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The effect of brisk walking on perceived stress among undergraduate students

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ABSTRACT

Undergraduate students globally experience stress that adversely affects their well-being and academic outcomes. While physical activity is well-established as an effective intervention to reduce stress and mitigate the risk of depression and anxiety, there is a notable lack of research examining the effect of brisk walking on stress reduction among Malaysian undergraduate students. This study aimed to examine the effects of brisk walking on perceived stress in this population. Thirty-seven students participated in a quasi-experimental design (one-group pre-test-post-test design), completing the Perceived Stress Scale-10 (PSS-10) before and after a brisk-walking intervention. The brisk-walking intervention consisted of 30-minute brisk walking sessions conducted twice a week over a four-week period. Results revealed a significant reduction in PSS-10 scores from pre- to post-intervention, supporting the effectiveness of brisk walking in reducing stress. These findings are consistent with previous research and suggest that structured brisk walking programmes may serve as a preventive strategy to manage stress not only among university students but also in broader populations. Future research should employ probability sampling across multiple higher education institutions to improve representativeness, use randomised controlled trial designs with larger sample sizes to strengthen causal inferences, and ensure gender-balanced recruitment to enhance generalisability.

Keywords: brisk walking, perceived stress, undergraduate students, intervention study

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1 INTRODUCTION

Studies report high rates of perceived stress among undergraduates, with some experiencing severe stress mainly due to academic stressors (Gazzaz et al., 2018; Nivetha et al., 2018; Seedhom et al., 2019). The COVID-19 pandemic further intensified stress levels, and even post-pandemic, many students continue to experience moderate to high perceived stress due to the impact of the pandemic on their studies (Marcén-Román et al., 2021) and the completion of the academic year (Koirala et al., 2024). In Malaysia, 37.7% of undergraduates report experiencing perceived stress, with one in three facing severe stress levels due to academic, psychosocial, and environmental stressors (Jia & Loo, 2018). In a recent study, Abas et al. (2024) found that inadequate sleep, financial problems, and course load were the sources of stress among sport science undergraduate students in Universiti Teknologi MARA (UiTM) Perlis. Upon university re-entry, moderate perceived stress remained prevalent (Al-Rawi et al., 2022; Muhsain et al., 2024). Failure to manage these stressors can lead to adverse outcomes, including anxiety, depression, low self-esteem, behavioural changes, and lower academic performance (Khan & Shamama-Tus-Sabah, 2019; Mahdzar et al., 2022; Mirón et al., 2019; Rana et al., 2019). Stress, as originally defined by Selye (1983), refers to the body's general, non-specific reaction to any demand. In contrast, perceived stress, as described by Cohen et al. (1983), refers to an individual's subjective appraisal of a situation as stressful. However, the present study adopts Lazarus and Folkman's (1984) definition of stress, which describes it as exposure to stimuli interpreted as harmful, threatening, or overwhelming relative to one's coping resources. This perspective aligns closely with the concept of perceived stress, as both emphasise the role of appraisal rather than mere physiological response. Therefore, in this study, the terms "stress" and "perceived stress" are used interchangeably.

The rise in perceived stress among students has prompted extensive research into intervention strategies, with general physical activity and specific forms such as aerobic exercise emerging as one of the most effective approaches (Al-Fazari et al., 2021; Bauman et al., 2016; Herbert et al., 2020; Singh et al., 2023). Huic et al. (2019) found that university students in Croatia and Italy who engaged in high levels of physical activity reported significantly lower stress. Similarly, Herbert et al. (2020) observed reduced depression and perceived stress following a six-week aerobic exercise program among university students, highlighting the link between cardiovascular fitness, measured based on changes in resting heart rate variability (HRV) and mental well-being, measured using validated scales such as Beck Depression Inventory-II (BDI-II), Stress and Coping Inventory (SCI), and Positive and Negative Affect Schedule (PANAS). Al-Fazari et al. (2021) also identified a negative correlation between physical activity and stress levels, highlighting the importance of regular physical activity in maintaining mental well-being among Omani students; however, the study's correlational design limited causal inference. Supporting this, Singh et al. (2023) concluded in a systematic review that physical activity has a moderate effect on psychological distress, with higher-intensity activities, such as running, that require more effort, energy expenditure, and cardiovascular demand, yielding greater benefits. Biologically, the endorphin hypothesis posits that exercise stimulates the release of endorphins, enhancing mood and well-being (Cox, 2012). The amine hypothesis suggests that physical activity enhances neurotransmitters such as norepinephrine, dopamine, and serotonin, which play a central role in

