Original Article

JHSMR Journal of Health Science and Medical Research

The Cross-Cultural Adaptation and Psychometric Properties of the Exercise Benefits and Barriers Scale Following Translation into the Telugu Language for Use in Type 2 Diabetes Patients

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Received 27 July 2023 ● Revised 18 December 2023 ● Accepted 18 December 2023 ● Published online 30 April 2024

Abstract:

Objective: Although it is well known that exercise has many benefits, many people encounter barriers to following a regular fitness regime. The Exercise Benefits and Barriers Scale (EBBS) had been developed in the English language to understand the perceptions of people about the benefits and barriers of exercise participation. The main intent of the current study was to translate the EBBS into the Telugu language and assess the psychometric properties of cross-culturally adapting the scale in people with Type 2 diabetes in Telangana State of India.

Material and Methods: According to the translation guidelines, forward and backward translation was carried out and the final Telugu version of the questionnaire was prepared and distributed. A total of 103 responses were received from Type 2 diabetes patients in Telugu-speaking states of India from March 2022 to June 2022. Reliability and validity were assessed using Intra class Correlation Coefficient and Cronbach's alpha was calculated to evaluate the internal consistency.

Results: The reliability of the complete EBBS and its subscales were significantly high, with Cronbach's alpha of more than 0.7 (0.946 for the Exercise Benefits subscale and 0.879 for the Exercise Barriers subscale) for all items in the Telugu version showing good internal consistency.

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J Health Sci Med Res 2024;42(5):e20241059
doi: 10.31584/jhsmr.20241059
www.jhsmr.org

Conclusion: The results of the translated and cross-culturally adapted Telugu version of EBBS demonstrated satisfactory reliability and validity in a Type 2 Diabetes population, and therefore can be used in the Telugu-speaking population.

Keywords: cross-cultural adaptation, EBBS, psychometric properties, Telugu language, type 2 Diabetes

Introduction

Diabetes is a common metabolic disease and a global health concern with a 2- to 3-fold increased risk of mortality[1]. Moreover, individuals with diabetes are more susceptible to other infections, and the development of microvascular complications like neuropathy, retinopathy and nephropathy and macrovascular complications like cardiovascular diseases or stroke[2]. According to the International Diabetes Federation statistics 2021, the global prevalence of diabetes is 10.5%, with an estimated urban prevalence of 12.1% (360.0 million) and an 8.3% (176.6 million) rural prevalence[3]. India ranks second with 74.2 million people with diabetes, with an expected increase to 124.9 million by 2045[3]. Physical activity of any duration and type is considered as the cornerstone in the management of diabetes[4]. Thus, there is an urgent need to implement multidimensional health promotion strategies which involve early diagnosis, screening for the complications of diabetes, and increasing awareness through diabetes education including physical activity and exercise along with lifestyle modifications in the management of diabetes[5].

Regular aerobic exercise can reduce glycosylated haemoglobin, triglycerides and blood pressure and improve insulin sensitivity[6]. The benefits of resistance exercise include enhanced strength, glycemic control, decreased body fat mass, regulating blood pressure and decreasing insulin resistance[7]. Balance training increases sensory feedback, improves gait and prevents falls in type 2 diabetes.[8] When there is no culture-based specific instrument to assess, medical practitioners need to use tools developed in other cultures more commonly available in English. But in the context of countries like India with many states and diversities in language and culture, standardized patient-reported health questionnaires in English are not easily understood by all individuals as English is not the native language of the Indian population. Therefore, there is a need to develop a language-specific questionnaire for this population as it can save time and energy. Hence, it is more practical and helpful in patient care and clinical application to translate and cross-culturally adapt the questionnaires to the local languages[9]. The Exercise Benefits and Barriers Scale (EBBS) has been translated into the Farsi/Persian and Spanish languages[10-12]. There is currently no specific subjective questionnaire which measures the perceived benefits of and barriers to exercise that has been culturally adapted in the Telugu language. The American Diabetes Association recommends physical activity for diabetes individuals of at least 150 minutes per week.[13] The objective of the present study was to translate the EBBS questionnaire into the Telugu language and to cross-culturally adapt the scale for the Telugu-speaking population in Telangana. More particularly, the EBBS questionnaire was translated to identify the perceived benefits and barriers to exercise in type 2 diabetes individuals to encourage health promotion and create awareness of the benefits of physical activity and exercise in Hyderabad, which is the capital of Telangana.

