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Original scientific paper

Correlation of Nutrition and Physical Activity on BMI Values in Adolescents

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ABSTRACT: Proper nutrition and regular physical activity from early childhood are important prerequisites for healthy growing up. Conversely, in children and adolescents, over time, there may be an increase in the body mass index (BMI), which results in the development of obesity. **The goal**. The main goal of the paper is to point out the correlation between proper nutrition and BMI values in adolescents of the secondary medical school in Bihać. **Methods**. The respondents are students of both sexes, from the first to the third grade of the secondary medical school in Bihać, aged 15 to 17. The total number of students included in the research was 120. The time of data collection is 04.11. - 29.11.2022. year The respondents were divided into two groups, working and control, with 60 students in each group. The working group consisted of students from first to third grade who had irregular food intake during the week (≤ 1x-2x a week) and were physically inactive. The control group consisted of students from the first to the third grade who had a proper food intake (2x or ≥3x a week) and were physically active (≥3x a week for 60 min). **Results**. Mean values of BMI (29.14 kg/m^2) in students of the work group from I-III grades who had irregular food intake (≤ 1x-2x a week) and were not physically active in relation to BMI (21.79 kg/m^2) of the control group of I-III graders who were physically active and had a proper food intake (≥ 3x per week) is statistically significantly different in favor of the control group of students (p=0.039). **Conclusion.** Proper food intake with regular physical activity in adolescents has positive effects on BMI values and represents an important segment in the prevention of obesity in adults and older people.

Key words. Proper nutrition, body mass index, physical activity, adolescents

INTRODUCTION

Nutrition, in addition to physical activity, is a very important segment in the proper growth of children and adolescents, ie. their proper growth and development from early childhood. The need for food is a feature of all living beings, and it takes place constantly through the process of changing certain substances, i.e. the process of the death of some and the creation of other, new cells needed for the proper functioning of the organism. For that process, it is necessary to ingest food in order to "draw" certain building materials from it and create the necessary energy for proper growth and development. For the proper functioning of the organism, it is necessary to make a proper choice of ingested food because proper nutrition is considered one of the most important factors of human life, health and development in general (Dobročinac et al., 2019). The term food refers primarily to foodstuffs in raw, semi-processed or combined form for the purpose of human nutrition. Foods that are most common in the human diet include cereals, milk and milk products, meat, fish, vegetables, fruits, visible fats and oils, sugars and concentrates. Food also includes additives used in preparation, water and various types of beverages that come in different forms. The modern food production industry enables the production of improved quality foodstuffs as well as the adjustment of their nutritional content, i.e. value, and the production of a large number of foods (organically produced food or genetically modified food) (Backović et al., 2014). According to Grujić et al., (2007) there are different criteria for the division of foodstuffs, so in relation to their origin, foodstuffs are divided into: foodstuffs of plant, animal and mineral origin. All of them are very important for the proper growth and development of

