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# Psychosocial determinants of physical activity behavior in postgraduate students in Yogyakarta: An extended theory of planned behavior

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Original article

## Abstract

**Introduction:** Graduate students face a high risk of adopting a sedentary lifestyle due to academic demands and stress. Although physical activity is crucial for health, there remains a gap in understanding the psychosocial factors that influence this behavior in specific populations. This study aimed to test an expanded Theory of Planned Behavior (TPB) model by incorporating Anticipated Affect and Habit to analyze the determinants of intention and physical activity behavior among postgraduate students in Yogyakarta.

**Methods:** Using a quantitative approach, 249 postgraduate students (Master's and Doctoral) were recruited via voluntary sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The research instrument measured core TPB constructs (Attitude, Subjective Norms, Perceived Behavioral Control – PBC), additional constructs (Habit, Anticipated Affect), Intention, and actual physical activity behavior (T_MET) using the International Physical Activity Questionnaire Short Form (IPAQ-SF). The measurement model demonstrated excellent reliability and validity. The structural model showed a high predictive power for Intention, explaining 75.1% of its variance ($R^2 = 0.751$). Anticipated Affect ($\beta = 0.353$), Habit ($\beta = 0.221$), and PBC ($\beta = 0.205$) were the strongest predictors of Intention. In contrast, the model demonstrated a very weak association with actual physical activity behavior (T_MET), with $R^2 = 0.002$.

**Results:** All hypothetical pathways to Behavior (from Intention, Habit, and PBC) were found to be statistically insignificant. These findings suggest a weak intention–behavior correspondence among graduate students. Although emotional factors and habitual tendencies strongly shape intention, they are insufficient to translate into actual physical activity.

## Keywords

- physical activity
- theory of planned behavior
- postgraduate students
- intention–behavior gap
- anticipated affect
- habit

## Contribution

A – Preparation of the research project
B – Assembly of data
C – Conducting of statistical analysis
D – Interpretation of results
E – Manuscript preparation
F – Literature review
G – Revising the manuscript

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**Conclusion:** Contextual limitations, including unmeasured environmental factors, may contribute to this limited translation from intention to behavior. Health interventions on campuses may benefit from integrating volitional strategies (such as implementation intentions) and creating a supportive environment to help students bridge the intention–behavior gap.

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# Introduction

Physical activity is widely recognized as a fundamental pillar of physiological health and psychological well-being. Maintaining an active lifestyle is particularly important for postgraduate students, who often experience substantial academic demands that may compromise both physical and mental health.[1-3] Ideally, individuals at this educational level possess adequate health literacy to maintain regular physical activity and prevent the decline of cognitive and physical functioning.[4-5] However, empirical evidence reveals a notable paradox. Despite their awareness of the health benefits of physical activity, postgraduate students remain vulnerable to sedentary lifestyles due to intensive academic workloads, psychological stress, and complex time-management challenges.[6-7] This trend is further exacerbated by environmental constraints within campus settings that may not sufficiently support active lifestyles,[8] as well as psychological factors such as anxiety and academic pressure.[9] Consequently, prolonged sedentary behavior may increase the risk of chronic health conditions and mental health disorders among this population.[10-11]

To understand the discrepancy between health awareness and actual behavior, the Theory of Planned Behavior (TPB) has frequently been applied as a theoretical framework for predicting health-related behaviors.[12-13] According to TPB, behavioral intention is shaped by three primary determinants: attitude, subjective norms, and perceived behavioral control.[14] Numerous studies have demonstrated that these constructs are effective predictors of behavioral intention. However, scholars have also highlighted the limitations of TPB in explaining the translation of intention into actual behavior, a phenomenon commonly referred to as the intention–behavior gap.[15-16] This limitation suggests that cognitive determinants alone may not fully capture the complex psychological and contextual processes underlying health behavior.

