

A Longitudinal Study: Correlation Between Physical Activity and Stress Level Among Undergraduate Students in IPB University

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Received March 20, 2024/Received in revised form June 5, 2024/Accepted June 21, 2024

The COVID-19 pandemic-related restrictions on physical activity outside can cause changes in physical activity in humans compared to before the pandemic. Differences in levels of physical activity are frequently associated with changes in stress levels, including in students. However, no longitudinal research has been conducted on the relationship between physical activity and stress levels in undergraduate students using the same respondents in different settings. This study aimed to assess the relationship between physical activity and stress levels in Indonesian students and to assess its consistency under different conditions. The data was collected from 81 undergraduate students in IPB University in two sampling phases: 2021 (during the Covid-19 pandemic) and 2023 (after the pandemic). The International Physical Activity Questionnaire (IPAQ) was used to assess the prevalence of physical activity, and the Perceived Stress Scale (PSS) was used to assess students' perceived stress. The findings revealed that there were no differences in physical activity and stress levels between the two sampling phases. There was no significant relationship between physical activity and stress levels at either sampling time. These findings suggest that stress level at a certain level does not show any link to physical activity of the students.

Key words: IPAQ, Longitudinal, PSS, University Student

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) had various impacts on human life. After the initial outbreak that occurred at the end of 2019, the Indonesian government established a physical and social distancing policy. This policy has an impact on activities that involve physical activity. Previous studies found that physical distancing during the COVID-19 pandemic was associated with a decrease in the trend of physical activity (Hammami *et al.* 2020; López-Valenciano *et al.* 2021; Puccinelli *et al.* 2021; Park *et al.* 2022). A longitudinal study among students in London showed that students tended to do fewer physical activity during the COVID-19 pandemic, compared to after the pandemic (Bu *et al.* 2021). This is due to the availability of sports facilities, as well as lifestyles that are starting to be active in the outside environment back to normal.

In addition to physical activity, the ongoing global pandemic has also led to elevated stress levels among

the general population. The pandemic has compelled humans to adapt to new conditions, which can in turn lead to higher stress levels. Previous research has indicated that stress levels during the pandemic were higher than after the pandemic or the last year of the pandemic (Awadalla *et al.* 2022; Wróblewski *et al.* 2024). The elevated stress levels observed during the pandemic have been attributed to a number of lifestyle changes, including social isolation and reduced physical activity (Sepúlveda-Loyola *et al.* 2020; Caroppo *et al.* 2021; Walugembe *et al.* 2022).

Physical activity is commonly associated with various aspects of human life, including stress level (Rimmele *et al.* 2009; Anderson and Shivakumar 2013; Mahfouz *et al.* 2020). Studies have shown that a higher level of physical activity is associated with a lower level of stress (Carmack *et al.* 1999; Nguyen-Michel *et al.* 2006; Habibzadeh 2015). However, no longitudinal research has examined the correlation between physical activity and stress levels among Indonesian undergraduate students using the same respondents with different conditions. This study aimed to examine the correlation between physical activity and stress levels in IPB University students in during and after the COVID-19 pandemic.

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MATERIALS AND METHODS

Ethical Permission. This study has been approved by the Ethics Committee of the Indonesian Public Health Association of Southeast Sulawesi (Ref: 46/ECHR-IPHA/IV/2023). All the methods were carried out following ethical approval. All respondents were informed about the study and provided informed consent before continuing their participation.

Time and Place. This study conducted two data collections. The first data was taken on July 5-July 12 in 2021 during the Covid-19 pandemic and the second was on May 11-May 15 in 2023, after the pandemic in Indonesia. Data sampling was carried out in IPB University, Bogor, Indonesia.

Respondents. The participants were 81 bachelor students of the Department of Biology, IPB University. The participants consisted of students in biology majors enrolled in the 2019 (coded as BIO56) and 2020 (coded as BIO57) academic years. Data sampling occurred on two phases: first, in 2021, when students labelled as BIO56 were in their fourth semester and students coded as BIO57 were in their second semester during Covid-19 pandemic; second, in 2023, when students labelled as BIO56 were in their eighth semester and students coded as BIO57 were in their sixth semester after the pandemic. All respondents were informed about the study's consent requirements. The longitudinal study method was used (Cook and Ware 1983), where the data collection was carried out continuously at different periods with the same respondent.

