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The validity of Arabic version of Vestibular Disorder Activities of Daily Living Scale in common episodic vestibular disorders during and in between the attacks: a cross-sectional study

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Abstract

Background: Activities of daily living (ADLs) are activities oriented toward taking care of one's own body independently. Vestibular Disorder Activities of Daily Living Scale (VADL) includes 28 questions designed to specifically assess the effects of different vestibular disorders on activities of daily living and assess the validity and reliability of the Arabic version of VADL and applying it to assess severity of the attacks related to most common episodic vestibular disorders. The Arabic version of VADL was distributed to 52 participants, recruiting two participants per question. The participants filled up the Arabic version of VADL scale, in-between and during the vertigo episodes.

Results: All participants have been diagnosed as having one of these vestibular disorders benign paroxysmal positional vertigo (BPPV), vestibular migraine, and Meniere's disease. The reliability analysis was calculated with Cronbach's alpha score, and it was 0.980, indicating high reliability. There was a positive correlation between the VADL scores during and in between the attacks of vertigo for the three diseases ($p = 0.03$). There was a statistical difference between the three disorders during and in between the attacks (p -value during the attack < 0.0001 , p -value in between the attacks = 0.046). Meniere's disease had the most negative impacts on daily activities performance, followed by BPPV, and vestibular migraine had the least effect. There was statistically significant correlation between VADL and visual analog scale (VAS) during and in between the attacks (Pearson correlation 0.74, $p < 0.0001$).

Conclusion: The Arabic version of VADL scale has high validity and an excellent reliability among our demographic population. Meniere's disease has the worst impact on patients' performance in activities of daily living compared to BPPV and vestibular migraine.

Keywords: BPPV, Migraine, Meniere's disease, Activities of daily living

Background

Vertigo, an illusionary sense of motion, is a complaint that impairs patient's quality of life (QoL) and decreases independence in performing activities of daily living (ADLs) [1, 2]. The prevalence of dizziness (including vertigo) among the general population was reported to be up to 20 to 30% [3, 4]. Vertigo caused by vestibular disorders

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accounts for about 25% of dizziness complaint, which means prevalence of 5% [4]. Vestibular vertigo is at least twice more common in females than males [4]. Some vestibular disorders cause episodic vertigo such as BPPV, vestibular migraine, and Meniere's disease. The vertigo attacks interfere with functional performance in life [5]. ADLs are the essential activities that people do routinely and independently in their daily life, for example, dressing and bathing [6]. It was reported that vertigo affects the employee's capacity in terms of lost working days (67%), reduced workload (67%), and changing or quitting of the job (4.6%) [7]. A study conducted by Benecke et al. concluded that the presence of vertigo markedly reduces the work performance [1]. VADL scale which was first published by Cohen & Kimball in 2000 was used in this study to assess the effects of the three most common episodic vestibular disorders (BPPV, vestibular migraine, and Meniere's disease) on independency and the quality of life of patients during and in between the attacks. The advantage of VADL scale is that it has been designed to specifically assess the negative impact of vestibular disorders on ADLs performance [8]. Patients who are suffering from the above-mentioned disorders usually avoid head and neck movements and postural changes to minimize vertigo sensation [9]. Based on what has been reported in different studies, we assumed that patients with any of the three mentioned diseases will have difficulty performing ADLs during the attacks of vertigo [10–12]. In other words, they will be more dependent on others in performing their activities and that compromise their quality of life. Furthermore, their performance in between the attacks might be affected by the existing vestibular disorder. The VADL scale helps to address the effect of vestibular disorders on patients life and to assess their level of independence [8]. It was originally published in English, and up to the time of finalizing this manuscript, the authors are not aware of any study that published an Arabic version of this questionnaire and assessed its validity and reliability. We used VADL scale in order to know how far vertiginous attacks do affects patients' life during and in between the attacks and which disease has more negative impact on patients' ADLs and quality of life [13].

