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# Physical activity and psychological well-being among female health college students at a public university in Riyadh, Saudi Arabia: A cross-sectional study

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Lack of physical activity can adversely affect university physical and psychological well-being. However, little is known about physical activity among young students, where rapid urban-industrial transformation may negatively affect psychological health well-being. Thus, this study examines the relationship between physical inactivity and psychological well-being in undergraduate female health college students at a public university in Riyadh (n= 274). A cross-sectional correlation design was utilized. Physical activity was measured using the International Physical Activity Questionnaire and the 12-item General Health Questionnaire. The dimensions of the General Health Questionnaire included anxiety, depression, and social discomfort. Three physical activity levels are vigorous, moderate, walking, and sitting (immobility). Almost 80% of students performed a low-intensity activity, with more than 84% sitting (immobility) for more than 9 hours daily. The mean body mass index (BMI) was 23.16, with 30% being in the overweight to morbidly obese category. Social discomfort was significantly negatively correlated with immobility (r = -0.19, p = 0.003). No other significant relationships were found between anxiety, depression, and other physical activity levels. The medical and pharmacy college students sat more than those in the nursing college (f = 4.22, p = 0.016). The age of students was significantly negatively correlated with walking (r = -0.19, p = 0.05) and significantly positively correlated with the setting (r =.137, p = 0.02). Students' GPAs were significantly negatively correlated with vigorous activity (r = -.368; p = 0.03). Other socio demographic data, such as marital status, family income, place of residence, and BMI, showed no significant relationships with physical activity levels. Physical activity may reduce social discomfort in female health college students. However, further research is needed to establish whether this causal relationship exists in other female college student populations.

**Keywords: psychological well-being, physical activity, sociodemographic data, female health college students**

## INTRODUCTION

Physical inactivity accounts for 6% of deaths worldwide (Anderson & Durstine, 2019). About 70% of American adults are physically inactive and have lower than recommended physical activity levels (Barone Gibbs, Hivert, Jerome et al. 2021). The prevalence of physical inactivity among Arab countries is as follows: Tunisia (88%), Algeria (92.8%), Sudan (33.4%), Lebanon (32.6%), Kuwait (71.3%), and Bahrain (72.1%) (Aljayyousi, Abu Munshar, Al-Salim et al. 2019). In Saudi Arabia, the prevalence of physical inactivity was (57% in children, 71% in youths, and 58.5% in adults) (Al Zahib & Baarimah, 2020).

Globally, more than 1.4 billion adults risk developing or exacerbating diseases linked to physical inactivity (Fikre, Shehmolo, Boti et al. 2022). Physical inactivity has a negative effect on human physical and psychological well-being. It is one of the leading causes of death because it is linked to numerous illnesses, such as diabetes, cardiovascular disease, and hypertension (Anderson & Durstine, 2019). In addition, physically inactive people are more likely to exhibit signs of depression and nervousness, which are mood disorders (Kołomańska, Zarawski, & Mazur-Bialy, 2019).

The university environment has many significant advantages and more accessible opportunities for improving physical activity among students. However, in university, unlike in primary and secondary schools, the absence of proper structure for physical education, health promotion, and awareness activities makes the students most often neglect the opportunities of utilizing the available facilities effectively. Studies relating mental health and physical inactivity among health college students in Saudi Arabia are limited. Findings may also

help update records in the undergraduate prospectus concerning physical activity. It can also be used to reflect the prevalence of the age group 18-25 in the general population since a public university is a composition of the general public. This study aimed to examine the relationship between participation in physical activity and psychological well-being in Saudi female medical students. In addition, this study will examine the effect of demographic variables on psychological well-being and physical activity.

## MATERIALS AND METHODS

A cross-sectional survey examined the association between physical activity engagement and psychological well-being among Saudi female medical students. A convenience sample of 274 students was recruited to participate in the research. The students were selected due to their availability at the university during data collection. The researcher was not personally responsible for any of these students.

King Saud University approved this study. Permission was gained by the college of Nursing, Medicine, and Pharmacy to recruit students to study. Each cohort was approached separately and asked to complete an anonymous questionnaire at the end of a lecture. A participant information sheet was provided with each questionnaire, detailing the purpose of the study, assuring confidentiality and anonymity, and highlighting the benefits and risks of the study. Participants were reassured that they had the right to refuse participation and that failure to complete the questionnaire would not influence their studies. This was reinforced before distributing the questionnaire so that participants would not feel compelled to participate.

