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Mental health and physical activity assessed in university students of Education

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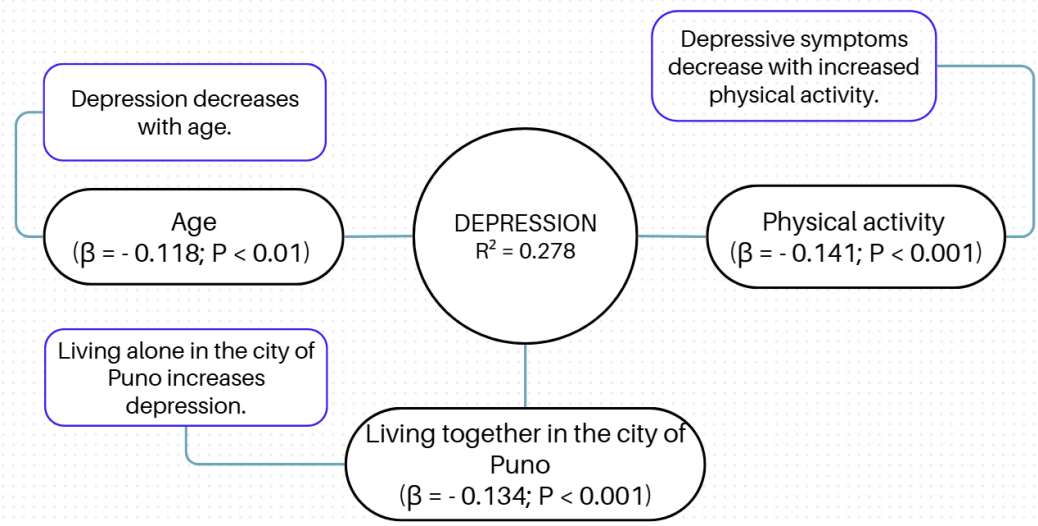
Graphical Abstract



Highlights

- *This study evaluated whether physical activity predicts anxiety, depression, and stress among 544 university students from Puno.*
- *An explanatory quantitative design was applied, using multiple linear regression and Pearson's correlation analysis.*
- *Physical activity showed a significant inverse relationship with depressive symptoms (β = –0.141; P < 0.001).*
- *Age and living alone in Puno were also negatively associated with depression, yielding a predictive model of R^2 = 0.278.*

Abstract

The objective of this study was to investigate whether physical activity predicts levels of anxiety, depression, and stress among Education students at the Universidad Nacional del Altiplano de Puno. A quantitative approach with an explanatory research design was adopted. The study included 544 university students, 280 men (51.5%) and 264 women (48.5%), with a mean age of 20.19 ± 3.075 years. Multiple linear regression and Pearson's correlation analyses were employed. This predictive model (R^2 = 0.278) identified three main variables as significant determinants: physical activity (β = –0.141; P < 0.001), age (β = –0.118; P < 0.01), and living arrangements in the city of Puno (β = –0.134; P < 0.001). Physical activity showed an inverse correlation with depressive symptoms, indicating that higher levels of physical activity are associated with decreased depressive symptoms. Conversely, age demonstrated a moderate negative correlation, suggesting that as individuals grow older, depression levels tend to decrease slightly. Finally, it was also found that living alone in the city of Puno correlates with depressive symptoms.

Keywords: Physical Activity. Anxiety. Depression. Stress. Mental Health.

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INTRODUCTION

According to the World Health Organization (WHO), the lack of physical activity — or physical inactivity — constitutes a major global mortality risk factor, accounting for 6% of all deaths[1]. Furthermore, the WHO highlights that 31% of adults and 80% of adolescents fail to meet the recommended levels of physical activity, which are directly associated with physical and mental well-being, particularly among adolescents[2]. These figures are concerning, as physical inactivity is closely linked to both physical and mental health issues. Moreover, this trend is projected to increase by up to 35% in physical inactivity by the year 2030 if authorities and national governments do not implement effective policies to promote more active lifestyles[3]. For mental health benefits among adolescents, the WHO recommends 60 minutes of daily moderate or vigorous physical activity[4]. Mental health and physical activity among university students have become a critical global concern, particularly exacerbated by the COVID-19 pandemic. The disruption of daily routines and social isolation led to a significant rise in anxiety, depression, and stress levels among young people, with studies indicating that up to 75% of students experienced symptoms of anxiety during this period[5]. At the same time, physical activity — shown to improve mental health and reduce the symptoms of these disorders — declined sharply due to the closure of sports facilities and the lack of motivation[6]. This situation created a vicious cycle, where poor mental health reduced engagement in physical activity, which in turn worsened psychological problems, underscoring the urgent need to implement effective strategies that integrate exercise as a component of emotional well-being within the university environment[7].

