

Physical activity and sports performance among Ethiopian university students: the moderating role of self-esteem and the mediating effect of stress

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Abstract

The primary objective of this study was to investigate the impact of physical activity (PHA) on the academic performance (ACP) of university athletes in Ethiopia. The study also examined the moderating effect of self-esteem (SEE) and the mediating effect of stress control. In order to achieve the objectives of this study, the researchers adopted a quantitative cross-sectional design and employed well-established measurement instruments to evaluate the aforementioned variables. A purposive sampling technique was employed to gather data from a sample of 300 university sports students. The findings obtained from the application of Partial Least Squares (PLS)-Structural Equation Modelling (SEM) indicate a statistically significant and positive correlation between physical health attributes (PHA) and academic performance indicators (ACP). These results underscore the importance of incorporating physical fitness components into the academic curricula designed for university athletes. The study additionally showcased the efficacy of PHA as a stress management strategy by highlighting its notable impact on reducing stress levels. Furthermore, it has been observed that self-efficacy expectations (SEE) play a moderating role in the relationship between perceived academic performance (PHA) and academic career planning (ACP), thus emphasising the potential benefits of interventions aimed at enhancing SEE among students belonging to this particular demographic. The aforementioned observations contribute to a comprehensive understanding of the academic and psychological well-being of Ethiopian university athletes. Furthermore, they offer recommendations for tailored educational strategies aimed at fostering their overall development.

Keywords: physical activity, stress, self-esteem, Ethiopia, students.

Introduction

Physical activity (PHA) is widely acknowledged to have significant benefits for health (Hallal et al., 2006). According to Archer (2014), there are several health-related benefits associated with this particular activity for children and adolescents. Consequently, there has been a surge of interest in investigating the notable correlation between academic psychological health and performance (ACP) (Kohl & Cook, 2013). In recent years, numerous studies have been conducted to investigate the potential cognitive benefits of PHA, with a particular focus on its efficacy in improving psychological well-being (Biddle & Mutrie, 2007; Zamani Sani et al., 2016). According to Tomporowski (2003), PHA also plays a role in mitigating depression among adult individuals. The authors posited that PHA (positive human-animal) interactions played a significant role in reducing individual stress levels, thereby contributing to an increase in their adaptive coping processes (ACP).

The release of endorphins, improvement in mood, and reduction in cortisol levels are some of the ways in which PHA effectively mitigates stress. Chang et al. (2012) conducted a study. The reduction in stress levels has been

found to have a positive impact on cognitive function, concentration, and memory. As a result, students observe enhanced academic performance as a consequence of heightened concentration and an improved psychological state. Thus, the concept of positive health attitude (PHA) emerges as a significant determinant in mitigating stress levels among students, ultimately leading to enhanced academic performance (ACP). The assertion is bolstered by the study conducted by Chang et al. (2012), which aimed to examine the correlation between PHA and cognitive abilities in children. The researchers posited that PHA serves as a valuable resource for children as it aids in mitigating depression, thereby potentially enhancing their academic achievements.

Taras (2005) conducted a study that established a connection between PHA and ACP, highlighting the significance of PHA in relation to ACP. In contrast, Tomporowski et al. (2008) conducted a comprehensive literature review examining the impact of physical activity on academic performance. The researchers reached the conclusion that PHA has a significant impact on improving cognitive function and, subsequently, ACP. Similarly, the promotion of self-esteem is facilitated by PHA through the attainment of accomplishments and the

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improvement of body image. Elevated levels of self-esteem contribute to the cultivation of confidence in one's academic aptitude. Enhanced self-esteem among students correlates with heightened motivation, increased resilience, and improved academic performance, as it is closely associated with a positive self-concept (Kayani et al., 2018).

Numerous empirical investigations have been conducted to examine the relationship between PHA and ACP. However, the results of these studies have exhibited inconsistency, thereby creating a significant void in the current body of literature. Several studies have proposed a positive relationship between PHA and ACP, although other investigations have not found a statistically significant connection (Abbasi et al., 2021; Feraco et al., 2023). The relationship between physical activity (PHA) and academic performance (ACP) in schoolchildren was investigated (Trudeau & Shephard, 2008). The researchers reached the conclusion that the influence of the time allocated for pre-hospital advanced (PHA) care on the occurrence of acute care presentations (ACP) is not solely deterministic, as no discernible patterns were observed in the data. Hillman, Erickson, and Kramer (2008) conducted a study to examine the effects of PHA on ACP. The conducted research failed to reveal any empirical evidence indicating that the augmentation of PHA had adverse consequences for ACP. The discrepancy observed in this study may be attributed to the failure to account for potential mediating and moderating variables, such as stress and self-efficacy expectations (SEE). These variables are essential components of an athlete's overall well-being and could potentially influence the relationship between physical health attributes (PHA) and athletic performance outcomes (ACP).

