

**Dizziness Index of Impairment in Activities of Daily Living Scale for  
Indian Population**

---

AIISH Research Fund Project No. SH/CDN/ARF/4.57/2012-13  
August 29, 2012 to December 31, 2013

**Principal Investigator**

Niraj Kumar Singh, M.Sc. (Audiology)

**Co-Investigators**

Prawin Kumar, Ph.D. (Audiology)

Animesh Barman, Ph.D. (Speech & Hearing)

AIISH Research Fund Project  
Sanction No. SH/CDN/ARF/4.57/2012-13

<b>Personnel:</b>	Aparna T. H. (4 months) Kumari Apeksha (9 months) Research Officer
<b>Total fund:</b>	Rs 3,80,000.00
<b>Project duration:</b>	13 months
<b>Principal investigator:</b>	Niraj Kumar Singh, M.Sc. (Audiology) Lecturer in Audiology Department of Audiology All India Institute of Speech and Hearing Manasagangothri, Mysore-570006 Karnataka, India
<b>Co-investigators:</b>	Prawin Kumar, Ph.D. (Audiology) Lecturer in Audiology Department of Audiology All India Institute of Speech and Hearing Manasagangothri, Mysore-570006 Karnataka, India
	Animesh Barman, Ph.D. (Speech & Hearing) Reader in Audiology Department of Audiology All India Institute of Speech and Hearing Manasagangothri, Mysore-570006 Karnataka, India

## **Acknowledgements**

The investigators would like to acknowledge the Director of All India Institute of Speech and Hearing for being pivotal in granting the funds for the study. We would also like to acknowledge the HODs, Department of Audiology and Department of ENT, for allowing us to use the resources from the departments for testing. Lastly the gratitude is also extended to all the participants of the study for their participation and kind cooperation throughout the testing.

## **Abstract**

Dizziness accounts for a substantial population of patients visiting otology clinics and has been reported to affect an individual's daily living drastically. There are several scales available for assessment of the impact of the vestibular impairment on the daily living of an individual. However, lacking from literature is a scale that extracts the information from these individuals in sufficient detail without being too difficult to administer on an individual with lower educational and/or socio economic background. A number of existing questionnaires in this regard have several questions that would not be applicable to a large proportion of Indians. Hence the present study was aimed at developing a questionnaire for evaluation of activities of daily living that could aptly be administered on the Indian population. For this, items were collected from the existing questionnaires and additions were made using activities that were fit for Indian population. The selection of questions to the questionnaire and their suitability to 'functional', 'ambulatory' and 'instrumental' sections were performed by two sets of 5 occupational and physiotherapists. The questionnaire thus developed was validated on 56 individuals, 7 of whom had central pathology. The questionnaire was found to have moderate to excellent internal consistency and reliability as well as excellent test-retest reliability. However, it showed lack of efficacy in differential diagnosis between different vestibular pathologies. Thus, the questionnaire developed is a valid tool to assess the impact of vestibular impairment on the activities of daily living in Indian population but not fit for differential diagnosis between different types of vestibular impairments.

**Key words:** Activities of daily living, vestibular impairment, dizziness

## **Introduction**

Dizziness is often described as various sensations of body orientation and positions in absence of actual such motion of the body or the environment. Dizziness is one of the most frequent complaints with estimates of 20-30% of the population having experienced it at least once in their life time (Neuhauser & Lempert, 2009). Amongst the patients visiting an otologist with various complaints, it is estimated that 5 to 10% report of giddiness. Giddiness has been reported to be even more prevalent among the elderly, among whom 30 to 40% have been found to suffer from giddiness (Dereberry, 1999).

People with vestibular disorders often complain of vertigo, disequilibrium, and other symptoms. These complaints and the underlying impairments can lead to functional limitations or deficits in performing routine daily life tasks known as activities of daily living (ADL) (Cohen, 1995). Many individuals with vestibular disorders limit their activities and restrict their participation within the community in order to avoid aggravation of symptoms and potential embarrassments of unexpected episodes of dizziness or disequilibrium.

Activities of daily living can be classified in several different ways. Reed (1984) categorized them into 'self-maintenance', 'productivity', and 'leisure'. As per this classification 'self maintenance' involved the activities which are performed to maintain a person's health and his/her well-being. This included the activities pertaining to self-care, communication, and home management. 'Productivity' was inclusive of activities associated with financial importance. These activities are performed in order for an individual not only to sustain himself but also his/her family and the society. The activities like paid employment, volunteer work, and hobbies formed a part of this section. 'Leisure' comprised of activities performed for amusement and restoration of fun in work. Although the activities included in this segment are not quintessential acts that help one to sustain him/herself financially or physically, these activities were considered equally important for maintain

oneself in the society and keeping oneself fresh for more fruitful tasks. Some of the others (Gresham & Dittmar, 1997) have divided ALDs into two main streams. The first was 'basic' which incorporated activities related to self-care and locomotion. The second was 'instrumental'. This included activities related to community living skills and other working responsibility related tasks.

Of the several questionnaires for assessing the performance on activities of daily living, most are intended for the type of patients that are usually referred to rehabilitation centres. These include people with significant orthopaedic disorders or those with nervous system related deficits that were either caused by certain diseases or injuries. Although the use of any of these tools would empower a clinician with adequate information to compare the functional limitations of patients spread across a wide range of diagnoses, the rating scales used in these tools lack finer elaboration that would facilitate the detection of subtle problems frequently encountered by patients with vestibular impairment.

Cohen (1992), using a 5-point qualitative scale which is similar to those used in the clinics by numerous occupational therapists working with other patient populations, reported about the ADL performance of persons with vestibular impairment. The patients were asked to rate their performance on daily living tasks which ranged from mobility tasks in bed, such as rolling over, to instrumental tasks, like grocery shopping. This was done before as well as after participating in the vestibular rehabilitation program. Subjects reported having decrements in all performance areas. A few years later Cohen, Ewell and Jenkins (1995), using modified versions of the same scale, suggested regarding the existence of significant functional limitations in individuals with Meniere's disease during an attack. They also reported significant limitations in the patients with acoustic neuroma during their acute phase of recovery after the surgical excision of the tumour. However, the problem with these studies was a lack of documentation regarding the psychometric characteristics of the scale

which posed severe limitations for its usefulness in future research and planning of the treatment strategies.

