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The Role of Physical Activity to Mitigate Academic Burnout among Moroccan Adolescents

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ABSTRACT

Objective: The current study explores the potential mediating effects of body mass index (BMI) in the impact of physical activity on academic burnout.

Methods and Materials: 1197 participants from public secondary school students from Rabat-Sale-Kenitra Region (Morocco) with a mean age of 17.15 years (SD=1.328), including 59.1% of girls, responded to an Arabic version of the Maslach Burnout Inventory-Student Survey (MBI-SS), a short from the International Physical Activity Questionnaire (IPAQ-sf), and standardized questions to calculate BMI. The IBM SPSS statistics 26.0 and Amos 24 were used to analyze the data.

Findings: The findings indicated a detrimental association between school burnout, BMI, and physical activity levels. An inverse correlation was observed between physical activity and this mental disorder, with BMI functioning as a mediating factor in this dynamic. Regular physical activity mitigates academic burnout by achieving a healthier BMI.

Conclusion: These findings can be explored to propose suitable strategies for mitigating academic burnout in secondary school.

Keywords: Academic burnout, Secondary school, Physical activity.

Introduction

Academic burnout refers to profound emotional, cognitive, and physical exhaustion precipitated by sustained high levels of academic pressure. Predominant symptoms of this disorder include profound fatigue, cynicism or alienation from academic activities, and a reduced perception of personal accomplishment (Chen et al., 2022). Academic settings, such as institutions of higher learning or secondary education, represent the principal environments in which academic burnout manifests, characterized by continuous stressors related

to performance expectations, academic obligations, or overwhelming school burdens. Individuals may display avoidance behaviours, procrastination, or a withdrawal from academic duties, including absenteeism from classes or a lack of interest in previously engaging in academic pursuits and extracurricular activities (Tang et al., 2021). Academic burnout has been associated with detrimental repercussions for health, school achievement and well-being (Tang et al., 2021). Identifying all burnout signs to tailor effective interventions to mitigate this issue among students is primordial. Recent research has emerged several strategies to mitigate student burnout efficiently, improving student well-being and academic performance, such as psychological interventions (Benchelha, Chakit, Mouilly, et al., 2023; Messina et al., 2024), peer-assisted learning (Campillo et al., 2024), and mindfulness practices (Benchelha, Chakit, Lotfi, et al., 2023; Lotfi & Chakit, 2024; Ozan et al., 2024).

Persistent experiences of stress and anxiety associated explicitly with school demands can lead to burnout (Read et al., 2022). The three components of emotional exhaustion, a cynical disposition towards educational institutions, and sentiments of inadequacy in student performance characterize the burnout syndromes (Salmela-Aro et al., 2009). The first component manifests as an enduring energy depletion devoted to academic tasks (Bask & Salmela-Aro, 2013). By cultivating a cynical perspective regarding their educational experiences, students tend to be emotionally irresponsible towards their school assignments. Continuous self-doubts about their capability of achieving educational goals lead to a feeling of inadequacy in school (Salmela-Aro & Read, 2017). This disorder can obstruct student's academic success. The implications of school burnout are significant, as it may precipitate depressive symptoms and heighten the likelihood of students disengaging from their educational pursuits (Salmela-Aro & Read, 2017).

Physical activity characteristics encompass various dimensions, including specific intensity, frequency, and duration levels to enhance physical and mental health (Benchelha, Chakit, Ahami, et al., 2023; Pan et al., 2021). Such participation not only facilitates the attainment of favorable modifications in the physical condition and emotional state but also mitigates physiological reactivity to stress (Mikkelsen et al., 2017; Sani et al., 2016), concurrently promoting student achievement and aiding integration in society (Wunsch et al., 2021). Given that these benefits might alleviate burnout, various research has systematically explored the effects of physical activities. For instance, one investigation revealed that students in vocational schools who engaged in the minimum amount of moderate and vigorous physical exercise exhibited diminished signs of burnout by improving psychological and biological factors (Gerber et al., 2020). In contrast, another research indicated that only intense physical exercises correlated with decreased burnout levels (Elliot et al., 2015). In addition, an inverse correlation between this disorder's manifestations and physical activity levels was demonstrated in a university context (Ricardo Guilherme et al., 2021).

