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Translation and validation of the dizziness handicap inventory in Bengali language

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Abstract
The Dizziness Handicap Inventory (DHI) assesses the impact of dizziness on Quality of Life and evaluative tool. Present study aimed to translate and validate the Dizziness Handicap Inventory (DHI) into the Bengali language to provide a reliable and culturally relevant tool for assessing dizziness-related handicaps among Bengali-speaking individuals. The DHI in English was translated into Bengali language with the help of qualified and expert professionals, who use Bengali as their mother tongue. After following content validation, the final DHI-Bengali was administered to the present study included 160 Participants, out of which 77 were male and 83 were female. The mean age of the participants was 44.98 years, with standard deviation of 14.29. The age range of the participants was 20-70 year. The scores obtained from the translated questionnaire (DHI-B) from the participants were statistically analysed using SPSS version 29.0 software. Statistical analysis was performed in which Cronbach Alpha, internal consistency, and test-retest reliability were assessed among the psychometric properties of the DHI-Bengali. The overall Cronbach's alpha total score of 0.917 (0.92) which is considered to be an excellent reliability according to the statistics and the score of 0.786 (0.78), 0.777 (0.78) and 0.828 (0.83) were obtained on three subscales i.e. physical, emotional and functional respectively. The overall ICC (Cronbach's Alpha) value is pre- and post-database, demonstrating high internal consistency and reliability of the DHI-Bengali questionnaire. The excellent reliability and high internal consistency of Cronbach's Alpha properties of the Dizziness Handicap Inventory in the Bengali version.

Keywords: Bengali version, physical, function, emotional, gaze stabilization (Nystagmus), postural control, vegetative system (nausea), vestibular neuritis, labyrinthitis, otoneurological

Introduction
Balance may be defined as the capacity to maintain posture and spatial orientation at rest and during movement. The sensory inputs for maintenance of equilibrium comes from three main systems i.e., visual, proprioceptive and vestibular system. Disturbances in any of these systems results in perception of disequilibrium.

The balance of the body depends on information from the vestibular, visual and stomato-sensory systems. It is a motor-sensory function, regulated by the central nervous system (CNS) that includes this information, coordinating eye and head movements to maintain a sharp image. These functions are fundamental for increasing motor skills, enabling children to have full command of their body in different activities, such as jumping, running balancing on one leg, and writing, among others.

The vestibular system is the organ of balance, helps to maintain a balanced position in three-dimensional space. Vestibular stimulation results in three types of reflex responses: vestibulo-ocular, vestibulo-spinal, and vestibulo-collic reflexes. The vestibule-ocular reflexes help to maintain gaze on a stationary object while the head or body is in motion. Two types of the vestibulo-ocular reflex system are the semi-circular canal ocular reflex and the otolith ocular reflex (Bronstein & Gresty, 1991) [12]. Vestibulo-spinal reflex is primarily responsible for control of tone in skeletal muscles of the trunk and extremities. Vestibulo-collic reflexes are thought to act on neck muscles in order to stabilize the head, especially during unpredictable movements (Schubert & Shepard, 2008) [46]. Any disturbance to these reflexes leads to vestibular dysfunction.

Vestibular dysfunction can be peripheral and central. Peripheral vestibular dysfunction refers to dysfunction of vestibular end organs or vestibular nerve. Central vestibular

dysfunction involves dysfunction of vestibular nuclei, cerebellum or the oculomotor, vestibulospinal, and proprioceptive pathways.

A peripheral vestibular dysfunction describes a lesion in the balance organs of the inner ear, or on the balance nerve forward to its entrance in the brainstem. Such lesions will lead to a disturbed inflow of signals from the balance organ to the vestibular nuclei. A lesion can arise from vestibular neuritis, Meniere's disease, temporal bone fracture etc. Patients with peripheral vestibular dysfunction often complain about symptoms such as dizziness, unsteadiness, impaired visual acuity and oscillopsia.

Dizziness and unsteadiness will be experienced if signals from the vestibular, the visual and/or the somatosensory system to the central nervous system (CNS) are incorrect. Dizziness is considered one of the most common clinical manifestations among adults, specially the elderly (Ganança, Caovilla, 1998) [25]. It may be defined as a wrong perception, an illusion or a movement hallucination, a sensation of spatial disorientation of the rotatory type (vertigo), or not rotatory (instability, unbalance, fluctuation, oscillation, oscillopsia). Both types may be due to a vestibular disorder that can be assured by an otoneurological evaluation (Ganança, Caovilla, 1998) [25].

Vertigo, disorientation and unsteadiness are the most common symptoms of vestibular disorders. These symptoms could become more common as people age (Whitney *et al*., 2005) [58]. Ageing cause a number of anatomical and functional changes to the vestibular system, but these changes don't always make it difficult for healthy senior people to carry out daily tasks (Activities in daily living). However, the existence of vestibular problems in this population creates obstacles to carry out Activities in daily living, necessitating the utilization of functional reserves in order to carry out such task effectively (Cohen *et al*., 2000) [17].

The dizzy patient usually reports mental concentration difficulty, loss of memory and fatigue. The physical insecurity generated by the chronic dizziness and by the lack of body balance may lead to irritability, loss of self-confidence, fear to go out alone, fear of a serious disease, sensation of being out of reality, besides anxiety, depression or panic (Yardley & Putman, 1992; Ganança & Caovilla, 1998; Ganança *et al*., 2000) [25, 60].

The vestibular system's disorders besides generating physical and emotional problems, may provoke incapacity for performing professional, social and domestic activities, worsening the quality of life (QOL) of these patients (Enloe & Shields, 1997; Ganança *et al*., 2002) [21, 24].

The conventional tests that evaluate the vestibular system are not appropriate to demonstrate the psychological interference in the clinical picture and in the dizzy patient's suffering, as well as to evaluate the functional damages imposed by this symptom (Yardley, 1994) [59]. The necessity to evaluate these aspects in the dizzy patient leaded several researchers to elaborate questionnaires to evaluate the quality of life (QOF) of these patients.