Sampling Process. Each respondent was asked to provide their sociodemographic information, such as sex, age, and year of study (semester). The respondents were asked to complete the International Physical Activity Questionnaire (IPAQ) and the Perceived Stress Scale (PSS) using PSS-10. The IPAQ assesses the frequency, intensity, and duration of physical activity (Craig *et al.* 2003). On the other hand, the PSS-10 measures stress levels using a 10-question psychological instrument with 5-point Likert scales ranging from 0 (never) to 4 (very often). The total score is categorized into three ranges representing three levels of stress (Wongpakaran and Wongpakaran 2010). Both the IPAQ and PSS-10 were shared through Google Forms and social media.

International Physical Activity Questionnaire. The IPAQ, a self-reported measure consisting of 27 items, assesses the physical activity levels of adult individuals aged 15 to 69 years old within the previous week (Ainsworth and Macera 2012). For this study,

the IPAQ long version questionnaire was utilized. An illustrative question from the questionnaire is, "Over the past 7 days, how many days did you engage in work-related walking for at least 10 minutes consecutively?" Respondents could report their activity in minutes or hours per day.

The scoring procedure for this questionnaire adhered to the guidelines outlined in the IPAQ scoring protocol (<https://sites.google.com/site/theipaq/scoring-protocol>). The questionnaire employs Metabolic Equivalent Tasks (MET) minutes for scoring. A single MET is defined as oxygen consumption while seated at rest, equivalent to 3.5 ml O₂ per kg body weight x min (Jetté *et al.* 1990). Within each domain (work, transportation, domestic tasks, gardening, and leisure), median values and interquartile ranges were computed for walking (W), moderate-intensity activities (M), and vigorous-intensity activities (V). The total MET-minute scores, obtained by combining W, M, and V, serve as the basis for categorizing physical activity into three groups. Individuals scoring below 600 MET minutes/week are classified as having low physical activity, while those achieving at least 600 MET minutes/week fall under the moderate physical activity category. The high physical activity category includes respondents who accumulate a total MET score of 3,000 MET minutes/week or more.

Perceived Stress Scale. The Perceived Stress Scale (PSS-10) is a self-report questionnaire comprising 10 items designed to assess an individual's perceived stress levels over the past month (Cohen *et al.* 1983; Cohen and Williamson 1988). Each item in the PSS-10 is rated on a five-point Likert scale, ranging from "never" (0 points) to "very often" (4 points). In calculating the PSS-10 score, the scores on questions 4, 5, 7, and 8 are reversed. Specifically, a score of 0 is converted to 4, 1 becomes 3, 2 remains unchanged, 3 becomes 1, and 4 becomes 0. The total score is derived by summing the responses to all ten questions. The total score on this questionnaire ranges from 0 to 40, with scores falling within the range of 0-13 indicative of low-stress levels, scores ranging from 14-26 suggestive of moderate stress levels, and scores between 27-40 representing high-stress levels.

Data Analyses. All analyses were conducted using R software (R Core Team 2021). The correlation between physical activity and stress levels during and after the COVID-19 pandemic was assessed using the Pearson's correlation test. The Generalized Linear Model (GLM) was used to examine the variables associated with physical activity and stress levels.

RESULTS

The demographic profiles of the respondents were shown in Table 1. In two sampling phases, 81 undergraduate students (14 males and 67 females) were participated in this study. Most of the participants were BIO57 (51.85%).