The Dizziness Handicap Inventory (Jacobson & Newman, 1990) was one of the earliest developed scales of ADL which was specifically developed keeping in mind the persons with vestibular impairment. By way of addressing a large variety of requirements and behaviours that range from self-care to psychosocial communications, it completed an important link in the evaluation battery. This is a 25-item questionnaire that uses a 3-point qualitative scale to sum up the scores in order to obtain segment-scores and total scores. However, the problem of using a 3-point scale is that it limits the possible sensitivity of the middle rating. Infact, several patients have remarked regarding the ambiguity in the definition of level 2 which is “sometimes”. A graver problem with using this inventory is related to the broader domain of the scale which provides only an overview rather than in depth analysis of a particular domain (Cohen, 1992). On the contrary, the Activities-specific Balance Confidence Scale, which is a 16 item collage of activities rated along a 10-point scale, has items more explicit to equilibrium.

Several well-designed evaluations make use of multilevel scales for the patients to rate their difficulties on various domains of daily living activities. The Activities-specific Balance Confidence Scale incorporates an 11-level rating scale that uses 10% progressions which range from 0% (no confidence) to 100% (complete confidence). There are two well known rating scales that use 10-point rating systems. These are Canadian Occupational Performance Measure (COPM) (Law, Baptiste, McColl, Opzooomer, Polatajko, & Pollock, 1990; Law, Baptiste, Carswell-Opzooomer, McColl, Polatajko, & Pollock, 1991) and International Classification of Impairments, Disabilities, and Handicaps (ICIDH, 1980). While the COPM uses the scales for the rating of self-efficacy, satisfaction with self efficacy, and level of importance of the task to one’s life, ICIDH is more useful for predicting

recovery. However, these two questionnaires either use the levels of scales that are purely qualitative and ill defined or have specific definitions for each level of disability, but the definitions of the levels tend to vary across different domains.

The Dizziness Handicap Inventory was developed and published by Jacobson and Newman in 1990. Since then, Yardley and co-workers have published several papers that use a questionnaire-based mode for evaluating the effects of vestibular pathologies on the psychosocial function (Yardley, Masson, Cerschuur, Haacke, & Luxon, 1992; Yardley, Verschuur, Masson, Luxon, & Haacke, 1992; Yardley & Hallam, 1996). Nonetheless, neither these publications nor any of their predecessors have made use of questions that are directed specifically to the basic and instrumental activities. Also, there are no published reports of any such scale which is standardized on the Indian population as many questions of the existing western scales would not be applicable to the Indian socio-economic-cultural scenario. For example, the ABC scale has 8 questions that are related to walking up or down a ramp, using escalators, walking through a crowded mall etc. These questions would not be applicable for a sub-urban or rural Indian population as these facilities are not available in such areas.

There are a number of physiological and electrophysiological tests, like Vestibular Evoked Myogenic Potentials (VEMP), Electronystagmography (ENG), Videonystagmography (VNG), Computerised Dynamic Posturography, Rotatory chair test etc., which are available commercially for the evaluation of disorders related to giddiness. These tests, however, are expensive and their availability may be restricted to only a few centres. The previous studies that have developed the questionnaires have not explored the possibility of usefulness of their questionnaire in differential diagnosis of various disorders of giddiness. Thus, the study aimed at developing a questionnaire and validating it on the clinical population. The specific objectives of the study were:



1. To develop an assessment scale and standardize it in Indian socio-economic and cultural context.
2. To validate the so standardized scale on clinical population.
3. To check if the developed scale could be used for differential diagnosis of various vestibular pathologies.

### **Method**

The present study was conducted with an aim of developing a standardized assessment scale for the individuals with dizziness that was specifically associated with dysfunctional vestibular system. It also aimed to validate the scale on the clinical population and to check its utility in the differential diagnosis of various pathologies.

### **Participants**

A total of 56 subjects with peripheral (N = 49; 29 males & 20 females) and central (N = 7; 4 males & 3 females) vestibular disorders, as proved by the clinical examination and diagnostic battery. The participants were in the age range of 17 to 65 years. Those with tympanic membrane perforations or otitis media were not considered.

The group of participants with peripheral pathology consisted of three main entities- definite Meniere's disease (Group I; N = 28; 19 males & 9 females), Benign paroxysmal positional vertigo (BPPV; Group II; N = 14; 6 males & 8 females) and vestibular neuritis (Group III; N = 7; 4 males & 3 females). The diagnosis of definite Meniere's disease was attained on the basis of the criteria described by the American Academy of Otolaryngology-Head and Neck Surgery Committee on Hearing and Equilibrium (AAO-HNS, 1995). As per the AAO-HNS (1995) criteria for 'Definite Meniere's disease', the participants will be required to have history of at least two episodes of spinning vertigo, each lasting for a

duration of 20 minutes or more. In addition, they will also be required to have at least one instance of documented hearing loss, episodes of tinnitus accompanied by aural fullness in absence of other causes of hearing loss and vertigo. The diagnosis of BPPV was ascertained by the presence of a complaint of positional vertigo not lasting for more than a few seconds and positive results on Dix-Hallpike maneuver performed as per the guidelines given by the AAO-HNS (Bhattacharya et al., 2008). As per this guideline, the diagnosis of posterior canal BPPV be made on the basis of provocation of vertigo associated with nystagmus by the Dix-Hallpike maneuver which is performed by bringing the patient from an upright to supine position with the head turned 45° to one side and neck extended 20° and repeating the test on the other side also. The diagnosis of vestibular neuritis was arrived on the basis of persistent vertigo for days together with a history of significant illness or upper respiratory tract infections preceding the bout of vertiginous attacks. This was also confirmed by an otolaryngologist who diagnosed the condition by using exclusion criteria for other vestibular pathologies. Further, normal auditory brainstem responses and middle ear function characterized the participants with any of the above mentioned pathologies. In addition to the above mentioned criteria, none of the participants exhibited symptoms related to neural pathology or general weakness. Participants had no visual defects or the defects were correctable to within 6/6 on Metric acuity scale. None of the participants had diabetes as revealed by the blood test.

The group of participants with central pathology consisted of individuals with the diagnosis of Meningioma, cerebro-vascular attack, road traffic accidents and other intracranial tumors. The diagnosis was based on case history consistent with the above mentioned pathologies (like history of accident with injury to the head, history of stroke, intracranial pressure with persistent headache, tinnitus, & giddiness), positive results on ENG battery for central pathologies (like evidence of nystagmus on gaze test, asymmetric or poor morphology

of optokinetic tracking, under or over shooting on saccade test, direction changing nystagmus and/or high directional preponderance on bithermal caloric irrigation) and radiological confirmation of the pathology through Computerised tomography scans (CT scans) or Magnetic resonance imaging (MRI). The participants in this group were also devoid of any history of diabetes or other neural pathologies that affected client's mobility. The diagnosis of central as well as the peripheral pathologies was ensured through necessary examinations by an experienced otorhinolaryngologist.