Yardley *et al*. have developed three questionnaires for patients with dizziness and unsteadiness: The Vertigo Symptom Scale (VSS, 1992), the Vertigo Handicap Questionnaire (VHQ, 1992) and the Dizziness Beliefs Scale (DBS,1994). The VSS consists of 31 questions, but only a few are about dizziness. The rest of the questions are about autonomic and anxiety symptoms, such as sweating, breathing difficulties and chest pain. The VHQ looks at the psychosocial consequences of dizziness and the DBS studies beliefs about the negative consequences of dizziness. These three questionnaires give limited information about dizziness, so that to evaluate a patient's well-being and level of physical ability, two questionnaires were developed that is the Dizziness Handicap Inventory (DHI) and the Activities-specific Balance Confidence (ABC) scale.

In 1990, Jacobson and Newman designed and validated a specific questionnaire for dizziness, the Dizziness Handicap Inventory (DHI), which evaluated the self-perception of the incapacitating effects, on the quality of life (QOL), caused by dizziness. The DHI questionnaire has been used in many studies to evaluate the effects of vestibular diseases. DHI is a useful tool for physiotherapists and professional rehabilitation teams to list patient's problems, define intervention goals, and plan and evaluate rehabilitation programmes.

DHI consists of 25-item questionnaire designed to assess self-perceived dizziness-associated disability and handicap. The scale was divided into three sub categories that is physical, emotional and functional. 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. Subjects are instructed to answer the questions as it pertains to their dizziness and disequilibrium problems only. A "yes" response gives 4 points, a "sometimes" 2 points and a "no" 0 points. Total score ranging between 0 and 100. 0 suggesting no handicap and 100 indicating a severe level of self-perceived handicap. There is a positive correlation between DHI scores and the severity of dizziness related disability (0-30: mild, 31-60 moderate and 61-100 severe disability) (Whitney *et al*. 2004) [58].

The original American version of Dizziness handicap inventory (DHI) scale has been adapted and translated in various diverse languages & cultures around the world such as, Swedish (S Jarlsater, 2003), French (Nyabenda et. al,2004), Chinese (Poon *et al*., 2004), Dutch (Vereeck *et al*., 2006), Brazilian (Gastro As *et al*, 2007), Portuguese (Luzio CS, 2008), Colombia (Walteros D, 2009), German (Annette kurre, 2009), Italian (Nola *et al*., 2010), Hebrew (Kaplan *et al*., 2010), Japanese (Goto *et al*, 2011), Arabic (Alsanosi, 2012), Argetine (Caldara B *et al*, 2012), Bulgarian (Georgieva *et al*, 2014), Persian (Jafarzadeh *et al*, 2014), Greek(Nikitas *et al*, 2017), Lithuanian (Domantas Valancius *et al*,2019),Central Kurdish(Shero saeed f 2019), Pakistani (Ammar ahmed, 2020), Thai (Alongkot Emasithi *et al*, 2022), Polish (Tacikkowska G. *et al*, 2022), Spanish (Sommerfleck PA *et al*, 2023) [1, 4, 5, 14, 20, 26, 28, 34, 37, 39, 42, 43, 44, 45, 47, 52, 57].

Version of the DHI-E is not available in any of the Indian languages except Kannada (Akhilesh PM et.al 2016), Malayalam (Akhilesh PM et.al 2016), Gujarati (Anuj K Neupane et.al 2019) Hindi (Garima Upreti 2024) Telugu (C. P. Sunkar et.al 2024) & Odia (C. P. Sunkar et.al 2024) [2, 3, 41, 55].

Making the DHI available in regional languages like Bengali is critical for several reasons. First, accessibility in healthcare is a fundamental right. Every patient should be able to understand and respond to medical assessments in their preferred language. This ensures that patients can accurately describe their symptoms and participate in their treatment plans without misunderstandings. Second, cultural

relevance is vital in healthcare assessments. When tools like the DHI are translated into a regional language, they can be adapted to reflect the cultural and social contexts of that language group, making the assessment more meaningful and accurate.

Furthermore, improving clinician-patient communication is another reason why DHI translations are essential. Clinicians rely on patients to communicate their symptoms clearly to make accurate diagnoses. Without an assessment tool in the patient's native language, there is a greater risk of miscommunication or misinterpretation, potentially leading to incorrect diagnoses or inadequate treatments. A DHI in regional languages would bridge this gap, making it easier for clinicians to assess the degree of disability caused by dizziness and deliver appropriate care.

Lastly, from a broader perspective, translating the DHI into more regional languages aligns with India's commitment to equitable healthcare. In a country where linguistic diversity is celebrated, healthcare services must reflect this inclusivity by offering assessments in as many regional languages as possible. This would not only improve individual patient outcomes but also contribute to more comprehensive research and data collection, enabling a better understanding of dizziness-related disabilities across different linguistic and cultural groups.

2. Methodology

2.1 Aim: To translate and validate the DHI-E into Bengali language to be used by Audiologist among the Dizziness population in West Bengal, Tripura & Assam. (Who speak Bengali)?

2.2 Objectives

- Translate the English version of Dizziness Handicap Inventory to Bengali language
- Validation of Dizziness Handicap Inventory material.

2.3 Source of Data: The study data was carried out in several healthcare facilities (clinical, institutional & hospital setups) in West Bengal.

2.4 Ethical clearance and informed consent

The Ethical Committee approved ethical clearance to carry out the study. The patient and the patient's family were informed about the details of the study and a written consent was taken from each patient before the study.

2.5 Participants: 160 participants who were reported to have vertigo or dizziness aged between 20 to 70 were selected for the study. Participants with native Bengali speaking language were recruited for study. All the participants were instructed to complete the questionnaire themselves or with the help of their caretaker or clinician.

2.5.1 Subject selection criteria

2.5.1.1 Inclusion criteria

Subject with

- 20- 70 years.
- Normal Hearing.
- Both male and female participants.
- Conductive hearing loss (Chronic).
- Post lingual hearing loss.
- Mild to Profound degree of hearing loss.
- Either Sensorineural or mixed hearing loss.

