Validity and reliability of the Persian version of the dizziness handicap inventory

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Background: Dizziness as a common symptom affecting many aspects of the patient's life and it is hard to be fully evaluated. The dizziness handicap inventory (DHI) is a reliable self-perceived questionnaire in the evaluation of dizziness impacts. The purposes of this study are translation of the DHI to Persian language and measuring its psychometric properties, including face, content, discriminate and construct validity, internal consistency and reliability. **Materials and Methods:** The English version of the DHI is translated to Persian language based on international quality of life assessment protocol. 97 participants, including 57 patients with mean age of 44.5-year-old and 40 healthy people (mean age of 34.1) participated in this study during the period of November 2012 to June 2013 in audiology clinics of Tehran University of medical sciences. **Results:** The Persian version of DHI showed good face and content validity. The internal consistency of DHI-P was good, the Cronbach's alpha was 0.79, 0.82, 0.83, and 0.90 for total and emotional, physical and functional subscales; respectively, in reliability, There was a high correlation between test re-test scores ($r = 0.90$, $P = 0.000$). Intraclass correlation coefficient (ICC) was 0.96 for total score and 0.92, 0.92, and 0.96 for emotional, physical and functional subscales; respectively. **Conclusion:** Considering good psychometric properties, we suggest that DHI-P can use for evaluating the dizziness effects on quality of life in Persian population.

Key words: Dizziness handicap inventory, Persian version, reliability, translation, validity

INTRODUCTION

Dizziness is a common symptom that alters patient's abilities, job, habits, and functions even in remission.[1] It was showed that quality of life is lower in patients with vestibular related dizziness than normal people.[2] However, it's hard to measure and quantify the dizziness effects.[1] or fully perceive the effect of medication or rehabilitation on dizziness.[3] There are some clinical tests utilizing in evaluation of dizzy patients. However, they are not representing the dizziness effects on patient's life or treatment progress, for example caloric test remains abnormal even after resolving the dizziness.[1] These tests are not representing the dizziness effects on the patient's life or treatment progress. Therefore psychometric tools such as questionnaires seem as an alternative method.

Specific self-perceived questionnaire has been designed for measurement of dizziness. Considering the patients' complaints, the dizziness handicap inventory (DHI) was developed by Jacobson and Newman in 1990.[1] The DHI has 25 questions that classify the effects of dizziness in three categories of physical, functional and emotional.

The DHI is a valid and reliable questionnaire that has high internal consistency.[1] This questionnaire assesses the patient's condition and the effect of dizziness on the patient's quality of life. It is easy to perform and interpret and takes 10 min.[3] It is compatible with an international classification of functioning, disability and health that confirmed by WHO in 2001 for classifying the consequences of disease.[4]

The DHI is translated to many languages such as Arabic,[5] Brazilia,[6] Chinese,[2] Dutch,[7] French,[8] German,[9] Italian,[3] Norwegian,[10] Portuguese,[11] Spanish,[12] and Swedish[13] and show good psychometric properties such as validity, reliability and internal consistency in these translations. The DHI is a one of the most common and useful questionnaire for evaluating dizziness and unsteadiness that evaluate the effect of dizziness and unsteadiness and can be very helpful in vestibular rehabilitation. However, this questionnaire does not use in the Persian version yet. The purpose of this study is to translate the DHI into Persian language based on international quality of life assessment (IQOLA) protocol and study the validity and reliability of this version in order to make

this questionnaire available for research and clinics for Persian population.

MATERIALS AND METHODS

Translation

Professor Jacobson gave us the permission to translate DHI to Persian language. The translation was based on protocol of IQOLA[14-16] and included: forward translation with preparing a list of alternative translations, the translators had high proficiency in translation and complete familiarity in both languages. Then, determining the difficulties of translation according to the 100 point scale, and using the substitution of alternative words for making more fluent sentences. The quality of translation, clarity of text, conceptual equivalence (similarity of content/meaning) and use of common language were also determined. Finally, the text was back translated.

Participants

This was a descriptive – analytical and test development study. The 97 people in three set were participated in our study. First set consisted of 30 patients with dizziness and their results used for measuring face validity and reliability. Second set formed from patients of first set and 27 other patients, their results used in discriminate validity and dimensionality. The third set was 40 normal people from staffs and students, their data used for determining the discriminate validity between normality and dizziness effects. All the participants were native Persian speaker.