## **Procedure**

The procedure for development of the questionnaire began by collecting questions from the already existing inventories, scales, and checklists. The activities that were more apt to the Indian scenario were also added, although some of them did not exist in any of the already published questionnaires. The resulting list of 40 activities were sent to a panel of 5 occupational therapists (OTs) and physical therapists (PTs) who individually determined if the activities were important for an ADL scale. They were also asked for suggestion for any additional activities. They suggested placement of each activities in the list of 3 possible subscales namely 'functional' (involving questions about self-care and intimate activities), 'ambulatory' (involving questions about walking, stair-case climbing etc.) and 'instrumental' (inclusive of questions about home management, productivity, and leisure activities). Based on their suggestions, the scale was modified by eliminating or adding certain parameters and dividing the scale into the above mentioned three sub-scales. The resultant list of items was again sent to a second panel of 5 OTs and PTs who were asked to rate the items value to the scale and also their appropriateness to each of the sub-scales. Only the items that were affirmed by more than 50% of the therapists were retained to obtain the final scale. The full procedure yielded a final questionnaire of 23 items with functional subscale including 6

items, ambulatory subscale having 9 items and 8 items in instrumental subscale. For rating the degree of difficulties on all the parameters, two different rating scales were used- a 3-points and a 7-points rating scale. The final questionnaire, along with the two rating scales, was developed in English and was further translated into Kannada and Malayalam in order to use it on these populations in their native language. Three languages, that is English, Kannada and Malayalam (language widely spoken in Karnataka and Kerala) were only selected, as the individuals with giddiness visiting our department are mainly from the southern states of India, especially Karnataka and Kerala. Forward and backward translation of the full questionnaire along with the two rating scales was done to avoid any alteration in the meaning of the items. Each level of the rating scale was defined in words and with a number to reduce the possible ambiguities in the interpretation. The developed questionnaire was administered on individuals whose chief complaint was giddiness for the purpose of validation.

All the participants were diagnosed as having either peripheral or central vestibular pathologies based on their complaints. They underwent detailed audiological as well as vestibular evaluation. The detailed evaluation comprised of a battery of tests including both subjective as well as objective tests. After placing participants in appropriate groups based on their symptoms and test results, subjects were briefed regarding the study's purpose and were requested to sign a informed written consent to prove their agreement for participation in the study. Participants were given the questionnaire in the printed form and they were asked to rate all the activities with two different rating scale, a 7-points rating scale and a 3-points rating scale, which were also provided to the participants along with the questionnaire. The questionnaire given to the participants were in their native language or in the language which they preferred (Kannada, Malayalam, & English). The two rating scales were given randomly to the participants to avoid order effect. The participants were asked to write the appropriate

number to the space provided in front of the items in a separate column. They were also asked to rate an item as '0' if they don't perform that particular activity or if it was not applicable to them.

In order to obtain the data for the test-retest reliability assessment, each participant was asked to complete the same questionnaire once again after one to three weeks of having completed them the first time. This research protocol was approved by the institutional review board, All India Institute of Speech & Hearing, Mysore.

### **Results**

This study aimed to develop a questionnaire which would help to index the impairment in the activities of daily living in individuals with dizziness. It also aimed to validate the developed questionnaire on the clinical population and to investigate whether it could help the clinician to differentially diagnose individuals with various vestibular pathologies.

The development of the questionnaire began with selection of questions related to daily living from the already existing questionnaires. A few questions were also added in order for the questionnaire to suit the activities performed in Indian cultural and socio-economic context. This resulted in a total of 40 questions. These 40 questions were reviewed by a panel of 5 occupational therapists (OT) and physical therapist (PT) for their suitability to assessment of daily living, especially in the India scenario. Based on their selection, the final questionnaire consisted of 23 questions pertaining to daily living activities. The resulting list of 23 activities was further categorized by a second panel of PT/OT, again consisting of 5 members, into three categories namely *functional*, *ambulatory* and *instrumental*. The *functional section* included activities that mainly deal with gross changes in body position, like getting up from bed, sudden movement of head, bending and picking up something from

ground etc. The *ambulatory section*, as the name suggests, included activities pertaining to the movement of the body from one place to another. It included activities related to movement on different surfaces, moving alone in darkness or travel alone. The *instrumental section* included activities often performed by an individual for maintaining their immediate environment that lets an individual live independently in a community. Some of the activities included in this section were sweeping, dancing, reading, and attending social activities. The final questionnaire developed was in English and was translated and reverse translated into two south Indian languages, Kannada and Malayalam for its wider usage. The questionnaire had two rating scales, a 3-point rating scale and 7-point rating scale. The questionnaire and the two rating scales have been shown in Tables 1 and 2 respectively.

A total of 56 participants, who had giddiness as their primary complaint and fulfilled the subject selection criteria, were asked to rate their difficulties on the developed questionnaire using both the 3-point and the 7-point rating scales. The ratings given by the participants were summed to get total scores for all the three sections and further percentages were also calculated based on the total scores obtained for all the sections separately as well as for the overall questionnaire. Based on the ratings given by the participants, questionnaire was analyzed separately for 3-point and 7-point rating scales. The rating descriptions used in the 7-points rating scale were inspired by the 11-points rating scale used by Cohen and Kimball (2000). The results of descriptive statistics are shown in Table 3. Median was considered to summarize the total as well as separate segments of the questionnaire. The use of median rather than mean would help to guard against the bias that can creep in to a sum if a participant does not answer or opts for a rating of “not applicable” for a particular question (Cohen & Kimball, 2000). Unlike the mean, the median is not overly influenced by the extreme ratings that tend to disagree with the rest of the participant’s assessment (Cohen & Kimball, 2000).

Table 1.

*The dizziness questionnaire as a result of two tier selection by two teams of physiotherapists and occupational therapists*

<b>Instruction:</b> This questionnaire aims at identifying the difficulties that you may be experiencing because of your dizziness. Mentioned below is a rating scale which contains explanation for the extent of difficulty that may be faced by you. You might be facing difficulty in performing the below mentioned activities of daily living. Based on the above mentioned 3-point rating scale, please write the number that best explains the level of difficulty in the following situations. In case you do not perform any one or more activities, please mark it as “0”.		
<b>Functional</b>		
<b>F1</b>	Bend over and pick up something from ground	
<b>F2</b>	Getting up from the bed / turning over in bed	
<b>F3</b>	Sudden movement of head to side or upwards	
<b>F4</b>	Getting up suddenly from sitting position	
<b>F5</b>	Putting socks/ shoes/ tying shoe lace	
<b>F6</b>	Standing for a long time in a crowd	
<b>Ambulatory</b>		
<b>A1</b>	Climbing up/down stairs or use an escalator	
<b>A2</b>	Walk for long distances	
<b>A3</b>	Walking on an irregular surface (surface which is not leveled)	
<b>A4</b>	Walking through a narrow path (space between chairs in a social gathering/ path in fields)	
<b>A5</b>	Walking on slippery, soggy or soft surface (e.g. on a recently mopped floor/ muddy routes during rainy season)	
<b>A6</b>	Moving around quickly and freely	
<b>A7</b>	Walk alone around / stay alone at home	
<b>A8</b>	Travel alone	
<b>A9</b>	Walk alone in darkness	
<b>Instrumental</b>		
<b>I1</b>	Stand on your toes and reach for something above your head	
<b>I2</b>	Social activities like party, get together, sports, amusement rides etc	
<b>I3</b>	Making plans in advance	
<b>I4</b>	Job	
<b>I5</b>	Sweeping/ mopping/ washing	
<b>I6</b>	Dancing	
<b>I7</b>	Reading	
<b>I8</b>	Getting in or out of car/ driving alone	

Table 2.