2.5.1.2 Proficiently Exclusion criteria

Subject with

- Less than 20 years and more than 70 years.
- Any neurological & cognitive ailment.
- Visual Impairment.
- Postural Hypotension.
- Psychiatric Disorder.
- Traumatic Brain Injury

2.6 Mode of Assessment

The study was conducted offline, adhering to individual study criteria. The DHI-B questionnaire was given to the participants and/or their caretakers for completion.

2.7 Study Tool

The current study utilized the Dizziness Handicap Inventory, developed in 1990 by G.P. Jacobson and C.W. Newman. The inventory consists of 25 questions categorized into Physical (P), Functional (F), and Emotional (E) sections, addressing various aspects of the client's social, physical, functional, and personal life. The 25 items of the DHI-E are divided into three subscales: The Physical (DHI-P; 7 items), Emotional (DHI-E; 9 items), and Functional (DHI-F; 9 items) elements. There are three alternative answers to each question: "Yes," "Sometimes," and "No," with ratings of 4, 2, and 0, respectively. The maximum overall ranging from 0 to 100. Referrals for additional assessment to balance experts should be made for scores higher than 10. A score of 0-16 indicates no Dizziness impairment, 16-34 indicates a mild impairment, 36-52 indicates a moderate impairment, and 54+ indicates a severe impairment. A score of 100 indicates a major impairment in dizziness.

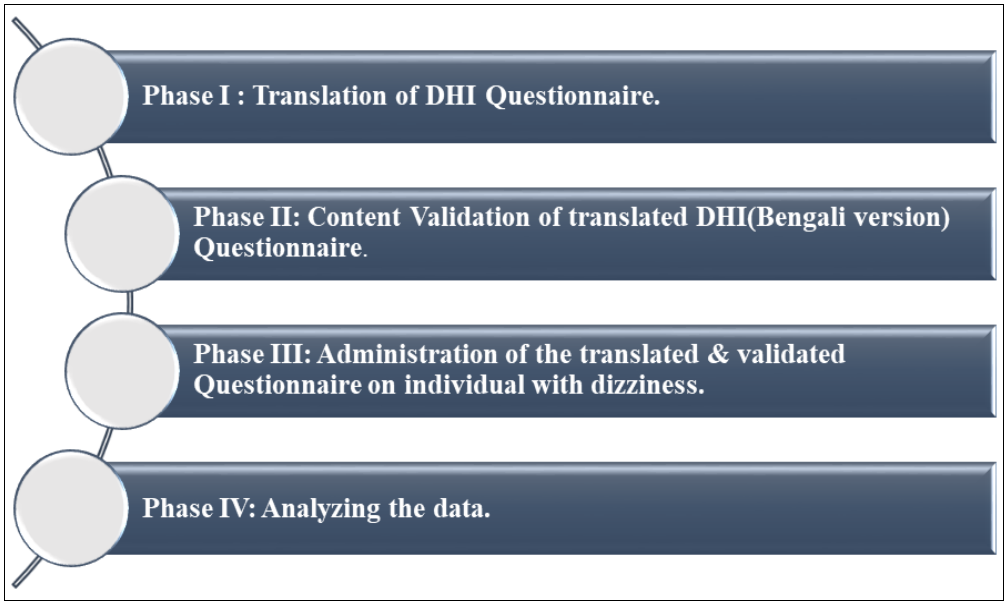
2.8 Procedure

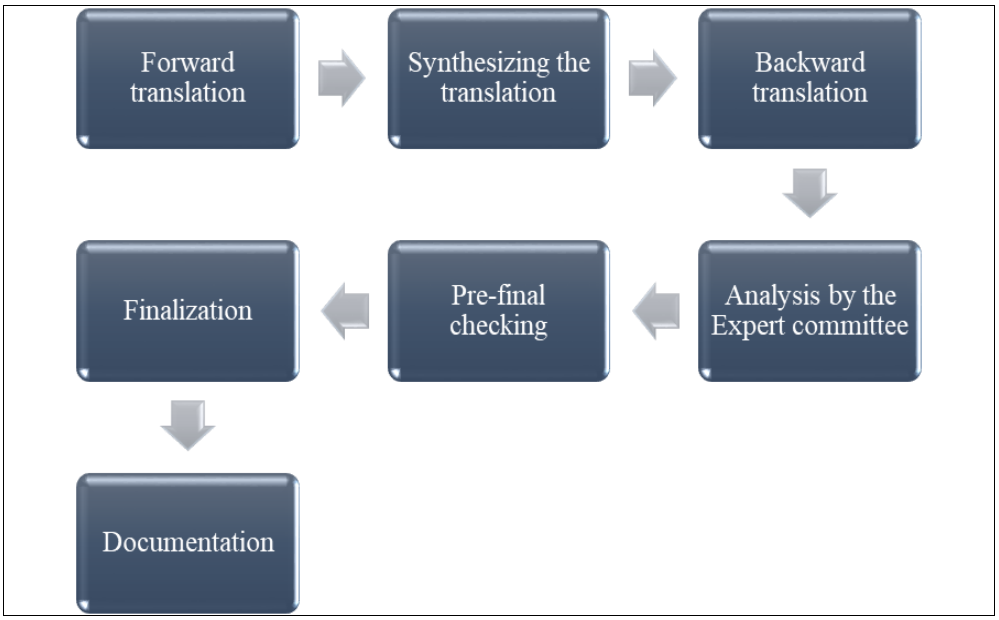
The DHI-B is a new tool designed to assess individuals with vestibular disease and to guide therapy planning and vestibular rehabilitation for Bengali speakers. To achieve this goal, the study was divided into four phases.

2.8.1 Phase 1: Translation of DHI Questionnaire

The original version of DHI-E questionnaire was translated into target language Bengali. Twenty-five questions make up the DHI-E to DHI-B, which is divided into three subscales: Physical (DHI-P; seven items), Emotional (DHI-E; nine items), and Functional (DHI-F; nine items). The translated version will be sent to one Linguist and three Bengali Teacher and seven qualified Senior Audiologists who are proficient in both English and Bengali language for content validity. After content validation suggestions given by the Teacher/Linguist & the Audiologists, they will be compared and suitable changes are made.

