta, Portugal), where Macedonia also belongs. The prevalence of obesity is lower in Western highly developed countries, with the exception of Great Britain. Scandinavian and Central European countries have a lower percentage of obese young people. The prevalence is lowest in the eastern EU countries (Currie et al., 2004).

In the research in Greece in Thessaloniki carried out on children and young people from 6 to 17 years, the prevalence of overweight is 22.2% and obesity is 4.1%. A higher percentage of children compared to adolescents were overweight and boys compared to girls. The prevalence of overweight among children in Greece has been increasing over the last six decades, especially among boys (Krassas, Tzotzas, Tsametis & Konstantinidis, 2001). Just like in Italy and Greece, the percentage can be observed north-south. There is a higher percentage of obese children in the southern than in the northern parts of Greece (Karayiannis, Yannakoulia, Terzidou, Sidossis & Kokkevi, 2003; Mamalakis, Kafatos, Manios, Anag-nostopoulou & Apostolaki, 2000; Meksis, Bogkanis & Maridaki, 2004).

And in Spain, the distribution of child obesity is most represented in the southern regions, ranging from 7.5 to 15% in boys and 4 to 12% in girls (Martinez, Moreno & Martinez-González, 2004; Rios, Fluiters, Perez Mendez, Garcia- Garcia-gradonačelnik i gradonačelnik, 1999). There were clear indications that overweight and obesity were increasing year on year.

Such a high percentage of body fat is associated with an increased risk of acute and chronic diseases, especially osteoarthritis, increased blood pressure, diabetes mellitus and cardiovascular disease, which can lead to a worse quality of life, increased personal and financial burden for the individual, family and society and shortening of lifespan (Williams et al., 1992; Aristiminoetal, 1984; Berensonetal, 1980; 1982; Dugan S.A., 2008).

## Conclusion

Based on the obtained results, it can be concluded that there are statistically significant differences in the level of nutrition between boys and girls. The percentage values show that a higher percentage of girls are classified as overweight (25.10% girls, against 21.50% boys) while a higher proportion of boys are classified as obese (15.70% boys, against 12.60% girls). The highest percentage of boys with a moderately elevated body mass index is in the 10th year (25.60%), while the highest percentage of boys with a high body mass index is in the 9th year (20.40%). The highest percentage of girls with a moderately elevated body mass index is in the 9th year (28.20%), while the highest percentage of girls with a high body mass index is in the 8th year (18.40%).

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