However, our comprehensive examination of the existing literature suggests that PHA may exert a more contextual influence on ACP. Moreover, previous research has established a negative association between perceived health autonomy (PHA) and stress levels (Elliot et al., 2012). Furthermore, it has been found that stress exerts a detrimental influence on adaptive coping processes (ACP) (Whitaker Sena, Lowe, & Lee, 2007). Consequently, it is widely acknowledged that athletes encounter varying degrees of stress due to the rigorous demands of their sport, the pressures of competition, and their academic responsibilities. The impact of stress on ACP is detrimental and can serve as a mediator between PHA and ACP. The primary objective of this study is to elucidate the potential indirect impact of PHA on ACP in athletes through the mechanism of stress reduction, with stress serving as a mediator.

In contrast, previous research has revealed a positive correlation between PHA and SEE (Sonstroem & Morgan, 1989), which subsequently has a positive impact on ACP (Alves-Martins et al., 2002). Hence, the overlooked aspect of the moderating effect of self-efficacy expectations (SEE) represents a significant factor in prior scholarly investigations. Self-efficacy expectation (SEE), as a psychological construct, has the potential to shape athletes' perceptions of the influence of psychological hardiness attributes (PHA) on their athletic career performance (ACP). A heightened level of self-efficacy (SEE) has the potential to amplify the favourable impacts of psychological hardiness (PHA) on adaptive coping processes (ACP), whereas a diminished SEE may impede or diminish these effects. Therefore, drawing upon existing scholarly works, this study posits that PHA could potentially exert an indirect influence on ACP among Ethiopian student-athletes through the mediation of stress levels and the moderation of self-efficacy beliefs.

The results of the study make noteworthy contributions within the Ethiopian context. Comprehending the intricate relationship among these variables is of utmost importance for educational institutions and policymakers in the academic sphere. If the findings of the study demonstrate a positive correlation between physical activity and academic performance, with stress reduction acting as a mediating factor and self-esteem acting as a moderating factor, it underscores the significance of implementing physical activity initiatives within educational institutions. This phenomenon has the potential to positively impact academic achievements, promote overall well-being, and foster self-assurance among students.

Furthermore, these discoveries have the potential to contribute to the advancement of comprehensive student support systems that encompass not only scholastic but also psychological and physiological well-being. This, in turn, may result in enhanced educational experiences and improved prospects for future careers among Ethiopian university students. The study was divided into five chapters. Following the introductory section, the research was structured into four primary chapters. These chapters encompassed a comprehensive literature review, which entailed an examination of both theoretical and empirical perspectives in order to establish the research hypothesis. The subsequent chapter focused on the research methodology, encompassing discussions on research design, survey instruments, and related topics. The subsequent chapter entailed the examination and interpretation of the collected data, wherein the outcomes were thoroughly deliberated. The preceding chapter was dedicated to the examination of findings in conjunction

with pertinent studies as well as the identification of research limitations and potential avenues for future exploration.

Literature Review and Hypothesis Development

Physical Activity and Academic Performance

In recent times, there has been an increasing societal apprehension regarding the significant repercussions associated with inadequate levels of physical activity (PHA) among student populations. The absence of PHA has been recognised as a potential factor contributing to a range of health conditions, such as obesity and diabetes. In the current body of literature, there exist varying viewpoints concerning the influence of physical health and activity (PHA) on the cognitive development of students. Furthermore, recent investigations have shed light on the positive effects of consistent physical exercise on an individual's psychological state and overall well-being (Tyson et al., 2010). Historically, it has been posited that engagement in non-academic pursuits may have the potential to impede academic performance (Lindner, 2002). Nevertheless, the current era has witnessed a comprehensive exploration of the association between PHA and ACP from various perspectives. Scholars have endeavoured to investigate the potential correlation between students' participation in physical activities and their academic performance (Huberty et al., 2013; Sallis et al., 1999). These investigations have produced disparate and conflicting results.

A series of studies did not yield definitive evidence supporting a causal relationship between PHA and ACP (Sallis et al., 1999). In contrast, previous studies have identified a correlation between children's active commuting patterns (ACP) and physical health outcomes (PHA) (Trudeau & Shephard, 2010). Trudeau and Shephard conducted a noteworthy study that examined the correlation between participation in physical health activities (PHA) and academic performance (ACP) among students. The findings of this study demonstrated a statistically significant positive association between engagement in PHA and ACP. There is evidence to suggest that there is a positive correlation between PHA levels and academic achievements, indicating that as PHA levels increase, academic performance tends to improve (Trudeau & Shephard, 2008).

It was discovered that engaging in physical exercise can effectively improve inter-neuronal connections and enhance attentiveness, thereby potentially providing cognitive advantages (Symons et al., 1997). In contrast, the research conducted by Strong et al. (2005) provided

evidence supporting the beneficial impact of PHA on health; however, it did not succeed in establishing a definitive correlation with cognitive performance. Lindner (2002) conducted a study in Hong Kong that revealed the presence of a significant, albeit modest, association between ACP and engagement in PHA. In a similar vein, a study was conducted by Dwyer et al. among a cohort of Australian students, wherein they observed a modest association between ACP (academic performance concern) and PHA (psychological health and well-being) levels (Morales et al., 2011). Thus, based on previous discussion, following hypothesis is formulated below,

H1: *Physical activity has positive and significant effect on academic performance.*

Physical Activity and Stress

Stress, specifically depression, is a widely recognised mental health disorder that manifests through various symptoms such as feelings of sadness, difficulty concentrating, lack of energy, anxiety, restlessness, low self-esteem, negative thoughts, and, in some cases, suicidal ideation (DeRoma, Leach, & Leverett, 2009). Nevertheless, there is a significant dearth of research pertaining to the examination of the correlation between depression and physical activity (PHA) among university students. The majority of research in this field has predominantly centred on individuals in the age groups of children and teenagers, examining the correlation between their academic achievements and increasing levels of PHA (Zamani Sani et al., 2016). The available literature suggests that there is evidence supporting the notion that physical health activities (PHA) and exercise can potentially exert a beneficial influence on individuals suffering from depression (Dinas, Koutedakis, & Flouris, 2011).