emotional regulation and stress mitigation (Anderson & Shivakumar, 2013; Ransford, 1982). In addition, exercise has been shown to lower cortisol, the primary stress hormone, thereby providing a biological basis for reduced stress perception (James et al., 2023). Among the various forms of physical activity, brisk walking stands out as a particularly accessible and sustainable option for students, being a low-cost and easy-to-implement exercise that requires no special equipment (Nwadike & Hanisch, 2022). It can be readily incorporated into the daily lives of university students, especially since most campuses feature pedestrian-friendly environments with walking trails suitable for brisk walking, jogging, and running. Early work by Fischer (2020) demonstrated significant reductions in stress after a four-week walking intervention among university staff, although it lacked conclusive evidence on which demographics (i.e., age, sex, employment status, or race) benefited most. Hsu et al. (2021) found that brisk walking significantly reduced anxiety and depression among Taiwanese adolescents, both closely linked to perceived stress, through a 12-week intervention. Nwadike and Hanisch (2022) reported a 15% reduction in stress among healthcare workers following a 30-day brisk walking program. Posey (2024) also observed reduced stress among behavioural health providers after a one-week walking intervention.

In the Malaysian context, studies have reported links between physical activity and mental health among university students (Congsheng et al., 2022), with one also showing associations with academic performance (Zamri & Raman, 2020). Other research has examined perceived stress and contributing stressors among undergraduates (Abas et al., 2024). However, none of these studies have specifically tested brisk walking as an intervention for reducing perceived stress. By contrast, most existing brisk-walking intervention studies have been conducted in non-Malaysian populations, such as university staff, adolescents, and healthcare workers (Fischer, 2020; Hsu et al., 2021; Nwadike & Hanisch, 2022), highlighting the need for student-centred intervention research in Malaysia. Therefore, the present study aims to investigate the effect of brisk walking on perceived stress among undergraduate students at IIUM. It is hypothesised that participants will show a significant reduction in PSS-10 scores following a brisk-walking intervention. This study advances theoretical understanding by extending existing frameworks on physical activity, particularly brisk walking, and its effects on perceived stress among IIUM undergraduates. Building on Bauman et al.'s (2016) findings on the mental health benefits of physical activity for older adults, this study provides new insights into the psychological impact of brisk walking on young adults. Practically, the findings indicate that brisk walking is a cost-effective and sustainable strategy for managing stress among undergraduates. Given the rising prevalence of stress-related issues linked to anxiety and depression (Al-Rawi et al., 2022; Jia & Loo, 2018; Mirón et al., 2019; Muhsain et al., 2024), universities could consider integrating structured brisk walking into their wellness initiatives. Lastly, this study addresses significant research gaps. Previous studies, such as those by Al-Fazari et al. (2021), have reported correlations between physical activity and stress among Omani undergraduates, but did not establish causality.

Meanwhile, intervention studies on brisk walking and stress reduction have been conducted primarily in non-Malaysian populations, such as university staff, adolescents, and healthcare workers (Fischer, 2020; Hsu et al., 2021; Nwadike & Hanisch, 2022), which limits their relevance to Malaysian undergraduates. By employing an experimental design with a Malaysian student population, this study contributes to the growing body of evidence suggesting that brisk walking

may help reduce perceived stress. While findings may not be fully generalisable, they lay the groundwork for future research across different populations and cultural settings.

2 METHOD

2.1 Design

This study employed a quasi-experimental, one-group pre–test–post–test design. This design was appropriate for examining the effect of brisk walking on perceived stress because it allows each participant to serve as their own control. By comparing pre- and post-intervention scores on the PSS-10, the design helps isolate the impact of brisk walking, consistent with prior evidence of its stress-reducing effects (Fischer, 2020; Nwadike & Hanisch, 2022; Posey, 2024). Moreover, this design has been successfully applied in earlier stress-reduction research, providing a well-established methodological foundation for the present study (Charness et al., 2012; Nwadike & Hanisch, 2022).

