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# Reliability and Validity of the Short Version of Perceived Benefits and Barriers Scale for Physical Activity

RESEARCH

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## ABSTRACT

**Introduction:** The purpose of this study was to promote a short version of the perceived benefits and barriers scale (SVPBBS), verify its reliability and validity in college teachers, and provide a reliable and convenient tool for domestic research on the benefits and barriers of physical activity.

**Methods:** A SVPBBS was translated, SVPBBS-CN was used to test 553 teachers for project analysis, reliability, and validity test. One hundred thirty college teachers were retested four weeks later, and the criterion validity was verified using exercise benefits and barriers scale.

**Results:** Project analysis showed that each item was significantly correlated with the subscale score and total amount score (R = 0.526–0.726, P < 0.001). The Cronbach's alpha of the total SVPBBS-CN scale was 0.844. The results of confirmatory factor analysis supported a two-dimension structure. The fitting indexes were $\chi^2$ (429.809), $\chi^2$/ df (2.9043), P < 0.001, NFI (0.960), CFI (0.973), IFI (0.973), TLI (0.966) and RMSEA (0.059). The Cronbach's alpha of the two subscales of perceived benefits and barriers were 0.894 and 0.819, respectively. The retest reliability after four weeks, the Cronbach's alpha for the total scale and two subscalesare all qualified The results showed that correlation coefficients between the total score of SVPBBS-CN and EBBS-CN and between the score of subscales ranged from 0.612 to 0.922 (p < 0.01).

**Conclusion:** The SVPBBS-CN has good reliability and validity and can be used as a tool to evaluate perceived benefits and barriers.

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## INTRODUCTION

Perceived benefits and barriers are considered cognitive/perceptual factors as the main determinants of health-promoting behavior in Pender's (1982; 1987) health promotion model. The two cognitive/perceptual determinants in this model are the perceived benefits of health-promoting behavior and the perceived barriers to health-promoting behavior (Sechrist et al., 1987; Wang et al., 2020). The initial motivation to participate in physical activity may be closely related to the perceived benefits (Dishman et al., 1985). If a person lacks confidence in completing an activity, it becomes a barrier to performing. Lacking the confidence to complete an activity appears to be a barrier to initiating it. The perception of benefits is composed of positive psychological representations, including factors that strengthen, promote, cultivate, and enable behaviors to be adopted. Benefits can be intrinsic (e.g., improved health and feelings of well-being) or extrinsic (e.g., social interaction and financial rewards) (Silva et al., 2011; Silva et al., 2011). In contrast, barriers include obstacles, inconvenience, difficulties, and costs. Barriers can be real or imagined. The perception of barriers is an integral part of decisions affecting behavior. Generally, the frequently reported barriers regarding physical activity participation were fear of falling or injury, fear of becoming the victim of violence during outdoor physical activity, fatigue, sickness, physical limitations, pain, and lack of company, time, and family encouragement (Cassou et al., 2008; Kaori et al., 2009).

Exercise benefits and barriers scale (EBBS) is a widely used tool to measure benefits and barriers from exercises currently (Sechrist et al., 1987). Guo (2011) translated and constructed the revised Chinese version of EBBS (EBBS-CN), which was consisted of two subscales: perceived benefits and perceived barriers. There were a total of 43 questions in the EBBS-CN; among them, 29 questions were related to perceived benefits, and the remaining 14 questions were related to perceived barriers. Perceived benefits were then divided into five aspects: life promotion (8 questions), physical performance (8 questions), psychological concept (6 questions), social communication (4 questions), and preventative care (3 questions). Perceived barriers consisted of four aspects: environment (6 questions), time expenditure (3 questions), physical exertion (3 questions), family resistance (2 questions) (Guo, 2016; Guo and Xu, 2011). The reliability and validity of EBBS have been verified in many studies from Europe, America, Japan, and other countries.

