



Translation and Validation of Dizziness Handicap Inventory in Hindi Language

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Abstract

The dizziness handicap inventory (DHI) is a widely used questionnaire for assessing the impact of dizziness on daily life. There is a need for validated translations of the DHI to accommodate diverse linguistic populations, enabling clinical and research comparisons. This study aimed to translate and validate the DHI into Hindi language. The DHI was translated into Hindi following established guidelines. The translated version underwent validation among Hindi-speaking patients presenting with dizziness at an outpatient ENT clinic in this cross-sectional study. Reliability and validity analyses were conducted, including Cronbach's alpha, split-half reliability, and factor analysis. A total of 153 participants completed the DHI-Hindi, with a mean score of 37.28 (SD = 15.63). Ceiling and floor effects were absent. The Cronbach's alpha coefficient for the overall scale was 0.785, indicating good reliability. Factor analysis revealed a three-factor solution, consistent with previous studies, indicating good construct validity. The translation and validation process yielded a reliable and valid version of the DHI in Hindi language, suitable for assessing the impact of dizziness in Hindi-speaking population.

Keywords Dizziness Handicap Inventory · Hindi language · Dizziness · Quality of life · Factor analysis · Statistical · Translations · Patient reported outcome measures · Reliability · Validity

Introduction

Dizziness is a common symptom for seeking consultation in otology clinic. It is a distressing symptom significantly impacting daily functioning and quality of life. The Dizziness Handicap Inventory (DHI) is a widely utilized patient reported outcome measure consisting of 25 items to assess the impact of dizziness on quality of life [1]. With its comprehensive focus on physical, emotional, and functional aspects related to dizziness, the DHI offers valuable insights into the challenges faced by individuals with vestibular disorders. Originally developed in the English language in

1990 [2], the DHI has since been translated and validated in various languages, reflecting its wide acceptability and reliability [3–10].

Translation, cross cultural adaptation and validation of DHI in different languages enables catering to linguistically diverse populations, facilitating clinical comparisons and cross-cultural research. Hindi being the most widely spoken language in the Indian subcontinent, presents a significant opportunity for translation and standardization of the DHI.

The proposal to translate and validate DHI in Hindi stems from recognizing the limitations of solely relying on English-based assessment tools. Language barriers can impede accurate understanding and response to assessment questions, potentially leading to misinterpretation and misdiagnosis. Moreover, the absence of standardized tools may introduce variability due to translation or interpretation by the questionnaire administrator.

This study aims to translate and validate the Dizziness Handicap Inventory in the Hindi language, thereby providing a standardized tool to assess the impact of dizziness in patients, ensuring its acceptance and validity amongst Hindi-speaking individuals. By overcoming language barriers and reducing assessment variability, this standardized tool aids

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in the diagnosis and management of vestibular disorders. Furthermore, it facilitates comparisons across languages for clinical or research purposes, fostering a more comprehensive understanding of impact of dizziness across linguistically diverse populations.

Methodology

Study Design and Setting

This study employed a cross-sectional design to assess the validity and reliability of the Hindi translated version of Dizziness Handicap Inventory among individuals presenting with dizziness or vertigo in the Out-Patient Department of Otorhinolaryngology in a tertiary health-care centre.

DHI-Hindi Development

The Dizziness Handicap Inventory questionnaire originally comprises of 25-items in English, where responses are scored as 0 points for “no,” 2 points for “sometimes,” and 4 points for “yes.” To develop the Hindi version (DHI-Hindi), we employed a systematic translation process.

Two forward translators proficient in both English and Hindi languages independently translated the DHI questionnaire into Hindi. Discrepancies between these independent translations were resolved by the authors, ensuring consistency, resulting in reconciliation into a single forward translation.

Subsequently, another bilingual individual, not familiar with the original questionnaire, independently back-translated the Hindi version into English. The back-translated version was then reviewed by the authors against the original instrument, and any discrepancies were identified and resolved. The DHI-Hindi underwent further iterative refinement based on feedback obtained from a pilot test involving 20 dizzy patients attending the Out-Patient Department. Incorporating this feedback, the translation was finalized to ensure its suitability and effectiveness in accurately capturing respondents' experiences. Before validation, the final version of DHI-Hindi underwent a thorough proof-reading process to ensure accuracy and completeness (Table 1).