In Peru, university students' mental health and physical activity face considerable challenges, which have been further aggravated by the effects of the COVID-19 pandemic. During this period, there was a notable increase in anxiety, depression, and stress levels among young people, with studies reporting that up to 52.4% of students exhibited symptoms of anxiety and 42.7% showed signs of depression in various universities across the country[8]. This deterioration in mental health was correlated with decreased physical activity, as confinement measures and the transition to virtual education limited opportunities for students to exercise and socialize — factors essential to emotional well-being[9]. In addition, the lack of access to psychological support programs exacerbated this situation, creating a feedback loop in which deteriorating mental health reduced motivation to engage in physical activities, further worsening psychological conditions[10]. Numerous studies have demonstrated that regular sports and exercise stimulate the release of endorphins, which induce feelings of happiness and improve mood. This is particularly relevant for individuals experiencing emotional or psychological difficulties[9,11,12].

At the Universidad Nacional del Altiplano de Puno, the Professional School of Physical Education organized the eighteenth edition of the "Aerotón Universitaria" with the aim of promoting physical activity. This annual event seeks to encourage exercise as a key tool for preventing non-communicable chronic diseases. In 2024, the event took place in the Plaza Mayor of the lakeside city of Puno[13]. A study revealed that 42% of students experienced symptoms of burnout, indicating high levels of emotional exhaustion and stress[14]. Moreover, research conducted in other regions of the country showed that up to 52.4% of students suffered from anxiety and 42.7% from depression during social isolation. This mental health crisis has been aggravated by the decline in physical activity, as restrictions limited opportunities for exercise and social interaction — both essential for emotional well-being. Therefore, the purpose of this research was to investigate whether physical activity predicts levels of anxiety, depression, and stress among education students at UNA Puno.

METHODOLOGY

The study included 544 students from the Professional School of Secondary Education, part of the Faculty of Educational Sciences at the Universidad Nacional del Altiplano de Puno, Peru. The participants had a mean age of 20.19 ± 3.075 years, with the majority being over 20 years old (37.3%). Among them, 280 were men (51.5%) and 264 were women (48.5%). More than 74% reported using the internet for four or more hours per day. Intensive internet use, defined as four or more hours of daily consumption, has be-

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come a significant component of daily life, particularly among young people and university students. This high level of digital exposure can influence various aspects of physical and mental well-being, generating both benefits and risks. An important finding of this study was that the majority of students (69.7%) lived alone in the city of Puno, where the Universidad Nacional del Altiplano is located, indicating that many of them come from other provinces within the Puno region (Table 1).

Table 1 - Sociodemographic characteristics of university students at UNAP, 2025.

Variable	$\bar{X} \pm SD$	Frequency	Percentage (%)
Age	**20.19 ± 3.075 years**		
< 19 years old		171	31.4
19 - 20 years old		170	31.3
> 20 years old		203	37.3
Gender			
Male		264	48.5
Famale		280	51.5
Daily Internet use			
More than 5 hours/day		169	31.1
Between 4–5 hours/day		237	43.6
Less than 4 hours/day		138	25.4
Living arrangements in the city of Puno			
Alone		377	69.3
With father		12	2.2
With mother		46	8.5
With both parents		109	20.0

The research instruments were applied in person in the classrooms of the secondary education professional school of the Faculty of Education Sciences at UNAP. Before applying the instruments in each classroom, the way to fill in the items was explained, as well as the purposes of the study and the importance of the results. Written informed consent was obtained, guaranteeing that their participation was voluntary and confidential. In addition, the importance of answering all the questionnaire questions completely and honestly was emphasized, highlighting that their responses would be important for future decision-making. In the development of this research, the ethical guidelines established in the Declaration of Helsinki were strictly followed, ensuring respect and protection of the rights, dignity, and well-being of the participants. Prior informed consent, confidentiality of the collected data, and responsible handling of information were ensured in order to comply with the ethical principles governing research involving human beings. The researchers developed questions to assess sociodemographic variables, considering their respective measurement levels, such as: Age (categorized as < 19 years old; between 19 - 20 years old and > 20 years old); Hours of internet use (More than 5 hours/day; Between 4 to 5 hours/day and Less than 4 hours/day) and With whom they live in the city of Puno (Alone = 1 point; With Father = 2 points; With Mother = 3 points and With Father and Mother = 4 points). In this study, the DASS-21 instrument was used to assess the mental health of the participating students. This instrument consists of 21 items divided into three subscales: Depression Subscale: Assesses symptoms such as sadness, lack of interest, and hopelessness; Anxiety Subscale: Measures worry, fear, and muscle tension; and Stress Subscale: Examines irritability and difficulty relaxing. Each item is rated on a Likert scale from 0 to 3, where 0 means "not at all" and 3 "very much or most of the time." Higher scores indicate greater severity of symptoms. The internal consistency of the DASS-21 instrument was $\alpha = 0.94$. To assess physical activity, the eating habits and physical activity questionnaire applied in this research was used, which consists of four sections: Section 1: contains 6 questions focusing on the frequency and quantity of consumption of recommended foods, such as the consumption of vegetables, fruits, water, milk, and its derivatives.

