ASSESSMENT OF FITNESS AND BODY WEIGHT FOR PROPHYLACTIC PURPOSES IN MIDDLE SCHOOL STUDENTS

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Abstract. Studies indicate that maintaining a good level of fitness and appropriate body weight is crucial for the physical, cognitive, and emotional development of children. Good fitness reduces the risk of obesity, chronic diseases, and improves academic performance and overall well-being. Eurostat data shows that only 26% of children aged 6 to 9 and 22% of those aged 10 to 12 participated in organized sports activities in 2019. According to the World Health Organization (WHO), approximately 19% of children aged 5 to 19 were overweight or obese in 2016. The aim of this study is to analyze the importance of assessing fitness and body weight in preventing health issues among middle school students, focusing on prophylactic perspectives. Correct evaluation of these aspects is crucial for early identification of risk factors and for implementing appropriate physiotherapeutic interventions. Increased screen time and decreased physical activity can lead to an increased risk of obesity and associated health problems among primary school children. A sample of 166 middle school students from Oradea-Bihor County (Romania), including 84 girls and 82 boys, participated in the study, who underwent the following tests summarized below. The results revealed that the average weight for boys is 59.53 kg, while for girls it is 55.03 kg. The average age is 14.02 years. Additionally, the average BMI is 57.10 (percentiles), with boys having an average BMI of 58.23 (percentiles and girls 55.91 (percentiles). The average obesity grade is 101.13, with the lower limit being 90 and the upper limit being 125. Notably, 23 boys were found to be below the lower limit, while 27 were above the upper limit.

Keywords: fitness, body weight, middle school students.

Introduction

In Romania, according to the National Study on the Prevalence of Diabetes, Prediabetes, Overweight, Obesity, Dyslipidemia, Hyperuricemia, and Chronic Kidney Disease (PREDATORR), 31.4% of adults aged 20 to 79 suffer from obesity. Among them, 21.5% have grade I obesity, 7.2% have grade II obesity, and 2.7% suffer from morbid obesity. Regarding overweight, 34.6% are affected. The World Obesity Federation estimates that, without drastic prevention and treatment measures, by 2030, nearly 500,000 children aged 5 to 19 will suffer from obesity in Romania. (aipnsf.ro/studiu-obezitatea-in-romania)

Over the course of 10 years, the number of obese children in Romania has steadily increased from 2.2% to 13.9%. These results are presented in the report on childhood obesity surveillance, COSI, from round I (2007–2008) and, respectively, in Romania's national report from round five of COSI (2018–2019). According to the data from COSI round I in Romania, 4,274 children (ages 6–9) were examined, and 2.2% were identified as obese, with 3.8% being boys and 0.5% being girls (Spinelli, 2019).

According to the national report of Romania from round five of COSI, 10,393 children aged 7–9 were examined, with 16.4% of boys and 11.6% of girls being obese, resulting in a total of 13.9% obese children (Assessment of the nutritional status of primary school children

according to the WHO through participation in the 'European Childhood Obesity Surveillance Initiative (COSI)', National Report Romania (2020)).

In the quest for optimal health during the formative years of middle school, understanding and managing Body Mass Index (BMI) has emerged as a crucial tool. This metric not only serves as an indicator of fitness but also plays a significant role in identifying potential health risks associated with obesity and underweight conditions among adolescents. The importance of assessing fitness and body weight in middle school students cannot be overstated, given the rising concerns surrounding childhood obesity and its long-term impacts on health. By acknowledging BMI as a pivotal component of health assessments, educators, and health professionals pave the way for more targeted and effective interventions in school settings. (Wohlfahrt-Veje et al, 2014). Achieving and maintaining an appropriate level of aerobic fitness is a critical educational outcome for physical education programs. Research indicates that a healthy aerobic fitness level, as defined by criterion-referenced standards, significantly correlates with academic performance in middle school students. Extensive data from statewide and national studies support these findings, showing a consistent association between physical fitness and better academic outcomes (Committee on Physical Activity and Physical Education in the School Environment, 2013). In middle school students, the relationship between physical fitness and academic performance extends beyond general health. For instance, fitness levels in boys and weight status in girls have shown significant correlations with both health status and academic achievements across various behavioral backgrounds. This highlights the importance of personalized fitness assessments in schools to address specific needs based on gender and individual health profiles (Invang et. al., 2018).

