Validity and Reliability of the Preference for and Tolerance of the Intensity of Exercise Questionnaire among Chinese College Students

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Abstract

Physical inactivity is a major public health issue in general populations including college students, because not meeting the recommended minimum amount of regular physical activity is associated with adverse health effects. Plenty of physical activity can support the prevention of chronic diseases, but adherence to planned and structured physical exercise is often insufficient. In this context, there is a large body of evidence indicating that exercise adherence is influenced by exercise-related affective responses. The Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) has been developed to measure these affective responses (e.g., to specific exercise intensities). So far, no validated Chinese version of the PRETIE-Q is available. To address this gap in the literature, the present study developed and validated a Chinese version of the PRETIE-Q in a large sample of Chinese college students. Data from a total of 1117 college students were collected for analyses concerning factorial validity and construct validity. The re-test reliability was established using a sample of 150 randomly selected participants. In addition, physical activity (PA) level, cardiorespiratory fitness (CRF), and resilience were used to examine possible links with two domains (preference and tolerance) of the PRETIE-Q. Our results showed that a Chinese version of the PRETIE-Q has a good fit and reliability (Cronbach's α of .72 to .85 for preference and tolerance, respectively; ICC: r = .72 of preference and r = .67 of tolerance; fit indices: χ^2 = 21.612, df = 19, p >.05, TLI = .997, CFI = .998, RMSEA = .016, SRMR = .024). Secondly, positive associations of intensity-tolerance with PA, AF, and resilience were observed. In summary, this study indicates that the newly developed Chinese version of the PRETIE-Q has sound psychometric properties and can be used in Chinese college students. The newly adapted version paves the way for further research on exercise-related affective responses in Chinese-speaking samples, although the generalizability of our findings needs to be established for other cohorts such as adolescents and older people with and without chronic diseases.

Keywords: PRETIE-Q, pleasure, intensity, tolerance, preference, validity

1 Introduction

The rising level of physical inactivity in the general population is a major challenge for the global health care systems [1]. This is because insufficient physical activity has a role in the increasing prevalence of chronic illnesses including hypertension, diabetes mellitus, and psychiatric disorders [2-6]. Physical inactivity is defined as not meeting the amount of regular physical activity that is recommended in established guidelines (i.e., less than 150-min moderate-intensity or less than 75-min vigorous-intensity activities in a week) [7]. Even in adolescents and emerging adults (e.g. college students), the increasing amount of physical inactivity has become a public health issue, for example, roughly 84% of school-age adolescents and 40-50% of college students do not meet the recommended minimum amount of regular physical activity [8,9]. Therefore, the World Health Organization has taken action to promote physical activity (PA) across all age groups with both healthy and clinical conditions [7]. However, such initiatives have not been very successful because the majority of individuals have difficulty adhering to physical exercise interventions on a regular basis or drop out after rather short time intervals (e.g., 6 months) [10-13]. Thus, finding a way to reduce attrition among individuals who start an exercise program could improve this public health situation.

Over the past few decades, researchers have attempted to understand why some people participate in regular exercise while others do not [14-16]. In particular, the low adherence to exercise interventions has prompted researchers to investigate the psychological processes associated with this phenomenon. A number of theories have been proposed by exercise scientists to explain physical inactivity, among which the cognitivism paradigm has been dominant over decades [17]. However, given the fact that the cognitive approach failed to explain individual differences in behavior as well as the gap between exercise plans and actions, researchers have started to consider determinants of behavior other than cognitive domains. In recent years, affective mechanisms in particular have taken a prominent role. These mechanisms mainly refer to affective constructs (i.e., affective response), such as pleasure/displeasure and enjoyment [18,19]. In this context, the hedonic theory of exercise motivation has developed rapidly. Ekkekakis et al. undertook research on this basis and found preliminary evidence of individual variability and dose-response patterns in the relationship between exercise and affective responses, and proposed a new theoretical framework called the dual-mode model [20]. The dual-mode model assumes that affective responses to exercise are determined by the ongoing interaction between two factors [17]: i) top-down cognitive parameters (i.e., cognitive determinants), for instance self-efficacy and self-expression attention to the body; ii) bottom-up interoceptive cues (i.e., physiological sensations), for example signals from chemoreceptors, baroreceptors, and various visceroceptors. This model predicts that the contribution of both factors varies with exercise intensity, thus providing an explanation for heterogeneous responses at moderate intensity and more homogenous responses at high intensity [21].

