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The reliability of the Dutch version of the vestibular activities avoidance instrument in persons with and without dizziness

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Abstract.
BACKGROUND: Avoidance of activities that trigger dizziness in persons with vestibular disorders may inhibit dynamic vestibular compensation mechanisms.
OBJECTIVE: To determine the reliability of the Vestibular Activities Avoidance Instrument (VAAI) 81 and 9 item tool and to compare the VAAI scores in Dutch-speaking healthy adults and in patients with vestibular disorders.
METHODS: A prospective cohort study was conducted including 151 healthy participants and 106 participants with dizziness. All participants completed the 81-item VAAI. Within 7 days, the VAAI was completed a second time by 102 healthy adults and 43 persons with dizziness.
RESULTS: The average 81-item VAAI scores [54.8(47.1) vs. 228.1(78.3)] and 9-item VAAI scores [2.4(5.9) vs. 28.1(12)] were significantly different between healthy adults and participants with dizziness ($p < 0.001$). In participants with dizziness the ICC for the 81-item VAAI was 0.95 (95%CI: 0.91, 0.97) and for the 9-item VAAI was 0.92 (95%CI: 0.85, 0.95). Cronbach's alpha for the 81-item VAAI was 0.97 and 0.85 for the 9-item VAAI. The minimal detectable change was 47.8 for the 81-item VAAI and 8.9 for the 9-item VAAI.
CONCLUSIONS: Persons with dizziness have a greater tendency to avoid movements. Both test-retest reliability and internal consistency of the Dutch version of the VAAI were excellent.

Keywords: Dizziness, vertigo, fear avoidance

1. Introduction

Dizziness is a common problem in the general population estimated to affect between 10 and 30% of adults [1, 6, 17]. Dizziness caused by vestibular disorders is accompanied by neurovegetative symptoms, oscillopsia, postural imbalance and disorientation leading to activity limitations, participation restrictions and diminished quality of life [1, 6, 17]. In addition to negatively impacting the patient from a medical perspective, dizziness also has a significant impact on work productivity and use of healthcare resources [5]. To manage the burden of dizziness, vestibular rehabilitation is one of the options available. A key component of vestibular rehabilitation

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is the promotion of (head) movements to habituate the patient to the movement stimulus that triggers the dizziness symptoms. However, despite its proven efficacy, up to 55% of patients maintain chronic complaints after an acute vestibular insult [10–12, 14, 16, 18]. It is therefore important to gain insight into factors that adversely affect the efficiency of vestibular rehabilitation [7, 26].

Avoiding symptom-provoking movements is a possible counterproductive factor. Persons experiencing dizziness are motion sensitive and often avoid movements and activities that provoke dizziness. Anxiety and avoidance of movements and activities that trigger dizziness are associated with a longer duration of symptoms and may inhibit dynamic vestibular compensation mechanisms [10, 12, 27]. Despite the growing evidence for the adverse effect of movement anxiety and other behavioral and psychological factors on recovery, few clinical tools are available to measure these constructs in patients with vestibular disease. With this goal in mind, the 81 item Vestibular Activities Avoidance Instrument (VAAI) was recently developed [2]. However, the length of this questionnaire makes the test less useful clinically, so that the original version has now been shortened to a 9-item version based on an exploratory factor analysis [8]. To be clinically relevant it is important that a measuring instrument has acceptable psychometric properties. It has already been shown that both the 81-item and 9-item VAAI have excellent internal consistency and are associated with quality of life, psychological well-being, activity limitations and participation restrictions [8, 9]. In addition, the 9-item VAAI at baseline is predictive for activity limitations and participation restrictions 3 months after administration when controlling for age, medications, baseline dizziness and the severity of depressive feelings in persons with vestibular disorders [9]. To continue its development for clinical use it is important to demonstrate the reliability of the instrument and to report normative data so that it becomes possible to document persons who might need additional care beyond physical therapy.