Furthermore, EBBS-CN has been assessed and confirmed that all items express exactly the required content. Although EBBS-CN has been used as a comprehensive assessment of perceived benefits and perceived barriers in China, it has some limitations. On one hand, EBBS-CN has too many questions and takes a long time to investigate. On the other hand, the heavy respondent burden is easy to induce response fatigue and response bias and may reduce the response rate. So it is not a suitable tool for large-scale comprehensive epidemiological investigations. Therefore, Japanese scholars revised and constructed a simplified scale: a short version of the perceived benefits and barriers scale (SVPBBS) in Japanese (Kaori et al., 2009). SVPBBS was widely used and has been translated into many languages (Tanaka et al., 2016). The present study aims to validate a Chinese version of SVPBBS (SVPBBS-CN), to confirm that its reliability and validity are consistent with the original version, and to provide a reliable and convenient tool for domestic research on benefits and barriers of physical activity.

## METHODS

### PARTICIPANTS

The SVPBBS-CN was administered to Chinese-speaking teachers from a university in Zhejiang Province. A total of 620 university teachers with different majors. After excluding the invalid questionnaires, 553 valid questionnaires were recorded with an effective recovery of 89.19%. The age of the participants ranged from 24 to 59 years. Among them, 249 were male (45.03%), and 304 were female (54.97%). 178 participants were majoring in humanities and social sciences (32.18%), 134 were majoring in science (24.23%), 143 were majoring in engineering (25.86%), and 98 were medical (17.72%).

A total of 130 teachers were tested for reliability again and Criterion validity. As for these teacher participants, 119 valid questionnaires were received, with an effective recovery of 91.53%. Among them, 52 were males (43.70%), and 67 were females (56.30%). The age ranged from

26 to 50 years. The study was approved by the Research Ethics Committee of University and the written informed consent was obtained from all participants. The data collection was in accordance with the Helsinki declaration

## INSTRUMENT

### Exercise benefits and barriers scale

EBBS is divided into the perceived benefits scale (29 questions) and the perceived barriers scale (14 questions) (Sechrist et al., 1987). This measuring tool used Likert style questions, anchored in four points ranging from "1 – very disagree" to "4 – very agree". It was widely used to investigate the cognition of perceived benefits and barriers (Guo and Xu, 2011; Robbins et al., 2008). The Chinese version of the two subscales has a high degree of intrinsic consistency, with Cronbach's coefficients of 0.97 and 0.93, respectively (Tung, 2004).

However, there were so many questions that it took a long time. Therefore, the present study aimed to adopt a simplified scale developed by a Japanese scholar (Kaori et al., 2009). The intrinsic consistency (Spearman-Brown reliability coefficient = 0.48–0.82) and test-retest reliability (r = 0.51–0.79) of the scale are acceptable. Harada et al. (2020) also used the structure and standard correlation validity of the scale (Harada et al., 2020; Tanaka et al., 2016).

### A short version of perceived benefits and barriers scale

The original version of SVPBBS was developed in Japanese by Ishii et al. (2009), which included 20 Likert-type questions in total. The scale had two subscales: perceived benefits and perceived barriers. Each subscale consisted of 10 questions. Questions with regard to perceived benefits can relieve pressure, relax mood, can enjoy happily, deepen friendship, can maintain a suitable weight, can improve appearance, can be healthy, can do with friends, can enhance overall endurance, can challenge possibility to deepen friendship, can let others recognize their abilities. Perceived barriers were insufficient time, no energy, laziness, lack of motivation, fatigue due to sports, boring sports, bad weather, no facilities, family support, too much work, no one to do sports together. These 20 questions were anchored in five points ranging from 10 to 50. The scores of 10 questions in each of the two subscales are summarized, with benefits scored by positive scores and barriers scored by negative scores. A higher score indicated more intensive benefits perceived.