*Three-point and seven-point rating scales to be used with the questionnaire mentioned in Table 1.*

3-point Rating Scale		7-point rating scale	
Rating point	Rating description	Rating point	Rating description
1	Never face difficulty	1	I am not disabled; this problem has not changed my performance in any way.
		2	I am uncomfortable performing the activity but perceive no difference in the quality of my performance.
2	Sometimes face difficulty	3	I perceive a drop in the quality of my performance, but I continue to perform in the same manner as before.
		4	I have changed the manner of my performance (eg, I do things more slowly or carefully than before).
3	Always face difficulty	5	I use an object in the environment for assistance (eg, stair railing while climbing up or down).
		6	I am dependent on another person to perform this activity.
		7	I no longer perform the activity due to vertigo or a balance problem.

### Comparison between groups on 3-point rating scale

A *Kruskal-Wallis test* was done for the between group comparison for each of the questions in order to identify the questions that could separate the groups. When the rating percentage was taken for the entire questionnaire for the 3-point rating scale, there was no significant main effect of group on the rating score [ $\chi^2(3) = 3.31, p > 0.05$ ]. For the individual questions, the results for only 3 questions were found to show a significant main effect of group. These were A3 [ $\chi^2(3) = 8.96, p < 0.05$ ], I3 [ $\chi^2(3) = 8.11, p < 0.05$ ] and I4 [ $\chi^2(3) = 11.46, p < 0.05$ ]. A Mann-Whitney U test was done for pair-wise comparison between the groups which revealed a significant difference only between BPPV and central pathologies for A3 [ $Z = -2.53, p < 0.05$ ]. Between all the other groups there was no significant difference on A3. For I3, the difference existed only between MD and BPPV [ $Z = -2.69, p < 0.05$ ] and



not between any of the other pathologies. The results of comparison between groups on I4 revealed a significant difference between all the pairs of groups except between MD and vestibular neuritis [ $Z = -1.20, p > 0.05$ ] and also between BPPV and central [ $Z = -0.70, p > 0.05$ ].

### **Comparison between groups on 7-point rating scale**

The between group comparison on each of the questions using a 7-point rating scale revealed a significant main effect of group only for A8 [ $\chi^2(3) = 8.26, p < 0.05$ ]. On all the other questions, there was no group difference. A Mann Whitney U test was administered for pair-wise comparisons between the groups on A8. The results revealed a significant difference only between MD and BPPV [ $Z = -2.46, p < 0.05$ ]. Between all the other pairs, there was no significant difference.

Table 3.

*The median values for the percentage of rates given by all the participants taken together for both the rating scale.*

<b>Item</b>	<b>Median for 3-point scale</b>	<b>Median for 7-point scale</b>
<b>F1</b> (Bend over and pick up something from ground)	67	29
<b>F2</b> (Getting up from the bed / turning over in bed)	67	29
<b>F3</b> (Sudden movement of head to side or upwards)	67	29
<b>F4</b> (Getting up suddenly from sitting position)	33	14
<b>F5</b> (Putting socks/ shoes/ tying shoe lace)	33	14
<b>F6</b> (Standing for a long time in a crowd)	67	29
<b>A1</b> (Climbing up/down stairs or use an escalator)	33	21
<b>A2</b> (Walk for long distances)	67	29
<b>A3</b> (Walking on an irregular surface)	33	14
<b>A4</b> (Walking through a narrow path)	33	14
<b>A5</b> (Walking on slippery, soggy or soft surface)	33	14
<b>A6</b> (Moving around quickly and freely)	33	14
<b>A7</b> (Walk alone around / stay alone at home)	33	14
<b>A8</b> (Travel alone)	33	14
<b>A9</b> (Walk alone in darkness)	33	14
<b>I1</b> (Stand on toes & reach for something above head)	33	14
<b>I2</b> (Social activities like party/sports/amusement rides etc)	50	21
<b>I3</b> (Making plans in advance)	33	14
<b>I4</b> (Job)	67	14
<b>I5</b> (Sweeping/ mopping/ washing)	33	29
<b>I6</b> (Dancing)	0	0
<b>I7</b> (Reading)	33	14
<b>I8</b> (Getting in or out of car/ driving alone)	33	14

**Note:** ‘F’- parameters of functional section, ‘A’- parameters of ambulatory section, ‘I’- parameters of instrumental section.

## **Internal consistency and reliability**

In order to determine the reliability on the basis of internal consistency, the Chronbach  $\alpha$  coefficient was calculated (Nunnally, 1978). Further, the item-test correlations were used for detecting the items that fitted poorly with the entire test as well the specific segments to which they belonged. The results of item-test correlation as well as the Chronbach  $\alpha$  coefficient for the 3-point and 7-point rating scales are shown in Tables 4, 5, 6 and 7. The highest item-test correlations in each table indicate the items that best represent the scores on that segment of the scale. The interpretations of alpha values were based on the classification by Versino, Colnaghi and Callieco (2001). As per this, alpha values greater 0.7 were considered to have excellent reliability, lesser than 0.4 to have poor reliability and intermediate values were considered to have fair/moderate reliability. In the present study, several items showed poor internal consistency and reliability on the overall questionnaire and the individuals segments (functional, ambulatory, & instrumental). The use of 3-point rating scale demonstrated more number of items with lower values on item-test correlation as well as Cronbach alpha than the 7-point rating scale. Nonetheless, the values of  $\alpha$  of less than 0.4 were obtained only for F5 (putting socks/ shoes/ tying shoe lace) and I6 (dancing) on both the rating scales. Additionally, these two items also fared poorly on the internal consistency as well on both rating scales.

Table 4.