In response to these limitations, recent research has proposed the integration of additional psychosocial constructs to enhance the predictive capability of TPB-based models.[17] In particular, affective and automatic processes have received increasing attention in explaining health behavior. Anticipated Affect, which refers to the expected emotional consequences following a behavior, may influence the formation of behavioral intentions by shaping individuals' motivational expectations.[18] Meanwhile, Habit, defined as behavioral automaticity developed through repeated actions, has been suggested as a potential factor that may help explain how intentions translate into consistent behavioral patterns.[19] Incorporating these constructs may therefore provide a more comprehensive explanation of how individuals translate intentions into regular physical activity behavior.

Although research on physical activity determinants in Indonesia has grown in recent years, existing studies have primarily focused on adolescents and undergraduate students.[20-22] Comparatively little attention has been directed toward postgraduate students, despite their unique academic and psychological challenges. Postgraduate students frequently encounter distinctive volitional barriers, including thesis or dissertation demands, academic productivity pressures, and competing professional responsibilities. Consequently, findings derived from undergraduate populations cannot be directly generalized to postgraduate students, as these groups often differ in terms of autonomy, motivational structures, and time-management constraints.[23-24] Furthermore, empirical studies integrating extended TPB constructs particularly affective determinants such as anticipated affect and automatic determinants such as habit within postgraduate populations remain limited. This gap highlights the need for a more context-sensitive examination of the psychosocial determinants underlying physical activity behavior among postgraduate students.

Therefore, the present study examines an extended Theory of Planned Behavior model by integrating anticipated affect and habit alongside the core TPB constructs to explain physical activity intention and its relationship with self-reported physical activity behavior among postgraduate students in Yogyakarta, Indonesia. By focusing on a population that has received relatively limited attention in previous research, this study aims to evaluate whether affective and habitual determinants enhance the explanatory power of TPB in predicting both intention formation and physical activity behavior. The proposed structural model and hypothesized relationships are illustrated in Figure 1.

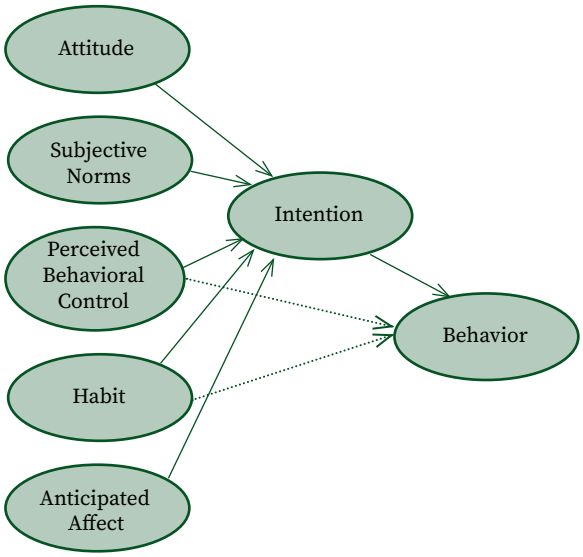


**Figure 1.** Research hypothesis model

# Method

## Study design, ethical considerations, and participants

This study employed a quantitative cross-sectional design. Participants were recruited through voluntary sampling among postgraduate students (Master's and Doctoral levels) enrolled at several universities in Yogyakarta, Indonesia. All participants provided written informed consent prior to participation. The study was conducted in accordance with the principles of the Declaration of Helsinki and received ethical approval from the Ethics Committee of the Directorate of Research and Community Service.

### *Measures (Instrument)*

A structured online questionnaire was used to assess the study variables. The core constructs of the Theory of Planned Behavior Attitude, Subjective Norms, Perceived Behavioral Control (PBC), and Intention were measured using items adapted from.[12,14] The extended constructs included Habit, adapted from,[19] and Anticipated Affect, adapted from.[18,25] All psychological items were scored on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Physical activity behavior was assessed using the International Physical Activity Questionnaire Short Form (IPAQ-SF), with data converted into Total MET-minutes/week (T_MET) scores according to official scoring protocols.

