Original Manuscript

Evaluation & the Health Professions
2024, Vol. 0(0) 1–12

DOI: 10.1177/01632787241271117
journals.sagepub.com/home/ehp
Sage

Validation and Measurement Invariance of the Tendency to Avoid Physical Activity and Sport Scale (TAPAS) Among Thai Young Adults

Kamolthip Ruckwongpatr[1,*], Daniel Kwasi Ahorsu[2,*], Apiradee Pimsen[3], Chirawat Paratthakonkun[10], Serene En Hui Tung[4], Iqbal Pramukti[5], Nadia Bevan[6], Jung-Sheng Chen[7], Chi Hsien Huang[8,9], Amir H. Pakpour[11], Mark D. Griffiths[12], and Chung-Ying Lin[1,5,13]

Abstract

Examining ways of reducing physical inactivity has been at the forefront of public health research. Moreover, valid and reliable scales are needed to objectively assess physical activity (PA) avoidance. Previous research has shown that experiencing weight stigma and physical appearance-related concerns are associated with physical inactivity. However, there is currently no Thai instrument that assesses physical inactivity in relation to weight stigma. Therefore, the present study examined the psychometric properties of the Thai version of the Tendency to Avoid Physical Activity and Sport Scale (TAPAS). Thai university students (N = 612) recruited via convenience sampling completed an online survey using *SurveyMonkey* between September 2022 and January 2023. Confirmatory factor analysis (CFA), multigroup CFA, and Pearson correlations (between TAPAS scores, age, body mass index, and time spent exercising) were used to analyze the data. The CFA showed robust psychometric properties for the Thai version of TAPAS regarding its unidimensional structure. The TAPAS was measurement invariant across sex, weight status, and daily hours of exercise. However, no significant Pearson correlations were found. In general, the results showed that the TAPAS is a good scale for assessing PA avoidance among Thai young adults across different sexes, weight status, and daily hours of exercise.

Keywords

tendency to avoid physical activity and sport scale, TAPAS, psychometric properties, measurement invariance, university students, Thai

Introduction

According to the World Health Organization (WHO), physical activity (PA) is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organization, 2022a). Moreover, the WHO suggests that adults should participate in at least 150-300 minutes of moderate intensity aerobic PA per week to maintain their health (World Health Organization, 2022a). PA has the potential to enhance physical health such as reducing the risks of non-communicable diseases (e.g., cardiovascular diseases, cancer, and diabetes), improving body composition, and reducing psychological distress (e.g., depression, anxiety, stress) which can contribute to an individuals' quality of life (An et al., 2020; World Health Organization, 2022a).

Worldwide, rates of physical inactivity (defined as not engaging in the WHO recommended levels of PA) have increased from 31.6% in 2001 to 36.8% in 2016 (World Health Organization, 2010; 2022a). Previous studies have reported that many adults and adolescents living in high-income countries as well as South-East Asia are not sufficiently physically active (Guthold et al., 2018). According to the WHO (2022b), 74% of adolescents (i.e., aged 11–17 years) and 17% of adults (i.e., aged ≥ 18 years) in the South-East Asia region do not meet the physical activity levels as specificied in their guidelines. Similarly, Thailand (one country in South-East Asia) is experiencing an increasingly high prevalence of insufficient physical activity which has the potential to negatively impact healthcare (Liangruenrom et al., 2018; Thanamee et al., 2017). A recent Thai study found that the prevalence of physical activity among adults (i.e., at least 150 minutes of moderate to vigorous PA per week) had decreased from approximately 80.8% in 2015 to 69.1% in 2020 among Thai adults (Topothai et al., 2023). Moreover, a Thai study among medical students reported that approximately 50.5% of students are physically inactive. Further, this study showed that PA participation was associated with physical factors (e.g., sex and body weight), social factors (e.g., family and friends support), and cultural factors (e.g., living in a very sunny country which may result greater time indoors and not exercising to avoid the damaging effects of sunlight) (Wattanapisit et al., 2016). Therefore, further examination of the differences in PA (or its avoidance), and the relationship with these factors (e.g., sex, and body weight) is needed.

Several factors (e.g., psychological, social, and biological) influence an individual's decision to avoid PA and sports engagement (Bevan et al., 2023; Pearl et al., 2015; Puhl & Suh, 2015; Vartanian & Shaprow, 2008; Vartanian & Novak, 2011). One of these studies indicated that individuals who had experienced weight stigma were more likely to avoid exercising (Pearl et al., 2015), indicating that weight issues can be a precursor to PA avoidance. The issue of weight is important because there have been reported yearly increases in obesity among young Thais, especially among those in higher education (i.e., university), males, those with indoor occupations, and those who do not engage in regular exercise (Hatthachote et al., 2019). For instance, individuals who are overweight may report greater experiences of weight stigma which is associated with lower body satisfaction, lower self-esteem, and increased depression, and – consequently – lower motivation to exercise (Vartanian & Shaprow, 2008). Moreover, sex differences may be a factor associated with lower engagement in exercise. That is, females who perceive themselves to be overweight tend to experience more weight stigma than males because they are more vulnerable to perceived weight stigma in various environments (e.g., workplace, school), which can result in PA avoidance (Sabiston et al., 2014; Saffari et al., 2023; Sattler et al., 2018). Therefore, further studies among young Thai university students and their tendency to avoid PA and sports are needed.

The Tendency to Avoid Physical Activity and Sport Scale (TAPAS) is a recently developed self-report measure (Bevan et al., 2022). The TAPAS uses ten items to identify experiences of weight stigma and physical appearance-related concerns relating to the tendency to avoid PA and sports (Bevan et al., 2022). Before the TAPAS was developed, there was a lack of psychometrically robust measures assessing the tendency to avoid PA and sports due to weight stigma, and body-related concerns. Although several studies have reported significant associations between weight stigma experiences and avoidance of PA (Bevan et al., 2023; Pearl et al., 2015; Puhl & Suh, 2015; Vartanian & Shaprow, 2008; Vartanian & Novak, 2011), the process of these associations remains complicated and inconsistent (Liangruenrom et al., 2019; Thiel et al., 2020).

Moreover, few studies have explored the relationships between experiencing weight stigma, having physical appearance concerns, and a lack of motivation for PA and sport. It has been suggested that more empirical evidence is needed to investigate the effect of weight stigma on PA avoidance (Bevan et al., 2022; Pearl et al., 2021). Therefore, the TAPAS was developed as a specific scale assessing PA avoidance due to psychosocial concerns (i.e., weight stigma and physical appearance) (Bevan et al., 2022).

The original version of the TAPAS was found to have strong psychometric properties, including reliability and factor validity across males and females (Bevan et al., 2022). More specifically, the TAPAS has been found to have a unidimensional structure (Bevan et al., 2022; Fan et al., 2023a; Saffari et al., 2023). However, no study on the psychometric properties of a Thai version of the TAPAS among the Thai population currently exists. Translating and validating the TAPAS into the Thai language may help Thai healthcare providers to assess the psychosocial reasons for PA avoidance among Thai people. Additionally, a Thai version of the TAPAS would assist in increasing the growing body of research on PA avoidance due to weight stigma and physical appearance concerns.