The translation process of the Dizziness Handicap Inventory - English (DHI-E) into Bengali (DHI-B) was carried out to ensure accuracy, clarity, and cultural relevance in several phases that are listed below:





The following procedure was employed

Forward Translation

Seven native Bengali speakers in the field of Audiology (with experience ranging from 15 to 25 years), three Bengali Teacher and one native Bengali speaker in the field of linguistics, particularly translation of the Dizziness Handicap Inventory from English to Bengali (DHI-B) of any differences were discussed and resolved by the translators, resulting in a single unified Bengali version.

Synthesis of the Translations

Seven Senior Audiologist, three Bengali Teacher and one linguistics native Bengali speaker's separate translations of the Dizziness Handicap Inventory questionnaires were compared and synthesized into a single version of DHI-B. Confusions about the items translated were resolved among raters.

Back-Translation

In this step, the conceptual equivalence between the dutiful forward translation and the original text was established. Here five multilingual translators who are fluent in both Bengali and English languages were independently translated the consolidated approved version from Bengali into English. In this stage, it was taken into account that these specialists were not aware of the actual inventory (DHI questionnaire). This stage of the current study was done to ensure that the Bengali translated questionnaire done in forward translation is accurate, legitimate, reliable, and free of linguistic biases.

Review by an Expert Committee

This step involved a review of both the forward and back translations by an expert committee made up of one linguist, three Bengali Teacher and seven Senior Audiologists with expertise in both Bengali and English. Here one linguist, three Bengali Teacher and seven Senior Audiologists assessed whether the translation made was acceptable and if it follows the item's original purpose. Here the consistency between the translated and original version was made by the committee made regarding any instructions or punctuation in the instrument that have been translated in four areas:

1. Semantic resemblance, which considers vocabulary and syntax as well as word meaning
2. Idiomatic similarity, which considers common phrases and idioms that should be present in both languages.

3. Experimental similarity, also referred to as cultural equivalent, requires that the conditions depicted in the original versions of the objects match those found in the setting of the culture
4. The validity of the hypothesis under study and the experiences the person reporting them in the questionnaire about the target culture are examples of conceptual similarity.

Pre-Testing: The pre-final version of the DHI-B was pre-tested with a small sample of 20 participants who met the study criteria. Participants were asked to complete the questionnaire and provide feedback on the clarity, relevance, and comprehensibility of the items.
The cognitive interviewing and debriefing stage included the pre-final version of Questionnaire DHI (Bengali version) that was administered to the target population sample to obtain their opinion and feedback on the acceptance and interpretation of the questions. Based on their suggestions, appropriate changes were made to the questionnaire.

Finalization: Based on the feedback from the pre-test, necessary modifications were made to the DHI-B. The final version was then approved by the expert committee for use in the main study.

Documentation
After validating the DHI-B Version questionnaire in various clinical settings and private hospitals, data collected from these locations gave useful insights into how well the questionnaire worked. This helped confirm its reliability and usefulness for Bengali-speaking patients dealing with dizziness or vertigo.

2.8.2 Phase II: Content Validation of translated DHI-B (Bengali version) questionnaire
The participants were seven native Bengali speakers who were language experts reviewed the pre final translated DHI-B questionnaire that had been prepared in Bengali for content validity. The experts were asked to evaluate each item and recommend adjustments if needed. After incorporating the suggestions from seven native Bengali speakers during content validation the final questionnaire was prepared. The Dizziness Handicap Inventory (Bengali version) DHI-B questionnaire is attached in APPENDIX I.

DHI Scoring Instructions
The patient is asked to answer each question as it pertains to dizziness or unsteadiness problems, specifically considering their condition during the last month. Questions are designed to incorporate functional (F), physical (P), and emotional (E) impacts on disability.

To each item, the following scores can be assigned: - No=0 Sometimes=2 Yes=4

Scores
1. 16-34 Points (mild handicap)
2. 36-52 Point Points (moderate handicap)
3. 54+ Points (severe handicap)

2.8.3 Phase III: Administration of the translated DHI Questionnaire on Individuals with dizziness
Once the participants were satisfied with the requirements of the current study, participants were informed about the purpose, necessity and goals of the study. The consent was taken from the participants when they were decided to participate in the study. The final translated and validated DHI -Bengali version questionnaire was given to the participants with vertigo/dizziness who were native Bengali speakers using an individual form. Although the questionnaire was meant to be self-administered, if required the patients were suggested to take assistance from the care taker while answering the questions. Participants were encouraged to assess each query on a 4-point scale depending on how severe the vertigo/dizziness was in various scenarios. Initially final DHI-B questionnaire was administered on 160 participants with dizziness. Later to examine the pre and post-test (test & retest) mean score difference of the translated DHI, the same procedure was followed and take the 50% participants of the total study population. The participants had to tick the most suitable/appropriate option out of it. Participants had to read the questionnaire and mark appropriately by themselves and return it to the researcher.

2.8.4 Phase IV: Analyzing the data
Each participant received an individual numerical score as their response for the questionnaire (DHI-B). For statistical purposes, the raw scores were tabulated using SPSS software. To examine how people with vertigo/dizziness performed on different domains of the DHI, the data was analyzed through appropriate statistical analysis. The mean and standard deviation (SD) scores for the 3 subscales of the questionnaire (Emotional (E), Physical (P) & Functional (F)) were calculated. Cronbach's alpha test was used to formulate the internal consistency of the translated DHI-B questionnaire.

Results & Discussion
The aim of the present study was Translation and validation of the dizziness handicap inventory to one of the Indian language Bengali which is the native language of the West Bengal, Tripura & Assam which is situated in the East & North-east part of India.
The scores obtained from the translated questionnaire (DHI-B) from the participants were statistically analysed using SPSS version 29.0 software. The comparison was done between the mean score of each subscale and Cronbach's alpha coefficient for internal consistency of the translated Dizziness Handicap Inventory (DHI-B) questionnaire.