Material and Methods

This prospective cross-sectional validation study included 103 type 2 diabetes subjects referred to an

outpatient physiotherapy department for rehabilitation as well as online consultation in Telangana. Subjects with a medical diagnosis of type 2 diabetes aged between 25 and 80 years of both genders with Telugu as their native language and those who could read and understand the Telugu language were enrolled. For those people who could not read (due to vision problems), a caretaker or assistant was allowed to help to fill in the questionnaire. Institutional Ethics Committee approval was obtained (EC/AIMSR/1527/2022/05/015) and the research was conducted following the guidelines of the Declaration of Helsinki and standard translation guidelines[14]. Permission from the original authors of the Exercise Benefits and Barriers questionnaire was sought and consent was received to translate and cross-culturally adapt it into the Telugu language and also use it in the diabetic population in Telugu-speaking states. Convenience sampling was used to select the participants. The participants were given an explanation of the study objectives, and the EBBS questionnaire requesting to complete was provided. The required sample size was 103 with allowance for a 10% drop out rate, 0.10 precision and 0.05 alpha. A written or electronic informed consent was given by the participants before filling out the questionnaire. A pilot test was done on 30 healthy individuals fluent in Telugu to check if they could comprehend the translated version well and the translated version was found to be valid. Later, the final version was given to type 2 diabetes individuals through an offline mode for patients visiting the Apollo Hospitals, Hyderabad and also forwarded among diabetes patient groups of Telangana through social media. The primary researcher collected the data. Out of 413 questionnaires distributed, 103 responses were received.

Phase 1 Cross-cultural adaptation

This process of EBBS translation into the Telugu language involved 6 stages according to the standard Mapi Research Trust translation guidelines and guidelines by Beaton et al[14].

Stage1 First step translation: Two native blinded bilingual Telugu translators forward-translated the EBBS from English to Telugu independently, generating Forward translation 1 (FT1) and Forward translation 2 (FT2). The blinded translators were a qualified Telugu teacher and a senior Telugu lecturer.

Stage 2 FT1 and FT2 were synthesized by two researchers and the primary investigator and arrived at FT3 after resolution of any issues by consensus.

Stage 3 Two bilingual translators back-translated FT3 from Telugu to English generating Backward translation 1 (BT1) and Backward translation 2 (BT2). The translators were one English teacher and one Senior English lecturer.

Stage 4 Expert committee: All translated versions were reviewed and analysed by the experts and a pre-final version in consolidated form was prepared after a consensus was reached. Both forward and backward translations (FT and BT) were critically analyzed by an expert committee comprised of nine members, namely one certified translator, two experts in the two languages (Telugu and English), one coordinator, one process moderator, two senior physiotherapists and two professors from the departments of Medicine and Biochemistry. The committee evaluated the translated questionnaires for consistency, cultural word adaptation and finalized the penultimate version of the EBBS-Telugu version. The primary investigator documented the whole process in a comprehensive manner, which included the suggestions of the expert committee members.

Stage 5 Pretesting EBBS-T: Thirty healthy subjects completed the pre-final version of the EBBS-T and answered the following questions to assess face validity- Were the questions comprehensible so that they could answer? What was their response to the items? Were the translated questions relevant to understand the

perceived benefits and barriers to exercise? Were there any difficulties encountered in understanding the questions and did they have any suggestions for improvements in the questionnaire?

After changes were made based on the responses, the same participants were given the final version for validation.

Stage 6 Documents Submission to original author

A report on the EBBS-T questionnaire translation procedure and all the documentation was submitted to the original author.