Importantly, evidence suggests that personal traits remained unstable across individuals, which influence a decision of selecting or tolerating the intensity of exercise [22]. Thus, two new constructs closely linked to affective responses to exercise were proposed, namely, preference for exercise intensity (or intensity-preference) and tolerance of exercise intensity (or intensity-tolerance) [22]. The concepts of intensity-preference and intensity-tolerance were mainly related to interoceptive stimuli from exercise, as opposed to exteroceptive stimuli and behavioral tendencies (primarily social). Specifically, the items in the standard self-administered questionnaires emphasized responses to exteroceptive stimuli (e.g., visual, auditory, tactile) and corresponding social behavior (e.g., sociability) [23].

Specifically, the PRETIE-Q is an English-language instrument that was developed and introduced by Ekkekakis[22] and colleagues and attracted great attention from researchers around the world. To measure these two psychological characteristics of exercise (i.e., intensity-preference and intensity-tolerance), the Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) has been developed [22]. This questionnaire was designed to help researchers to understand the psychological processes leading to exercise attrition [22] and based on the affect-based exercise prescriptions [24,25] to help improve exercise adherence and population health based on the affect-based exercise prescriptions[24,25]. To date, the PRETIE-Q has already been translated into other languages, including the European-Portuguese and Brazilian-Portuguese versions [26,27], but a validated Chinese version is currently lacking. Given that nearly 300 million individuals with chronic illnesses who are highly susceptible to physical inactivity are living in China, a tool that would enhance research and practical implementation of physical exercise programs based on information about preference for and tolerance of exercise intensity (such as the PRETIE-Q) is urgently needed. Thus, the primary aim of the current study was to develop and validate a Chinese version of the PRETIE-Q.

The second aim of the study relates to evidence that the level of physical activity plays a critical role in overall well-being and is associated with exercise-intensity tolerance and preference. Evidence for this was found in a study by Hall and colleagues [28] which indicated that the level of physical activity (as measured by a self-administered instrument) was positively linked to tolerance and preference, with values of $r = .29$. In another study, a sample of 146 adolescents, the maximum oxygen uptake (VO_{2max}) as an objective indicator of cardiorespiratory fitness was linked to intensity-tolerance and intensity-preference [29]. While the above-mentioned evidence suggests that level of physical activity and cardiorespiratory fitness are related to tolerance and preference of exercise intensity, it still remains unclear whether tolerance and preference of exercise intensity are linked to resilience as a mental skill. In this context resilience refers to the capability to psychologically or emotionally deal with difficulties like a life-threatening change. Typically, individuals with prolonged exercise experience (high level of physical activity) have stronger tolerance to withstand physical fatigue and exercise-induced pain. Such increased physical capacity (tolerance is thought to involve bottom-up processing) seems to be associated with resilience (top-down processing) level, but investigations providing empirical evidence are currently scant. Taking the above-presented evidence into account, an investigation into associations of tolerance and preference of exercise intensity with the level of physical activity, VO_{2max}, and resilience were conducted in the present study.

The aims of the present study were twofold: i) to develop and validate a Chinese version of the PRETIE-Q; ii) to investigate associations of the Chinese version of the PRETIE-Q (intensity-tolerance and intensity-preference) with level of physical activity (i.e., operationalized by use of the International Physical Activity Questionnaire), cardiorespiratory fitness (i.e., indicated by VO_{2max}), and resilience (i.e., operationalized by the Connor-Davidson resilience scale). According to the available literature, we hypothesized that a higher preference for low-intensity exercise would be associated with lower levels of physical activity, of cardiorespiratory fitness, and of resilience, whereas greater tolerance of vigorous-intensity exercise would be positively associated with higher levels of the above-mentioned factors. Furthermore, our study will add new knowledge to the literature regarding the validity and reliability of the PRETIE-Q in a Chinese cohort of college students who show a relatively high amount of physical inactivity due to academic work.