The first aim of this study was to determine the reliability of the VAAI in Dutch-speaking healthy adults and in patients with vestibular disorders. Specifically, we aimed to examine the test-retest reliability, internal consistency, standard error of the measure (SEM), and minimal detectable change (MDC) of both the 81-item and 9-item VAAI to aid in the clinical interpretation of the Dutch version of the VAAI. A second aim of this study was to compare the VAAI scores in healthy adults versus persons with dizziness.

2. Methods

2.1. Participants

A convenience sample of healthy adults over the age of 20 were recruited from relatives and friends of students and staff of the Department of Rehabilitation Sciences and Physical Therapy (University of Antwerp, Belgium) through advertisements and personal contacts of the researchers. The recruitment period was from March 22, 2018 to April 9, 2019. Participants were eligible to participate if they were without complaints of dizziness/instability in the past 6 months. Additional reasons for exclusion were (1) neurological, otologic, orthopedic or other medical conditions that could affect balance, (2) dependence on a third party or an assistive device during walking, (3) a fall within the last six months, (4) persons taking medication that may affect balance, and (5) known serious cognitive or psychiatric problems. Normal balance function was verified by an interview in combination with an extensive checklist and balance testing [20]. All healthy subjects had normal balance and a normal horizontal video head impulse test. Otolith function was not specifically assessed.

Patients were recruited through the ENT department of two hospitals, namely the Augustinus Hospital in Antwerp (European Institute for ORL-HNS), Belgium and the Erasmus Medical Centre in Rotterdam, the Netherlands in the period from January 1, 2019 to August 31, 2020. All patients older than 20 years visiting one of the 2 centers for consultation were asked to participate in the study. A structured anamnesis was taken in all patients and medical-technical examinations were carried out if indicated.

This multicenter study was approved by the University of Antwerp Ethics Committee (B300201836594, reference number: 18/12/162) and the UMC Erasmus Hospital Ethics Committee (reference number: WT/aj/MEC-2018-1190). All participants provided informed consent.

2.2. Descriptive variables

Descriptive variables such as age, gender, the Activities-specific Balance Confidence scale (ABC) and Dizziness Handicap Inventory (DHI) were collected from all participants at the initial visit. In addition, the ENT diagnosis and the duration of the complaints were recorded.

The ABC-scale examines the extent to which people feel confident that they can perform various activities from everyday life without falling. In total, 16 activities are described. Every activity is scored from 0 to 100 (0—no confidence; 100—maximal confidence) [19]. The total ABC-score is the sum of the individual item scores, which is averaged to obtain a percentage score. The Dutch version of the ABC shows moderate correlations with static and dynamic balance tests [13]. Subjects with a peripheral vestibular disorder with low confidence (ABC < 50%) have poorer balance and are more likely to have experienced multiple falls [13].

The DHI questionnaire is used to assess self-perceived handicap as a consequence of dizziness and instability. In total, 25 items are rated on an ordinal 3-level scale ('no' = 0; 'sometimes' = 2; 'yes' = 4 points). The DHI ranges in score from 0–100 with higher scores indicating greater handicap due to dizziness symptoms [15]. The Dutch version of the DHI has previously demonstrated excellent test-retest and internal consistency reliability and a measurement error below 10% of the scoring range (95% CI lower bound; –9, upper bound: 7) [22, 23].

2.3. Outcome measures

Healthy participants and the patients from the Sint-Augustinus Hospital completed the Dutch version of the VAAI with pencil and paper at the initial study visit. Participants were then asked to complete the VAAI again the following day to determine test-retest reliability. The retest form was returned to the researchers with prepaid envelopes after completion. The patients from the Erasmus Medical Centre completed the questionnaire digitally on both occasions. The number of days between test and retest was noted.