Physical activity interventions can effectively mitigate student burnout in complex educational settings. Research indicates that increased physical activity can alleviate stress and enhance student well-being. Studies have identified various mediators in this relationship. Intense exercises enhance self-efficacy and resilience, reducing burnout (Chen et al., 2022). Physical activity also influences body mass index (BMI) and adherence to a healthy diet, which are associated with lower academic burnout. This sequential mediation highlights the multifaceted benefits of exercising (Baataoui et al., 2023; Rehman et al., 2024). Physical activity is one of the most common interventions to significantly mitigate student burnout (Madigan et al., 2024). In a quasi-experimental study, an active meditation intervention reduced burnout with structured physical activity programs in university (Banda Guzmán et al., 2023). While physical activity interventions promise to mitigate burnout, students might respond differently. Thus, to maximize benefits across diverse student populations from physical activity a specific approach may be necessary.

The investigation into the correlation between physical activity to reduce school burnout leading to better academic performance carries considerable ramifications for enhancing educational methodologies. Integrating physical activity within the academic day, whether through structured physical education sessions, active intermissions, or shares to practice the chosen physical activity, presents a holistic approach to mitigating academic burnout among students. It may be prudent for policymakers and educators to consider

incorporating empirically supported physical activity initiatives as a strategy to facilitate educational environments, reduce burnout levels, and promote the comprehensive well-being of learners. Enhanced academic outcomes can be attributed to the neurobiological, psychological, and cognitive benefits conferred by physical activity. Analyzing the intricate relationships that characterize the interplay between physical exercise and brain function underscores the imperative to motivate students towards active life, thereby fostering improvements in both their physical and mental abilities, alongside their academic performance through less stressful learning.

Physical activity has been empirically demonstrated to enhance cognitive functionality and alleviate academic burnout through several of physiological and psychological mechanisms. These mechanisms encompass enhancements in cerebral health, augmented self-efficacy, and increased resilience, collectively facilitating improved academic performance and diminished burnout experiences. Physical activity encourages the upregulation of genes associated with synaptic plasticity within the hippocampus, thereby augmenting memory retention and learning proficiency (Dwojaczny & Bejtka, 2023). Exercise stimulates the secretion of Brain-derived neurotrophic factor and insulin-like growth factor 1, vital for maintaining neuronal integrity and cognitive functionality (Dwojaczny & Bejtka, 2023). Consistent practice of physical exercise has been shown to attenuate stress hormones, thereby enhancing mood and cognitive lucidity (Popov & Jakovljev, 2017). Physical exercise elevates self-efficacy and fosters resilience, which correlates with diminished academic burnout (Chen et al., 2022). Furthermore, anxiety and depression are factors that can exacerbate academic burnout reduced by physical exercise (Popov & Jakovljev, 2017). Although the advantages of physical activity on cognitive functioning and academic burnout are extensively documented, it is imperative to acknowledge that excessive or high-intensity exercise may yield deleterious effects, potentially culminating in fatigue or burnout if not managed judiciously (Popov & Jakovljev, 2017).

The educational framework in Morocco incorporates physical education as a fundamental component within the secondary school curriculum, thereby emphasizing the pivotal significance of physical activity in augmenting students' overall academic performance. Despite its recognized value, numerous challenges hinder the effective implementation of physical education programs. The scheduling of various physical activities that students express interest in is allocated on Friday evenings within the timetable for each secondary school pupil; however, in recent years, the Moroccan Ministry of Education has supplanted these designated hours for physical activity with official teaching hours for physical education teachers. Moreover, many of these educators fail to participate and lack attention towards these activities, potentially alleviating school-related burnout among students. Additionally, overcrowded classrooms exacerbate the challenges associated with providing physical education, thereby constraining individual student involvement and engagement. Thus, there is a need for comprehensive reforms to support physical education initiatives and to give students more opportunities to practice various physical activities chosen by them.

Methods and Materials

Study Design and Participants

A total of 1116 secondary school students hailing from the Rabat-Sale-Kenitra Region of Morocco (Figure 1) participated in the study. Among these participants, 59.1% were female, with an average age of M=17.15 (SD=1.174). Maslach Burnout Inventory-Student Survey (MBI-SS), and short form of the International Physical Activity Questionnaire (IPAQ-sf), were completed by all participants. Data about the practice of physical activities in school and standardized sociodemographic inquiries were also collected.