## PROCESS

### Translation

To perform the translation into Chinese, Brislin's translation model, which highlighted the need for a double translator and forward and backward translation, was used (Guo & Li, 2012). The Japanese version was independently translated by two masters of physical education who were proficient in Japanese. The two versions were compared and discussed, and from them, a preliminary version was drawn up by the researchers and translators. The preliminary Chinese version was then given to two PhDs of physical education who had studied in Japan. The two PhDs had no contact with the original scale and had experience in the compilation and localization of physical activity-related scales. They performed the back translation, from which the semantic equivalence was assessed, and the first version was formed.

### Cross-cultural adaptation

Different cultural backgrounds led to differences in language expression (Sousa & Rojjanasrirat, 2015). Therefore, not only the linguistic aspects were taken into account during translation and back-translation, but also the cultural difference. The cross-culture adaptation was based on the guideline proposed by Sousa et al.(2015). The full set of items was presented to nine experts in sports psychology, sports medicine, and other related fields, including 3 PhDs, 6 masters, 5 professors, 3 associate professors, and 1 senior coach. The cultural adaptation and content validity of the first version were evaluated. The cultural adaptation of the scales was evaluated from four aspects, including language expression clarity, language habits, language and culture, and content relevance, to fully ensure the cultural practicality and content equivalence of the Chinese version of SVPBBS. Content validity was assessed using a 4-point Likert scale, including l = irrelevant, 2 = weak correlation, 3 = strong correlation and 4 = very strong correlation. Finally, according to the content validity index and experts' suggestion, a Chinese version of SVPBBS was developed for pre-test (Shi et al., 2012).

### Pre-test

In order to validate the scale, a pre-test was conducted on small sample size. A face-to-face survey was conducted on 30 university teachers by 3 administrators who were well trained and qualified. The 30 pre-test teachers answered the questionnaires simultaneously in the morning, and the questionnaires were recalled immediately after completion. The results were analyzed and revised by the researchers, after which the final version of SVPBBS-CN was formed.

### Statistical analysis

Statistical analyses were performed by SPSS version 22.0 and Amos version 22.0. Descriptive statistics, project analysis, confirmatory factor analysis (CFA), Pearson correlation analysis, and criterion validity test was used.

### Project analysis

Project analysis was performed by correlation analysis and significant two-group differences. Pearson correlation coefficient was calculated between the score of each item and the score of subscales, as well as the total score of scale. According to Wu et al. (2012), the item was retained when its correlation coefficient was more than 0.4. When examining the significant two-group differences, the score of each question from each participant was ranked, with 27% as the threshold to distinguish two groups: the high score group and the low score group (Wu & Tu, 2012). After that, the Mann-Whitney test was used to examine whether there was a significant difference between the high score and the low score of each question. The question was kept when significant differences existed (Luo et al., 2020).

### Validity test

Validity was examined by content validity, construct validity, and criterion validity.

### Content validity

Content validity was evaluated by using content validity indexing (CVI). CVI was calculated for each item (I-CVI). Calculations for the CVI score were as follows: the number of experts with a score of 3 or 4 in each item divided by the total number of experts. An item with an I-CVI value greater than or equal to 0.78 was considered acceptable. Scale-level CVI (S- CVI) was used to evaluate the content validity of the whole scale. S-CVI was assessed by two indicators: 1) unanimous S- CVI (S- CVI/universal agreement (UA)) is the percentage of items that were rated as 3 or 4 by all experts. The overall validity of the scale was good when S-CVI/UA was not less than 0.8 (Davis, 1992). 2) average S-CVI (S-CVI/Ave) was the average of the I-CVI scores. It was acceptable when S-CVI/Ave was greater or equal to 0.90 (Shi et al., 2012).