Phase 2 validation study

Questionnaire implementation in type 2 diabetes individuals in Telugu-speaking states: Informed consent with consent to publish results were obtained from 103 participants who were then asked to fill in the questionnaire. The survey contained a demographics form, the EBBS questionnaire-English, the EBBS-Telugu version (EBBS-T), EBBS-Telugu_Version.pdf (Supplementary file 1 – the original EBBS version can be accessed with permission from https://deepblue.lib.umich.edu/handle/2027.42/85354).

Statistical analysis

This research was conducted to assess the psychometric properties of the Exercise Benefits/Barriers Scale [EBBS-T]. In the study, factor analysis was applied to simplify the data by condensing the numerous individual items into a smaller set of dimensions. This method was used to assess the psychometric properties of the study, revealing important information about the test's adequacy, relevance, and usefulness. This study included 103 participants with 53 males and 50 females between 25 and 80 years of age (mean=51.8, S.D.=11.5).

The sample size was calculated based on Cronbach's alpha estimation at a 95% confidence level, with a 5% alpha error and 80% power, number of items(k)=5 with expected Cronbach's alpha 70% and 10% absolute precision, the minimum sample size required for this study was 92 participants with no dropouts and 103 with 10% dropouts.

Description of variables

There were 43 items in the original EBBS version, with 29 items in the Benefits subscale and 14 items in the Barriers subscale.

The demographic factors used as explanatory variables were age, gender – female or male, BMI (kg/meter^2), duration of diabetes (in years), and physical activity (regularly, irregularly, rarely, not at all)

The full version of the EBBS-T was analysed, and its subscales were analysed separately. Statistical analysis was performed using statistical package for the social sciences (SPSS) version 21 and Microsoft Excel 2019.The categorical variables were expressed as percentages while continuous variables were expressed as mean±standard deviation. Cronbach's alpha was used to assess the internal consistency of the EBBS-T with a 5% significance level (p-value<0.05=significant). The Kaiser Meyer Olkin (KMO) sample adequacy coefficient was used to assess the construct validity. The measurement models were assessed through parsimonious fit, the goodness of fit of the model per subscale to compare the observed data with the expected data and absolute fit ratios[15]. Chi-square test and $\chi 2 / df < 5$; the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed Fit Index (NFI) >0.90 and Parsimony goodness of fit index (PGFI) (0-1) were used for the data analysis as fit indices. The absolute fit was analysed through the standardized root mean square residual (SRMR)<0.1, the root means square error of approximation (RMSEA)<0.08 and Root Mean Squared Residual (RMR) coefficients ranged between 0.05 and 0.1[16]. Exploratory and confirmatory factor analysis was done using AMOS 26.0 statistical software.

Results

Out of the 103 study participants, 52% were male and 48% female. The average age of the study participants was 51.8 years (S.D.=11.5). 29% of the participants were overweight and 46% of the participants were obese. 44% of the subjects had diabetes for more than 5 years and 42% of them worked out regularly while 10% of them never did any physical activity.

Table 2 shows the sample's means and standard deviations of the exercise benefits subscale, internal consistency and item analysis. The study participants mostly agreed with most of the benefits under examination, reflecting that they felt that many of the statements actually represented the benefits of regular exercising. The alpha coefficient of the exercise benefits subscale was found to be 0.946, indicating a high level of internal consistency. A wide range between 0.325 and 0.703 among the inter-item correlations was observed. The alpha coefficient showed that the internal consistency could not be enhanced with the elimination of items.

Table 3 shows the means and standard deviations of the answers in the exercise barriers subscale, internal consistency and item analysis. The study participants either disagreed or strongly disagreed with many of the barrier subscale's items, reflecting that they felt that several of the statements actually represented barriers to their regular physical activity. The alpha coefficient of the exercise barriers subscale was 0.879, indicating good internal consistency. A wide range between 0.355 and 0.681 among the inter-item correlations was observed. The alpha coefficient showed that internal consistency could not be enhanced with the elimination of items.