Data were collected using the MBI-SS and IPAQ instruments after securing the requisite permissions. A designated representative from each educational institution was engaged to facilitate the process. The administration of the questionnaires was conducted in collaboration with the respective educator and in the presence of a member of the research team at the outset of each session; the aims of the study and the items within the questionnaire were elucidated to the students while guaranteeing their confidentiality and privacy, although no details about the research subject matter were disclosed to the adolescents. Ultimately, students

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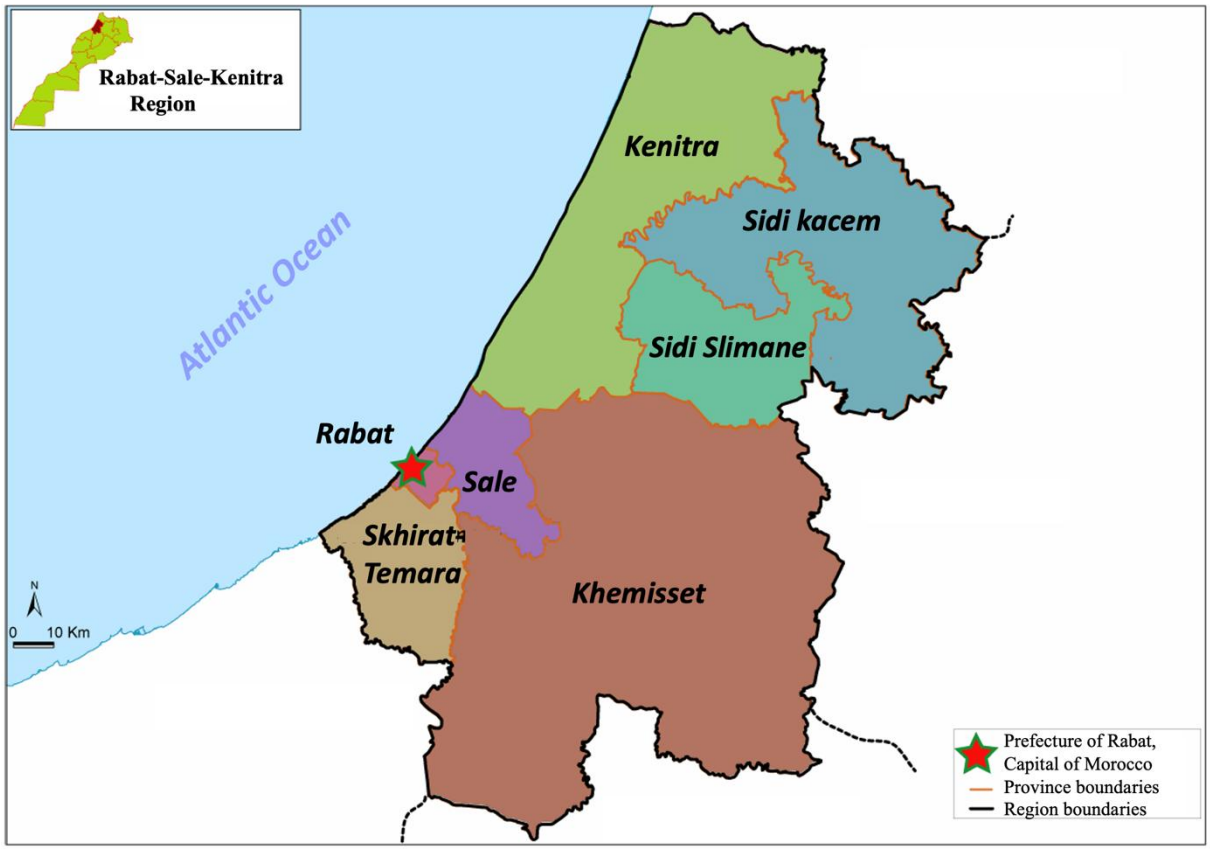
were allowed to decide whether to participate in the questionnaire or abstain from it. All participants completed the assessment individually, averaging 20 minutes. Under these circumstances, we encountered no refusals, yet 21.06% of the questionnaires were submitted with incomplete data. These incomplete responses were excluded from the analysis utilizing the missing values function in SPSS.

Figure 1

Region study location.



