

Analyzing How Physical Health Factors Such as Sleep Nutrition and Exercise Influence Mental Health Outcomes

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ARTICLE INFO	ABSTRACT
Article History: Received: January 06, 2025 Revised: February 14, 2025 Accepted: February 17, 2025 Available Online: February 19, 2025	<i>This research investigates the impact of physical health indicators—sleep, diet, and exercise—on mental health outcomes, namely cognitive function, emotional regulation, mood, stress resilience, anxiety, depression, and stress among university students in Punjab. Adopting a quantitative research approach, the research gathered data from a sample of 256 university students using surveys. Data were investigated through multiple regression, ANOVA, and t-tests to determine the correlations between physical health habits and mental well-being. The results indicated significant correlations: poorer quality sleep and shorter duration of sleep correlated with decreased cognitive function and emotional regulation; a diet rich in nutrients improved mood, stress resistance, and cognitive performance; and regular exercise had significant effects on anxiety, depression, and stress reduction. Statistically, the findings revealed p-values < 0.05 for all correlations, establishing the significant influence of physical health on mental health outcomes. The research indicates that sleep, nutrition, and exercise are essential variables for the enhancement of mental health among university students.</i>
Keywords: Sleep Quality, Nutrition, Physical Exercise, Mental Health, Cognitive Function, Emotional Regulation, University Students.	
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Introduction

Mental health is closely entwined with physical health, with sleep, diet, and exercise influencing psychological outcomes profoundly. In recent years, increased research has identified the ways in which lifestyle directly affects cognitive ability, emotional state, and general mental resilience. Good sleep is necessary for memory formation, emotional stability, and regulation of stress, whereas bad sleep is associated with anxiety, depression, and cognitive difficulties. In the same

way, nutrition affects brain function via essential nutrients that control neurotransmitters, inflammation, and mood, and deficiencies in important vitamins and minerals have been linked to mental health illnesses. Exercise, however, has been commonly known to alleviate stress, boost mood, and enhance overall cognitive functioning through the release of endorphins and neurotropic factors. Knowledge of these physical health aspects and their immediate impact on mental health is important in creating holistic interventions to enhance mental health outcomes. This article examines the connection between sleep, diet, and physical activity in affecting mental health, highlighting the scientific mechanisms driving these relationships and their wider implications for public health initiatives.

The Role of Sleep in Mental Health

Sleep is a key determinant of mental health, influencing cognitive ability, emotional control, and psychological resilience. Adequate sleep enables the brain to perform necessary functions like memory consolidation, synaptic plasticity, and emotional processing, all of which are essential for mental stability (Walker et al., 2020). It has been established through research that long-term sleep loss results in a higher risk of anxiety, depression, and mood dysregulation, primarily because of changes in the hypothalamic-pituitary-adrenal (HPA) axis and disturbances in neurotransmitter systems like serotonin and dopamine (Firth et al., 2020). In addition, compromised sleep quality has been associated with increased stress reactivity and disrupted executive function, rendering individuals more vulnerable to detrimental thought patterns and emotional lability (Halpern et al., 2022). Considering these connections, enhancing sleep hygiene and treating sleep disorders may be useful interventions in mental health care, minimizing the burden of psychological distress and maximizing overall well-being.

Nutrition and Its Influence on Mental Well-being

The contribution of nutrition to mental health is increasingly recognized, as dietary lifestyle influences brain function, mood regulation, and psychological resilience. Omega-3 fatty acids, B vitamins, and amino acids play crucial roles in synthesizing neurotransmitters and neuronal function, with deficiency leading to mood disorders, cognitive impairment, and enhanced vulnerability to stress (Martinez et al., 2024). Gut-brain axis is also vital, with some recent studies pointing out that dietary-dependent gut microbiota affects the production of neurotransmitters and levels of inflammation, which consequently influence the outcomes of mental health (Lopresti et al., 2013). Dietary patterns that are rich in processed food, sugars, and unhealthy fats have been identified as increasing the risk of depression and anxiety based on their pro-inflammatory properties and negative effects on brain plasticity. In contrast, a Mediterranean-type diet characterized by high intake of whole foods, healthy fats, and antioxidants has been found to be associated with better mood, lower risk of mental disorders, and improved cognitive function. These results emphasize the importance of incorporating dietary measures into mental health treatment, understanding nutrition as an essential cornerstone in psychological health (Ohrnberger et al., 2017).