Study Participants and Methodology for Validation

Potential participants were adults (age ≥ 18 years) with chief complaint of dizziness or vertigo and possessing the ability to read and comprehend the Hindi language sufficiently to independently respond to the DHI-Hindi. Participants were recruited after obtaining informed written consent.

We excluded individuals with significant cognitive impairments or conditions that might affect their ability to

provide reliable responses, thereby impeding questionnaire completion. Also, individuals who presented with dizziness as part of an acute medical emergency requiring immediate intervention were excluded from the study. Participants were asked to complete the DHI-Hindi by themselves during their OPD visit. Responses on the DHI-Hindi were recorded in an Excel sheet for subsequent analysis.

Data Analysis

Data analysis was conducted using SPSS version 23.0. The reliability of the DHI-Hindi questionnaire was assessed using Cronbach's alpha coefficient and split-half reliability analysis. Construct validity was examined through factor analysis. The Kaiser–Meyer–Olkin (KMO) measure was utilized to assess sampling adequacy. The results of the study are summarized below.

Results

Participant Characteristics and DHI-Hindi Score

A total of 153 participants completed the Hindi version of the Dizziness Handicap Inventory (DHI-Hindi). Of these participants, 78 were female and 75 were male. The mean age of the participants was 51.47 years, with standard deviation of 12.86. The age range of the participants was 24 to 77 years.

The mean total DHI-Hindi score for all participants was 37.28, with a standard deviation of 15.63. The mean score for females was 37.64 (standard deviation = 15.01), while the mean score for males was 36.89 (standard deviation = 16.35). The difference in mean scores between females and males was not statistically significant ($p=0.40$). On analysis of variance (one-way ANOVA), the total DHI-Hindi scores among the different age groups did not exhibit significant differences ($p=0.07$). (The age groups were categorized as 20–30 years, 31–40 years, 41–50 years, 51–60 years, 61–70 years, and 71–80 years.)

Ceiling and Floor Effect

The Dizziness Handicap Inventory has a potential score range from 0 to 100. In our sample, the lowest score recorded was 12, observed in 1 participant (0.7%), while the highest score was 88, recorded in 2 participants (1.3%). Nine participants (5.88%) scored below 20, and 3 participants (1.96%) scored above 80. The interquartile range (IQR) for the DHI-Hindi total score ranged from 27 to 44, with a median score of 34. Overall, no ceiling or floor effects were observed. The scatter plot and median (IQR) of DHI-Hindi score in our participants are depicted in Figs. 1 and 2.