Table 1 Demographic characteristics

Demographic characteristic		N=103
Age	Mean±S.D.	51.79±11.51
Gender	Male	53 (51.5%)
	Female	50 (48.5%)
BMI (kg/m^2)	Underweight (<18.5)	2 (1.9%)
	Normal weight (18.5-24.9)	24 (23.3%)
	Over weight (25-29.9)	30 (29.1%)
	Obese class I (30.34.9)	25 (24.3%)
	Obese class II (35-39.9)	10 (9.7%)
	Obese class III (>40)	12 (11.7%)
	Mean±S.D.	30.05±7.73
Duration of Diabetes (in years)	<1	7 (6.8%)
	1-2	25 (24.3%)
	3-5	26 (25.2%)
	6-10	17 (16.5%)
	>10	28 (27.2%)
Physical activity	Regularly (at least >150 min walking/week)	43 (41.7%)
	Irregularly (between 50-150 min per week)	28 (27.2%)
	Rarely (<50min per week)	22 (21.4%)
	Not at all	10 (9.7%)

S.D.= standard deviation, kg=Kilogram, m^2=meter^2, BMI=body mass index

Table 2 Correlation coefficients and Cronbach's alpha of the exercise benefits subscale in the Exercise Benefits and Barriers–Telugu Scale, India 2022

Item description	Mean ± S.D.	Corrected item–total correlation	Cronbach's Alpha if Item is eliminated
1. Nenu vyayamanni Anandistaanu	3.25±0.59	0.643	0.944
2. Vyayaamam naaku ottidi mariyu aandolanala bhavaalanu taggistundi	3.22±0.58	0.630	0.944
3. Vyayaamam naa maanasika aarogyaanni meruguparustundi	3.29±0.54	0.621	0.944
5. Nenu Vyayaamam cheyadam dwaaraa gundepotunu nirodhistaanu	3.07±0.62	0.664	0.944
7. Vyayaamam naa kandaraala balaanni penchutundi	3.23±0.53	0.558	0.945
8. Vyayaamam naaku vyaktigata saafalyata yokka bhaavaanni istundi	3.19±0.49	0.634	0.944
10. Vyayaamam naaku sedateerinatlugaaa anipistundi	3.14±0.58	0.636	0.944
11. Vyayaamam cheyadam valana nenu aanandinche snehitulu mariyu vyaktulato parichayam erpadutundi	2.99±0.63	0.463	0.946
13. Vyayaamam cheyadam valla naaku adhika raktapotu raakundaa chestundi	3.03±0.63	0.508	0.946
15. Vyayaamam cheyadam valla naa saareeraka dhrudhatvam sthaayi perugutundi	3.33±0.49	0.673	0.944
17. Vyayaamamto naa kandaraala patutvam merugu padindi	3.19±0.49	0.699	0.944
18. Vyayaamam naa hrudaya naala vyavastha paniteerunu meruguparustundi	3.24±0.55	0.703	0.944
20. Vyayaamam nenu chaalaa baagaa unnaanane bhaavananu kalugajestundi	3.22±0.46	0.699	0.944
22. Vyayaamam naa sattuvanu penchutundi	3.28±0.53	0.679	0.944
23. Vyayaamam naa kandaraalanu saanukoolangaa undelaa maarustundi	3.25±0.46	0.632	0.944
25. Vyayaamamto naa swabhaavam merugupadindi	3.08±0.54	0.594	0.945
26. Vyayaamam naaku raatri poota baagaa nidrapovadaaniki sahaayapadutundi	3.21±0.49	0.595	0.945
27. Nenu Vyayaamam cheste ekkuva kaalam jeevistaanu	3.20±0.65	0.638	0.944
29. Vyayaamam alasatanu tagginchadaaniki naaku sahaayapadutundi	3.00±0.56	0.655	0.944
30. Vyayaamam naaku krotta vyaktulanu kalavadaaniki manchi maargam	2.90±0.67	0.325	0.948
31. Vyayaamam cheyadam dwaaraa naa saareeraka saamardhyam merugupadutundi	3.18±0.48	0.663	0.944
32. Vyayaamam naa sweeya bhaavananu meruguparustundi	3.17±0.51	0.504	0.946
34. Vyayaamam naa maanasika apramattatanu penchutundi	3.20±0.51	0.628	0.944
35. Vyayaamam alasipokundaa saadhaarana kaaryakalaapaalu nirvahinchadaaniki nannu anumatistundi	3.04±0.61	0.602	0.945
36. Vyayaamam naa pani naanyatanu meruguparustundi	3.21±0.48	0.690	0.944
38. Vyayaamam naaku manchi vinodamu	2.97±0.60	0.569	0.945
39. Vyayaamam cheyadam valla itarulu nannu ishtapadtaaru	2.85±0.66	0.510	0.946
41. Vyayaamam naa sareera paniteerunu mottamgaa meruguparustundi	3.20±0.53	0.606	0.945
43. Vyayaamam naa sareeram andamgaa kanipinchelaa chestundi	3.13±0.64	0.594	0.945