The patients randomly select from who referred for vestibular evaluation. The inclusion criteria were suffering from vertigo and dizziness for at least 1 month and ability to walk independently or do their routine tasks. They also should not have blindness, musculoskeletal abnormalities, neurologic disorder or paralysis in ENT or neurologic evaluation by ENT and neurologist. The exclusion criteria were inability of cooperation.

During the period of November 2012 to June 2013, dizzy patients were referred from ENT and neurologist specialists to audiology clinics of Tehran University of medical sciences for routine auditory and vestibular evaluation. Auditory evaluation consisted of case history, otoscopy (Reister Inc, Germany), Audiometry (Maico, Germany), tympanometry and acoustic reflex (Maico, Germany.) Case history, bedside examination and video nystagmography (eye Dynamics, United States) were performed for vestibular evaluation. This study approved by Ethics Committee of the Tehran University of Medical Sciences (91d1303430), the patients were informed and consented to participate.

Questionnaire

The DHI is a self-perceived measure with 25 questions. Answer "Yes" to each question has 4 scores; "sometimes" has 2 and "No" has 0 scores. Total score ranges from 0 to 100. The higher total score show a greater amount of disability. The questionnaire has three subscales; physical (7 item), functional (9 item) and emotional (9 item)[1] [Table 1] and showed good validity, reliability and internal consistency in original version[1] and other translations.[2,3,5-13]

Assessment of psychometric properties

Validity

Face validity

The face validity determine by taking views of affected patients.[17-19] The Persian version presented to groups of healthy participants and dizziness patients who were asked about understandability of each sentence.

Content validity

the main questionnaire, Persian version and back translated version presented to five specialists who working in an area of vestibular assessment or rehabilitation for at least 5 years. First they scored each question based on quality, fluency and the cultural context and then they gathered in a focus group session and discussed the quality of translation and cultural adaptation. Because of widely and longtime use of questionnaire, we were almost assured about the content validity and focused more on the cultural adaptation. In the focus group, we tried to match the content of translation to content of original questionnaire.

Discriminate validity

For measuring the discriminate validity, we use the result of handicapped dizziness patients and healthy people to determine a cutoff point for discriminate of handicapping in dizziness patients.

Construct validity

Construct validity is "the degree to which a test measures what it claims, or purports, to be measuring."[20-22] and measure by dimensionality using item-scale correlation after correction for overlap and finally the factor analysis was performed to show the different diminutions of the questionnaire.

Internal consistency

Cronbach α and item internal consistency used for determining the internal consistency[18-23] of the subscales and total score of the DHI-P separately.

Reliability

To determine the test retest reliability, The DHI-P tested twice in 30 patients with 2 days interval. During this period the patients were not taking any treatment and it was assumed that the patients had no change in health

Table 1: The DHI

Items	yes	sometimes	no
P1. Does looking up increase your problem?	Yes	Sometimes	No
E2. Because of your problem, do you feel frustrated?	Yes	Sometimes	No
F3. Because of your problem, do you restrict your travel for business or recreation?	Yes	Sometimes	No
P4. Does walking down the aisle of a supermarket increase your problem?	Yes	Sometimes	No
F5. Because of your problem, do you have difficulty getting into or out of bed?	Yes	Sometimes	No
F6. Does your problem significantly restrict your participation in social activities such as going out to dinner, going to movies, dancing, or to parties?	Yes	Sometimes	No
F7. Because of your problem, do you have difficulty reading?	Yes	Sometimes	No
P8. Does performing more ambitious activities like sports, dancing, household chores such as sweeping or putting dishes away increase your problem?	Yes	Sometimes	No
E9. Because of your problem, are you afraid to leave your home without having someone accompany you?	Yes	Sometimes	No
E10. Because of your problem, have you been embarrassed in front of others?	Yes	Sometimes	No
P11. Do quick movements of your head increase your problem?	Yes	Sometimes	No
F12. Because of your problem, do you avoid heights?	Yes	Sometimes	No
13. Does turning over in bed increase your problem?	Yes	Sometimes	No
F14. Because of your problem, is it difficult for you to do strenuous housework or yardwork?	Yes	Sometimes	No
E15. Because of your problem, are you afraid people may think you are intoxicated?	Yes	Sometimes	No
F16. Because of your problem, is it difficult for you to go for a walk by yourself?	Yes	Sometimes	No
P17. Does walking down a sidewalk increase your problem?	Yes	Sometimes	No
E18. Because of your problem, is it difficult for you to concentrate?	Yes	Sometimes	No
F19. Because of your problem, is it difficult for you to walk around your house in the dark?	Yes	Sometimes	No
E20. Because of your problem, are you afraid to stay home alone?	Yes	Sometimes	No
E21. Because of your problem, do you feel handicapped?	Yes	Sometimes	No
E22. Has your problem placed stress on your relationships with members of your family or friends?	Yes	Sometimes	No
E23. Because of your problem, are you depressed?	Yes	Sometimes	No
F24. Does your problem interfere with your job or household responsibilities?	Yes	Sometimes	No
P25. Does bending over increase your problem?	Yes	Sometimes	No