Methods

This study was granted an approval by the Institutional Review Board at King Abdullah International Research Center to be conducted at King Abdulaziz Medical City-Jeddah (KAMC-J). The used study design is an observational, analytical, cross-sectional study, where patients with vestibular disorders who presented to ENT clinic were invited to participate in the study by filling up a questionnaire aiming to assess the validity and reliability of the Arabic version of the VADL scale and,

furthermore, to assess severity of the attacks related to different episodic vestibular disorders. The study was conducted at the ENT Department at the Kin Abdul Aziz Medical City, Jeddah, Saudi Arabia, between October 2019 and December 2019. The sampling technique in the study was a non-probability, consecutive sampling technique, where all patients who fulfill the inclusion criteria were included.

Study group

The inclusion criteria are as follows: patients who attended the ENT clinic complaining of vertigo either as a first visit or as a follow-up and were finally diagnosed with any one of the three disorders (BPPV, definite Meniere's disease, and definite vestibular migraine) according to the Barany society diagnostic criteria [14–16] and were invited to participate in the study by filling the questionnaire. Only patients who has been diagnosed at KAMC-J were included.

The exclusion criteria are as follows: patients with probable Meniere's disease and probable vestibular migraine and patients with simultaneous vestibular migraine and Meniere's disease or simultaneous vestibular migraine and BPPV were excluded. Patients with structural brain lesions, cognitive impairments, comorbidity with other vestibular pathologies, other otological diseases, and neurological diseases other than vestibular migraine were also excluded.

Measurement tool: the VADL scale

The used instrument (VADL) is an English questionnaire which has been created by Cohen and Kimball in 2000. It has been previously validated in many international studies and is being used clinically. Consent was obtained from the original authors of the scale to translate the questionnaire and use it for clinical practice and research studies. The process was carried out in correspondence with Cross-Cultural Adaptation guideline [17]. The questionnaire encompasses 28 activities that address functional, ambulation, and instrumental activities. It has a 1–10 scale to assess each activity depending on the participant self-perceived performance of daily activities. Not applicable (N/A) was scored as zero to avoid extreme values. Afterwards, scores are summed and calculated to get the mean score for each participant. The participants ($n=52$) were given the VADL, and they filled the questionnaire twice at the same session (once to describe their condition during the attack, and once to describe their condition in-between the attack). Participants rated their performance on each item according to their performance in each task.

Statistical analysis

The data were processed and managed by the Statistical Package for the Social Sciences Program (SPSS 21). Simple descriptive analysis was reported, frequencies and percentages were used for qualitative data, mean and standard deviation or median, and IQR were used for the quantitative variables. In bivariate analysis, we reported the paired sample *t*-test and correlation analysis to identify the significance between variables, and *p* value of 0.05 was considered a significant.

Results

Basic characteristics of study population

Overall, 52 participants who met the inclusion criteria were included in the final analysis. There were 33 female (63%) and 19 male patients (37%). The mean age of our study population was 40.6 years (standard deviation=0.12), 43 years for the male and 39 years for the female group (*t*-test = 1.18, *df* = 50, *p* = 0.245).

Regarding the diagnostic categorization of participants in this study, there were 17 patients (33%) diagnosed with BPPV, 23 patients (44%) with definite vestibular migraine, and 12 patients (23%) with definite Meniere's disease as shown in Table 1.

Creating the Arabic version of the VADL scale: validity and reliability

The English version of the VADL scale has been already validated in different studies. The original VADL scale was given to an expert member of the research team (Dr. Alfarghal Mohamed) to translate it from English to Arabic. Then, the translated Arabic version was sent to another research team member (Dr. Mohammed Al Garni), who was neither involved nor aware of the original questionnaire for reverse translation back to English. Finally, the two English scales, original and the reversely translated one, were reviewed by a third expert (Dr. Hadi

Al-Hakami) to compare between them, and the questionnaire was validated through face-validity. Then, a pilot study was conducted where we distributed the Arabic version of the questionnaire to 52 participants, with a ratio of two participants per one question. The reliability analysis of the Arabic version (Supplementary file 1) of VADL scale was performed through SPSS, and the Cronbach's alpha score was 0.980 that indicates excellent reliability.