Educational institutions play a crucial role in fostering environments that support physical activity and fitness assessments. Implementing youth fitness testing with modern technologies and self-testing methodologies could address privacy concerns and the misuse of testing results, making the process more engaging and less intrusive. This approach not only promotes a physically active lifestyle among students but also integrates health-related fitness education into school curriculums effectively (Keating, 2019). Obesity rates among children and adolescents have shown a troubling increase globally. In England, for instance, the proportion of overweight and obese children aged 10 to 11 rose from 35.2% in 2019-2020 to 40.9% in 2020-2021, and despite a slight decrease afterward, rates remained higher than pre-pandemic levels. This trend indicates an additional 56,000 children falling into the overweight or obese category, highlighting a significant public health concern (Mavilidi et al., 2019). In the United States, the situation mirrors this alarming trend. Over the past three decades, the prevalence of childhood and adolescent obesity has more than doubled in children and tripled in adolescents. Data from the National Health and Nutrition Examination Survey (NHANES) for 2015-2016 show that 18.5% of US children and adolescents were obese. This prevalence was notably higher among adolescents aged 12-19 years at 20.6%, and school-aged children aged 6-11 years at 18.4%. The data also revealed significant racial and ethnic disparities, with non-Hispanic black (22.0%) and Hispanic (25.8%) children and adolescents experiencing higher rates of obesity compared to their non-Hispanic white (14.1%) and Asian (11.0%) peers (Sanyaolu et al., 2019). Childhood obesity is influenced by a combination of genetic and environmental factors. Genetic predisposition plays a significant role, particularly when combined with lifestyle choices such as diet and physical activity levels. Research indicates that certain ethnic

groups are more prone to obesity due to genetic factors. For instance, in the United States, Hispanic children have the highest prevalence of obesity at 26.2%, followed by non-Hispanic Black children at 24.8%, non-Hispanic White children at 16.6%, and non-Hispanic Asian children at 9%. These disparities highlight the complex interplay between genetics, ethnicity, and environmental factors in the prevalence of childhood obesity (Song et al., 2021).

Education and policy also significantly impact the prevalence of obesity among children. Educational attainment can influence health outcomes through various mechanisms, including socioeconomic status, health literacy, and health behaviors. Studies have shown that lower educational levels are often associated with higher rates of obesity, particularly in lower-income countries. This relationship is also influenced by gender and the economic development level of the country, suggesting that education policies could be potent tools for obesity prevention. Furthermore, the presence of policies that promote physical activity and regulate food quality in schools can play a pivotal role in preventing obesity by creating healthier school environments and improving students' lifestyle choices (Cohen et al., 2013).

Regular physical activity in schools supports growth and development, offering extensive benefits for students' physical, mental, and psychosocial health, which contribute significantly to their learning. It reduces the risk of numerous health issues such as heart disease, diabetes mellitus, osteoporosis, high blood pressure, obesity, and metabolic syndrome. Furthermore, it enhances aerobic capacity, muscle and bone strength, flexibility, insulin sensitivity, and lipid profiles. By incorporating varied physical activities, including aerobic and resistance exercises, schools can provide a comprehensive health benefit, addressing unique health concerns through distinct types of physical activities (Committee on Physical Activity and Physical Education in the School Environment, 2013).

Physical activity is crucial for improving mental health by decreasing and preventing conditions such as anxiety and depression, while also enhancing mood and overall well-being. Schools play a pivotal role in promoting physical activity, which has been shown to improve self-concept, social behaviors, goal orientation, and notably, self-efficacy. These psychosocial outcomes are critical for encouraging continued engagement in physical activities. Regular physical activity has been associated with lower levels of morbidity and healthcare expenditures, highlighting its role in fostering a healthier mental state (Mahindru et al., 2023).

Methodology

Objectives

The aim of this study is to analyze the importance of assessing fitness and body weight in preventing health issues among middle school students, focusing on prophylactic perspectives. Correct evaluation of these aspects is crucial for early identification of risk factors and for implementing appropriate physiotherapeutic interventions. Increased screen time and decreased physical activity can lead to an increased risk of obesity and associated health problems among primary school children.

Research question

- 1) Why is BMI considered important for assessing fitness?
- 2) What is the relationship between BMI and physical activity?

- 3) How can physical activity be encouraged among middle school children?
- 4) What are the advantages of using BMI as a method to assess body fat?

Participants

A sample of 166 middle school students from Oradea-Bihor County (Romania), including 84 girls and 82 boys, participated in the study, who underwent the following tests summarized below. The results revealed that the average weight for boys is 59.53 kg, while for girls it is 55.03 kg. The average age is 14.02 years.