### Construct Validity

Confirmatory factor analysis (CFA) was used to establish construct validity. The measures of the model fit are as follows: Comparative Fit Index (CFI), Tucker-Lewis index (TLI), Root Mean Square Error of Approximation (RMSEA). The CFI and TLI values are more significant than 0.90, and the RMSEA values are less than 0.08, indicating the model fitting is good (Mcdonald & Ho, 2002). The acceptable reliability coefficient is more significant than 0.70, and excellent reliability was achieved with a reliability coefficient of 0.90 (Li et al., 2021).

### Criterion validity

EBBS-CN was used as the criterion to evaluate the criterion validity of the SVPBBS-CN. The correlation coefficient (R-value) is calculated between the scores of the two subscales of SVPBBS-CN and the total scores of the two subscales of EBBS-CN. The correlation coefficient greater than 0.4 indicated a good correlation (Wu & Tu, 2012).

### Reliability

Cronbach's alpha was used to assess the internal consistency of each question. Cronbach's alpha 0.65 indicated poor internal consistency, between 0.65 and 0.80 was considered good internal consistency, and 0.80 was very good internal consistency (Vellis et al., 2003; Wu & Tu, 2012).

# RESULT

## CHINESES-TRANSLATION OF THE SVPBBS

Following the procedure described rigorously, the SVPBBS was Chinese-translated without any major difficulties. The pre-test version was tested by 30 participants, and no problems were observed in understanding and completing the questionnaire. The final version of SVPBBS-CN was approved by the committee composed of experts and researchers.

## PROJECT ANALYSIS

### Correlation analysis

Pearson correlation was used to analyze the correlation between the score of each item in SVPBBS-CN and the total score and the score of subscales. SVPBBS-CN contained 20 questions. The total score was obtained by adding up the score of each question. After that, the Pearson correlation coefficient was calculated between the score of each question and the total score. As shown in Table 1, the correlation coefficient between the score of each question and the total score ranged from 0.526 to 0.726 ($p < 0.001$), and the correlation coefficient between the score of each question and the score of its subscale ranged from 0.720 to 0.934 ($p < 0.001$), both indicating a significant correlation.

| CLAUSES AND SUBCLAUSES BENEFITS OF PHYSICAL ACTIVITY/ REASONS FOR NOT PERFORMING PHYSICAL ACTIVITY | PERCEIVED BENEFITS | PERCEIVED BARRIERS | THE TOTAL SCORE OF THE SCALE | DIFFERENCES BETWEEN HIGH AND LOW GROUPS |
|---|---|---|---|---|
| Can eliminate stress and relax my mind? | .934** | | .708** | 13.978** |
| Can be enjoyable? | .924** | | .721** | 14.028** |
| Can strengthen friendship? | .869** | | .610** | 11.939** |
| Can maintain a suitable weight? | .916** | | .667** | 13.265** |
| Can make a good appearance? | .880** | | .638** | 12.073** |
| Can make you healthy? | .897** | | .652** | 12.890** |
| It can be done with friends. | .835** | | .582** | 10.827** |
| Can build up total endurance? | .913** | | .676** | 13.064** |
| Unable me to challenge myself more. | .927** | | .693** | 13.308** |
| It makes others recognize their abilities. | .870** | | .615** | 12.317** |
| I don't have enough time. | | .729** | .546** | 11.542** |
| I have no energy and am lazy. | | .740** | .526** | 10.506** |
| I lack the motivation. | | .816** | .673** | 12.833** |
| I am tired from physical activity. | | .798** | .642** | 12.180** |
| Sports are boring. | | .790** | .726** | 13.979** |
| Bad weather. | | .779** | .637** | 12.848** |
| No facilities. | | .778** | .670** | 13.052** |
| Family members are not supportive. | | .720** | .656** | 13.324** |
| Working too much. | | .750** | .568** | 11.111** |
| No one does sports together. | | .730** | .606** | 11.556** |

**Table 1** Correlation coefficients (r) and differences of the score of high and low groups for all items in the SVPBBS-CN scale (Z).

*Note*: *Reverse score.
** $P < 0.001$.