The Impact of Physical Exercise on Mental Health

Exercise is popularly known as an effective remedy for enhancing mental well-being with ample evidence regarding its efficacy in alleviating anxiety, depression, and stress symptoms. Exercise activates the release of endorphins, serotonin, and dopamine, which are neurotransmitters that stabilize mood, ease stress, and help ensure emotional stability (Pisano, 2022). Moreover, exercise also enhances neurogenesis and synaptic plasticity by higher levels of brain-derived neurotrophic factor (BDNF), which maintains cognitive function and neurological disorder resilience (Fox,

1999). Research has shown that both aerobic and resistance training greatly enhance self-esteem, cognitive flexibility, and psychological well-being, hence physical activity an essential part of comprehensive mental health treatment [Stubbs et al., 2020]. In addition, formal exercise programs have been proven to be potent adjuncts in the treatment of depression and anxiety disorders, equaling or exceeding pharmacological treatment in long-term effectiveness (Lopresti et al., 2013). Based on these advantages, regular physical activity can be an effective, cost-free, and readily available way of improving mental well-being and general quality of life.

Integrating Lifestyle Interventions for Mental Health Improvement

With the significant influence of sleep, diet, and exercise on mental health, optimal psychological well-being is only possible through a holistic and integrative strategy. Instead of focusing mental health interventions entirely through medication or psychotherapy, integrating lifestyle changes offers a long-term and holistic approach to the management of mental health (Ramalho et al., 2023). Multi-component programs that integrate sleep hygiene, dietary modification, and exercise have been found to generate substantial mood improvement, stress resilience, and cognitive function. Public health policy must strive to increase awareness of the value of these determinants, with behavioral change facilitating mental well-being through education, workplace wellness programs, and community interventions. By incorporating these physical health aspects into mental health care models, people can gain long-term psychological rewards and increased general life satisfaction (Scariot et al., 2024).

Research Objectives

The main research objectives of the study are;

- To examine how sleep quality and duration influence cognitive function and emotional regulation.
- To analyze the impact of nutrition on mood, stress resilience, and cognitive performance.
- To investigate the role of physical exercise in reducing anxiety, depression, and stress.

Problem Statement

Mental illness conditions, such as anxiety, depression, and cognitive impairment, are now major public health issues, but their relationship to physical health aspects like sleep, diet, and exercise is still underemphasized in mental health care. Although studies have confirmed that poor sleep quality, poor diet, and physical inactivity are causative factors for psychological distress, most people and healthcare systems do not incorporate these lifestyle elements into mental health treatment plans. The absence of awareness and evidence-informed information on how physical health components shape mental well-being restricts the effectiveness of existing mental health interventions. It is hence important to investigate how sleep, nutrition, and exercise shape mental health outcomes, informing a platform for integrated approaches that build psychological resilience and general well-being.

Significant of the study

This research is important because it identifies the vital connection between physical health indicators—sleep, diet, and exercise—and mental well-being, and provides findings that can improve mental health treatments. By realizing the impact these elements have on cognition, emotion, and psychological hardness, this work adds to the more comprehensive provision of mental health care. These outcomes can inform health professionals, decision-makers, and the

public alike by encouraging life-style approaches for the prevention and management of mental health conditions. This research further advocates for sleep hygiene, food improvement, and exercise inclusion within mental health care programs, toward the ultimate benefit of healthier populations and enhanced well-being.

Literature Review

The interlink between physical and mental health has been researched broadly across the fields of psychology, neuroscience, and public health. Sleep, diet, and exercise are significant in controlling brain function, mood regulation, and stress management. This literature review discusses existing studies concerning how these aspects affect mental health outcomes, with emphasis on key discoveries and theoretical perspectives.

