UDC: 613.2-053.6(497.752)
Professional paper

ASSESSMENT OF EARLY ADOLESCENTS EATING HABITS THROUGH SELECTED FACTORS INFLUENCING FOOD CHOICES

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Abstract

Adolescents from 12 to 15 years of age from three elementary schools in Gostivar are included in this research. The purpose of this research was to assess the eating habits of adolescents, to perceive the real current state of food knowledge among adolescents from the 6th to the 9th grade (total 593). We also assessed the lifestyle of the adolescents, looking from a nutritional point of view, and determined the most significant factors that influence food choice, the formation and/or change of eating habits among these participants, and the possible occurrence of obesity and/or malnutrition and their prevention. For the purposes of this research, a survey questionnaire was prepared and available in three languages (Macedonian, Albanian and Turkish), which included questions related to the socio-demographic characteristics of the adolescents, further, how much knowledge the adolescents have about food and questions about their lifestyle with the representation and frequency of physical activity. After the statistical processing of the data, it was observed that the greatest influence on increased body mass among adolescents is gender ($p = 0.002$), age ($p = 0.002$), the number of members in the family ($p = 0.05$). The results show that there is no statistical significance between BMI and physical activity, frequency ($p=0.145$) and duration ($p=0.131$) and time spent in front of TV screens and computers ($p=0.686$). The results also showed us that the majority of adolescents know the basic nutrients and their presence in food, but we still recommend that schools start regular education from an early age in order to encourage a higher level of awareness about proper and healthy nutrition.

*Key words***:** BMI, adolescent food choice, eating habits, nutrition, adolescent lifestyle

1. Introduction

Adolescence is a period of development that begins at puberty and ends at adulthood. The World Health Organization (WHO) defines adolescence as the age between 10 and 19 years and youth as the age between 15 and 24 years, while youth encompasses the entire age group from 10 to 24 years (Patton et al., 2016; Das et al., 2017). The period of adolescence is divided into three age categories: early adolescence (10–14 years), late adolescence (15–19 years), and young adulthood (20–24 years). Physiologically, early adolescence is dominated by puberty and sexual development, late adolescence is characterized by pubertal maturation, and young adulthood is characterized by the adoption of adult roles and responsibilities (Kapur, 2015). Healthy mental development in adolescence undergoes several developmental changes, which are: the creation of sexual identity, psychological separation from parents, reduction of dependence on peer groups, consolidation of personality structures through self-identification and consolidation (Pernar & Frančišković, 2008; Obranic, 2016). Early adolescence is a period of rapid growth, adequate nutrition is crucial for achieving full growth potential, and failure to achieve optimal nutrition can lead to delayed and stunted linear growth and impaired organ remodeling, while a healthy and balanced diet positively affects the composition and health of children's bodies and reduces cognitive stress and psychological problems (Avenell et al., 2005; Hellerstedt, 2005; Cappa et al., 2012; Das et al., 2017). Healthy meals in childhood and adolescence contribute to optimal child health, growth and intellectual development and prevent health problems later in adulthood and old age (Gabhainn et al., 2002). Increased intake of foods with low nutritional