Instruments

An Arabic-translated MBI-SS Questionnaire (Schaufeli et al., 2002b) and IPAQ-sf were employed to evaluate school-related burnout and physical activity levels among Moroccan adolescents attending secondary school, respectively, alongside questions about the practice of physical activities in school, and standardized sociodemographic inquiries. The MBI-SS encompasses 15 items distributed across three distinct components: Emotional exhaustion in response to educational demands is measured through five items starting with "I feel emotionally drained by my studies", four items evaluate cynicism starting with "I have become less interested in my studies since my enrollment at the high school"), and six items assess academic efficacy starting with "I can effectively solve the problems that arise in my studies"). The items within the MBI-SS are rated utilizing a Likert scale of 6 points (from 0 = never to 6 = every day) and facilitate the assessment of academic burnout through individual scores on exhaustion, cynicism, and academic efficacy.

The IPAQ-sf comprises seven items, which collected data based on the preceding seven days regarding the frequency of days per week and the mean duration per day allocated to walking, moderate-intensity activities, and vigorous activities, and facilitating the computation of energy expenditure in metabolic equivalents (METs) (Craig et al., 2003). The score of the IPAQ-sf is obtained by employing the formula "MET level × minutes of activity per day × days per week" and is represented in METs-minutes per week. Following established IPAQ guidelines, instances were excluded in which the

cumulative duration of walking, moderate, and vigorous physical activities surpassed 960 minutes. Additionally, responses indicating less than 10 minutes of each respective activity were reclassified as zero. Finally, durations of walking, moderate, and vigorous activity that exceeded 240 minutes were adjusted to reflect a maximum of 240 minutes. The questionnaire is devoid of any associated costs and is accessible via the IPAQ website, providing comprehensive scoring guidelines.

Following the guidelines promulgated by the International Test Commission regarding scale translation within the context of cross-cultural research (ITC—Hambleton, 2001), a pair of bilingual linguists undertook the independent translation of the original editions of the MBI-SS and the IPAQ into Arabic. Subsequently, these two translated versions were subjected to comparative analysis and dialogue to achieve a consensus. Following this, a third individual retranslated the Arabic version to facilitate a comparison with the original text. The resulting two versions exhibited a high degree of similarity, prompting the authors to affirm the validity of the retranslation.

Data Analysis

The dataset was initially subjected to an analysis utilizing descriptive statistics, which included the calculation of the Mean, Standard Deviation, Skewness, and Kurtosis; subsequently, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) employing maximum likelihood estimation were implemented to examine the factorial validity of the two scales uzed. The quality of the fit was assessed by these indices were used in the CFA: the ratio of Chi-square to degrees of freedom ($\chi 2/DF$), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). The following benchmarks were considered: $\chi 2/DF$ values below five and equal to or less than three indicating acceptable and good fit, respectively; an RMSEA of less than .05 signifying a "good" fit and an RMSEA of less than .08 indicative of an "acceptable" fit; TLI values were deemed acceptable if it exceeded .9, while a CFI value greater than .95 was also required. The reliability of the model was assessed utilizing Cronbach's alpha coefficient.

The Body Mass Index (BMI) was evaluated using a self-reported measurement of body mass (kg) divided by the square of height (m), according to the WHO adults classification.

The results derived from the IPAQ-sf were analyzed as follows: The foundational activity pattern requisite for an individual to be categorized as "minimally active" encompasses the fulfilment of any one of the following three criteria: a) 3 or more days of vigorous activity of at least 20 minutes per day, or b) 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day, or c) 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week. The dual criteria for classification as "HEPA active" consist of: a) vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-minutes/week, or b) 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week. Those individuals who do not meet the criteria for the two mentioned categories are classified as "inactive".

The statistical analysis was conducted using IBM SPSS Statistics version 26.0, IBM SPSS Amos version 24.

Findings and Results

The constructs utilized in the two assessment instruments present a normal distribution. According to Finney and DiStefano, the absolute value of skewness is within 2, and the absolute value of kurtosis is within 7 (Finney & DiStefano, 2013). The current investigation recorded that the peak absolute values for skewness and kurtosis were .96 and 1.45 for the MBI-SS and 1.60 and 3.36 for the IPAQ-sf, respectively.