*Item-test correlation and Chronbach  $\alpha$  coefficient of full questionnaire for the two rating scales*

Item	3-point scale		7-point scale	
	Item-test correlation	$\alpha$	Item-test correlation	$\alpha$
<b>F1</b> (Bend over and pick up something from ground)	0.54	0.65	0.56	0.58
<b>F2</b> (Getting up from the bed / turning over in bed)	0.17	0.30	0.56	0.65
<b>F3</b> (Sudden movement of head to side or upwards)	0.63	0.65	0.73	0.76
<b>F4</b> (Getting up suddenly from sitting position)	0.58	0.66	0.64	0.78
<b>F5</b> (Putting socks/ shoes/ tying shoe lace)	0.29	0.46	0.19	0.41
<b>F6</b> (Standing for a long time in a crowd)	0.53	0.62	0.64	0.70
<b>A1</b> (Climbing up/down stairs or use an escalator)	0.62	0.65	0.60	0.67
<b>A2</b> (Walk for long distances)	0.38	0.50	0.50	0.64
<b>A3</b> (Walking on an irregular surface)	0.72	0.73	0.59	0.75
<b>A4</b> (Walking through a narrow path)	0.63	0.74	0.60	0.75
<b>A5</b> (Walking on slippery, soggy or soft surface)	0.58	0.66	0.61	0.76
<b>A6</b> (Moving around quickly and freely)	0.70	0.74	0.74	0.76
<b>A7</b> (Walk alone around / stay alone at home)	0.33	0.54	0.74	0.86
<b>A8</b> (Travel alone)	0.61	0.69	0.51	0.75
<b>A9</b> (Walk alone in darkness)	0.64	0.71	0.59	0.69
<b>I1</b> (Stand on toes & reach for something above head)	0.61	0.66	0.75	0.74
<b>I2</b> (Social activities like party/sports/amusement rides etc)	0.56	0.57	0.58	0.59
<b>I3</b> (Making plans in advance)	0.40	0.59	0.55	0.73
<b>I4</b> (Job)	0.32	0.40	0.69	0.77
<b>I5</b> (Sweeping/ mopping/ washing)	0.39	0.50	0.74	0.78
<b>I6</b> (Dancing)	0.31	0.38	0.23	0.31
<b>I7</b> (Reading)	0.40	0.58	0.39	0.69
<b>I8</b> (Getting in or out of car/ driving alone)	0.54	0.59	0.62	0.76

**Note:** 'F'- parameters of functional section; 'A'- parameters of ambulatory section; 'I'- parameters of instrumental section; ' $\alpha$ '- Chronbach  $\alpha$  coefficient

Table 5.

*Item-test correlation and Chronbach  $\alpha$  coefficient of functional segment of the questionnaire for 3-point and 7-point rating scales*

Items	3-point scale		7-point scale	
	Item-test correlation	$\alpha$	Item-test correlation	$\alpha$
<b>F1</b> (Bend over and pick up something from ground)	0.73	0.76	0.66	0.74
<b>F2</b> (Getting up from the bed / turning over in bed)	0.37	0.52	0.66	0.72
<b>F3</b> (Sudden movement of head to side or upwards)	0.73	0.73	0.72	0.75
<b>F4</b> (Getting up suddenly from sitting position)	0.64	0.67	0.63	0.81
<b>F5</b> (Putting socks/ shoes/ tying shoe lace)	0.30	0.49	0.29	0.59
<b>F6</b> (Standing for a long time in a crowd)	0.47	0.56	0.60	0.70
<b>Functional total</b>	0.84	0.92	0.87	0.93

**Note:** ‘F’- parameters of functional section; ‘A’- parameters of ambulatory section; ‘I’- parameters of instrumental section; ‘ $\alpha$ ’- Chronbach  $\alpha$  coefficient

Table 6.

*Item-test correlation and Chronbach  $\alpha$  coefficient of ambulatory segment of the questionnaire for 3-point and 7-point rating scales*

Items	3-point scale		7-point scale	
	Item-test correlation	$\alpha$	Item-test correlation	$\alpha$
<b>A1</b> (Climbing up/down stairs or use an escalator)	0.73	0.79	0.72	0.79
<b>A2</b> (Walk for long distances)	0.56	0.71	0.65	0.81
<b>A3</b> (Walking on an irregular surface)	0.74	0.87	0.67	0.82
<b>A4</b> (Walking through a narrow path)	0.73	0.85	0.68	0.83
<b>A5</b> (Walking on slippery, soggy or soft surface)	0.67	0.80	0.65	0.78
<b>A6</b> (Moving around quickly and freely)	0.68	0.84	0.74	0.79
<b>A7</b> (Walk alone around / stay alone at home)	0.32	0.63	0.71	0.87
<b>A8</b> (Travel alone)	0.71	0.78	0.52	0.82
<b>A9</b> (Walk alone in darkness)	0.67	0.79	0.67	0.81
<b>Ambulation total</b>	0.85	0.91	0.90	0.94

**Note:** ‘F’- parameters of functional section; ‘A’- parameters of ambulatory section; ‘I’- parameters of instrumental section; ‘ $\alpha$ ’- Chronbach  $\alpha$  coefficient

Table 7.

*Item-test correlation and Chronbach  $\alpha$  coefficient of instrumental segment of the questionnaire for 3-point and 7-point rating scales*

Items	3-point scale		7-point scale	
	Item-test correlation	$\alpha$	Item-test correlation	$\alpha$
<b>I1</b> (Stand on toes & reach for something above your head)	0.65	0.69	0.78	0.80
<b>I2</b> (Social activities eg. party, sports, amusement rides etc)	0.80	0.73	0.70	0.74
<b>I3</b> (Making plans in advance)	0.47	0.55	0.56	0.77
<b>I4</b> (Job)	0.52	0.64	0.67	0.80
<b>I5</b> (Sweeping/ mopping/ washing)	0.53	0.71	0.71	0.80
<b>I6</b> (Dancing)	0.38	0.12	0.26	0.32
<b>I7</b> (Reading)	0.36	0.32	0.42	0.74
<b>I8</b> (Getting in or out of car/ driving alone)	0.46	0.32	0.64	0.75
<b>Instrumental total</b>	0.78	0.90	0.92	0.94

**Note:** ‘F’- parameters of functional section; ‘A’- parameters of ambulatory section; ‘I’- parameters of instrumental section

#### **Comparison between 3-point and 7-point rating scales**

A *Wilcoxon Signed Rank test* was done to compare the two rating scales. Since both the rating scales had unequal number of response categories, the ratings given by the participants were converted into percentage scores. For the further analysis only the percentage scores were considered. The percentage median scores for all the four groups have been shown in the Table 8. Figure 1 shows the median scores of each question for all the three sub-scales of the study in all four groups.

Table 8.