https://doi.org/10.62792/ut.jftn.v8.i15-16.p2930

value results in a generally lower intake of nutrients, which leads to the occurrence of dietary deficiencies (Bowman et al., 2004; Paklarcic, 2015). On the other hand, adolescents affected by obesity are exposed to an increased risk of developing comorbidities. As BMI increases, so does the risk of hypertension. According to Skinner et al. (2015), obese adolescents in the overweight category (12-18 years) have a 2.5-7.6 times higher risk of high blood pressure, compared to adolescents in the undernourished category. Obese adolescents begin to develop cardiovascular damage that is also observed in adults (Hanevold et al., 2004; Chinali et al., 2006; Cote et al., 2013). Davison & Birch (2001) consider that risk factors for obesity in children are: food intake, physical activity and sedentary behavior. According to Nakic (2015), boys, unlike girls, spend more time in front of the TV. Physical activity in children makes children have greater self-confidence, receive social recognition and meet more young people. Eating habits and attitudes towards food are influenced by a multitude of interrelated factors (Chenhall, 2010). Knowledge about food and nutrition are critical factors that help adolescents navigate the complex food system, including purchasing healthy foods to prepare healthy meals, understanding what foods contain, and how nutrients affect the body (Thomas & Irwin, 2011; Pendergast & Dewhurst, 2012; Vidgen & Gallegos, 2014). However, it has been noted that teenagers often lack sufficient knowledge about food and nutrition to choose and consume healthy diets (Pendergast & Dewhurst, 2012; Vidgen & Gallegos, 2014; Wickham & Carbone, 2018; Seabrook et al., 2019). Weight gain in children and adolescents is an important global health problem and is associated with certain factors that influence food choices (Cirak et al., 2018). This study provides results on the impact of certain factors on body mass index.

2. Materials and Methods

In this research, a survey was conducted among adolescents from VII, VIII and IX grades or adolescents from 12 to 15 years of age (a total of 593 participants) in primary schools in Gostivar: Primary School "Edinstvo-Baschimi-Birlik", Primary School "Mustafa Kemal Ataturk" and Primary School "Goce Delchev". A questionnaire was prepared for the needs of this research, available in three languages (Macedonian, Albanian and Turkish). The questionnaire included 46 questions, and this paper presents the results of the questions related to the socio-demographic characteristics of the students, how much students know about food and questions about the lifestyle of the students, with the prevalence and frequency of physical activity. The calculations for the BMI of the participants were made based on the percentiles or graphs for that age (Law on Health Care "Official Gazette of the Republic of Macedonia" 2015). BMI is calculated by dividing body mass by height in meters squared. BMI categories for children include underweight, normal range, overweight, and obesity. The results were analyzed using statistical methods: statistical crossovers, Chi-square test ($\chi 2$-test), and frequency distribution.

3. Results and discussion

3.1 Socio-demographic characteristics: A total of 593 participants were surveyed, of which 334 (56.3%) were female and 259 (43.7%) were male. In terms of the representation of students by nationality, Macedonians are represented by 48.9%, Turks by 35.1%, while Albanians are represented by 11.8%, and representatives of other ethnic communities are 4.2%. The participants stated that 81.2% live in a city, and 18.8% live in a village. According to the level of education of the parents, the largest percentage of parents have a secondary education, i.e. 52.8% of mothers have completed secondary education, and 53.2% of fathers have secondary education. Mothers with higher education are 30.8%, compared to fathers with higher education 34.5%. A small proportion of the total number of participants have only completed primary

education, i.e. 14.0% (mothers) and 7.8% (fathers). 2.4 and 4.6% of mothers and fathers, respectively, have another type of education. According to the number of family members among participants, it is noted that the respondents live in a family: with two members 0.8%, three members with 6.1%, four members with 38.5%, while with five or more members 54.6%. Of the total number of participants, 9.9% are participants aged 15, 37.6% are aged 14, 32% are aged 13, and 20.4% are aged 12.

3.2 Body mass index of the participants

Figure 1 shows the body mass index (BMI) of all participants.