3.1: Gender distribution
The present study included 160 Participants, out of which 77 were male and 83 were female. The mean age of the participants was 44.98 years, with standard deviation of 14.29. The age range of the participants was 20-70 year.

Figure 1 show the percentage of male and female and table 4.1 show gender distribution of total participants.

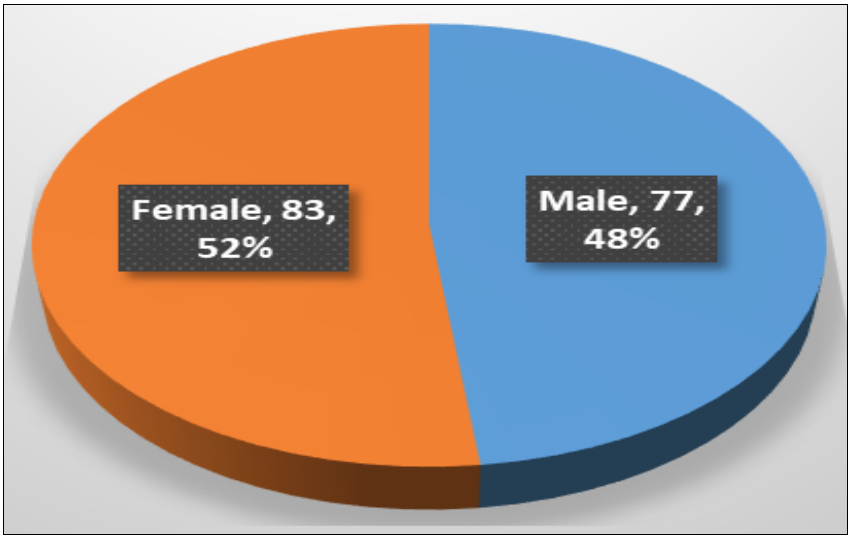


Fig 1: A pie chat represents the gender wise distribution of study population

Table 1: Gender Distribution of total no. of male and female participant

Gender	No. Total Subject
Male	77
Female	83

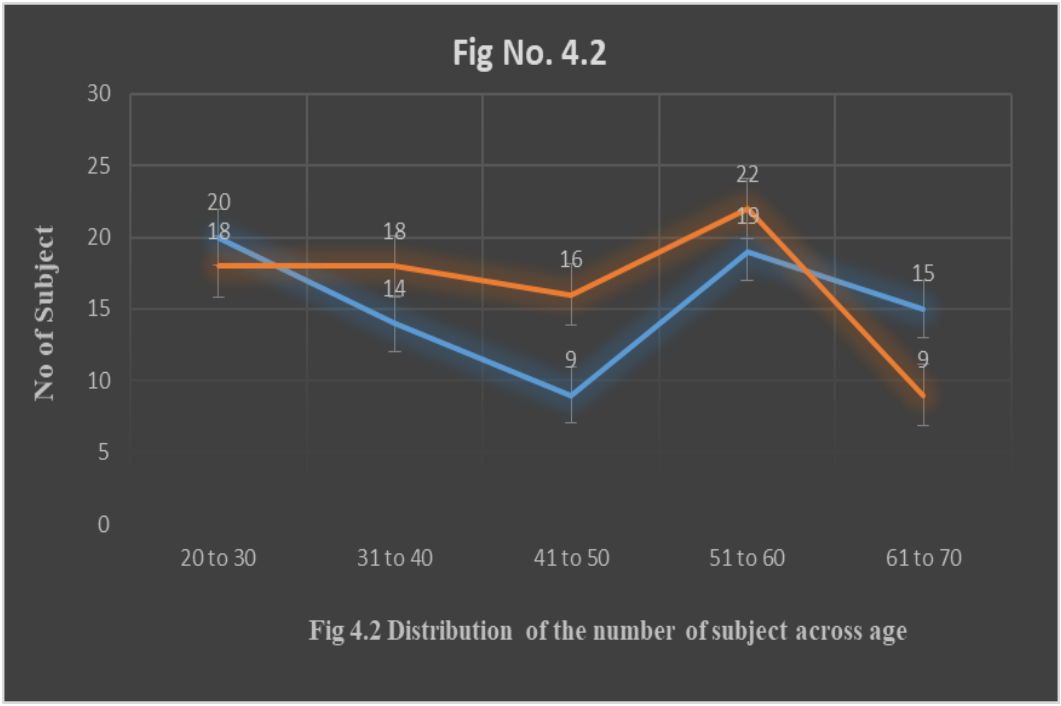


Fig 2: Distribution of the number of subject across age

Table 2: Results of distribution of males and females across various age ranges

Gender	Age Range				
	20 to 30	31 to 40	41 to 50	51 to 60	61 to 70
Male	20	14	9	19	15
Female	18	18	16	22	9

3.2 Content validation of the translated DHI-Bengali questionnaire

The final translated questionnaire (DHI-Bengali) was given to 11 validators for content validation. Content validation of the translated DHI-B questionnaire was done by different validators like seven Senior Audiologists, one linguistics and three Bengali teachers who were experts and fluent in both Bengali and English languages. The translated DHI (Bengali version) content was verified on different aspects such as grammar of the sentences, sentence structures, socio-cultural aspects, and reader friendliness. The questionnaire was scored using a three-point Likert scale ("Correct," "Incorrect," And "Correction Required").

Nearly every question received a rating between more

appropriate and correct. The validators' opinions and recommendations, such as modifications in grammatical form, question length, appropriate level of abstraction about the socio-cultural context of modification were taken into consideration when developing the translated questionnaire to make it more clear for Bengali -speaking (DHI-Bengali) individuals having dizziness/vertigo.