2.2 Participants

The study population comprised Malaysian undergraduate students recruited through purposive sampling. This method was appropriate because the study required participants who met specific inclusion criteria as follows: (1) being a Malaysian undergraduate and (2) scoring ≥14 on the PSS-10, which indicates moderate to high perceived stress. Participants with this stress threshold were targeted because prior research has shown that interventions are more likely to yield measurable effects in individuals experiencing at least moderate stress (Nwadike & Hanisch, 2022). Exclusion criteria included (1) being diagnosed with a mental health disorder and (2) being unable to engage in physical activities, to avoid confounding effects. Initially, 46 participants were recruited, of whom 37 remained after data cleaning and the application of inclusion and exclusion criteria. The sample size was pragmatically determined based on recommendations suggesting a minimum of 30–40 participants for small-scale quasi-experimental interventions. This range is consistent with prior brisk-walking research, including the study by Nwadike and Hanisch (2022), which recruited 30 participants, and Fischer's (2020) study, which involved 53 participants.

2.3 Instruments

Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10; Cohen, 1988), developed as an adaptation of the original 14-item version by Cohen et al. (1983). The PSS assesses the extent to which individuals perceive their life situations as stressful (Cohen, 1988). It is a self-report questionnaire in which participants rate the frequency of their thoughts and feelings over the past month on a 5-point Likert scale ranging from 0 (Never) to 4 (Very Often). Items 4, 5, 6, and 7 are reverse scored. Total scores range from 0 to 40, with scores of 0–13 indicating low stress, 14–26 indicating moderate stress, and 27–40 indicating high stress. In a study conducted by Abdul Ghafar et al. (2022), the PSS-10 showed very good internal consistency (Cronbach's $\alpha = .854$). The scale is valid for use in this study as previous research has demonstrated strong validity among

university student populations (Abdul Ghafar et al., 2022; Anwer et al., 2020). Brisk walking was operationalised by instructing participants to walk for 30 minutes, twice weekly, over four weeks (Nwadike & Hanisch, 2022). In line with Hsu et al. (2021), brisk walking was defined as a walking speed of at least 2.5 miles per hour. Adherence was monitored using the Pacer app, which recorded walking time and distance. Participants submitted screenshots of their activity logs to a Google document provided by the researcher.

2.4 Procedure

The study employed both a poster and a digital recruitment message, which were disseminated through social media platforms, including WhatsApp and Telegram, to various residential and faculty-based student groups. To extend reach, the poster was also shared by peers with other student groups beyond those directly accessible to the researcher. Potential participants could scan a QR code embedded in the poster to participate. Informed consent was obtained online through a digital information sheet outlining the study's purpose, procedures, risks, benefits, and confidentiality measures. Participants confirmed their voluntary participation by selecting the "I agree" option before proceeding, and the researcher's contact details were provided for clarification purposes. Data security and anonymity were assured, and participants were informed of their right to withdraw at any time. Participants first completed the PSS-10, which served as both a screening tool for inclusion and a baseline pre-test measure. The brisk walking intervention lasted four weeks, with sessions held twice weekly. This duration and frequency were based on Nwadike and Hanisch (2022), who demonstrated that a similar protocol was sufficient to reduce stress. The PSS-10 was administered only twice: once before the intervention (pre-test) and once immediately after the four-week programme (post-test).

Participants were required to send in their proof of brisk walking to the researcher by uploading a screenshot of their record into a Google document provided by the researcher after every brisk walking session. After the intervention period ended, participants completed a post-test PSS-10 via a Google Form, following the same procedure as the pre-test. The PSS-10 was administered only once before and once after the intervention, which was consistent with previous brisk-walking intervention studies (Fischer, 2020; Nwadike & Hanisch, 2022). This single pre- and post-administration was commonly used to evaluate change in perceived stress while minimising participant burden and reducing the risk of testing effects that might have arisen from repeated administration. Although repeated weekly measures might provide additional detail on stress fluctuations, the pre–post design is an established and valid method for detecting overall changes following an intervention.