To optimize the psychometric evidence of TAPAS, the present study examined its measurement invariance to examine how the one-factor structure of TAPAS fitted across different subgroups: sex (female vs. male), weight status (non-overweight vs. overweight), and amount of daily physical activity (less than one hour vs. one hour or more). A meta-analysis found that moderate to vigorous intensity physical activity (i.e., approximately one hour per day) appeared to decrease the negative health consequences of sedentary behaviors (e.g., high level of sitting time) (Ekelund et al., 2016). Therefore, it is essential to assess the factor structure of TAPAS taking into account those who have spent different amounts of daily time exercising and whether TAPAS items are interpreted differently among these two groups.

More specifically, the purpose of the present study was to examine the psychometric properties of the Thai version of the TAPAS among university students. Utilizing university settings for research has proven highly effective, especially in terms of efficient participant recruitment and streamlined data collection (e.g., see Saffari et al., 2023). This approach aligns well with the present study's goals and sets a strong foundation for future research in similar demographic areas. The present study had three aims. These were to examine the (i) psychometric properties of the Thai TAPAS (i.e., factor structure and internal consistencies), (ii) measurement invariance of Thai TAPAS across sex (female vs. male), weight status (non-overweight vs. overweight), and daily hours of exercise (less than one hour vs. one hour or more), and (iii) between-group differences in sex, weight status, and daily hours of exercise on the Thai TAPAS.

Methods

Participants

The present cross-sectional online survey recruited participants through a convenience sampling technique using *SurveyMonkey* (an online survey tool platform for data collection). Data were collected between September 2022 and January 2023. All participants were recruited using a link which was circulated on *Facebook* and in a university forum. The participants were university students (i.e., undergraduate and postgraduate) residing in Thailand (n = 612). The inclusion criteria were, (i) being ≥ 18 years old; (ii) being able to read and understand the Thai language; and (iii) being enrolled at a university in Thailand. The aim of the study was presented at the start of the online survey page. All participants provided online informed consent before they started the survey.

Ethical considerations

The present study was ethically approved by the Human Research Ethics of National Cheng Kung University (NCKU HREC-E-110-486-2) and endorsed by the ethics committee at Mahidol University. Moreover, the researchers adhered to other ethical principles and concerns such as respecting the participants' right, confidentiality, anonymity, and data security.

Translation process

After obtaining permission to translate the TAPAS from the developers (Bevan et al., 2022), the translation was carried out taking into consideration the Thai cultural adaptation (Beaton et al., 2000). The first stage was a forward translation method. The original TAPAS (English version) was translated into the Thai language by two independent bilingual speakers with experience in psychometric translation (i.e., in nursing and sports sciences). Subsequently, both forward translations were examined, and discussed by the two forward translators. Moreover, both forward translators were encouraged to indicate any possible problem with the original text in which its intended meaning was not clearly understood. It was then discussed, and the consensually agreed scale was used for the forward translation. The second stage involved a backward translation. The complete forward translation was back-translated into two English versions by another two individual bilingual speakers who were fully blinded to the original version. The third translation stage involved the evaluation of all the TAPAS materials for approval. More specifically, the original TAPAS version, the forward translations (i.e., the two forward translations and completed forward translation), and the two backward translations were reviewed and consolidated into a prefinal Thai version by three expert committees (see Thai version of TAPAS in the Supplementary S3). However, a problem with the word ‘private setting’ was observed for Item 10 (i.e., ‘I would prefer to participate in physical activity in a more private setting’) during the translation process. In the Thai language, ‘private setting’ can refer to an enclosed area (e.g., home) or a reserved area in a fitness gym. However, all three expert committees concluded and decided not to replace or provide a light alternative to these words for Item 10 to retain the original version’s wording. The criteria for selecting expert committees were: (i) being a native Thai speaker; (ii) working in healthcare; (iii) having experience in psychometric translation; and (iv) having a published a psychometric validation paper. Later, the prefinal version was finalized after obtaining equivalence according to language and clinical perspective between the original and final versions.

Measures

Demographic information

All participants reported their age, sex, self-reported weight (in kilograms) and height (in centimeters), any relevant health condition or disease during the survey period, academic degree, and daily hours of exercise. Additionally, body weight index (BMI) was divided into four groups (i.e., < 23 kg/m^2 being classed as non-overweight, ≥ 23 kg/m^2 being classed as overweight; > 25 being classed as obesity type I, and > 30 being classed as obesity type II), using BMI reference for Thai populations (Sakboonyarat et al., 2020).

Tendency to Avoid Physical Activity and Sport Scale (TAPAS)

The TAPAS is a self-report measure for assessing the tendency to avoid PA and sports because of weight stigma and physical appearance-related concerns (Bevan et al., 2022). The instrument consists of ten items scored on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). An example item is *"I find myself avoiding participating in sport because of my weight"*. The total score is calculated by adding each item response to generate a sum score between 10 and 50 with higher scores indicating a higher avoidance of PA and sports. Both the original version of the TAPAS (Cronbach's α = .93; Bevan et al., 2022) and the Chinese versions of TAPAS (e.g., Cronbach's α = .95 to .96; Fan et al., 2023a; 2023b; Saffari et al., 2023) have been reported to have good internal reliability. Moreover, the Thai version of TAPAS had excellent internal consistency among the present sample (Cronbach's α = .95).

Statistical analysis

Descriptive statistics were used to assess participants' demographic information. For item examination, skewness and kurtosis were used to assess the distribution of responses. The evidence shows that confirmatory factor analysis (CFA) is well-established for psychometric evaluation (Alavi et al. 2020; Cao et al., 2023). Therefore, CFA was used to verify the validity of factor structure and item analysis for the Thai TAPAS. Additionally, CFA was used to derive factor loadings and corrected item-total for testing each item of TAPAS and values above .4 were considered reasonable (Maskey et al., 2018). CFA was applied to examine the factor structure of the TAPAS using diagonally weighted least squares (DWLS) estimation. The DWLS estimation was used because it is the method that is most appropriate for measures using ordinal scales (Li, 2021), like the Likert scale used for response items in the TAPAS. The reliability of the TAPAS was assessed using Cronbach's α and McDonald's ω coefficients and values above .7 were considered adequate. More specifically, values between .7 and .8 are often considered good, .8 and .9 are considered very good, and .9 or more are considered excellent (Kalkbrenner, 2023; Nunnally, 1978).