Research has indicated that individuals who participate in consistent physical activity (PHA) demonstrate a reduced likelihood of experiencing symptoms associated with anxiety and depression in comparison to individuals who maintain a sedentary lifestyle. The findings of De Mello et al. (2013) and Paluska and Schwenk (2000) indicate that individuals with lower levels of physical activity are more likely to experience elevated levels of depression. Conversely, consistent exercise and progressive homeostasis adaptation (PHA) have been shown to alleviate symptoms of anxiety. De Moor et al. (2008) and other researchers have found evidence supporting the efficacy of regular physical health activities (PHA) in mitigating symptoms of depression, as observed in research conducted in Brazil. It is noteworthy that a considerable segment of the population fails to integrate regular exercise into their daily routines (Warburton, Nicol, & Bredin, 2006), despite the evident positive impact

on mental well-being attributed to routine physical activity (Deshayes & Périard, 2023).

Multiple cross-sectional studies have consistently shown an adverse association between depression and PHA (Won et al., 2023). Moreover, recent studies have brought attention to the notable impact of physical activity on mood, encompassing both individuals with clinical conditions and those without (Josefsson, Lindwall, & Archer, 2014). There is a consistent inverse relationship between depression and PHA, which is applicable to both adolescents and adults Lindwall et al. (2014). Several time-series studies have examined the relationship between depression and PHA (Qureshi et al., 2019). According to a study conducted by Jerstad et al. (2010), there exists a bidirectional association between PHA (positive affect) and depression. Their research findings indicate that an increase in PHA is associated with a reduced risk of depression, while conversely, depression can lead to decreased levels of PHA. Nevertheless, it is important to acknowledge that the existing literature predominantly focuses on adolescents and is primarily conducted over relatively limited durations (Jerstad et al., 2010). Based on previous (Won et al., 2023) discussion, following research hypothesis is formulated below.

H2: *physical activity has negative and significant effect on stress.*

Physical activity, Self Esteem, and academic performance

The concept of self-esteem (SEE) is derived from an individual's self-perception and is grounded in Maslow's hierarchy of needs theory. In this theory, esteem needs are recognised as one of the higher-level necessities for achieving personal satisfaction. Nevertheless, the precise definition of self-esteem (SEE) can differ among various psychological studies, depending on the specific dimensions that are taken into account. Consequently, these variations in definition can result in divergent interpretations of self-esteem across different studies. Rosenberg (YEAR) provided a definition of self-esteem (SEE) as the cognitive evaluation of an individual's intrinsic value, encompassing both positive and negative assessments, and influenced by subjective personal principles. The notion discussed herein bears substantial significance for students and their parents, as engaging in activities that foster sentiments of encouragement can contribute to the enhancement of their aptitudes and competencies (Rosenberg, 2015).

Multiple studies have indicated that individuals who possess a high level of self-efficacy tend to demonstrate enhanced levels of efficiency and effectiveness. According to Rahmani (2011), the utilisation of social and emotional

education (SEE) has the potential to act as a catalyst for effectively tackling various challenges encountered in life. Academic achievement pertains to the acquisition of knowledge by an individual during their academic pursuit in a specific subject or set of subjects within an academic timeframe, such as a semester. Vialle, Heaven, and Ciarrochi (2005) contend that academic achievement is not exclusively determined by cognitive abilities but is instead shaped by a range of additional factors, such as motivation, self-efficacy beliefs, and social dynamics. This highlights the intricate nature of academic attainment, which is shaped by a multitude of social, emotional, and personality factors. The association between self-efficacy beliefs (SEE) and academic performance (ACP) has been the subject of scholarly investigation, with research indicating a positive correlation between these two variables. In alternative terms, there is a belief that a high level of self-efficacy expectation (SEE) is associated with the cultivation of a high level of academic career planning (ACP).

Multiple studies have substantiated the positive correlation between self-efficacy expectations (SEE) and academic performance (ACP) (Naderi et al., 2009). These studies posit that there is a positive correlation between self-esteem enhancement (SEE) and improved academic outcomes. This is because students who possess optimistic self-perceptions resulting from previous achievements tend to exhibit higher academic performance. Aryana conducted a research study involving a sample of 100 students from Azerbaijan, in which she discovered a statistically significant positive association between ACP (academic confidence and performance) and SEE (self-esteem and self-efficacy). The study's findings indicated that individuals who possess high self-efficacy often exhibit higher academic performance. In a separate investigation conducted by Doodman, Zadeh, and Changizi (2017) a cohort of 169 students from Lamerd, selected from a larger population of 300 individuals, was examined. The sample consisted of 73 male and 96 female participants.