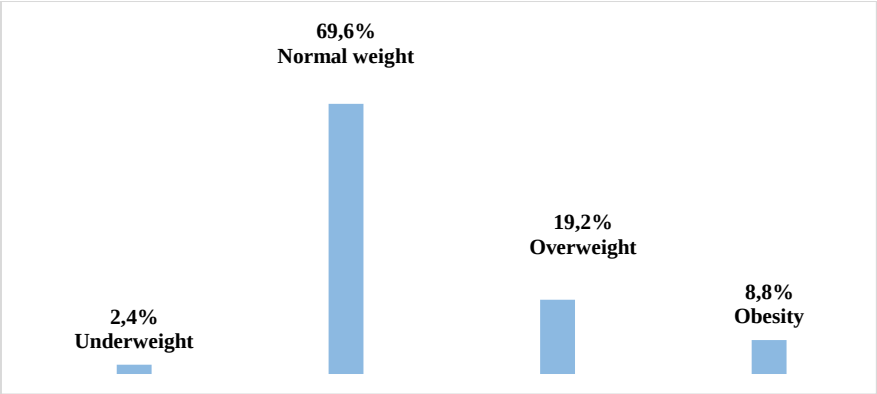

Figure 1. Nutrition category of the participants according to BMI

3.3. Cross-correlation of sociodemographic data with BMI

Table 1 presents the cross-reference of the two variables BMI and gender of the participants, all in order to see their statistical relationship.

Table 1. Cross-correlation of gender and BMI

Gender/ BMI	BMI categories				
	Underweight	Normal weight	Overweight	Obesity	Total
Female	6 (1,8 %)	262 (78,4 %)	50 (15,0%)	16 (4,8%)	334 (100 %)
BMI (%)*	42,9	63,4	43,9	30,8	56,3
Total (%)*	1,0	44,2	8,4	2,7	56,3
Male	8 (3,1%)	151 (58,3%)	64 (24,7 %)	36 (13,9 %)	259 (100%)
BMI (%)*	57,1	36,6	56,1	69,2	43,7
Total(%)*	1,3	25,5	10,8	6,1	43,7

Total	14 (2,4%)	413 (69,6%)	114 (19,2%)	52 (8,8%)	593 (100%)

BMI (%)* represents the percentage of adolescents who belong to a certain category of nutrition according to the BMI value.
Total (%)* represents the percentage of adolescents who belong to the given category within the total number of respondents.
After processing the data with the $\chi 2$ test, we obtained that $p = 0.000$ ($p < 0.05$), confirming that there is a statistical relationship between *BMI and gender* of the participants. A statistical relationship was also observed in the assessment between *BMI and age* of the adolescents, i.e. $p = 0.002$ ($p < 0.05$) (table 2).

Table 2. Cross-correlation of BMI and age

Age and BMI	BMI categories				
	Underweight	Normal weight	Overweight	Obesity	Total
12 years	1 (8 %)	74 (61,2 %)	28 (23,1%)	18 (14,9%)	121 (100 %)
BMI (%)*	7,1	17,9	24,6	34,6	20,4
Total (%)*	0,2	12,5	4,7	3,0	20,4
13 years	5 (2,6%)	128 (67,4%)	41 (21,6%)	16 (8,4%)	190 (100%)
BMI (%)*	35,7	31,0	36,0	30,8	32
Total (%)*	0,8	21	6,9	2,7	32,0
14 years	4 (1,8%)	161 (72,2)	40 (17,9)	18 (8,1)	223(100%)
BMI (%)*	28,6	39,0	35,1	34,6	37,6
Total (%)*	0,7	27,2	6,7	3,0	37,6
15 years	4 (6,8%)	50 (84,7%)	5 (8,5 %)	0 (0 %)	59 (100%)
BMI (%)*	28,6	12,1	4,4	0	9,9
Total (%)*	0,7	8,4	0,8	0	9,2
Total	14 (2,4%)	413 (69,6%)	114 (19,2%)	52 (8,8%)	593 (100%)

.BMI (%)* represents the percentage of adolescents who belong to a certain category of nutrition according to the BMI value.
Total (%)* represents the percentage of adolescents who belong to the given category within the total number of respondents.
When crossing BMI (%) and place of residence, the largest deviation is observed among children living in villages in the underweight category where there is not a single adolescents, while in the other three categories there are no major differences (table 3).