Model fit was assessed using the comparative fit index (CFI), a Tucker-Lewis index (TLI), a root mean square error of approximation (RMSEA), and a standardized root mean square residual (SRMR) (Jun, 2005; Yi et al., 2021). More specifically, it was assessed by: a non-significant χ^2, CFI > .9, TLI > .9, RMSEA < .08, and SRMR < .08 (Lin et al., 2020; Nejati et al., 2021). In addition, measurement invariance was tested across sex (female vs. male), weight status (non-overweight vs. overweight), and daily hours of exercise (less than one hour vs. one hour or above) among the sample using three nested models in the multigroup CFA (MGCFA). The three nested models of measurement invariance were: a configural invariance (investigating whether the factor structure of TAPAS was similar across subgroups; named as M1); a metric invariance model (investigating whether the factor loadings of the TAPAS items were similar across subgroups; named as M2); and a scalar invariance model (investigating whether both factor loadings and item intercepts of TAPAS were similar across subgroups; named as M3) (Leung et al., 2020; Pakpour et al., 2019). Moreover, evidence comprising SRMR, RMSEA, and CFI were used to compare the model for measurement invariance across subgroups (Jun, 2005). For assessment of invariance, every two nested models (i.e., M2-M1 and M3-M2) were compared, and non-significant χ^2 difference tests together with cut-off values for the ΔCFI > −.01, ΔSRMR < .03 (for factor loading) or .01 (for item threshold), and ΔRMSEA < .015, indicate invariance across the tested subgroups (Chen, 2007; Chen, Huang et al., 2022).

Independent *t*-tests were used to compare the mean score of TAPAS for subgroups including sex (female vs. male), weight status (non-overweight vs. overweight) and daily hours of exercise (less than one hour vs. one hour or above) to determine whether there were any significant or substantial differences. According to previous studies, poor physical health and mental health are among the barriers that reduce individuals' engagement in exercise (Firth et al., 2016; Maruf et al., 2018; Murphy et al., 2011). Therefore, participants with a physical condition or disease (n = 80) were excluded from the sensitivity analyses in the independent *t*-tests to reduce confounding effects. Independent *t*-test were therefore used to compare males and females' mean scores on the TAPAS excluding those having a physical condition or disease.

Independent *t*-tests were also used to compare mean scores of males and females on the TAPAS according to their weight status. The extant literature has reported that weight status (i.e., body weight and BMI) are determinant health behaviors that contribute to sex differences. Females who are overweight have higher body dissatisfaction and social appearance anxiety than males (Xian & Tink, 2022). Therefore, male and female participants were considered separately for comparison in relation to their weight status on TAPAS scores to understand different levels of weight concerns. Additionally, p-values $< .05$ were considered statistically significant. Cohen's d was calculated to indicate the effect size of TAPAS score on subgroups (sex, weight status, and daily hours of exercise); small effect size ($d = .2$), medium effect size ($d = .5$) and large effect size ($d = .8$) (Cohen, 2013).

Additionally, Pearson correlation tests were performed between the TAPAS score, age, BMI, and exercise time to determine concurrent and divergent validity of the TAPAS. In addition, Jeffrey's Amazing Statistics Program (JASP) version 0.17.3 was used to analyze all data because this statistic software is often used in the psychological sciences field and is supported by R programming to analyze the data (Han & Dawson, 2020; JASP Team, 2023).

Results

Table 1 shows the descriptive statistic results on the demographic information of the participants including age, sex, BMI, any relevant health condition or disease reported during the survey period, academic degree, and daily hours of exercise. The findings show the demographic distribution of participants (*N* = 612) with an average age of 20.57 years (*SD* = 2.29) between 17 to 33 years. The participants comprised 444 females (73%) and 168 males (27%). The mean BMI for the participants was 21.79 (*SD* = 4.26) kg/m^2 with 70% classed as being non-overweight, 11% classed as being overweight, 13% classed as being obesity type I, and 6% classed as being obesity type II. Most participants did not have any health condition or diseases during the survey period (87%), and almost all participants were undergraduate students (96%). Moreover, 41% of participants engaged in less than one hour of exercise per day and 59% engaged in more than one hour of exercise per day. The average TAPAS score was 22.66 (*SD* = 9.19).

[Please insert Table 1 here]

Table 2 shows the results of the examination of the item and scale properties of the TAPAS. All item properties of the TAPAS were normally distributed with no extreme values for both skewness (between -0.43 to 0.78) and kurtosis (between -1.02 to 0.21). All factor loading values ranged between .69 to .91 and all item-total correlation values ranged between .67 to .88 except for Item 10 (factor loading = .36 and item-total correlation = .35). Moreover, internal consistency was excellent with higher values (both Cronbach's α and McDonald's ω = .95). The unidimensional structure was supported for the TAPAS given its excellent fit (CFI = .996, TLI = .995, RMSEA = .041, SRMR = .049) except for the significant χ^2 (χ^2 = 70.88, *df* = 35, *p*-value < .001)

[Please insert Table 2 here]

Table 3 shows the results of the measurement invariance testing across sex, weight status, and daily hours of exercise using three nested models of MGCFA. All the MGCFA supported the measurement invariance across subgroups with satisfactory values for reference indicators of fit indices as follows: sex (M2-M1: ΔCFI = -.001, ΔRMSEA = .010, ΔSRMR = .006; M3-M2: ΔCFI = .000: ΔRMSEA = -.008, ΔSRMR = -.004), weight status (M2-M1: ΔCFI = .000, ΔRMSEA = .001, ΔSRMR = .004; M3-M2: ΔCFI = .000: ΔRMSEA = -.002, ΔSRMR = -.003), and daily hours of exercise (M2-M1: ΔCFI = .000, ΔRMSEA = .000, ΔSRMR = .003; M3-M2: ΔCFI = .001, ΔRMSEA = -.008, ΔSRMR = -.003).

[Please insert Table 3 here]

Supplementary Table 1 shows the results of the independent *t*-test on TAPAS scores between the subgroups (i.e., sex, weight status, and daily hours of exercise). There were no significant differences between sex (females *M* = 23.10, *SD* = 9.07 vs. males *M* = 21.51, *SD* = 9.43, *p* = .057), weight status (non-overweight *M* = 22.72, *SD* = 9.04 vs. overweight *M* = 22.52, *SD* = 9.54, *p* = .804), and daily hours of exercise (less than one hour *M* = 22.72, *SD* = 9.40 vs. one hour or above *M* = 22.62, *SD* = 9.05, *p* = .898) in TAPAS scores among Thai university students.

Moreover, after the exclusion of participants with a physical condition or disease (total *N* = 532), females had a significantly higher TAPAS score (*M* = 23.27, *SD* 9.03) than males (*M* = 21.38, *SD* 9.22; *p* = .033; Cohen's *d* = .21). In relation to weight status, non-overweight males had slightly a higher TAPAS score (*M* = 21.55, *SD* = 9.12) than males with obesity type I (*M* = 21.13, *SD* = 9.92), but this was not significant (*p* = .818; Cohen's *d* = .05). Males with obesity type II had a higher TAPAS score (*M* = 24.78, *SD* = 12.39) than non-overweight males (*M* = 21.55, *SD* = 9.12), but this was not significant (*p* = .331; Cohen's *d* = .34). Further, females with obesity type I had higher a TAPAS score (*M* = 25.71, *SD* = 9.74) than non-overweight females (*M* = 23.10, *SD* = 8.82) but was marginally non-significant (*p* = .059; Cohen's *d* = .29). Females with obesity type II had a greater TAPAS score (*M* = 26.31, *SD* = 7.10) than non-overweight females (*M* = 23.10, *SD* = 8.82), but this was not significant (*p* = .153; Cohen's *d* = .37). There were moderate effects between non-overweight and obesity type II among males (Cohen's *d* = .34) and females (Cohen's *d* = .37) (Table S1).