### Study instruments

### Physical activity

The International Physical Activity (IPAQ) short-format questionnaire (Craig, Marshall, Sjostrom et al. 2003) was chosen for its high validity and reliability in assessing frequency, intensity, and duration of self-reported physical activity in the previous week (7 days) in five domains: occupational, transportation, household, leisure time, and sedentary activity. Physical activity is reported as the metabolic equivalent of a task (METS). The IPAQ has been specifically developed for adults aged 18–65 years. Students fall within this age range, making the IPAQ sensitive to the population under study. Cronbach's alpha was 0.92 in the current study, indicating that IPAQ has good internal consistency.

The 12-item General Health Questionnaire (GHQ-12) developed by Goldberg (1988) to assess students' psychological well-being comprises three categories: anxiety and depression, and social dysfunction. The GHQ-12 assesses the severity of a mental problem over the past few weeks using a 4-point Likert-scale range. The score was used to make a total score ranging from 0 to 36. Low scores indicate healthy psychological well-being. The reliability coefficient was 0.88 in El-Metwally, Javed, Razzak et al. (2018) study. Cronbach's alpha was 0.86 in the current study, indicating that GHQ-12 has good internal consistency.

### Data Analysis

The Statistical Package for Social Sciences (SPSS) version 28 was used. For descriptive data analysis to describe the characteristics of the students. Pearson-Product-Moment Correlation Analysis was also used to investigate the links between physical activity and psychological well-being. The T-test and the one-way analysis of variance (ANOVA) test were used to investigate differences in the mean of psychological well-being. For all statistical analyses, the significance level was set at ≤0.05.

## RESULTS

### Demographic characteristics of the students

A total of 274 students participated in this study, with a response rate of 92%. The age range of students ranges from 18 to 28 years old, with an age mean of 20.79 (1.48). Most of the study sample (40.5%) came from the pharmacy college, and most (97.1%) were single. Students' GPA points averaged 4.29 (0.54). The students had a mean BMI of 23.16 (SD 4.5), falling within the normal weight category (18.0–24.5). However, there was a wide range of BMI from 16.4 to 38.8 (underweight to morbidly obese), with approximately 30% being within the overweight to morbidly obese categories. Approximately three-quarters (74.4%) of the students had a moderate income, with the majority of them from Riyadh (94.2%) (Table 1).

### Results of physical activity level

Physical activity levels include vigorous, moderate, walking, and sitting (immobility). In vigorous physical activities, 8.4% of the subjects did them on average for 3.1 days per week and 1.7 hours per day. About 16% of the students engaged in moderate physical activities on average 2.7 days per week and 1.7 hours per day. Walking for at least 10 minutes was done by 79.9% of the students on average 4.8 days per week and 1.9 hours per day. On weekdays, 83.9% of the subjects were immobile, with an average of 9.6 hours of daily sitting (immobility) (Table 2).

**Table1: Characteristics of the sample (N=274)**

| Variable | N | % | Mean (S.D.) |
|---|---|---|---|
| **Age** | | | 20.79 (1.48) |
| **GPA** | | | 4.29 (0.54) |
| **BMI** | | | 23.16 (4.53) |
| **College** | | | |
| **Medical** | 76 | 27.7 | |
| **Pharmacy** | 111 | 40.5 | |
| **Nursing** | 87 | 31.8 | |
| **Marital status** | | | |
| **Single** | 266 | 97.1 | |
| **Married** | 8 | 2.9 | |
| **Family income** | | | |
| **Low** | 7 | 2.6 | |
| **Moderate** | 204 | 74.4 | |
| **High** | 63 | 23.0 | |
| **Place of residence** | | | |
| **Riyadh** | 258 | 94.2 | |
| **Out of Riyadh** | 16 | 5.8 | |