**Table 1.** Research instrument

| Sub--Variable | Item |
|---|---|
| Attitude | For me, exercising regularly is a fun thing. |
| | I feel that exercising regularly makes me more energized. |
| | Doing physical activity regularly is very beneficial to my physical and mental health. |
| | I believe that exercising regularly is important for my quality of life in the future. |
| | Overall, my view of regular exercise activities is very positive. |
| Subjective Norms | People who are important to me (such as family or partner) support me in exercising regularly. |
| | My close friends thought that I should be actively exercising. |
| | Most of my friends have a physically active lifestyle. |
| | In my environment (academic/work), being physically active is considered natural and positive. |
| | I often see people around me exercising. |
| Perceived Behavioral Control | I believe I am able to exercise regularly, despite my busy schedule. |
| | I am confident that I can overcome obstacles (such as tiredness or laziness) to keep exercising. |
| | Starting and maintaining a workout routine is easy to. |
| | I have enough access and resources (time, place, cost) to exercise. |
| | In general, how much control I have to exercise regularly is entirely in my hands. |
| Habit | Exercising regularly is something I do automatically. |
| | I started exercising without having to think about it first. |
| | Exercising regularly is an integral part of my daily/weekly routine. |
| | I would feel weird if I did not exercise regularly. |

| Sub--Variable | Item |
|---|---|
| Anticipated Affect | I would feel proud of myself if I managed to exercise regularly this week. |
| | I would regret missing the workout schedule I had already planned. |
| | Exercising regularly will make me feel better and satisfied with myself. |
| | I would feel guilty if I did not make an effort to be physically active. |
| Intention | I intend to do regular physical activity in the next few weeks. |
| | I will try my best to move more and reduce sitting time. |
| | I have made a clear plan regarding when and where I will exercise. |
| | I am committed to my goal of living a more physically active lifestyle. |

### *Data analysis*

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software. The analysis followed a systematic two-step approach.[26] First, the measurement model (outer model) was evaluated for internal consistency reliability (Composite Reliability > 0.7), convergent validity (Average Variance Extracted/AVE > 0.5), and discriminant validity (Fornell-Larcker criterion). Second, the structural model (inner model) was assessed for multicollinearity using the Variance Inflation Factor (VIF), explanatory power ($R^2$), predictive relevance ($Q^2$), and hypothesis testing using bootstrapping with 5,000 resamples to estimate path coefficients, *t*-statistics, and *p*-values.

# Result

## Participants characteristics

A total of 249 valid responses were collected, consisting of 206 Master's students (82.7%) and 43 Doctoral students (17.3%). The majority of respondents were female (67.9%) and aged between 22–30 years (83.1%). Although the sample size (N = 249) was slightly below the ideal threshold suggested by some PLS-SEM guidelines (10 times the number of indicators), post-hoc power analysis indicated sufficient statistical power to detect the hypothesized effects in the model.

**Table 2.** Distribution of respondents

| Category | | N = 249 | Percentage |
|---|---|---|---|
| Gender | Man | 80 | 32.1 |
| | Woman | 169 | 67.9 |
| Age | 22–30 years | 207 | 83.1 |
| | 31–35 years | 32 | 12.9 |
| | 36–40 years | 7 | 2.8 |
| | >40 years | 3 | 1.2 |
| Respondents' Domicile | Boarding house | 31 | 12.4 |
| | Dormitory | 185 | 74.3 |
| | Family house | 33 | 13.3 |
| Degree Level | Master's | 206 | 82.7 |
| | Doctoral | 43 | 17.3 |

## Measurement model evaluation

The analysis began with a rigorous assessment of the measurement model to ensure the reliability and validity of the instruments used. First, the internal consistency and convergent validity were evaluated. As presented in Table 4, all constructs exhibited excellent reliability, with both Cronbach's Alpha and Composite Reliability (rho_c) values surpassing the recommended threshold of 0.70. Furthermore, convergent validity was firmly established, as the Average Variance Extracted (AVE) for all variables ranged from 0.749 to 0.805, well above the required 0.50 cutoff. These results confirm that the measurement items are statistically reliable and valid indicators of their respective constructs.