Table 1. The respondent’s demographic data

Category	Variables	N*	Percentages (%)
Sex	Males	14	17.28
	Females	67	82.72
	Total	81	100
Batch of study	BIO56	39	48.15
	BIO57	42	51.85
	Total	81	100

Table 2. The respondent’s physical activity each year

Category	Sex	During pandemic (N*)	During pandemic (Total N*)	Percentage (%)	After pandemic (N*)	After pandemic (Total N*)	Percentage (%)
Low physical activity	Males	4	16	25	4	16	20
	Females	12	16	75	16	16	80
Moderate physical activity	Males	6	49	12.25	8	44	18.18
	Females	43	49	87.75	36	44	81.82
Moderate physical activity	Males	4	16	25	2	17	11.76
	Females	12	16	75	15	17	88.24
Total		81	81	100	81	81	100

N*: Number of respondents

The findings indicated that the most of respondents exhibited a moderate level of physical activities based on the results presented in Table 2.

The results also showed that there was no significant different (Kruskal-Wallis, p-value = 0.59) on the physical activity between each year of data sampling (Figure 1).

There was no significant difference in the stress levels among university students, either during and after the pandemic (p-value = 0.068) (Figure 2).

The research demonstrated that in the initial year of data collection (during pandemic), there was no significant correlation between physical activity and stress (correlation coefficient $[\rho] = 0.0584$, p-value