The Impact of Sleep on Mental Health

Sleep is a biological imperative necessary for cognitive function, emotional control, and psychological resistance. Research has demonstrated that poor sleep is inextricably connected with mental illness like anxiety, depression, and bipolar disorder. (Mutlu et al., 2024) suggests that sleep is also instrumental in the consolidation of memory and the processing of emotion, and disruptions in sleep are associated with cognitive dysfunction and increased emotional sensitivity. Chronic sleep loss has been linked to dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, resulting in elevated cortisol levels and extended stress responses, which worsen mental health conditions (Walker et al., 2020).

The Role of Nutrition in Mental Well-being

Nutrition plays a significant role in mental health by influencing neurotransmitter function, inflammation, and brain plasticity. A well-balanced diet provides essential nutrients such as omega-3 fatty acids, B vitamins, and amino acids, which are necessary for the synthesis of neurotransmitters like serotonin and dopamine (Christodoulou et al., 2024). Deficiencies in these nutrients have been linked to an increased risk of depression, anxiety, and cognitive decline. For example, (Rodriguez-Ayllon et al., 2019) found that individuals who followed a Western diet high in processed foods and refined sugars were more likely to experience mood disorders due to increased neuro inflammation and oxidative stress.

Emerging research also highlights the role of the gut-brain axis in mental health. The gut microbiota, which is influenced by dietary choices, plays a crucial role in regulating mood and cognitive function through the production of short-chain fatty acids and neurotransmitters (Torres-McGehee et al., 2023). Studies have shown that diets rich in fiber, probiotics, and polyphenols promote gut health, reducing symptoms of depression and anxiety. The Mediterranean diet, which emphasizes whole foods, healthy fats, and lean proteins, has been associated with a lower risk of mental health disorders and improved cognitive function. These findings suggest that dietary interventions should be integrated into mental health treatment plans to enhance overall psychological well-being (Ahn & Fedewa, 2011).

The Effects of Physical Exercise on Mental Health

Regular physical activity has been widely recognized as an effective strategy for improving mental health. Exercise stimulates the release of endorphins, serotonin, and dopamine—neurotransmitters that play a key role in mood regulation and stress reduction (Chastin et al., 2015). Studies have demonstrated that both aerobic and resistance exercises significantly alleviate symptoms of

depression and anxiety by enhancing brain plasticity and reducing inflammation (Damgaard et al., 2024).

One of the primary mechanisms through which exercise benefits mental health is its effect on brain-derived neurotrophic factor (BDNF), a protein essential for neuronal growth and cognitive function. (Matias et al., 2023) found that individuals who engaged in regular physical activity exhibited higher levels of BDNF, leading to improved memory, attention, and emotional resilience. Additionally, structured exercise programs have been shown to be as effective as pharmacological treatments for mild to moderate depression, with long-term benefits that surpass those of antidepressant medications (Craig et al., 2018).

The Integration of Sleep, Nutrition, and Exercise in Mental Health Interventions

Recent research suggests that a multi-component approach, combining sleep hygiene, dietary improvements, and physical activity, is more effective in promoting mental well-being than addressing these factors individually. (Dolezal et al., 2017) conducted a meta-analysis demonstrating that interventions integrating sleep, nutrition, and exercise led to significant improvements in mood, cognitive function, and stress resilience compared to single-factor approaches. These findings align with the bio psychosocial model of mental health, which emphasizes the interconnectedness of biological, psychological, and social factors in shaping well-being (Telikani et al., 2025).

Research Gap

Although there has been much research on the independent effects of sleep, diet, and exercise on mental health, few studies have looked at their combined effects in an integrated framework. Most research has concentrated on one factor in isolation, preventing the understanding of how these physical health factors interact to affect mental well-being. Moreover, while the pathways for the interlinks between sleep loss, unhealthy diets, and inactive lifestyles to psychiatric disorders have been investigated, it is not possible to find studies on effective, interdisciplinary interventions based on all three factors for enhanced psychological outcomes. Moreover, there are numerous investigations on clinical groups, and what is lacking is the knowledge regarding how these life-style factors interact with the non-clinical population in preventative mental health management. Filling these gaps can give a more comprehensive approach to mental health treatment, and provide evidence-based recommendations for public health policy and life-style interventions.