Table 3. Cross-correlation of BMI and place of residence

City/village	BMI categories				
	Underweight	Normal weight	Overweight	Obesity	Total
City	14 (2,9 %)	332 (69,2 %)	91 (19,0%)	43 (9,0%)	480 (100 %)
BMI (%)*	100	80,8	79,8	82,7	81,2
Total (%)*	2,4	56,2	15,4	7,3	81,2
Village	0 (0 %)	79 (71,2%)	23 (20,7%)	9 (8,1%)	111 (100%)
BMI (%)*	0	19,2	20,2	17,3	18,8
Total (%)*	0	13,4	3,9	1,5	18,8
Total	14 (2,4%)	411 (69,5%)	114 (19,3%)	52 (8,8%)	591 (100%)

BMI (%)* represents the percentage of adolescents who belong to a certain category of nutrition according to the BMI value.
Total (%)* represents the percentage of adolescents who belong to the given category within the total number of respondents.
With the $\chi 2$ - test we obtained that $p = 0.320$ ($p < 0.05$), which means that there is no statistically significant relationship between BMI and place of residence. According to Mladenova & Andreenko (2015) boys who live in the city have higher average BMI values, contrary to their peers who live in the villages and no statistically significant difference was observed, as in our research.
The relationship between BMI and nationality, in the category of underweight, Macedonians are 57.1%, Albanians are 14.3%, Turks are 21.4%, and Others are 7.1%. In the category of normal weight, the largest percentage of that category of adolescents are Macedonians 48.7% and Turks 36.1%. In the category of underweight, the largest percentage is Macedonians 52.6% and Turks 34.2%, while Albanians and other nationalities are very few in this category. The $\chi 2$ - test showed us that $p = 0.410$ ($p < 0.05$) and there is no statistical relationship between BMI and nationality of adolescents. According to Limbres et al. (2015), parents who gave greater importance to religious faith in shaping family life were associated with a lower percentile of the body mass index of children from 6 to 16 years of age.
From the processing of data on the relationship between *BMI and the level of education of the mother*, results were obtained indicating that the majority of adolescents with mothers who have secondary and higher education have normal weight. After processing the data with the $\chi 2$ - test, we obtained that $p = 0.05$ ($p < 0.05$), confirming that there is no statistical significance between BMI and the level of education of the mother. BMI and the level of education of the father of the adolescents, for BMI (%) no difference was observed in the categories of obesity among students who have fathers with different levels of education. Among adolescents who have fathers with primary education, a slight difference can be observed in the categories of nutrition (21.4% are underweight adolescents compared to adolescents with normal weight who include 6.8%, overweight 8.8% and obese 9.6%). The result of the statistical analysis $p = 0.322$ ($p < 0.05$), confirmed that there is no statistically significant correlation between *BMI and the father's level of education*. Stevens et al. (2012) found that the level of education of parents had a positive impact on nutrition and BMI in adolescents, which suggested that parents can play an effective role, since their nutritional knowledge and behavior would differ due to differences in the level of education.

Table 4 shows the relationship between BMI and the number of members in the family.

Table 4. Cross- correlation of BMI and number of members in the family

Family members	BMI categories				
	Underweight	Normal weight	Overweight	Obesity	Total
Two members	0 (0%)	3 (60,0 %)	0 (0%)	2 (40,0%)	5 (100 %)
BMI (%)*	0	0,7	0	3,8	0,8
Total (%)*	0	0,5	0	0,3	0,8
Three members	3 (8,3 %)	24 (66,7 %)	6 (16,7 %)	3 (8,3 %)	36 (100%)
BMI (%)*	21,4	5,8	5,3	5,8	6,1
Total (%)*	0,55	4,1	1,0	0,5	6,1
Four members	6 (2,6%)	152 (66,7%)	53 (23,2%)	17 (7,5%)	228 (100%
BMI (%)*	42,9	35,2	37,7	25,0	38,5
Total (%)*	1,0	25,7	9,0	2,9	38,5
Five members and more	5 (1,5%)	233 (72,1%)	55 (17,0%)	30 (9,3%)	323 (100%)
BMI (%)*	35,7	56,6	48,2	57,7	54,6
Total (%)*	0,8	39,4	9,3	5,1	54,6
Total	14 (2,4%)	412 (69,6%)	114 (19,3%)	52 (8,8%)	584 (100%)