children and adolescents and must be equally represented in their daily diet. A proper, balanced diet, which is important for the normal growth of children and adolescents, and which consists of three main meals and two snacks, supplies the body with all the necessary substances such as proteins, carbohydrates, vitamins and minerals (Petraš, 2022). The modern way of life has a negative effect on nutrition because people do not have time to cook and therefore eat "fast food" which is easily available and unfortunately unhealthy. Children's eating habits are acquired in early childhood and are influenced first by the parents with their behavior model and later by the environment and peers with the dominance of one or the other depending on the age of the child (Stojisavljević et al., 2013). That is why Bogl (2020) believes that parents represent the primary social context and pattern of behavior in the approach to nutrition and physical activity that children adopt and develop as healthy or unhealthy lifestyles. In children, we find that the most common form of behavioral change is a change in eating habits (Stojisavljević et al. 2013). Imbalance in caloric intake and physical activity in childhood is the main cause of obesity in children and adolescents with a significant role of environmental factors (Lee, Yoon. 2018). In accordance with these theses, Lobstin and Jackson-Leach (2006) claim that obesity in childhood can be the beginning of the development of chronic conditions and diseases in adulthood and old age. Therefore, against the obesity epidemic, it is necessary to create a healthy environment and preventive measures at the level of the social community (WHO, 2011). In most countries, according to scientific data, children and adolescents have a low prevalence of the overall level of physical activity, i.e. a high prevalence of sedentary behavior, which includes time spent awake, sitting or lying down with low energy expenditure (watching television, working on a computer, using smartphones and etc.) which ultimately leads to a serious increase in the prevalence of obesity (Zhu et al., 2019). It is considered that physical inactivity with inadequate nutrition is the main cause of health problems in children and adolescents and can lead to serious diseases, including heart diseases, so Štimac et al. (2017) recommend developing a proper nutrition program in cooperation with doctors. Also, in accordance with the previous one, the recommendation of the World Health Organization (WHO) is that children and young people spend at least 60 minutes a day in some physical activity of medium intensity, all with the aim of preventing obesity (WHO, 2022). However, considering the worrying epidemiological data in the direction of the increase in obesity and obesity among children and adolescents, the member states of the WHO set an important goal until 2025 in order to stop this negative trend and approved the project under the slogan "No increase in excess body weight and obesity" (Baran, 2022; WHO, 2022). Improper nutrition accompanied by a lack of physical activity in childhood and adolescence leads to an increase in overweight and the appearance of obesity already in preschool age, which will represent a very serious health problem in the 21st century (Jurić, 2023).

Objective

The objective of our work is to examine the correlation of proper nutrition and physical activity on BMI values in adolescents of the secondary medical school in Bihać.

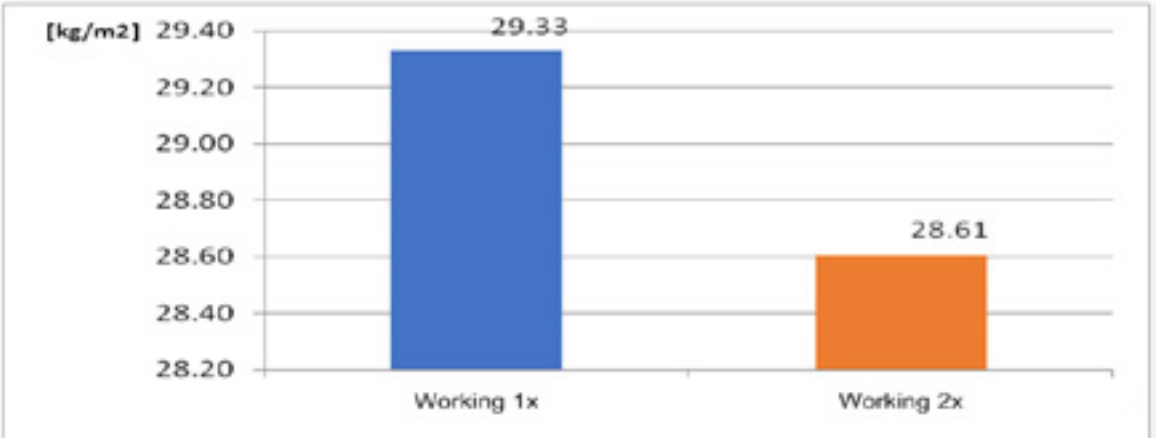
METHODS AND RESPONDENTS

The respondents were students from the first to the third grade of the secondary medical school in Bihać, aged 15 to 17, of both sexes. The total number of students in the research was 120. The time of data collection is the period from 04.11. - 29.11.2022. year. The respondents were divided into two groups, working and control, with 60 students in each group. The working group consisted of students from first to third grade who did not engage in any physical activity in their free time and whose food intake was insufficient (≤ 1x-2x a week). The control group consisted of students from the first to the third grade who en-

gaged in physical activity 1x-3x a week for up to 60 minutes, during free time and had a proper food intake (≥ 3x a week). Anthropometric measurements of body height and weight were performed on the subjects in order to calculate the BMI value, and were carried out on an Omron scale (BF 511/201-107-00214F/ 2018/ Amsterdam). In order to investigate the relationship between BMI on the one hand and dietary intake and physical activity on the other hand, a separate survey questionnaire was created in the form of a test with provided answers. For the purpose of data processing, the arithmetic mean method was applied, and the results were presented graphically. The data were processed in MS EXCEL to determine the arithmetic mean (AVERGE) and the statistical value p (STAT-p).

