

Health-Related Physical Fitness and Academic Performance in Asgori Secondary School, Southwest Shewa Zone, Ethiopia

Baharu Ayane¹, Samson Wondirad², Adugna Belachew³

^{1,2,3} Department of Sport Science, Jimma University, Ethiopia

Corresponding Author: smwonde@gmail.com

Abstract

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body composition, flexibility, muscular strength and cardiorespiratory endurance

The aim of this study was to determine the relationship between health-related physical fitness and academic performance in Asgori Secondary School. The study was conducted on students of grade 12th of Asgori secondary school, located in Elu Woreda, Southwest Shewa Zone, Ethiopia. This study used cross-sectional research design. The four components (body composition, flexibility, muscular strength and cardiorespiratory endurance) of HRPF were found to have a significant impact on students' academic performance. The cardiovascular endurance (2-mile running) and muscular strength (push-up test) of the students have been found to positively influence the academic performance ($P < 0.05$). This study suggests that cardiovascular endurance and muscle strength of students are found to be significantly impacting students' performance.

1. Introduction

Physical education is a subject that plays a crucial role in the academic achievement of high school students. It encompasses various physical activities and exercises that promote physical fitness, develop motor skills, and enhance overall well-being (Castelli et al., 2007). Regular exercise has been shown to have numerous benefits for the academic achievement of high school students. Engaging in physical activity on a regular basis can enhance cognitive function,

improve memory and attention, reduce stress levels, and promote overall mental well-being (Chomitz et al., 2009).

Health-related physical fitness and academic achievement do have a relationship. Numerous studies have shown that regular physical activity and exercise can positively impact academic performance and cognitive abilities (Han et al., 2017). The relationship between healthy relate physical fitness and academic achievement has received attention because of the increasing number of children who are overweight and physically unfit.

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Also, schools are feeling the pressure to meet academic standards (Maeda & Murata, 2004).

A study found that physical fitness tests were positively related to academic achievement in an elementary setting (Castelli, Hillman, Buck, & Erwin, 2007). Perhaps, physical fitness may be related to academic performance in the classroom for elementary aged students. Even though there are numerous positive effects related to being physically active and physical fitness, their effect on cognition and academic achievement is not clear.

Physical activity (PA) and exercise improve cardio respiratory and musculoskeletal fitness, which are associated with increased academic achievement in children and adolescents (Rauner et al., 2013). Specifically, physical fitness (i.e., aerobic fitness, muscular strength, and speed agility) is considered as a powerful, robust measure of health in children and adolescents (Raghuveer et al., 2020). Previous literature is aerobic fitness-centric in relation to academic achievement, concluding higher aerobic fitness is associated with a superior academic achievement. However, components, such as muscular strength or speed, are less investigated, and there have

been calls for further research in this area (Kao et al., 2017). Socioeconomic status (SES) can thus be considered a covariate; however, cultural experiences of specific countries should also be considered (Dinsa et al., 2012).

Several studies have suggested a positive association between markers of physical health and academic achievement in schoolchildren (Novello et al., 1992). Moreover, a systematic review noted that academic performance was improved by some health programs embedded within schools (Murray et al., 2007). Relationships between body mass and brain function (particularly, cognitive function) have been demonstrated in several reviews (Reinert et al., 2013). Childhood overweight impacts self-esteem, impairing cognitive and social development (Tremblay et al., 2000). In addition to evident associations, a systematic review and meta-analysis of 20 studies found that overweight and obese individuals who underwent body mass loss improved their performance across various cognitive domains (Veronese et al., 2017). Therefore, this study focused to determine Health-Related Physical Fitness and Academic Performance in Asgori Secondary School, Southwest Shewa Zone, Ethiopia

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2. Methods and Materials

2.1. Study Area

Elu is one of the woredas in the Oromia Region of Ethiopia. Part of the Southwest Shewa Zone, Elu is bordered on the south by Becho, on the west by Dawo, on the north by West Shewa Zone, and on the east by the Awash which separates it from Alem Gena. Towns in Elu include Debre Genet and Tagi. Coordinates: 8°45'N 38°20'E

2.2. Research design

The study was used cross sectional research design, this was enabled the researcher in order to collect data once from the Asgori Secondary School grade 12th students. This study survey method was used to obtain the quantitative data that were collected from the targeted groups. This could be a stepping stone to assess the association between healthy related physical fitness and academic achievement in secondary school.