DHI = Dizziness handicap inventory

condition based on the case history and duration of dizziness. The reliability was determined by intraclass correlation coefficient (ICC [2,1]); 2 times testing and one examiner. The smallest detectable change (SDC) shows the real change in the individual patient's condition that is not due to measurement errors.

Data analysis

The analysis was performed with SPSS version 19.0, (IBM SPSS software). Quantitative data reported by mean and standard deviation. Normality of data was checked by K-S test. For discriminate validity, we used the receiver operating characteristic (ROC) curve to computed cut-off point. In construct validity, item scale correlation in each subtest and between items in different subtest and also calculate correlation between each item and total score used by Pearson correlation. The factor analysis with no rotation, performed in two ways, extracting all factors and limiting the extraction to three factors. We choose ceiling effect as if more than 15% of participants achieved the highest score.[23] In reliability section, Pearson correlation used for conform relationship between test re-test scores. ($ICC_{(2,1)}$) was compute by one way ANOVA. To calculate of the SDC we used; $SDC = 1.96 \times \sqrt{2 \times SEM}$ and SEM = Standard deviation $\sqrt{1}$-test score reliability.

RESULTS

Translation and cultural adaptation

The translation was performed without serious problem. Most items high scores in both area (quality of the translation and cultural adaptation). However, the items 1, 2, 4, 6, 8, 14, 17, 19 and 21 had lowest score, which were discussed in focus group. The specialists discussed about the substitutions as below: In item 6, order of examples of social activity changed and we first mentioned more popular social activity in our culture. We had some difficulty in adaptation of the word "ambitious" In item 8 and the word "strenuous" in item 14, but we tried to choose the best word according to subscales of items. It was mentioned about item 21 that the word "handicapped" may cause some defensive behavior and negative emotion for the patients in our culture, so we tried to choose the word that not change the item and not cause the negative emotion.

Study population

The 97 people participated in this study. 30 patients were in the first set for testing the reliability (46% females) aged in average 45.3-year-old (18-70 years, SD: 14.0.) The second set formed of 57 patients (35% female) for factor analysis and they had mean age of 44.5-year-old (18-70 years, SD: 14.2.) In patients, the

duration of dizziness ranged from 1 month to 10 years (mean: 34.3 month, SD: 39.8) the third set was 40 normal people that didn't have dizziness (11 females 27.5%) with 17-68-year-old with the mean age of 34.1 ± 12.8. The five specialists with at least 5 years experience in vestibular assessment and rehabilitation also helped us in the focus group.

Assessment of psychometric properties
Validity
Face validity
The questionnaire presented to healthy participants and patients to find out how much understand each item correctly. The fluency and understandability of the Persian version of DHI confirmed by healthy participants and patients showed good face validity.

Discriminate validity
The results of normal people compared to the patients. The normal persons earned the score 0-12 with the mean score of 4.1 (SD = 3.6) the ROC curve used for determining the sensitivity and specificity of different cutoffs. The cut-off value of 10 has had the best combination of sensitivity (90%) and specificity (98%) to discriminate the handicap patients from normal people.

Construct validity
Checking dimensionality showed the moderate correlation between most items scale in each subtest ($0.28 < r < 0.58$, $P < 0.05$) and There was a moderate correlation between each item and total score too ($0.32 < r < 0.72$, $P < 0.02$).