2.4. Vestibular activities avoidance instrument

The VAAI is an 81-item questionnaire that was designed to measure fear avoidance beliefs among persons with dizziness. The English version of the questionnaire has demonstrated excellent internal consistency and test-retest reliability in persons with vestibular disorders [2]. Based on an exploratory factor analysis the VAAI has recently been shorted to include only 9 items to decrease the time burden for individuals completing the questionnaire [8]. The 81-item version of the VAAI scores range from 0–485 with higher scores indicating more fear avoidance beliefs. The 9-item version of the VAAI score range is 0–54. The 9 items were abstracted from the 81-item VAAI, and this analysis included the reliability estimates for the 81-item version as well as the 9-item version.

The English version of the VAAI was translated into Dutch according to an established double (back) translation method [4]. In addition to native English speakers, both Flemish (Dutch-speaking part of Belgium) and Dutch (the Netherlands) healthcare providers were involved in the translation process to obtain the most widely supported translation.

2.5. Statistical analyses

The sample demographics and outcome measure scores were described using means and standard deviations. For the analysis of test-retest reliability, the samples of healthy participants and participants with vestibular disorders were limited to include those who completed the second questionnaire within 7 days of the initial visit for consistency. The intraclass correlation coefficient (ICC) was calculated to determine test-retest reliability of the 81-item VAAI as well as the abstracted 9-item VAAI. Internal consistency of the 81-item and 9-item versions of the VAAI was determined using Cronbach's alpha. The SEM, or expected measurement error, was determined for the 81-item and 9-item VAAI using the following equation: $SEM = SD_{pooled} \times \sqrt{(1 - ICC)}$. The Minimal Detectable Change (MDC_{95}) for the 81-item and 9-item VAAI was then calculated at the 95% level using the equation: $MDC = SEM \times \sqrt{2} \times 1.96$. The MDC_{95} indicates the change in scores required for the clinician to be 95% confident that actual change beyond measurement error has occurred.

The demographic characteristics and outcome measure scores of the healthy participants and participants with dizziness were compared using Mann-Whitney U and Chi-square tests. All analyses were conducted using IBM SPSS Statistics Version 26.

3. Results

3.1. Sample characteristics

One hundred fifty-four healthy control subjects enrolled in the study. After eligibility checks, three subjects were excluded and therefore the analytic sample consisted of 151 healthy adults. One subject because of a Ramsey Hunt recurrence less than 3 months prior to the study with hearing loss and unilateral peripheral vestibular hypofunction, one subject was attending physical therapy sessions for balance problems at the time, and 1 subject had bilateral knee prostheses that impeded their balance. One hundred and six persons with dizziness took part in the study, 45 were enrolled in the Sint-Augustinus hospital in Antwerp and 61 in the Erasmus Medical Centre in Rotterdam.

The mean age for the 151 adults without dizziness was 50.9 (18.5) and 59.6% of the sample were female (Table 1). The mean age for the 106 participants with dizziness was 57.3 (14.7) and 62 (58.5%) of them were female. There was no significant difference in gender in persons experiencing dizziness compared to healthy adults, but the group of healthy persons was significantly younger ($p = 0.002$). More than 65% of the participants with dizziness and instability had a peripheral vestibular disorder (Table 2).

For healthy adults, the mean ABC score was 92.9 (8.4) and mean DHI score was 4.2 (8.0), indicating that on average participants were confident in their balance and had low reported handicap due to dizziness as expected in a sample without dizziness. For participants with dizziness, the mean ABC score was 61.6 (21.6) and mean DHI score was 47.5 (20.6), indicating that patients had significantly less confidence in their balance ($p < 0.001$) and felt significantly more handicapped ($p < 0.001$). Twenty-nine subjects with dizziness (28.2%) scored above 60 on the DHI indicating that they felt severely disabled as a result of their dizziness. Thirty-two persons with dizziness (31.7%) scored less than 50 on the ABC indicating that they had little confidence in performing activities of daily living. Among the subjects without dizziness, no one scored above 60 on the DHI and there was only one subject who scored below 50 on the ABC.