**Table 3.** Measurement model parameter estimation

| | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|---|---|---|---|---|
| Anticipated Affect | 0.908 | 0.908 | 0.936 | 0.784 |
| Attitude | 0.939 | 0.940 | 0.954 | 0.805 |
| Habit | 0.917 | 0.917 | 0.941 | 0.800 |
| Intention | 0.889 | 0.891 | 0.923 | 0.749 |
| PBC | 0.925 | 0.926 | 0.943 | 0.769 |

| | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|---|---|---|---|---|
| Subjective Norms | 0.916 | 0.919 | 0.937 | 0.749 |

Following the reliability check, discriminant validity was assessed to ensure that each construct was empirically distinct from the others. The Fornell-Larcker criterion was applied for this purpose. The results, detailed in Table 3, show that the square root of the AVE for each construct (represented by the bold values on the diagonal) is greater than its highest correlation with any other construct in the model. This confirms that each construct is empirically distinct from the others, supporting the discriminant validity of the measurement model.

## Structural model and hypothesis testing

Once the measurement model was validated, the structural model was evaluated to test the proposed hypotheses and assess the model's predictive power. The overall model fit was found to be acceptable, with a Standardized Root Mean Square Residual (SRMR) of 0.051, which is below the conservative threshold of 0.08, and a Normed Fit Index (NFI) of 0.835.

In terms of predictive capability, the model demonstrated a substantial ability to explain the variance in Intention (R2 = 0.751), indicating that 75.1% of the changes in intention can be attributed to the psychosocial determinants in the model. However, the model showed very limited predictive power for actual Physical Activity Behavior (T_MET), explaining only 0.2% of the variance ($R^2$ = 0.002). Similarly, the predictive relevance (Q2) was strong for Intention (0.552) but negligible for Behavior (−0.031). The visual representation of the structural model, including the path relationships, is illustrated in Figure 2.

## Multicollinearity assessment

Prior to interpreting the structural relationships, multicollinearity among the predictor constructs was assessed using the Variance Inflation Factor (VIF). The results indicate that VIF values ranged from 1.391 to 3.253, which are below the recommended threshold of 5.0.[26] These findings suggest that multicollinearity was not a concern in the structural model and that the predictor constructs are statistically independent.

**Table 5.** Multicollinearity assessment (VIF)

| Predictor → Endogenous | VIF |
|---|---|
| Predictor → Endogenous | VIF |
| Attitude → Intention | 1.645 |
| Anticipated affect → Intention | 3.253 |
| Habit → Intention | 2.331 |
| Habit → T_MET | 1.939 |
| PBC → Intention | 2.753 |
| PBC → T_MET | 1.939 |
| Subjective Norms → Intention | 1.391 |

**Table 4.** Discriminant validity test (Fornell-Larcker Criterion)

| | Anticipated Affect | Attitude | Habit | Intention | PBC | Subjective Norms | T_MET |
|---|---|---|---|---|---|---|---|
| Anticipated Affect | 0.886 | — | — | — | — | — | — |
| Attitude | 0.598 | 0.897 | — | — | — | — | — |
| Habit | 0.707 | 0.542 | 0.894 | — | — | — | — |
| Intention | 0.810 | 0.624 | 0.736 | 0.866 | — | — | — |
| PBC | 0.762 | 0.540 | 0.696 | 0.756 | 0.877 | — | — |
| Subjective Norms | 0.523 | 0.309 | 0.400 | 0.516 | 0.453 | 0.865 | — |
| T_MET | −0.033 | 0.045 | −0.020 | 0.015 | 0.003 | 0.004 | 1.000 |