Instruments

Anthropometric examination involved precise measurements of body parameters, such as height, weight, to assess body composition and tissue distribution in the body. A quality life assessment questionnaire was administered to evaluate various aspects of quality of life, including physical activity levels, dietary behaviors, and emotional well-being, through the PedsQL[™] questionnaire (Pediatric Quality of life inventory). Calculation of the physical activity index evaluated the level of physical activity among students, considering time spent in moderate and intense physical activities. Calculation of body parameters and skinfold measurements were conducted using standardized methods to calculate BMI, optimal weight, real lean mass, real adipose tissue by using the Inbody 770 device.

Body Mass Index (BMI) is an essential tool used to measure body weight relative to height, providing a standardized metric to assess growth patterns and potential health risks in children. It is calculated by dividing a person's weight in kilograms by their height in meters squared (kg/m²). For children, BMI calculations are adjusted for age and sex, using percentile charts to reflect normal growth and body composition changes during development (Nihiser et al., 2007).

BMI categories are defined using specific percentile ranges established by health authorities such as the CDC. These categories help identify children who may be underweight, at a healthy weight, overweight, or obese:

Underweight: Less than the 5th percentile

Healthy Weight: 5th to less than the 85th percentile

Overweight: 85th to less than the 95th percentile

Obese: Equal to or greater than the 95th percentile

These categories are crucial for screening as they guide further assessments and interventions. Children identified as overweight or obese are at a higher risk for various health issues, such as cardiovascular diseases and diabetes, and may require additional medical evaluations and lifestyle modifications. Conversely, those categorized as underweight might need assessments to identify potential undernutrition or other underlying health conditions. Regular BMI monitoring in schools, using accurate methods like electronic or beam balance scales for weight and stadiometers for height, ensures reliable data to assess and address the health needs of students. This proactive approach in schools is vital for early identification of potential health risks, allowing timely interventions that can significantly alter a child's health trajectory (Zapata et al., 2023).

Results

This study was conducted among 166 middle school students. These students, full of youthful energy and dreams, embarked on a journey to uncover insights about their health and physical activity. Among them were 84 spirited girls and 82 enthusiastic boys, all around the age of 14.

As the study progressed, it became clear that boys and girls had their own unique health profiles. On average, the boys weighed 59.53 kilograms, their sturdy frames carrying a bit more weight compared to the girls, who averaged 55.03 kilograms. The difference in their physical makeup was further highlighted by their Body Mass Index (BMI) – a measure that considers both height and weight. The boys had an average BMI of 58.23 percentiles, while the girls had a lower average BMI of 55.91 percentiles.

This higher BMI among boys suggested a greater body mass relative to their height. But what did this mean in terms of their overall health? To dig deeper, the researchers looked at the obesity grades, a crucial indicator of health risks. The average obesity grade for the students in the study was 101.13, as measured using the InBody 770 device. This grade was used to categorize the students based on a benchmark that included a lower limit of 90 and an upper limit of 125. The data collected from the InBody 770 provided an accurate assessment of body composition, including measures of obesity, allowing for more precise health evaluations and targeted interventions for the students.

By using this method, it was possible to categorize students into specific obesity ranges and tailor health and fitness programs to address their individual needs. The findings were eyeopening. Twenty-three boys were found to be below the lower limit, suggesting that they were at a healthier weight range. However, a more concerning number -27 boys – were above the upper limit, indicating higher levels of obesity. This imbalance highlighted a significant health challenge among the boys, with a notable segment facing risks associated with higher obesity levels.

From PedsQLTM questionnaire, the Physical Health scale indicate a moderately good level of physical health among the group, with room for improvement. A score of 81.25 suggests that the children generally perceive their physical health as positive, but not exceptional. While it falls within a relatively healthy range, it still reflects some variability in individual experiences or health conditions.

While some children report very little or no physical activity, as shown by the 83 children who selected "Never," the majority of children are still somewhat active, with 50 children selecting "Almost Never" and 25 choosing "Sometimes." Only a small number of children reported engaging in physical activity more frequently, as indicated by the 8 children who selected "Often." This suggests that most children are not sufficiently active, with a notable portion showing low or irregular levels of physical activity, but there is also a smaller group that engages more regularly in physical exercise.

This score could indicate that some children may experience occasional physical limitations or lower levels of perceived well-being, possibly due to factors such as less frequent physical activity or underlying health issues. The Physical Activity Index (PAI) would help further clarify the reasons for these perceptions, emphasizing the need for interventions to enhance physical activity levels and overall health.