[**See Supplementary Table S1**]

Supplementary Table 2 shows the results regarding the relationships between the TAPAS score, age, BMI, and exercise time. TAPAS scores showed no significant relationship with age (r = -.07, p = .092), BMI (r = -.01, p = .835) and exercise time (r = -.02, p = .673). Exercise time had no significant relationship with age (r = -.04, p = .289) and BMI (r = -.04, p = .379). However, there was a significant relationship between age and BMI (r = .16, $p < .001$).

[**See Supplementary Table S2**]

Discussion

Using a cross-sectional design, the present validation study examined the psychometric properties, measurement invariance, and between-group differences in sex, weight status, and daily hours of exercise on the Thai version of the TAPAS. In general, the participants were older adolescents and/or young adults at university who were mostly in the normal BMI weight range, and engaged in appropriate levels of physical activity as evidenced by the TAPAS score which was below the mean score. This suggests that the Thai young adults in the present study were (on average) not avoiding PA and/or sports. Moreover, the majority of the participants were classed as being non-overweight (70%) which suggests that most participants would not have weight-related stigma issues which may contribute to the avoidance of PA and sports.

The CFA results showed that, in general, the Thai version of the TAPAS has robust psychometric properties. First, the results showed that the TAPAS has a unidimensional structure, indicating that all the TAPAS items belong to the same construct. This is consistent with previous studies which also reported a unidimensional structure for the TAPAS (Fan et al., 2023a; Saffari et al., 2023). However, the findings showed a significant χ^2 which is contrary to the needed criteria of fit indices. However, because the chi-square statistic can be affected by a larger sample size (Alavi et al. 2020), evidence recommends reporting it in combination with RMSEA, CFI and SRMR to present a good model fit (Alavi et al. 2020). The fit indices of CFI, TLI, RMSEA, and SRMR of the present study were acceptable which suggests the TAPAS has robust psychometric properties.

Moreover, both internal consistency values (i.e., Cronbach's α and McDonald's ω) found in the present study were excellent, indicating that the TAPAS will produce similar results for PA avoidance under similar conditions. These findings are also similar to previous studies (Fan et al., 2023a; 2023b; Saffari et al., 2023) which extend the use of the TAPAS across different populations and cultures. Although the internal consistency was high, there were no issues of redundancy among TAPAS items because the values of item-total correlation ranged between .35 and .88, which were all lower than .9 (Tavakol & Dennick, 2011). In general, the factor loading and corrected item-total for testing each TAPAS item were above a reasonable level. However, the results showed that Item 10 presented lower factor loadings (.36) and item-total correlation (.35).

A previous study also found that Item 10 (*I would prefer to participate in physical activity in a more private setting*) was a misfitting item (Fan et al., 2023a; 2023b). The authors in that study suggested that the research participants could have misunderstood the word '*private setting*' which refers to individual special privilege settings or places (e.g., a reserved area in the gym) (Fan et al., 2023a: 2023b). Therefore, participants might have misinterpreted Item 10 and therefore assessed it differently. Hence, our findings encourage future studies to revise Item 10's description or examine whether it should be retained (Fan et al., 2023a: 2023b).

The measurement invariance across sex, weight status, and daily hours of exercise on the TAPAS showed that there were invariant assessments of TAPAS items across males and females (sex), being non-overweight and overweight (weight status), and engaging in less than one hour and one hour or more of exercise (daily hours of exercise). This suggests that the TAPAS can be used to combine and compare across sex, weight status, and daily hours of exercise without significant measurement errors. These findings are also consistent with previous studies (Fan et al., 2023a; Saffari et al., 2023) which give credit to the extension of the use of TAPAS across different cultures. These findings suggest that the diverse contextual characteristics of individuals (i.e., sex, weight status and exercise) may still have the same individual perception of the TAPAS items.

In addition, a direct comparison between males and females (sex), being non-overweight and overweight (weight status), and engaging in less than one hour and one hour or more of exercise (daily hours of exercise) showed that there were no significant differences between males and females (sex), non-overweight and overweight (weight status), and less than one hour and one hour or more of exercise (daily hours of exercise), although females were more likely to avoid PA compared to males. These findings suggest that there is no significant difference between those who are non-overweight and overweight (weight status), and those who exercise for less than one hour and one hour or more of exercise (daily hours of exercise) in avoiding PA. Also, there was no significant difference between sexes although a trend indicated that females were more likely to avoid PA compared to males. Comparatively, a previous study suggested that there was a significant difference between sexes and weight status on the TAPAS, contradicting the present findings (Saffari et al., 2023). This indicates that further studies are needed to understand PA avoidance between sexes among the Thai population. A study with a similar number of males and females may be particularly pertinent, since the number of females in the present study was almost two-thirds of the total number of participants.

In line with previous research (Sattler et al., 2018), the present study found that females had a significantly higher TAPAS score than males after removing a key confounding variable (i.e., participants with a physical health condition and/or disease). Sattler et al. (2018) reported that females experience more weight-based discrimination than males due to a greater perception of their own weight status (i.e., feeling overweight). A recent study showed that social appearance anxiety is a key factor that reduced body satisfaction for females and causes negative behaviors (e.g., eating disorders) (Xian & Tink, 2022). Moreover, it has been reported that there are strong associations between weight-based experiences and motivation to exercise among females, leading to physical inactivity (Sattler et al., 2018). Therefore, weight stigma experiences and physical appearance concerns might be a barrier to participants' exercise engagement in the present study, especially, among females. There is a lack of evidence regarding a direct relationship between experiencing weight stigma and PA avoidance. However, weight-bias internalization might be mediator between such a relationship (Pearl et al., 2015). Future research should further examine whether experiencing weight stigma directly contributes to lower levels of PA among females compared to males.

Previous studies have reported that approximately 26%-50% of Thai university students are physically active, with males and preclinical students appearing to be the most active (Narin et al., 2008; Wattanapisit et al., 2016). Therefore, the large sample size disparity may have accounted for the non-significant difference. Moreover, previous studies have suggested that factors such as time, socioeconomic status, purpose (e.g., for fitness), schools, families, and personal factors (e.g., weight, cardiovascular disease, type 2 diabetes) significantly influence physical activities among university students, older adolescents, and/or young adults (Edwards & Sackett, 2016; McCarthy & Warne, 2022; Narin et al., 2008; Rungruang et al., 2019; Telford et al., 2016). Therefore, involving a more diverse group of participants in future studies using the TAPAS could support a better understanding of PA and/or its avoidance.