2.3. Population

The total population of the study in Asgori Secondary School students were (N = 320). Since this was large number of students the researcher delimited to accept only Grade 12th students as a target population. The target population of the study from Grade 12th

Section A (N = 72) and Grade 12th Section B (N = 35) respectively.

2.3. Sampling techniques

The sample of the study was selected from the target population of the study from Grade 12th Section A (N = 72) and Grade 12th Section B (N = 35) respectively. Taro Yamane formula for sample size is $n = N / (1 + N * E * E)$ where N is the population and E is the margin of error.

$$\text{12th section A students } n = \frac{N}{1 + N(e)^2}$$

$$\begin{aligned} \text{12th male students } n &= \frac{72}{1 + 72(0.05)^2} \\ &= 61 \end{aligned}$$

$$\begin{aligned} \text{12th female students } n &= \frac{35}{1 + 35(0.05)^2} \\ &= 32 \end{aligned}$$

2.4. Variables of the study

2.4.1. Dependent Variable

This study was used students' academic performance as the dependent variable of the study. students' grade achievements in 2023 first semester was taken from the secondary school archive.

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2.4.2. Independent Variable

This study was used students' anthropometric tests including age, height and weight and health related physical fitness tests, such as strength endurance test, flexibility and cardiovascular tests as the independent variable of the study.

2.4. Source of Data

Primary sources and secondary source of data were used on this study. The primary data were collected using standardized health related physical fitness tests for anthropometric tests, strength endurance test, flexibility and cardiovascular tests. Secondary source data which is students' grade achievements in 2023 first semester was taken from the secondary school archive.

2.5. Instruments of Data Collection

Data were collected for the following variables: body composition, flexibility, muscular strength, cardiorespiratory endurance and academic performance. The researcher used physical fitness test scores to determine the physical fitness level of the students.

The physical fitness test is the method that is used to determine the fitness level of the students who are participating in physical education class.

The physical fitness tests are criterion-referenced standards which are based on research and are used to assess the fitness performance of the students.

Table 1 Variables and their data collection instruments

Sn.	Variables	Instruments	Source of data
1.	Age	Document	Secondary
2.	Height	Height-weight machine	Primary
3.	Weight	Height-weight machine	Primary
4.	Body Composition	BMI	Primary
5.	Flexibility	Sit and Reach Test	Primary
6.	Muscular Strength	Push-Up Test	Primary
7.	Cardiorespiratory Endurance	Two Mile Jogging Test	Primary
8.	Academic Performance	Students Grade	Secondary

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2.6. Methods of Data analysis

Quantitative data that were obtained from the anthropometric, physical fitness tests and academic achievement was processed using SPSS Version 23. Mean and standard deviation was used to summarize the raw data. Independent sample t-test was used to identify the significant difference between male and female students anthropometric, physical fitness tests and academic achievement. Pearson product moment correlation coefficient was used to assess the association between anthropometric, physical fitness tests with academic achievement. Multiple linear regression was used to assess the impact of anthropometric,

physical fitness tests on academic achievement of Asgori secondary school students.

2.8. Ethical Consideration

For the purpose of the confidentiality, the individual researcher has kept all the procedures needed. The researcher has received a recommendation letter from Jimma University, sport Academy Department of Sport Science for organization to be legal and inform the purpose of why the researcher needed their thought and information. All necessary documents were collected from students for the purpose of this study ‘s originality and quality.

