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Psychometric Properties of the Tendency to Avoid Physical Activity and Sport Scale Among Hong Kong University Students

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ABSTRACT

The present study aimed to validate the Chinese version of the Tendency to Avoid Physical Activity and Sport Scale (TAPAS) among university students living in Hong Kong to assess weight and body image concerns. A convenience sample of 787 students (63.5% females; 24.5% overweight) were recruited online. The factor structure of the scale was examined using confirmatory factor analysis (CFA). Multigroup CFA was used to assess measurement invariance across gender and weight categories. The unidimensional structure of the scale was confirmed ($\chi^2 = 78.046$, CFI = 0.996). Factor loading ranged from 0.536 to 0.902, and internal consistency was good ($\alpha = .93$, $\omega = .95$). The scale was measurement invariant across gender and weight status using both metric and scalar invariance methods ($-0.004 < \Delta CFI < -0.002$). The scale can help to identify barriers of weight concerns regarding physical activity engagement which would help in the development of preventive interventions.

KEYWORDS

Tendency to Avoid Physical Activity and Sport Scale; factor analysis; physical activity avoidance; psychometrics; measurement invariance

Introduction

Regular physical activity (PA) is an important health behavior which may help promote physical and psychological well-being (Manferdelli et al., 2019). For example, PA may contribute to preventing a number of chronic diseases such as cardiovascular disease, osteoporosis, type 2 diabetes, specific types of cancer, and even poor mental health outcomes including severe anxiety and depression (Warburton & Bredin, 2017). It may also support better individual psychology including self-concept, self-esteem, and cognitive performance (Lubans et al., 2016). However, the prevalence of physical inactivity is growing, and a significant number of the world's population, particularly young people, are not engaging in adequate levels of PA as recommended by the World Health Organization (150 min. moderate to vigorous weekly PA) (Bull et al., 2020; Katzmarzyk et al., 2022). Established evidence has shown that lifestyle changes, specifically among youth, is the leading cause of physical inactivity and

currently 40%-50% of college students are inactive (Romero-Blanco et al., 2020).

PA is a complicated and multidimensional concept and there are different definitions for it (Dasso, 2019). However, based on a common definition, it refers to all movements, even those which happen during leisure time, transport, and occupational tasks (World Health Organization, 2022). According to the Association of Applied Sport Psychology, sport includes all forms of PA that require casual or organized participation in various activities with the aim of expressing or improving physical fitness and mental health, making social relationships and/or participating in competitions (Association for Applied Sport Psychology, 2020). By either definition, the statistics indicate that both PA and sport participation rates have decreased significantly among youth, so that in 2019, nearly 75% of college students in China failed to meet the weekly PA levels recommended by WHO (Guthold et al., 2020). Therefore, to better understand underlying factors that may facilitate or impede PA, it is necessary to assess these factors more accurately.

One factor for engaging in PA and sport is being a 'normal' weight and having a good level of physical fitness (Molanorouzi et al., 2015). However, there are critical periods during an individual's lifespan in which weight gain may be more likely to occur. Young people usually experience rapid growth, so weight gain may happen faster at this age than other developmental stages (Balasundaram & Avulakunta, 2023). Moreover, young people, especially those who go to college/university have adopted increasingly sedentary behaviors such as sitting in classrooms, working at a computer, and inactivity on campus that may contribute to gaining weight (Haidar et al., 2018). Studies also indicate general weight gain among college students particularly during the first year of university (Ludy et al., 2018). Moreover, lifestyle patterns formed during this period may become a normative physically inactive lifestyle, which may transition into future life stages and contribute to persistent negative health outcomes (Balasundaram & Avulakunta, 2023; Romero-Blanco et al., 2020).

Therefore, this population group may be vulnerable to poor lifestyle habits including weight gain, which requires further assessment in relation to PA.

