Contribution of Body Mass Index to the Physical Fitness Level of Students

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Abstract. The purpose of this study was to determine the contribution of body mass index to the level of physical fitness of junior high school students in Medan City in 2023. This study used descriptive analytic method. The sample amounted to 23 people, obtained by purposive sample. To determine the correlation of body mass index to the level of physical fitness is sought using the product moment formula. This research uses body mass index test instruments and physical fitness tests carried out to find out data on research variables, namely body mass index data and student physical fitness tests. From the results of statistical analysis, the correlation coefficient between body mass index and physical fitness is rcount = 0.55. To find out how much the contribution of body mass index to the level of physical fitness is calculated with R = (0.55)2 x 100% = 30.25%. The contribution is 30.25%. Thus the hypothesis that states there is a contribution of body mass index to the level of physical fitness of junior high school students in Medan City in 2023 can be accepted in this study. This research opens insights into knowledge for teachers, especially physical education teachers so that this information can be applied in schools.

Key words: contribution, body mass index, physical fitness, students

INTRODUCTION

School physical fitness programs play an important role in improving health and well-being among students. Various studies have highlighted the effectiveness of different exercise modalities in improving physical fitness indicators in a school-based environment(Wu et al., 2023). The quality of a child is also influenced by physical fitness. Conversely, students with low physical fitness will have an impact on the quality of the child's education because high physical fitness can support the implementation of effective education for children. That is one of the reasons students are required to take physical education classes(Gulo et al., 2023). If we look at the current reality, many school children are obese. This happens when children lack motivation to take exercise seriously and become accustomed to it(Saputra et al., 2020). The imbalance between energy expended and digested can lead to overweight. This happens because students eat but are lazy to do physical activity (exercise). As a result, the student's body has a lot of fat in it and is overweight. Measuring our weight is one way to determine whether we are overweight or not Body Mass Index (BMI)(Apriyano et al., 2022).

By measuring Body Mass Index (BMI), we can find out whether our weight is ideal or not and overweight or not. BMI measurements are easy to take and can be done on a large scale. They only require two measurements - weight and height - and anyone with practice can do both accurately(Wiguno et al., 2023). Body Mass Index (BMI) is a widely used anthropometric measure that calculates body mass by dividing weight in kilograms by height in meters squared (kg/m²)(Hristova & Platikanova, 2023). Despite its simplicity and cost-effectiveness, BMI has some limitations. It does not distinguish between fat and lean tissue, making it a

poor indicator of body fat percentage and metabolic health, especially in athletes and individuals with high muscle mass(Chandrasekaran, 2018). In addition, the accuracy of BMI can be affected by factors such as gender, age, ethnicity, and body composition, which requires additional measures such as waist circumference and body composition analysis for more accurate assessment of obesity and associated health risks (Mohajan & Mohajan, 2023). Extensive research has shown that higher BMI is associated with increased morbidity and mortality, making it an important factor in clinical guidelines and student health policies in schools. However, the utility of BMI is more prominent in population-based studies rather than individual diagnostics, where its limitations are more apparent. Therefore, while BMI is a useful initial screening tool, it should be complemented by other diagnostic methods to provide a comprehensive evaluation of an individual's health status.

The study showed that BMI did not significantly affect the number of steps taken by female physical education students, who generally met the WHO physical activity requirements (Herbert Jarosław et al., 2019). However, in-school students tended to have better physical fitness attributes such as explosive strength, agility, flexibility and speed compared to out-of-school students, although there was no significant difference in BMI between the groups(Sharath & Sushmitha, 2023). Among all students at the school, male students generally had a higher BMI than female students, with a large proportion being overweight or obese, which was associated with a lack of physical activity and a balanced diet. In male students, BMI was significantly correlated with percentage body fat and waist-hip ratio, suggesting that higher BMI is associated with higher body fat and central obesity(Shaban & Jundishapur, 2013). In another study, balance performance in students varied with BMI, with underweight and normal weight students generally performing better than overweight students in a balance test(Ivanyut, 2022). Finally, motor competence and involvement in physical education settings are essential for physical activity participation, although BMI and self-perception are not significant predictors of physical activity in children.