*The median percentage scores of all the four groups for both the rating scales*

	MD		BPPV		VN		CP	
	3-point	7-point	3-point	7-point	3-point	7-point	3-point	7-point
<b>F1</b>	67	29	50	29	67	57	33	14
<b>F2</b>	67	29	67	43	67	57	67	29
<b>F3</b>	67	29	33	36	67	43	67	14
<b>F4</b>	50	21.5	33	14	67	14	33	14
<b>F5</b>	33	14	33	14	33	14	0	0
<b>F6</b>	67	29	33	14	67	14	67	29
<b>A1</b>	67	36	33	21.5	33	14	67	57
<b>A2</b>	67	36	33	14	33	29	67	14.
<b>A3</b>	33	21.5	33	14	33	14	67	14
<b>A4</b>	50	21.5	33	14	33	14	67	14
<b>A5</b>	50	14.	33	14	33	14	67	14
<b>A6</b>	33	29	33	14	33	14	67	43
<b>A7</b>	33	14	33	14	33	29	33	14
<b>A8</b>	67	14	33	14	33	14	33	14
<b>A9</b>	33	29	33	14	33	14	67	14
<b>I1</b>	33	14	50	21	67	29	67	0
<b>I2</b>	50	29	33	14	67	29	33	14
<b>I3</b>	33	14	33	14	33	14	33	14
<b>I4</b>	67	29	33	14	67	43	33	14
<b>I5</b>	33	29	33	29	67	29	33	14
<b>I6</b>	0	0	0	0	0	0	0	0
<b>I7</b>	33	14	33	14	33	14	33	14
<b>I8</b>	33	14	33	14	33	14	33	14

Note: MD- Meniere's disease, BPPV- Benign paroxysmal positional vertigo, VN- Vestibular Neuritis, CP- central pathology.

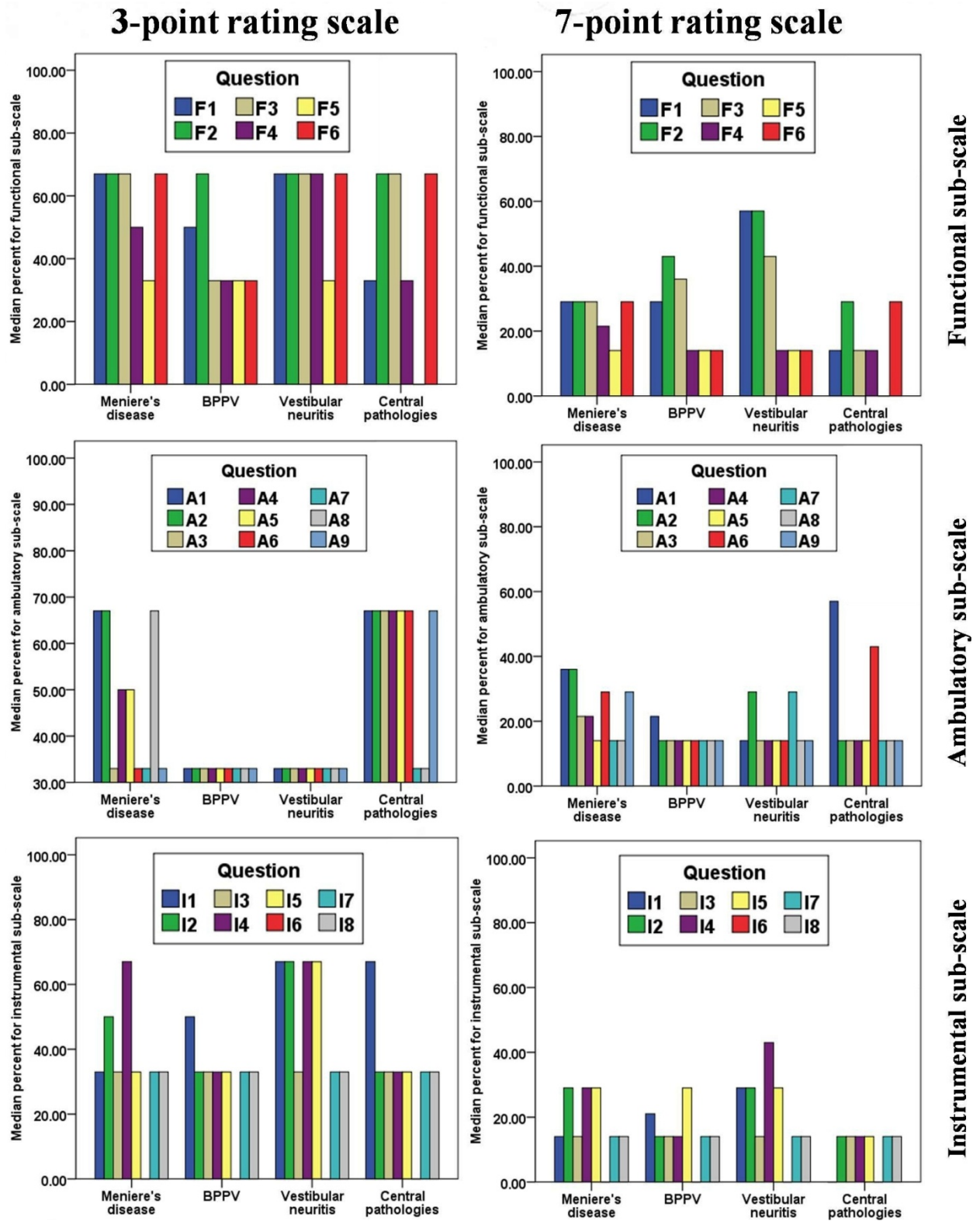


Figure 1: Median percent scores (Y-axis) of different questions of each sub-scale in all the four pathologies of the study for both 3-point and 7-point rating scales



The *Wilcoxon signed rank test* was done for the overall data irrespective of the groups and the results revealed a significant difference between the scales at every question ( $p < 0.05$ ). Later, all the four groups were analyzed separately. In group of individuals with MD, all the questions showed statistically significant difference ( $p < 0.05$ ) except for A9 [ $Z = -1.74, p > 0.05$ ] and I6 [ $Z = -1.07, p > 0.05$ ]. When the group of individuals with BPPV was analyzed, again there was a significant difference between the two scales for every question ( $p < 0.05$ ) other than A1 [ $Z = -0.76, p > 0.05$ ] and I6 [ $Z = -0.73, p > 0.05$ ]. In case of the vestibular neuritis group, the difference between the scales was obtained only for some questions. These included A4 [ $Z = -2.03, p < 0.05$ ], I2 [ $Z = -2.03, p < 0.05$ ], I3 [ $Z = -1.99, p < 0.05$ ], I4 [ $Z = -2.20, p < 0.05$ ] and I7 [ $Z = -2.03, p < 0.05$ ].

In order to know the relation between both the rating scales, *Pearson's correlation* analysis was carried out. It was done for the total scores as well as the percentage scores of the questionnaire. The results revealed a significant association for the total scores ( $\rho = 0.68, p < 0.05$ ) as well as the percentage scores ( $\rho = 0.684, p < 0.05$ ) between the rating scales. Thus, a high positive correlation was observed between the two rating scales.