The present results indicated non-significant differences between different weight statuses after stratifying by sex (non-overweight vs. obesity type I; non-overweight vs. obesity type II). This was most likely due to insufficient sample sizes in subgroups. Previous evidence has shown that *p*-values are sensitive to sample sizes with a small number of participants (Sullivan & Feinn, 2012). The same authors recommend reporting effect sizes alongside *p*-values to better understand the magnitude of the difference between subgroups for independent *t*-tests (Sullivan & Feinn, 2012). According to Table S1, the effect sizes among males (Cohen's d = .34) and females (Cohen's d = .37) were highest between non-overweight and obesity type II. The findings showed that there were lower TAPAS scores among those who were non-overweight compared to those with obesity type II. Moreover, those with obesity type II had a higher TAPAS score than those who were non-overweight among both males and females. It is possible that those with a higher

BMI avoid being physically active. The extant literature indicates that having a higher BMI is commonly associated with weight stigma (Sattler et al., 2018), and individuals with weight-based experiences may fear being negatively judged in fitness clubs or the gym, leading to PA avoidance (Vartanian & Novak, 2011). Possibly, participants in the present study with higher BMIs may experience greater weight stigma which affects their PA engagement. Consequently, future research should comprise of a much larger sample size (as well as the resulting effect sizes) to better understand the relationship between different weight status groups and PA avoidance using the TAPAS.

Additionally, the nonsignificant relationships between the TAPAS and age, weight status, and exercise time are consistent with a previous review study among Thais (Liangruenrom et al., 2019), especially taking into consideration some of the factors that influence PA (Edwards & Sackett, 2016; McCarthy & Warne, 2022; Narin et al., 2008; Rungruang et al., 2019; Telford et al., 2016). Nonetheless, there was a significant positive relationship between age and BMI which suggests that as age increases, BMI may also increase and vice versa. This supports a previous study which indicated that age has a potential impact on BMI and body fat percentage (Ranasinghe et al., 2013).

Limitations, strengths, and implications

The limitations of the present study should be considered when interpreting the findings. Firstly, the TAPAS is a self-report scale, meaning there may be social desirability response bias among participants. Therefore, researchers should try to support participants to feel safe and anonymous when completing the scale. Secondly, a convenience sampling strategy was used which is a non-probability sampling strategy. This sampling strategy may not ensure representative sampling from the population, although a relatively large sample was recruited to ameliorate this limitation. Future studies may use probability sampling strategies among Thais to replicate these findings. However, caution is required given size of the sub-samples. Although the entire sample size was relatively large (i.e., $n = 612$), some of the sub-sample sizes were small after stratification. More specifically, the sample sizes were small for the groups of male obesity type I ($n = 39$), male obesity type II ($n = 9$), female obesity type I ($n = 49$), and female obesity type II ($n = 16$). Therefore, future studies could recruit patients with clinical obesity to increase the sample size in this population to further investigate the external validity of the TAPAS. Thirdly, the present study used *SurveyMonkey* (an online system) which supported data collection. However, situations associated with the online method of data collection may be different from the traditional paper-pencil method (e.g., reporting bias, identity of participants), which may be useful to utilize in future studies. The participants were predominantly females which may also limit the representativeness of the sample to the population and possibly the generalizability, although the measurement invariance results negated this likelihood.

The main strengths of the present study were its relatively large sample size (n=612), robust statistical analyses, and measurement invariance across sex, weight status, and daily hours of exercise. Therefore, the TAPAS, in addition to other scales, could be used for assessing PA avoidance among Thai older adolescents and/or young adults to help researchers understand the biological, psychological, social, and cultural factors that contribute to avoiding physical activity among these populations. Moreover, the Thai version of the TAPAS should be used among older adults to ascertain its psychometric properties, and the psychosocial factors associated with PA avoidance.

Conclusion

The present validation study examined the psychometric properties and measurement invariance of the TAPAS and demonstrated that the ten-item scale has a unidimensional structure with robust psychometric properties. The scale is invariant across sex, weight status, and daily hours of exercise. This suggests that the TAPAS is a good scale for assessing psychosocial factors in PA avoidance among older adolescents and/or young adults across sexes, weight status, and daily hours of exercise. Nonetheless, further studies are be needed to extend the use of this scale beyond the presently studied population and to explore additional factors (e.g., time) that may contribute to physical inactivity among these population groups.

References

Alavi, M., Visentin, D. C., Thapa, D. K., Hunt, G. E., Watson, R., & Cleary, M. (2020). Chi-square for model fit in confirmatory factor analysis. *Journal of Advanced Nursing*, *76*(9), 2209–2211. https://doi.org/10.1111/jan.14399

An, H., Chen, W., Wang, C., Yang, H., Huang, W., & Fan, S. (2020). The relationships between physical activity and life satisfaction and happiness among young, middle-aged, and older adults. *International Journal of Environmental Research and Public Health, 17*(13), 4817. https://doi.org/10.3390/ijerph17134817

Annis, N. M., Cash, T. F., & Hrabosky, J. I. (2004). Body image and psychosocial differences among stable average weight, currently overweight, and formerly overweight women: The role of stigmatizing experiences. *Body Image, 1*(2), 155-167. https://doi.org/10.1016/j.bodyim.2003.12.001

Atlantis, E., Barnes, E. H., & Ball, K. (2008). Weight status and perception barriers to healthy physical activity and diet behavior. *International Journal of Obesity, 32*(2), 343-352. https://doi.org/10.1038/sj.ijo.0803707

Ball, K., Crawford, D., & Owen, N. (2000). Too fat to exercise? Obesity as a barrier to physical activity. *Australian and New Zealand Journal of Public Health, 24*(3), 331-333. https://doi.org/10.1111/j.1467-842x.2000.tb01579.x

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine, 25*(24), 3186-3191. https://doi.org/10.1097/00007632-200012150-00014

Bevan, N., O'Brien, C. K. S., Latner, J. D., Vandenberg, B., Jeanes, R., & Lin, C. (2023). The relationship between weight stigmatization, avoidance, enjoyment and participation in physical activity and sport, and psychological distress. *American Journal of Health Behavior, 47*(2), 360-368. https://doi.org/10.5993/AJHB.47.2.15

Bevan, N., O'Brien, K. S., Latner, J. D., Lin, C., Vandenberg, B., Jeanes, R., & Fung, X. C. C. (2022). Weight stigma and avoidance of physical activity and sport: Development of a scale and establishment of correlates. *International Journal of Environmental Research and Public Health, 19*(23), 16370. https://doi.org/10.3390/ijerph192316370

Call, C. C., Eckstrand, K. L., Kasparek, S. W., Boness, C. L., Blatt, L., Jamal-Orozco, N., Novacek, D. M., Foti, D., & Scholars for Elevating Equity and Diversity (SEED) (2023). An ethics and social-justice approach to collecting and using demographic data for psychological researchers. *Perspectives on Psychological Science*, *18*(5), 979–995. https://doi.org/10.1177/17456916221137350

Cao, C. H., Liao, X. L., Jiang, X. Y., Li, X. D., Chen, I. H., & Lin, C. Y. (2023). Psychometric evaluation of the Depression, Anxiety, and Stress Scale-21 (DASS-21) among Chinese primary and middle school teachers. *BMC Psychology, 11*(1), 209. https://doi.org/10.1186/s40359-023-01242-y

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling, 14*(3), 464-504. https://doi.org/10.1080/10705510701301834

Chen, I., Huang, P., Lin, Y., Gan, W. Y., Fan, C., Yang, W., Tung, S. E. H., Poon, W. C., Griffiths, M. D., & Lin, C. (2022). The Yale Food Addiction Scale 2.0 and the modified Yale Food Addiction Scale 2.0 in Taiwan: Factor structure and concurrent validity. *Frontiers in Psychiatry, 13*, 1014447. https://doi.org/10.3389/fpsyt.2022.1014447

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.

