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Correlation of BMI with Agility and Balance in School Going Children

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ABSTRACT

Introduction: Physical development is an important aspect of individual development. For School going children, optimal physical growth and development are very important. Body type will affect a person's speed, strength, and balance because these two components cannot be separated from the characteristics of their muscles and anthropometry. So, the purpose of this study is to examine the correlation of BMI with agility and balance in school-going children.
Materials and methods: A total of 120 children of both genders were selected from different schools. The age of the subjects ranged from 9 to 14 years. Selected variables for the study were height, weight, BMI, agility, and balance. Standardised test or tools like a stadiometer, weighing machine, agility T-test, or stork standing test were used to collect the data for selected variables. Ethical clearance was obtained from the ethics committee.
Result: SPSS 23 software is used for data analysis. There is a very strong and significant negative correlation found between BMI and balance ($r= -0.817$, $p<0.001$), and a strong and significant negative correlation found between BMI and agility. ($r= -0.720$, $p<0.001$).
Conclusion: The result of this study suggests that the as weight increase balance and agility decreases.

Keywords: height, weight, BMI, agility, and balance

INTRODUCTION

Physical development, often known as biological growth, is an essential part of individual personal development. Physical development includes changes in the body (such as brain, nervous system, sensory organ growth, height and weight growth, etc.), changes in how people use their bodies (such as motor skill development and sexual development), and changes in physical abilities (such as decreased heart function, vision, and so on). [(1)] Physical growth and development are critical for school age and teenage children. Because the child's physical development will have an impact on their daily behavior. Directly, the child's physical development will determine the child's ability to move. Physical development has an indirect impact on how children view themselves and others. This is evident from the typical pattern of child adjustment. [(2)]

Because speed and strength cannot be isolated from a person's muscular features and anthropometry, body type will influence them. Body mass index units are more commonly used to describe a person's body type. The body mass index (BMI) is calculated by dividing weight in kilograms by height in square meters [3]. BMI is impacted by a variety of factors, including dietary intake, food, physical activity, and a variety of other factors. BMI is also affected by age and gender, since boys and girls have

varying levels of body fat. [4] BMI in children varies with age as well as with changes in height and weight.

Agility is one of the physical conditions that need to be addressed in youngsters. It is the capacity to swiftly alter course. In agility, two terms must be mastered: speed and the ability to change direction. Language agility is derived from the term agile, which implies "always moving" and "unable to be quiet, calm, or fixed." An agile individual is one who can alter the direction and position of his body rapidly and precisely while moving without losing balance or awareness of his body position. [5] Agility may also be defined as a person's ability to shift position and direction as rapidly as feasible in response to a given scenario [6]. Cognitive and decision-making speeds are also important factors in agility. [7] Balance, as opposed to BMI, is a measure of body fat based on height and weight. Excess body fat, particularly in the abdomen, can cause the body's center of gravity to shift and impair balance. (8) Muscular power and control also have an impact on balance. Students who have more muscular mass and strength have greater balance. BMI, on the other hand, does not give information on muscle mass or distribution. Individuals with a higher BMI may have more muscular mass, which might help them maintain their balance. (9)

Regular exercise improves muscle strength, coordination, and proprioception, all of which help with balance and agility. BMI can alter posture, body alignment, and speed, all of which can affect balance and agility. So the aim of the study is to find out Correlation of BMI with Agility and Balance in School children

MATERIALS & METHODS

A cross-sectional observational study was conducted in Ahmedabad, Gujarat, India, after approval from the institutional ethical committee. The purposive sampling method was used. Data was collected for a period of two months, from July 1 to August 31, 2023.For this study, 120 children from different schools were selected. Of those, 50 were female and 70 were male. The students aged between 9 to 14 years are selected. The informed consent was obtained from the principal after explaining to them the purpose and nature of study and the role of their students in it. After proper explanation of the number of groups of students who were all willing to participate in the studies. Participants were instructed to take off all their belts or any other tight clothing. The subjects were explained properly and shown now to do every test correctly and the data of each test was recorded on the data sheet. Children with any disability, having other co-morbidities like Asthma, Pneumonia, mentally intellectually challenged children, children who cannot follow commands. Any recent injuries or surgery, the subject having any cardiac problem, vestibular or vision impairment, any congenital or structural deformity were all excluded. First, the participant's heights were measured. The stadiometer was used to measure height. The weight of the individuals was then determined by the use of a weighted machine. Then evaluating participant's balance using the stork test and testing their agility using the T-test.