Throughout the intervention weeks, the researcher reminded the participants by sending them reminder texts to engage in brisk walking biweekly, every Sunday and Wednesday. To ensure consistency, reminders were sent at approximately 7:00 am, with the researcher setting scheduled alarms to maintain regularity. After the intervention period ended, participants were sent the link to the post-test Google Form and reminded to complete it. Participants who did not complete the post-test were excluded from the analysis, and their corresponding pre-test scores were not considered.

2.5 Analysis

The data collected from the pre-test and post-test were entered into the Statistical Package for the Social Sciences (SPSS, version 27; IBM). Data analysis involved two steps: (1) descriptive statistics were used to summarise participants' demographic background; and (2) a paired-sample t-test was used to compare pre- and post-intervention perceived stress scores.

3 RESULTS

As mentioned earlier; after cleaning the data, 37 participants (80.43%) remained, having passed the inclusion and exclusion criteria and completed the intervention period. Descriptive analysis was conducted among the remaining participants (n = 37). Based on the results of participants' demographic backgrounds presented in Table 1, the study consists of 33 females (89.2%) and four males (10.8%). Participants' year of study ranges from first to fourth/final year, with the majority being from the fourth/final year (64.9%), followed by third year (16.2%), second year (13.5%), and first year (5.4%).

Table 1. Participant's demographic background.

Variables	Frequency	Percentage
Gender:		
Female	33	89.2%
Male	4	10.8%
Year of Study:		
First Year	2	5.4%
Second Year	5	13.5%
Third Year	6	16.2%
Fourth Year	24	64.9%

A paired-sample t-test was conducted to compare PSS-10 scores of 37 participants before and after the intervention. Table 2 below shows a significant decrease in PSS-10 scores from pre-intervention (M = 23.16, SD = 5.19) to post-intervention (M = 15.86, SD = 5.76), $t(36) = 6.07$, $p < .001$, Cohen's d = 0.998. Thus, the null hypothesis can be rejected.

Table 2. PSS-10 pre-and post-intervention scores.

			Paired Differences			
Variables	*M*	*SD*	*t*	*df*	*p*	Cohen's *d*
Pre-test scores	23.16	5.19				
Post-test scores	15.86	5.76	6.07	36	<.001	.998

4 DISCUSSION

The purpose of this study was to investigate the impact of brisk walking on perceived stress in undergraduate students. The results show that the participants' mean perceived stress level before the intervention was moderate, which is unsurprising given the timing, in the middle of the semester, during peak academic demands. This finding is consistent with Abas et al. (2024), who also reported moderate stress levels among UiTM Perlis undergraduates during the mid-semester period. However, their survey findings indicated that stress remained moderate across the semester, attributed to persistent challenges such as insufficient sleep, inadequate exercise, financial concerns, and course load. In contrast, the present study observed a decline to low stress levels by semester's end, likely due to the inclusion of a targeted intervention, specifically brisk walking, that directly promoted stress reduction. Thus, compared with the descriptive insights of Abas et al. (2024), the present study provides evidence that even modest physical activity can shift stress outcomes, highlighting the potential of intervention-based approaches to complement and extend observational research.

These results reinforce prior evidence supporting brisk walking as a stress management tool. For instance, Nwadike and Hanisch (2022) observed a 15% reduction in stress after a similar intervention, and Posey (2024) reported lower stress levels among health professionals. The findings align with those of Bauman et al. (2016), whose framework supports the psychological benefits of physical activity, particularly in reducing stress. Psychologically, this study supports Lazarus and Folkman's coping theory, suggesting that brisk walking functions as an emotion-focused strategy (Biggs et al., 2017), enabling students to manage stress responses when unavoidable stressors, such as exams, presentations, and deadlines, arise. Physiologically, the stress reduction observed in this study can be understood through two well-established mechanisms, namely the endorphin hypothesis and the amine hypothesis. The endorphin hypothesis posits that exercise stimulates the release of endogenous opioids, particularly β-endorphins, which act on the central nervous system to produce analgesic and euphoric effects (Harber & Sutton, 1984). These endorphins inhibit the activity of the hypothalamic-pituitary-adrenal (HPA) axis, thereby reducing cortisol secretion, the primary stress hormone released in response to psychological and physiological stress (James et al., 2023). Elevated β-endorphin levels following aerobic activity have been empirically linked to improved mood states and reduced anxiety (Boecker et al., 2008; Dishman & O'Connor, 2009). This provides a biological pathway through which regular brisk walking may attenuate stress responses in university students.