Edwards, E. S., & Sackett, S. C. (2016). Psychosocial variables related to why women are less active than men and related health implications. *Clinical Medicine Insights. Women's Health, 9*(Suppl 1), 47-56. https://doi.org/10.4137/CMWH.S34668

Ekelund, U., Steene-Johannessen, J., Brown, W. J., Fagerland, M. W., Owen, N., Powell, K. E., Bauman, A., Lee, I. M., Lancet Physical Activity Series 2 Executive Committee, & Lancet Sedentary Behaviour Working Group (2016). Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women. *Lancet*, *388*(10051), 1302–1310. https://doi.org/10.1016/S0140-6736(16)30370-1

Fan, C.-W., Chang, Y.-L., Huang, P.-C., Fung, X. C. C., Chen, J.-K., Bevan, N., O'Brien, K. S., Yeh, Y.-C., Chen, H.-P., Chen, I.-H., Lin, I.-C., Griffiths, M. D., & Lin, C.-Y. (2023a). The Tendency to Avoid Physical Activity and Sport Scale (TAPAS): Rasch analysis with differential item functioning testing among a Chinese sample. *BMC Psychology, 11*, 369. https://doi.org/https://doi.org/10.1186/s40359-023-01377-y

Fan, C. W., Huang, P. C., Chen, I. H., Huang, Y. T., Chen, J. S., Fung, X. C. C., Chen, J. K., Yang, Y. N., O'Brien, K. S., Lin, C. Y., & Griffiths, M. D. (2023b). Differential item functioning for the Tendency of Avoiding Physical Activity and Sport Scale across two subculture samples: Taiwanese and mainland Chinese university students. *Heliyon*, *9*(12), e22583. https://doi.org/10.1016/j.heliyon.2023.e22583

Farhat, T. (2015). Stigma, obesity and adolescent risk behaviors: Current research and future directions. *Current Opinion in Psychology, 5*, 56-66. https://doi.org/10.1016/j.copsyc.2015.03.021

Fikkan, J. L., & Rothblum, E. D. (2012). Is fat a feminist issue? Exploring the gendered nature of weight bias. *Sex Roles, 66*(9), 575-592. https://doi.org/10.1007/s11199-011-0022-5

Firth, J., Rosenbaum, S., Stubbs, B., Gorczynski, P., Yung, A. R., & Vancampfort, D. (2016). Motivating factors and barriers towards exercise in severe mental illness: A systematic review and meta-analysis. *Psychological Medicine*, *46*(14), 2869–2881. https://doi.org/10.1017/S0033291716001732

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. *The Lancet Global Health*, *6*(10), e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7

Han, Hyemin & Dawson, Kelsie. Author initials missing. (2020). *JASP* [software]. https://doi.org/10.31234/osf.io/67dcb.

Hatthachote, P., Rangsin, R., Mungthin, M., & Sakboonyarat, B. (2019). Trends in the prevalence of obesity among young Thai men and associated factors: From 2009 to 2016. *Military Medical Research*, *6*(1), 13. https://doi.org/10.1186/s40779-019-0201-1

Jackson, S. E., & Steptoe, A. (2017). Association between perceived weight discrimination and physical activity: A population-based study among English middle-aged and older adults. *BMJ Open, 7*(3), e014592-014592. https://doi.org/10.1136/bmjopen-2016-014592

JASP Team (2023). *JASP version 0.17.3* [computer software]. JASP Team: Amsterdam, The Netherlands

Jun, S. (2005). Assessing goodness of fit in confirmatory factor analysis. *Measurement and Evaluation in Counseling and Development*, *37*(4), 240-256. https://doi.org/10.1080/07481756.2005.11909764

Kalkbrenner, M. T. (2023). Alpha, omega, and H internal consistency reliability estimates: Reviewing these options and when to use them. *Counseling Outcome Research and Evaluation, 14*(1), 77-88. https://doi.org/10.1080/21501378.2021.1940118

Leung, H., Pakpour, A. H., Strong, C., Lin, Y., Tsai, M., Griffiths, M. D., Lin, C., & Chen, I. H. (2020). Measurement invariance across young adults from Hong Kong and Taiwan among three internet-related addiction scales: Bergen Social Media Addiction Scale (BSMAS), Smartphone Application-Based addiction Scale (SABAS), and Internet Gaming Disorder Scale-Short Form (IGDS-SF9) (study part A). *Addictive Behaviors, 101*, 105969. https://doi.org/10.1016/j.addbeh.2019.04.027

Li, C. H. (2021). Statistical estimation of structural equation models with a mixture of continuous and categorical observed variables. *Behavior Research Methods, 53*(5), 2191-2213. https://doi.org/10.3758/s13428-021-01547-z

Liangruenrom, N., Craike, M., Biddle, S. J. H., Suttikasem, K., & Pedisic, Z. (2019). Correlates of physical activity and sedentary behaviour in the Thai population: A systematic review. *BMC Public Health, 19*(1), 414. https://doi.org/10.1186/s12889-019-6708-2

Liangruenrom, N., Suttikasem, K., Craike, M., Bennie, J. A., Biddle, S. J. H., & Pedisic, Z. (2018). Physical activity and sedentary behaviour research in Thailand: A systematic scoping review. *BMC Public Health, 18*(1), 733. https://doi.org/10.1186/s12889-018-5643-y

Lin, C., Broström, A., Griffiths, M. D., & Pakpour, A. H. (2020). Psychometric evaluation of the Persian eHealth Literacy Scale (eHEALS) among elder Iranians with heart failure. *Evaluation & the Health Professions, 43*(4), 222-229. https://doi.org/10.1177/0163278719827997

Maruf, F. A., Ojukwu, C. C., & Akindele, M. O. (2018). Perception, knowledge, and attitude toward physical activity behaviour: Implications for participation among individuals with essential hypertension. *High Blood Pressure & Cardiovascular Prevention*, *25*(1), 53–60. https://doi.org/10.1007/s40292-017-0235-y

Maskey, R., Fei, J., & Nguyen, H. (2018). Use of exploratory factor analysis in maritime research. *The Asian Journal of Shipping and Logistics, 34*(2), 91-111. https://doi.org/10.1016/j.ajsl.2018.06.006

McCarthy, C., & Warne, J. P. (2022). Gender differences in physical activity status and knowledge of Irish university staff and students. *Sport Sciences for Health, 18*(4), 1283-1291. https://doi.org/10.1007/s11332-022-00898-0

Murphy, C. L., Sheane, B. J., & Cunnane, G. (2011). Attitudes towards exercise in patients with chronic disease: the influence of comorbid factors on motivation and ability to exercise. *Postgraduate Medical Journal*, *87*(1024), 96–100. https://doi.org/10.1136/pgmj.2010.105858

Narin, J., Taravut, T., Sangkoumnerd, T., Thimachai, P., Pakkaratho, P., Kuhirunyaratn, P., & Sinsupan, N. (2008). Prevalence and factors associated with sufficient physical activity among medical students in Khon Kaen University. *Srinagarind Medical Journal, 23*(4), 389-395.

