Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i6.7071

THE LEVEL OF DEPRESSION AMONG UNIVERSITY STUDENTS WITH THE ROLE OF PHYSICAL ACTIVITY AND DAYTIME SLEEPINESS

Ambreen Fatima[1], Zill e Huma[2*], Rimsha Moubeen[3], Syeda Falak Batool Naqvi[4], Nimra Azeem[5], Sana Sultan[6]

[1,2*,3,4,6]Riphah Institute of Clinical and Professional Psychology, Riphah International University, Pakistan
[5]Department of Psychology, University of Lahore, Pakistan

***Corresponding Author:** Zill e Huma
*Email: z.huma710@gmail.com

Abstract
The lifestyles of many in Pakistan and other countries have been disrupted in recent years, especially among the younger generation. Often during this disruption, people reduce their physical activities and suffer from lack of good sleep both quality and quantity wise. Furthermore, university students are increasingly becoming depressed. The purpose of the study was to investigate the link between mental health, physical activity, physical fitness and daytime sleepiness. There were 85 undergraduate participants (52 men, 33 women; mean age ± SD: 18.9 ± 1.4 years). Physical activity levels were tracked for a two-week period using an accelerometer device. The V˙O2max as an index for assessing physical fitness has been indirectly estimated through a cycle ergometer. Depression tendency of the subjects and daytime sleepiness were evaluated by Patient Health Questionnaire (PHQ-9). PHQ-9 score had a positive correlation with sleepiness ($r = 0.35$, $p = 0.001$) and total steps per day ($r=0.39$, $p<0.001$). Moreover, PHQ-9 score had a positive relationship with V˙O2max ($r=0.25$, $p=.019$). Students with exercise habits or part-time jobs that are better had more PHQ-9 scores on average than others do not have such factors contributing to their life style choices. A significant finding was that depression positively correlated with any variable related to physical activity level. In conclusion, it means that engagement in intense physical activity such as exercises as well as having part time jobs could be associated with increased risk of depression among university students.

Keywords: healthy life style, depression, developing country, students

Introduction

There is an increasing concern about mental health problems among university students. It is vital in this day and age of modernity and stress to be able to manage pressure well and maintain good psychological wellbeing. The prevalence of severe depressive symptoms was 38% among university students from Asia (e.g., Pakistan, Japan) according to the study conducted by Steptoe et al. on 17,348 university students aged between 17 and 30 years across 23 countries (Auerbach et al., 2016). Similarly, Ahmed et al. (2023) based on World Mental Health Survey data on the mental health issues of university students, observed severe mental health problems among university

students that participated in previous studies. The most prevalent mental health complaints among learners are anxiety and depression. Students' academic achievement suffers because of depressive symptoms (Mushtaque et al., 2021). There are so many former researches showing that without wasting time, there is a global spread of student's welfare issues particularly those connected with their minds.

The period when they join a college or a university has several major changes and events in individuals' lives. Different people at universities begin their days differently; many begin living alone for the first time while others get part-time jobs or start attending various extracurricular activities. Consequently, it is possible to guess that these significant changes in life style always cause both emotional and physical stresses for young people studying at universities. Santana et al. (2016) considered number of ways, stated that during this stage which is one of the most stressful periods in human life, teenagers pass through a special kind of crisis called "university age". Academic performance and quality socializing can be hampered by poor mental status observed within students who go through institutions of higher learning.

In Pakistan, however, where pupils spend a considerable amount of time preparing for this exam; it therefore results into reduced daily (physical Activity) PA levels leading to declined physical fitness. Yet regular exercise positively influences academic performance. Physical activity contributes greatly towards overall body wellness including brain development (Luan et al., 2019). For instance, previous studies have shown a negative association between the numbers of steps walked daily and obesity, diabetes, and depression (Schlarb et al., 2017). Other existing reports indicate that reduced PA decreases sleep quality and mental health. In fact physical activity, physical fitness and sleep are interconnected as they also significantly impact on the mental health of university students (Ingram et al., 2020).

Sleep problems in students often come together with mental health issues more than just academic concerns. Among other things, life is characterized by depressive states or changes like chronic fatigue syndrome, stress, decreased optimism, anxiety neurosis and low quality of living conditions for insomniac people (Viner et al., 2019). The current estimates show that between 9.4% - 13.1% of students from around the world meet diagnostic criteria for insomnia. There are also lower academic motivation and self-efficacy linked to sleep disorders, poor sleep quality, and excessive daytime sleepiness (Guo et al., 2021). Such an age group must also be studied due to these reasons where the connection between mental well-being and proper sleep can be determined.