Correlation of VADL scale score and vestibular disorders during and in between the attacks

The VADL scale includes 28 items, with a score from 1–10 for each question, and the anticipated maximum score is 280. The higher the score is, the less independent and more severe disease process.

The median VADL score for the study population during the attacks of vestibular disorders was 141 (IQR = 169.5), while the median score in between the attacks was 28 (IQR = 17.5). There was a positive correlation between the two scores which was statistically significant in Spearman correlation analysis with *p* = 0.03. The higher the score during the attacks leads to higher score in between the attacks (Fig. 1).

There was a statistically significant difference between the three disorders during the attacks where the mean scores of Meniere's disease were the highest with a value of 243 in comparison to BPPV with a mean score 133 and vestibular migraine with a mean of 121 on the performance of daily life activities (ANOVA, *p* value < 0.0001).

The same relationship was observed in between the attacks, where a statistically significant difference in the mean score of the three diseases, with Meniere's disease patients got the worst score with mean value of 54, then BPPV patients with mean value of 43 and vestibular migraine patients with mean value of 30 (ANOVA, *p* value = 0.046). Table 2 demonstrated summary of the mean VADL score among the three vestibular disorders.

Table 1 Demographic features of the study population

| Total study population | Frequency % |
|---|-------------------|
| Gender | |
| Male | 19 (37%) |
| Female | 33 (63%) |
| Mean age (SD) | 40.6 years (0.12) |
| Disease | |
| BPPV | 17 (33%) |
| Vestibular migraine | 23 (44%) |
| Ménière's disease | 12 (23%) |
| VADL mean scores during attacks (SD) | 153.1 (83.51) |
| VADL mean scores in between the attacks (SD) | 39.7 (29.06) |

Correlation between the VADL scale and visual analog scale

In this study, we add a visual analog scale for independence of daily activity to assess the patients' overall daily activities of living performance.

Figures 2 and 3 showed the correlation of the VADL scores and VAS scores during and in between the attacks. Both graphs indicate that there is statistically significant correlation (Pearson correlation 0.74, *p* < 0.0001) between the two scores, which means the higher the VADL score, the higher the VAS score, during and in between the attacks.

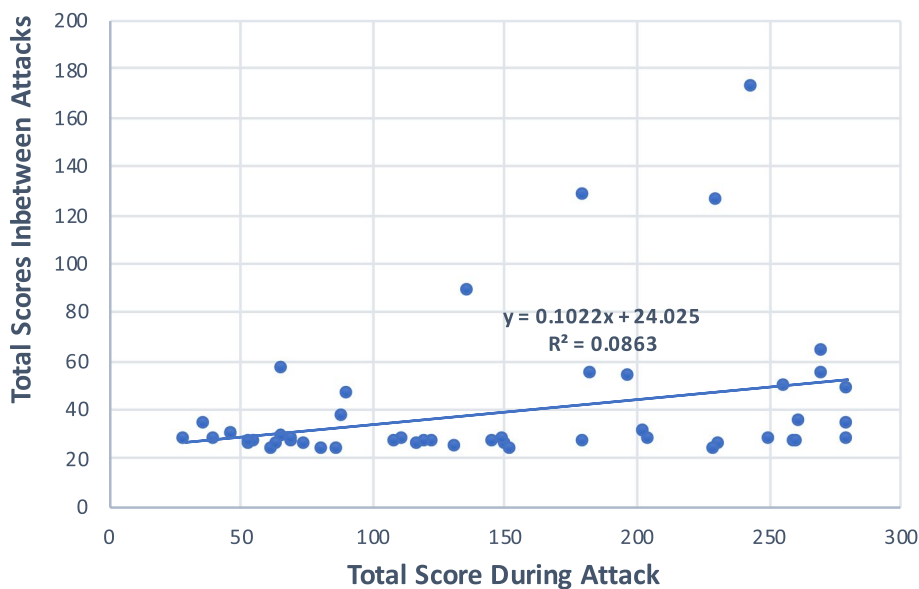


Fig. 1 Correlation between VADL scores during the attacks and in between the attack. VADL, Vestibular Disorder Activities of Daily Living Scale