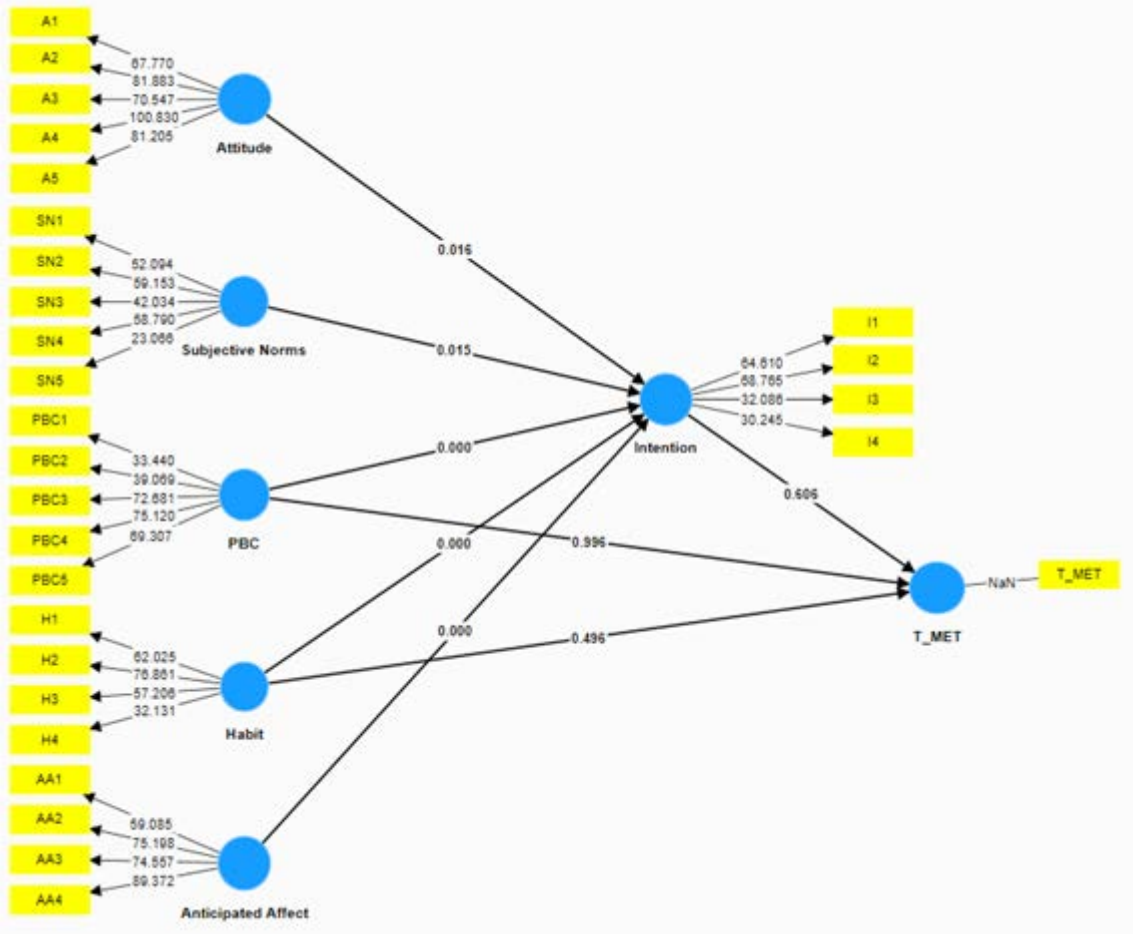


**Figure 2.** Model of PLS-SEM path analysis diagram

**Table 6.** Structural model path coefficients

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T statistics O/STDEV | P-values | Results |
|---|---|---|---|---|---|---|
| Anticipated Affect → Intention | 0.353 | 0.352 | 0.053 | 6.598 | 0.000 | Accept |
| Attitude → Intention | 0.150 | 0.148 | 0.063 | 2.402 | 0.016 | Accept |
| Habit → Intention | 0.221 | 0.225 | 0.061 | 3.650 | 0.000 | Accept |
| Habit → T_MET | −0.058 | −0.056 | 0.085 | 0.681 | 0.496 | Reject |
| Intention → T_MET | 0.058 | 0.057 | 0.112 | 0.516 | 0.606 | Reject |
| PBC → Intention | 0.205 | 0.205 | 0.048 | 4.245 | 0.000 | Accept |
| PBC → T_MET | −0.001 | −0.001 | 0.098 | 0.005 | 0.996 | Reject |
| Subjective Norms → Intention | 0.104 | 0.106 | 0.043 | 2.434 | 0.015 | Accept |

## Hypothesis testing

The final hypothesis testing was conducted using a bootstrapping procedure with 5,000 subsamples. The detailed path coefficients and significance levels are summarized in Table 6. The results revealed that all five proposed antecedents Anticipated Affect (β = 0.353), Habit (β = 0.221), PBC (β = 0.205), Attitude (β = 0.150), and Subjective Norms (β = 0.104) had a positive and statistically significant influence on Intention ($p < 0.05$). Among these, Anticipated Affect emerged as the strongest predictor.