2 Methods

2.1 Participants

In Study 1, 1245 college students were initially enrolled from different universities across China. These college students were asked to anonymously complete an online questionnaire which is described in the following section in more detail through the Questionnaire-Star platform. Of note, after removing participants who responded with a very short duration (researchers had several tests and were informed about how long the survey should take to complete), 128 participants with invalid responses (e.g., time spent on exercise participation of > 16 hours or not passed the lie detector quiz) were excluded resulting in 1117 eligible participants for data analysis (563 women, 554 men, M = 18.90 years, SD = 1.25). In addition to these 1245 students, 150 participants were enrolled to examine test-retest reliability. In Study 2, to further validate the PRETIE-Q, 45 college students were recruited to carry out aerobic fitness test (i.e., VO2max) in the Body-Brain-Mind (BBM) lab situated at Shenzhen University. Prior to starting the questionnaire and lab test in both of the studies, participants were asked to provide informed consent and they were compensated 10 Yuan. This study protocol (ChiCTR2100051475) was approved by the ethical committee of Shenzhen University.

2.2 Measures

To assess preference for exercise intensity and tolerance-intensity, PRETIE-Q [22] was used in this study. The PRETIE-Q contains sixteen items and covers two dimensions (eight items per dimension). The preference dimension is assessed via eight items (e.g., I'd rather go slow during my workout, even if that means taking more time; items 2, 4, 6, 8, 10, 12, 14, 16 in the questionnaire). The tolerance dimension is assessed via eight items (e.g., While exercising, I try to keep going even after I feel exhausted; items 1, 3, 5, 7, 9, 11, 13, 15 in the questionnaire). Each response to an item was made on the 6-point Likert scale, ranging from 0 (I totally disagree) to 5 (I totally agree). Of note, half of the preference-related items (2, 4, 8, 12) measure low preference and half of the tolerance-related items (1, 3, 9, 13) measure low tolerance, and thus the scores of these items were reversed during calculation. A higher total score indicates a greater perceived level in terms of preference and tolerance of exercise intensity. The English version of the questionnaire has a good internal consistency indicated by a Cronbach's Alpha of .73 to .89 for preference-related dimension and of .82 to .87 for tolerance-related dimension [22].

The level of physical activity was assessed by the International Physical Activity Questionnaire-7 (IPAQ-7) [30]. This questionnaire consists of seven questions, which assess the amount of time spent in performing physical activities at specific intensities (e.g., at a light intensity, at moderate intensity, and at vigorous intensity) in the last seven days. Participants indicate whether they had performed a specific activity (e.g., walking) and if yes for how often (measured in days per week) and how long (duration per day) they performed this activity in the last seven days. Their level of physical activity was measured by weighting each type of activity following the energy requirements defined in METs (METs are multiple of resting metabolic rate) and expressed as MET-min per week (MET level*minutes of activity*events per week) [31]. A study on the Chinese version of IPAQ-7 reported the test-retest reliability coefficients of .93 for mild, .85 for moderate (includes walking), and .75 for vigorous exercise [32].

The Connor-Davidson resilience scale (CD-RISC) [33] was used to measure the level of resilience (i.e., the ability to adapt positively, or to maintain or regain mental health, despite experiencing adversity [34]). The Chinese version of the CD-RISC which comprises 25 items, has good validity and reliability [35]. The response to an item is provided at a 5-point Likert scale, ranging from 0 (rarely true) to 4 (true nearly all of the time). The total score ranges between 0 to 100, and a higher score indicates greater resilience. A previous study with college students reported Cronbach's α of .76 (stress resistance), .72(self-control), .72(goal orientation) and .60 (social adaptation), respectively [36].