S.D.=standard deviation
*The item numbers correspond to the numbers assigned in the original scale

Table 3 Correlation coefficients and Cronbach's alpha of the Exercise Barriers subscale in the Exercise Benefits and Barriers Telugu Scale, India 2022

Item description	Mean±S.D.	Corrected item–total correlation	Cronbach's Alpha if Item is eliminated
4. Vyayaamam naa samayam chaalaa ekkuva teesukuntundi	2.15±0.62	0.592	0.869
6. Vyayaamam nannu alasataku guri chestundi	2.38±0.70	0.570	0.870
9. Vyayaamam cheyadaaniki sthalaalu naaku chaalaa dooranlo unnaayi	2.22±0.64	0.609	0.868
12. Nenu Vyayaamam cheyadaaniki chaalaa ibbandi padutunnaanu	2.10±0.63	0.543	0.871
14. Vyayaamam cheyadaaniki chaalaa ekkuva kharchavutundi	1.95±0.62	0.537	0.872
16. Vyayaama soukaryaalu naaku anukoolamaina vidhamgaa levu	2.29±0.72	0.636	0.866
19. Nenu Vyayaamam valla alasipotunnaanu	2.44±0.68	0.595	0.869
21. Naa jeevita bhaagaswaami (ledaa mukhyamaina itara vyakti) vyaayaamaanni protsahincharu	1.98±0.64	0.359	0.880
24. Vyayaamam kutumba sambandhaala nundi ekkuva samayam teesukuntundi	2.01±0.59	0.681	0.865
28. Vyayaama dustullo unna vyaktulu tamaashaagaa kanipistaarani nenu anukuntunnaanu	2.05±0.60	0.355	0.880
33. Naa kutumba sabhyulu nannu Vyayaamam cheyamani protsahincharu	1.93±0.66	0.599	0.869
37. Vyayaamam naa kutumba baadhyatala samayam nundi ekkuva samayam teesukuntundi	2.10±0.67	0.493	0.874
40. Vyayaamam naaku chaalaa kashtamaina pani	2.29±0.70	0.526	0.872
42. Naaku Vyayaamam cheyadaaniki chaalaa takkuva pradesaalu unnaayi	2.43±0.72	0.566	0.870

S.D.=standard deviation
*The item numbers correspond to the numbers assigned in the original scale

The method for selecting the Exercise Benefits and Exercise Barriers subscales followed the background provided in a previous study done on Mexican elderly women[12] and this approach was used to gather evidence in the Indian context.

In Table 4, a coefficient of 5 or lower was regarded as good adjustment for the chi^2/df index. CFI, GFI, AGFI and NFI coefficients more than 0.90 indicated good adjustment. The standardized PGFI coefficients range between 0 and 1 and both the items were within this range. For the 29 items of the EBBS-T, none of them reached the limit of .90 and only AGFI did not reach the limit of 0.9 for 6 items of the Exercise Benefits subscale.