Table 2 Summary of the mean VADL scores among the three episodic vestibular disorders

| Disease | N (52) | Means during the attacks (SD) | Means in between the attacks (SD) |
|---------------------|--------|-------------------------------|-----------------------------------|
| BPPV | 17 | 133 (SD 72.3) | 43 (SD 37.1) |
| Vestibular migraine | 23 | 121 (SD 74.9) | 30 (SD 8.4) |
| Ménière’s diseases | 12 | 243 (SD 42.9) | 54 (SD 36.1) |

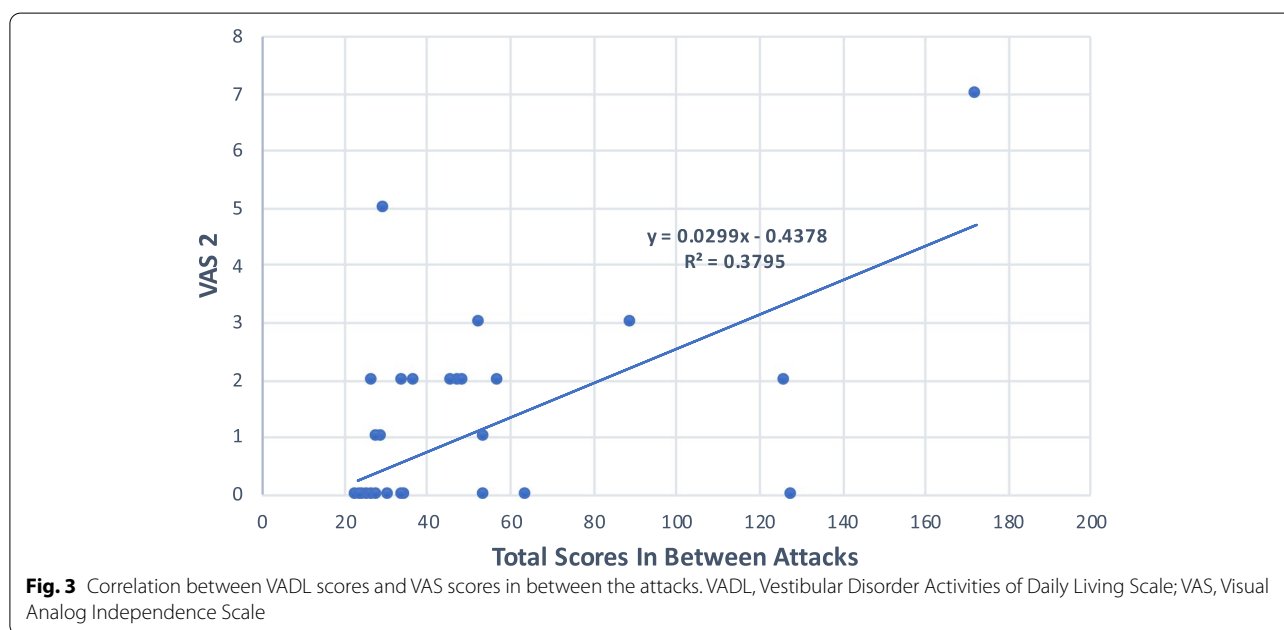
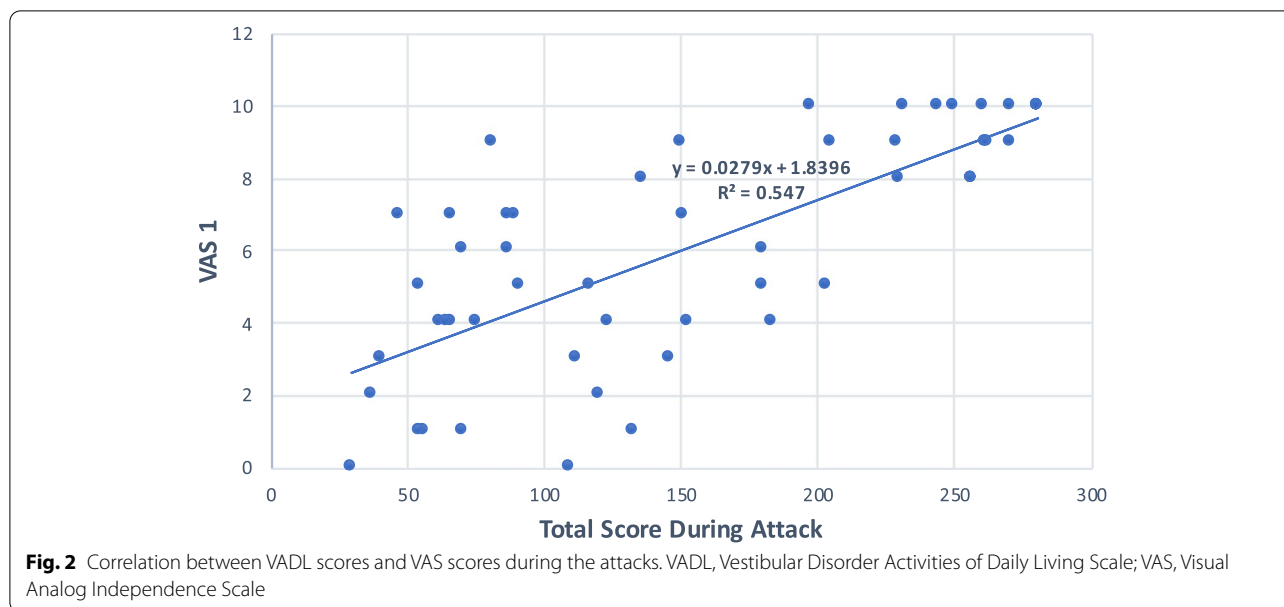
VADL Vestibular Disorder Activities of Daily Living Scale, N number of participants, BPPV benign paroxysmal positional vertigo