Table 1 Dizziness Handicap Inventory-Hindi

Item	Original item of DHI in English language	Translated item of DHI-H in Hindi language
dhi1	Does looking up increase your problem?	क्या ऊपर देखने से आपकी समस्या बढ़ जाती है?
dhi2	Because of your problem, do you feel frustrated?	आपकी समस्या के कारण, क्या आप हताश महसूस करते हैं?
dhi3	Because of your problem, do you restrict your travel for business or recreation?	आपकी समस्या के कारण क्या आप काम या मनोरंजन के लिए यात्रा करने से बचते हैं?
dhi4	Does walking down the aisle of a supermarket increase your problems?	क्या बाज़ार में चलना आपकी समस्याओं को बढ़ाता है?
dhi5	Because of your problem, do you have difficulty getting into or out of bed?	आपकी समस्या के कारण, क्या आपको बिस्तर पर लेटने या बिस्तर से उठने में कठिनाई होती है?
dhi6	Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to the movies, dancing, or going to parties?	क्या आपकी समस्या सामाजिक कार्यों में बाधा डालती है, जैसे कि खाने के लिए बाहर जाना, फिल्म देखने जाना वगैरह?
dhi7	Because of your problem, do you have difficulty reading?	आपकी समस्या के कारण, क्या आपको पढ़ने में कठिनाई होती है?
dhi8	Does performing more ambitious activities such as sports, dancing, household chores (sweeping or putting dishes away) increase your problems?	खेल, नृत्य, घर के काम (जैसे झाड़ू लगाना या बर्तन साफ करना) क्या आपकी समस्याओं को बढ़ाते हैं?
dhi9	Because of your problem, are you afraid to leave your home without having someone accompany you?	आपकी समस्या के कारण क्या आप अकेले बाहर जाने से डरते हैं?
dhi10	Because of your problem have you been embarrassed in front of others?	अपनी समस्या के कारण क्या आपको कभी दूसरों के सामने शर्मिंदा होना पड़ा है?
dhi11	Do quick movements of your head increase your problem?	क्या तेजी से सिर हिलाने से आपकी समस्या बढ़ जाती है?
dhi12	Because of your problem, do you avoid heights?	आपकी समस्या के कारण, क्या आप ऊँचाई से बचते हैं?
dhi13	Does turning over in bed increase your problem?	क्या करवट बदलने पर आपकी समस्या बढ़ जाती है?
dhi14	Because of your problem, is it difficult for you to do strenuous homework or yard work?	आपकी समस्या के कारण, क्या आपके लिए घर या आंगन में शारीरिक मेहनत वाले काम करना मुश्किल है?
dhi15	Because of your problem, are you afraid people may think you are intoxicated?	अस्थिर होने के कारण, क्या आप डरते हैं कि लोग सोच सकते हैं कि आप नशे में हैं?
dhi16	Because of your problem, is it difficult for you to go for a walk by yourself?	आपकी समस्या के कारण, क्या आपके लिए अकेले चलना मुश्किल है?
dhi17	Does walking down a sidewalk increase your problem?	क्या सड़क किनारे फुटपाथ पर चलना आपकी समस्या को बढ़ाता है?
dhi18	Because of your problem, is it difficult for you to concentrate	आपकी समस्या के कारण, क्या आपके लिए ध्यान केंद्रित करना मुश्किल है?
dhi19	Because of your problem, is it difficult for you to walk around your house in the dark?	आपकी समस्या के कारण, क्या आपके लिए अंधेरे में अपने घर में चलना मुश्किल है?
dhi20	Because of your problem, are you afraid to stay home alone?	आपकी समस्या के कारण, क्या आप अकेले घर पर रहने से डरते हैं?
dhi21	Because of your problem, do you feel handicapped?	आपकी समस्या के कारण, क्या आप असमर्थ महसूस करते हैं?
dhi22	Has the problem placed stress on your relationships with members of your family or friends?	क्या आपकी समस्या आपके रिश्तेदार या दोस्तों के साथ आपके संबंधों में तनाव का कारण है?
dhi23	Because of your problem, are you depressed?	आपकी समस्या के कारण, क्या आप उदास हैं?
dhi24	Does your problem interfere with your job or household responsibilities?	क्या आपकी समस्या आपकी नौकरी या घरेलू जिम्मेदारियों में बाधा डालती है?
dhi25	Does bending over increase your problem?	क्या झुकने से आपकी परेशानी बढ़ जाती है?

Hindi translation of the items of Dizziness Handicap Inventory validated in our study

Reliability Analysis

The Cronbach's α coefficient for the overall DHI-Hindi scale was 0.785, indicating good internal consistency. Removal of any item did not significantly increase the reliability of the scale, as indicated by the values of Cronbach's alpha if item deleted (Table 2).

Additionally, split-half reliability analysis yielded satisfactory results, with a Cronbach's alpha coefficient of 0.746 for odd items and 0.704 for even items of the DHI-Hindi scale. The Spearman-Brown coefficient for unequal length was 0.813, and Guttman split-half coefficient was 0.811, further supporting the good reliability and internal consistency of the DHI-Hindi questionnaire (Table 3).