In Table 5, a coefficient of 5 or lower was regarded as good adjustment for the chi^2/df index. For the 14 items of EBBS-T, only CFI reached the limit of .90 and only CFI & GFI reached the limit of .90 for 9 items of the Exercise Barriers subscale. The standardized PGFI coefficients range between 0 and 1 and both the items were within this range. An ideal coefficient for the RMSEA is 0.08 or lower and only 9 items reached the given limits in the Barriers subscale. For the SRMR, ideal coefficients would be 0.1 or lower, and both the items reached the given limits.

Cronbach's alpha coefficient was higher than 0.7 for all items and showed strong internal consistency for the complete scale, as well as the Benefits and Barriers subscales. Kaiser Meyer Olkin (KMO) values greater than 0.8 can be considered good indicating factor analysis process to be beneficial for these variables. (Table 4, 5)

Table 4 Factorial analysis of the Exercise Benefits subscale of the Exercise Benefits/Barriers Scale, 29 and six-item versions

Benefits of exercise	29 Items	6 Items*	Fit
Validity			
Kaiser Meyer Olkin	0.875	0.841	>0.700
P-value	<0.001	<0.001	<0.05
Absolute and incremental fit†			
Chi-squared	652.565	18.469	
Chi-squared/degrees of freedom	1.803	2.052	<5
P-value	<0.001	<0.001	<0.05
Comparative fit index (CFI)	0.824	0.950	>0.9
Goodness of fit index (GFI)	0.728	0.937	>0.9
Adjusted goodness of fit index (AGFI)	0.673	0.853	>0.9
Normed fit index (NFI)	0.683	0.909	>0.9
Parsimony goodness of fit index (PGFI)	0.606	0.402	0-1
Root mean square error of approximation (RMSEA)	0.089	0.100	<0.08
Root Mean Squared Residual (RMR)	0.026	0.015	0.05-0.1
Standardized Root Mean Square Residual (SRMR)	0.082	0.055	<0.1
Reliability			
Cronbach's alpha	0.946	0.827	>0.70

* The selected items 2, 3, 15, 22, 23, 25 of the exercise benefits subscale correspond to the numbers assigned in the complete questionnaire
†estimation method: maximum likelihood

Table 5 Factorial analysis of the Exercise Barriers subscale of the Exercise Benefits/Barriers Scale, 14 and 9-item versions.

Barriers to exercise	14 Items	9 Items*	Fit
Validity			
Kaiser Meyer Olkin	0.849	0.836	>0.700
P-value	<0.001	<0.001	<0.05
Absolute and incremental fit†			
Chi-squared	123.674	31.553	
Chi-squared/degrees of freedom	1.671	1.214	<5
P-value	<0.001	<0.001	<0.05
Comparative fit Index (CFI)	0.901	0.979	>0.9
Goodness of fit index (GFI)	0.857	0.938	>0.9
Adjusted goodness of fit index (AGFI)	0.797	0.893	>0.9
Normed fit index (NFI)	0.787	0.895	>0.9
Parsimony goodness of fit index (PGFI)	0.604	0.542	0-1
Root mean square error of approximation (RMSEA)	0.081	0.046	<0.08
Root Mean Squared Residual (RMR)	0.032	0.019	0.05-0.1
Standardized Root Mean Square Residual (SRMR)	0.074	0.048	<0.1
Reliability			
Cronbach's alpha	0.879	0.837	>0.70

*The selected items 4, 9, 12, 14, 16, 24, 28, 37, 42 of the exercise barriers subscale correspond to the numbers assigned in the complete questionnaire
†estimation method: maximum likelihood