Discussion

The authors developed a Visual Analog Independence Scale (VAS), which is a quick overall rating tool of the participants’ perception regarding their activities of daily living performance and how much the attacks affect their quality of life. This study aims to create an Arabic version of the VADL and to assess its validity and reliability and, in addition, to compare the relationship between the measured VADL scores during the attacks and between the attacks and to correlate the VADL scores with the Independency Visual Analog Scores. In this study, we found that the performance of ADLs for patients with BPPV, vestibular migraine, and Meniere’s disease is markedly affected during the attacks of vertigo. Higher scores in VADL indicate that those patients have difficulty and need help in performing activities of daily living. Moreover, higher scores of

independence VAS means that patients are less satisfied with their functional daily performance and overall quality of life. Patients reported higher scores during attacks of vertigo, which means they have marked difficulty and inability to independently perform activities of daily living. On the other hand, patients reported lower scores in between the attacks, which means they do much better in the daily activities with more independence level. However, there was positive correlation between their scores during the attacks and in between the attacks which indicates that their performance in between the attacks is affected by the residual vestibular dysfunction or the negative psychological sequel of the attacks; the three episodic vestibular disorders included in the study have been reported to have residual symptoms in between the attacks [14–16].

Patients with vestibular migraine got lower scores during and in between the attacks, according to this study; the disease has the least effect on patients’ quality of life. Patients with vestibular migraine perform their activities independently either during or in between the attacks. This could be explained by the variability of the duration and severity of the attacks, or the effect of the small size of the sample or due to the higher frequency of attacks, so patients get habituated [14]. BPPV comes second; it has a more negative impact on daily performance and quality of life than VM. Patients with BPPV usually avoid carrying out their ADLs during the attacks. Also, in between the attacks, BPPV negatively affect patients more than VM. This could be explained by the intense vertigo attacks



and their psychological sequel or due to the otolith dysfunction which sometimes accompany BPPV [16].