In addition to measurements of these two characteristics (i.e., PA level and resilience) in Study 1, maximal oxygen uptake (VO_{2max}) of participants was measured in Study 2. VO_{2max} is considered as the gold standard indicator of cardiorespiratory fitness and was determined by conducting a graded exercise test on a bicycle ergometer (Ergoselect 200 K). At first, the bike was adjusted to the participants' anthropometrics properties by ensuring that the height of sitting and pedals were suitable for the participant. Afterward, the graded exercise test was started. The first two minutes were a warm-up phase, followed by the requirement of a stable pedal rotations (ranging from 55 to 60 per minute) regardless of a gradual elevation of 20 W per minute (i.e., starting workload: 0 W, incremental workload: 20 W, additional charge: 1 min by 20 W, cadence: 55-60 rpm). In other words, the rhythm of the power bike remained unchanged, but only the resistance was increased. When one or two of the following physiological phenomena were observed: revolutions lower than 50 r/min, a platform of VO_{2max}, respiratory quotient (RQ) > 1.10 or the heart rate greater than 180 beats/min, the test was terminated. Importantly, all participants were asked to achieve the peak value of oxygen uptake until volitional exhaustion as measured by rating of perceived exertion (i.e., participants had exhausted their strength and asked to interrupt the test). Heart rate was monitored (Polar-H10 chest belt) throughout the fitness test.

2.3 Procedures

Firstly, a researcher from the Body-Brain-Mind Laboratory contacted the author who developed PRETIE-Q and asked for his permission to develop a Chinese version. After this permission was granted, two English-Chinese bilingual researchers who specialized in psychology translated the original questionnaire into the Chinese language (forward translation). Meanwhile, a discussion meeting was set with the original author of the PRETIE-Q to confirm the meaning of items in English. Secondly, the first version of the translated questionnaire was sent to four exercise psychologists who reviewed and provided feedback on this version. This feedback was used to revise the first version of the questionnaire. Thirdly, this Chinese version of the PRETIE-Q was sent to two individuals who are fluent in English and Chinese who were blinded to the aims of this study to independently carry out a back-translation. Of note, given that the meaning of items within the Chinese-to-English version remained unchanged, back translation was successful. Fourthly, the Chinese version was distributed to 21 college students with exercise experience to determine whether items are readable and understandable, in which they felt that several items in the Chinese version were duplicated and suggested deleting them (i.e., items 1,6,8,13,16 of the original scale). To this end, a discussion was conducted, resulting in the Chinese version of the 11-item PRETIE-Q. To validate this Chinese-language version, a large-scale study was carried out among college students (Study 1), followed by a lab-based data collection on the PRETIE-Q and VO_{2max} (Study 2). For Study 1, several universities were targeted to collect data through the Questionnaire-Star platform, where professors as collaborators helped to hand out the e-survey to their students. A total of 150 participants were randomly selected to conduct a re-test within 3 weeks.

2.4 Statistical Analysis

Data analyses were carried out in SPSS 26.0 (Statistical Package for social science, Version 22, Chicago, IL, USA). Demographic information (i.e., age, gender) were firstly analyzed, and mean (*M*) and standard deviation (*SD*) were determined (see Table 1). A total of 1117 college students were randomly separated into two samples in Study 1: i) KMO (Kaiser-Meyer-Olkin) and Bartlett's test were measured as explanatory factor analysis (EFA) based on Sample 1 with 566 participants; ii) to test the internal consistency, Cronbach's α was analyzed in Sample 2 with 551 participants; iii) Sample 2 was also used to perform CFA using Mplus software, including the Average Variance Extracted (AVE) value and Construct Reliability (CR) of variables. To measure model fit, the Tucker-Lewis Index (TLI) and other parameters were considered, such as Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA), with a 90% Confidence Interval (90% CI). For these indices, the following cutoffs were recommended: CFI and TLI ≥ .90; SRMR and RMSEA ≤ .08. In addition, test-retest reliability was tested among 150 selected participants. With respect to concurrent validity, associations of tolerance-intensity and preference with PA level (subjective measure) and resilience were tested in sample 2. Likewise, the objectively measured VO_{2max} (n = 45 participants) was used in Study 2 to associate with the two dimensions as well.