Conversely, the transition from intention to action proved to be non-significant in this population. The analysis showed that Intention (β = 0.058, $p = 0.606$), Habit (β = −0.058, $p = 0.496$), and PBC (β = −0.001, $p = 0.996$) failed to significantly predict actual Physical Activity Behavior (T_MET). This lack of significant direct effects on behavior statistically confirms the existence of a severe intention-behavior gap among the postgraduate students in this study.

# Discussion

This study examined the psychosocial determinants of physical activity intention among postgraduate students using an extended Theory of Planned Behavior (TPB) model incorporating Habit and Anticipated Affect. The findings demonstrate a clear contrast: the model explains a substantial proportion of variance in intention ($R^2 = 0.751$), yet shows minimal explanatory power for self-reported physical activity behavior ($R^2 = 0.002$). This pattern suggests the presence of an intention–behavior gap among postgraduate students, a phenomenon also highlighted in recent studies examining physical inactivity in university settings. For example, Ndupu et al. [27] found that university staff and students often face similar barriers to physical activity, including academic workload and lack of time, which hinder the transition from intention to behavior.

## Determinants of intention: Dominance of affective factors

The high variance in intention observed in this study suggests that postgraduate students possess strong cognitive and psychological motivation to engage in physical activity. A key finding was the dominance of Anticipated Affect as the strongest predictor (β = 0.353). This is consistent with research by Li et al.,[28] who found that emotional pleasure and intrinsic enjoyment serve as more powerful motivators than rational health benefits for students under mental stress. Similarly, recent studies emphasize the importance of affective and habitual factors in predicting health-related behaviors.[29] Postgraduate students may perceive physical activity as an emotional coping mechanism rather than just a fitness routine.

In addition, the significant influence of Habit and Perceived Behavioral Control (PBC) suggests that students have successfully developed "cognitive schemes" regarding exercise. However, recent research by Khairunnisa and Pratama[30] warns that in a highly sedentary student population, these cognitive schemes are often defeated by the physiological inertia of sitting for too long, creating a disconnect between what is planned and what is executed.

## The intention–behavior gap

Despite the strong intentions, none of the predictors significantly influenced actual physical activity behavior, as indicated by the very low $R^2$ (0.002). This suggests that while postgraduate students demonstrate strong cognitive and psychological motivation to exercise, the translation of intention into actual behavior is constrained by structural and contextual barriers. This finding aligns with the well-documented intention–behavior gap in health psychology,[31] where strong intentions do not necessarily translate into corresponding actions.

Several explanations can account for this discrepancy. Contextual constraints, such as academic pressure and competing priorities, are key barriers preventing the translation of intention into behavior. This finding is in line with Ndupu et al.,[27] who identified similar barriers particularly academic workload and lack of time that hinder the transition from intention to behavior among university students. In this study, postgraduate students often prioritize academic demands over physical activity, leading to high levels of physical inactivity despite having strong intentions to exercise. As emphasized by Prieto-González & Alkouatli,[32] competing priorities such as academic deadlines and burnout consistently take precedence over physical activity plans, even when students have strong initial intentions to exercise.

Another key factor contributing to the intention–behavior gap is the role of mental fatigue and volitional depletion. The failure of Perceived Behavioral Control (PBC) to predict actual behavior suggests that perceived control does not always align with actual capacity. As Cody et al.[33] point out, mental health stress depletes the self-regulation resources necessary for initiating exercise, particularly after prolonged periods of cognitive

work. This leads to students falling into patterns of behavioral avoidance or automatic business minimization, even when they have the intention to live a healthier life. This pattern is commonly observed in university settings where students face substantial cognitive load and mental fatigue, making it difficult to enact their intentions despite their best efforts.