Considering all these matters, this study aimed to find out whether there was any relationship between psychological wellbeing, exercise routine / regime, body healthiness and feeling sleepy during day time among Pakistani university students; hence some highly significant links were discovered in this regard.

Methodology

Participants

Eighty-five undergraduates (52 males and 33 females) were included in the study. The investigation went in two steps that are from November to December 2023 and from May to June 2024, starting after six to eight weeks since the end of each semester. This is a longitudinal research design that was followed in this study. Participants selected were first year university students who are enrolled in programs like Literature, Law, Economics, Engineering and Medicine; however, this did not limit participants' recruitment only for these majors. The participants were chosen by using convenience sampling method. In fact all participants were registered for a first-year liberal arts class. In this course they received a detailed oral explanation about the research and its content from instructors. Students then accepted their participation voluntarily. Researchers took full medical history of each participant as well as conducted an ordinary physical examination without any serious medical conditions among them (from initial sample size of 121 people out of which dropouts = 9 and incomplete data =23) Therefore, 73.6% of the initial sample took part in the analysis.

Questionnaires

Physical Activity and Fitness: To quantify physical activity, for two weeks, an accelerometer was used. Steps per day (SPD), 24-hour total energy expenditure (TEE; kJ/day) and energy expenditure from physical activity (EEPA; kJ/day) were recorded by the instrument. Except during bathing, participants wore the monitor throughout the day. A participant's clothing included a waistband attachment at the right anterior mid-line of their thigh where the device was mounted. The data was transferred to a computer for analysis following the 14-day period. The accelerometer is small and lightweight (42 g, 60 mm × 46 mm × 26 mm). Moreover it has a uniaxial piezo-electric accelerometer built within it. At intervals of 32 Hz it has sampled vertical accelerations between 0.06 G and 1.94 G. The endurance fitness levels of participants were determined using maximal oxygen uptake (V˙O2max) calculated indirectly through cycle ergometer method. V˙O2max was predicted using MARITZ et al. (1961) nomogram which is commonly used as a modality to estimate V˙O2max.

Daytime Sleepiness: Daytime sleepiness was measured by employing the Epworth Sleepiness Scale (ESS). This well-known measure is often used for screening obstructive sleep apnea (Takegami et al., 2009). There are eight situations in which participants decide how likely they are to drift off to sleep on a scale of 0-3. The sum of the eight item scores known as total ESS score is then used to determine the risk of obstructive sleep apnea.

Depression: The Patient Health Questionnaire (PHQ-9) is one such module that is used for major depressive disorder (Muramatsu et al., 2018). Because this questionnaire is used in general medical and mental health settings to make a diagnosis of depression and assess its severity it helps identify whether or not a person meets criteria for major depressive episode according to DSM-IV. A score from 0 to 3 is assigned based on each sign out of nine signs required for diagnosing a major depressive disorder as provided in DSM IV; hence the total score ranges from 0 to 27.A higher PHQ-9 score means greater depressive tendencies and severity of depression.

Lifestyle Assessment: The researchers had the participants complete a self-administered questionnaire. The items in the inventory included name, age, gender, undergraduate course of study, extracurricular activities and part-time jobs. For this research study those extracurricular activities that were performed over three times weekly were classified as "exercise habits". Students who worked as part-timers consistently throughout were classified to have a "part-time job".

Data Analysis

Data are presented as means and standard deviations (±SD). Mann–Whitney U-test was used to compare mean values of participants with and without regular exercise habits; also between those with and without part-time jobs. Statistical analyses were conducted using SPSS V.25.0 software package. Differences at $p < 0.05$ in which all statistical analyses were considered significant.

Results

Table 1 Characteristics of Participants (N=121)

Variable	**Mean SDV**
Age of students	19.4 ± 2.1
Physical Health Scale score	4.4± 2.6
Day time sleep score	11.6 ± 4.5
Vo_2max	31.5± 5.7
Daily Walking Steps	7431±2585

Table 1 presents the characteristics of the participants (N=121). The mean age of the students was 19.4 years (SD = 2.1). The Physical Health Scale score had a mean of 4.4 (SD = 2.6), while the daytime sleep score averaged 11.6 (SD = 4.5). The mean VO2max was 31.5 (SD = 5.7), and the participants took an average of 7,431 daily walking steps (SD = 2,585).