Table 1

Descriptive statistics, and internal reliability of the two questionnaires

	Components	Mean	SD	Skewness	Kurtosis	Cronbach alpha	Kaiser-Meyer-Olkin	Bartlett's sphericity
MBI-SS (15 items)	EE	12.78	2.37	-.18	-1.45	.726	.867	$\chi 2 = 3853.641$ p<.000
	CY	8.62	2.22	.96	-.55	.815		

AE	24.01	2.25	-.73	-.95	.775		
IPAQ-sf (7 items)	42.88	2.50	1.60	3.36	.746	.795	χ2 = 1199.572 p<.000

The two instruments have a Cronbach alpha greater than .70 for each of the three components of the MBI-SS, with values of .73 and .77 for Emotional Exhaustion and Academic Efficacy, respectively. According to the Cronbach alpha criteria, internal consistency is acceptable for the two tools and good for Cynicism, with a value of .815. The Kaiser-Mayer-Olkin coefficient indicates the data is adequate for factor analysis, and values of KMO = .867 and KMO = .795 mean that the sampling is middling for the MBI-SS and meritorious for the IPAQ-sf, respectively. Moreover, Bartlet's test of sphericity χ2 = 3853.641. p<.000, and χ2 = 1199.572 p<.000 for the MBI-SS and IPAQ-sf, respectively, shows a high correlation between items. Table 1 elucidates further details regarding the descriptive statistics.

Table 2

Fit indexes of the two questionnaires

Model	χ2	DF	χ2 /DF	CFI	TLI	RMSEA
MBI-SS	218.7	87	3.26	.955	.938	.045
IPAQ-sf	66.12	21	3.15	.950	.925	.080

DF: Degree of Freedom; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; RMSEA: Root Mean Square Error of Approximation; MBI-SS: Maslach Burnout Inventory-Student Survey; IPAQ-sf: International Physical Activity Questionnaire Short-Form.**P<0.01

A confirmatory factor analysis was used to test the suitability of the two assessment instruments used in this study. It was studied by several fit indices, such as chi-square, the root mean square error of approximation, the comparative fit index, and the Tucker-Lewis index. With a value of 0.045 and 0.08 for the root mean square error of approximation for the MBI-SS and IPAQ-sf, respectively, the Arabic version of the MBI-SS and the IPAQ-sf have an acceptable fit (Table 2).

Table 3

Correlation between BMI classification and the Emotional Exhaustion levels in the seven regional directorates

Regional directorate	Emotional Exhaustion levels	BMI			P-value
		Normal	Over-weight	Obese	
Rabat	Low	46	6	1	.008
	Moderate	39	6	0	
	High	14	3	4	
Sale	Low	41	5	0	.001
	Moderate	32	7	2	
	High	13	2	5	
Kenitra	Low	205	14	3	.025
	Moderate	127	15	2	
	High	21	4	5	
Khemisset	Low	97	13	3	.001
	Moderate	81	11	1	
	High	32	10	11	
Temara	Low	6	3	0	.077
	Moderate	3	1	0	
	High	5	6	0	
Sidi Kacem	Low	69	9	3	.005
	Moderate	51	7	2	
	High	20	7	6	
Sidi Slimane	Low	41	7	2	.001
	Moderate	30	5	1	
	High	9	2	3	

BMI: body mass index.

There is a significant correlation between Emotional Exhaustion levels, the main burnout component, and BMI classification in six regional directorates except for Temara (Table 3). There is no significance in the other two components, cynicism and academic efficacy. Students with the lowest levels of Emotional exhaustion (between moderate and high) had a normal BMI compared to overweight and obese students. Consequently, the likelihood of experiencing burnout is elevated among students classified as overweight and obese in comparison to their peers who possess a normative Body Mass Index (BMI).

To assess the adequacy of the model, Table 4 presents the fit indices of SEM. The results indicate that all obtained fit indices are at an adequate level, demonstrating a good fit between the data and the factorial structure of this model.