BMI (%)* represents the percentage of adolescents who belong to a certain category of nutrition according to the BMI value.
Total (%)* represents the percentage of adolescents who belong to the given category within the total number of respondents.
The result obtained with the $\chi 2$ - test is $p = 0.047$ ($p < 0.05$) and there is a statistically significant relationship between *BMI and the number of family members.*

3.2 Food knowledge among adolescents: The results of the questions about food knowledge by adolescents are presented in Table 5.

Table 5. Questions and statements of adolescents about food knowledge

Why does food serve us?	It helps the body grow and develop	It protects us from diseases	We eat so that we are not hungry	Too much food causes diseases (obesity, diabetes...)	
Frequency / percentage	517 (88,5 %)	17 (2,9%)	29 (5,0%)	21 (3,6%)	
Where are carbohydrates most abundant?	potatoes, cereals, bread, pasta	honey, jam, fruits	Meat	marg arine/ butte r	chees e
Frequency / percentage	260 (45,9%)	222 (39,2%)	53 (9,4%)	27 (4,8 %)	4 (0,7 %)
Which food is rich in dietary/vegetable fiber?	cereals, fruits, vegetables	eggs	meat	milk	
Frequency / percentage	509 (87,8%)	40 (6,9%)	27 (4,7%)	4 (0,7%)	
Which food contains the most iron?	spinach, beets, cabbage	milk, cheese	rice, biscuits	orange juice	
Frequency / percentage	522 (90,0%)	42 (7,2%)	9 (1,6%)	7 (1,2%)	
Which food contains the most protein?	hamburger	puff pastry/bakery products	grilled fish	vegetables	
Frequency / percentage	446 (76,4%)	70 (12,0%)	62 (10,6%)	6 (1,0%)	
Which food contains the most protein?	eggs, meat, fish, dairy products, cereals	fruits	butter, vegetable oils	puff pastry	
Frequency / percentage	342 (91,2%)	17 (4,5%)	10 (2,7%)	6 (1,6%)	
Which food contains the most sugars?	still and carbonated juices	naturally squeezed vegetable and fruit juices	herbal tea/fruit tea	milk, yoghurt	
Frequency / percentage	540 (92,9%)	19 (3,3%)	6 (1,0%)	16 (2,8%)	

When cross-referencing the data between *BMI and food knowledge* at $p < 0.05$, we obtained the following: Why does food serve us? $p = 0.496$; Where are carbohydrates most abundant? $p = 0.521$; Which food is rich in dietary fiber? $p = 0.629$; Which food contains the most iron? $p = 0.955$; Which food contains the most fat? $p = 0.835$ and Which food contains the most protein?

p = 0.325. The results of the statistical analysis indicate that students have a high knowledge of food.

3.3 Lifestyle and physical activity: Table 6 and Table 7 present the results of the adolescents lifestyle and physical activity and the cross-referencing between *BMI and the frequency of daily and weekly physical activity*.

Table 6. Results of the questions related to the respondents' physical activity

How many times a week do you do physical activity?	No answer	I am not physically active	Sometimes/ Rarely	2-3 times a week	Every day	
Number of students/ Percentages	3 (0,5%)	7 (1,2%)	51 (8,6%)	220 (37,1%)	312 (52.6%)	
How much time during the day are you physically active?	No answer	I am not physically active	30 minutes a day	60 minutes a day	two hours a day	more than two hours a day
Number of students/ Percentages	4 (0,7%)	17 (2,9%)	101 (17,0%)	130 (21,9%)	152 (25,6%)	189 (31,9%)
How much time during the day do you spend in front of a screen?	did not answer	less than 1 hour per day	1-2 hours per day	more than 3 hours per day	most of the day	
Number of students/ Percentages	3 (0,5%)	67 (11,3%)	183 (30,9%)	216 (36,4%)	124 (20,9%)	

The $\chi 2$ test determined that $p = 0.145$ ($p < 0.05$), with no statistical relationship between these two variables (physical activity and BMI).