Nejati, B., Fan, C., Boone, W. J., Griffiths, M. D., Lin, C., & Pakpour, A. H. (2021). Validating the Persian Intuitive Eating Scale-2 among breast cancer survivors who are overweight/obese. *Evaluation & the Health Professions, 44*(4), 385-394. https://doi.org/10.1177/0163278720965688

Nunnally, J. C. (1978). *Psychometric theory: 2d ed*. McGraw-Hill.

Pakpour, A. H., Tsai, M., Lin, Y., Strong, C., Latner, J. D., Fung, X. C. C., Lin, C., & Tsang, H. W. H. (2019). Psychometric properties and measurement invariance of the Weight Self-

Stigma Questionnaire and Weight Bias Internalization Scale in children and adolescents. *International Journal of Clinical and Health Psychology, 19*(2), 150-159. https://doi.org/10.1016/j.ijchp.2019.03.001

Pearl, R. L., Puhl, R. M., & Dovidio, J. F. (2015). Differential effects of weight bias experiences and internalization on exercise among women with overweight and obesity. *Journal of Health Psychology, 20*(12), 1626-1632. https://doi.org/10.1177/1359105313520338

Pearl, R. L., Wadden, T. A., & Jakicic, J. M. (2021). Is weight stigma associated with physical activity? A systematic review. *Obesity, 29*(12), 1994-2012. https://doi.org/10.1002/oby.23274

Puhl, R., & Suh, Y. (2015). Health consequences of weight stigma: Implications for obesity prevention and treatment. *Current Obesity Reports, 4*(2), 182-190.

Ranasinghe, C., Gamage, P., Katulanda, P., Andraweera, N., Thilakarathne, S., & Tharanga, P. (2013). Relationship between body mass index (BMI) and body fat percentage, estimated by bioelectrical impedance, in a group of Sri Lankan adults: A cross-sectional study. *BMC Public Health*, *13*, 797. https://doi.org/10.1186/1471-2458-13-797

Rungruang, S., Pattanittum, P., & Kamsa-ard, S. (2019). Physical exercise of Khon Kaen university students - การออกกำลังกายของนักศึกษามหาวิทยาลัยขอนแก่น. *Journal of Health Science - วารสารวิชาการสาธารณสุข, 15*(2), 315-322. I would delete these or put them in brackets https://thaidj.org/index.php/JHS/article/view/6843

Sabiston, C. M., Pila, E., Pinsonnault-Bilodeau, G., & Cox, A. E. (2014). Social physique anxiety experiences in physical activity: A comprehensive synthesis of research studies focused on measurement, theory, and predictors and outcomes. *International Review of Sport and Exercise Psychology, 7*(1), 158-183. https://doi.org/10.1080/1750984X.2014.904392

Saffari, M., Chen, I., Huang, P., O'Brien, K. S., Hsieh, Y., Chen, J., Chang, Y., Jiang, X., Bevan, N., Chang, Y., Chen, J., Tsai, C., Griffiths, M. D., & Lin, C. (2023). Measurement invariance and psychometric evaluation of the Tendency to Avoid Physical Activity and Sport Scale (TAPAS) among mainland Chinese university students. *Psychology Research and Behavior Management, 16*, 3821-3836. https://doi.org/10.2147/PRBM.S425804

Sakboonyarat, B., Poovieng, J., Jongcherdchootrakul, K., Srisawat, P., Hatthachote, P., Mungthin, M., & Rangsin, R. (2022). Rising trends in obesity prevalence among Royal Thai Army personnel from 2017 to 2021. *Scientific Reports*, *12*(1), 7726. https://doi.org/10.1038/s41598-022-11913-2

Sakboonyarat, B., Pornpongsawad, C., Sangkool, T., Phanmanas, C., Kesonphaet, N., Tangthongtawi, N., Limsakul, A., Assavapisitkul, R., Thangthai, T., Janenopparkarnjana, P., Varodomvitaya, P., Dachoviboon, W., Laohasara, J., Kruthakool, N., Limprasert, S., Mungthin, M., Hatthachote, P., & Rangsin, R. (2020). Trends, prevalence and associated factors of obesity among adults in a rural community in Thailand: Serial cross-sectional surveys, 2012 and 2018. *BMC Public Health*, *20*(1), 850. https://doi.org/10.1186/s12889-020-09004-w

Sattler, K. M., Deane, F. P., Tapsell, L., & Kelly, P. J. (2018). Gender differences in the relationship of weight-based stigmatisation with motivation to exercise and physical activity in overweight individuals. *Health Psychology Open, 5*(1), 2055102918759691. https://doi.org/10.1177/2055102918759691

Sullivan, G. M., & Feinn, R. (2012). Using effect size - or why the p value is not enough. *Journal of Graduate Medical Education*, *4*(3), 279–282. https://doi.org/10.4300/JGME-D-12-00156.1

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Telford, R. M., Telford, R. D., Olive, L. S., Cochrane, T., & Davey, R. (2016). Why are girls less physically active than boys? Findings from the LOOK longitudinal study. *PloS One, 11*(3), e0150041. https://doi.org/10.1371/journal.pone.0150041

Thanamee, S., Pinyopornpanish, K., Wattanapisit, A., Suerungruang, S., Thaikla, K., Jiraporncharoen, W., & Angkurawaranon, C. (2017). A population-based survey on physical inactivity and leisure time physical activity among adults in Chiang Mai, Thailand, 2014. *Archives of Public Health, 75*, 41. https://doi.org/10.1186/s13690-017-0210-z

Thiel, A., John, J. M., Carl, J., & Thedinga, H. K. (2020). Weight stigma experiences and physical (in)activity: A biographical analysis. *Obesity Facts, 13*(3), 386-402. https://doi.org/10.1159/000507936

Topothai, T., Tangcharoensathien, V., Edney, S. M., Suphanchaimat, R., Lekagul, A., Waleewong, O., Topothai, C., Kulthanmanusorn, A., & Müller-Riemenschneider, F. (2023). Patterns and correlates of physical activity and sedentary behavior among Bangkok residents: A cross-sectional study. *PloS One*, *18*(10), e0292222. https://doi.org/10.1371/journal.pone.0292222