The original DHI quantify the handicap due to dizziness on the physical, emotional and functional aspect of an individual. Items in physical part assesses various physical activities that induce dizziness such as looking up, walking down the aisle, quick movements of the head etc. items in the emotional part assesses various emotional problems the patients suffer because of the dizziness such as frustrations, isolated from family members, difficult to concentrate on work etc. The items in the functional part assess the functional aspects affected due to dizziness such as restrictions to travel, difficulty getting into bed, participation in social activities etc.

The 7 content validators gave the overall test content ratings that ranged from correct to correction required across all the three domains of the questionnaire. The validator's suggestions and recommendations were considered and the questions in the DHI-B questionnaire were modified and finalized. DHI-B has three subscales, which include Physical, Emotional, and Functional. The subscale involves questions regarding self-maintenance, productivity, and leisure. The final translated and validated DHI questionnaire in Bengali (DHI-B) is included in Appendix C.

3.3 Comparison of mean scores for three subscales of DHI-Bengali questionnaire

The responses to the DHI-B questionnaire administered on patients with dizziness/vertigo symptoms was scored and mean scores for each subscale was obtained. The mean score of a first segment of the DHI- Bengali questionnaire (physical subscale) obtained for the participants was 17.22. The mean score of a second segment of the DHI- Bengali questionnaire (Emotional subscale) obtained for the participants was 15.27. For the mean score of a third segment of the DHI-H questionnaire (Functional subscale) obtained for the participants was 21.35. The SD (Std. Deviation) scores obtained for three subscales namely Physical (SD = 6.540), Emotional (SD = 7.635) and Functional (SD = 7.996).

The mean, Std. Deviation and total No. of participants scores obtained for three subscales namely Physical, Emotional and Functional conditions are given in Table 4.3

Table 3: Mean, Std. Deviation and total No. of participants for three sub-scales of the DHI - Bengali Questionnaire

Item Statistics			
	Mean	Std. Deviation	No. of Subject
PQ = Physical	17.22	6.54	160
EQ = Emotional	15.27	7.64	160
FQ = Functional	21.35	7.99	160

The overall questionnaire score ranged from 0 to 100, as rated by all participants, with a score of 0 indicating no perceived disability and a score of 100 indicating the maximum perceived severity due to dizziness.

Table 4: Represent the severity scale of DHI

S. N.	Severity	Point Score
	Mild Handicap	16-34 Points
	Moderate Handicap	36-52 Points
	Severe Handicap	54+ Points

In the present study, the participants' scores on three subscales varied as follows: the physical subscale had a minimum score of 2 and a maximum score of 28, the emotional subscale had a minimum score of 2 and a maximum score of 30, and the functional subscale had a minimum score of 4 and a maximum score of 36. The combined total score of the subscales ranged from a minimum of 8 to a maximum of 94.

In this study, out of 160 participants, 34 were classified as having a mild handicap, 45 were identified with a moderate handicap, and 81 participants were categorized as having a severe handicap, based on the Dizziness Handicap Inventory (DHI) scale.

Table 5: Reliability Statistics of Cronbach's Alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.917 (.92)	0.915	25

To obtain internal consistency of the DHI-Bengali, Cronbach's alpha test and an item-total correlation was carried out. The DHI-Bengali achieved an overall Cronbach's alpha based on standardized items score 0.915 and a Cronbach's alpha score of 0.917 (0.92) which is considered to be an excellent reliability according to the statistics and the score of 0.786 (0.78), 0.777 (0.78) and 0.828 (0.83) were obtained on three subscales i.e. physical, emotional and functional respectively.

Table 6: Represents the DHI-Bengali with the scale mean if the scale mean if item deleted, scale variance if item deleted, the corrected item total correlation and the Cronbach's Alpha score for every 25 questions

Item-Total Statistics					
	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Squared Multiple Correlation**	**Cronbach's Alpha if Item Deleted**
PQ = 1	50.87	379.096	.544	.668	.913
EQ = 2	51.19	375.453	.575	.690	.913
FQ = 3	51.31	372.478	.588	.695	.912
PQ = 4	52.14	368.514	.595	.629	.912
FQ = 5	51.18	366.711	.702	.640	.910
FQ = 6	50.94	394.833	.205	.395	.919
FQ = 7	52.14	369.218	.633	.716	.912
PQ = 8	51.04	385.904	.400	.597	.916
EQ = 9	52.08	365.710	.628	.718	.912
EQ = 10	52.48	377.635	.478	.645	.915
PQ = 11	50.92	384.088	.399	.625	.916
FQ = 12	51.93	366.442	.676	.739	.911
PQ = 13	51.17	371.588	.596	.659	.912
FQ = 14	51.21	382.794	.530	.559	.914
EQ= 15	52.97	396.546	.184	.428	.919
FQ = 16	51.87	370.857	.649	.722	.911
PQ = 17	52.48	369.710	.614	.636	.912
EQ = 18	51.39	389.196	.340	.442	.917
FQ = 19	51.48	374.528	.607	.580	.912
EQ = 20	52.71	372.184	.614	.673	.912
EQ = 21	52.79	373.485	.603	.671	.912
EQ = 22	52.11	387.291	.334	.426	.917
EQ = 23	51.71	370.536	.604	.621	.912
FQ = 24	51.29	384.787	.458	.419	.915
PQ = 25	51.14	373.709	.613	.600	.912

3.4 Pre and post-test reliability of DHI questionnaires

Table 7: Mean, standard deviation and Cronbach's Alpha score (pre and post) for three subscales of DHI-B questionnaire

Scale	Mean	SD	Cronbach's Alpha
P pre	17.17	6.28	0.767 (0.77)
P post	17.22	6.54	0.786 (0.79)
E pre	15.47	7.47	0.755
E post	15.27	7.63	0.777 (0.78)
F pre	21.19	7.20	0.781
F post	21.36	7.99	0.828 (0.83)

Note: P pre - Physical subscale pre-test response, P post - Physical subscale post-test response, E pre - Emotional subscale pre-test response, E post - Emotional subscale post-test response, F pre - Functional subscale pre-test response, F post - functional subscale post-test response.