The relationship between *BMI and the frequency of daily physical activity* and this result confirms that, however, adolescents with normal weight have the most frequent physical activity, as follows: 30 min. per day are physically active 67.3% of adolescents, 60 min. are active 72.3% of adolescents, 2 hours per day 69.1% and more than two hours 70.9% of adolescents. The prevalence of daily physical activity of adolescents in the categories of overweight and obesity is much lower, which may affect the increased value of BMI. According to BMI (%), the lowest percentage of all obesity categories is observed in the answer to the question "I am not physically active", which shows us that there is still interest among adolescents and awareness of physical activity and everything that contributes to the development and maintenance of the body is increasingly developing.

Table 7. Cross-correlation of BMI and frequency of daily physical activity

How much time during the day are you physically active?	BMI categories				
	Underweight	Normal weight	Overweight	Obesity	Total
not physically active	0 (0%)	9 (52,9%)	2 (11,8%)	6 (35,3%)	17 (100 %)
BMI (%)*	0,0%	2,2%	1,8%	11,5%	2,9%
Total (%)*	0,0%	1,5%	0,3%	1,0%	2,9%
30 minutes a day	3 (3,0%)	68 (67,3%)	21 (20,8%)	9 (8,9%)	101 (100%)
BMI (%)*	21,4%	16,6%	18,6%	17,3%	17,1%
Total (%)*	0,5%	11,5%	3,6%	1,5%	17,1%
60 minutes a day	3 (2,3%)	94 (72,3%)	22 (16,9%)	11 (8,5%)	130 (100%)
BMI (%)*	21,4%	22,9%	19,5%	21,2%	22,1%
Total (%)*	0,5%	16,0%	3,7%	1,9%	22,1%
two hours a day	4 (2,6%)	105 (69,1%)	33 (21,7%)	10 (6,6%)	152 (100%)
BMI (%)*	28,6%	25,6%	29,2%	19,2%	25,8%
Total (%)*	0,7%	17,8%	5,6%	1,7%	25,8%
more than two hours per day	4 (2,1%)	134 (70,9%)	35 (18,5%)	16 (8,5%)	189 (100,0%)
BMI (%)*	28,6%	32,7%	31,0%	30,8%	32,1%
Total (%)*	0,7%	22,8%	5,9%	2,7%	32,1%
Total	14 (2,4%)	411 (69,6%)	113 (19,2%)	52 (8,8%)	590 (100,0%)

BMI (%)* represents the percentage of adolescents who belong to a certain category of nutrition according to the BMI value.
Total (%)* represents the percentage of adolescents who belong to the given category within the total number of respondents.
The p=0.131 ($p < 0.05$), indicating no statistically significant association between *BMI and frequency of daily physical activity.* The global prevalence of adolescents aged 13 to 15 years attending school who did not meet the WHO and US guidelines for physical activity of 60 minutes or more of moderate-to-vigorous intensity daily activity was 80.3% (Hallal et al., 2012). For adolescents aged 11 to 17 years, a similar global prevalence of 78.4% for boys and 84.4% for girls was shown (Sallis et al., 2016).
From our results, which were made by crossing *BMI and frequency of physical activity during the week*, it can be seen that adolescents with normal weight (71.8%) are active every day, while