MD has the most significant negative impact on execution of the ADLs; patients with this disease have the highest scores in the VADL during and in between the attacks compared to the other two disorders. It impairs patient's quality of life and restricts their independence. Patients with Ménière's disease are unable to perform their ADLs without assistance during the attacks. Also, in between the attack, patients have difficulty in their daily

activities with compromised quality of life [15]; this could be explained by the negative psychological sequel of the severe attacks, the associated vestibular end organ dysfunction, or the associated tinnitus and hearing loss [15].

Using the VAS, the authors assessed the patient's perception of their ADLs performance. Their scores in independence VAS were highly correlated to their VADL scores during and in-between the attacks. Most of the patients reported poor performance during the vertigo attacks. Variable scores were obtained in between the

attacks but significantly less than their scores during the attacks. Few studies have addressed quality of life in people with vestibular disorders by using Vestibular Activity of Daily Living Scale (VADL). The results indicated that people with MD were the most affected compared to patients with BPPV or vestibular migraine. Generally, people with vestibular disorders have difficulties in performing daily activities. Moreover, according to different studies, there was a significant association between vestibular dysfunction and ADLs impairment [18]. A study conducted by Cohen indicated that no differences were found on the total VADL score or any sub scores between male and female patients [18].

When comparing this study with other studies, there were similarities and differences. The results of this study are in agreement with results reported by Cohen; MD was the worst in limiting functional performance [18]. A Brazilian study reported difficulties in understanding some phrases of the Portuguese version of VADL scale. On the contrary, the Arabic version was well understood and comprehensible to the degree that most of the patients filled out the scale independently [8]. This study is the first one that addressed ADL performance during and in-between the attacks of BPPV, VM, and MD and compared between them. None of the previous studies used independence VAS to rate the patient's perception of their performance.

Strength and limitation of present study

The strength of this work is that it is the first study that tested the validity and reliability of the Arabic version of VADL scale to assess the impact of vestibular disorders on ADLs performance. Another point of strength is that an independence VAS scale was used. Remarkably high correlation between VADL scale and independence VAS was found. One of the limitations of this study is the small sample size, besides imbalance between the group numbers of the three vestibular disorders. It should also be mentioned that some patients were elderly and illiterate, so they refused to participate in the study; another limitation is that either the VADL scale during the attack or VADL scale in between the attacks was filled from the memory recall, as both filled in the same session.

Conclusions

The Arabic version of VADL scale is a valid and reliable tool to explore the functional capacity of individuals with episodic vestibular disorders. Meniere's disease has the worst impact on activities of daily livings during and in-between the attacks in comparison to other episodic vestibular disorders. There is high correlation between independence VAS and VADL scores during and in between the attacks. Both independence VAS and VADL

scale could be helpful tools in planning the management of episodic vestibular disorders.

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Authors' contributions

Conceptualization, A.M., H.B. and M.G.; methodology, H.B., M.A., S.A.; software, H.B.; validation, A.M., A.G. and H.H.; formal analysis, H.B.; investigation, M.G.; resources, A.M.; data curation, H.H.; writing—original draft preparation, H.B. A.M and M.A; writing—review and editing, M.G. and H.B.; visualization, M.A. and S.A.; supervision, A.G.; project administration, M.G.; all authors have read and agreed to the published version of the manuscript.

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Availability of data and materials

All data are provided in this study and raw data can be requested to corresponding author.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from IEC of College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Science, Jeddah, KSA. Informed consent was obtained from the participants with the option to withdraw them from the study at any time.

Consent for publication

Not applicable.

Competing interests

Dr Alfarghal Mohamad is a co-author of this study and an Editorial Board member of the journal. He was not involved in handling this manuscript during the submission and review processes. The rest of the authors have no conflict of interest to declare.

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