Discussion

The translation of the EBBS–Telugu version strongly adhered to the recommended translation guidelines[15–17]. It was also ensured that the EBBS–T was a feasible and simple tool that can be administered to Telugu–speaking individuals from various educational and geographical backgrounds. The study found that 45.7% of the participants were obese with a high BMI and 29.1% were overweight with a higher risk of obesity in type 2 diabetes individuals. Only 41.7% were physically active which might be the reason for the risk of obesity in this population. This is similar to another study conducted by Shivani Gupta et al. which provided evidence that increased BMI was a diabetes risk factor in India[18]. Our study provided evidence for a four–factor structure for the Exercise Benefits measure and a two–factor structure for the Exercise Barriers measure which was in agreement with other studies[10,12]. The findings of the present study support the original EBBS nine–factor structure proposed by Sechrist et al[19]. We also found good reliability with Cronbach's alpha value of 0.946 for benefits scale and 0.879 for the Barriers scale. In a similar EBBS study by Victor et al. in an elderly population the Cronbach's alpha values were 0.94, 0.93 and 0.87 for the complete scale, benefits and barriers scale, respectively[10], while a study by Akbari Kamrani reported 0.83, 0.94 and 0.68, respectively, with acceptable reliability and validity[20]. The EBBS was used in a healthy population in technical University students[21], non–exercising female university students in the UK[22], physically active and elderly people[10,20].

In the present study, the EBBS was translated into the Telugu language and psychometric properties along with reliability and validity were analysed in type 2 diabetes individuals. The results of the pilot study done as a pretest procedure demonstrated that the EBBS–T had satisfactory face validity and content validity. A similar study conducted in urban Nepal with type 2 diabetes patients showed a higher prevalence of physical activity with identified Exercise facilitators improved physical fitness, strength and flexibility, social interaction, improved sleep and longevity[23]. The EBBS was also used in patients with polycystic ovary disease[24].

Clinical Implications: The basic objective of using a exercise benefits and barriers tool in different patient populations was to understand their perceptions on the barriers and benefits to exercise which would enable healthcare professionals to address the barriers and encourage patients to engage in exercise programs and also ensure that proper exercise facilities would be provided with necessary evaluation procedures and continuous monitoring throughout the exercise session. Supervised exercise and patient education would also increase exercise compliance and confidence.

Cross cultural adaptation

There were no major issues encountered in the translation and adaptation process of the EBBS into a Telugu version titled "*vyayama prayojanalu mariyu prathibandhakamula kolatha*". Minor problems were experienced in selecting the right synonyms for eg. *Vashyatha, addankulu.*

Some items needed consensus from the experts, like Item 23 – Exercise improves flexibility, of the benefits scale '*vyayamam na vashyatha meruguparustundi'* and the second item— Exercise decreases feelings of stress and tension for me, '*vyayamam naaku othidi mariyu asaukarya bhavalanu taggistundi*'– of the barriers scale. Therefore, after expert consensus, the word '*asaukarya*' in the item was then rephrased to '*aandolana*'. The term flexibility in the 23rd item on the benefits scale was appropriately translated to *vashyatha*. These items required multiple amendments and a trial in the pretesting of EBBS–T before being accepted by the expert committee for implementing the tool in a Telugu–speaking population. After the consensus, the

expert committee finally agreed to finalise the suitable term – '*kandaralanu saanukulam ga undela maarustundi*'– in the pre-testing of the EBBS-T. Analysis of the pretesting of the EBBS reported no problems encountered by the participants in the translated items of the questionnaire.

The strengths of the study were the selection of an adequate sample size and following standard translation methods and guidelines.

Limitation

The limitation of this study was that it was aimed at cross-cultural validation of a subjective questionnaire (EBBS) and objective outcome measures were not included. The study included most responses from an urban population in Telangana.

Future recommendation

A multi-centric study should be conducted in both rural and urban settings and observe any significant differences in the perceptions of exercise participation in future studies.

Conclusion

This study investigated the psychometric properties of a Telugu version of the EBBS in type 2 diabetes and was found to have satisfactory and acceptable reliability and validity. This suggests that the EBBS can be cross-culturally adapted to populations in Telugu-speaking states like Telangana and Andhra Pradesh in India.

Acknowledgement

The authors would like to sincerely thank Dr. Karen Sechrist, Ph.D. for giving permission to take up this research and all the language experts for their exceptional contributions to the whole translation process.

Funding source

The authors did not receive support from any organization for the submitted work.

Conflict of interest

None to declare.

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