Section 2: contains 9 questions related to the frequency and quantity of consumption of non-recommended foods, such as: ham, sausage, fast food, chocolates, hamburgers, salchipapas, bottled drinks, alcoholic beverages. Section 3: contains 12 questions related to company during consumption, which address the frequency, company, and place of meals. Section 4: contains 4 questions related to physical activity. Although this section is not part of eating habits, it is considered relevant to evaluate it simultaneously due to its important relationship with them. This section addresses the performance of physical activity, hours of physical activity, the practice of any sport, and lifestyle. For the evaluation of eating habits and physical activity, specific scores were assigned to the items: from 0 to 3 points for those with a single question and from 0 to 1.5 points for items with two or more questions. Thus, the maximum score for Section 1 is 12 points, for Section 2 is 21 points, and for Section 3 is 18 points, totaling a maximum of 51 points for the evaluation of eating habits. Section 4 has a maximum score of 12 points. The internal consistency of this instrument was $\alpha = 0.92$. To investigate the correlation between physical activity and anxiety, depression, and stress, the Pearson correlation statistical test was used, and to evaluate the influence of physical activity on anxiety, depression, and stress, the multiple linear regression statistical technique was applied. The analyses were performed using IBM SPSS v.25 software, and a significance level of $P<0.05$ was considered in this study.

RESULTS

The findings derived from the statistical analysis indicate a notable negative correlation between physical activity and the three main indicators of mental health: depression, anxiety, and stress. More precisely, a negative correlation was identified with depression ($r = -0.132$; $p < 0.01$), which suggests that higher levels of physical activity are correlated with a decrease in depressive symptoms. Similarly, a negative correlation was detected with anxiety ($r = -0.167$; $p < 0.01$), indicating that an increase in physical activity corresponds to a reduction in anxiety symptoms. Finally, a negative correlation was also established with stress ($r = -0.129$; $p < 0.01$), meaning that participation in physical activities is associated with lower levels of perceived stress. These correlations, all statistically significant at the threshold of $p < 0.01$, underline the potential importance of physical activity as a protective factor in mental health (Table 2).

The multiple linear regression analysis, with a coefficient of determination $R^2 = 0.278$, allowed for the detailed identification and understanding of the factors that significantly influence depression, explaining approximately 27.8% of the variability in the levels of this condition (Table 3). This predictive model highlighted three key variables as significant determinants: physical activity ($\beta = -0.141$; $P < 0.01$), age ($\beta = -0.118$; $P < 0.01$), and cohabitation in the city of Puno ($\beta = -0.134$; $P < 0.01$). Physical activity showed an inverse relationship with depression, suggesting that higher levels of physical activity are associated with fewer depressive symptoms. On the other hand, age presented a moderate negative relationship, indicating that as age increases, depression levels tend to decrease slightly. Finally, living alone in the city of Puno was also negatively associated with depression. It is important to note that most students (69.3%) live alone in the city of Puno, as they come from provinces in the Puno region.

Table 2 - Correlations between physical activity, depression, anxiety, and stress among UNAP university students, 2025.

Variables	(1)	(2)	(3)	(4)
Physical Activity (1)	-	-0,132**	-0,167**	-0,129**
Depression (2)		-	0,787**	0,733**
Anxiety (3)			-	0,749**
Stress (4)				-

**Note: Correlation is significant at the 0.01 level (two-tailed).

Table 3 - Predictive model based on multiple linear regression for assessing depression risk among UNAP university students, 2025.

