Original Article

Validity and Equivalence of the Portuguese Version of the Veterans Specific Activity Questionnaire

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Abstract

Background: **The Veterans Specific Activity Questionnaire (VSAQ) has been used to individualize exercise testing (ET) and to indirectly assess cardiorespiratory fitness (CRF) in epidemiological studies. Nevertheless, there is no validated Portuguese version.**

Objective: **To verify the criterion-related validity and the measurement equivalence of a Portuguese version of VSAQ in 95 individuals, 8 women (aged 69 ± 7 years) referred to ET.**

Methods: **The subjects performed a cardiopulmonary test with incremental to maximal exercise on a cycle ergometer. The correlation between VSAQ score and Maximum Measured and Estimated METs was compared to results from other studies. The VSAQ Nomogram was calculated and its results were compared to CRF real values by linear regression. Limits of concordance and mean differences (biases) were assessed according to the Bland Altman methodology.**

Results: **The VSAQ scores were significantly correlated to the Measured METs (r = 0.64) and Estimated METs (r = 0.67), results that were equivalent to those obtained by the original versions. The VSAQ Nomogram presented multiple R of 0.78 (Measured MET) and 0.80 (Estimated MET). However, the Nomogram seems to have underestimated CRF values greater than 6 METs.**

Conclusion: **The VSAQ version confirmed its validity and equivalence to the original version, especially when evaluating individuals with coronary heart disease and older adults. (Arq Bras Cardiol 2011; 97(2) : 130-135)**

Keywords: **Validity of tests; physical fitness; exercise test; cardiovascular diseases.**

Introduction

Low levels of cardiorespiratory fitness (CRF) have been considered a risk factor for morbimortality[1,2]. Determining the CRF through an exercise test (ET) makes this type of assessment very important, as it is used as an important diagnostic and prognostic tool[3].

In spite of its importance, the ET can be made unattainable by several difficulties, such as the time spent to perform it and the high cost of material and human resources[4,5]. In at-risk populations, such as the elderly and those with heart disease, the ET performance is impaired by the lower functional capacity and frailty exhibited by these individuals[6,7].

Thus, alternatives have been created, especially through the use of submaximal tests, questionnaires on symptoms and models without exercise to estimate CRF. Although these alternatives very often generate only modest correlations, many tools have demonstrated considerable prognostic value. One of the main tools found in the literature is the Veterans Specific Activity Questionnaire (VSAQ)[7]. Initially developed for the individualization of the ET[8], using a predictive equation together with the age variable (VSAQ Nomogram), the questionnaire has also been used to estimate CRF of revascularized individuals[9], as an indicator or mortality risk in male individuals with an ET indication[10].

Due to the importance of the VSAQ, in 2008, Maranhão Neto et al[11] carried out the transcultural adaptation of the scale. This investment was justified by the fact that, until then, in spite of the use of the VSAQ in national publications[12,13], this necessary adaptation had been carried out. The VSAQ adaptation process demonstrated that the version developed in Portuguese showed very good equivalence with the original version, as well as good reproducibility[11]. However, it is still necessary to analyze the equivalence of measurement - once demonstrated that the validity of the Portuguese version is similar to that of the original version of the tool, its clinical and epidemiological applicability would be ratified, especially in individuals with heart disease.

Thus, the present study aimed at: a) performing the criterion validation of VSAQ in individuals with ET indication; b) verifying the measurement equivalence of this version; and

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c) verifying the criterion validity of the VSAQ Nomogram in order to analyze its clinical applicability in individuals with heart disease.

Methods

Sampling

The sample was selected among elderly individuals treated from 2005 to 2006 at the Outpatient Clinic of *Núcleo de Atenção ao Idoso* (NAI) of *Universidade Aberta da Terceira Idade* (UnATI-Uerj). The following inclusion criteria were established for participating in the present study: all participants had stable heart disease, were asymptomatic, had no electrocardiographic alterations at rest and had been followed for at least six months at the outpatient clinic. A total of 95 individuals (8 women) aged 60 to 85 years (69 ± 7 years) met the inclusion criteria. All participants signed the Free and Informed Consent Form, according to the recommendations of the Helsinki Convention and Decree #.196/96 of the National Council of Health (*Conselho Nacional de Saúde*) for researches involving human subjects. The study was approved by the Institutional Board. There was no conflict of interest related to the present study.

Procedures

All participants answered the VSAQ (Chart 1). The Portuguese version used in the study was based on the proposal revised by Myers et al[14]. Body mass was obtained using a digital Filizola™ ID 1500 scale (Filizola, São Paulo, Brazil) with a minimum capacity of 2.5 kg and maximum capacity of 150 kg, with precision of 1 g. Height was determined using a wooden stadiometer with precision of 0.1 cm. The body mass index (BMI) was calculated based on the measured weight and height.