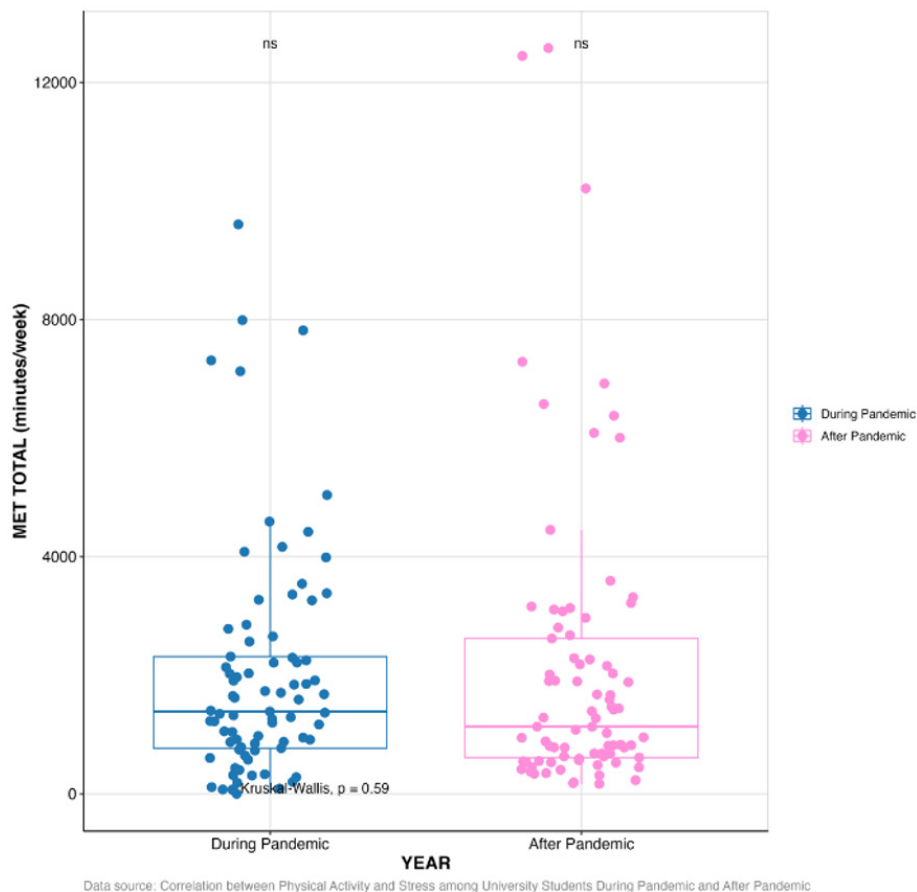


Figure 1. MET score among the respondents

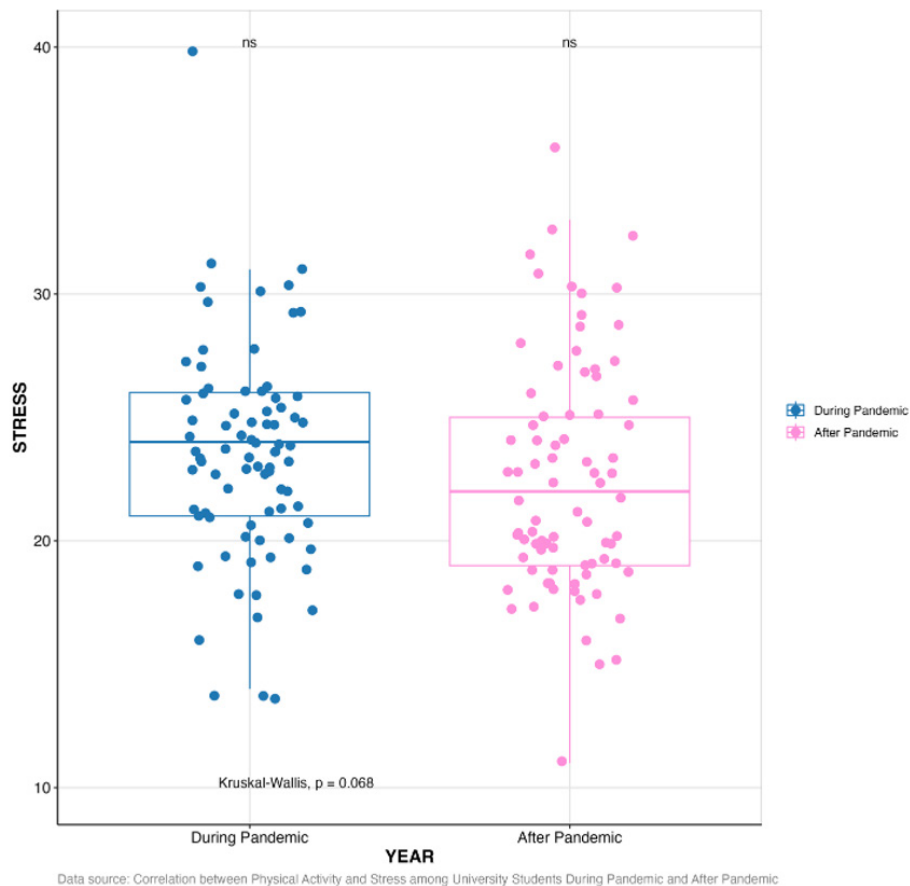


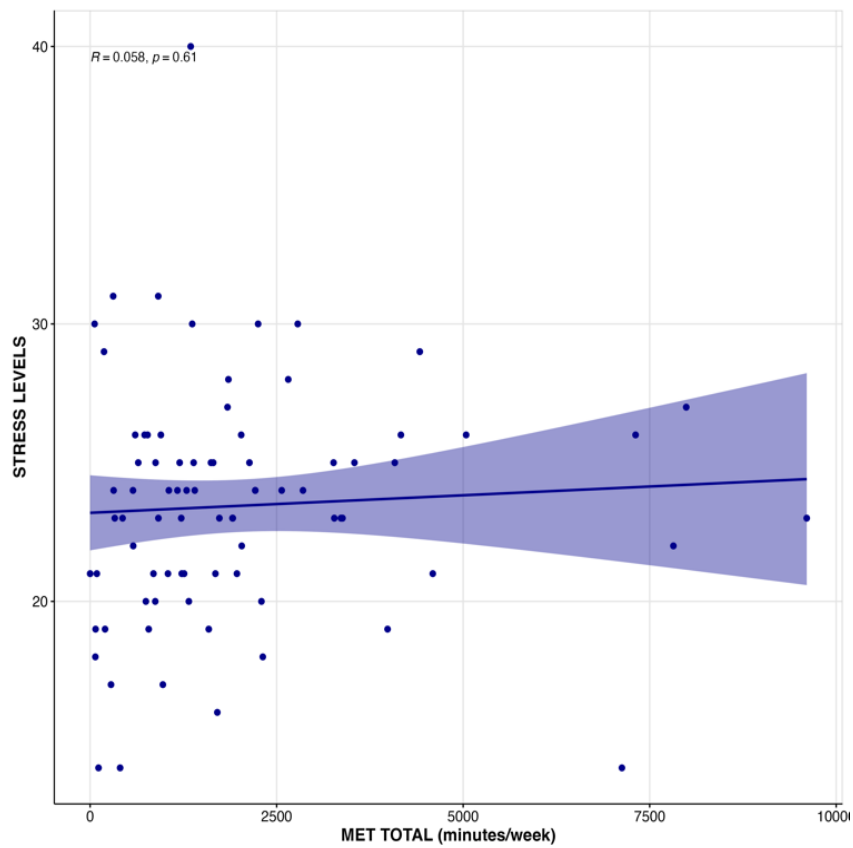
Figure 2. Stress levels among the respondents