Similarly, the amine hypothesis emphasises the role of neurotransmitter regulation in exercise-induced stress reduction. Physical activity increases the synthesis and availability of monoamines, including dopamine, serotonin, and norepinephrine (Cox, 2012; Ransford, 1982). These neurotransmitters play a crucial role in regulating mood, arousal, and emotional resilience. For instance, serotonin has been associated with improved emotional stability and reduced depressive symptoms, while dopamine and norepinephrine are involved in motivation and attentional control (Anderson & Shivakumar, 2013). Through the enhancement of neurotransmitter systems, exercise not only produces immediate improvements in mood but also supports longer-term reductions in perceived stress. Collectively, these physiological mechanisms align with the present findings and

reinforce the rationale for advocating exercise as a non-pharmacological strategy for stress management.

This study expands the understanding of how simple and sustainable lifestyle changes, such as brisk walking, can regulate perceived stress while addressing a critical research gap in experimental studies focused on Malaysian undergraduates. For higher education institutions, structured brisk walking programmes could be implemented as preventive mental health initiatives. These could be further enhanced through collaboration with university counsellors, as their involvement ensures that brisk walking programmes not only promote physical activity but also provide structured psychological support. For example, 'walk-and-talk' counselling sessions could combine movement with therapy, making mental health services more approachable and less stigmatising for students (Prince-Llewellyn & McCarthy, 2024). Such strategies can enhance student well-being, academic engagement, and overall quality of life. The findings therefore support integrating brisk walking into student wellness initiatives, whether through orientation programmes, co-curricular activities, or counselling services, to help students manage stress more effectively.

This study has several limitations. Firstly, purposive sampling was used, which limits generalisability to the wider undergraduate population. However, it is necessary to ensure participants met the inclusion criteria, and similar intervention studies have employed this approach (Fischer, 2020; Nwadike & Hanisch, 2022). Thus, while generalisation is limited, the findings still provide valuable preliminary evidence for stress reduction among Malaysian undergraduates. Next, the within-subject quasi-experimental design lacked a control group, limiting the ability to attribute changes in perceived stress solely to the intervention. While a control group is recommended to minimise confounding variables and psychological biases (Charness et al., 2012), this was not feasible given the small sample size.

Nevertheless, the one-group pre-test–post-test design allowed each participant to serve as their own control and has been widely used in exercise–stress research (Fischer, 2020; Nwadike & Hanisch, 2022). Additionally, the study did not collect information on participants' engagement in other forms of physical activity, such as gym workouts or sports. As various forms of physical activity can contribute to better mental health outcomes (Eather et al., 2023), this unmeasured factor may have confounded the results. Another limitation is the gender imbalance among participants, which may restrict the generalisability of the findings across male and female students. Gender has been shown to influence both stress perception and coping strategies (Graves et al., 2021). In light of these limitations, future research should consider probability sampling across multiple higher institutions to improve representativeness, adopt randomised controlled trial designs with larger samples to strengthen causal inference, and recruit gender-balanced samples to enhance generalisability.

In conclusion, this study demonstrates that brisk walking is an effective intervention for reducing perceived stress among undergraduate students. The findings extend existing knowledge on the role of physical activity in mental health by providing experimental evidence within a Malaysian undergraduate context, which has been underexplored in previous research. In doing so, the study

contributes to the body of knowledge by demonstrating that even simple and low-cost forms of exercise, such as brisk walking, can have measurable psychological benefits. The cultural context adds to this relevance, as brisk walking is already a familiar and common activity within university campuses, requires no financial cost or specialised equipment, and is widely promoted in national health campaigns. University campuses are often large, providing safe and convenient walking spaces, and students typically have flexible schedules that allow them to integrate walking into breaks between classes. Moreover, brisk walking is culturally appropriate for diverse ethnic and religious groups, as it is modest, non-contact, and easily incorporated into daily routines. These factors may help explain the positive reception and adherence observed in this study.

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AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study. The first author was responsible for material preparation, data collection, and data analysis. The first author wrote the first draft of the manuscript, while the second author reviewed and edited all drafts, including the final version. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to this study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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