- **Assessing stork standing test to rule out balance in each participant**

To pass the stork-balancing test, one must maintain one leg's balance for as long as feasible. It was instructed for the participants to remove their shoes. The participants were told the complete test method. The non-supporting foot must be placed on the knee of the supporting leg before it can get into position. The individual then elevates the heel to balance on the football as soon as the timer starts. The person is timed using a stopwatch to determine how long they can stay balanced. Timing is halted in any situation where the person feels off-balance, has their hands come off their heels, etc. The data sheet is being used to track each person's standing

capacity over time. [10] 0.9 test-retest reliability of stork standing test. [11]

RATING	SCORE (seconds)
Excellent	> 50
Good	40 - 50
Average	25 -39
Fair	10 - 24
Poor	< 10

- **Checking their agility by T-test:**

The T-test is a simple running test that comprises forward, lateral, and backward running. The entire exam will be shown to the participants. Place four cones five yards apart in a "T" formation. Cones A, B, C, and D. The subject begins at cone A. When the timer goes off, the subject sprints to cone B and places his right hand on the cone's base. Then they turn left, shuffle to the right to cone D, contact with their left hand, and dash backwards to cone A. The timer stops when they travel through cone A. Agility t test intraclass reliability is 0.7. [12]

Score	Male	Female
Excellent	< 9.5	< 10.5
Good	9.5 to 10.5	10.5 to 11.5
Average	10.5 to 11.5	11.5 to 12.5
Poor	> 11.5	> 12.5

RESULT

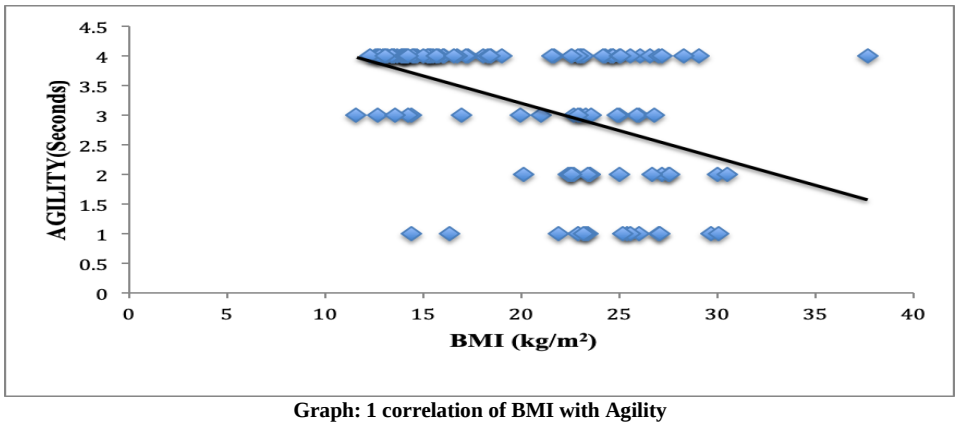
Out of the 120 participants, 50 were female and 70 were male; the finding shows that 40% were of normal weight. 25% of participants were overweight, 20% were obese, and nearly 35% of respondents fell under the underweight category.

Statistical analysis was performed using SPSS version 23 for data analysis. Data normality was checked by using the Shapiro-Wilk test because, as per the analysis, the data was not normally distributed and a non-parametric Spearman's correlation test was used and p value <0.05 is considered statistically significant.