This study further substantiates a significant correlation between self-efficacy expectations (SEE) and academic performance (ACP). The previous research recognises the well-established correlation between self-esteem (SEE) and academic performance (ACP). It is widely observed that there is a positive relationship between these two variables, highlighting the importance of self-esteem as a factor that influences students' educational achievements. Hence, within the context of this particular study, the aforementioned connection emphasises the importance of investigating the potential interaction between self-esteem, a recognised influential element in academic

achievements, and physical activity in order to gain a deeper understanding of how they collectively impact students' academic performance. This methodology facilitates a more profound comprehension of the intricate dynamics inherent in this intricate relationship. Based on previous discussion, following research hypothesis is formulated below,

H3: *self-esteem significantly moderates between the relationship of physical activity and academic performance.*

Physical activity, Stress and Academic Performance

Depression is a multifaceted psychological condition characterised by the presence of tension, anxiety, and persistent concerns, all of which exert an impact on the functioning of the nervous system (Lee et al., 2007). The profound impact of this phenomenon on individuals can manifest in various ways, rendering their daily lives arduous and fraught with challenges. Depression is classified as a range of emotional and behavioural disorders. In the context of students, it can manifest as negative attitudes towards their education, such as reduced interest in learning and below-average performance in examinations (Vitasari et al., 2010).

There are a multitude of psychological indicators of depression within the student population, encompassing manifestations such as anxiety, impaired concentration during examinations, a perceived disintegration of cognitive functioning during task execution, and a diminished inclination towards engaging with intellectually demanding subjects. It is noteworthy that there exists an inverse correlation between depression and academic performance, whereby an increase in depression levels is associated with a decline in academic performance (Mihăilescu et al., 2016). The correlation between depression and academic performance has been acknowledged by both students and researchers alike. The research conducted by McCraty (2007) highlights the importance of recognising depression as a significant factor that has a negative impact on educational performance.

It is noteworthy that, despite its significant influence, there exists a limited body of research that explicitly investigates the correlation between elevated levels of depression and inadequate advance care planning. Numerous studies have shown the negative effects of depression on students, such as the research by Aronen et al. (2005). These effects encompass impairments in memory function and heightened levels of distractibility. However, researchers have discovered certain cases in which a more intricate relationship exists. Several studies have indicated that depression may exert both detrimental and beneficial

influences on anticipatory cognitive processing (ACP). As exemplified by Vitasari et al. (2010), there exists a correlation between inadequate academic coping skills and elevated levels of depressive symptoms. Essentially, the aforementioned studies consistently indicate that students who are confronted with elevated levels of depression commonly encounter difficulties pertaining to memory retention, concentration, self-assurance, and cognitive processing.

Previous research has primarily concentrated on investigating the direct impact of PHA on ACP within the field of study. Remarkably, there is a conspicuous dearth of scholarly investigations that delve into the indirect ramifications of PHA on ACP, particularly through the intermediary role of depression. Although there have been some studies examining the relationship between psychological well-being, perceived health agency (PHA), and advance care planning (ACP), research in this area is still limited. Nevertheless, drawing upon the extant corpus of scholarly works, we put forth a conjecture. According to earlier empirical studies (Pasco et al., 2011), the current study hypothesizes that an increase in physical activity may be associated with a decrease in depressive symptoms. Consequently, there is an indirect correlation between this phenomenon and the enhancement of academic achievement, which is consistent with the conclusions drawn from research that emphasises the detrimental impact of depression on educational results (McCraty, 2007). This perspective posits a potentially noteworthy correlation between physical activity, psychological well-being, and scholastic achievement that justifies additional investigation. Based on previous discussion, following hypothesis is formulated below,

H4: *stress has negative and significant effect on academic performance.*

H5: *stress significantly mediates between physical activity and academic performance.*

The research framework depicted in Figure 1 has been developed based on a comprehensive review of previous literature, which revealed several gaps in knowledge. Prior research predominantly concentrated on foreign nations. Our primary focus was on examining the direct impact of PHA on ACP, with limited attention given to exploring potential mediating and moderating effects, particularly within the context of Ethiopia. Consequently, the scholars incorporated self-esteem as a moderating variable and stress as a mediating variable in the examination of the association between physical activity and academic performance within the Ethiopian context. The aforementioned variables are anticipated within the research framework depicted in Figure 1 below.