### Discriminative power

The total score was ranked from the maximal to the minimal, with the top 27% and the bottom 27% of the total score as the threshold to distinguish the high score group from the low score group. The total score was 92 for the high group and 91 for the low group. Significant two-group differences were observed in each question ($p < 0.01$). After testing the normality of the data,

scores of each question in both groups did not follow a normal distribution. Therefore, the non-parametric method for independent sample (Mann-Whitney U test) was used. Z-score ranged from 10.506 to 14.028, with $p < 0.001$. A statistically significant difference between groups was observed (Details in Table 1).

## VALIDITY TEST

### Content validity

The results corresponding to I-CVI showed that 9 questions in the perceived benefits subscale were 1, and 8 questions in the perceived barriers subscale were 1. Since I-CVI for each question was more than 0.78, all questions were acceptable, indicating excellent content validity of each question. Additionally, S-CVI/UA = 0.75, S-CVI/Ave = 0.96, showing that the scale content validity is also acceptable and, consequently, all questions were maintained (Shi et al., 2012).

### Structural Validity

The original scale revision Ishii divided SVPBBS into two subscales: perceived benefits and barriers, and each subscale divided into five-degree models, where motor benefits included items 1 – 10 and perceived benefits t included items 11 – 20. This model was tested using the maximum likelihood method. The results showed that the model was well fitted, and the standard load coefficient for each item was between 0.664~0.930. In addition, the average variance variation (AVE) of each latent variable is greater than or close to 0.5, and the combined reliability (CR) is greater than 0.8, indicating that the convergence validity is ideal (Table 2). After correction, $\chi^2 = 429.809$, $\chi^2/df = 2.904$, $P < 0.001$, NFI = 0.96, CFI = 0.973, IFI = 0.973, TLI = 0.966, and RMSEA = 0.059.

| PERCEIVED BENEFITS | ESTIMATE | AVE | CR | PERCEIVED BARRIERS | ESTIMATE | AVE | CR |
|---|---|---|---|---|---|---|---|
| Can eliminate stress and relax my mind? | 0.923 | 0.783 | 0.972 | I don't have enough time. | 0.672 | 0.522 | 0.916 |
| Can be enjoyable? | 0.916 | | | I have no energy and am lazy. | 0.664 | | |
| Can strengthen friendship? | 0.856 | | | I lack the motivation. | 0.783 | | |
| Can maintain a suitable weight? | 0.920 | | | I am tired from physical activity. | 0.76 | | |
| Can make a good appearance? | 0.851 | | | Sports are boring. | 0.761 | | |
| Can make you healthy? | 0.911 | | | Bad weather. | 0.774 | | |
| It can be done with friends. | 0.776 | | | No facilities. | 0.769 | | |
| Can build up total endurance? | 0.909 | | | Family members are not supportive. | 0.665 | | |
| Unable me to challenge myself more. | 0.930 | | | Working too much. | 0.688 | | |
| It makes others recognize their abilities. | 0.842 | | | No one does sports together. | 0.671 | | |

**Table 2** SVPBBS-C Scale Loads of each factor in the two-factor model.

### Criterion validity

The total score of EBBS-CN and its two subscales were used as the criterion to test the SVPBBS-CN. The results showed that correlation coefficients between the total score of SVPBBS-CN and EBBS-CN and between the score of subscales ranged from 0.612 to 0.922 ($p < 0.01$) (Table 3).

| | PERCEIVED BARRIERS | COGNITION PERCEIVED | SIMPLE PERCEIVED BENEFITS | SIMPLY PERCEIVED BARRIERS | SIMPLE COGNITION PERCEIVED |
|---|---|---|---|---|---|
| Perceived benefits | .275** | .922** | .612** | .422** | .633** |
| Perceived barriers | – | .626** | .225* | .693** | .626** |
| Cognition Perceived | | – | .587** | .622** | .765** |
| Simply perceived benefits | | | – | .239** | .704** |
| Simply perceived barriers | | | | – | .858** |

**Table 3** Total score of SVPBBS-CN and EBBS-CN and the correlation coefficients of the two corresponding subscales (r).