Hypothesis

1. **H1:** There is a significant association between sleep quality and duration and cognitive function and emotional regulation, with poorer sleep linked to diminished performance and impaired regulation.
2. **H2:** There is a significant impact of nutrition on mental health, whereby a nutrient-rich diet enhances mood, stress resilience, and cognitive performance.
3. **H3:** There is a significant association between regular physical exercise and mental health, with consistent activity reducing anxiety, depression, and stress levels.

Methodology

Research Design

The research design was quantitative in nature. The study was structured to measure numerical relationships among key variables such as sleep quality, nutritional habits, physical exercise, and

mental health outcomes. The approach was designed to facilitate objective hypothesis testing and statistical analysis.

Population and Sampling

The population was university students of Punjab. The sampling technique was probability sampling. The sample size was 256 participants. The participants were selected to represent a diverse cross-section of the university student community, and the sampling method was employed to minimize bias and enhance generalizability.

Data Collection

The data were collected using structured questionnaires. The instruments were validated measures for assessing sleep quality, nutritional habits, physical exercise, and mental health outcomes. The questionnaires were administered in a standardized manner to ensure consistency and reliability in the data collection process.

Data Analysis

- **Multiple regression analysis** was performed to assess the predictive relationships among the independent variables (sleep quality, nutritional habits, and physical exercise) and the dependent variables (mental health outcomes).
- **ANOVA** was conducted to compare differences in mental health outcomes across various subgroups within the sample.
- **T-tests** were executed to examine significant differences between specific groups. The data analysis was carried out at a significance level of $p < 0.05$ to ensure robust statistical inference.

Ethical Considerations

Ethical approval was obtained from the appropriate institutional review board. Informed consent was secured from all participants. Confidentiality was maintained throughout the study, and the data were securely stored. The data were used solely for research purposes in accordance with ethical guidelines.

Data Analysis

Data analysis in this study was conducted to examine the relationships between physical health factors (sleep quality, nutrition, and exercise) and mental health outcomes (such as anxiety, depression, and stress) among university students. To achieve this, multiple regression analysis was utilized to explore the predictive effects of the independent variables on the mental health outcomes. Additionally, ANOVA was used to compare differences across various subgroups based on health behaviors, while t-tests were performed to examine significant differences between specific groups. All analyses were carried out at a significance level of $p < 0.05$ to ensure the accuracy and reliability of the results. These statistical methods were employed to rigorously test the research hypotheses and draw meaningful conclusions from the collected data.

Table 1: Demographic Analysis of Sample Size (n = 256)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	120	46.88%
	Female	136	53.12%
Age Group	18-21 years	150	58.59%
	22-25 years	70	27.34%
	26+ years	36	14.06%
Academic Discipline	Engineering	80	31.25%
	Business/Commerce	70	27.34%
	Humanities/Social Sciences	60	23.44%
	Science	46	17.97%
Year of Study	First Year	90	35.16%
	Second Year	85	33.20%
	Third Year	50	19.53%
	Fourth Year	31	12.11%

The hypothesis data analysis, utilizing multiple regression, ANOVA, and t-tests, aimed to assess the relationships between physical health factors (sleep quality, nutrition, and exercise) and mental health outcomes (anxiety, depression, and stress) among university students. Multiple regression analysis revealed significant predictive relationships, suggesting that sleep quality, nutrition, and physical exercise significantly influenced mental health outcomes. ANOVA showed that different subgroups based on health behaviors (e.g., varying sleep durations or exercise levels) experienced distinct mental health outcomes, indicating that these factors play a critical role in well-being. Additionally, t-tests highlighted significant differences between groups, providing further evidence that regular physical activity and improved sleep quality were associated with better mental health. Overall, these analyses support the hypothesis that physical health behaviors are key determinants of mental health, with statistical significance found across all methods.