= 0.61), as well as in the subsequent phase (after pandemic) ($\rho = 0.032$, p -value = 0.77, Figure 3).

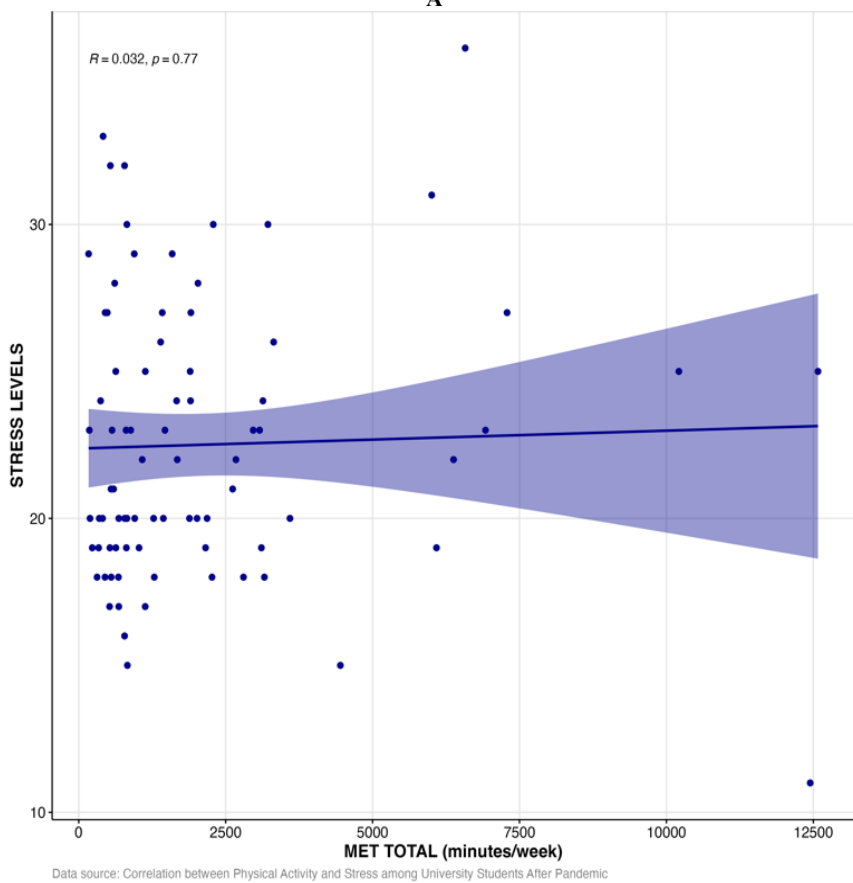
DISCUSSION

The results of the longitudinal study showed that the physical activity of the respondents was moderate, either during or after the pandemic. We assume that, despite the imposition of activity restrictions during the pandemic, the students in this research are still able to engage in physical activity, albeit in different forms, such as exercising at home. It indicated that students can adapt to every environmental condition, so that the recent pandemic was not a limitation for them to do physical activity (O'Loughlin *et al.* 2022). Moreover, the level of stress experienced by students is moderate both during and after the pandemic. We speculate that IPB University students may experience similar stress, either during or after the pandemic, probably due to academic stressors.