**Table 2: Measures of Central Tendency of physical activity levels, (N=274)**

| Activity | General answer | | | Yes answer | | | |
|---|---|---|---|---|---|---|---|
| **Vigorous** | | N | % | Days | N | % | Hours Mean/day |
| | Yes | 23 | 8.4 | 2.00 | 7 | 2.6 | 1.72 |
| | No | 251 | 91.6 | 3.00 | 9 | 3.3 | |
| | | | | 4.00 | 3 | 1.1 | |
| | | | | 5.00 | 4 | 1.5 | |
| | | | | Total | 23 | 8.4 | |
| | | | | Average | 3.17 | | |
| **Moderate** | Yes | 43 | 15.7 | 1.00 | 7 | 2.6 | 1.70 |
| | No | 231 | 84.3 | 2.00 | 12 | 4.4 | |
| | | | | 3.00 | 12 | 4.4 | |
| | | | | 4.00 | 8 | 2.9 | |
| | | | | 5.00 | 4 | 1.5 | |
| | | | | Total | 43 | 15.7 | |
| | | | | Average | 2.77 | | |
| **Walking for at least 10 minutes** | Yes | 219 | 79.9 | 1.00 | 8 | 2.9 | 1.97 |
| | No | 55 | 20.1 | 2.00 | 21 | 7.7 | |
| | | | | 3.00 | 33 | 12.0 | |
| | | | | 4.00 | 24 | 8.8 | |
| | | | | 5.00 | 56 | 20.4 | |
| | | | | 6.00 | 4 | 1.5 | |
| | | | | 7.00 | 73 | 26.6 | |
| | | | | Total | 219 | 79.9 | |
| | | | | Average | 4.84 | | |
| **Sitting on weekdays** | Yes | 230 | 83.9 | | | | |
| | No | 44 | 16.1 | | | | |
| | | | | | | | 9.63 |

**The results of general health level**

The mean anxiety, depression, and social dysfunction measured by the General Health Questionnaire (GHQ-12) among students were 2.54 (SD = 0.28). Most students (60%) rated their general health as "same as usual or rather more than usual." From a pool of 12 items, the item "felt that you are playing a useful part in things" was in the first rank, with a mean of 2.99 (SD = 0.79).

**The results of the relationship between physical activity, general health, and sociodemographic factors of students**

**College:**

Participants in this study were divided into three groups according to their college. One-way ANOVA was used to examine differences in the level of physical activity concerning college. The study's findings revealed a statistically significant difference (p=016) in the level of physical activity among different colleges. In addition, these results revealed that students in medical and pharmacy colleges scored higher in the setting than students in nursing colleges (Table 3).

**Table 3: Difference between college and physical activity, general health**

| Variable | Dimension | *df* | *F- value* | *P-value* |
|---|---|---|---|---|
| **Physical activity** | Vigorous | 2 | 1.008 | .384 |
| | | 19 | | |
| | Moderate | 2 | 1.164 | .322 |
| | | 40 | | |
| | Walking | 2 | .789 | .456 |
| | | 136 | | |
| | Setting | 2 | 4.238 | .016 |
| | | 277 | | |
| **General Health** | | 2 | .542 | .582 |
| | | 271 | | |

**Marital status:**

An independent-sample t-test was used to examine differences in the total level of physical activity and general health concerning marital status. The study revealed no statistically significant difference between married and single people regarding the total physical activity or general health (Table 4).

**Table 4: Difference between college and physical activity, general health**

| Variable | Dimension | Marital Statues | Mean | t-value | *df* | *P-value* |
|---|---|---|---|---|---|---|
| **Physical activity** | Vigorous | Single | 1.38 | .472 | 21 | .642 |
| | | Married | 1.00 | | | |
| | Moderate | Single | 1.27 | .224 | 41 | .824 |
| | | Married | 1.00 | | | |
| | Walking | Single | 1.96 | -.327 | 137 | .744 |
| | | Married | 2.20 | | | |
| | Setting | Single | 9.60 | -.511 | 228 | .610 |
| | | Married | 10.37 | | | |
| | | Married | .59 | | | |
| **General Health** | | Single | 2.54 | .201 | 272 | .841 |
| | | Married | 2.52 | | | |

**Family income:**

Participants in this study were divided into three groups according to their family income. A one-way ANOVA was used to examine differences in the level of physical activity concerning family income. The study's findings revealed no statistically significant difference in physical activity levels among families of different income levels at p <.05 (Table 5).