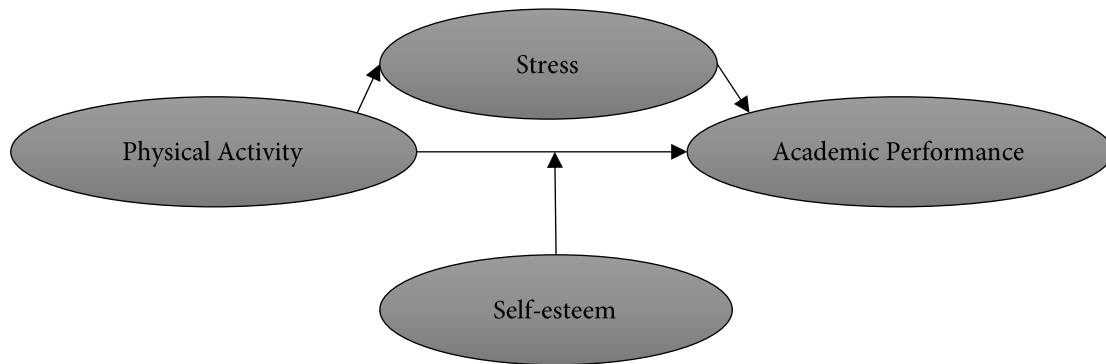


Figure 1: Conceptual Framework

Materials and Methods

The primary objective of this study was to examine the relationship between physical activity (PHA) and academic performance (ACP) among university students in Ethiopia. Additionally, the study aimed to investigate the potential moderating effect of self-esteem (SEE) and the potential mediating role of stress in this association. In order to achieve the objectives of this study, a cross-sectional research design was utilised, employing a quantitative research approach. The present study employs a survey instrument that has been derived from previous scholarly investigations. We employed the abbreviated version of the International PHA Questionnaire (Craig et al., 2003), which consists of seven items. In order to assess the academic performance of students, three items were used. In order to evaluate the self-esteem of the participants, we utilised the English version of the unidimensional Rosenberg Self-esteem Scale, which consisted of 10 items (Rosenberg, 2015). To assess the levels of stress encountered by students in their academic endeavours, we utilised a University Stress Scale consisting of 21 items (Stallman & Hurst, 2016). The scale not only offers comprehensive insights into the various stressors experienced by university students, but it also quantifies the overall intensity of these encounters.

Following the completion of the research instrument, the initial phase entailed informing the relevant authorities at Ethiopian universities regarding our research intentions and objectives, with the aim of obtaining formal authorization to engage with the student population. After obtaining the requisite permissions, we proceeded to contact educators affiliated with the universities involved in the study who had expressed their willingness to contribute to the administration of the survey. Following this, the professors provided guidance and supervision in the administration of the self-report surveys within the regular semester timetables. It is crucial to acknowledge

that prior to their involvement in the study, all participants had given informed consent, which had been duly authorised by the Institutional Review Board. The researchers ensured strict adherence to confidentiality protocols when handling the gathered data during the entirety of the research endeavour. The questionnaires were distributed among 400 sports students from Ethiopian universities. Out of a total sample size of 400 students, 300 questionnaires were deemed valid and suitable for subsequent analysis. The data collected for this study was analysed using SPSS version 20, a software developed by IBM in Chicago, USA. As part of our initial examination, we conducted a thorough review of the data to ascertain its precision and reliability. No missing values were identified in the dataset, indicating that the data is complete and reliable.

Data Analysis and Statistical Techniques

Reliability and Validity

The analysis conducted by the researcher utilised Partial Least Squares-Structural Equation Modelling (PLS-SEM), a widely recognised approach that is commonly employed when multiple essential multivariate assumptions must be satisfied (Hair, Howard, & Nitzl, 2020). This method allows for the evaluation of both the measurement and structural models. Evaluating the measurement model constitutes a crucial stage in this procedure, encompassing the examination of both convergent and discriminant validity aspects pertaining to the indicators and constructs (Hair et al., 2020). In order to assess the reliability of a construct, researchers typically begin by examining convergent validity, which involves evaluating the loading of items and calculating Cronbach's alpha coefficient to determine the instrument's reliability. Furthermore, the researchers employed the measures of composite reliability (CR) and average variance extracted (AVE) to demonstrate the degree to which latent constructs explain

the variability observed in the indicators. The metrics known as CR and AVE are widely acknowledged and employed for this particular objective.

In order for a construct to be deemed significant, it is essential that the external loading surpasses or is at least equivalent to 0.5 (Hair et al., 2020). In order to enhance the trustworthiness of the results, it is advisable for the Cronbach's alpha coefficients to exceed or closely approximate the recommended threshold of 0.7 for all constructs (Werts, Linn, & Jöreskog, 1974). In addition to Cronbach's alpha, the evaluation of composite reliability (CR) for the constructs was conducted, deviating from the traditional methodology (Werts et al., 1974). Typically, a value falling within the range of 0.6 to 0.7 indicates

a satisfactory degree of reliability, while a range of 0.8 to 1.0 signifies an exceptionally high level. Nevertheless, it should be noted that values greater than 0.95 may indicate redundancy, a circumstance that may not always be beneficial (Hair Jr, Ringle, & Sarstedt, 2013; Henseler, Ringle, & Sarstedt, 2015). The obtained results validate the high levels of reliability indicated by the findings, consistently surpassing the threshold of 0.7. Cronbach's alpha is a statistical measure used to assess the extent to which a set of items are interrelated, indicating the overall reliability of the measurement. However, despite alpha displaying a "high" value, it does not necessarily indicate one-dimensionality. The predicted values for the aforementioned variables are presented in Table 1 below.