PA avoidance can be related to beliefs that PA may psychologically trigger or evoke negative feelings (Fan et al., 2023a, 2023b; Kagawa et al., 2022). Therefore, consistent with fear-avoidance models, individuals who tend to avoid PA may experience poor emotional states that deter them from engaging in PA (Vlaeyen et al., 2016). This may also be explained by hedonic theory. Based on this theory, individuals usually tend to engage in activities that make them feel better and avoid those that cause negative feelings (Rhodes & Kates, 2015). PA avoidance has been frequently reported among individuals with obesity (Ekkekakis et al., 2016). Indeed, despite PA being an effective behavior to prevent and treat obesity, many individuals with obesity do not meet the recommended levels of PA. Therefore, identifying psychological factors which may prevent individuals with obesity from being more physically active is required.

A negative psychological consequence of obesity that may also contribute to PA avoidance is weight stigma (Ajibewa et al., 2022). Weight stigma can be defined as any negative attitudes or beliefs related to weight manifested through stereotypes, prejudice or rejection due to being overweight or obese (Corrigan & Watson, 2002). Individuals with obesity may encounter weight stigma in different situations including at work, home or educational environments (Puhl et al., 2020). This kind of stigmatization may not only cause psychological problems such as depression, low self-esteem, and body dissatisfaction but may also decrease the likelihood of PA engagement to avoid rejection and discriminative social interactions, particularly in exercise settings (Ajibewa et al., 2022; Puhl & Suh, 2015). Frequent exposure to weight stigma in social contexts may cause self-stigma (also called internalized weight stigma), in which individuals attribute low social value to themselves and agree with the negative stereotypes and views of other individuals regarding their weight (Corrigan & Watson, 2002). Internalized

weight stigma may poorly affect individuals' psychological health (Alimoradi et al., 2020).

Current evidence indicates that higher levels of self-stigma are correlated with greater avoidance of PA and sport (Liu et al., 2022; Saffari et al., 2022). Studies have found that decreased motivation for PA may be associated with weight stigma experiences (Fung et al., 2019). Similarly, higher rates of body dissatisfaction, particularly among women, have been significantly related to lower levels of PA participation, PA intention, and avoidance of PA (Dues et al., 2020; Jankauskiene et al., 2022). Weight stigmatization also has been reported as a barrier to PA in several studies (Ajibewa et al., 2022; Puhl & Suh, 2015; Puhl et al., 2020). However, few studies have assessed the relationship between appearance-related concerns and PA avoidance mainly due to a lack of suitable measures.

There are a few instruments designed to assess PA avoidance. However, these measures generally have inadequate psychometric assessment and are developed for specific research (Bevan et al., 2022). Such measures usually assess general aspects of PA avoidance that may not specifically indicate the effect of weight stigma and body image concerns, particularly among youth. Therefore, to overcome these limitations, Bevan et al. developed and psychometrically tested the 10-item Tendency to Avoid Physical Activity and Sport Scale (TAPAS) among 581 English-speaking university students. The TAPAS was reported to have good internal consistency (Cronbach's α = .93) and test-retest reliability (r = .82; p <.001). Moreover, it was reported that the TAPAS had a single-factor solution (eigenvalue = 6.84) and that lower levels of PA enjoyment were associated with weight stigma (Bevan et al., 2022). The Chinese version of the TAPAS used for mainland Chinese (Fan et al., 2023a, 2023b, Saffari et al., 2023) also demonstrated good psychometric properties. More specifically, the Chinese version of the TAPAS was found to be measurement invariant across variables such as gender, PA level, and weight status (Fan et al., 2023a, 2023b, Saffari et al., 2023); and to have good discriminant validity with significant but differential associations with related scales, such as

Weight Bias Internalization Scale and International Physical Activity Questionnaire (Saffari et al., 2023).