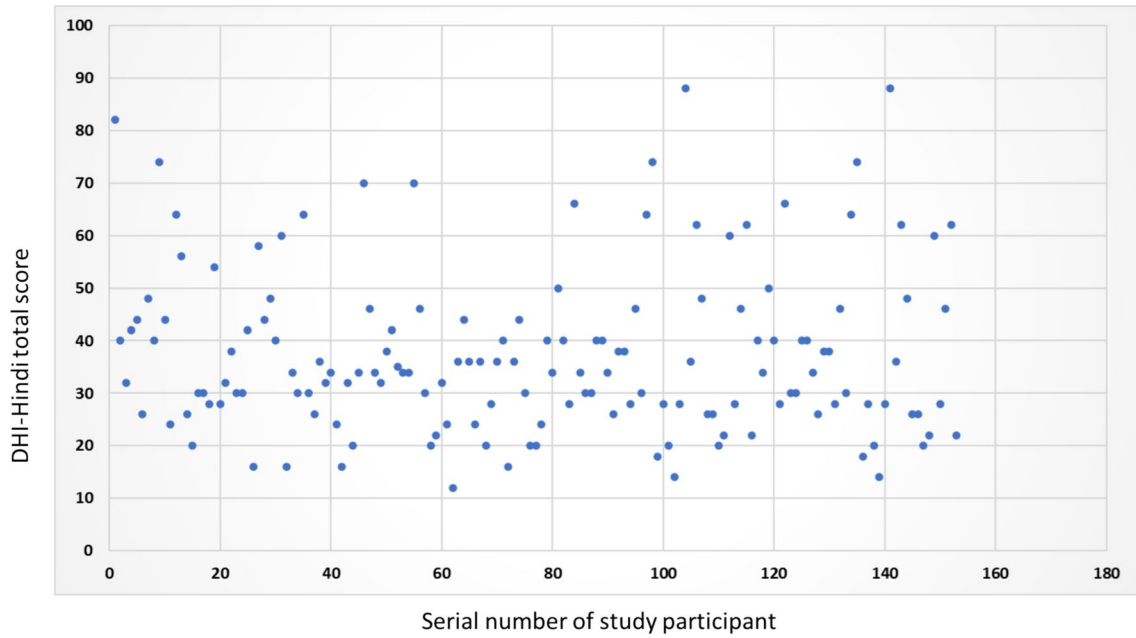


Fig. 1 Scatter plot for DHI- Hindi total score in our study participants

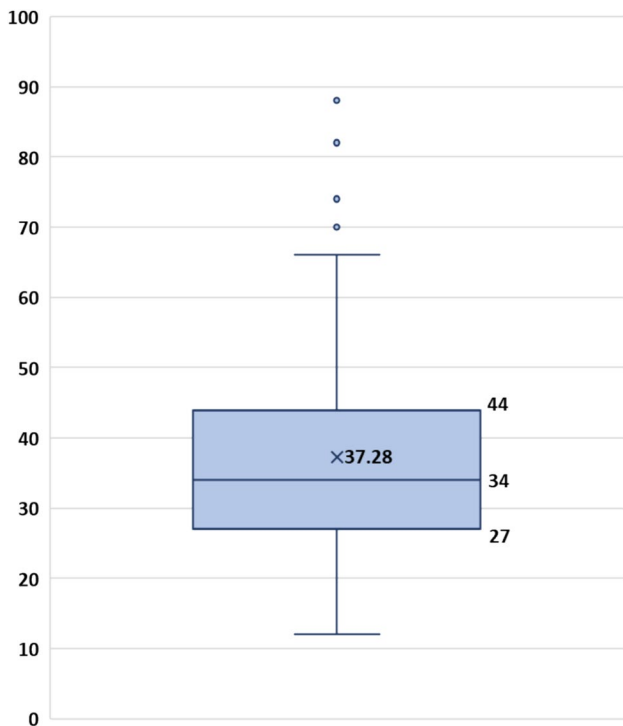


Fig. 2 Mean and Median (inter-quartile range) for DHI-Hindi total scores

Table 2 Cronbach's Alpha coefficient for the DHI-Hindi scale if item is delayed

Items	Scale mean if item deleted	Cronbach's alpha if item deleted
dhi1	35.52	0.786
dhi2	35.84	0.776
dhi3	35.92	0.779
dhi4	36.06	0.773
dhi5	34.93	0.783
dhi6	36.42	0.771
dhi7	36.57	0.776
dhi8	36.07	0.771
dhi9	36.10	0.770
dhi10	36.92	0.774
dhi11	35.01	0.790
dhi12	34.99	0.772
dhi13	35.04	0.789
dhi14	36.24	0.770
dhi15	36.97	0.780
dhi16	36.48	0.772
dhi17	36.57	0.769
dhi18	36.06	0.766
dhi19	36.42	0.766
dhi20	36.63	0.773
dhi21	36.67	0.768
dhi22	36.90	0.779
dhi23	36.27	0.766
dhi24	36.19	0.764
dhi25	35.31	0.778