**Table 5: Difference between family income and physical activity, general health**

| Variable | Dimension | *df* | *F- value* | *P-value* |
|---|---|---|---|---|
| **Physical activity** | Vigorous | 1 | 1.979 | .174 |
| | | 21 | | |
| | Moderate | 2 | .457 | .636 |
| | | 40 | | |
| | Walking | 2 | 1.112 | .332 |
| | | 136 | | |
| | Setting | 2 | .777 | .461 |
| | | 227 | | |
| | | 271 | | |
| **General Health** | | 2 | 1.717 | .182 |
| | | 271 | | |

**Place of residence:**

An independent-sample t-test was used to examine differences in the total level of physical activity and general health concerning the place of residence**.** The study's findings revealed no statistically significant difference between those who live in Riyadh and those who live outside of Riyadh regarding total physical activity or general health (Table 6).

**GPA:**

The Pearson product-moment correlation (Pearson's r) coefficient for a 2-tailed significant test was used to determine the relationship between physical activity, general health, and GPA. The result revealed a statistically significant negative relationship between vigorous physical activity and GPA (r = -.36; n = 274; p = 0.023) (Table 6). This means that students with high GPAs have increased physical activity.

**Age:**

The Pearson product-moment correlation (Pearson's r) coefficient for a 2-tailed significant test was used to determine the relationship between physical activity, general health, and age. The relationship between waking physical activity and age is a statistically significant negative relationship (r = -.191; n = 274; p = 0.012). Furthermore, the setting (immobility) and age have a statistically significant positive relationship (r =.137; n = 274; p = 0.041) (Table 6). This means that older students

have less physical activity.

**Table 5: Difference between the place of residence and physical activity, general health**

| Variable | Dimension | Place of residence | Mean | t-value | *df* | *P-value* |
|---|---|---|---|---|---|---|
| **Physical activity** | Vigorous | Riyadh | 1.3941 | .640 | 21 | .529 |
| | | Out of Riyadh | .8700 | | | |
| | Moderate | Riyadh | 1.2822 | .321 | 41 | .750 |
| | | Out of Riyadh | 1.0000 | | | |
| | Walking | Riyadh | 1.9231 | -1.363 | 137 | .175 |
| | | Out of Riyadh | 2.6667 | | | |
| | Setting | Riyadh | 9.6955 | 1.105 | 228 | .270 |
| | | Out of Riyadh | 8.2000 | | | |
| | | Out of Riyadh | .7049 | | | |
| **General Health** | | Riyadh | 2.5339 | -1.556 | 272 | .121 |
| | | Out of Riyadh | 2.6458 | | | |

**BMI:**

The Pearson product-moment correlation (Pearson's r) coefficient for a 2-tailed significant test was used to determine the relationship between physical activity, general health, and BMI. The study showed no statistically significant relationship at p <.05 between physical activity, general health, and BMI (Table 6). This means that all students with different BMIs have similar physical activity.

**Table 6: Correlations between physical activity, general health, GPA, and BMI**

| Variables | | GPA | Age | BMI |
|---|---|---|---|---|
| **Physical activity** | Vigorous | -.368* | -.123 | -.047 |
| | Moderate | -.018 | .104 | .078 |
| | Walking | .109 | -.191* | -.014 |
| | Setting | .097 | .137* | .030 |
| **General Health** | | -.026 | -.050 | .037 |
| ***Significant at p ≤ 0.05.** | | | | |

**The results of the relationship between physical activities and general health dimensions of students**

The Pearson product-moment correlation coefficient (Pearson's r) for a 2-tailed significant test was used to determine the relationship between physical activity and general health dimensions. The result of the study showed that setting (immobility) and social discomfort have a statistically significant negative relationship (r = -193; n = 274; p = 0.003) (Table 7). This means that students who prefer to be immobile have increased social discomfort.