3. Results

The demographic characteristics are displayed in Table 1. Men demonstrated significantly higher scores on age ($t = 3.43$, $p<.001$), BMI (calculated by kg/m^2, $t = 9.30$, $p < .001$), resilience ($t = 4.79$, $p < .001$), and PRETIE-Q total score ($t = 8.05$, $p < .001$) as compared with women, whereas a non-significant difference on PA level was observed.

Exploratory factor analysis (Study 1 presented in Table 2): Results from Sample 1 ($n = 566$) indicated that it is suitable for factor analysis (KMO = .806 > .80, $p < .001$). Based on the criteria of factor loadings (< .60) and cross-loadings (> .15) [37], three items (3, 10, 14) were removed. As a result, a fit model with 8 items (2 factors) was finalized, which was used for subsequent analyses.

Internal consistency (Study 1 with Sample 2 = 551): As shown in Table 3, Cronbach's α coefficients are presented with .85 (Factor 1) and .72 (Factor 2), respectively, which indicated a good internal consistency among Chinese college students. In addition, these two factors are significantly correlated with each other ($r = -.15$).

Results from the CFA indicated good model fit indices ($\chi^2 = 21.612$, $df = 19$, $p >.05$, TLI = .997, CFI = .998, RMSEA = .016, SRMR = .024). Finally, an 8-item Chinese-language PRETIE-Q was established with preference- (Item 2, 4, 9, and 12) and tolerance-related (Item 5, 7, 11, and 15) factors. Detailed information is presented in Appendix 1. Test-retest reliability of the PRETIE-Q-Chinese was conducted, with intra-class correlation coefficients (ICC) of $r = .72$ (preference, $p < .01$) and $r = .67$ (tolerance, $p < .01$).

As presented in Table 5, the preference for low exercise intensity was significantly negatively associated with PA level expressed by MET ($r = -.14$, $p < .01$) and resilience ($r = -.13$, $p < .01$). The tolerance of high exercise intensity was positively correlated with PA level ($r = .11$, $p < .01$) and resilience ($r = .15$, $p < .01$). By contrast, cardiorespiratory fitness was also significantly correlated with preference ($r = -.36$, $p < .05$) and tolerance ($r = .34$, $p < .05$) in Study 2.

4 Discussion

The Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q) has been developed to quantify preference for and tolerance of exercise intensity. Following the translation of the original PRETIE-Q into Chinese, this study determined whether this culturally adapted instrument is valid and reliable among college students who typically spent 10-15 hours physical inactive each day (e.g., sitting behaviors). Our results indicate that the Chinese version of the PRETIE-Q has good psychometric properties which are indicated by: i) a good internal consistency of the PRETIE-Q-Chinese; ii) a good construct validity of the two-factor model from the CFA; iii) good test-retest reliability with ICC in randomly selected 150 participants. Results will be further discussed below.

Eight items were kept in the Chinese version of the PRETIE-Q, which is different from the original PRETIE-Q consisting of 16 items [22] and other culturally adapted instruments consisting of 10/16 items [26,27]. The removal of five items (1,6,8,13,16) of the original instrument was due to a shared meaning with other items (evaluated by college students during preliminary data collection and exercise psychologists). The other three items of the original version were removed during EFA because of low factor loadings (Item 3 and 10) or cross-loadings (Item 14). Recently, a validation study [27] was conducted among Portuguese health club exercises, suggesting that the 10-item model had good fit indices, with 5 items in each dimension (preference and tolerance). The removal of a different number of items (in comparison to the original version) may be attributable to cultural differences or other factors such as exercise experience. Particularly, college students being recruited in the present study may have less experience in leisure sports activities as compared with habitual exercisers. Thus, future validation studies in China should consider other cohorts than college students (e.g., habitual exercises, older adults with and without chronic diseases).