RESULTS

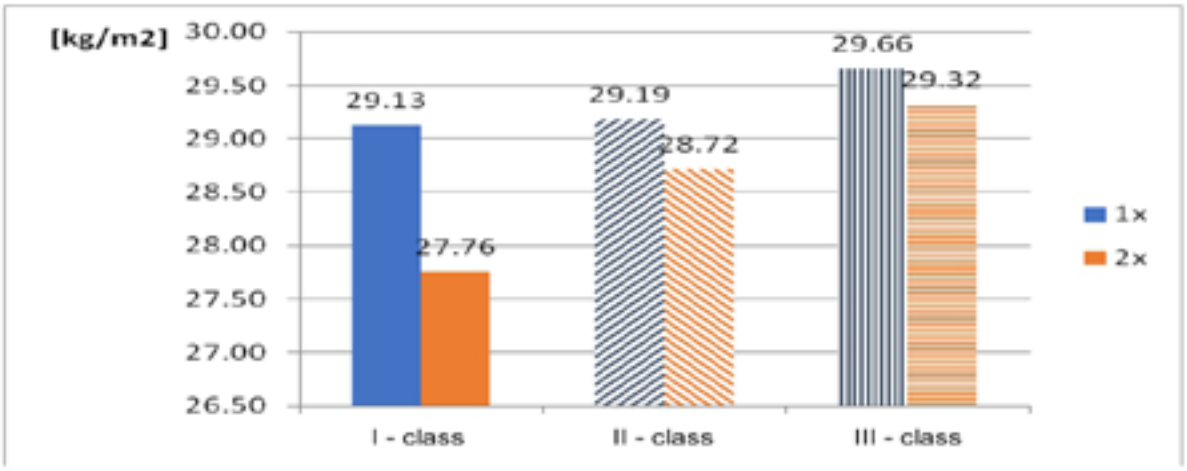
In our study, 120 students of both sexes, from the 1st to the 3rd grade of the secondary medical school in Bihać, aged 15-17 years, were included. The respondents were divided into two groups - a working group and a control group, 60 students each. The working group consisted of 29 boys and 31 girls who did not have proper food intake during the week (≤ 1x-2x) and were physically inactive. The control group consisted of 28 boys and 32 girls, who had a proper food intake during the week (≥ 3x a week) and were physically active (1x-3x a week, min. 60 minutes). Graph 1 shows the mean BMI value of the working group with irregular food intake (≤1x per week and no physical activity) and is 29.33 kg/m², while the BMI value of the working group with 2x weekly food intake was 28. 61 kg/m².