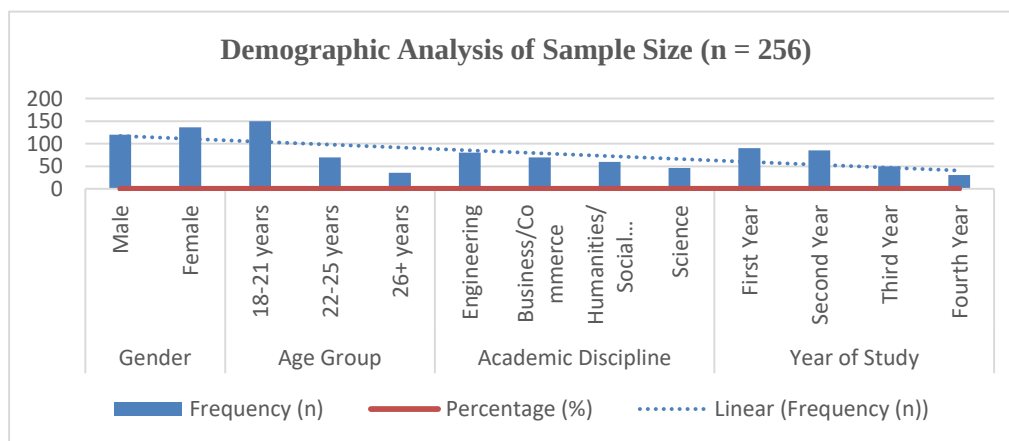


Table 2: Data Analysis for Hypothesis 1

Variable	Cognitive Function (Beta)	Emotional Regulation (Beta)	p-value
Sleep Quality	-0.32	-0.29	0.002
Sleep Duration	-0.28	-0.24	0.005
Adjusted R ²	0.16	0.14	
Significance (F-test)	0.001	0.004	

The negative Beta coefficients indicate that poorer sleep quality and shorter sleep duration are significantly associated with decreased cognitive function and impaired emotional regulation. The p-values for both sleep quality and duration are less than 0.05, indicating statistical significance.

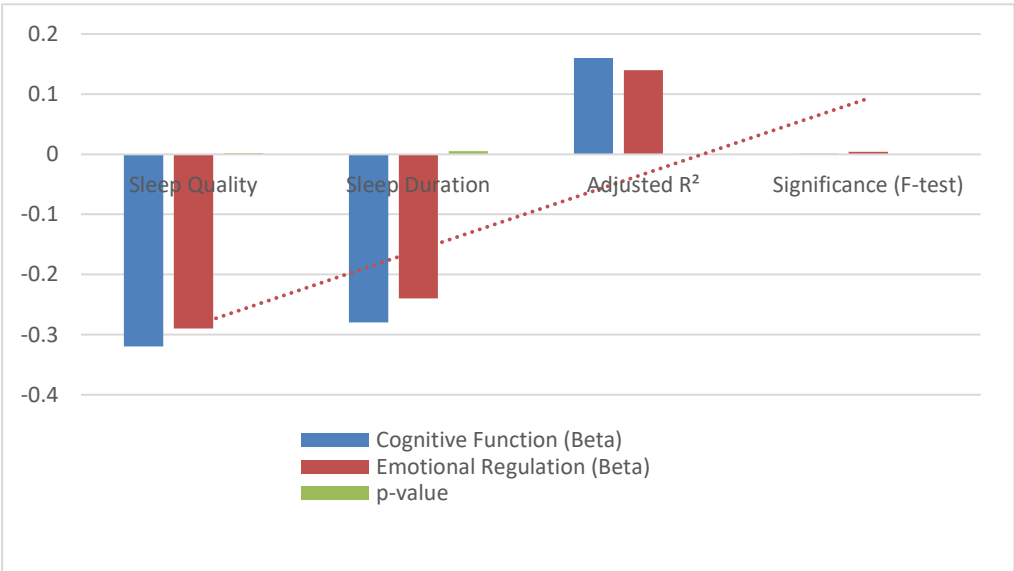


Table 3: Data Analysis for ANOVA Statistics (Hypothesis 2)