Table 2 Physical Activity Comparison Day Time Sleep and Exercise Habits

Day time Sleep		**Exercise Habits**	
Yes (n= 56)	No (n= 29)	Yes (n = 37)	No (n = 48)
7.7 ± 2.8	3.1 ± 2.5	3.4 ± 2.7	6.4 ± 3.7
P value	0.034*	P value	0.012

Table 2 compares physical activity in relation to daytime sleep and exercise habits. Participants with exercise habits (n=56) had a mean daytime sleep score of 7.7 (SD = 2.8), while those without exercise habits (n=29) had a mean score of 3.1 (SD = 2.5), with a significant p-value of 0.034. Additionally, participants with exercise habits (n=37) had a mean physical activity score of 3.4 (SD = 2.7), compared to a mean score of 6.4 (SD = 3.7) for those without exercise habits (n=48), with a significant p-value of 0.012.

Table 3 comparison of Daily number of Steps Exercise Habits and Part Time Job

Exercise Habits		**Part Time Job**	
Yes (n= 37)	**No (n= 48)**	**Yes (n= 14)**	**No (n= 107)**
8820.8 ± 1339.2	882.3 ± 329.4	9188.0 ± 1588.8	952.1 ± 448.7
P value	0.031	**P value**	0.001

Table 3 compares the daily number of steps taken by participants with and without exercise habits and part-time jobs. Participants with exercise habits (n=37) had an average of 8,820.8 steps per day (SD = 1,339.2), while those without exercise habits (n=48) averaged 882.3 steps per day (SD = 329.4), with a significant p-value of 0.031. Additionally, participants with part-time jobs (n=14) averaged 9,188.0 steps per day (SD = 1,588.8), compared to 952.1 steps per day (SD = 448.7) for those without part-time jobs (n=107), with a significant p-value of 0.001.

Table 4 Correlation of PHQ -9 with various Variables

Variables		**1**	**2**	**3**	**4**
1.	Physical health	-	0.35***	0.39***	0.25*
2.	Sleep		-	-	-
3.	Step per day			-	-
4.	Vo_2max				-

Table 4 presents the correlation of PHQ-9 scores with various variables. Physical health showed a significant positive correlation with sleepiness ($r = 0.35$, $p = 0.001$), total steps per day ($r = 0.39$, $p < 0.001$), and V˙O2max ($r = 0.25$, $p = 0.019$). No significant correlations were found between sleepiness, total steps per day, and V˙O2max.

Discussion

The present study specifically examined the relationships between mental health, physical fitness, physical activity, and daytime sleepiness among first-year university students in Pakistan. The major discovery we came up with was the positive association of depression and factors related to levels of physical activity. We found out that higher PHQ-9 scores were observed among those students with exercise habits or part-time jobs. Even if sleep itself did not form a part of this research analysis, there is a possibility that insufficient sleep accompanied by delayed sleep phases and increased daytime sleepiness emanated from part time work and regular physical exercise; which in turn can

lead to a decline in one's mental health. In other words, for busy university students who engage themselves mostly in studies, part-time jobs and extracurricular sports clubs—activities usually considered beneficial for mental health—might be excessively demanding leading to lack of night rest hence causing depression.

This research also demonstrated that increase in the amount of physical activity associated with either having a side job or exercising regularly causes depressed mood disposition such as propensity towards depressive symptoms and excessive daytime sleepiness. The impact of exercise on vagal nerve activity varies depending on the intensity level of an exercise regime. Many reports have shown that vagal tone increases with moderate training. It has been generally noted that how often you go for exercises and the amount of physically active life you live will improve your vagal tone thus improving quality of your slumber. This is achieved when vagal signals decrease workload as well as oxygen uptake by heart via lowering resting heart rate plus myocardial contractility. According to previous findings it seems possible that immediately this happens stimulation from vagus acts at SA node directly along with myocardium thereby interfering adrenergic influence. However during severe athletic exercise these physiological adaptations are retarded according to Buch et al. (2002) research report. The study also presented findings that an increase in vagal tone based on HRV indices was reached only by athletes undergoing moderate training but not those who were highly trained. High-intensity training is known as a factor of exercise-induced insomnia with regard to the relationship between training intensity and sleep quality. Although it is unclear how intensely these participants exercised, students who belonged into extracurricular sports clubs might have been involved in high-intensity physical training; and this negative effect of vigorous athletic activity may be due—at least partly—to the observed association between levels of physical activities and depressive tendencies in this research.

Also, other researchers such as Tseng et al. (2020) reasoned that different types of activities induce distinct health effects from physical activity. According to these studies, occupational physical activity (OPA) does not promote parasympathetic predominance during sleep, which is present during leisure-time physical activity (LTPA). At the same time, there is a sympathetic predominance for OPA rather than LTPA. Work-related exercise increases risk of cardiovascular diseases and mortality unlike LTPA that decreases them. In light of these findings, it could be speculated that autonomic nerve activity mediates at least some relations between having a part time job and depressive symptoms among students participating in sports clubs.