Table.1

Convergent Validity

	Coding's	Factor Loadings	T statistics	Cronbach's Alpha	CR	AVE
Physical Activity			12.882	0.823	0.866	0.788
	PHA1	0.670				
	PHA2	0.782				
	PHA3	0.892				
	PHA4	0.784				
	PHA5	0.870				
	PHA6	0.794				
Self-esteem	PHA7	0.796				
			23.782	0.847	0.894	0.734
	SEE1	0.891				
	SEE2	0.893				
	SEE3	0.831				
	SEE4	0.933				
	SEE5	0.783				
	SEE6	0.856				
	SEE7	0.812				
	SEE8	0.849				
Stress	SEE9	0.841				
	SEE10	0.867				
			19.673	0.867	0.870	0.704
	STR1	0.945				
	STR2	0.932				
	STR3	0.943				
	STR4	0.942				
	STR5	0.790				
	STR6	0.842				
	STR7	0.845				
	STR8	0.879				
	STR9	0.749				
	STR10	0.831				
	STR11	0.845				
	STR12	0.879				
	STR13	0.804				
Academic Performance	STR14	0.806				
	STR15	0.808				
	STR16	0.898				
	STR19	0.788				
	STR21	0.899				
				0.832	0.883	0.703
ACP1	0.672					
ACP2	0.902					
ACP3	0.672					

Moreover, in the context of evaluating the discriminant validity of measurement models, the Fornell-Larcker criteria is a commonly used approach. This criterion establishes a straightforward principle: The correlation between a construct and any other construct should exceed the square root of the typical variance it captures. In order to evaluate the discriminant validity of the proposed model, we employed two commonly used techniques: the Fornell-Larcker criteria and the heterotrait-monotrait (HTMT) ratios. These methods were chosen based on the recommendations of renowned experts in the field (Hair et al., 2020; Hair et al., 2021).

Table 2 displays the most notable correlations between variables within each column. This confirms that we adhered to the Fornell-Larcker criteria, as outlined by Fornell and Larcker (1981), to establish discriminant validity in accordance with the provided guidelines. It is imperative to bear in mind that although the Fornell-Larcker criteria serve as a valuable tool for evaluating discriminant validity, they may not definitively ascertain the presence or absence of such validity. As a result of this limitation, we employed the HTMT ratio technique, an innovative approach for assessing discriminant validity. Table 3 presents the hierarchical task model testing (HTMT) values corresponding to each of the criteria examined in the study. The HTMT values obtained from the variables in this study consistently demonstrate values below 0.90, which provides robust evidence of discriminant validity and confirms the successful attainment of the study's objectives (Henseler et al., 2015). Above values are predicted in following Table 2 and 3.

Table.2

Fornell and Larcker

	PHA	SEE	STR	ACP
PHA	0.881			
SEE	0.556	0.870		
STR	0.442	0.531	0.890	
ACP	0.534	0.567	0.594	0.820

Table.3

HTMT

	VIF	PHA	SEE	STR	ACP
PHA	1.23				
SEE	1.34	0.452			
STR	1.89	0.234	0.231		
ACP	0.452	0.452	0.231	

Hypothesis Testing

Following the evaluation of the measurement model in the study, the subsequent phase involves the examination of the research hypotheses. Hence, the PLS-SEM 5000 resampling bootstrap resampling technique is employed. Table 4 shows the predicted outcomes that show the connections between physical activity (PHA), academic performance (ACP), stress, and self-esteem (SEE), along with the beta coefficients, t-values, and p-values that go with them. The first hypothesis (H1) says that there is a strong positive relationship between PHA and ACP. The beta coefficient of 0.415, which means there is a positive association, and the p-value of 0.000, which means there is a strong level of statistical significance, support this. This observation suggests that an increase in PHA is associated with an enhancement in ACP.

Additionally, a beta coefficient of -0.214 and a p-value of 0.002 support hypothesis H2 that there is a significant negative association between PHA and stress. This suggests that individuals who participate in a higher frequency of physical health activities are more likely to report lower levels of stress. The literature extensively supports the notion that PHA is linked to decreased stress levels. This can be attributed to the release of endorphins and the reduction of stress hormones through exercise, thereby promoting mental well-being in general. Furthermore, in hypothesis (H3), it is hypothesised that the presence of the moderating effect of self-efficacy expectations (SEE) leads to a positive association between perceived health anxiety (PHA) and adaptive coping processes (ACP), with a beta coefficient of 0.422 and a statistically significant p-value of 0.001. This implies that the influence of PHA on ACP is not only direct but also indirect, mediated by its positive effect on self-esteem.

The aforementioned discovery is of considerable significance, as it emphasises the comprehensive advantages of engaging in physical activity for both mental well-being and academic achievements. Additionally, hypothesis H4 presents evidence of a negative correlation between stress and ACP, as indicated by a beta coefficient of -0.311 and a statistically significant p-value of 0.000. This highlights the negative impact of stress on academic performance, a phenomenon that has been extensively acknowledged in scholarly works. In hypothesis (H5), the beta coefficient of 0.353 signifies the statistical significance of the indirect association between physical activity, stress, and academic performance. To clarify, it appears that the indirect impacts of PHA on ACP exhibit a greater magnitude in relation to academic performance. The following table, Table 4, presents the anticipated findings.