Due to the absence of a validated measure for university students in Hong Kong, the present study aimed to validate the Chinese version of TAPAS in this specific region of China. Hong Kong is socio-culturally different to mainland China, where the Chinese version was initially examined. Although this area may be considered as a city under governance of the People's Republic of China, it is a special administrative region with more than 7 million residents mostly with different nationalities that have immigrated to this area (The World Factbook, 2023). Honk Kong is culturally very different from China and has a strong Western influence (such as no restrictions on social media), and are not defined by race or language (with children learning English from kindergarten). Therefore, these different conditions make it useful to study the psychometric variables of the TAPAS there. Moreover, Guthold et al. (2020) performed a study to assess trends in insufficient PA among adolescents around the world and gathered data from different countries. They found that even across the areas which have similar cultural characteristics (e.g., Mainland of China and Taiwan), the prevalence of PA insufficiency could be different. Moreover, the prevalence rates of PA insufficiency, sparts participation, and being overweight are different. More specifically, the prevalence of PA insufficiency among young adults was 17.9% for those from mainland China in 2010 and 22.3% in 2018 (Zhang et al., 2023), and 31.0% for those from Hong Kong in 2005 (Abdullah et al., 2005) and from 40% to 46% in 2018 (Huang et al., 2019). The prevalence of sports participation was 20.7% for those from mainland China in 2017 (Wang et al., 2018) and from 47% to 53% for those from Hong Kong in 2018 (Huang et al., 2019). Finally, the prevalence of being overweight was 16.9% for those from mainland China in 2018 (Wang et al., 2020), and 24.15% for those from Hong Kong in 2015 (Department of Health, HKSAR). Moreover, exploring associations between weight stigma and the tendency to avoid PA would help provide

localized knowledge for scientists and healthcare providers to help reduce PA barriers related to psychosocial factors such as weight stigma. Therefore, the present study assessed the psychometric properties of the TAPAS through internal consistency, factor structure, convergent and discriminant validity, and measurement invariance to show how the TAPAS may produce comparable and invariant data when used among individuals with different genders or weight ranges.

Methods

Data collection

The study sample comprised 787 university students from Hong Kong, who were recruited through convenience sampling and the data were collected through an online self-administered survey from June to August 2023 via a web-based survey platform (i.e., *Qualtrics*). The URL of the survey was distributed through mass email systems and electronic bulletin board groups at Hong Kong-based universities. Participants accessed the survey website free of charge, reducing barriers to participation in the present study. Before the official survey began, a pilot study was conducted to modify the questionnaire to suit the social context of Hong Kong. The final version contained more than 70 items covering topics such as basic demographic characteristics, personal experience with mental health, and weight status. It took approximately 20 minutes to complete.

The survey was designed for participants who were full-time students enrolled in a Hong Kong-based university program. Participants were free to complete the survey in their own time and encouraged to complete the survey honestly. Participants who completed the survey received a HK$50 gift voucher. This type of incentive was offered both to increase the response rate and to thank participants for their time. Participants were assured that the survey data were anonymous and confidential. Moreover, data quality was ensured using the following methods.

More specifically, participant data were removed when participants (i) had extreme high or low values in calculated body mass index (BMI; higher than 50 kg/m^2 or lower than 10 kg/m^2); (ii) reported over 20% of missing values; and (iii) completed the survey too quickly (i.e., shorter than two minutes). The survey, informed consent, research procedures, and ethical issues were reviewed and approved by The Survey and Behavioural Research Committee of the third author's university.

Measures

Tendency to Avoid Physical Activity and Sport Scale (TAPAS). The TAPAS is a 10-item scale with all items rated on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The total score of the TAPAS ranges between 10 and 50, with a higher score indicating higher levels of tendency to avoid PA and sport due to weight stigma and appearance related concerns. An example TAPAS item is *"I find myself avoiding participating in sport because of my weight"*. For all the TAPAS items (including English and Chinese), please see Supplementary A. Prior research showed that the TAPAS has satisfactory psychometric properties (Bevan et al., 2022), and its Chinese version has been validated among mainland Chinese (Saffari et al., 2023) but not among those living in Hong Kong. The psychometric properties of the scale are reported in the Results section.

Weight Bias Internalization Scale (WBIS). The WBIS is a 11-item scale with all items rated on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The total score of the WBIS ranges between 11 and 55, with a higher score indicating greater levels of weight-related self-stigma. An example WBIS item is *"I am less attractive than most other people because of my weight"*. Prior research showed that the WBIS has satisfactory psychometric properties (Durso & Latner, 2008; Lin et al., 2020), and its Chinese version has been validated among Hong Kong individuals (Pakpour et al., 2019). In the present study, the WBIS had

excellent internal consistency (Cronbach's α = .90; McDonald's ω = .94).