65% of adolescents are active 2-3 times a week. In the category of overweight, lower physical activity is already observed, so 20.5% of adolescents are represented 2-3 times a week and 19.6% of adolescents in this category are physically active every day. In the category of obesity, a higher percentage of adolescents who are not physically active at all (28.6%), while 19.8% of adolescents in this category are sometimes active. 10.5% of adolescents in the obese category practice physical activity 2-3 times, while 7.1% of adolescents in this category are physically active every day. Obesity can occur due to physical inactivity (Hallal et al., 2012; Sallis et al., 2016). According to BMI (%), of those adolescents who have physical activity 2-3 times a week, 64.3% are underweight, 34.8% are normal weight, 39.8% are overweight and 44.2% are obese, and of adolescents who are physically active every day, 35.7% are underweight, 54.5% are normal weight, 54.0% are overweight and 42.3% are obese. A very small proportion of adolescents are less physically active. The $\chi 2$ test yielded a value of $p = 0.131$ ($p < 0.05$), which does not indicate a statistical relationship between BMI and the frequency of weekly physical activity.

When connecting *BMI and the duration that students spend in front of a screen* during the day, in the category of overweight, it can be noted that 20.2% of adolescents spend less than one hour and 1-2 hours a day in front of a screen. In the category of obesity, 10.4% of adolescents spend less than one hour in front of a screen, and 12.1% of adolescents spend most of the day in front of a screen. In the category of overweight, where 18.5% of adolescents spend more than three hours a day in front of a screen, and 17.7% spend most of the day in front of a screen. According to BMI (%), no major differences are observed in all the answers offered and compared to all categories. By applying the $\chi 2$ test, we obtained a value of $p = 0.686$ ($p < 0.05$), i.e. the results of our research did not confirm a statistically significant relationship between screen time and BMI in adolescents. The answers to the *question of what is most often consumed while spending time in front of a TV screen or computer* showed that the largest percentage of adolescents consume chocolate (underweight are a total of 50.0%, normally weight are 37.2%, overweight are 24.1% and obese are 34.7%). The least of the adolescents in all categories are those who consume fruit while spending time in front of a computer or TV (underweight 0%, normal weight 6.6%, overweight 9.8% and obese 6.1%). When processing the results for the relationship between BMI and the answer to the question with the $\chi 2$ test, a result of $p = 0.141$ ($p < 0.05$) was obtained, i.e. no statistically significant relationship was determined. For the *factor sleep duration*, according to BMI (%), of all categories of BMI, the majority of adolescents reported sleeping 7-8 hours (underweight 64.3%, normal weight 55.0%, overweight 58.4% and obese 53.8%). According to the $\chi 2$ test, $p = 0.406$ ($p < 0.05$), and there is no statistically significant association between BMI and time spent sleeping. According to Alison et al., (2015), more variable sleep time in a given week is associated with higher energy intake, regardless of total sleep duration, screen time and demographic factors.

4. Conclusion

This study assessed the relationship between certain factors and body mass index in adolescents in primary schools in Gostivar. Possible influencing factors included gender, age, place of residence, nationality, education of parents and number of family members. From the results, it can be concluded that gender, age and number of family members have a statistically significant correlation with body mass index. We believe that knowledge of food is also a significant factor in the choice of food by adolescents. The study showed that adolescents know the composition of food, know important information about food and this may be a factor that influences the majority of participants to have a normal weight. Physical activity, type and frequency, were also taken into account in this study, where it was shown that adolescents practice physical activity as they age, which would indicate an increase in awareness of the impact of activity on

their appearance. Sleep duration as a factor, the time that adolescents spend in front of a computer or TV screen, the type of food they consume while in front of the screen, have been shown to have no statistically significant correlation with body mass index and that most adolescents sleep the recommended number of hours. We recommend education for acquiring eating habits that are conducive to (promote) good health, active involvement of adolescents, teachers, parents, local and national authorities who have an influence and role in achieving a healthy population. Additional research in the future may clarify whether nationality, education, or place of residence significantly affect BMI when controlling for other variables such as age, gender, and physical activity.

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