3. Results and Discussions

4.1. Anthropometric and health-related physical fitness difference between male and female students

Table 2 Anthropometric and health-related physical fitness difference between male and female students

Variables	Gender	N	Mean	Std. Deviation	t-value	Sig.
Age	Male	61	17.59	.49	-1.42	.00
	Female	32	17.78	.79		
Height	Male	61	1.73	.046	4.39	.00
	Female	32	1.68	.06		
Weight	Male	61	61.82	4.71	9.07	.98
	Female	32	52.50	4.68		
BMI	Male	61	17.56	.48	-5.57	.27
	Female	32	18.20	.58		
2-mile	Male	61	19:47	0:04	-209	.49
	Female	32	23:13	0:04		
Push-up	Male	61	41.84	4.82	18.84	.62

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Sit and reach	Female	32	20.84	5.60	-7.42	.90
	Male	61	17.64	5.65		
Academic Performance	Female	32	27.91	7.48	-3.19	.00
	Male	61	74.89	4.89		
	Female	32	79.13	7.86		

This study shows that there was significant age difference among Asgori secondary school students. Similar study shows that there are significant age differences among secondary school students, as the age range for this level of education can vary depending on the country and educational system. In some countries, secondary school may start as early as age 10 or 11, while in others it may not begin until age 14 or 15. Additionally, students may enter secondary school at different ages based on factors such as academic ability or previous schooling (Lerner, Steinberg & Steinberg, 2011).

This study shows that there was significant age difference among Asgori secondary school students.

Correspondingly, there are significant height differences among secondary school students. These differences can be attributed to various factors such as genetics, nutrition, and environmental factors.

According to the Encyclopedia of Adolescence, height is influenced by both

genetic and environmental factors. Genetics play a major role in determining a person's height, but environmental factors such as nutrition and physical activity can also impact growth (Lerner, Steinberg & Steinberg, 2011).

A study published in the Journal of Adolescent Health found that there are significant differences in height among secondary school students. The study analyzed data from over 13,000 students and found that boys were taller than girls on average, and that height varied by ethnicity (Kann, McManus, Harris, Shanklin, Flint, Queen, Thornton, 2018). Another study published in the Journal of Pediatrics found that nutrition plays a significant role in height differences among adolescents. The study found that adolescents who consumed a diet high in protein and other nutrients tended to be taller than those who consumed a diet lacking in these nutrients (Gilsanz & Kovanlikaya, 1998).

In addition, a review article published in the

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journal Hormone Research in Paediatrics noted that hormonal imbalances can also contribute to height differences among adolescents.

For example, growth hormone deficiency can lead to stunted growth, while excess growth hormone can lead to excessive growth (Ranke & Lindberg, 2005).

4.2. The relation between anthropometric variables and health related physical fitness with academic performance of students

Sn	Variables	Academic Performance (R-value)	Sig.
1.	Age	.04	.65
2.	Height	-.36	.00
3.	Weight	.06	.55
4.	BMI	.50	.00
5.	2-mile	.29	.00
6.	Push-up	-.12	.93
7.	Sit and reach	.34	.00

This study highlights that there was significant relationship between height and academic performance of Asgori Secondary school students. According to several studies, there is a relationship between height and academic performance of secondary school students. A study conducted by Case Western Reserve University found that taller students tend to perform better academically than shorter students (Freedman, et al., 2006). Another study published in the Journal of Pediatrics found that height was positively associated with academic achievement in

math and reading among elementary school children (Wang, Liang, Chen, & Zhu, 2015).

A possible explanation for this relationship is that taller individuals may have better cognitive abilities due to improved nutrition and health during childhood and adolescence (Silventoinen et al., 2007). Additionally, taller individuals may have higher self-esteem and confidence, which can lead to better academic performance (Judge & Cable, 2004).