Weight Self-Stigma Questionnaire (WSSQ). The WSSQ is a 12-item scale with all items rated on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The total score of the WSSQ ranges between 12 and 60, with a higher score indicating higher levels of weight-related self-stigma. An example WSSQ item is *"I caused my weight problems*". Prior research showed that the WSSQ has satisfactory psychometric properties (Chirawat et al., 2022; Gan et al., 2022; Nadhiroh et al., 2022), and its Chinese version has been validated among Hong Kong individuals (Pakpour et al., 2019). In the present study, the WSSQ had excellent internal consistency (Cronbach's α = .92; McDonald's ω = .93).

Perceived Weight Stigma Scale (PWSS). The PWSS is a 10-item scale with all items rated on a dichotomous scale (0 = no; 1 = yes). The total score of the PWSS ranges between 0 and 10, with a higher score indicating higher levels of perceived weight stigma. An example PWSS item is *"people act as if you are inferior".* Prior research showed that the PWSS has satisfactory psychometric properties (Chirawat et al., 2022; Gan et al., 2022; Nadhiroh et al., 2022), and its Chinese version has been validated among Hong Kong individuals (Pakpour et al., 2019). In the present study, the PWSS had very good internal consistency (Cronbach's α = .80; McDonald's ω = .85).

Depression, Anxiety, Stress Scale-21 (DASS-21). The DASS-21 is a 21-item scale with all items rated on a four-point Likert scale (0 = no; 3 = almost always). The total score of the DASS-21 ranges between 0 and 63, with a higher score indicating higher levels of psychological distress. An example DASS-21 item is *"I found it hard to wind down".* Prior research showed that the DASS-21 has satisfactory psychometric properties (Cao, Liao, Gamble, et al., 2023; Cao, Liao, Jiang, et al., 2023), and its Chinese version has been validated among Hong Kong individuals (X. Li et al., 2021). In the present study, the DASS-21 had excellent internal consistency (Cronbach's α = .94; McDonald's ω = .95).

Demographics. The following items were used to collect the participants' demographics: age (in years), gender (male or female), height (in cm), and weight (in kg). BMI was later calculated using weight divided by squared height. A cutoff of 23 kg/m^2 in BMI for Asians (WHO Expert Consultation, 2004) was further used to classify if the participant was overweight (> 23 kg/m^2) or not.

Data analysis

The demographic variables and the measures' scores were firstly analyzed using descriptive statistics, including means and frequencies. Then, item properties of the TAPAS items were checked using means, frequencies, skewness, kurtosis, factor loading, and corrected item-to-total correlation. The factor loading was derived from the confirmatory factor analysis (CFA) that tested if the TAPAS had a one-factor structure. More specifically, the CFA used a diagonally weighted least square (DWLS) estimator to see if all TAPAS items loaded onto the same latent construct. In addition, several fit indices were used to evaluate if the data fitted well with the one-factor structure including the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square residual of approximation (RMSEA), and standardized root mean square residual (SRMR). CFI and TLI > 0.9 together with RMSEA and SRMR < 0.08 indicate good fit (L. Li et al., 2023; Pramukti et al., 2023). For both factor loading and corrected item-to-total correlation, a value > .4 indicates satisfactory (Y. H. Wang et al., 2023). For the CFA in the present study (i.e., a one-factor structure with 10 items and estimated using DWLS), the required sample size to achieve adequate statistical power should be between 200 and 500 (Kyriazos, 2018). Therefore, the a priori sample size for the present study was set at over 500.

In addition to testing whether the TAPAS had a one-factor structure using CFA, Cronbach's α and McDonald's ω were used to examine if the 10 TAPAS items had good internal consistency. A value > .7 for either α or ω indicates acceptable internal consistency (Lee et al.,

2023; T. Y. Wang et al., 2023). After confirming the one-factor structure of the TAPAS, multigroup CFA was conducted to examine if the one-factor structure was measurement invariant across gender (male vs. female) subgroups and across weight status (overweight vs. non-overweight) subgroups. For the multigroup CFA, metric and scalar invariances were examined using the following three nested models: the configural invariance model that did not constrain any parameters in the one-factor TAPAS structure; the metric invariance model that constrained factor loadings to be equal across the tested subgroups for the one-factor TAPAS structure; and the scalar invariance model that constrained factor loadings and item intercepts to be equal across the tested subgroups for the one-factor TAPAS structure. Metric invariance is supported when ΔCFI > -0.01, ΔTLI > -0.01, ΔRMSEA < 0.03, and ΔSRMR < 0.03 between the configural and the metric invariance models. Scalar invariance is supported when ΔCFI > -0.01, ΔTLI > -0.01, ΔRMSEA < 0.015, and ΔSRMR < 0.03 between the metric invariance and the scalar invariance models (Lee et al., 2023).