The purpose of this study is Overall, school physical fitness programs are very important for the development of motor skills and lifelong healthy habits, but require consistent monitoring and tailored interventions to address diverse needs and to find out more about body mass index in students, so as to perform physical activities more efficiently without causing fatigue and educational goals can be realized properly.

METHODS

This research design uses a correlation approach. The purpose of this approach is to find out how strong the correlation is between the variables obtained and other variables. The purpose of this approach is based on the magnitude of the correlation coefficient. The purpose of correlational research is to detect the extent to which variations in a factor are related to variations in one or more other factors based on the correlation coefficient(Sugiyono, 2013).

In this study, the sample taken was 23 junior high school students in Medan City. The sampling technique used is purposive sampling, where the sample is taken based on certain criteria. This study uses two tests, namely the body mass index test and the physical fitness test to determine the level of physical fitness of Medan city junior high school students.

In this study, the instruments used were the Body Mass Index test and the Physical Fitness Test which were carried out to find out the research variable data, namely body mass index data and physical fitness tests of Medan city junior high school students.

1. Body Mass Index Test

Body mass index data was obtained using a formula that compares body weight (kg) with the square of height (m). The formula is:

$$BMI = \frac{Body\ weight}{Height\ (m)\ X\ Height\ (m)}$$

2. Indonesian Physical Fitness Test (TKJI)

Data collection on the physical fitness level of the research sample was obtained using the Indonesian Physical Fitness Test Book. In the physical fitness workshop held in 1984 "Indonesian Physical Fitness Test" (TKJI) has been agreed and determined to be an instrument / test tool that applies throughout Indonesia because TKJI is compiled and adapted to the conditions of Indonesian children. TKJI is divided into 4 age groups, namely: 6-9 years, 10-12 years, 13-15 years, and 16-19 years. In this study used TKJI for the age group 13-15 years

Table 1. Indonesian Physical Fitness Test Norms

Number of scores	Classification Physical Fitness
22 – 25	Very good
18 – 21	Good
14 – 17	Medium
10 – 13	Less
5 – 9	Very poor

Source : (Rohmah & Muhammad, 2021)

The data analysis technique used to answer the research hypothesis is to use correlation analysis techniques. Analysis to find the relationship between the predictor variable and the dependent variable is carried out by analysing the product moment correlation type with the formula, namely : $R = r2 \times 100\%$.

RESULT AND DISCUSSION

Body Mass Index

Based on the results of research conducted in Medan city junior high school using body mass index measurements, data on body mass index of grade 1 students in Medan city junior high school were obtained with the lowest score of 2.00 and the highest score. the score is 2.41, with an average score of 2.18. Based on the measurement of body mass index, it is explained that 23 grade 1 students of the first middle school of the city of Medan have a body mass index in the fat range and for more details, see the Frequency Distribution table of Body Mass Index of grade 1 students of the first middle school of the city of Medan.

Table 2. Frequency distribution of Body Mass Index in 1st grade students of Medan city junior high school.

No	Kategori	f	(%)
1	Very thin	-	-
2	Skinny	-	-
3	Normal	-	-
4	Fat	23	100%
5	Very fat	-	-
	Total	23	100

Physical Fitness Level

From the results of the study by conducting a physical fitness test, data on the level of physical fitness in 1st grade students of Medan city junior high school with the lowest score of 10 and the highest score is 21 with an average of 15.39.

Table 3. Frequency Distribution of Physical Fitness Tests in 1st grade students of Medan city junior high school

No	Kategori	f	(%)
1	Very good	-	-
2	Good	6	26,08 %
3	Medium	7	30,44 %
4	Less	10	43,48 %
5	Very poor	-	-
	Total	23	100 %

By using the product moment correlation formula above, the correlation coefficient between Body Mass Index and Physical fitness is rcount = 0.55. To find out whether the correlation is significant or not is to compare rcount with rtable. rtable is obtained from the table list with n = 23 where rtable is 0.413. Thus rcount> table (0.55> 0.413 after obtaining the magnitude of the correlation between Body Mass Index to the level of physical fitness then the next will be sought the magnitude of the contribution of Body Mass Index to the level of Physical Fitness of 1st grade students of the first middle school of the city of Medan with the following calculations:

$R = r^2$ x 100%

$R = (0,55)^2$ x 100%

= 30,25 %

From the results of the correlation obtained worth 0.55, when viewed through the table of interpretation of the value of r, it is found that the value of r is between 0.400 to 0.600 with a rather low interpretation. The amount of contribution or contribution of Body Mass Index to the level of physical fitness in 1st grade students of Medan city junior high school is 30.25%, while 69.75% is contributed from other factors which in this case are not examined, because researchers only want to know the contribution of body mass index to the level of physical fitness of 1st grade students of Medan city junior high school.