Despite these challenges, the boys showed a commendable level of physical activity (Table 2.). The study showed that boys had a higher Physical Activity Index (PAI) of 58, indicating more frequent or intense engagement in physical activities compared to the girls, who scored a PAI of 46. This difference suggests that boys, on average, were more physically active, either due to engaging in activities with greater intensity or participating in them more often (Figure 1.). This difference indicated that boys were generally more active, engaging in physical activities with greater frequency or intensity (Table 1.).

The findings align with existing research that highlights gender differences in physical activity levels, with boys typically participating in more vigorous physical activities, such as sports, while girls may engage in less intense physical activities (e.g., walking or recreational play). The observed difference in PAI scores underscores the importance of tailoring physical education programs and promoting activities that are engaging and inclusive for both boys and girls to ensure equal participation in physical activities.

Additionally, it's important to note that the PAI can serve as a useful tool to track engagement in physical activity, but fitness assessments would require more comprehensive measures such as endurance tests, muscle strength assessments, and flexibility evaluations. Therefore, while PAI is indicative of physical activity, it should be considered alongside other fitness metrics to gain a fuller picture of an individual's fitness level.

Category	Total (n=166)	Boys (n=82)	Girls (n=84)	
Average Age (years)	14.02	-	-	
Average Weight (kg)	57.28	59.53	55.03	
Average BMI (percentiles)	57.10	58.23	55.91	
Average Obesity Grade	101.13	106.94	95.23	
Lower Limit Obesity Grade	90	-	-	
Upper Limit Obesity Grade	125	-	-	
Boys/Girls Below Lower Limit	-	23	15	
Boys/Girls Above Upper Limit	-	27	12	
Physical Activity Index (PAI-score)	52	58	46	
PedsQL [™] Physical Health (score)	81.25	-	-	

Table 1. Summary of Health Metrics by Gender

These findings painted a complex picture. While boys in Oradea were more active, they also faced greater challenges with weight and obesity compared to the girls. This paradox suggested that even with higher activity levels, other factors such as diet, lifestyle, or genetic predispositions might be influencing their higher BMIs and obesity grades.

The study shone a light on the importance of balanced lifestyles and the need for targeted interventions. Encouraging healthy eating habits, providing education on the benefits of regular exercise, and fostering environments that support active living became clear priorities. These young students of Oradea, with their unique strengths and challenges, offered valuable lessons on the path to healthier futures.

Table 2. Physical Activity Index

Parameter Score Type of activity					
 Intensity 	5	Physical activity leading to			
accelerated		marked breathing (gasping) and sweating			
		relatively abundant;			
		Effort that only occasionally (intermittently) leads to			
		panting and sweating;			
	4	for example: field tennis;			
	3	Not too difficult an effort, for example, the one in recreational sports - cycling;			
	2	Moderate effort, e.g. volleyball;			
	1	Light efforts, e.g. fishing, walking.			
•Duration	4	Over 30 minutes;			
	3	20-30 minutes;			
	2	10-20 minutes;			
	1	under 10 minutes.			
•Frequency 5 daily o	r almost daily;				
	4	3-5 times a week;			
	3	1-2 times a week;			
	2	a few tim es a m onth;			
	1	less than once a month.			

То	find out	what PAI	we have	we need to	use the	questionnaire	helow
10	Thiu out	whatra	i we nave	we need to	useune	questionnare	Derow.

PAI is obtained by summing the scores of each parameter: PAI = Intensity x Duration x Frequency

Score Characterisation Physical condition category

80-100 very active lifestyle superior

60-80 active and healthy very good person

40-60 acceptable reasonable

20-40 insufficiently active/relatively sedentary poor

under 20 sedentary very weak



Figure 1. Summary of Health Metrics by Gender

Discussions

Schools should prioritize the creation of a supportive and inclusive environment in physical education (PE) classes. This involves teaching students to support and encourage each other, incorporating positive feedback into lessons, and using visual reminders such as encouraging words and images on gym walls.

Additionally, physical educators are encouraged to constantly interact with students, being mindful of their body language and tone, to ensure all students feel valued and supported, regardless of their skill level. It is crucial for students to feel both physically and psychologically safe in PE classes, which can be achieved by carefully considering the type of activities and the setup of the learning environment to minimize risks and promote positive engagement (Achper, 2022).