After ensuring the measurement invariance, the TAPAS total score was compared between the gender subgroups (male vs. female) and between the weight status subgroups (overweight vs. non-overweight) using the independent *t*-tests. Lastly, concurrent validity of the TAPAS was tested using Pearson correlations with the WBIS, WSSQ, PWSS, and DASS-21.

Results

Among the 787 participants (*M* age = 22.47 years [*SD*=4.38]), nearly two-thirds were female (*n* = 500; 63.5%). On average, the participants' BMI was 21.18 (*SD* = 3.63), resulting in one-fifth of participants being overweight (*n* = 169; 21.5%). The participants *M* (and *SD*) scores were as follows; TAPAS, 26.11 out of 50 (9.18), WBIS, 22.21 out of 55 (8.41), WSSQ, 27.49 out of 60 (9.42), PWSS, 1.07 out of 10 (1.86), and DASS-21, 16.11 out of 63 (12.07) (Table 1). (Insert Table 1 here)

Table 2 shows the item properties of the TAPAS. More specifically, all of the TAPAS items

were distributed in a pattern close to normal distribution (skewness = -0.912 to 0.837; kurtosis = -1.245 to 0.196). Moreover, all items had satisfactory factor loading derived from CFA (range between 0.538 and 0.902) and corrected item-to-total correlation (range between 0.477 and 0.862) (Table 2). In addition, the one-factor structure of the TAPAS was supported by the fit indices in the CFA: χ^2 = 78.046 (*df* = 35); $p < .05$; CFI = 0.996; TLI = 0.995; RMSEA = 0.040 (90%CI = 0.028, 0.051); SRMR = 0.044. Moreover, the TAPAS had excellent internal consistency: Cronbach's α = .93; McDonald's ω = .95.

(Insert Table 2 here)

Multigroup CFA results indicated that the TAPAS was measurement invariant across gender in both metric invariance (ΔCFI=-0.004; ΔTLI=-0.004; ΔRMSEA=0.022; and ΔSRMR=0.012) and scalar invariance (ΔCFI=0.000; ΔTLI=0.000; ΔRMSEA=-0.001; and ΔSRMR=0.002). The same invariance results were found for the TAPAS across the two classes of weight status (i.e., overweight vs. non-overweight) in both metric invariance (ΔCFI=-0.002; ΔTLI=-0.002; ΔRMSEA=0.012; and ΔSRMR=0.005) and scalar invariance (ΔCFI=-0.001; ΔTLI=-0.001; ΔRMSEA=0.003; and ΔSRMR=0.004) (Table 3).

(Insert Table 3 here)

The independent t-tests showed that female participants (*M* = 26.89; *SD* = 8.95) had significantly higher TAPAS scores than did their male counterparts (*M* = 24.77; *SD* = 9.40; *t* = 3.15; *p* = .002); participants who were overweight (*M* = 29.86; *SD* = 9.91) had significantly higher TAPAS scores than did their non-overweight counterparts (*M* = 25.08; *SD* = 8.69; *t* = 5.71; $p < .001$). Finally, the TAPAS was found to have good discriminative validity based on its correlations with other measures: Pearson's *r* =.62 with WBIS, *r* = .64 with WSSQ, *r* = .28 with PWSS, and *r* = .31 with DASS-21 (Table 4). All of the correlations with other external measures had significant *p*-values (all <.001).

(Insert Table 4 here)

Discussion

The present study was performed to assess the psychometric properties of the TAPAS in a sample of university students from Hong Kong. Internal consistency of the scale was examined using both Cronbach's alpha and McDonald's ω, and both indicated good inter-correlation between the items. Through CFA, the TAPAS showed an acceptable factor structure, indicating a one-factor solution for the scale as supported by the theoretical basis. The convergent and divergent validity of the scale also showed that the concept of the tendency to avoid PA and sport was differentiated from other related concepts such as weight bias internalization, weight stigma, perceived weight stigma, and mental health problems (including anxiety and depression). Therefore, researchers and practitioners can use the scale as an appropriate instrument to assess the tendency to avoid PA among Hong Kong college students.