Table 4

Correlation between physical activity levels and Emotional Exhaustion levels in the seven regional directorates

Regional directorate	Emotional Exhaustion levels	Physical activity levels			P-value
		Inactive	Minimally-active	Hepa-active	
Rabat	Low	18	21	40	.001
	Moderate	13	9	12	
	High	4	3	0	
Sale	Low	14	45	26	.026
	Moderate	15	45	11	
	High	10	12	7	
Kenitra	Low	72	120	69	.001
	Moderate	56	58	11	
	High	18	6	7	
Khemisset	Low	33	57	30	.045
	Moderate	26	28	6	
	High	15	5	3	
Temara	Low	2	2	3	.602
	Moderate	5	1	4	
	High	4	2	1	
Sidi Kacem	Low	25	42	21	.011
	Moderate	17	22	5	
	High	10	3	2	
Sidi Slimane	Low	15	36	18	.002
	Moderate	11	13	3	
	High	4	1	0	

These results reinforce the validity of the model and highlight the importance of resilience and self-compassion in enhancing the psychological well-being of cancer patients.

A correlation was identified between levels of physical activity and Emotional Exhaustion in six regional directorates, except for one (Temara); this particular dimension of burnout exhibits an inverse relationship with physical activity, and no correlation was observed between physical activity and the other two subfactors of burnout (Cynicism and Academic Efficacy). Among students experiencing moderate to high levels of Emotional Exhaustion, those categorized as physically "inactive" recorded higher scores compared to their "minimally active" peers, who in turn exhibited higher scores than those classified as "hepa active." Based on the analysis of IPAQ-sf alongside these findings, students engaging in vigorous-intensity activities for a minimum of three days, thereby achieving at least 1500 MET-minutes per week, or participating for seven or more days in any combination of walking, moderate-intensity, or vigorous-intensity activities to attain a minimum of 3000 MET-minutes per week, exhibited lower levels of Emotional Exhaustion than those who engaged in merely three or more days of vigorous activity lasting at least 20 minutes per day, or five or more days of moderate-intensity activity or walking for at least 30 minutes per day, or five or more days in any combination of walking, moderate, or vigorous activities, achieving at least 600 MET-minutes per week across all regional directorates, with a minimum difference of 6% and a maximum of 15%. Furthermore, students

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identified as "minimally active" also demonstrated reduced levels of Emotional Exhaustion compared to their "inactive" counterparts, with the highest differential rate recorded at 23% and the lowest at 9% across all regional directorates.

Table 5

Correlation between the practice of physical activities on Friday evening and the Emotional Exhaustion levels

	Emotional Exhaustion levels			P-value
	Low	Moderate	High	
Students who practice physical activities on Friday evening	170	85	15	
Students who don't practice physical activities on Friday evening	422	346	77	.015

The results show the beneficial impact of physical activities on alleviating burnout among secondary school students. Students who do not practice physical activities on Friday evening have higher Emotional Exhaustion levels (50%) than their counterparts who practice these activities (37%). Emotional Exhaustion is the key factor of burnout alongside Cynicism and Academic Efficacy; therefore, students' chosen physical activities play an essential role in mitigating school burnout.

Discussion and Conclusion

Physical activity has been shown to mitigate academic burnout through several mechanisms. This study has investigated the direct relationship between physical activity and school burnout and BMI as a mediator in this relationship. Research indicates that physical exercise can significantly reduce burnout, especially the emotional exhaustion component.

The Body Mass Index mediates the relationship between physical activity and school burnout. Recent research highlights that anxiety related to stressful stimuli modifies an individual's body composition by changing diet behavior (Eddolls et al., 2018; Grasdalsmoen et al., 2019). Anxiety can activate the parasympathetic nervous reflex, accelerating metabolic processes and enhancing appetite (Skead et al., 2018). Moreover, prolonged stress over time has been associated with more food consumption, which may be explained by changing the hypothalamus's capacity to synthesize neurotransmitters responsible for appetite regulation (Gidugu & Jacobs, 2019). In addition, BMI negatively correlates with academic achievement and levels of burnout; students with normal BMI tend to achieve higher points in school results and experience lower burnout levels (Alhazmi et al., 2021). To prevent this mental disorder, it is imperative to highlight the importance of dietary behaviors in this relationship. Maintaining a balanced diet can mitigate stress levels, especially the Emotional Exhaustion component, by furnishing the human organism with essential nutrients and averting irregularities in neuronal integrity, leading to intensified anxiety. Moreover, consuming unhealthy food can be increased by stressors through maladaptive behaviors (Bektaş et al., 2015). The sequential mediation analysis suggests that BMI mediates the connection between physical activity and school burnout, indicating that physical activity can improve BMI, reducing burnout (Rehman et al., 2024).