All subjects completed the VAAI during the initial study visit. Pencil and paper questionnaires were checked for missing answers, after which the subjects were asked to answer the questions left open so that all questionnaires were completed in full. With the digital version it was only possible to proceed to the next question if the previous question was answered. The average 81-item VAAI at the initial study visit was 54.8 (47.1) and 2.4 (5.9) for the 9 items that were abstracted from the 81-item questionnaire indicating low fear avoidance beliefs on average among healthy adults. The mean score of participants with dizziness on the 81-item VAAI was 228.1 (78.3) and was 28.1 (12.0) on the 9-item version. All VAAI scores were significantly different between the healthy adults and persons with dizziness ($p < 0.001$), indicating that persons with dizziness have a significantly greater tendency to avoid movements.

Since the patient population was significantly older than the healthy population, we also looked at the association between age and VAAI test results. The VAAI was not related to age (VAAI-9: Spearman's Rho: 0.058 ($p = 0.553$); VAAI-81: Spearman's Rho: 0.027 ($p = 0.783$) in patients with dizziness and was only weakly associated with age in healthy controls (VAAI-9: Spearman's Rho: 0.224 ($p = 0.003$); VAAI-81: Spearman's Rho: 0.225 ($p = 0.005$). The two highest scores among the healthy septuagenarians ($n = 11$) were 16 and 17 and among the octogenarians

Table 1
Demographic Characteristics and Outcome Measure Scores for 151 Healthy Participants and 106 Participants with Dizziness

	Healthy Participants ($n = 151$)	Participants with Dizziness ($n = 106$)	p
Age, y	50.9 (18.5)	57.3 (14.7)	0.002
Female, n (%)	90 (59.6)	62 (58.5)	0.858**
Dizziness, months		33.3 (54.7)	
Activities-specific Balance Confidence scale (0–100)	92.9 (8.4)	61.6 (21.6)	<0.001*
Dizziness Handicap Inventory – Functional (0–36)	1.3 (3.2)	18.1 (9.1)	<0.001*
Dizziness Handicap Inventory – Emotional (0–36)	0.7 (2.5)	12.9 (8.6)	<0.001*
Dizziness Handicap Inventory – Physical (0–28)	2.1 (3.7)	16.5 (6.5)	<0.001*
Dizziness Handicap Inventory Total (0–100)	4.2 (8.0)	47.5 (20.6)	<0.001*
Vestibular Activities Avoidance Instrument 81 Item (0–485)	54.7 (47.1)	228.1 (78.3)	<0.001*
Vestibular Activities Avoidance Instrument 9 Item (0–54)	2.6 (6.0)	28.0 (12.0)	<0.001*

Note: mean values (standard deviation) are shown except for gender (% females); missing data in patient group: Dizziness ($n = 4$), Activities-specific Balance Confidence scale ($n = 5$), Dizziness Handicap Inventory ($n = 3$); *$p < 0.05$ (independent samples t-test); **: Pearson Chi Square p-value.

Table 2
Diagnostic Categories for 106 Participants with Dizziness

Category	n (%)	Examples of specific diagnoses
Benign paroxysmal Positional Vertigo	13 (12.3)	Benign paroxysmal Positional Vertigo
Other peripheral vestibular disorders	57 (53.8)	Menière's disease; peripheral vestibulopathy; vestibular schwannoma; ...
Central vestibular disorders	21 (19.8)	Vestibular migraine; tumor cerebellar pontine angle; ...
Functional disorders	3 (2.8)	Persistent Perceptual Postural Dizziness
Mixed central and peripheral diagnoses	6 (5.7)	Menière's disease and vestibular migraine; ...
Unspecified or non vestibular	6 (5.7)	No diagnosis; hyperventilation syndrome; ...