	Unstandardized coefficients		Standardized coefficients		95.0% Confidence interval for B		
Model	**B**	**D.P.**	**β**	**t**	**Sig**	**Lower bound**	**Upper bound**
Physical activity	-.280	.084	-.141	-3.314	.001	-.446	-.114
Age	-.752	.271	-.118	-2.770	.006	-1.285	-.219
Gender	.464	.451	.044	1.030	.304	-.421	1.349
Daily internet use	.485	.299	.069	1.624	.105	-.102	1.072
Living arrangements in puno	-.570	.181	-.134	-3.148	.002	-.925	-.214

a. Dependent variable: depression.

Table 4 - Predictive model based on multiple linear regression for assessing anxiety risk in UNAP university students, 2025.

	Unstandardized coefficients		Standardized coefficients		95.0% Confidence interval for B		
Model	**B**	**D.P.**	**β**	**t**	**Sig**	**Lower bound**	**Upper bound**
Physical Activity	-.317	.080	-.167	-3.939	.000	-.475	-.159
Age	-.594	.258	-.098	-2.301	.022	-1.102	-.087
Gender	-.560	.429	-.056	-1.304	.193	-1.402	.283
Daily Internet Use	.412	.284	.062	1.449	.148	-.147	.971
Living Arrangements in Puno	-.358	.172	-.089	-2.080	.038	-.697	-.020

a. Variável dependente: Ansiedade.

The multiple linear regression analysis, with a coefficient of determination $R^2 = 0.244$, allowed for a detailed identification and understanding of the factors that significantly influence anxiety levels, explaining 24.4% of the variability observed in this psychological condition. This predictive model highlighted three key variables as significant determinants in this context: physical activity ($\beta = -0.167$; $P < 0.01$), age ($\beta = -0.098$; $P < 0.05$), and living in the city of Puno ($\beta = -0.089$; $P < 0.05$) (Table 4). Physical activity showed a significant inverse relationship with anxiety levels, suggesting that greater engagement in physical activities is associated with a reduction in anxious symptoms, possibly due to its beneficial effects on the nervous system and emotional well-being. Likewise, age also presented a negative relationship, indicating that older individuals tend to experience slightly lower levels of anxiety, which could be related to greater experience in stress management or changes in life priorities over time. Finally, living alone without family members in the city of Puno was negatively associated with anxiety.

Table 5 - Predictive model based on multiple linear regression for assessing stress risk among UNAP university students, 2025.

	Unstandardized coefficients		Standardized coefficients		95.0% Confidence interval for B		
Modelo	**B**	**D. P.**	**β**	**t**	**Sig**	**Lower bound**	**Upper bound**
Physical Activity	-.235	.077	-.130	-3.037	.003	-.388	-.083
Age	-.444	.249	-.077	-1.784	.075	-.933	.045
Gender	-.049	.413	-.005	-.119	.905	-.861	.763
Daily Internet Use	.484	.274	.076	1.768	.078	-.054	1.023
Living Arrangements in Puno	-.175	.166	-.045	-1.053	.293	-.501	.151

a. Dependent Variable: Anxiety.

The multiple linear regression analysis, with a coefficient of determination $R^2 = 0.232$, provided a deep and detailed understanding of the factors influencing stress levels, explaining 23.2% of the variability observed in this psychological condition (Table 5). This predictive model highlighted one key variable as a significant determinant in this context: physical activity ($\beta = -0.130$; $P < 0.01$). Physical activity emerged as a crucial factor in stress modulation, showing a significant inverse relationship. The negative beta coefficient ($\beta = -0.130$) indicates that as participation in physical activities increases, stress levels tend to decrease. This robust association ($P < 0.01$) underscores the importance of exercise as a potential tool for stress management. Identifying physical activity as a significant predictor of stress has important implications for public health interventions and individual stress management strategies. These findings support the promotion of exercise programs as an integral part of mental well-being initiatives and could inform the development of policies that encourage physical activity as a means to reduce stress in the population.

DISCUSSION

Physical activity, age, and living alone in the city of Puno offer relevant insights for targeted interventions. The inverse relationship between physical activity and depression ($\beta = -0.141$; $P < 0.01$) reinforces the protective role of exercise, consistent with previous studies highlighting its psychological and physiological benefits. Similarly, the negative association between age and depression levels ($\beta = -0.118$; $P < 0.01$) suggests possible adaptive mechanisms or shifts in emotional priorities with aging. Finally, the finding that living alone in Puno is negatively correlated with depression ($\beta = -0.134$; $P < 0.001$) provides empirical evidence that can be integrated into existing theoretical models of mental health determinants, emphasizing the protective role of physical activity and the cultural and social particularities linked to specific geographic contexts[15,16,17]. Living alone may have a significant impact on mental health, as the absence of constant companionship can heighten feelings of loneliness and social isolation. These factors are associated with an increased risk of developing disorders such as anxiety and depression and can negatively affect overall emotional well-being. The lack of daily social interaction and emotional support that cohabitation provides may hinder stress regulation, increasing vulnerability to psychological problems. From a practical standpoint, these results suggest potential applications in the design of personalized interventions. For instance, promoting physical activity programs could be an effective strategy to reduce depressive symptoms, particularly among young populations[18,19]. Furthermore, focusing on contextual factors — such as living conditions in cities like Puno — could guide public policies aimed at improving the psychological well-being of students facing challenges related to internal migration. These practical applications underscore the need for comprehensi-

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ve approaches combining individual interventions with community strategies to address depression more effectively[11,18,20].