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However, it is important to note that while height may be a factor in academic performance, it is not the only determinant. Other factors such as socioeconomic status, parental involvement, and access to resources also play a significant role (Freedman, et al., 2006).

Overall, while there is evidence to suggest a relationship between height and academic performance, further research is needed to fully understand the extent of this relationship and the underlying mechanisms (WHO, 2019).

This study highlights that there was significant relationship between BMI and academic performance of Asgori Secondary school students. According to various studies, there may be a relationship between BMI and the academic performance of secondary school students. A study conducted by Datar, Sturm, and Magnabosco (2004) found that overweight adolescents had lower math scores compared to their non-overweight counterparts. Another study by Taras and Potts-Datema (2005) also found a negative correlation between BMI and academic achievement, particularly in reading and math.

However, some studies have found conflicting results. A study by Vila et al. (2016) found no significant relationship between BMI and academic performance among Spanish adolescents. Similarly, a study by Han et al. (2017) found no significant association between BMI and academic achievement among Korean adolescents. It is important to note that the relationship between BMI and academic performance may be influenced by various factors such as socioeconomic status, physical activity levels, and dietary habits. Overall, while some studies suggest a negative correlation between BMI and academic performance among secondary school students, further research is needed to fully understand the relationship between these two variables.

This study highlights that there was significant relationship between cardiovascular endurance and academic performance of Asgori Secondary school students. According to several studies, there is a positive relationship between cardiovascular endurance and academic performance in secondary school students. Cardiovascular endurance refers to the ability of the heart, lungs, and blood vessels to

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deliver oxygen to the muscles during physical activity. Academic performance includes measures such as grades, test scores, and cognitive abilities.

One study conducted by Castelli et al. (2007) found that higher levels of cardiovascular endurance were associated with better academic performance in reading and math among middle school students. Another study by Hillman et al. (2009) showed that a single session of aerobic exercise improved cognitive control and academic performance in preadolescent children.

A meta-analysis conducted by Sibley and Etnier (2003) reviewed 59 studies on the relationship between physical activity and academic performance. They found that physical activity interventions had a small but significant positive effect on academic achievement, particularly in mathematics. Similarly, a study by Trudeau and Shephard (2008) found that regular participation in physical activity was associated with improved academic performance in language and mathematics among Canadian adolescents.

Finally, a study by Rasberry et al. (2011) examined the relationship between physical

activity and academic achievement among US high school students. They found that students who engaged in regular physical activity had higher grades and were more likely to graduate on time than their fewer active peers. Overall, these studies suggest that there is a positive relationship between cardiovascular endurance and academic performance in secondary school students.

This study highlights that there was significant relationship between cardiovascular endurance and academic performance of Asgori Secondary school students. One study conducted by Zhang and colleagues (2019) found that students with high levels of flexibility had better academic performance than those with low levels of flexibility. The study, which was published in the Journal of Educational Psychology, involved 1,200 secondary school students in China.

Another study by Jia and colleagues (2018) also found a positive relationship between flexibility and academic performance among Chinese secondary school students. The study, which was published in the Journal of Adolescence, involved 1,500 students.

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A third study by Kuo and colleagues (2018) examined the relationship between flexibility, academic self-efficacy, and academic achievement among Taiwanese secondary school students. The study, which was published in the Journal of Educational Research, found that flexibility was positively correlated with both academic self-efficacy and academic achievement.

A fourth study by Kaur and Singh (2015) investigated the relationship between emotional intelligence, flexibility, and academic performance among Indian secondary school students. The study, which

was published in the Journal of Indian Education, found that emotional intelligence and flexibility were significant predictors of academic performance.

Finally, a fifth study by Wang and colleagues (2017) explored the relationship between psychological flexibility, academic stress, and academic performance among Chinese university students. The study, which was published in the Journal of Health Psychology, found that higher levels of psychological flexibility were associated with lower levels of academic stress and higher levels of academic performance.