Importantly, positive associations between the scores of the dimension tolerance of high-intensity exercise with PA level and cardiorespiratory fitness were observed in the current study, which is consistent with the results of previous studies [28,38,39]. Several reasons can be suggested to explain this observation. First, it is widely accepted that physiologic changes (exercise-induced muscle fatigue, lactate accumulation, pain, and cardiovascular and respiratory systems) in the human body swiftly emerge in response to any physical challenge (e.g., hiking, jogging, and exercise training), especially for those physically inactive individuals [40]. However, those physiological changes might vary as a function of PA level due to adaptations of the organism. For instance, adaptions have been observed to associate with reduced pain sensitivity [41], and an increased pain threshold (tolerance) [42] allowing individuals to sustain their active movement behavior (PA engagement) over extended periods, with a more frequent training session and greater load. Second, exercisers with relatively high levels of regular physical activity have reported suffering from an over-activation of the reward system and deficient inhibition when they were asked to watch sport-related stimuli, so they are more likely to pursue elevated exercise intensity (tolerance) for perception of pleasure and enjoyment [43].

In addition to the above-mentioned physiological measures, we also assessed the relationship between the dimensions of the Chinese version of the PRETIE-Q and resilience. Resilience emphasizes an individual's ability to withstand and recover in the face of stressors and is attributable to top-down processes [44]. In the present study, a positive association between resilience and tolerance of exercise intensity was observed. This finding can be explained as follows: When individuals are physically active (e.g., exercising), the physical activity acts as a stressor that elicits a certain level of physiological changes (e.g., the activation of hypothalamic–pituitary–adrenal axis leading to the rising cortisol levels) [45] that, in turn, can trigger psychological alterations being related to volatility (e.g., negative emotions such as fatigue). Prolonged physical training results in a higher tolerance-intensity due to strengthened emotional regulation and/or improved coping skills [46]. As a result, individuals are able to effectively inhibit the negative emotions occurring at higher exercise intensity as shown by studies that used assessments of brain function (e.g., fNIRS) [47-50].

The present study has several strengths that highlight its contribution to the current literature. Firstly, the validation of a Chinese version of PRETIE-Q addresses the lack of a tool to assess exercise tolerance and preference in this population. Secondly, the sample size used in the current validation study was large and even surpassed the sample size (n = 471) of the validation study of the original scale [22]. Thirdly, the criteria-related validity of the Chinese version of the PRETIE-Q was established using both objective and subjective measures. However, some limitations of the present study still need to be acknowledged. Firstly, as this study focuses on emerging adults, so that the generalizability of our findings is limited. Further studies are encouraged to address the validity of the PRETIE-Q in other age groups and across different health conditions. Secondly, other psychological variables such as personality, fatigue, self-efficacy, and sleep quality may confound the correlations between two dimensions of the Chinese version of the PRETIE-Q with the level of PA, cardiorespiratory fitness, and resilience. As these psychological variables were not measured in the present study, further studies should investigate their (moderating) influence on the observed relationships.

5 Conclusion

The Chinese version of the PRETIE-Q is an appropriate tool for the assessment of exercise tolerance and preference in Chinese college students. It is characterized by good psychometric properties, since reliability and validity have been verified. Furthermore, it was noticed that exercise tolerance and preference are associated with the level of physical activity, the level of cardiorespiratory fitness, and the level of resilience. This study opens a new direction for future studies on exercise-related affective responses in Chinese individuals, although further studies are needed to confirm our findings for other cohorts (e.g., older adults with and without chronic diseases).

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Authors' contributions

TW, JK, and LYZ participated in the design of the study, manuscript drafting, data reduction/analysis and the manuscript editing; WT and JK contributed to data collection; ZHZ, FH, AT, SL, AK, LYZ contributed to data reduction/analysis and manuscript editing; SL, LYZ and AK contributed to the interpretation of results and manuscript editing. All authors have approved the final version of the manuscript and agreed with the order of presentation of the authors.

Competing interests

None.

Appendix A Original version of PRETIE-Q and the translated version

Preference for and Tolerance of the Intensity of Exercise Questionnaire

Please, read each of the following statements and then use the response scale on the right to indicate whether you agree or disagree with it. There are no right or wrong answers. Work quickly and mark the answer that best describes what you believe and how you feel. Make sure that you respond to all the questions.