To date, few measures have been developed to assess PA avoidance due to weight stigma and body image concerns. Vartanian and Shaprow (2008) examined the effects of weight stigma on exercise motivation and behavior in a pilot study among female college students. They developed a measure using previously developed scales such as Myers and Rosen's Coping Responses Inventory and the Restricted Activities Scale and adding some additional items. This Exercise-Avoidance Motivation Scale (EAMS) comprised eight items that asked participants about their personal reactions when experiencing negative situations related to weight in times of exercise and weight control behaviors (Vartanian & Shaprow, 2008). Although the scale was developed based on a similar basis to the present study, they did not report any psychometric properties of the scale. They reported its face validity, meeting the minimal requirements of the psychometric quality of any scale. However, the present study's findings showed that the TAPAS has good psychometric properties, indicating that the TAPAS may be a good alternative for the EAMS.

The EAMS also had other limitations including: (i) it was not specifically made to assess

weight stigma and body image concerns when exercising. Moreover, some relatively non-specific items were also included such as *"I avoid looking in the mirror so that I don't have to think about my weight"* and asking about fear of being teased in public places. The TAPAS was developed to assess psychosocial factors, with all items asking about PA or sport avoidance due to weight or appearance-based concerns; (ii) the TAPAS not only addresses PA behavior avoidance in all items but it also differentiates between PA and a specific activity (sport) which seems to be more comprehensive than the EAMS; (iii) the EAMS was only tested among females, whereas the TAPAS has been tested with both genders; and (iv) the EAMS was only evaluated with 100 students, a very small sample for psychometric evaluation. Comparatively, the present study recruited over 780 participants to evaluate the scale, a suitably sufficient sample size.

In the initial development of the TAPAS, Bevan et al. (2022) used exploratory factor analysis to test the preliminary factor structure. The present study also found a one-factor structure for the scale using confirmatory analysis (Bevan et al., 2022). This finding suggests that although the scale was designed to cover both concerns related to PA and sport avoidance, and despite their different definitions, there was no significant difference between PA and sport avoidance at an item level. Both PA and sport are inter-correlated and did not produce two different factors. Indeed, since sport is a type of PA, this finding is not surprising and indicates the integrity of the scale to assess the tendency to avoid PA and sport. A previous validation study of the Chinese version of TAPAS in mainland China also replicated the present study's findings (Saffari et al., 2023).

Another of the present study's findings that supports previous results on the measurement invariance is that the TAPAS may be used accurately for both males and females, and across different weight ranges. Similar to the findings of the Chinese TAPAS validation study, the present study found that the TAPAS appears to be suitable to assess weight and body concerns

related to PA avoidance among different groups of Chinese-speaking populations without different interpretations. However, because such invariance testing has not been carried out using the English TAPAS, further evaluation and new translations of the scale are needed to understand the applicability of the TAPAS in different settings and populations.

The present study also assessed the construct validity of the TAPAS using divergent and convergent scales. The TAPAS score was correlated more strongly with scores on the WBIS and WSSQ than the PWSS. This finding shows that the tendency to avoid PA or sport may be greater among individuals who self-stigmatize compared to perceived or social self-stigma. Indeed, when individuals internalize others' attitudes and beliefs regarding their weight status, this may mean a greater avoidance of PA and sport. This finding has been reported in previous studies showing the important role of self-stigma in PA avoidance (Ajibewa et al., 2022; Bevan et al., 2023). Therefore, any intervention programs designed to reduce such avoidance should aim to prevent or minimize self-stigma by mitigating the frequent exposure of individuals with social stigma. Similarly, significant associations between the TAPAS and DASS-21 suggested that PA avoidance may be rooted in poorer mental health. Moreover, individuals' psychological health may also be influenced by weight stigma and PA avoidance (Alimoradi et al., 2020; Dues et al., 2020). However, the causal relationships between these variables require further research.