### Reliability

The Cronbach's alpha of the total SVPBBS-CN scale for teachers was 0.844. The Cronbach's alpha of the two subscales of perceived benefits and perceived barriers were 0.894 and 0.819, respectively. These values indicated a high level of internal consistency.

The University teachers were retested four weeks later. The results showed excellent reliability for the total scale, with a Cronbach's alpha value of 0.792. Excellent reliability was also observed in two subscales, with a Cronbach's alpha value of 0.900 for the perceived benefits scale and 0.708 for the perceived barriers scale.

## DISCUSSION

The SVPBBS was a simplified scale based on the health diagnostic and health guidance in general adults (Kaori et al., 2009). This scale effectively reduced the burden on respondents, increased response rates, and reduced response bias. It applies to comprehensive studies with a large sample size, particularly in the field of physical activity and health. In the present study, a Chinese version of SVPBBS was developed, and its reliability and validity were tested among Chinese university teachers. The result showed it was a reliable and easy measurement tool to investigate perceived benefits and barriers in China.

Project analysis showed that each question of SVPBBS-CN has a significant positive correlation with its subscale and total scale. Furthermore, questions in the scale were well-differentiated, and there were significant differences between the scores of high and low groups in each question. Therefore, all 20 questions were maintained.

A reliability test is fundamental to prove the availability of a scale. Reliability was considered high when Cronbach's alpha value was above 0.8 (Qiu, 2013; Wu & Tu, 2012). In the current study, the Cronbach's alpha of the total scale was 0.844, and the values of two subscales of perceived benefits and perceived barriers were more than 0.819. Furthermore, the test-retest reliability of the total scale was 0.792, and the values of the two subscales were more than 0.708. These indicated that the SVPBBS-CN had good internal consistency, stability, and reliability.

Validity refers to the degree to which a research tool can truly reflect the concept it was expected. The more the research concept was expected, the more accurate the measurement result was, showing a high level of Validity (Hu, 2012). Structural validity meant that the concept measured by the scale was able to show the scientific significance and meet theoretical assumptions (Greco & Morris, 2001). The two subscale models of the SVPBBS-CN originated from the original version. In order to better understand the structural Validity of the SVPBBS-CN, confirmatory factor analysis was used for the first time in the present study. The results showed that the fit indices CFI, IFI, and TLI were all greater than 0.9, RMSEA = 0.059, and the factor load for each question was 0.664 ~0.930. These statistical results indicated that the two-subscale model fits well and that SVPBBS-CN had a good structural validity. Meanwhile, in the content validity test, the I-CVI value is greater than 0.78, indicating a good content validity.

This study also has some limitations. On the one hand, individuals with low education levels were not included in the test. On the other hand, the cross-regional test has not been carried out. Therefore, it is recommended that future studies should be conducted on a wider range of individuals, and cross-regional tests with a large sample size should be conducted to further verify and improve the scale, making it a widely used tool of physical activity cognition among Chinese.

## CONCLUSION

Given the excellent performance, the SVPBBS-CN can be considered to be a reliable and valid measurement tool among university teachers. It is consistent with the original version and has the advantages of being easy to understand and time-saving. It seems to be an appropriate tool used to investigate the physical activity benefits and barriers in university teachers.

This study also has some limitations. On the one hand, individuals with low education levels were not included in the test. On the other hand, the cross-regional test has not been carried out. Therefore, it is recommended that future studies should be conducted on a wider range of individuals, and cross-regional tests with a large sample size should be conducted to further verify and improve the scale, making it a widely used tool of physical activity cognition among Chinese.

## COMPETING INTERESTS

The authors have no competing interests to declare.

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