**Table 7: Correlations between physical activity and general health dimensions**

| | General Health | | | |
|---|---|---|---|---|
| **Physical activity** | **Social discomfort** | | **Anxiety and depression** | |
| | r | *P-value* | r | *P-value* |
| Vigorous | -.305 | .157 | .283 | .190 |
| Moderate | .235 | .129 | -.049 | .756 |
| Walking | -.137 | .107 | .047 | .584 |
| Setting | -.193* | .003 | .057 | .391 |
| ***Significant at p ≤ 0.05.** | | | | |

## DISCUSSION

This study aimed to examine the relationship between participation in physical activity and psychological well-being in Saudi female medical students. A small percentage of students (8%) were doing vigorous physical activity, and 15.7% were doing moderate physical activity. This means that students in this study fail to meet international recommendations on physical activity. Most students (84%) were immobile for more than 9 hours daily. The more time spent in inactivity and immobility while watching television, playing videogames (or) games on mobile phones, and eating or drinking unhealthy food, the less likely the person is to engage in any physical activity (Syed, Syed, Meraya et al. 2020). This is comparable to 58% of Norwegian university students who were physically inactive and did not meet the global recommendation (Grasdalsmoen, Eriksen, Lønning et al. 2019). In addition, a study conducted by Al-Harbi and Farajat (2019) in Saudi Arabia showed that 97.9% of students did not perform any intense activity, 95.9% did not perform a moderate activity, and 86.6% did not even perform a low activity. However, this is incomparable to 23.1% of the Sudanese medical students doing vigorous physical activity, and 32% reported a "moderate" level of physical activity (Yousif, Kaddam, & Humeda, 2019).

A statistically significant negative relationship exists between vigorous physical activity and students' GPAs. This finding is consistent with a study by Daniels, Human, Gallagher et al. (2021) and inconsistent with other studies (Alhazmi, Aziz, & Hawash, 2021; Fattahi, Jahansouz, Halabchi et al. 2019). The difference in study results can be explained by the fact that students with higher GPAs consider the importance of physical activity for both physical and mental health, which will thus improve their thinking and concentration in their studies.

The association between walking activity and age is a statistically significant negative relationship. Furthermore, the setting and age have a statistically significant positive relationship. This refers to the fact that older adults are

better suited to sitting than walking. This finding consists of a study by Yang, Ao, Ke et al. (2021) that showed that the proportion of individuals engaging in physical activity decreases with age. This may be due to a decline in muscle strength and mass with advanced age.

Not all physical activity variables were found to correlate with psychological well-being. However, the result of the study showed that the setting (immobility) of physical activity variables and social discomfort have a statistically significant negative relationship. This finding consists of a study by Rask, Castaneda, Koponen et al. (2015) that discovered that mental health symptoms and social isolation are significantly related to mobility limitation in the studied and the general Finnish populations. This could increase our understanding of developing new interventions and create more supportive environments for those who prefer setting and immobility.

### Study limitation

Many limitations affect the interpretation of the study's results. The use of only self-ratings is one limitation. It is commonly known that individuals are likely to overestimate their physical activity and psychological well-being in self-rating physical activity and general health studies due to factors like social desirability. Other limitations include the fact that the study was conducted at only one university, limiting the generalizability of the findings. Furthermore, because this is a cross-sectional analytic study, it is not easy to know the process and direction of the identified relationships, and the focus was on sociodemographic associations.

## CONCLUSION

The findings of this study add to existing evidence that physical activity among Saudi Arabian students is at an all-time low; thus, increased sedentary lifestyles appear to be a severe problem among these students. In addition, this study shows that most female students in health colleges are not engaged in moderate to high levels of physical activity. As a result, academics must include physical activity in the curriculum to promote university students' health. Therefore, school and college physical education is an important subject that exposes students to physical activity.

## CONFLICT OF INTEREST

The authors declared that the present study was performed without conflict of interest.

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## AUTHOR CONTRIBUTIONS

RA wrote the manuscript. M.A., S.A. performed data analysis. S.A. reviewed the manuscript. All authors read and approved the final version.



## REFERENCES

Al-Harbi, N., & Farajat, M. (2019). Health-risk behaviors among medical students at Qassim University, Saudi Arabia: A prevalence study. *International Journal of Public Health Safety*, *4*(177), 2.

Al Zahib, Y., & Baarimah, H. (2020). Physical activity profile among Saudi adults in Abha City, Saudi Arabia. *Middle East J Family Med*, *7*(37), 10.5742.