Validity

Construct validity was assessed using factor analysis. The Kaiser–Meyer–Olkin measure of sampling adequacy was

Table 3 Split-half reliability analysis for DHI- Hindi

Cronbach's Alpha	Part 1	Value	0.746
		Number of Items	13 ^a
	Part 2	Value	0.704
		Number of Items	12 ^b
	Total Number of Items		25
Correlation Between Forms			0.684
Spearman-Brown Coefficient	Equal Length		0.812
	Unequal Length		0.813
Guttman Split-Half Coefficient			0.811

^aOdd items in DHI-H (dhi1, dhi3, dhi5, dhi7, dhi9, dhi11, dhi13, dhi15, dhi17, dhi19, dhi21, dhi23, dhi25);
^bEven items in DHI-H (dhi2, dhi4, dhi6, dhi8, dhi10, dhi12, dhi14, dhi16, dhi18, dhi20, dhi22, dhi24)

0.76, and Bartlett's test of sphericity was significant ($\chi^2(300) = 1085.72, p < 0.001$), indicating suitability for factor analysis. Principal component extraction revealed nine components with Eigen values greater than 1; however, based on the scree plot (Fig. 3), which levelled out at the fourth factor, three components were retained. Item allocation for the three-factor extraction, after suppressing small components (<0.3), is presented in Table 4. Note that dh2 did not exhibit a factor loading greater than 0.3 onto any of the three

components; therefore, the highest factor loading of 0.277 onto component 1 was considered. The component correlation matrix of the three-factor solution for DHI-Hindi is shown in Table 5.

The consistency of the three-factor solution with both the original instrument (Table 6) and validated versions of the Dizziness Handicap Inventory (DHI) in various other languages further reinforces the construct validity of the translated DHI-Hindi.