Table.4

Hypothesis Results

Hypothesis	Relationships	Beta	T-value	p-value	R Square	Q Square
H ₁	PHA->ACP	.415	6.162	0.000	0.762	0.273
H ₂	PHA->STR	-0.214	2.227	0.002	0.871	0.372
H ₃	PA*SEE->ACP	0.422	3.234	0.001	0.794	0.451
H ₄	STR->ACP	-0.311	4.126	0.000
H ₅	PHA->STR->ACP	0.353	2.963	0.001

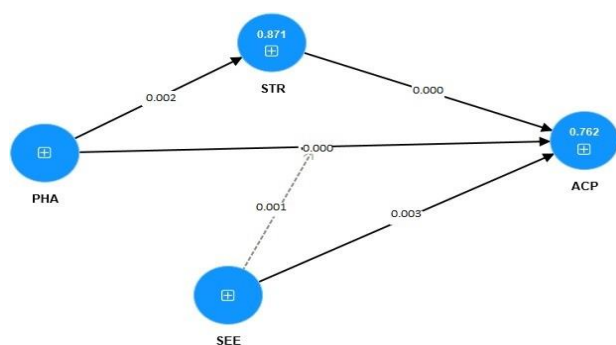


Figure 2: Structural Model

Discussion

The main objective of this study was to examine the correlations between physical activity (PHA), academic performance (ACP), and the mediating effect of stress, as well as the moderating role of self-esteem (SEE) among university students in Ethiopia. The primary outcomes of this study emphasise a favourable correlation between PHA and ACP, consistent with prior research that primarily employed PHA as a predictor for ACP (Andersen et al., 2017; Muntaner-Mas et al., 2018). Significantly, contemporary research is pioneering novel approaches by placing emphasis on physical activity as an independent predictor. It is noteworthy to mention that several previous studies have documented associations between PHA and ACP, thereby strengthening the robustness of these findings (Andersen et al., 2017; Muntaner-Mas et al., 2018). The present study additionally demonstrates that stress exerts a substantial and adverse influence on ACP, aligning with previous research conducted in diverse settings (McCraty, 2007; McCraty et al., 2000). It is worth noting that existing research has identified a noteworthy inverse correlation between PHA (perceived healthiness of activities) and stress levels, which is consistent with findings reported in previous studies (Barcelos-Ferreira et al., 2009; Pasco et al., 2011).

On the other hand, it is worth noting that stress plays a beneficial role in the relationship between physical activity and academic performance, highlighting the considerable influence it has on cognitive functioning and overall

scholastic success. This study provides evidence that an indirect relationship exists between increased PHA and ACP, with stress acting as a mediator. An increase in levels of PHA is associated with a decrease in stress, leading to improved ACP (Dorfman, 2015). It is noteworthy to mention that physical activity has been increasingly recognised as an efficacious approach to addressing depression among adult individuals (Angevaren et al., 2008). Nevertheless, it is important to acknowledge that existing literature also indicates that PHA predominantly affects stress levels, thereby indirectly affecting academic achievement.

Furthermore, Andersen et al. (2017) found evidence suggesting that PHA may have a detrimental effect on depression, despite a potential association with poorer ACP. On the other hand, it is worth noting that stress plays a beneficial role in the relationship between physical activity and academic performance, highlighting the considerable influence it has on cognitive functioning and overall scholastic success. This study provides evidence that an indirect relationship exists between increased PHA and ACP, with stress acting as a mediator. An increase in levels of PHA is associated with a decrease in stress, leading to improved ACP (Dorfman, 2015). It is noteworthy to mention that physical activity has been increasingly recognised as an efficacious approach to addressing depression among adult individuals (Angevaren et al., 2008). Nevertheless, it is important to acknowledge that existing literature also indicates that PHA predominantly affects stress levels, thereby indirectly affecting academic achievement. Furthermore, Andersen et al. (2017) found evidence suggesting that PHA may have a detrimental effect on depression, despite a potential association with poorer ACP (Whitaker Sena, Lowe, & Lee, 2007).

Finally, the variable of self-efficacy (SEE) plays a significant and positive role in moderating the relationship between perceived health agency (PHA) and adaptive coping processes (ACP). The aforementioned discovery highlights the potential advantages of advocating for PHA (positive health attitudes) and bolstering SEE (self-efficacy expectations) among university students in Ethiopia. This

underscores the significance of implementing comprehensive strategies to enhance both psychological well-being and academic achievements in this particular setting. The results of this study highlight the potential of positive health assets (PHA) as a significant instrument for enhancing cognitive development and psychological welfare among university students in Ethiopia. Additionally, these findings offer valuable insights that can inform the development of targeted interventions and programmes tailored to address the needs of individuals within this particular demographic.