The relationship between students' physical fitness and Body Mass Index (BMI) is diverse, involving various factors such as physical activity, nutritional status, and lifestyle habits. Studies show that physical fitness, often measured by the Physical Fitness Index (PFI), and BMI are interconnected, although the nature of this relationship can vary. For example, a study on university students in India found no significant correlation between BMI and PFI, suggesting that BMI alone may not be a reliable indicator of physical fitness(Keliat et al., 2019). A study among Chinese college freshmen revealed a nonlinear relationship, where underweight and overweight/obese students exhibited poorer physical fitness compared to their normal BMI peers, forming an approximate inverted U-shaped curve for physical fitness and an inverted J-shaped association for muscle fitness(Ghosh et al., 2023). In addition, physical activity levels significantly impacted BMI, with higher physical activity correlating with lower BMI and reduced fatigue, this is supported by the finding that greater physical activity is associated with lower BMI and fewer health problems among students(Djoni Rumondor et al., 2019).

The impact of physical fitness on academic performance is also important, with significant correlations found between physical fitness and learning outcomes in various studies(Ramayandi & Kurniawan, 2022). Despite these findings, some studies, such as the study on medical students, found only a weak negative association between BMI and physical fitness, suggesting that other factors may also play a significant role(Ghanshyam Patel & Thakrar, 2023). Overall, while BMI and physical fitness are related, this relationship is influenced by a complex interaction of physical activity, lifestyle, and other health factors.

CONCLUSION

Based on the above calculations, it can be concluded that the hypothesis which states that there is a Contribution of Body Mass Index to the level of Physical fitness in 1st grade students of Medan city junior high school can be accepted in this study by 30.25%.

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REFERENCES

Apriyano, B., Zainuddin, Z. A., & Hashim, A. H. M. (2022). Physical Activity Module in Health Sports Physical Education Learning on Physical Fitness and Health. *International Journal of Human Movement and Sports Sciences*, *10*(4), 716–722. https://doi.org/10.13189/saj.2022.100412

Chandrasekaran, A. (2018). Body Mass Index-Is it Reliable Indicator of Obesity? *Journal of Nutrition & Weight Loss*, *03*(01), 29–31. https://doi.org/10.35248/2593-9793.18.3.111

Djoni Rumondor, Motto, C. A., & Patras, M. D. (2019). Relationship between Nutritional Status and Physical Freshness Levels with Learning Outcomes of Physical, Sports and Health Education. *Britain International of Linguistics Arts and Education (BIoLAE) Journal*, *1*(2), 303–316. https://doi.org/10.33258/biolae.v1i2.98

Ghanshyam Patel, A., & Thakrar, G. (2023). Correlation of BMI with Physical Activity and Fatigue in College Going Students. *International Journal of Health Sciences and Research*, *13*(5), 38–42. https://doi.org/10.52403/ijhsr.20230505

Ghosh, D., Bose, S., Hor, S., Firdaus, S. B., Mandal, S., Singha, P. S., Ghosh, S., & Panda, B. (2023). A cross-sectional study of the association of Body Mass Index and Physical Fitness Index of college students of Madpur region of West Midnapore district of West Bengal, India. *Indian Journal of Clinical Anatomy and Physiology*, *10*(1), 41–45. https://doi.org/10.18231/j.ijcap.2023.009

Gulo, R. K., Putri, R. J. A., Sitepu, P. P., & Tarigan, P. U. (2023). Studi Analisis Permainan Tradisional Egrang Terhadap Kebugaran Jasmani Untuk Siswa SD Negeri Desa Doulu Kecamatan Berastagi. *JURNAL ILMIAH STOK BINA GUNA MEDAN*, *11*(2), 208–2016. https://doi.org/doi.org/10.55081/jsbg.v11i2.1461