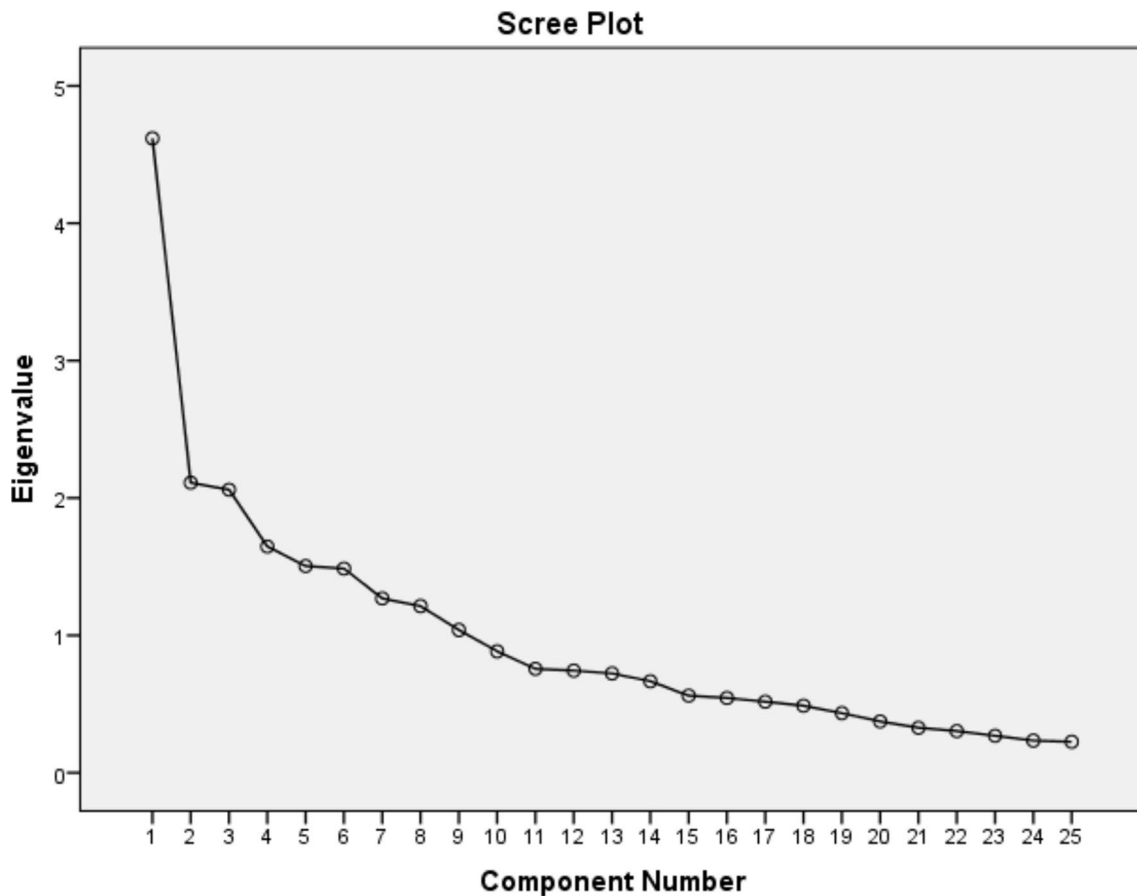


Fig. 3 Scree plot for factor analysis

Table 4 Structure matrix for Principal Component Analysis

Items	Component		
	1	2	3
dhi1		0.531	
dhi2	0.277		
dhi3			0.621
dhi4			0.627
dhi5		0.634	
dhi6			0.583
dhi7			0.583
dhi8			0.551
dhi9	0.356		
dhi10	0.323		
dhi11		0.344	
dhi12			0.350
dhi13		0.539	
dhi14			0.612
dhi15	0.442		
dhi16	0.520		
dhi17	0.572		
dhi18	0.619		0.306
dhi19			0.335
dhi20	0.639		
dhi21	0.593		
dhi22	0.495		
dhi23	0.526		0.336
dhi24	0.728		
dhi25		0.362	

Rotation method: Oblimin with Kaiser Normalization

Small components with absolute value 0.3 are suppressed (except dh2)

Table 5 Component Correlation Matrix

Component	1	2	3
1	1.000	0.011	0.251
2	0.011	1.000	0.057
3	0.251	0.057	1.000

Extraction method: Principal Component Analysis; Rotation method: Oblimin with Kaiser Normalization

Table 6 Component structure of DHI-Hindi

Domains of DHI	Originally proposed item allocation	Equivalent component structure in our study (DHI- Hindi)
Physical	1, 4, 8, 11, 13, 17, 25	1, 5 , 11, 13, 25
Functional	3, 5, 6, 7, 12, 14, 16, 19, 24	3, 4 , 6, 7, 8 , 12, 14, 19
Emotional	2, 9, 10, 15, 18, 20, 21, 22, 23	2, 9, 10, 15, 16 , 17 , 18, 20, 21, 22, 23, 24

Comparison of items included in the originally proposed domains of DHI and equivalent component structure of DHI-Hindi. (Bold items represent the items which load onto a different component than in the original DHI proposal)

Overall, these results support the reliability and validity of the translated version of Dizziness Handicap Inventory in Hindi-speaking populations.

Discussion

The translation and validation of assessment tools such as the Dizziness Handicap Inventory (DHI) are crucial for ensuring accurate evaluation and effective management of vestibular disorders across diverse linguistic populations. In this study, we successfully developed the Hindi translated version of DHI (DHI-Hindi) using a systematic process, and subsequently validated the same in Hindi-speaking individuals suffering from dizziness.

The process of translation involved multiple steps to ensure linguistic and cultural equivalence between the original English version and the translated DHI-Hindi. This included forward translation by bilingual individuals, reconciliation of translations, back translation, iterative refinement based on feedback from pilot testing and proof-reading. Such a rigorous approach is essential for crafting a translated version that accurately captures the intended meaning of the original instrument, ensures that the translated instrument is not only understandable and pertinent to individuals proficient in Hindi, but also aligns with recommended practices for translation and cross-cultural adaptation of patient-reported outcomes measures [11].