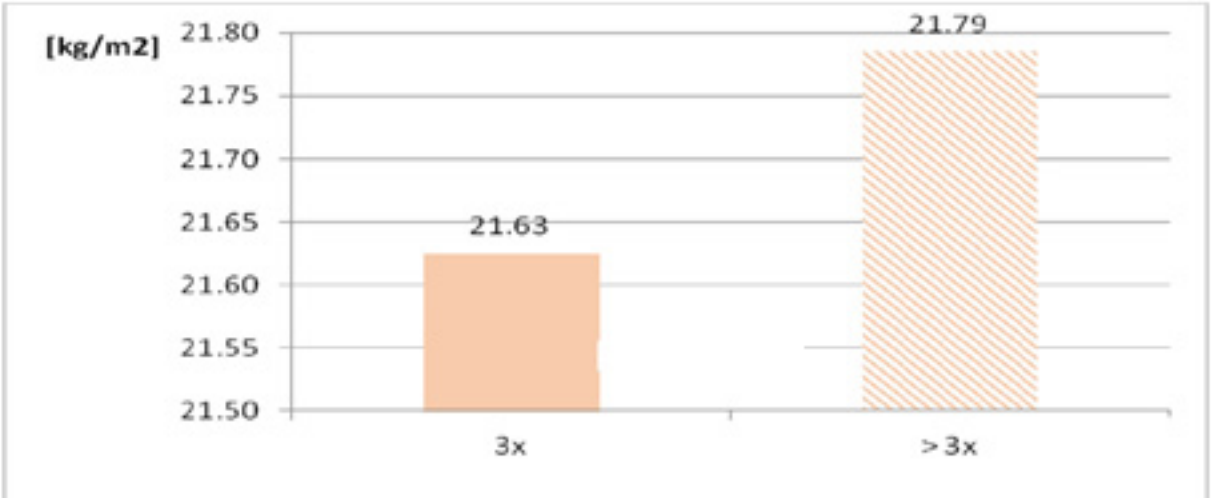
Graph 1. BMI values of the working group of subjects with proper food intake 1x & 2x a week

Graph 2 shows the mean values of BMI in the working group from I to III grades in relation to insufficient food intake ≤1x and 2x per week. When we compare the mean values of BMI, we see that the biggest statistically significant difference is in the first grade (p= 0.025), and the smallest in the third grade, i.e. Grades I have the lowest mean BMI, and Grades III the highest. In classes that have a more regular food intake during the week (2x per week), the mean BMI value is lower compared to the BMI values of classes that have insufficient food intake (≤1x per week).

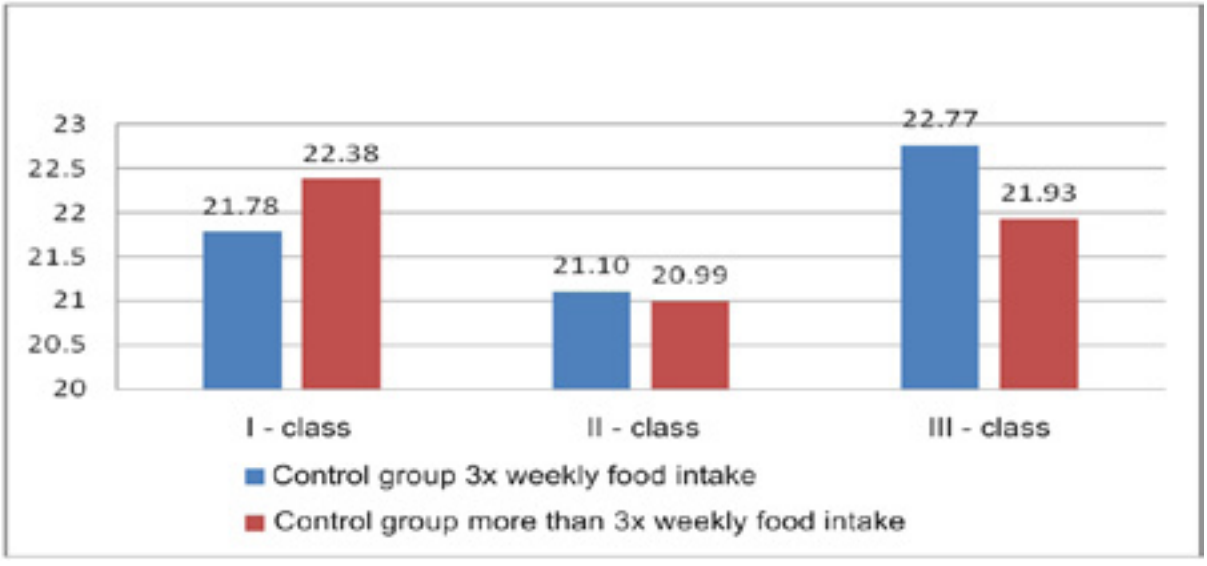
A comparison was also made of the mean value of BMI in subjects of the control group who have a proper food intake (3x and > 3x per week) and are physically active, which is presented in Graph 3. The mean value of BMI in subjects who consume food 3x per week is 21.63 kg/m², and for respondents who eat food more than 3 times a week, it is 21.79 kg/m², which does not represent a significant statistical difference (p=2.043). The study showed that there is no significant difference in BMI values between classes I-III in this regard (graph 4).