Table 3
The Vestibular Activities Avoidance Instrument (VAAI) Test Results per Decade in Healthy Participants

		9-item VAAI		81-item VAAI	
Decade	n	Median (IQR)	90% percentile	Median (IQR)	90% percentile
3	31	0.00 (0.00 – 0.00)	6.80	32.00 (20.00 – 55.00)	126.4
4	15	0.00 (0.00 – 0.00)	4.80	30.00 (28.00 – 48.00)	98.0
5	14	0.00 (0.00 – 0.00)	0.00	33.50 (29.50 – 36.00)	43.0
6	46	0.00 (0.00 – 4.25)	9.30	40.50 (30.00 – 79.75)	120.6
7	21	0.00 (0.00 – 0.50)	4.40	30.00 (26.50 – 51.00)	96.0
8	11	6.00 (0.00 – 14.00)	16.80	100.00 (34.00 – 144.00)	195.0
9	13	0.00 (0.00 – 6.50)	27.20	54.00 (30.00 – 99.50)	201.0

Table 4
The Vestibular Activities Avoidance Instrument (VAAI) scores in the Different Patient Categories

		VAAI-9	VAAI-81
Patient Category	n	Median (IQR)	Median (IQR)
Benign Paroxysmal Positional Vertigo	13	23.0 (12.0 – 33.5)	193.0 (113.5 – 241.5)
Other peripheral vestibular disorders	57	29.0 (21.5 – 37.0)	229.0 (177.0 – 283.5)
Central vestibular disorders	21	28.0 (20.0 – 32.5)	220.0 (187.5 – 261.5)
Functional disorders	3	32.0 (28.0 – X.X*)	247.0 (235.0 – X.X*)
Mixed central and peripheral diagnoses	6	35.0 (28.5 – 46.8)	271.0 (196.5 – 331.8)
Unspecified or non-vestibular disorders	6	23.5 (11.5 – 39.0)	189.0 (163.3 – 301.8)

*: there are too few participants to calculate IQR.

($n = 13$) 11 and 38. The VAAI results for the healthy subjects (per decade) can be found in Table 3.

The patients in the categories 'functional disorders' and 'mixed central and peripheral categories' had slightly higher VAAI-scores but there were no statistically significant differences in between the VAAI scores of the diagnostic groups (VAAI-9: ANOVA $p = 0.139$; VAAI-81: ANOVA $p = 0.148$). The VAAI scores in the different patient categories can be found in Table 4.

3.2. Reliability

One hundred and fourteen 81-item VAAI retest forms were returned by persons without dizziness, but twelve retest forms were not retained for the statistical analysis due to missing answers ($n = 3$) or a time interval of more than 7 days between test and retest ($n = 9$). The mean 81-item VAAI score for these 102 participants was 56.7 (50.3) at the initial study visit and 51.5 (46.9) at retest. The average 9-item VAAI score was 2.6 (6.4) at initial visit and 2.2 (6.1) at retest. On average the test-retest questionnaire was completed 1.6 days after the initial study visit (Table 5).

The ICC for the 81-item VAAI was 0.96 (95% CI: 0.94, 0.97) and for the 9-item VAAI was 0.94 (95% CI: 0.92, 0.96) indicating excellent test-retest reliability. The Cronbach's alpha values for both the 81-item (0.96 for both baseline test and retest) and 9-item VAAI (0.91 and 0.94 for baseline test and retest respectively) indicate excellent internal consistency.

Forty-seven participants with dizziness completed the VAAI retest but 4 forms were excluded from analysis because they were not completed within 7 days after the initial visit. Therefore, the final analytic sample for test-retest reliability consisted of 43

Table 5
Reliability of the Dutch Version of the Vestibular Activities Avoidance Instrument (VAAI) in 102 Healthy Participants

	Mean (SD)	
N = 102	VAAI-81 (0–485)	VAAI-9 (0–54)
Baseline score	56.65 (50.3)	2.60 (6.4)
Retest score	51.51 (46.9)	2.16 (6.1)
Change in score over time	10.43 (11.0)	1.09 (1.8)
Days between tests (0–7)	1.61 (1.4)	1.61 (1.4)
	Reliability Measures	
Intraclass Correlation Coefficient (95% CI)	0.957 (0.936, 0.971)	0.944 (0.919, 0.962)
Cronbach's Alpha – Baseline test	0.960	0.919
Cronbach's Alpha – Retest	0.961	0.944
Standard Error of Measurement	10.08	1.48
Minimum Detectable Change$_{95}$	27.95	4.10