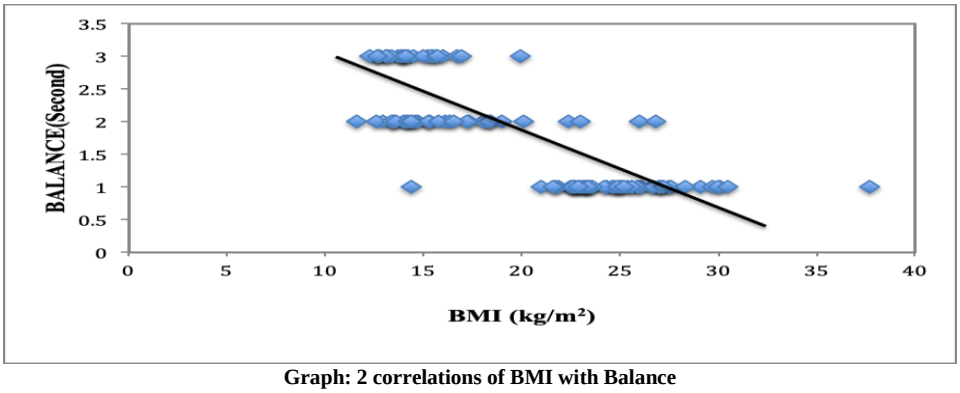
A strong but significant negative correlation was found between BMI and Agility. (r value = -0.720, p value <0.001). A very strong but significant negative correlation was found between BMI and balance. (r value = -0.817, p value <0.001)

Spearman's correlation	r-value	p-value
BMI & AGILITY	-0.720	<0.001
BMI & BALANCE	-0.817	<0.001

Table: 1 correlation of BMI with Agility and Balance



Graph: 1 correlation of BMI with Agility



Graph: 2 correlations of BMI with Balance

DISCUSSION

The current study was an observational study that involved testing the physical fitness of school-aged children aged 9 to 14 years old in terms of agility and balance. Total 120 students were selected among them 50 were female and 70 were male and assess their fitness based on BMI using several criteria, such as underweight, normal, overweight, and obese. And decided to perform it since there were relatively few studies that incorporated all four BMI criteria and examined children's fitness.

The present study found a negative correlation between BMI and balance, which is comparable to a study done by Seryonzha Gontarev et al. [(13)] They concluded from their findings in 2018 that undernourished students require a higher amount of energy expenditure due to lower muscle mass and thus get fatigued and tired more easily due to a lower amount of physical activity, with overweight or obese children achieving poorer results in health-related fitness tests, especially when they need to move their bodies through space. They also discovered that, as compared to children of average weight, both under- and over-nourished children performed worse on the agility test. Participation According to our data, the normal category BMI children scored excellent on the T-test utilized for agility in schoolchildren. However, underweight, obese, and overweight children primarily received average and good scores.

Judith Greve et al. [(14)] In a 2007 study on obesity and postural balance, researchers discovered that having a high BMI necessitates more displacements to maintain postural balance. Although further research is needed to study the relationship between body mass and balance in the community, McGraw et al. 2020 [(15)] found that the build-up of fat tissue can affect body balance and contribute to falls in highly obese teens and adult patients. After studying 20 boys (10 obese and 10 with normal body weight) aged 8–10 years, researchers discovered that the obese boys had considerably higher regions of medial and lateral sway and swing than the non-obese boys. We found that in the present study, a negative correlation was found between BMI and balance.

With this background, the current study was conducted to investigate the relationship between BMI and agility and balance.

CONCLUSION

Agility and balance are essential factors that have a significant inverse relationship with BMI. Study shows that the as weight increase balance and agility decreases. Therefore, it should be planned in physical activity to improve these factors and also body mass index and to reach optimal weight. There are some limitations to this present study. The study was conducted on healthy young individuals within the age group of 9 to 14 years. So, results cannot be generalized to the adult population. Future similar studies can be done with variation in age groups to generalize the results to maximum populations.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: None

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