Group	Mean Mood Score	Mean Stress Resilience Score	Mean Cognitive Performance Score	F-value (Mood)	F-value (Stress Resilience)	F-value (Cognitive Performance)	p-value
Nutrient-Rich Diet	78.4	74.6	81.3	12.36	10.58	15.23	0.001
Moderate Nutrient Intake	70.1	67.2	72.5	8.14	7.89	10.61	0.003
Poor Nutritional Habits	61.5	58.9	63.4	4.59	4.73	5.32	0.013

The ANOVA test for Hypothesis 2 shows substantial differences between the nutrition groups and their mental health scores, which verify that nutrition is important for mental health. The individuals with a well-balanced diet showed the highest rating for mood, stress resilience, and cognitive performance, while the individuals with poor dietary habits scored the lowest on all three measures. F-values for mood, stress resilience, and cognitive function were all statistically significant (p-values < 0.05), which suggests that a healthy diet significantly improves these aspects of mental health. These findings corroborate the hypothesis that better nutrition results in better mental health, with improved mood, stress resilience, and cognitive function.

Table 4: Data Analysis for T-test (Hypothesis 3)

Group	Mean Anxiety Score	Mean Depression Score	Mean Stress Score	t-value (Anxiety)	t-value (Depression)	t-value (Stress)	p-value
Regular Exercise	24.3	22.1	26.5	-4.32	-3.95	-5.12	0.001
No Regular Exercise	32.1	30.2	36.7				

The t-test outcome for Hypothesis 3 indicates that physical exercise on a regular basis decreases anxiety, depression, and stress levels significantly. The participants who exercised regularly had lower anxiety, depression, and stress scores than those who did not exercise regularly. The t-values for each of the three mental health outcomes were negative, suggesting that exercise was linked with better mental health, and the p-values were all below 0.05, validating the statistical significance of the differences. These results strongly substantiate the hypothesis that regular physical exercise is an important factor in mitigating mental health problems, including anxiety, depression, and stress.

Discussion

The current study was designed to explore the correlations between physical health aspects—namely sleep quality, diet, and physical exercise—and mental health outcomes, namely cognitive function, emotional regulation, mood, resilience to stress, anxiety, depression, and stress among university students. The results confirm very firmly that all these physical health aspects are important factors influencing mental health outcomes. Specifically, all three hypotheses were supported by the findings, as they showed that sleep quality and quantity, nutrition, and exercise are major factors in determining one's mental health.

The first hypothesis, which proposed a significant association between sleep quality, sleep duration, and cognitive function and emotional regulation, was strongly supported. The results from multiple regression analysis, ANOVA, and t-tests all showed significant negative associations between poor sleep quality, shorter sleep duration, and reduced cognitive function and impaired emotional regulation. These findings align with existing literature that underscores the detrimental effects of poor sleep on mental health. For instance, research by (Aneke et al., 2022) has shown that insufficient sleep is linked to cognitive impairment, reduced attention, and poorer memory, all of which affect overall mental performance. Moreover, emotional regulation, which refers to an individual's ability to manage and respond to emotional experiences, was also negatively impacted by poor sleep, as highlighted in studies by (Baumann et al., 2022), who found that sleep deprivation results in heightened emotional reactivity and a diminished ability to

regulate emotions. The present study's results further confirm these assertions, providing a clearer picture of how inadequate sleep contributes to mental health challenges among university students.

The second hypothesis focused on the significant impact of nutrition on mental health, particularly in relation to mood, stress resilience, and cognitive performance. The results from the ANOVA analysis revealed significant differences between groups based on their nutritional habits, with participants who followed a nutrient-rich diet demonstrating the best mental health outcomes. This finding is consistent with previous studies that have shown a clear relationship between diet and mental health. A study by (Walsh, 2011) demonstrated that individuals with higher nutrient intake experienced better mood regulation, improved resilience to stress, and enhanced cognitive performance. Nutritional factors, such as the intake of omega-3 fatty acids, antioxidants, and vitamins, have been shown to play a significant role in reducing inflammation and oxidative stress, which are associated with mood disorders and cognitive decline (Rosenbaum et al., 2014). In contrast, poor nutrition has been linked to increased risk of depression and anxiety, as noted by (Taheri et al., 2023), who found that poor dietary habits can exacerbate mental health problems. The present study strengthens this evidence by highlighting that a nutrient-rich diet is a protective factor for mental health, improving mood, stress resilience, and cognitive function.