Table 6
Reliability of the Dutch Version of the Vestibular Activities Avoidance Instrument (VAAI) in 43 Participants with Vestibular Disorders

	Mean (SD)	
N = 43	VAAI-81 (0–485)	VAAI-9 (0–54)
Baseline score	240.05 (78.4)	29.72 (11.0)
Retest score	239.09 (77.3)	30.47 (10.9)
Change in score over time (test 2 – test 1)	17.79 (6.5)	3.44 (3.0)
Days between tests (0–7)	1.84 (1.5)	1.84 (1.5)
	Reliability Measures	
Intraclass Correlation Coefficient (95% CI)	0.951 (0.911, 0.973)	0.915 (0.849, 0.953)
Cronbach's Alpha – Baseline test	0.967	0.846
Cronbach's Alpha – Retest	0.970	0.872
Standard Error of Measurement	17.23	3.19
Minimum Detectable Change$_{95}$	47.77	8.85

individuals with dizziness. The average number of days between test and retest was 1.8 days (Table 6). The mean 81-item VAAI score for participants with dizziness was 240.0 (78.4) at the initial study visit and 239.1 (77.3) at retest. The average 9-item VAAI score was 29.7 (11.0) at initial visit and 30.5 (10.9) at retest.

In participants with dizziness the ICC for the 81-item VAAI was 0.95 (95% CI: 0.91, 0.97) and for the 9-item VAAI was 0.92 (95% CI: 0.85, 0.95) indicating excellent test-retest reliability. The Cronbach's alpha values for both the 81-item (0.97 for both baseline test and retest) and 9-item VAAI (0.85 and 0.87 for baseline test and retest respectively) indicate excellent internal consistency.

3.3. *Measures of Change*

In healthy controls the SEM for the 81-item VAAI was 10.1 and 1.5 for the 9-item VAAI. This indicates that in people who do not complain of dizziness, a change of less than 10.1 on the 81-item VAAI or 1.5 on the 9-item VAAI could be attributed to measurement error and may not represent actual change in fear avoidance beliefs. The MDC_{95} was 28.0 for the 81-item VAAI and 4.1 for the 9-item VAAI. These values represent the minimum amount of change that represents actual change in fear avoidance beliefs beyond measurement error.

In patients with dizziness, the SEM for the 81-item VAAI was 17.2 and 3.2 for the 9-item VAAI. The MDC_{95} was 47.8 for the 81-item VAAI and 8.9 for the 9-item VAAI. These values represent the minimum amount of change that represents actual change in fear avoidance beliefs beyond measurement error. Test results representing actual change in patients are about twice as high than in people who do not complain of dizziness.

4. Discussion

The participants with dizziness had significantly higher fear avoidance beliefs than healthy adults. The 81-item and 9-item version of the Dutch VAAI showed excellent test-retest reliability and internal consistency in both participants with and without dizziness. The minimal detectable change in healthy participants was 4.10 and 8.85 in participants with dizziness, being respectively 8% and 16 % of the total score of the 9-item VAAI.

As expected, the healthy controls showed little or no avoidance behavior. Indeed, the profile of the participants in this group did not indicate that these individuals would exhibit fear-avoidance behavior. Persons without dizziness were screened for balance problems and impaired vestibular function and were excluded if they had known psychiatric problems. Only 1 person indicated having little confidence in being able to carry out daily activities without falling.