This study showed that there is no significant correlation between physical activity and stress. This result implied that either higher or lower stress level might not be associated with students' physical activity. In this study, physical activity did not play a role in students' stress levels. This argument was supported by Nguyen-Michel (2006) and Pilipović-Spasojević *et al.* (2020), who stated that student's stress levels were not associated with student stress levels. The findings of this study indicate that the overall physical activity levels and stress level of the study population remained largely unchanged following the onset of the pandemic. Should this level of physical activity and stress level be maintained, it is possible that the relationship between stress and physical activity may also remain unchanged. The findings of this research suggest that IPB University students may employ other coping strategies to manage stress, rather than solely relying on physical activity.



A



B

Figure 3. Relationship between physical activity and stress levels (A = during pandemic, B = after pandemic)

Limitations. The respondents of this study consisted of undergraduate students at the same university, thus there was no significant difference on sociodemographic variable among the respondents. Furthermore, study on wide-scale sampling is needed to provide socio-demographic factors that may affect the results.

ACKNOWLEDGEMENTS

We express our sincere gratitude to all the respondents who have participated in this study.

REFERENCES

- Ainsworth BE, Macera CA. 2012. Physical Activity and Public Health Practice. Florida (US): CRC Press. <https://doi.org/10.1201/b11718>
- Anderson E, Shivakumar G. 2013. Effects of exercise and physical activity on anxiety. *Frontiers in Psychiatry* 4:1-4. <https://doi.org/10.3389/fpsyg.2013.00027>
- Awadalla N, Alsabaani A, Alsaleem M, Alsaleem S, Alshaikh A, Al-Fifi S, Mahfouz A. 2022. Increased mental stress among undergraduate medical students in south-western Saudi Arabia during the COVID-19 pandemic. *PeerJ* 10: e13900. <https://doi.org/10.7717/peerj.13900>
- Bu F, Bone JK, Mitchell JJ, Steptoe A, Fancourt D. 2021. Longitudinal changes in physical activity during and after the first national lockdown due to the COVID-19 pandemic in England. *Scientific Reports* 11:1-11. <https://doi.org/10.1038/s41598-021-97065-1>
- Carmack CL, de Moor C, Boudreaux E, Amaral-Melendez M, Brantley PJ. 1999. Aerobic fitness and leisure physical activity as moderators of the stress-illness relation. *Annals of Behavioral Medicine* 21:251-257. <https://doi.org/10.1007/BF02884842>
- Caroppo E, Mazza M, Sannella A, Marano G, Avallone C, Claro A, Janiri D, Moccia L, Janiri L, Sani G. 2021. Will nothing be the same again?: changes in lifestyle during covid-19 pandemic and consequences on mental health. *International Journal of Environmental Research and Public Health* 18: 8433. <https://doi.org/10.3390/ijerph18168433>
- Cohen S, Kamarck T, Mermelstein R. 1983. A global measure of perceived stress. *Journal of Health and Social Behavior* 24:385-396. <https://doi.org/10.2307/2136404>
- Cohen S, Williamson GM. 1988. Perceived stress in a probability sample in the United States, in: Spacapan S, Oskamp S (Eds.), *The Social Psychology of Health*. Newbury Park: Sage Publications, Inc. p 31-67.
- Cook NR, Ware JH. 1983. Design and analysis methods for longitudinal research. *Annual Review of Public Health* 4:1-23. <https://doi.org/10.1146/annurev.pu.04.050183.000245>
- Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund U, Yngve A, Sallis JF, Oja P. 2003. International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise* 35:1381-1395. <https://doi.org/10.1249/01.MSS.0000078924.61453.FB>
- Habibzadeh N. 2015. The physiological impact of physical activity on psychological stress. *Prog Health Sci* 5:245-248.