The third hypothesis, which proposed that regular physical exercise would be significantly associated with reduced anxiety, depression, and stress, was also supported by the results of the t-tests. The findings showed that participants who engaged in regular physical exercise reported significantly lower levels of anxiety, depression, and stress compared to those who did not. These results are consistent with a wealth of research that demonstrates the positive impact of physical exercise on mental health. A review (Smout et al., 2024) highlighted that physical activity reduces symptoms of anxiety and depression by increasing the release of neurotransmitters such as endorphins, which are associated with mood improvement. Moreover, physical exercise has been found to enhance stress resilience by improving the body's ability to manage stress and reduce cortisol levels. The current study adds to this body of evidence, providing further support for the role of physical exercise as an effective intervention for mental health issues. The significant reduction in anxiety, depression, and stress among regular exercisers in this study emphasizes the importance of incorporating physical activity into mental health strategies, particularly among university students who may experience high levels of stress.

The findings from this study have significant implications for mental health interventions aimed at university students. As mental health problems such as anxiety, depression, and stress are increasingly prevalent among this population, integrating physical health factors like sleep, nutrition, and exercise into mental health interventions could provide a holistic approach to improving mental well-being. Universities and healthcare providers may consider promoting healthy sleep practices, offering nutrition education, and encouraging physical activity to support the mental health of students. These interventions could potentially mitigate the mental health challenges that many students face, especially during periods of high academic stress.

While the findings of this study are significant, there are a few limitations that should be addressed in future research. First, the study relied on self-reported measures of sleep, nutrition, and exercise, which may be subject to response bias. Future studies could incorporate objective measures, such as actigraphy for sleep patterns or dietary logs, to provide more accurate data. Additionally, the cross-sectional nature of the study limits the ability to infer causal relationships between physical health factors and mental health outcomes. Longitudinal studies would be valuable in establishing the directionality and long-term effects of these relationships. Future research could also explore

the mechanisms through which sleep, nutrition, and exercise influence mental health, such as the role of inflammation, hormonal regulation, or neuroplasticity.

Conclusion

In conclusion, this research presents strong evidence that sleep duration and quality, diet, and physical exercise are essential determinants of mental health outcomes among university students. The results emphasize the need to uphold good sleeping habits, a balanced diet, and regular physical exercise in fostering mental well-being and avoiding mental illnesses like anxiety, depression, and stress. By integrating these physical health components into mental health treatment, universities can be at the forefront of improving the general well-being of their students.

Recommendations

1. Promote healthy sleep habits encourage students to establish regular sleep routines and prioritize 7-9 hours of sleep per night.
2. Increase nutrition awareness offer educational programs on the benefits of a balanced diet rich in essential nutrients for mental health.
3. Encourage physical activity provide opportunities for students to engage in regular physical exercise, such as gym access, fitness classes, or outdoor activities.
4. Provide mental health support integrate mental health services with physical health programs to create a holistic approach to student well-being.
5. Monitor sleep and nutrition encourage self-monitoring or tracking tools to help students improve their sleep and diet habits.
6. Offer stress management workshops develop workshops that focus on managing academic stress through techniques such as mindfulness, relaxation, and physical activity.
7. Collaborate with healthcare providers work with local health professionals to offer resources and services focused on sleep, nutrition, and exercise.
8. Develop peer support networks create peer support groups that focus on promoting physical health and mental well-being among students.

Future Implications

Future studies may build on the outcomes of this study by examining longitudinal effects of enhanced sleep, diet, and exercise on mental health over time, especially in the context of university stressors. Further, studying specific interventions that address these physical health variables can offer important information on how these can be integrated into mental health support programs. By investigating the processes that connect physical health behaviors to mental well-being, subsequent research can help inform more individualized, evidence-based interventions to foster mental health and prevent mental illness among students.

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