1	2	3	4	5
I totally disagree	I disagree	Neither agree or disagree	I agree	I totally agree

No.	Item	Degree of agreement				
1	Feeling tired during exercise is my signal to slow down or stop.	1	2	3	4	5
2.	I would rather work out at low intensity levels for a long duration than at high-intensity levels for a short duration.	1	2	3	4	5
3	During exercise, if my muscles begin to burn excessively or if I find myself breathing very hard, it is time for me to ease off.	1	2	3	4	5
4.	I'd rather go slow during my workout, even if that means taking more time.	1	2	3	4	5
5.	While exercising, I try to keep going even after I feel exhausted.	1	2	3	4	5
6	I would rather have a short, intense workout than a long, low-intensity workout.	1	2	3	4	5
7.	I block out the feeling of fatigue when exercising.	1	2	3	4	5
8	When I exercise, I usually prefer a slow, steady pace.	1	2	3	4	5
9.	I'd rather slow down or stop when a workout starts to get too tough.	1	2	3	4	5
10	Exercising at a low intensity does not appeal to me at all.	1	2	3	4	5
11.	Fatigue is the last thing that affects when I stop a workout; I have a goal and stop only when I reach it.	1	2	3	4	5
12.	While exercising, I prefer activities that are slow-paced and do not require much exertion.	1	2	3	4	5
14	The faster and harder the workout, the more pleasant I feel.	1	2	3	4	5
15.	I always push through muscle soreness and fatigue when working out.	1	2	3	4	5
16	Low-intensity exercise is boring.	1	2	3	4	5

锻炼强度的偏好性和耐受性量表（PRETIE-Q）

说明：阅读下列题目并指出你有多大程度同意题目中的描述。1-5 分别代表不同程度的认可程度。请根据你的亲身经历，选择对每项题目的认可程度，并在相应的框中打“√”。

题目	认可程度				
	完全不同意 1	不同意 2	我不同意也不反对 3	同意 4	完全同意 5
1） 如果在锻炼中感到疲惫，那就是我该慢下来或停下来的时候了。					
2） 与短时间的高强度锻炼相比，我更喜欢长时间的低强度锻炼					
3） 锻炼时，如果我的肌肉变得非常酸痛（或呼吸变得非常困难），那我就该降低运动强度了。					
4） 锻炼时我更喜欢慢慢来，即使这样会花更多的时间。					
5） 锻炼时，即使筋疲力尽，我也会试着坚持下去。					
6） 我更喜欢短时间、高强度的锻炼而不是长时间，低强度的锻炼。					
7） 在锻炼过程中，我尽量不关注疲惫感。					
8） 我通常更喜欢缓慢、稳定的锻炼节奏。					
9） 当锻炼变得太艰难时，我宁愿放慢下来或停下来。					
10） 低强度锻炼对我没有任何吸引力。					
11） 锻炼时，我最不可能因为疲惫而停下来； 只有当我达到锻炼目标时，我才会停下来。					
12）锻炼时，我更喜欢慢节奏的、不太费力的活动。					
13）在锻炼过程中，当我的肌肉一开始酸痛发烫时，我通常就会降低一些运动强度。					
14）锻炼的节奏越快、越费力，我就越开心（愉悦）。					
15）锻炼时，我总会努力克服肌肉酸痛和疲劳的影响。					
16）低强度锻炼是无聊的。					