The Mean, Standard Deviation (SD) and Cronbach's Alpha of test and retest scores obtained for Physical, Emotional and functional of DHI-B questionnaire were calculated and are shown in Table. 7. It can be observed that the pre and post-test mean scores of Physical subscales were found to be 17.17 and 17.22, Emotional subscale was 15.47 and 15.27 and Functional subscale was found to be 21.19 and 21.36 respectively**.** By observing the pre and post-test mean scores obtained for all 3 subscales of DHI-B, it can be observed that there is not much difference in mean scores obtained between two evaluations for individuals with vestibular dysfunctions. This indicates that the accuracy of the translated questionnaire (DHI) is found to be good.

In the Present study the performance of subscale Cronbach's Alpha score, low score was seen in Emotional subscale. Other studies which translated DHI to any other language got different result depend upon the performance of subscale Cronbach's Alpha score, low score was seen in Functional subscale in Gujarati version (Anuj k. *et al*., 2019), low score in Emotional subscale in English Version (Jacobson *et al*,1990) [33], low score in Emotional subscale in Arabic Version (Alsanosi *et al*, 2012) [4], low score in Physical subscale in Italian Version (Nola *et al*,2010), low score in Physical subscale in Greek Version (Nikitas *et al*, 2017) [42, 43], This could be due to the responses of participants who have dizziness/vertigo were either overestimated or underestimated in comparison to their real performance, hence it is critical to understand how patients feel about how dizziness Interferes with their daily life (Aratani *et al*., 2020).

3.5 Cronbach's alpha score for DHI Different version

Any scale with an alpha score of greater than 0.9 has an excellent internal consistency, alpha score between 0.8-0.9 has a good internal consistency, 0.7- 0.8 has an acceptable internal consistency, 0.6-0.7 has a questionable internal consistency, 0.5-0.6 has a poor internal consistency and any score less than 0.5 is unacceptable.

The original version of DHI-English has an overall alpha of 0.89 and for the subscales alpha score of 0.78, 0.72 and 0.85 for physical, emotional and functional respectively. The

Arab version of the DHI has an overall alpha score of 0.92 and individually for physical, emotional and functional, it has an alpha score of 0.81, 0.79 and 0.87 respectively. For the Italian version of DHI the overall alpha score was 0.92 and 0.75, 0.84 and 0.82 for the subscale physical, emotional and functional respectively. For the Greek version of DHI the overall alpha score was 0.89 and 0.72, 0.76 and 0.83 for the subscale physical, emotional and functional respectively. Other versions also demonstrated good reliability Gujarati (0.92), Kannada (α = 0.74), Telugu (α = 0.92), Malayalam (α = 0.94), Odia (α = 0.93), and Hindi (α = 0.78), which is statistically acceptable.

Similarly, the Polish version (DHI-POL) demonstrated a Cronbach's alpha of 0.93. The questions were divided into three subgroups: physical (P), emotional (E), and functional (F), with internal consistency scores of 0.81 for DHI-P, 0.85 for DHI-E, and 0.84 for DHI-F, as reported by Grażyna T. *et al*. (2022). This high level of consistency could be attributed to the patients' understanding of the terms used in the explanation rating scale.

The finding of the present study reported a Cronbach's alpha score of 0.917 (0.92), suggesting excellent internal consistency, with score of 0.78, 0.78 and 0.83 on the physical, emotional and functional respectively.

Based on the current study's findings, which include the content validators' responses and statistical analysis (mean, standard deviation, and Cronbach's alpha value), the Bengali version of the Dizziness Handicap Inventory (DHI-Bengali) can be considered a reliable tool for evaluating the difficulties experienced by Bengali-speaking individuals with vertigo or dizziness. The DHI-Bengali demonstrates excellent internal consistency, making it suitable for use in Bengali-speaking populations, particularly in regions like West Bengal, Tripura and Assam, to better understand and address their problems related to vertigo or dizziness.

Summary & Conclusion

In a multilingual and multicultural country like India, a large number of the population depends on regional language for general communication, making it impracticable to employ Dizziness Handicap Inventory English (DHI- E) in understanding the severity of the dizziness. Hence, translation and validation Dizziness Handicap Inventory Bengali (DHI-B) can be self-administered on native Bengali speakers with dizziness for assessing the impact of the condition in daily living.

In the present study, the English version of the Dizziness Handicap Inventory (DHI) was modified and translated into Bengali (DHI-B) with the assistance of a linguist and senior audiologists. The translation was then reviewed by bilingual language experts fluent in both Bengali and English to ensure the Bengali version retained the same meaning as the original. Necessary adjustments were made accordingly. The study included 160 native Bengali-speaking participants, aged 20 to 70, all of whom were diagnosed with various vestibular pathologies causing vertigo.

The study was conducted in four phases. In Phase I, the Dizziness Handicap Inventory (DHI) questionnaire was translated into Bengali. Phase II involved content validation of the translated Bengali version of the DHI (DHI-B). In Phase III, the validated DHI-B was administered to participants experiencing vertigo or dizziness who were native Bengali speakers. Phase IV, analysing the data. The questionnaire was distributed via individual forms. Participants rated each question on a 4-point scale based on the severity of their vertigo or dizziness in various situations. The DHI-B consists of three subscales: Physical, Emotional, and Functional. Initially, the final DHI-B was administered to 160 participants with dizziness. To assess the pre & post-test reliability of the total questionnaire, the same procedure was repeated after the data collected from 50% of the participants.

The results of the study showed that the mean scores for the Physical, Emotional, and Functional subscales of the DHI-B were 17.22, 15.27, and 21.36, respectively. Participants score low on the Emotional subscale, followed by the Physical and then the Functional subscale. The severity of dizziness or vertigo ranged from 15.27 to 21.36 across the three segments of the DHI-B questionnaire in individuals diagnosed with various vestibular dysfunctions.

The pre and post-test mean scores for the Physical subscale were 17.17 and 17.22, for the Emotional subscale were 15.47 and 15.27, and for the Functional subscale were 21.19 and 21.36, respectively. These results show minimal differences between the two assessments for individuals with vestibular dysfunctions, indicating that the accuracy of the translated DHI-B questionnaire is reliable.