- Hammami A, Harrabi B, Mohr M, Krustup P. 2020. Physical activity and coronavirus disease 2019 (COVID-19): specific recommendations for home-based physical training. *Managing Sport and Leisure* 27, 26-31. <https://doi.org/10.1080/23750472.2020.1757494>
- Jetté M, Sidney K, Blümchen G. 1990. Metabolic equivalents (METS) in exercise testing, exercise prescription, and evaluation of functional capacity. *Clin Cardiol* 13:555-565. DOI:10.1002/clc.4960130809
- López-Valenciano A, Suárez-Iglesias D, Sanchez-Lastra MA, Ayán C. 2021. Impact of COVID-19 Pandemic on university students' physical activity levels: an early systematic review. *Front Psychol* 11:624567. DOI:10.3389/fpsyg.2020.624567
- Mahfouz MS, Ali SA, Bahari AY, Ajeebi RE, Sabei HJ, Somaily SY, Madkhali YA, Hrooby RH, Shook RN. Association between sleep quality and physical activity in Saudi Arabian University Students. *Nat Sci Sleep* 12:775-782. DOI:10.2147/NSS.S267996
- Nguyen-Michel ST, Unger JB, Hamilton J, Spruijt-Metz D. 2006. Associations between physical activity and perceived stress/hassles in college students. *Stress & Health* 22:179-188. <https://doi.org/10.1002/smi.1094>
- O'Loughlin EK, Riglea T, Sylvestre MP, Pelekanakis A, Sabiston CM, Bélanger M, O'Loughlin JL. 2022. Stable physical activity patterns predominate in a longitudinal study of physical activity among young adults in Canada from before to during the COVID-19 pandemic. *Preventive Medicine Reports* 27:1-8. <https://doi.org/10.1016/j.pmedr.2022.101782>
- Park AH, Zhong S, Yang H, Jeong J, Lee C. Impact of COVID-19 on physical activity: A rapid review. *J Glob Health*. 2022 Apr 30;12:05003. doi: 10.7189/jogh.12.05003. PMID: 35493780; PMCID: PMC8979477
- Pilipović-Spasojević O, Ponorac N, Spremo M. 2020. Correlation of physical activity with stress, depression and anxiety in female students. *Scripta Medica* 51:244-251. <https://doi.org/10.5937/scriptamed51-27863>
- Puccinelli PJ, da Costa TS, Seffrin A, de Lira CAB, Vancini RL, Nikolaidis PT, Knechtle B, Rosemann T, Hill L, Andrade MS. 2021. Reduced level of physical activity during COVID-19 pandemic is associated with depression and anxiety levels: an internet-based survey. *BMC Public Health* 21:425. DOI:10.1186/s12889-021-10470-z
- R Core Team. 2021. R: A Language And Environment For Statistical Computing. Vienna: R Foundation for Statistical Computing.
- Rimmele U, Seiler R, Marti B, Wirtz PH, Ehler U, Heinrichs M. 2009. The level of physical activity affects adrenal and cardiovascular reactivity to psychosocial stress. *Psychoneuroendocrinology* 34:190-198. <https://doi.org/10.1016/j.psyneuen.2008.08.023>
- Sepúlveda-Loyola W, Rodríguez-Sánchez I, Pérez-Rodríguez P, Ganz F, Torralba R, Oliveira D, Rodríguez-Mañas L. 2020. Impact of social isolation due to covid-19 on health in older people: mental and physical effects and recommendations. *The Journal of Nutrition, Health & Aging* 24:938-947. <https://doi.org/10.1007/s12603-020-1500-7>
- Sukadiyanto S. 2010. Stress dan cara menguranginya. *Jurnal Cakrawala Pendidikan* 29:55-66. <https://doi.org/10.21831/cp.v1i1.218>
- Walugembe A, Ntayi J, Olupot C, Elasu J. 2022. Adaptive behaviors in education institutions before and after COVID-19: a systematic literature review. *Frontiers in Psychology* 13: 1-15. <https://doi.org/10.3389/fpsyg.2022.1017321>
- Wongpakaran N, Wongpakaran T. 2010. The Thai version of the PSS-10: an investigation of its psychometric properties. *BioPsychoSocial medicine* 4:1-6. <https://doi.org/10.1186/1751-0759-4-6>
- Wróblewski O, Michalczyk K, Kozłowski M, Nowak K, Chudecka-Głaz A, Skwirczyńska E. 2024. A longitudinal study of the influence of the covid-19 pandemic on anxiety and stress among medical university students. *J Clin Med* 13:890. <https://doi.org/10.3390/jcm13030890>