### **Test-retest evaluation**

The questionnaire was administered twice on seven participants, on the first visit to the institute and on follow-up within 15 days of their first visit. The participants were made to rate the questionnaire based on both the rating scales. Test-retest reliability was calculated using Cronbach  $\alpha$  coefficient. The calculated  $\alpha$  values for all the sections and full scale are given in Table 9.

Table 9.

*Test-retest reliability using Cronbach  $\alpha$  coefficient for both the rating scales*

Parameters	Cronbach $\alpha$ coefficient	
	3-point scale	7-point scale
<b>F1</b> (Bend over and pick up something from ground)	0.90	0.84
<b>F2</b> (Getting up from the bed / turning over in bed)	1.00	0.98
<b>F3</b> (Sudden movement of head to side or upwards)	0.58	0.69
<b>F4</b> (Getting up suddenly from sitting position)	0.73	0.78
<b>F5</b> (Putting socks/ shoes/ tying shoe lace)	0.90	0.96
<b>F6</b> (Standing for a long time in a crowd)	1.00	0.98
<b>Functional section (overall)</b>	<b>0.95</b>	<b>0.97</b>
<b>A1</b> (Climbing up/down stairs or use an escalator)	0.73	0.92
<b>A2</b> (Walk for long distances)	0.88	0.94
<b>A3</b> (Walking on an irregular surface)	0.35	0.99
<b>A4</b> (Walking through a narrow path)	0.92	0.86
<b>A5</b> (Walking on slippery, soggy or soft surface)	0.95	0.99
<b>A6</b> (Moving around quickly and freely)	0.73	0.77
<b>A7</b> (Walk alone around / stay alone at home)	0.50	0.78
<b>A8</b> (Travel alone)	0.71	0.76
<b>A9</b> (Walk alone in darkness)	0.68	0.69
<b>Ambulatory section (overall)</b>	<b>0.91</b>	<b>0.91</b>
<b>I1</b> (Stand on toes & reach for something above your head)	0.87	0.82
<b>I2</b> (Social activities eg. party, sports, amusement rides etc)	0.64	0.89
<b>I3</b> (Making plans in advance)	0.62	0.90
<b>I4</b> (Job)	0.93	0.76
<b>I5</b> (Sweeping/ mopping/ washing)	1.00	0.73
<b>I6</b> (Dancing)	0.90	1.00
<b>I7</b> (Reading)	0.92	0.97
<b>I8</b> (Getting in or out of car/ driving alone)	1.00	0.95
<b>Instrumental section (overall)</b>	<b>0.94</b>	<b>0.95</b>
<b>Total Scale</b>	<b>0.95</b>	<b>0.94</b>

The ' $\alpha$ ' values for all the three sections along with total scores was observed to be more than 0.90 for both the rating scales. This high value of coefficient indicates both the scales to show excellent test-retest reliability and thus can be used again and again with equal confidence. Since the difference in values between both the scales is marginal, both the scales can be treated as equally reliable.

## Discussion

The present study developed a questionnaire for assessing the changes in the efficiency of carrying out the daily living activities in persons with vestibular impairment. The output was named 'Dizziness Index of Impairment in Activities of Daily Living Scale for Indian Population' and it consisted of 23 items. The number of items here is an interplay between the Dizziness Handicap Inventory (Jacobson & Newman, 1990), which is a 16-item questionnaire and the 'Vestibular Disorders Activities of Daily Living' (Cohen & Kimball, 2000), which is a 28-item questionnaire. This ensures that the questionnaire is neither too long nor too superficial. The questionnaire dropped several questions that had lower probability of being applicable in Indian context, especially in the semi-urban and rural areas. For example, the ABC scale has 8 questions that are related to walking up or down a ramp, using escalators, walking through a crowded mall etc. These questions would not be applicable for a sub-urban or rural Indian population as these facilities are not available in such areas.

The internal consistency was assessed for 3-point as well as 7-point rating scale. All the items for the overall questionnaire as well as segments revealed moderate or excellent internal consistency when using a 3-point rating scale. The only exceptions to this were F2, F5, A7, I4, I5 and I6 for the overall questionnaire which revealed poor internal consistency (item-test correlation less than 0.4). Among these, only F5 (putting socks/ shoes/ tying shoe lace) and I6 (dancing) demonstrated poor reliability ( $\alpha < 0.4$ ) also. For the 7-point scale on the overall questionnaire, poor internal consistency was shown by F5, I6 and I7 nonetheless, poor reliability was noticed only for I6. Even when evaluating the segments functional, ambulatory and instrumental separately, F5 and I6 were observed to demonstrate poor internal consistency and reliability. One of the previously reported studies has reported poor internal consistency only for a task involving "sitting up and lying down" (Cohen & Kimball,

2000). For all the other items, they reported excellent internal consistency as well as reliability. The present study also revealed lower values of item-test correlation and Chronbach  $\alpha$  coefficient for most of the items than in study by Cohen and Kimball (2000). The differences in the findings of the present study to that reported previously might be attributed to the use of different populations. The present study validated the questionnaire on clients with Meniere's disease, BPPV, vestibular neuritis and central pathologies whereas Cohen and Kimball (2000) ruled out most of these pathologies when selecting participants for validating their questionnaire.

The reasons behind poor internal consistency and reliability for F5 (putting socks/shoes/ tying shoe lace) and I6 (dancing) could be hidden in the kind of individuals on whom the questionnaire was validated. Putting socks/shoes/tying shoe lace is more a male oriented activity which many of the Indian women do not take up. The questionnaire in the present study was validated on 23 females and 33 males. This would mean that a score of 0 was used by a large number of the participants who were women which would have resulted in lower median values and therefore poor internal consistency. Similarly, dancing is an activity that might not be performed by a large section of the society which would, like putting socks/shoes/tying shoe lace, produce lower medians and thereby lower internal consistency compared to some of the other more frequently performed activities. Nonetheless, these are important activities of daily living and therefore despite of being low on internal consistency, they were retained in the questionnaire.