The internal consistency of the DHI-B questionnaire was evaluated using Cronbach's Alpha test. The results of Cronbach's Alpha test indicated acceptable to good internal consistency for all three subscales obtained from both (pre and post) The Physical subscale (Pα = 0.78), the Emotional subscale (Eα = 0.78), and the Functional subscale (Fα = 0.83).

The study confirmed that the Bengali version of the Dizziness Handicap Inventory (DHI-B) demonstrates excellent internal consistency and reliability, comparable to the original English version and other established versions. Its strong test-retest reliability aligns with previous studies, making it a robust, easy to use and reliable tool for self-assessment of dizziness-related handicaps in both clinical and research settings. The DHI-B provides clinicians with valuable insights for managing patients with dizziness or vertigo, ultimately supporting their overall well-being.

Implications of the study

- The DHI-B questionnaire helps clinicians and audiology professionals understand vertigo-related issues and provides a framework for organizing vertigo treatment plans based on individual circumstances.
- The DHI-B questionnaire can be widely used to evaluate the prognosis of patients with dizziness or vertigo following vestibular rehabilitation therapy.
- The DHI-B questionnaire can be utilized to compare the quality of life and level of disability in Bengali-speaking individuals with vestibular disorders.
- The DHI-B questionnaire helps to improve the client's perception of his/her problem.

Limitation of the study's

- Small sample size was taken.
- Male and Female Ratio are unequal (male<female).
- The subject's age range was very broad.

Future Indication

- Study can be done using large sample size.
- DHI-B is a reliable tool so there is a need to do

translation in other regional languages for clinical utility.

- Future study using DHI-B in different aged population, different gender and different vestibular disordered population can be done.

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Appendix I: Dizziness Handicap Inventory in Bengali Language (DHI-B)
Name: Date

		হ্যাঁ (4)	মাঝে মাঝে (2)	না (0)
P 1	উপরের দিকে তাকালে কি আপনার সমস্যা বেড়ে যায় ?			
E 2	আপনার সমস্যার কারণে, আপনি কি হতাশা বোধ করেন?			
F 3	আপনার সমস্যার কারণে, আপনি কি পেশাগত কাজকর্ম বা বিনোদনের জন্য আপনার ভ্রমণ সীমাবদ্ধ করেন?			
P 4	পারমার্কেটের পণ্য রাখার শেলফের পাশ দিয়ে হাঁটলে কি আপনার সমস্যা বেড়ে যায়?			
F 5	আপনার সমস্যার কারণে, আপনার কি বিছানায় উঠতে বা বের হতে অসুবিধা হয়?			
F 6	আপনার সমস্যাটি কি সামাজিক ক্রিয়াকলাপে আপনার অংশগ্রহণকে উল্লেখযোগ্যভাবে সীমাবদ্ধ করে, যেমন ডিনারে যাওয়া, সিনেমাদেখতে যাওয়া, নাচ করা বা পার্টিতে যাওয়া?			
F 7	আপনার সমস্যার কারণে, আপনার কি পড়তে অসুবিধা হয়?			
P 8	খেলাধুলা, নাচ এর মতো উচ্চাভিলাষী কাজকর্ম বা গৃহস্থালির কাজ (ঝাড়ু দেওয়া বা থালা-বাসন সরিয়ে রাখা) করা কি আপনার সমস্যাগুলি বাড়িয়ে তোলে?			
E 9	আপনার সমস্যার কারণে, আপনি কি আপনার সাথে কাউকে না নিয়ে আপনার বাড়ির বাইরে যেতে ভয় পান?			
E 10	আপনার সমস্যার কারণে আপনি কি অন্যদের সামনে বিব্রত হন?			
P 11	আপনার মাথার দ্রুত নাড়াচাড়া কি আপনার সমস্যা বাড়িয়ে তোলে?			
F 12	আপনার সমস্যার কারণে, আপনি কি উচ্চতা এড়িয়ে চলেন?			
P 13	বিছানায় শুয়ে পাশ ফিরলে কি আপনার সমস্যা বৃদ্ধি পায়?			
F 14	আপনার সমস্যার কারণে, আপনার পক্ষে কঠোর গৃহকর্ম বা উঠানের কাজ করা কি কঠিন হয়ে পড়ে?			
E 15	আপনার কি ভয় হয় যে আপনার সমস্যার কারণে লোকেরা আপনাকে নেশাগ্রস্ত ভাবতে পারে?			
F 16	আপনার সমস্যার কারণে, আপনার পক্ষে একা হাঁটতে যাওয়া কি কঠিন?			
P 17	ফুটপাতে হাঁটার সময় কি আপনার সমস্যা বেশি হয়?			
E 18	আপনার সমস্যার কারণে কি আপনার পক্ষে কোনো কিছুতে মনোনিবেশ করা কঠিন মনে হচ্ছে?			
F 19	আপনার সমস্যার কারণে, অন্ধকারের মধ্যে আপনার নিজেরা বাড়ির ভিতর হাঁটা চলা কি আপনার পক্ষে কঠিন মনে হয়?			
E 20	আপনার সমস্যার কারণে, আপনি কি বাড়িতে একা থাকতে ভয় পান?			
E 21	আপনার সমস্যার কারণে, আপনি কি প্রতিবন্ধকতা বোধ করেন?			
E 22	আপনার সমস্যা কি আপনার নিকটবর্তী পরিবার বা বন্ধুদের সম্পর্কের মধ্যে চাপ সৃষ্টি করে?			
E 23	আপনার সমস্যার কারণে, আপনি কি হতাশ হয়ে পড়ছেন?			
F 24	আপনার সমস্যা কি আপনার চাকরি বা পারিবারিক দায়িত্বের পালনে ব্যাঘাত ঘটায়?			
P 25	অতিরিক্ত সামনে ঝুঁকলে কি আপনার সমস্যা বৃদ্ধি পায়?			