The results of the multiple linear regression analysis also have theoretical and practical implications for understanding and managing anxiety levels. The significant inverse relationship between physical activity and anxiety ($\beta = -0.167$; $P < 0.001$), together with the negative association between age ($\beta = -0.098$; $P < 0.05$) and anxiety levels, highlight the importance of both behavioral and demographic factors. Additionally, the significant effect of living alone in Puno ($\beta = -0.089$; $P < 0.05$) emphasizes the relevance of sociocultural and geographic contexts in modulating anxiety, suggesting potential protective factors associated with this region. Practically, these findings have direct applications for designing preventive and therapeutic interventions. Promoting physical activity programs may serve as an effective strategy to reduce anxiety levels, especially among young people facing high academic stress[21,22,23]. Moreover, public policies could leverage the identified contextual factors to develop community-based initiatives that foster social and cultural environments protective against anxiety[24,25]. Age-related differences could also inform specific interventions tailored to different age groups, focusing on adaptive coping strategies for younger populations and strengthening resilience mechanisms in older adults[26,27,28]. These findings highlight the need for an integrated and context-sensitive approach to addressing anxiety disorders from both individual and community perspectives.

The multiple linear regression results, with a coefficient of determination of $R^2 = 0.232$, provide a detailed understanding of the factors influencing stress levels, explaining 23.2% of its variability. From a theoretical perspective, these findings emphasize the importance of physical activity as a key element in stress regulation, evidenced by its significant inverse relationship ($\beta = -0.130$; $P < 0.01$). This strong association suggests that exercise functions as a protective mechanism against stress, aligning with theories linking physical activity to emotional regulation and reduced sympathetic nervous system hyperactivation[29,30,31]. Practically, these results have important implications for the design of preventive and therapeutic interventions. Promoting physical activity programs could be an effective strategy for reducing stress levels in various populations, particularly in occupational or educational settings where stress is prevalent[32,33]. Moreover, public policies could leverage these findings to develop community initiatives that promote physical activity as a tool for stress management. Comprehensive approaches could include workplace exercise programs, incentives for sports participation, or even the integration of physical activity routines into educational curricula.

CONCLUSION

In conclusion, the findings highlight key factors that can guide interventions aimed at reducing depression in the population of Puno. Physical activity is confirmed as a significant protective factor, reinforcing its importance both psychologically and physiologically. Similarly, the negative relationship between age and depressive symptoms suggests that aging may be associated with adaptive mechanisms or emotional shifts that promote mental well-being. Lastly, the finding that living alone in Puno is linked to lower levels of depression raises questions about possible benefits associated with independence or specific cultural characteristics of the region. These results underscore the need for personalized and culturally sensitive approaches in designing strategies to promote mental health.

The multiple regression findings also provide deeper insight into the factors influencing anxiety levels, revealing both theoretical and practical implications. The inverse relationship between physical activity and anxiety reinforces the role of exercise as an effective mechanism for mitigating this disorder, supporting the promotion of active lifestyles. Furthermore, the negative association between age and anxiety levels suggests that aging may be linked to greater emotional resilience. Finally, the finding that living alone in Puno correlates with lower anxiety symptoms highlights the influence of sociocultural and geographic context, suggesting that local factors may offer protection against anxiety. These insights are crucial for developing tailored interventions that address the specific needs of the population in this region.

The regression analysis results also identify key factors underlying stress levels, explaining 23.2% of their variability. From a theoretical standpoint, they emphasize the relevance of physical activity as a fundamental element in stress regulation, as evidenced by its significant inverse relationship. These findings reinforce the importance of promoting exercise as an effective strategy for managing stress, providing a strong foundation for practical

interventions aimed at enhancing psychological well-being. For future research, longitudinal designs are recommended to observe changes and causal relationships over time, offering a deeper understanding of the factors influencing mental health and physical activity.

CRediT author statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the workreported in this paper.

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