Vartanian, L. R., & Novak, S. A. (2011). Internalized societal attitudes moderate the impact of weight stigma on avoidance of exercise. *Obesity, 19*(4), 757-762. https://doi.org/10.1038/oby.2010.234

Vartanian, L. R., & Shaprow, J. G. (2008). Effects of weight stigma on exercise motivation and behavior: A preliminary investigation among college-aged females. *Journal of Health Psychology, 13*(1), 131-138. https://doi.org/10.1177/1359105307084318

Vartanian, L. R., & Novak, S. A. (2011). Internalized societal attitudes moderate the impact of weight stigma on avoidance of exercise. *Obesity*, *19*(4), 757–762. https://doi.org/10.1038/oby.2010.234

Wattanapisit, A., Fungthongcharoen, K., Saengow, U., & Vijitpongjinda, S. (2016). Physical activity among medical students in southern Thailand: A mixed methods study. *BMJ Open, 6*(9), e013479-013479. https://doi.org/10.1136/bmjopen-2016-013479

World Health Organization (2010). *Global recommendations on physical activity for health*. Retrieved March 18, 2024, from https://iris.who.int/bitstream/handle/10665/44399/9789241599979_eng.pdf?sequence=1

World Health Organization (2022a). *Physical activity.* Retrieved March 18, 2023, from: https://www.who.int/news-room/fact-sheets/detail/physical-activity

World Health Organization (2022b). Implementation roadmap for accelerating the prevention and control of noncommunicable diseases in South-East Asia 2022–2030. Retrieved March 18, 2024, from: https://www.who.int/publications/i/item/9789290229001

Xian, L. J., & Tink, C. W. (2022). Body dissatisfaction, social appearance anxiety and self-objectification: A narrative review of disordered eating. *Journal of Southeast Asia Psychology*, *10*(2), 22-22.

Yi, J., Chen, I. H., Lin, C. Y., Li, C. C., Liao, X. L., Wei, Z. H., & Gamble, J. H. (2021). The effect of primary and middle school teachers' problematic internet use and fear of COVID-19 on psychological need thwarting of online teaching and psychological distress. *Healthcare, 9*(9), 1199. https://doi.org/10.3390/healthcare9091199

Table 1

The characteristics of participants (N = 612)

	***Mean* (*SD*)**	***N* (%)**
Age (in years)	20.57 (2.29)	--
Sex		
Male	--	168 (27%)
Female	--	444 (73%)
BMI (kg/m²)	21.79 (4.26)	--
< 23	19.54 (1.84)	429 (70%)
23–24.9	24.00 (0.57)	69 (11%)
25–29.9	26.88 (1.33)	80 (13%)
≥ 30	33.52 (2.98)	34 (6%)
Any condition or disease		
Yes	--	80 (13%)
No	--	532 (87%)
Student status		
Undergraduate	--	590 (96%)
Postgraduate	--	22 (4%)
Daily hours of exercise	1.04 (1.04)	--
Less than one hour	0.20 (0.24)	251 (41%)
One hour or above	1.63 (0.97)	361 (59%)
TAPAS (T)	22.66 (9.19)	--

Notes. Non-overweight < 23 kg/m^2

Overweight ≥ 23–24.9 kg/m^2

Obesity Type I ≥ 25–29.9 kg/m^2

Obesity Type II ≥ 30 kg/m^2

SD Standard deviation

BMI Body mass index

TAPAS (T) Tendency to Avoid Physical Activity and Sport (Total score)

Table 2

Item properties and scale properties for TAPAS

Items level	Factor loadings*	Item-total correlation	Mean (SD)	Skewness	Kurtosis
Total					
T1	.69	.67	2.12 (1.06)	0.46	-0.88
T2	.77	.75	2.08 (1.07)	0.57	-0.67
T3	.87	.85	2.17 (1.11)	0.54	-0.65
T4	.86	.84	2.31 (1.18)	0.38	-0.92
T5	.84	.82	2.36 (1.18)	0.30	-1.02
T6	.88	.86	2.00 (1.08)	0.78	-0.21
T7	.91	.88	2.08 (1.12)	0.62	-0.62
T8	.91	.88	2.10 (1.11)	0.54	-0.80
T9	.90	.86	2.08 (1.11)	0.62	-0.58
T10	.36	.35	3.37 (1.18)	-0.43	-0.46
Scale level	**α/ω**	**CFI**	**TLI**	**RMSEA (90% CI)**	**SRMR**
TAPAS	.95/.95	0.996	0.995	0.041 (0.027, 0.055)	0.049
Cutoff	> .7	> 0.9	> 0.9	< 0.08	< 0.08

Notes. *Factor loadings and fit indices were derived from the confirmatory factor analysis; $p < .001$

TAPAS Tendency to Avoid Physical Activity and Sport

SD Standard deviation

α Cronbach alpha coefficient

ω McDonald omega coefficient

CFI Comparative fit index

TLI Tucker-Lewis index

RMSEA Root mean square error of approximation

SRMR Standardized root mean square residual

Table 3

Measurement invariance across sex (female vs. male), BMI (non-overweight vs. overweight), daily hours of exercise on TAPAS

	χ^2 (or $\Delta\chi^2$)	***p*-value**	**CFI (or ΔCFI)**	**RMSEA (or ΔRMSEA)**	**SRMR (or ΔSRMR)**
Sex					
M1 (*df*=70)	74.23	.342	1.000	0.014	0.050
M2 (*df*=79)	93.46	.127	0.999	0.024	0.056
M3 (*df*=88)	94.80	.291	0.999	0.016	0.052
M2-M1 (Δ*df*=9)	(19.23)	.023	(-0.001)	(0.010)	(0.006)
M3-M2 (Δ*df*=9)	(1.34)	.998	(0.000)	(-0.008)	(-0.004)
BMI (non-overweight vs. overweight)					
M1 (*df*=70)	76.56	.276	0.999	0.018	0.050
M2 (*df*=79)	88.06	.227	0.999	0.019	0.054
M3 (*df*=88)	95.85	.266	0.999	0.017	0.051
M2-M1 (Δ*df*=9)	(11.50)	.243	(0.000)	(0.001)	(0.004)
M3-M2 (Δ*df*=9)	(7.79)	.555	(0.000)	(-0.002)	(-0.003)
Daily hours of exercise (< 1 hour vs. ≥ 1 hour)					
M1 (*df*=70)	78.33	.232	0.999	0.020	0.051
M2 (*df*=79)	88.92	.209	0.999	0.020	0.054
M3 (*df*=88)	91.85	.368	1.000	0.012	0.051
M2-M1 (Δ*df*=9)	(10.59)	.305	(0.000)	(0.000)	(0.003)
M3-M2 (Δ*df*=9)	(2.93)	.967	(0.001)	(-0.008)	(-0.003)

Notes. TAPAS Tendency to Avoid Physical Activity and Sport
BMI Body Mass Index
M1 Configural model
M2 Loadings constrained equal
M3 Loadings and thresholds constrained equal
CFI Comparative fit index
TLI Tucker-Lewis index
RMSEA Root mean square error of approximation
SRMR Standardized root mean square residual