Alhazmi, A., Aziz, F., & Hawash, M. (2021). Association of BMI, Physical Activity with Academic Performance among Female Students of Health Colleges of King Khalid University, Saudi Arabia. *International Journal of Environmental Research Public Health*, *18*(20), 10912.

Aljayyousi, G. F., Abu Munshar, M., Al-Salim, F., & Osman, E. R. (2019). Addressing context to understand physical activity among Muslim university students: the role of gender, family, and culture. *BMC Public Health*, *19*(1), 1-12.

Anderson, E., & Durstine, J. L. (2019). Physical activity, exercise, and chronic diseases: A brief review. *Sports Medicine Health Science*, *1*(1), 3-10.

Barone Gibbs, B., Hivert, M.-F., Jerome, G., Kraus, W., Rosenkranz, S., Schorr, E. N., Spartano, N., & Lobelo, F. (2021). Physical activity as a critical component of first-line treatment for elevated blood pressure or cholesterol: who, what, and how?: a scientific statement from the American Heart Association. *Hypertension*, *78*(2), e26-e37.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., & Ainsworth, B. E. (2003). International Physical Activity Questionnaire: 12 country reliability and validity. *Medicine & Science in Sports and Exercise*, *35*(8), 1381–1395.

Daniels, B. T., Human, A. E., Gallagher, K. M., & Howie, E. K. (2021). Relationships between grit, physical activity, and academic success in university students: Domains of physical activity matter. *Journal of American College Health*, *2021*(2), 1-9.

El-Metwally, A., Javed, S., Razzak, H. A., Aldossari, K., Aldiab, A., Al-Ghamdi, S., Househ, M., Shubair, M., & Al-Zahrani, J. (2018). The factor structure of the general health questionnaire (GHQ12) in Saudi Arabia. *BMC health services research*, *18*(1), 1-11.

Fattahi, M.-R., Jahansouz, D., Halabchi, F., Golsoorat-

Pahlaviani, F., Abouzari, F., Sajedi-Monfared, Z., & Arabzadeh, T. (2019). Physical activity, sedentary behavior and correlates among students of Tehran University of Medical Sciences. *Acta Medica Iranica*, *3*(5), 663-671.

Fikre, A., Shehmolo, M., Boti, N., Oumer, B., Tenalem, B., Kibru, S., Temesgen, G., & Gebru, Z. (2022). Magnitude and risks of overweight/obesity among adults in Welkite town, Southern Ethiopia: A community based cross-sectional study. *Plos one*, *17*(9), e0275014.

Goldberg, D. (1988). User's guide to the General Health Questionnaire. *Windsor*, *2*(1), 1-13.

Grasdalsmoen, M., Eriksen, H. R., Lønning, K. J., & Sivertsen, B. (2019). Physical exercise and body-mass index in young adults: a national survey of Norwegian university students. *BMC Public Health*, *19*(1), 1-9.

Kołomańska, D., Zarawski, M., & Mazur-Bialy, A. (2019). Physical activity and depressive disorders in pregnant women—A systematic review. *Medicina*, *55*(5), 212.

Rask, S., Castaneda, A., Koponen, P., Sainio, P., Stenholm, S., Suvisaari, J., Juntunen, T., Halla, T., Härkänen, T., & Koskinen, S. (2015). The association between mental health symptoms and mobility limitation among Russian, Somali and Kurdish migrants: a population based study. *BMC Public Health*, *15*(1), 1-14.

Syed, N. K., Syed, M. H., Meraya, A. M., Albarraq, A. A., Al-Kasim, M. A., Alqahtani, S., Makeen, H. A., Yasmeen, A., Banji, O. J., & Elnaem, M. H. (2020). The association of dietary behaviors and practices with overweight and obesity parameters among Saudi university students. *Plos one*, *15*(9), e0238458.

Yang, L., Ao, Y., Ke, J., Lu, Y., & Liang, Y. (2021). To walk or not to walk? Examining non-linear effects of streetscape greenery on walking propensity of older adults. *Journal of transport geography*, *94*(3), 105-122.

Yousif, M. M., Kaddam, L. A., & Humeda, H. S. (2019). Correlation between physical activity, eating behavior and obesity among Sudanese medical students Sudan. *BMC nutrition*, *5*(1), 1-8.