Graph 2. BMI values in the working group I-III class according to food intake 1x and 2x a week

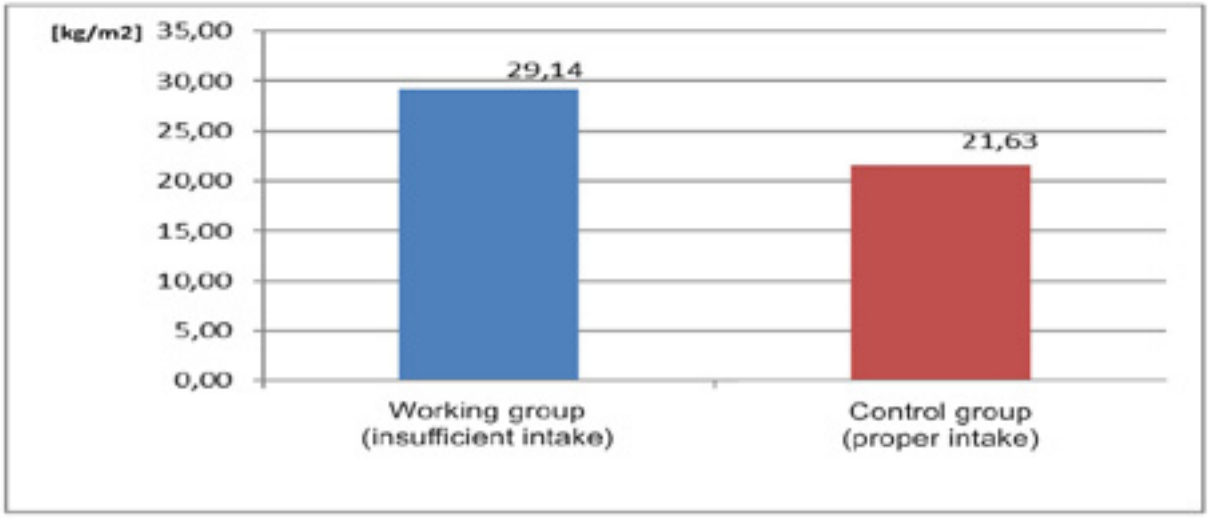


Graph 3. BMI values of the control group with food intake 3x and >3x a week



Graph 4. BMI values of the control group I-III classes in relation to food intake 3x or > 3x a week

Comparing the BMI values of the working group of subjects who have an insufficient food intake and are not physically active, with the BMI values of the control group of subjects, who have a proper food intake (≥ 3x) per week and are physically active (1x-3x per week up to 60 minutes) the results obtained show that there is a statistically significant difference between these two groups in this respect. The BMI value of the working group was 29.14 kg/m², compared to the control group where the BMI value was 21.63 kg/m² (p= 0.039) (graph 5).



Graph 5. Mean value of BMI of the working and control groups

DISCUSSION

Our research involved 120 students, of both sexes, from the secondary medical school in Bihać, aged 15 to 17. They were divided, 60 students each, into a work group and a control group. The study showed that students in the work group, who were physically inactive and had irregular/insufficient food intake during the week (≤ 1x-2x per week) had increased BMI values, i.e. they were obese. The results of the study showed that the mean value of BMI among the students of the working group by grade was: in the first grade 29.13 kg/m², in the second grade 29.19 kg/m², and in the third grade 29.66 kg/m², without statistical significance (p= 2.029). Our results are in line with other scientific studies that confirm that the absence of physical activity, along with improper food intake and a sedentary lifestyle, plays a very significant role in the development of obesity among young people, especially in urban areas (Petrinjak, 2021). Literature data show that 80% of adolescents worldwide are insufficiently physically active (Guthold et al., 2020), and that regular physical activity reduces the risk of heart disease, obesity and cancer (Coyle, 2009) and has a positive effect on psychological well-being. well-being, lower stress levels and better cognitive function (Dewi et al., 2021). However, despite numerous examples of the positive effect on people's health of engaging in physical activity, the number of people who regularly exercise is declining, according to the results of a study by Armstrong and associates (2000). Namely, already in adolescence, the level of physical activity begins to decline, which is confirmed by the results of longitudinal studies that indicate that the decrease in physical activity begins at an earlier age, around the age of 9 (Armstrong et al., 2000).