Some university students were likely to be suffering from a chronic fatigue-like state. Symptoms of chronic fatigue syndrome may include depression and unrefreshing sleep, which have been suggested as possibly being associated with the recession of biological rhythms (night-type) and chronic fatigue syndrome. This means that the sleep phases of adolescents are inclined towards getting delayed i.e. they retire to bed late and wake-up late in the morning. One study conducted an experiment in which participants were required to stay awake for five consecutive nights (Gupta et al., 2017). In this case, it was found out that there was a phase delay in melatonin rhythm, an increase in daytime sleepiness and reduced attention. Moreover, poor sleep is a recognized risk factor for the onset of depressive disorders during adolescence.

The well-being of college students has become one of the major social issues demanding urgent attention. Another study also found that universities' student mental health is majorly affected by physical activity levels, fitness status and daytime drowsiness feeling. Moreover, academic performance suffers when these factors deteriorate.

This article demonstrates the potential adverse effects on mental health and daytime somnolence from increased physical activity among University male students' population in Pakistan. These effects could be due to differences in physical activities such as labor or competitive sports activities. Labor activity as well as competitive sports activities conducted within college clubs can contribute to negative psychological health conditions like stress disorders and excessive daytime sleepiness. Stressful events like these often result into compromised mental health and increased levels of day time sleeping. The classification of different types/domains of physical activity which support or undermine mental health/sleepy are another necessary step towards further studies.

Steptoe et al also indicated that Pakistani college students who have fewer hours of sleep than others reported poor health statuses. Additionally, young individuals are considered to be under stress when they spend most of their time travelling. It can then be concluded that commuting home after night sports and/or part-time jobs is more stressful to the youngsters. The Pakistani contexts of this research could influence the findings and further proof on global scale may be required for confirmation.

The generalizability and interpretation of the results from this study are restricted by three key limitations. For example, it is not possible to analyses their effects because of lack of knowledge about such aspects as what type, intensity, duration or timing of physical activities these participants were engaged in. Additionally, future studies should consider the intensity at which extracurricular activities and part-time jobs are taken into account. This study's limited sample size and demographics also limit the expansion and generalizability of our results. Hence, our findings cannot be applied on a wider scale as they only involve first year university students from Pakistan. Fourthly, physical activity might have increased simply because people wore pedometers. Thus it is possible that data on exercise included monitoring with an accelerometer. In relation to this, future studies should aim at determining types as well as intensities associated with physical activities that promote mental health among college students such as these . Applying this finding will imply that those who do physical exercises or have part time jobs could face mental health issues later on in life.

Conclusion

This experiment probed the link between sound minds, physical activities, strong bodies and yawning in Japanese university students. Physical activity (PA) and sleepiness were positively correlated with depression level as measured by PHQ-9 scores. Moreover, a positive correlation was noted for the PHQ-9 scores and V˙O2max. The PHQ-9 scores of students engaged in sports or with part-time jobs were higher. There is however no knowledge as to why this should be the case but it is possible that part-time jobs and extracurricular sports may lead to excessive stress, lack of sleep and depression. Future research needs to ascertain how different types of physical activities or part-time employment both in terms of mode, intensity, duration, time can influence mental health in university students.

References

1. Ahmed, S., Rosario Yslado Méndez, Naveed, S., Akhter, S., Iqra Mushtaque, Malik, M. A., Ahmad, W., Roger Norabuena Figueroa, & Younas, A. (2023). Assessment of hepatitis-related knowledge, attitudes, and practices on quality of life with the moderating role of internalized stigma among hepatitis B-positive patients in Pakistan. *Health Psychology and Behavioral Medicine*, *11*(1). https://doi.org/10.1080/21642850.2023.2192782
2. Auerbach, R. P., Alonso, J., Axinn, W. G., Cuijpers, P., Ebert, D. D., Green, J. G., Hwang, I., Kessler, R. C., Liu, H., Mortier, P., Nock, M. K., Pinder-Amaker, S., Sampson, N. A., Aguilar-Gaxiola, S., Al-Hamzawi, A., Andrade, L. H., Benjet, C., Caldas-de-Almeida, J. M., Demyttenaere, K., & Florescu, S. (2016). Mental disorders among college students in the World Health Organization World Mental Health Surveys. *Psychological Medicine*, *46*(14), 2955–2970. https://doi.org/10.1017/s0033291716001665
3. Buch, A. N., Coote, J. H., & Townend, J. N. (2002). Mortality, cardiac vagal control and physical training - what's the link? *Experimental Physiology*, *87*(4), 423–435. https://doi.org/10.1111/j.1469-445x.2002.tb00055.x
4. Guo, Y., Liao, M., Cai, W., Yu, X., Li, S., Ke, X., Tan, S., Luo, Z., Cui, Y., Wang, Q., Gao, X., Liu, J., Liu, Y., Zhu, S., & Zeng, F. (2021). Physical activity, screen exposure and sleep among students during the pandemic of COVID-19. *Scientific Reports*, *11*(1), 8529. https://doi.org/10.1038/s41598-021-88071-4