Regarding the reliability of the TAPAS, there were also comparable findings between the present study and the two earlier studies. The Cronbach's α and McDonald's ω (which both indicate the internal consistency of the scale) were $\geq .90$ which was similar to that found in the original study ($\alpha = .93$) and those found in the Chinese version ($\alpha = .96$; $\omega = .95$; Bevan et al., 2022; Saffari et al., 2023). However, the stability of the scale needs further assessment particularly for the Chinese version.

The present study's strengths included a sufficient sample size and robust statistical tests

to assess the psychometrics of the TAPAS. However, the study must also be considered in relation to its limitations. First, the present study used a convenience sample of university students that is not representative of all youth in Hong Kong. Therefore, the appropriateness of the scale for all students in the region cannot be generalized, considering the diversity of cultures and languages in this area. However, using a relatively large sample size and recruiting through social networks to access the participants may have mitigated this limitation to some extent. Second, there was no equivalent scale to examine the concurrent validity of the TAPAS with previous validated ones, and instead divergent and convergent validity of the TAPAS with different but relatively associated scales were evaluated. Nevertheless, these instruments also corroborated construct validity of the TAPAS along with the factor structure investigation. Third, the study assessed weight status as well as stigma perceptions through self-report scales that may increase biases related to social desirability and acceptance. Therefore, future studies could assess weight using objective measurements. Nevertheless, since there are no alternative measures to assess stigmatization thoughts, and the scales used in the present study had strict validation processes, the data are likely to be trustworthy. Finally, further psychometric assessment of the scale by applying other techniques such as floor/ceiling effect, Rasch analysis, and structural equation modeling may also be useful to better understand the characteristics and accuracy of the TAPAS.

Conclusion

The present study indicated the Chinese version of TAPAS may appropriately be administered to university students in Hong Kong to identify likely concerns related to weight stigma and body image that may act as factors in avoiding PA and sport. Since the number of young people who are overweight or have obesity is growing in different regions of the world, validation and application of such a scale would be effective in identifying psychological barriers to engaging in physical activity. Moreover, it may support the development of interventions that promote

PA, particularly among young populations who are at high risk of physical inactivity and a sedentary lifestyle. Further examination of the TAPAS in other cultures and communities in young population groups, especially in developing countries should also be considered.

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Conflict of interest

The authors report there are no competing interests to declare.

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Disclosure statement

All authors declare no conflict of interest.

Data availability statement

Data used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical approval statement

The procedures for the present study adhered to the (i) Declaration of Helsinki, and (ii) ethical principles for medical research involving human participants. The Survey and Behavioural Research Committee at the Chinese University of Hong Kong approved the research project before the authors distributed the survey (Reference No. SBRE-22-0186).

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Table 1. Participant characteristics (N=787)

	Mean (SD)	n (%)
Age (in years)	22.47 (4.38)	
Gender		
Male		287 (36.5)
Female		500 (63.5)
Height (cm)	166.22 (8.70)	
Weight (kg)	58.78 (12.48)	
Body mass index (kg/m^2)	21.18 (3.63)	
Overweight (BMI≥23)		
Yes		169 (21.5)
No		618 (78.5)
TAPAS total score	26.11 (9.18)	
WBIS total score	27.21 (8.41)	
WSSQ total score	27.49 (9.42)	
PWSS total score	1.07 (1.86)	
DASS-21 total score	16.11 (12.07)	

TAPAS= Tendency to Avoid Physical Activity and Sport Scale; WBIS=Weight Bias Internalization Scale (Cronbach's α=0.90; McDonald's ω=0.94); WSSQ= Weigh Self-Stigma Questionnaire (Cronbach's α=0.92; McDonald's ω=0.93); PWSS= Perceived Weight Stigma Scale (Cronbach's α=0.80; McDonald's ω=0.85); DASS-21=21-item Depression, Anxiety, Stress Scale (Cronbach's α=0.94; McDonald's ω=0.95)

Table 2. Score distributions of the Tendency to Avoid Physical Activity and Sport Scale (TAPAS)