The reliability analysis of the DHI-Hindi revealed high internal consistency, as evidenced by a Cronbach’s alpha coefficient of 0.785 for the overall scale, exceeding the recommended level of 0.7 for establishing a reliable measure for population studies. Furthermore, delaying any item did not significantly increase the reliability of the scale, indicating that each item contributes meaningfully to the overall reliability of the DHI-Hindi. Additionally, the split-half reliability analysis yielded satisfactory results, with Cronbach’s alpha coefficients of 0.746 for odd items and 0.704 for even items of the DHI-Hindi scale. The high Spearman-Brown coefficient for unequal length (0.813) and Guttman split-half coefficient (0.811) further supports the good reliability and internal consistency of the DHI-Hindi questionnaire.

Furthermore, the factor analysis confirmed the construct validity of the DHI-Hindi.

Factor analysis revealed a three-factor solution in our study, consistent with the original instrument and validated versions in other languages. This indicates that the DHI-Hindi effectively captures the multidimensional aspects of dizziness-related handicap, encompassing physical, emotional, and functional components, similar to the original DHI.

In the original DHI instrument, items were categorized into three content domains representing the physical, functional and emotional aspects of dizziness, although this classification was not based on statistical factor analysis [2]. However, subsequent studies have proposed various factorial solutions, highlighting the multidimensional nature of the DHI.

For instance, some studies suggested a two-factor solution, such as general functional limitations and postural difficulties, while others revealed a three-factor solution [12]. A study conducted for validation of Lithuanian version of Dizziness Handicap Inventory found a two factor solution [4]. The analysis on Polish version of DHI identified three factor solution which was comparable to the original factor structure. However, the component structure was different from the original subscales [7]. In the Spanish version of the DHI, factors were related to vestibular handicap, vestibular disability, and visuo-vestibular disability. Similarly, the Brazilian version identified factors including mental structure, physical limitations, and loss of function [13]. The German version delineated three factor solution encompassing activity and participation limitations, emotional problems, and motion activity in everyday life [5]. Additionally, the Turkish version identified factors related to functional limitations, physical problems, and emotional problems [14]. Five factor solution has been reported in used of DHI for clinical evaluation of dizzy patients with various vestibular pathologies [1]. The Japanese version too found a five-factor solution, indicating further variability in the factorial structure of the Dizziness Handicap Inventory (DHI) [9].

Despite variations in factorial solutions across studies, most converge into two to three factor solutions, indicative of the multidimensional nature of the DHI. Our study's finding of a three-factor solution for the DHI-Hindi further supports this trend, albeit with slight variations in component structure (Table 6). Nevertheless, this suggests that the DHI-Hindi retains the fundamental conceptual framework of the original DHI, providing a comprehensive assessment of dizziness-related handicap in Hindi-speaking populations.

By providing a standardized tool to assess the impact of dizziness on quality of life, the DHI-Hindi enables healthcare professionals to accurately diagnose vestibular disorders and monitor treatment outcomes in Hindi-speaking patients. Moreover, researchers can conduct cross-cultural

studies comparing dizziness-related handicap across different linguistic populations, contributing to a broader understanding of vestibular disorders.

Conclusion

In conclusion, this study successfully translated and validated the Dizziness Handicap Inventory in Hindi, producing the DHI-Hindi. Through a rigorous translation process adhering to established guidelines, the DHI-Hindi maintains conceptual equivalence while capturing the nuances of the Hindi-speaking population. The statistical analysis demonstrates the reliability and validity of the DHI-Hindi, with high internal consistency and a three-factor solution consistent with the original instrument and validated versions in other languages, although with a different component structure.

The DHI-Hindi provides a standardized and reliable tool for assessing the impact of dizziness in Hindi-speaking individuals, aiding in the accurate diagnosis and effective management of vestibular disorders. By overcoming linguistic barriers and facilitating cross-cultural research, the DHI-Hindi contributes to a broader understanding of dizziness-related handicap. DHI-Hindi can be utilized in clinical practice to monitor treatment outcomes and guide interventions for individuals experiencing dizziness, ultimately improving patient care and research outcomes in Hindi-speaking populations.

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Declarations

Conflict of interest Authors have no potential conflict of interest (financial and non-financial).

Ethical Approval The study has been conducted in accordance with the ethical standards of the institution and the 1964 Helsinki declaration and its later amendments.

Informed Consent Informed written consent has been taken from the participants.

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