By analogy with low back pain, feelings of dizziness can lead to avoidance of activities that result in maladaptation of the vestibular system, chronic symptoms and an increased risk of disability [24, 25]. In our patient population only 15 patients experienced dizziness for less than 3 months. Most subjects had chronic dizziness (>3 months) and nine patients had dizziness for more than 10 years. This resulted in significantly increased activities avoidance behavior in the patient population compared to the non-dizzy subjects. Based on the 9-item VAAI, 95% of persons without dizziness scored below 15 out of 54 whereas only 14 % of people with dizziness scored below 15. Based on the 81-item VAAI, 95% of persons without dizziness scored below 150 out of 485 whereas only 18% of people with dizziness did, indicating that the VAAI may discriminate between those with and without dizziness that lasts greater than 3 months.

Our results show that individuals with dizziness have significantly different fear avoidance beliefs compared to individuals without dizziness. Recent evidence shows that fear-avoidance beliefs measured by the VAAI are predictive of activity limitations and participation limitations at 3 months when controlling for age, medications, dizziness and depression at baseline [9]. The VAAI may contribute to successfully stratifying patients with dizziness into groups with a low to high risk for the development of chronic complaints based on the presence of psychological and psychosocial factors in the acute stage. The VAAI may allow for timely therapeutic interventions such as cognitive behavioral therapy and balance training aimed at reducing fear avoidance beliefs and improving overall outcome [3, 21].

To further develop its clinical usefulness, it is therefore necessary to demonstrate that the Dutch VAAI is reliable and able to document change. The test-retest reliability and internal consistency in both subjects with and without vertigo and for both the 81-item and 9-item versions were excellent. When compared to the original English 9-item version, the internal consistency of the Dutch version is slightly lower (Cronbach's Alpha: 0.85 versus 0.92) in subjects with dizziness [8]. The SEM and MDC of the 81-item version in subjects with dizziness was higher compared to the original version with values of 17.2 versus 13.2 and 47.77 versus 36.5, respectively [2]. As the original 81-item VAAI was considered too long for clinical use we advocate the use of the 9-item VAAI. In persons with dizziness the MDC for the 9-item version is 8.85 which is about 16% of the total scoring range. Although above 10% of the scoring range of the VAAI it is lower than the 18% MDC of the Dizziness Handicap Inventory which is an outcome measure often used in vestibular rehabilitation [15].

4.1. Limitations

This study utilized a convenience sample and relied on self-reported normal vestibular functioning rather than vestibular function testing, however all the healthy subjects had a normal horizontal head impulse test and good balance control. The healthy subjects being significantly younger might have influenced the results. However, age was not associated with the tendency to avoid movement as documented by the VAAI in patients. In healthy subjects age was weakly associated with the VAAI but even in people in their seventies or eighties few subjects had VAAI scores that were equivalent to the patient's test results. There were no statistical differences between the patients with chronic dizziness and the 15 patients that had experienced dizziness for less than 3 months. However, a larger group of patients with acute dizziness and a design that makes it possible to monitor the tendency to avoid movements in homogeneous patient populations would be helpful to better understand the effect of acuity on VAAI scores. Because most of our patients had longstanding dizziness symptoms (>3 months), it is unclear if these findings would be generalizable to patients that were more acute.

Although we provided estimates of reliability for the Dutch version of the 9-item VAAI, these 9 items were abstracted from the full 81-item questionnaire and were not administered as a separate test. Therefore, the psychometric properties of the shortened 9-item VAAI should be assessed in a separate sample.

5. Conclusions

Participants with dizziness had significantly higher fear avoidance beliefs than healthy adults and both the 81-item and 9-item version of the Dutch VAAI showed excellent test-retest reliability and internal consistency in both participants with and without dizziness. The original 81-item VAAI was considered too long for clinical use. When using the 9-item VAAI, the minimal detectable change in healthy participants was 4.10 and 8.85 in participants with dizziness. Identifying fear avoidance early in the rehabilitation process may help to optimize care.

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None.

Supplementary material

The Dutch version of the 9-item VAAI can be accessed here: https://dx.doi.org/10.3233/VES-210108.

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