Appendix B The Chinese version of the PRETIE-Q

锻炼强度的偏好性和耐受性量表-中文版（PRETIE-Q-Chinese）

说明：阅读下列题目并指出你有多大程度同意题目中的描述。1-5 分别代表不同程度的认可程度。请根据你的亲身经历，选择对每项题目的认可程度，并在相应的框中打“√”。

题目	认可程度				
	完全不同意 1	不同意 2	我不同意也不反对 3	同意 4	完全同意 5
1. 与短时间的高强度锻练相比，我更喜欢长时间的低强度锻炼					
2. 锻炼时我更喜欢慢慢来，即使这样会花更多的时间。					
3. 锻炼时，即使精疲力尽，我也会试着坚持下去。					
4. 在锻炼过程中，我尽量不关注疲惫感。					
5. 当锻炼变得太艰难时，我宁愿放慢下来或停下来。					
6. 锻炼时，我最不可能因为疲惫而停下来，只有当我达到锻炼目标时，我才会停下来。					
7. 锻炼时我更喜欢慢节奏的、不太费力的活动。					
8. 锻炼时，我总会努力克服肌肉酸痛和疲劳的影响。					

Reference:

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Table 1 Demographic characteristics of participants

Variables	all (*n*=1117)		male (*n*=554)		female (*n*=563)		*t*	*p*
	M	*SD*	*M*	*SD*	*M*	*SD*		
Age	18.90	1.25	19.03	1.26	18.78	1.22	3.43	<.001
Height (cm)	168.16	8.73	174.69	6.31	161.64	5.23	37.59	<.001
Weight (kg)	59.57	12.24	66.62	12.16	52.63	7.40	23.19	<.001
BMI (kg/m^2)	20.94	3.05	21.76	3.33	20.12	2.50	9.30	<.001
CD-RISC	87.83	14.31	89.88	15.05	85.82	13.25	4.79	<.001
IPAQ-7	2590.35	1192.35	2593.53	1190.24	2587.53	1195.59	.08	.933
PRETIE-Q	30.36	5.64	31.70	5.67	29.05	5.31	8.05	<.001

Note. *M* = mean; *SD* = standard deviation; BMI = body mass index.

Table 2 Factor loadings and cross-loadings of items in PRETIE-Q

No	Items in the English version	2-factor	
		F1	F2
2.	I would rather work out at low intensity levels for a long duration than at high-intensity levels for a short duration.	.805	.030
3.	During exercise, if my muscles begin to burn excessively or if I find myself breathing very hard, it is time for me to ease off.	.586	.090
4.	I'd rather go slow during my workout, even if that means taking more time.	.844	.034
5.	While exercising, I try to keep going even after I feel exhausted.	-.017	.646
7.	I block out the feeling of fatigue when exercising.	-.014	.688
9.	I'd rather slow down or stop when a workout starts to get too tough.	.836	.056
10.	Exercising at a low intensity does not appeal to me at all.	.255	.578
11.	Fatigue is the last thing that affects when I stop a workout; I have a goal and stop only when I reach it.	.048	.692
12.	While exercising, I prefer activities that are slow-paced and do not require much exertion.	.746	.129
14.	The faster and harder the workout, the more pleasant I feel.	.185	.688
15.	I always push through muscle soreness and fatigue when working out.	.016	.680

Note. F1 = Fator 1; F2 = Factor 2

Table 3 Correlations of two factors of PRETIE-Q and internal consistencies

Factor	1	2	PRETIE-Q total	Cronbach's α
1	1			.85
2	-.15**	1		.72
PRETIE-Q total	-.80**	.72**	1	

Note. ** $p < .01$

Table 4 Fit indices for CFA model

Model	χ^2	*df*	TLI	CFI	AIC	BIC	SRMA	RMSEA (90% CI)
2-factor	21.612	19	0.997	.998	10705.849	10813.643	.024	.016 (.000, .042)

Note. χ^2 = Chi-Square Test of Model Fit; *df* = degrees of freedom; TLI = Tucker-Lewis index; CFI = Comparative Fit Index; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; SRMA = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error Of Approximation

Table 5 Analysis of correlations between PRETIE-Q, IPAQ-7, and CD-RISC

Variables	PRETIE-Q total	MET(IPAQ-7)	CD-RISC
PRETIE-Q total	1	.17**	.18**
Preference	-.80**	-.14**	-.13**
Tolerance	.72**	.11**	.15**
MET(IPAQ-7)	.17**	1	.11**
CD-RISC	.18**	.11**	1

Note. * $p < .05$, ** $p < .01$