These results are consistent with the literature, indicating a negative connection between physical activity and school burnout. The existing body of literature suggests a notable decrease in the manifestations of anxiety and stress among persons who consistently participate in physical exercise (Holmes et al., 2016; Jones et al., 2017). Some rare studies show the inverse; It is widely recognized that engaging in physical exercise enhances blood circulation and, as a result, facilitates oxygenation while concurrently stimulating the brain to synthesize chemical mediators. One of them is serotonin, a neurotransmitter that plays a pivotal role in mitigating depressive disorders. The elevation of heart rate during physical activity fortifies cardiac function and contributes to the efficiency of circulation (Eskilsson et al., 2017; Vries et al., 2017). Moreover, The effectiveness of physical activity in diminishing energy levels, providing an outlet for frustration, and mitigating muscle tension is thoroughly documented (Stubbs et al., 2017). Research has revealed that it enhances the levels of endorphins, alongside elevations in cortisol and norepinephrine degrees, both correlated with mental health disorders (Rebar et al., 2015). In addition, physical activity promotes the alleviation of depressive signs and

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managing complex emotional processes (McMahon et al., 2017).

Regular physical activity practice, especially those chosen by students, is essential for alleviating burnout in an academic context. The more school demands and big expectations, the higher the probability of students experiencing burnout. Thus, physical activity is vital in mitigating school burnout. Various studies demonstrate that physical exercise mitigates symptoms associated with school burnout by enhancing self-efficacy and resilience, essential for effectively managing stressors in educational contexts. A notable correlation exists between physical exercise and diminished levels of school burnout, including emotional exhaustion and decreased perceptions of own success (Chen et al., 2022). A systematic examination showed that medical students, who are particularly susceptible to burnout, gain considerable benefits from regular practice of physical exercises, which is associated with a good quality of life (Taylor et al., 2022). According to the World Health Organization, especially its physical activity guidelines, it has been demonstrated to reduce stress and burnout symptoms among educators, implying that similar benefits may extend to students (González-Valero et al., 2023). Specific research findings suggest that the effects of physical activity may differ depending on individual circumstances, including demographic variables and the specific academic environment (Ricardo Guilherme et al., 2021). Physical activity is a potent instrument for reducing burnout; however, its efficacy can be influenced by various contextual factors, necessitating a customized approach to student wellness initiatives.

Our findings indicate that education decision-makers and institutions should act more swiftly to promote students' practice of various physical activities and give more hours for physical education. There is a notable scarcity of effective campaigns to enhance physical exercise practice among students. Nevertheless, existing research indicates that tailored media communications can elevate awareness, augment knowledge, and inspire students to engage in these activities. The World Health Organization promulgated in 2010 a series of guidelines to inform national policymakers about the requisite levels of physical activity essential for preventing certain diseases, such as overweight, obesity, and academic burnout, given the alarming trends associated with physical inactivity. The study's findings reveal that being overweight and obese contributes to increased school burnout levels. This previously mentioned dilemma underscores the urgent need for more interventions and programs to promote physical activities in school.

Numerous limitations exist that must be acknowledged when analyzing our research findings. This study does not provide evidence for causal relationships. It is advantageous to emphasize the utilization of Body Mass Index (BMI) as a comprehensive health indicator rather than relying solely on body composition variables such as lean and fat mass. Nevertheless, a significant limitation of this investigation is its failure to account for additional factors that may affect stress levels, including familial income and overall health status. Future research avenues may involve conducting a similar examination with a more diverse cohort of university students. To obtain precise measurements of BMI, it is advisable to employ a bioimpedance analysis device. Furthermore, to improve the quality of data collection, implementing technology to measure physical activity levels among students.

Exercise may be augmented by engaging in chosen physical activities and achieving a healthier BMI. There exists a critical necessity for a holistic approach to instigating a transformative shift in fostering more significant involvement of secondary school students, a duty that parents, educational institutions, and student welfare organizations collectively assume. Additional empirical inquiry is warranted to explore the potential mediating effects of BMI in the interplay between physical activity and school burnout across more heterogeneous populations.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

A.E. and H.S. participated in data collection, writing and editing the manuscript. A.E. and M.C. analyzed and interpreted the collected data. M.C., Y.Y. and E.A. revised the data analysis. All contributors read the final manuscript and approved it. دوتا

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