The present study used 3-points as well as 7-points rating scales for the validation of the questionnaire. The Higher internal consistency as well as reliability was observed for the 7-point rating scale than the 3-point rating scale for the individual segments as well as the overall questionnaire. In terms of test-retest reliability, the results of the present study revealed nearly similar  $\alpha$ -values for both the scales, with 7-point showing marginally higher

values than the 3-point one for individual segments as well as the overall questionnaire. The previous studies that have developed the questionnaires to assess the functioning of individuals have used various different number of items in the rating scales however none of them have compared any two rating scales. Nonetheless, Preston and Coleman (2000) compared the effect of different number of items in the rating scales on various parameters and reported higher test-retest reliability, internal reliability, item-whole correlation and discriminating power for the 7-point rating scale than 3-point rating scale. Thus, the findings of the present study are in sync with that reported by Preston and Cohen (2000). In the present study, a 11-point rating scale as used by Cohen and Kimball (2000) was not used. This was owing to the fact that a 7-point rating scale has been reported to show better respondents' preference by virtue of being easier to use, quicker to respond and better in expressing feelings than a 11-point rating scale without particularly being detrimental to internal reliability, internal consistency, discriminating power and test-retest reliability (Preston & Colman, 2000). Some of the other studies also reported 6 to 7 point rating scales to be better than the scales using lower or higher number of items (Symonds, 1924; Green & Rao, 1970). Thus, the use of 7-point rating scale appears to be wiser.

The developed questionnaire was also checked for its ability to differentially diagnose between the vestibular pathologies. The results revealed no difference between the group of participants with Meniere's disease, BPPV, vestibular neuritis and central pathologies except on some sporadic questions which might have been just a chance occurrence. There was no particular pattern to these differences. None of the previously published questionnaires related to daily living have investigated the ability of the questionnaire to differentiate between the pathologies. Therefore this can be considered the first attempt at such an investigation. The reasons behind lack of difference between the groups could be attributed to the presence of overlapping symptoms like giddiness and other autonomic nervous system

activation related symptoms between the pathologies. The presence of such symptoms in an individual is likely to affect individuals with different pathologies in the same manner, irrespective of the differences in pathophysiology producing the symptoms since it's the symptom (regularity/unpredictability, severity & longevity of presence) that manipulates the individual's life and not the pathology itself. Since giddiness in different forms (like vertigo, imbalance, swaying sensation etc.) was mostly responsible for affecting an individual's life and since this was present in all the individuals irrespective of the groups, the lack of differences between the groups could be understood. Thus, it shows a lack of ability for a questionnaire on activities of daily living in discriminating between various vestibular pathologies.

### **Conclusion**

As a result of the present study a questionnaire namely 'Dizziness Index of Impairment in Activities of Daily Living Scale for Indian Population' was developed which was found to have moderate to excellent internal consistency and reliability as well as test-retest reliability. However, the questionnaire was not found to be useful in differential diagnosis between the vestibular pathologies. Nonetheless, it was validated to use with persons with vestibular pathologies for assessing the effect of the vestibular deficits on their activities of daily living.

## References

- American Academy of Otolaryngology-Head and Neck Surgery Committee on Hearing and Equilibrium (1995). Committee on hearing and equilibrium guidelines for the diagnosis and evaluation of therapy in Meniere's disease. *Otolaryngology-Head and Neck Surgery, 113*, 181-185.
- Bhattacharya N., Baugh, R. F., Orvidas, L., Barrs, D., Bronston, L. J., Cass, S. et al. (2008). Clinical practice guideline: Benign paroxysmal positional vertigo. *Otolaryngology and Head Neck Surgery, 139*, S47-S81.
- Cohen, H. (1992). Vestibular rehabilitation reduces functional disability. *Otolaryngology and Head & Neck Surgery, 107*, 638-643.
- Cohen, H. (1995). Defining disablement in otolaryngology. *Ear Nose Throat Journal, 74*, 233-237.
- Cohen, H. S., & Kimball, K. T. (2000). Development of the vestibular disorders activities of daily living scale. *Archives of Otolaryngology- Head and Neck Surgery, 126*, 881-887.
- Cohen, H., Ewell, L. R., & Jenkins, H. A. (1995). Disability in Meniere's disease. *Archives of Otolaryngology and Head & Neck Surgery, 121*, 29-33.
- Derebery, M. J. (1999). The diagnosis and treatment of dizziness. *The Medical Clinics of North America, 83(1)*, 163-77.2.
- Green, P. E., & Rao, V. R. (1970). Rating scales and information recovery: How many scales and response categories to use?. *Journal of Marketing, 34*, 33-39.
- Gresham, G. E., & Dittmar, S. S. (1997). Instruments used to assess function and measure outcomes in physical rehabilitation. In: *Dittmar SS, Gresham GE, eds. Functional Assessment and Outcome Measures for the Rehabilitation Professional. Gaithersburg, Md: Aspen Publishers Inc; 27-30.*
- International Classification of Impairments, Disabilities, & Handicaps. (1980). Geneva, Switzerland: World Health Organization.

- Jacobson, G.P., & Newman, C.W. (1990). The development of the dizziness handicap inventory. *Arch Otolaryngol Head Neck Surg*, 116: 424–7.
- Law, M., Baptiste, S., Carswell-Opzoomer, A., McColl, M. A., Polatajko, H., & Pollock, N. (1991). Canadian Occupational Performance Measure. Toronto, Ontario: Canadian Association of Occupational Therapists.
- Law, M., Baptiste, S., McColl, M., Opzoomer, A., Polatajko, H., & Pollock N. (1990). The Canadian Occupational Performance Measure: an outcome measure for occupational therapy. *Canadian Journal of Occupational Therapy*, 57, 82-87.
- Neuhauser, H. K., & Lempert, T. (2009). Vertigo: epidemiologic aspects. *Seminars in Neurology*, 29 (5), 473–81.
- Nunnally, J. C. (1978). *Psychometric Theory* (2<sup>nd</sup> Ed). New York, NY: McGraw-Hill Co.
- Preston, C. C., & Coleman, A. M. (2000). Optimal number of response categories in rating scales: reliability, validity, discriminating power, and respondent preferences. *Acta Psychologica*, 104, 1-15.
- Reed, K. L. (1984). *Models of Practice in Occupational Therapy*. Baltimore, Md: Williams & Wilkins.
- Symonds, P. M. (1924). On the loss of reliability in ratings due to coarseness of the scale. *Journal of Experimental Psychology*, 7, 456±461.
- Versino, M., Colnaghi, S., & Callieco, R. (2001). Vestibular evoked myogenic potentials; Test-retest reliability. *Functional neurology*, 16, 299-309.
- Yardley, L., & Hallam, R. S. (1996). Psychosocial aspects of balance and gait disorders. In: Bronstein AM, Brandt T, Woollacott M, eds. *Clinical Disorders of Balance, Posture and Gait*. London, England: Arnold; 251-267.
- Yardley, L., Masson, E., Verschuur, C., Haacke, N., & Luxon, L. (1992). Symptoms, anxiety and handicap in dizzy patients: development of the Vertigo Symptom Scale. *Journal of Psychosomatic Research*; 36:1-11.



Yardley, L., Verschuur, C., Masson, E., Luxon, L., & Haacke, N. (1992). Somatic and psychological factors contributing to handicap in people with vertigo. *British Journal of Audiology*; 26:283-290.