Contributions and Recommendations

The present study has made noteworthy contributions within the context of university athletes in Ethiopia. The significance of maintaining an active lifestyle for student-athletes is emphasised by the significant positive correlation between physical activity (PHA) and academic performance (ACP). It is imperative for Ethiopian universities that offer sports programmes to accord utmost importance to physical fitness and active engagement in sports as fundamental constituents of their educational framework. The focus on physical activity not only corresponds with the existing body of research that connects exercise to academic achievement but also provides a pragmatic approach to improving cognitive capacities and overall scholastic performance among students involved in sports. Further, the inverse correlation between physical activity and stress underscores the potential efficacy of sports and consistent physical activities as viable means of stress management for these students, who frequently encounter rigorous training regimens and academic obligations.

It is imperative for universities to acknowledge the distinct stressors encountered by student athletes and offer readily available psychoeducational and psychological health assistance options to facilitate enhanced stress management. In addition, it is important to note that self-esteem (SEE) plays a moderating role in the relationship between perceived holistic athletic support (PHA) and academic and career performance (ACP). This highlights the significance of comprehensive support systems for individuals who are both students and athletes. The implementation of interventions targeting the enhancement of self-efficacy beliefs (SEE), such as mentorship programmes or psychological support, has the potential to augment the positive influence of positive youth development programmes on academic achievements. The aforementioned findings offer significant insights into customising educational strategies that foster the physical well-being and academic achievement of Ethiopian university sports students, thereby contributing to their holistic growth and development.

The study also presents several recommendations that can be suggested to augment their advance care planning (ACP) and overall welfare. Universities should proactively endorse physical health awareness (PHA) as an essential component of their sports programmes, acknowledging its favourable correlation with academic and cognitive performance (ACP). The implementation of structured physical fitness routines and the promotion of regular exercise among student-athletes have the potential to enhance cognitive abilities and, consequently, academic performance. Moreover, it is imperative for universities to offer sports facilities and training opportunities that are easily accessible in order to facilitate the seamless integration of physical health activities (PHA) into the regular routines of sports students. In addition, it is imperative for universities to acknowledge the inverse correlation between perceived health and athletic performance (PHA) and stress levels (STR).

Consequently, it is crucial for academic institutions to place emphasis on implementing stress management interventions that are customised to address the unique requirements of student-athletes. Potential interventions may encompass stress-reduction initiatives that integrate physical activity, mindfulness training, and counselling services. Institutions can enhance the management of academic and athletic pressures for sports students by specifically targeting the stressors that are distinct to this demographic. Additionally, the moderating role of self-efficacy expectations (SEE) in the association between psychological hardiness attributes (PHA) and athletic career planning (ACP) underscores the significance of enhancing SEE among student-athletes. In order to foster a positive self-image and enhance self-confidence among students, universities may opt to implement various strategies such as mentorship programmes, psychological support services, and confidence-building workshops. By promoting the integration of socio-emotional education (SEE) in conjunction with physical health and activity (PHA), educational institutions have the opportunity to optimise the academic advantages for students involved in sports.

Conclusion

This study aimed to examine the impact of physical activity (PHA) on the academic performance (ACP) of athletes, taking into account the moderating effect of self-esteem (SEE) and the mediating effect of stress (STR) among sports students in Ethiopian universities. The results offer significant insights that could potentially revolutionise educational strategies and support mechanisms for this

particular demographic. The significance of exercise in enhancing academic performance among university athletes is readily apparent. This highlights the significance of integrating physical health and sports engagement into the pedagogical approach of Ethiopian colleges with sports programmes. By placing a higher emphasis on physical health and athletics (PHA), educational institutions have the potential to not only enhance cognitive capabilities but also cultivate academic achievements among student-athletes. The study emphasises the stress-reducing advantages of progressive high-intensity aerobic exercise (PHA) for students involved in sports. These individuals frequently encounter demanding training schedules and academic obligations, underscoring the importance of stress management for their overall welfare.

It is imperative for universities to acknowledge the distinct stressors faced by students and offer easily accessible physical activity options as a means to effectively manage stress, thereby enhancing their overall mental well-being. Nevertheless, the role of social and emotional support (SEE) in the relationship between psychological health and academic and career planning (ACP) underscores the importance of comprehensive support systems for student-athletes. The positive impacts of PHA on ACP can be augmented through the implementation of interventions aimed at bolstering social-emotional engagement (SEE), such as mentoring initiatives and psychological assistance. The

implementation of a comprehensive approach has the potential to positively impact the overall growth and achievement of students involved in sports.

Based on the results mentioned above, it is strongly advised that Ethiopian universities offering sports programmes proactively advocate for the inclusion of physical health activities (PHA) as an essential component within their academic curriculum. It is recommended that appropriate measures be taken to offer well-organised exercise regimens, easily accessible athletic facilities, and customised stress management techniques that cater to the unique requirements of student-athletes. Furthermore, the promotion of socio-emotional development (SEE) through mentorship and psychological support has the potential to optimise the academic benefits of individuals from disadvantaged backgrounds, commonly referred to as per with a history of adversity (PHA).

Furthermore, the scope of the study was restricted to Ethiopia, a developing nation. It is recommended that future research be conducted in other developed countries in order to investigate potential variations in the findings. In alternative contexts, future research endeavours could explore the implementation of a probability sampling approach in order to enhance the generalizability of findings. This recommendation arises from the recognition that the current study encountered limitations in terms of sample size and utilised a non-probability sampling method.

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