Our study showed a positive correlation of proper nutrition and physical activity on BMI values in adolescents of the secondary Medical School. Namely, the research showed that the BMI values of the control group of respondents were significantly lower (21.63 kg/m2) compared to the BMI values of the

working group (29.14 kg/m2) (p= 0.039). Literary data show that a proper, balanced diet is very important for the physical and psychological well-being of children. And in order for children to be healthy and in good physical condition, the best way to achieve this is to provide them with a healthy diet from the earliest childhood and to point out its importance to them so that even later in life as adults they will know how to choose properly (Kellow , 2006). Physical activity is always added to a healthy diet as an important health factor for the development of bones, muscles and internal organs in children and adolescents, and of course it also affects the mental health of the individual, which allows him to feel good and raise his mood (Pejčić and Trajkovski, 2018). Numerous scientific studies, including the study by Maslad (2020), show that physical inactivity and improper diet, as well as artificially grown food, are decisive risk factors for obesity, i.e. their elimination is important in the prevention of overweight and obesity in adolescents. That is why parents have a great responsibility to positively influence the formation of proper eating habits of their children with essential physical activity from the earliest childhood with their behavior model.

Busy lifestyle, stress, lack of time and will lead many families to often eat unhealthy food, so-called "fast food" or order from restaurants, and cook less and less at home (Jurić, 2023). Children often adopt these irregular eating patterns or change their eating habits under the influence of their peers, which can lead to serious health problems and the development of obesity already in elementary school children. As in adults, obesity in childhood can lead to the development of cardiovascular problems, childhood hypertension, diabetes, problems related to joint diseases, and breathing problems during sleep (Komnenović, 2010). Type 2 diabetes (T2D) used to be very rare in children and adolescents, but unfortunately the number of affected children is increasing every year, ie the number of children with insulin resistance and T2D is doubling every year. These diseases in later life can be an important risk factor for the development of heart disease, stroke and kidney failure. Research by Gavin and colleagues, unfortunately, indicates that diabetes can increase the risk of developing Alzheimer's disease (Gavin et al., 2007). It is important to emphasize that energy and nutritional needs are greatest during adolescence, that is, in this period of human life they reach their maximum. These needs certainly vary and depend on many factors such as growth, development, body size and physical activity. The difference in energy needs also exists between the sexes, in the male sex they are increased because they grow and develop faster than the female sex, especially if we consider the aspect of increasing the mass of muscle tissue. Also, the level of physical activity and diet play an important role in the formation of body composition, its metabolic composition and BMI values in children and adolescents (Kim OY et al., 2020). The results of some scientific studies have shown that proper nutrition of children and adolescents has a greater influence on BMI values than physical activity (Šabanović et al. 2012), without diminishing the importance of physical activity. The results showed that only 3.79% of the respondents had a quality diet, even 75.35% of the respondents needed to correct their diet, while 20.96% of the respondents had an unsatisfactory diet. About 90% of respondents had a moderate and low rate of physical activity, and 13.13% of respondents were obese. Proper food intake and physical activity remain a "winning combination" for healthy growth, i.e. proper growth and development of children and adolescents.

CONCLUSION

Proper food intake during the week with regular physical activity in adolescents has positive effects on BMI values and represents an important segment in the prevention of obesity in children and adolescents, which can be reflected later in adulthood and old age.

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