Factor analysis showed eight factors that contain 74% of variance [Figure 1]. As shown in the screen plot [Figure 1], the first factor was the most recognizable. This factor included 27.2% of all variance and consisted of items 9, 10, 15, 16, 18, 20, 21 and 23. These items consist with the emotional subscale of the original DHI, only the item 16 belongs to physical subscale. Items 2 and 22 belong to original emotional subscale but were not included in our factor 1. The other items belong to physical and functional subscale spread to different factors.

In factor analysis, we tried to analyze the data with three fixed factors too, but it only covers 46% of variance and 16 out of 25 items categorized in factor 1 that include the most emotional factors (items 9, 10, 15, 18, 20, 21, 22, 23) but the item 2 that belongs to original emotional subscale fit in factor 2. Factor 2 also includes item 5 and 6 (functional items) and item 3 include 1,7,13,17, and 19 that mostly are physical items in original subscale.

Ceiling effect
The score >80 selected for checking ceiling effect, because they cover at least 20% of all possible scores but Only 2
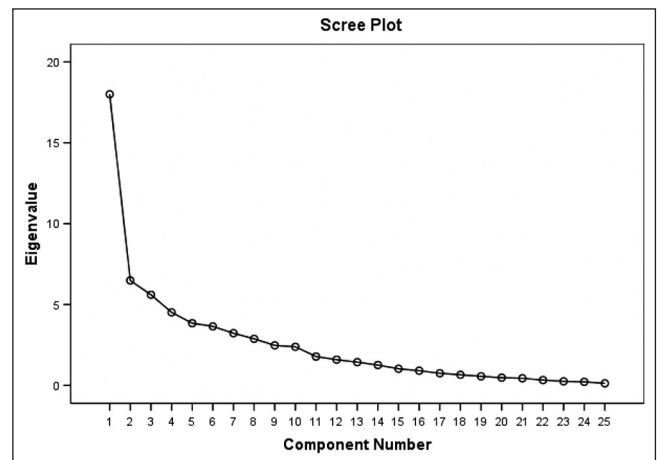

Figure 1: Screen plot of factors of the DHI-P

out of 57 patients (3.5%) had total score >80. Therefore, no ceiling effect was observed and the reliability results must be accurate.

Internal consistency
Cronbach's alpha for the total and emotional, physical and functional subscales were 0.79 and 0.82, 0.83, and 0.90; respectively it's showed good internal consistency for total score and individual subscales of the DHI-P. The scores of subscales had a good significant correlation with each other too ($0.64 < r < 0.75$, $P = 0.000$).

Reliability
To assessment of test-retest reliability, Paired *t*-tests showed no significant difference between test and re-test total scores ($P = 0.58$). There was a high correlation between test re-test scores ($r = 0.90$, $P = 0.000$). A high ICC[23-25] ICC$_{(2,1)}$ for total score obtained 0.96 for single measure ($P = 0.000$, 95% CI: 0.93-0.98) and 0.92, 0.92, and 0.96 in emotional, physical and functional subscales, respectively.

The SDC obtained 6.9, 6.3, 4.9 and 19.0 for emotional, physical and functional subscales and the total score, respectively, that show if an individual patient's condition has really changed, the total score must change at least 19.0 scores.

DISCUSSION

The DHI-P showed good face and content validity and good reliability. The fluency and understandability of DHI-P was confirmed by the participants. The original DHI[1] and its translated versions[2,3,5-13] also showed good validity and there are no problems in translations and cross-cultural adaptations[9] of this questionnaire.