Herbert Jarosław, Matłosz, P., Grzywacz, R., Jaskierska, P., & Sołek, A. (2019). BMI as a factor influencing the number of steps among physical education students. *European Journal of Clinical and Experimental Medicine*, *16*(4), 283–288. https://doi.org/10.15584/ejcem.2018.4.4

Hristova, P., & Platikanova, M. (2023). Body Mass Index (Bmi) - Predictor of Diseases Onset and Regulator of Prevention? *Journal of IMAB - Annual Proceeding (Scientific Papers)*, *29*(2), 4947–4950. https://doi.org/10.5272/jimab.2023292.4947

Ivanyut, N. (2022). Content and specific features of professional activity of fitness specialists. *Scientific Journal of National Pedagogical Dragomanov University. Series 15. Scientific and Pedagogical Problems of Physical Culture (Physical Culture and Sports)*, *1*(1(145)), 54–57. https://doi.org/10.31392/npu-nc.series15.2022.1(145).14

Keliat, P., Lubis, A. E., & Helmi, B. (2019). Profil Tingkat Kebugaran Jasmani Dan Kecukupan Gizi. *Jurnal Ilmiah STOK Bina Guna Medan*, *7*(2), 46–54. https://doi.org/10.55081/jsbg.v7i2.12

Mohajan, D., & Mohajan, H. K. (2023). Body Mass Index (BMI) is a Popular Anthropometric Tool to Measure Obesity Among Adults. *Journal of Innovations in Medical Research*, *2*(4), 25–33. https://doi.org/10.56397/jimr/2023.04.06

Ramayandi, R. A., & Kurniawan, R. (2022). Relationship of Physical Fitness Level to Student Achievement Junior High Shcool PGRI 08 Malang Hubungan Antara Tingkat Kesegaran Jasmani Terhadap Prestasi Belajar Siswa SMP PGRI 08 Malang penting untuk melaksanakan tugasnya sehari-hari sebagai anak didik. *Prosiding Seminar Nasional Pendidikan Jasmani Dan Keolahragaan*, *1*(1), 138–144. https://doi.org/doi.org/10.33503/prosiding_penjas_pjkribu.v1i1.2240

Rohmah, L., & Muhammad, H. N. (2021). Tingkat Kebugaran Jasmani dan Aktivitas Fisik Siswa Sekolah. *Jurnal Universitas Negeri Surabaya*, *09*(01), 511–519. https://ejournal.unesa.ac.id/index.php/jurnal-pendidikan-jasmani/article/view/38199

Saputra, M. F., Awaluddin, A., Rusli, K., & Ismail, A. (2020). Profil Kebugaran Jasmani Siswa Pasca Pandemi. *Jurnal Olahraga & Kesehatan Indonesia*, *1*, 37–45. https://doi.org/DOI: https://doi.org/10.55081/joki.v2i1.546

Shaban, M., & Jundishapur, A. (2013). Study Of Body Mass Index (BMI), Body Fat Percent (%BF), And Waist To Hip Ratio (WHR) In Male Physical Education Students. *Physical Education of Students*, *17*(6), 55–59. https://sportedu.org.ua/index.php/PES/article/view/112

Sharath, & Sushmitha. (2023). A comparative study on BMI and physical fitness between physical education and non-physical education students of Mangalore University. *International Journal of Sports, Health and Physical Education*, *5*(1), 100–105. https://doi.org/10.33545/26647559.2023.v5.i1b.63

Sugiyono. (2013). *Pdf-Buku-Metode-Penelitian-Sugiyono*. Alfabeta, 2013.

Wiguno, L. T. H., Kurniawan, A. W., Wahyudi, H., & Aqsha, A. H. (2023). Development of Interactive Multimedia-Based Physical Fitness Learning Media in Junior High School. *JOSSAE (Journal of Sport Science and Education)*, *8*(1), 54–68. https://doi.org/10.26740/jossae.v8n1.p54-68

Wu, J., Yang, Y., Yu, H., Li, L., Chen, Y., & Sun, Y. (2023). Comparative effectiveness of school-based exercise interventions on physical fitness in children and adolescents: a systematic review and network meta-analysis. *Frontiers in Public Health*, *11*(June), 1–14. https://doi.org/10.3389/fpubh.2023.1194779