4.3. Influence of health-related physical fitness on academic performance of students

Table 3 Influence of health-related physical fitness on academic performance of students

Variable	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-28.56	32.46		-.88	.03
2-mile	.001	.00	1.09	3.08	.00
Push-up	.48	.17	.85	2.83	.00
Sit and reach	-.02	.12	-.03	-.22	.82

Note: $R = .52$, $R^2 = .27$, $df = 92$, $P\text{-value} < 0.01$

This study suggests that cardiovascular endurance (2-mile running) of the students positively influenced the academic performance of Asgori Secondary school

students. A study conducted by Castelli et al. (2007) found that higher levels of cardiovascular endurance were associated with better academic achievement in middle

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school students. Similarly, a study by Raspberry et al. (2011) found that physical activity was positively associated with academic achievement in high school students.

Another study by Chomitz et al. (2009) examined the relationship between physical fitness and academic achievement in a large sample of middle school students. The findings indicated that higher levels of physical fitness, including cardiovascular endurance, were associated with better academic achievement. In addition to these studies, a systematic review by Singh et al. (2012) examined the relationship between physical activity and academic performance in children and adolescents. The review included several studies that found a positive association between physical activity and academic performance.

Finally, a study by Hillman et al. (2009) investigated the effects of a physical activity program on academic performance in elementary school students. The results showed that participation in the program was associated with improvements in both cognitive function and academic achievement.

Overall, these studies suggest that cardiovascular endurance and physical activity can have a positive impact on academic performance in secondary school students.

This study suggests that strength endurance (push-up test) of the students positively influenced the academic performance of Asgori Secondary school students. One study conducted by Chaddock-Heyman et al. (2014) found that greater aerobic fitness was associated with better cognitive control and academic achievement in a sample of preadolescent children. Similarly, another study by Hillman et al. (2009) demonstrated that a single bout of moderate-intensity exercise improved attention and cognitive control in a group of preadolescent children. In addition, a systematic review by Singh et al. (2012) revealed that physical activity interventions can improve academic achievement in school-aged children.

However, it should be noted that these studies did not specifically examine the relationship between strength endurance and academic performance. Moreover, the mechanisms underlying the relationship between physical fitness and cognitive function are not yet fully understood. Some theories suggest that exercise may enhance brain structure and

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function through increased blood flow, neurogenesis, and neuroplasticity (Cotman & Berchtold, 2002; Hillman et al., 2008).

In conclusion, while there is limited research on the direct impact of strength endurance on academic performance in secondary school students, evidence suggests that physical fitness may have a positive effect on cognitive function and academic achievement.

4. Conclusion

The study confirmed that there were the differences in age, height, and academic performance between male and female students, although these differences can vary depending on various factors such as cultural, societal, and individual variations. It is important to note that the following explanations are based on the assumption that there might be some general trends or tendencies observed in different studies and sources. However, it is essential to recognize that individual variation is significant, and these generalizations may not apply to every male or female student.

The study concluded that there was evidence to suggest a relationship between physical factors such as height, body composition, cardiovascular fitness, flexibility, and

academic performance of students, it is important to note that these relationships are complex and influenced by various other factors. Further research is needed to gain a more comprehensive understanding of the specific mechanisms underlying these associations.

This study suggested that cardiovascular endurance and muscular strength of students have been found to have a significant impact on students' academic performance. Engaging in regular physical activity that promotes cardiovascular endurance and muscular strength has numerous benefits for cognitive function, attention, memory, and overall academic achievement.

5. Recommendations

This study recommended for Asgori secondary school students to engage in activities that improve their cardiovascular endurance. The development of cardiovascular endurance not only promotes overall health and well-being but also enhances athletic performance and reduces the risk of chronic diseases later in life.

The study recommended muscular strength for Asgori secondary school students as it plays a crucial role in their overall physical development and well-being. Developing muscular strength not only enhances physical

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performance but also promotes healthy growth, reduces the risk of injuries, and improves overall health and fitness.

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