Item	n (%)					Mean (SD)	Skewness	Kurtosis	Factor loading	Item-total correlation
	Score 1	Score 2	Score 3	Score 4	Score 5					
TAPAS 1	223 (28.3)	349 (44.3)	80 (10.2)	118 (15)	17 (2.2)	2.18 (1.07)	0.789	-0.255	0.731	0.668
TAPAS 2	170 (21.6)	283 (36)	96 (12.2)	211 (26.8)	27 (3.4)	2.55 (1.19)	0.289	-1.162	0.738	0.678
TAPAS 3	199 (25.3)	289 (36.7)	93 (11.8)	175 (22.2)	31 (3.9)	2.43 (1.20)	0.462	-0.970	0.828	0.778
TAPAS 4	126 (16)	221 (28.1)	116 (14.7)	276 (35.1)	48 (6.1)	2.87 (1.23)	-0.078	-1.245	0.807	0.759
TAPAS 5	96 (12.2)	206 (26.2)	137 (17.4)	304 (38.6)	44 (5.6)	2.99 (1.17)	-0.236	-1.115	0.761	0.705
TAPAS 6	241 (30.6)	324 (41.2)	88 (11.2)	106 (13.5)	28 (3.6)	2.18 (1.12)	0.837	-0.173	0.835	0.780
TAPAS 7	201 (25.5)	306 (38.9)	99 (12.6)	157 (19.9)	24 (3)	2.36 (1.15)	0.533	-0.815	0.890	0.847
TAPAS 8	187 (23.8)	313 (39.8)	83 (10.5)	177 (22.5)	27 (3.4)	2.42 (1.17)	0.488	-0.929	0.902	0.862
TAPAS 9	191 (24.3)	306 (38.9)	107 (13.6)	156 (19.8)	27 (3.4)	2.39 (1.15)	0.514	-0.809	0.890	0.846
TAPAS 10	46 (5.8)	74 (9.4)	117 (14.9)	356 (45.2)	194 (24.7)	3.73 (1.11)	-0.912	0.196	0.538	0.477

Score 1=strongly disagree; Score 2=disagree; Score 3=neutral; Score 4=agree; Score 5=strongly agree.

Factor loadings were derived from one-factor structure confirmatory factor analysis using all participants' data. (DWLS estimator); χ^2 =78.046 (df=35); p<0.05; CFI=0.996; TLI=0.995; RMSEA=0.040 (90%CI=0.028, 0.051); SRMR=0.044

Internal consistency of the TAPAS: Cronbach's α=0.93; McDonald's ω=0.95

Table 3. Multigroup confirmatory factor analysis of the Tendency to Avoid Physical Activity and Sport Scale (TAPAS)

	Gender			Weight status		
	M1	M2-M1	M3-M2	M1	M2-M1	M3-M2
χ^2 or ($\Delta\chi^2$)	80.872	(51.763)	(13.098)	87.346	(33.497)	(23.36)
df or (Δdf)	70	(9)	(9)	70	(9)	(9)
p-value	0.176	<0.001	<0.001	0.079	0.002	<0.001
CFI or (ΔCFI)	0.999	(-0.004)	(0.000)	0.998	(-0.002)	(-0.001)
TLI or (ΔTLI)	0.999	(-0.004)	(0.000)	0.998	(-0.002)	(-0.001)
RMSEA or (ΔRMSEA)	0.020	(0.022)	(-0.001)	0.025	(0.012)	(0.003)
SRMR or (ΔSRMR)	0.041	(0.012)	(0.002)	0.044	(0.005)	(0.004)

M1=Configural model; M2=Metric invariance model; M3=Scalar invariance model

CFI=comparative fit index; TLI=Tucker-Lewis index; RMSEA=root mean square residual of approximation; SRMR=standardized root mean square residual.

Table 4. Concurrent validity of Tendency to Avoid Physical and Sport Scale (TAPAS) (N=787)

	TAPAS	WBIS	WSSQ	PWSS	DASS-21
TAPAS	--				
WBIS	0.62	--			
WSSQ	0.64	0.79	--		
PWSS	0.28	0.35	0.39	--	
DASS-21	0.31	0.32	0.39	0.40	--

Note. All *p*-values<0.001.

WBIS=Weight Bias Internalization Scale; WSSQ= Weigh Self-Stigma Questionnaire; PWSS= Perceived Weight Stigma Scale; DASS-21= Depression, Anxiety, Stress Scale-21.