## Practical implications

Given that intention levels are already relatively high, traditional motivation-based interventions may be insufficient to promote physical activity among postgraduate students. Instead, environmental restructuring may be a more effective strategy. Cui and Yin[34] recommend that universities "strategically allocate public sports resources" and create a supportive sports culture to reduce logistical barriers to physical activity. Additionally, interventions focusing on mind-body exercises that offer immediate stress reduction could capitalize on the strong affective motivations identified in this study.[30]

# Study limitations

This study has several limitations that should be acknowledged. First, the cross-sectional design restricts causal inferences between psychosocial determinants, intention, and physical activity behavior. Cross-sectional studies, while widely used in physical activity research, have inherent limitations in establishing causal relationships due to the inability to track changes over time.[35] Therefore, although the study identifies associations between intention and psychosocial factors, these cannot be interpreted as cause-and-effect relationships.

Second, a temporal mismatch between intention and behavior may have influenced the observed relationship. While intention was assessed with reference to future behavior, physical activity was measured retrospectively using the IPAQ-SF, which reflects activity during the past seven days. This inconsistency in temporal framing may have attenuated the strength of the association between intention and actual behavior, as the time gap between intention formation and actual behavior could vary across participants. This issue has been highlighted in previous studies as a limitation when using cross-sectional data to predict future behavior.[34]

Third, reliance on self-reported data for physical activity measurements may introduce recall bias and social desirability bias, common issues associated with the IPAQ-SF.[35] These biases can skew the reported levels of physical activity, potentially leading to overestimation of activity levels. This limitation is prevalent in large-scale surveys relying on self-report tools to capture health-related behaviors.[33] Moreover, distributional skew in the data could further affect the accuracy of these self-reports, especially when considering the variability in participants' recall abilities and their willingness to report physical activity levels truthfully.

Fourth, the voluntary sampling method raises the possibility of selection bias, as students who chose to participate may differ systematically in their health awareness or motivation to be physically active compared to the broader postgraduate population. This introduces the risk of an overrepresentation of students with higher health consciousness, thereby limiting the generalizability of the findings. Studies using more random sampling methods or incentives to encourage participation could mitigate this potential bias in future research.[30]

Finally, the absence of objective physical activity measures such as accelerometers or wearable devices limits the precision of the behavioral data collected. While the IPAQ-SF is a well-established self-report tool, it may not capture the full range of physical activity intensity or account for variations in activity that might be detected with more objective tools. Objective measurements would provide more accurate insights into participants' actual physical activity levels and could offer a better understanding of the relationship between intention and behavior.[27]

Future research should consider employing longitudinal designs and objective measurement approaches (such as wearable devices) to better capture fluctuations in intention and actual physical activity behavior over time. Such designs would provide stronger evidence of causality and enable researchers to track changes in intention and behavior more accurately. Additionally, experimental interventions could offer insights into how to reduce the intention–behavior gap by targeting both motivational and contextual barriers to physical activity.

# Conclusion

This study indicates a pronounced intention–behavior gap among postgraduate students in Yogyakarta. While the extended TPB model explained a substantial proportion of variance in intention, intention showed negligible explanatory power for self-reported physical activity behavior. This pattern suggests that intention formation is strong in this population, whereas translation into behavior may be constrained by factors not captured in the present model, such as barriers, competing priorities, or self-regulatory fatigue reported in previous studies.

Practically, these findings suggest that interventions focusing solely on awareness or motivation may have limited added value when intentions are already high. Universities may consider complementing motivational approaches with strategies that reduce barriers and support activity in daily routines (e.g., improved access to facilities, opportunities for active breaks, and programs that position physical activity as stress management). Future research should use longitudinal designs and, where feasible, objective or better-aligned behavioral measures to more accurately examine intention–behavior translation over time.

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## Ethical considerations and informed consent

This study was conducted in accordance with ethical research standards. Participation was voluntary, and all respondents were informed about the purpose of the study, data confidentiality, and their right to withdraw at any time without consequence. Informed consent was obtained electronically from all participants prior to completing the questionnaire. No personally identifiable information was collected, and all data were analyzed anonymously.

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