5. Gupta, L., Morgan, K., & Gilchrist, S. (2017). Does Elite Sport Degrade Sleep Quality? A Systematic Review. *Sports Medicine*, *47*(7), 1317–1333. https://doi.org/10.1007/s40279-016-0650-6
6. Ingram, J., Maciejewski, G., & Hand, C. J. (2020). Changes in Diet, Sleep, and Physical Activity Are Associated With Differences in Negative Mood During COVID-19 Lockdown. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.588604
7. Luan, X., Tian, X., Zhang, H., Huang, R., Li, N., Chen, P., & Wang, R. (2019). Exercise as a prescription for patients with various diseases. *Journal of Sport and Health Science*, *8*(5), 422–441.
8. MARITZ, J. S., MORRISON, J. F., PETER, J., STRYDOM, N. B., & WYNDHAM, C. H. (1961). A PRACTICAL METHOD OF ESTIMATING AN INDIVIDUAL'S MAXIMAL OXYGEN INTAKE. *Ergonomics*, *4*(2), 97–122. https://doi.org/10.1080/00140136108930512
9. Muramatsu, K., Miyaoka, H., Kamijima, K., Muramatsu, Y., Tanaka, Y., Hosaka, M., Miwa, Y., Fuse, K., Yoshimine, F., Mashima, I., Shimizu, N., Ito, H., & Shimizu, E. (2018). Performance of the Japanese version of the Patient Health Questionnaire-9 (J-PHQ-9) for depression in primary care. *General Hospital Psychiatry*, *52*, 64–69. https://doi.org/10.1016/j.genhosppsych.2018.03.007
10. Mushtaque, I., Rizwan, M., Abbas, M., Khan, A. A., Fatima, S. M., Jaffri, Q. A., Mushtaq, R., Hussain, S., Shabbir, S. W., Naz, R., & Muneer, K. (2021). Inter-Parental Conflict's Persistent Effects on Adolescent Psychological Distress, Adjustment Issues, and Suicidal Ideation During the COVID-19 Lockdown. *OMEGA - Journal of Death and Dying*, 003022282110543. https://doi.org/10.1177/00302228211054316
11. Santana, C. C. A., Azevedo, L. B., Cattuzzo, M. T., Hill, J. O., Andrade, L. P., & Prado, W. L. (2016). Physical fitness and academic performance in youth: A systematic review. *Scandinavian Journal of Medicine & Science in Sports*, *27*(6), 579–603. https://doi.org/10.1111/sms.12773
12. Schlarb, A. A., Claßen, M., Grünwald, J., & Vögele, C. (2017). Sleep disturbances and mental strain in university students: results from an online survey in Luxembourg and Germany. *International Journal of Mental Health Systems*, *11*(1). https://doi.org/10.1186/s13033-017-0131-9
13. Takegami, M., Suzukamo, Y., Wakita, T., Noguchi, H., Chin, K., Kadotani, H., Inoue, Y., Oka, Y., Nakamura, T., Green, J., Johns, M. W., & Fukuhara, S. (2009). Development of a Japanese version of the Epworth Sleepiness Scale (JESS) based on Item Response Theory. *Sleep Medicine*, *10*(5), 556–565. https://doi.org/10.1016/j.sleep.2008.04.015
14. Tseng, T.-H., Chen, H.-C., Wang, L.-Y., & Chien, M.-Y. (2020). Effects of exercise training on sleep quality and heart rate variability in middle-aged and older adults with poor sleep quality: a randomized controlled trial. *Journal of Clinical Sleep Medicine*, *16*(9). https://doi.org/10.5664/jcsm.8560
15. Viner, R. M., Aswathikutty-Gireesh, A., Stiglic, N., Hudson, L. D., Goddings, A.-L., Ward, J. L., & Nicholls, D. E. (2019). Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: a secondary analysis of longitudinal data. *The Lancet Child & Adolescent Health*, *3*(10), 685–696. https://doi.org/10.1016/s2352-4642(19)30186-5