It was reported that the anxiety and depression are related to dizziness and vertigo, and the secondary psychiatric

disorder can develop following vestibular vertigo.[26] And as a functional aspect, Patients who have higher scores of DHI, have the greater amount of functional impairment and walking problems.[27] The patients with a total score higher than 60 was functionally impaired and high-risk of falling.[27] in our study the patients could walk by themselves, this issue restricted the score higher than 60, and the scores in almost cases were under 60. Furthermore, there were no relations between DHI and age[1] or between physical performance, home management and recreation with age, sex or duration of symptom.[28]

In evaluating of normal persons, they obtain the low scores, 0.9 (±1.3), 2.0 (±2.2), 1.2 (±1.5) and 4.1 (±3.6) for physical, emotional, functional subscales and total score respectively. A score of 10 could be a good cutoff between normality and dizziness effects. Our patients' analysis showed a higher number of the patients had problems with items 5 (75%), 11 (74%), 25 (72%) and 1 (63%), respectively. These items are physical or functional items. In the other hand the Items 9 (24%), 20 (22%) and 15 (17%) had least positive response in the patients respectively. These items are emotional in the original subscale. These results are against the result of normal participants that show higher positive score in emotional questions. These may show the higher probability of physical or functional outcome due to dizziness than emotional outcomes.

The SDC shows real changes in individual patients. This change is not due to measurement errors and shows the change in the patient's status. Therefore, if the change of the total score was >19, the changes are significant, and the treatment considers helpful.

We performed factor analysis and compared extracted factors to original subscales. In the analysis, item 16 arranged in factor 1 that includes the most original emotional items, this item question the ability of walking by themselves and it is possible that the patients draw out the meaning of loneliness from walking without help. Item 2 and 22 are about the feeling and stress, and it's rational to categorize in emotional subscale, but they didn't but their variance in different factors was close. The difference between physical and functional items is somehow vague and we couldn't completely differentiate them.

Our result failed to completely support the original structure. Also the factor analysis of the original version (English),[29] Dutch,[30] Spanish,[31] German[4,9] and Norwegian[10] version of DHI showed various factors. It usually may because of the quality of translation, cultural difference or different sample size, but it seems that in the

creation of DHI, the items were selected and then arranged in three factors. Maybe the selecting the important context and subscales and then choose the compatible items for each subscale obtain better structure. We suggest to not using the DHI subscales or using two subscales of emotional and physical-functional.

The Persian version, the original version and other translations showed high internal consistency [Table 2].[1-3,5-13] The DHI-P also like other versions of DHI showed good reliability and high ICC [Table 3]. It is very important the time period between test and re-test was chosen correctly. The gap between test and re-test must be long enough to subjects forget the first test, and short enough for the patient's condition don't change. This period can be long as 7 days such as used in the Chinese translation of DHI[2] or be a shorter time period (2 day) such as our study or the Norwegian version of DHI.[10] Because of good reliability and internal consistency of Persian version, the total score and subscales of DHI-P can use for evaluating of patients and the origin of otologic or non-otologic seems to have no significant effect on the reliability of results.[10]

The DHI has advantages such as simplicity, understandability and compatibility with WHO's International Classification of Functioning[4] that give us the ability to identification of the patients[10] the DHI can differentiate between healthy condition and mild disability,[9] change in score due to treatment[2] and showing change or no change in patient's condition.[10] But the DHI have some limitations such as

Table 2: Internal consistency (Cronbach's alpha) of different versions of DHI

Version	Total	Functional	Emotional	Physical
Original (English, US)	0.89	0.85	0.72	0.78
Arabic	0.92	0.87	0.79	0.81
Chinese	0.75	0.87	0.84	0.79
German	0.90	0.80	0.82	0.71
Italian	0.92	0.82	0.84	0.75
Norwegian	0.95	–	–	–
Persian	0.79	0.90	0.82	0.83

DHI = Dizziness handicap inventory

Table 3: Intraclass correlation coefficient of total score of different versions of DHI

Version	ICC
Original (English, US)	0.72-0.97
Chinese	0.87 (0.77-0.93)
Dutch	0.95 (0.91-0.95)
French	0.98
German	0.89 (0.57-0.96)
Norwegian	0.90
Persian	0.96 (0.93-0.98)

DHI = Dizziness handicap inventory

ambiguity between physical and functional items or as mentioned before[9] 3 point response scale that miss the small change in the patient's condition.

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AUTHOR'S CONTRIBUTION

ShJ contributed in the conception and design of the work, analysis and interpretation of data, conducting the study, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. SJ contributed in the conception of the work, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. EB contributed in the conception of the work, conducting the study, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. AP contributed in the conception of the work, revising the draft, approval of the final version of the manuscript, and agreed for all aspects of the work. AD contributed in the conception of the work, approval of the final version of the manuscript, and agreed for all aspects of the work.

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