Physical educators should offer a variety of fitness activities to reduce monotony and increase enjoyment, which can motivate students to continue these activities outside of school. Introducing skill-based activities such as tennis, basketball, and swimming can equip students with the skills necessary for lifelong fitness. Educators should also ensure that the fitness experiences are perceived as achievable challenges rather than threats, starting with easy tasks and gradually increasing the difficulty to build confidence and prevent discouragement. Additionally, integrating physical activity into academic subjects like English could enhance both educational and physical outcomes by making learning more dynamic and physically engaging (Mavilidi et al., 2019).

Engaging families and the broader community in school-based physical activities can significantly enhance the effectiveness of these programs. Schools should develop strategies to involve parents in various school health activities, which can improve students' academic performance and social skills 67. Regular communication with parents and the community, such as through newsletters or special events like Family Fitness Nights, can increase participation and support for physical education programs 68. Schools should also consider partnerships with local organizations and community members to broaden the resources and opportunities available for promoting physical health (Agron et al., 2008).

Through this comprehensive examination, the pivotal role of BMI assessments and physical activity in fostering the health and academic success of middle school students has been unequivocally highlighted. A multifaceted approach, encompassing regular fitness assessments, personalized intervention strategies, and an active engagement in physical activity, stands as an essential component in combating the rising tide of childhood obesity and its associated health risks. These actions not only contribute to immediate improvements in physical health and academic performance but also instill habits conducive to long-term well-being.

Looking forward, it becomes imperative for schools, in collaboration with policymakers and the wider community, to forge environments that prioritize the health and fitness of students. By integrating a comprehensive physical activity curriculum, ensuring accessibility to nutritious food options, and fostering a supportive atmosphere, educational institutions have the power to significantly impact the lives of young individuals. This concerted effort promises not only to enhance the current health landscape but also to pave the way for a healthier, more academically adept future generation. Through these methods, the study aims to evaluate the fitness level and body composition of middle school students, identifying risk factors associated with sedentary behavior and excess weight. Additionally, it aims to promote an active and balanced lifestyle among students to prevent risks associated with chronic diseases and improve their quality of life. This research emphasizes the importance of periodically evaluating fitness and body weight among middle school students and implementing physiotherapeutic interventions to promote a healthy lifestyle from an early age.

Conclusion

In the context of middle school students, BMI is a critical metric for assessing fitness and health because it provides a standardized measure of body weight relative to height, helping to identify potential health risks such as obesity and underweight conditions. As noted in the study, BMI categories aligned with percentiles are used to differentiate students who may be at a healthy weight from those who may face increased health risks. This classification is vital in educational settings, where identifying students who fall into the overweight or obese categories can lead to timely interventions aimed at mitigating long-term health impacts associated with childhood obesity. Regular monitoring of BMI in schools allows educators and health professionals to proactively address weight-related health concerns during a critical period of physical and psychological development.

The relationship between BMI and physical activity among middle school students is evident in the findings of this study. Higher physical activity levels, as reflected in the Physical Activity Index (PAI) scores, tend to correlate with healthier BMI ranges. In this study, boys who exhibited a higher BMI also displayed a greater physical activity level (PAI of 58), indicating that physical activity might play a role in managing or mitigating health risks associated with higher body mass. Regular engagement in physical activities, particularly those integrated into school environments, supports not only better BMI management but also contributes to healthier growth patterns and overall wellness. Furthermore, physical fitness is shown to impact academic outcomes, highlighting the interconnected benefits of maintaining a healthy BMI through regular physical activity.

To promote physical activity among middle school students, schools can integrate diverse and appealing activities into the curriculum, providing students with both structured and unstructured opportunities for movement. This study emphasizes the role of educational institutions in fostering a supportive environment for physical activity, where privacy is respected through self-testing and modern technologies. For instance, introducing youth fitness testing and health-related fitness education as part of the curriculum could enhance student engagement by making physical activity more personalized and less intimidating. Encouraging inclusive and gender-sensitive physical activity programs that consider unique health and behavioral factors for boys and girls may further motivate students to adopt active lifestyles, thereby improving both their physical health and academic performance.

Using BMI as a method for assessing body fat provides several advantages, especially within school settings where resources and time may be limited. BMI is a straightforward, non-invasive calculation that offers a quick overview of students' health status, allowing educators and health professionals to identify those who might need further assessment or intervention.

According to the text, BMI categorization (underweight, healthy weight, overweight, and obese) helps guide decisions regarding additional health assessments and potential lifestyle changes, making it an effective screening tool in large populations, such as middle school students. Despite not measuring body fat directly, BMI's utility in reflecting weight-related health risks, such as the prevalence of obesity, provides valuable insight that supports proactive health management and intervention strategies in schools.

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