The individuals were submitted to a maximal cardiopulmonary exercise test in a Cateye EC-1600 lower-limb cycle ergometer (Cat Eye, Tokyo, Japan) using an individualized ramp protocol. For the analysis of expired gases, a VO2000 metabolic analyzer was used (*MedGraphics*, USA). The professionals that conducted the tests were blinded to the results obtained at the VSAQ. The workloads in Watts were selected based on the estimated maximum workload capacity, aiming at obtaining maximal exertion between 6 and 12 minutes, according to the recommendations of the American Heart Association[3]. Continuous monitoring was carried out through 12-lead electrocardiography (ECG) (Micromed™, Brasília, Brazil), and blood pressure measurements at rest and every test minute were carried out with a WelchAlln aneroid sphygmomanometer manufactured by Tycos™ (Arden, USA).

Criteria for test interruption were established according to the recommendations in the literature[15]. The test was interrupted due to maximum voluntary exertion. No threshold was pre-established regarding the heart rate (HR) value to be attained. Tests interrupted due to clinical reasons or considered to be submaximal would be excluded from the analysis.

The maximum MET value was calculated based on the maximum oxygen consumption during the test ($VO_{2\ peak}$) divided by 3.5, and the estimated maximum MET was determined based on the equations of the American College of Sports Medicine, considering the mechanical resistance of the cycle ergometer at the highest workload attained (in Watts)[16].

Chart 1 - **Portuguese version of VSAQ**

<u>Underline</u> the activity that would cause you to experience fatigue, shortness of breath, chest discomfort, or otherwise cause you to want to stop. Even if you do not normally perform a particular activity, try to imagine what it would be like if you did.	
MET	**Activities**
1	Eating, getting dressed, working at a desk
2	Taking a shower, go shopping at a mall and clothes stores, cooking Walking down 8 steps
3	Walking slowly on a flat surface for 1-2 blocks, Carrying groceries, doing moderate housework such as vacuuming and sweeping floors
4	Light yard or gardening work such as raking and gathering leaves, putting them into a plastic bag, planting seeds, sweeping or pushing power mower Painting or light carpentry
5	Walking briskly Social dancing, washing a car
6	Playing 9 holes of golf carrying your own clubs Heavy carpentry, mowing lawn with push mower
7	Walking briskly uphill, heavy outdoor work, such as digging holes, spading soil Carrying 25 kg
8	Moving heavy furniture Jogging slowly on flat surface, climbing stairs quickly, carrying grocery bags upstairs
9	Bicycling at a moderate pace, sawing wood, jumping rope (slowly)
10	Brisk swimming, cycling up a hill, walking briskly uphill, jogging 9.5 km/hour
11	Climbing two floors carrying something heavy, such as wood or a child in the arms Cycling briskly, continuously
12	Running briskly and continuously (level grounds, 5 minutes for each 1 km)
13	Any competitive activity including those with intermittent sprinting Running, rowing or cycling competitively

Statistical analysis

After confirming the normality of data by the univariate analysis, the correlation between the scores obtained at the VSAQ and the maximum measured and estimated MET variables was tested by calculating Pearson's r. Pearson's correlation analysis was also carried out between the values obtained for maximum MET and the result of the VSAQ Nomogram. The result was calculated based on the following equation: Maximum MET = 4.7 + 0.97(VSAQ score) - 0.06 (age in years)[7].

The visual analysis was carried out using the identity and Bland Altman plots to evaluate whether the VSAQ Nomogram varied according to the maximum MET levels (heteroscedasticity). To help this analysis, 95% limits of concordance (95%LC) were established, calculated from the mean difference between the reported and the measured

± the standard deviation of the differences multiplied by 1.96. All calculations were carried out using the Stata™ 10.1 Standard Edition for Windows software (Texas, USA). Statistical significance was set at $p \leq 0.05$.

Results

The sample characteristics, at rest and during the ET, are shown in Table 1. The mean duration of the ET was 9.6 ± 1.8 minutes and there were no complications during or after the tests.

The correlations obtained between the VSAQ scores and measured and estimated maximum MET values are shown in Tables 2 and 3, as well as the correlations reported by other studies.

The correlations between the VSAQ Nomogram and the measured and estimated MET are shown in Figure 1. The Bland-Altman plots (Figure 2) show, as dotted lines, the 95%LC values, which were respectively, -3.07 and +1.7; between Nomogram and Measured MET, and -2.98 and +1.01 for Estimated MET.

Discussion

The highest values observed for estimated in comparison with the measured MET (Table 1) corroborate the data in the literature, in the sense that, in individuals with heart disease, the CRF is usually overestimated when the VO_2 is not directly measured[14]. These results are also in accordance with previous studies that found higher correlations between VSAQ and estimated MET (Table 3), suggesting that the questionnaire would be better adapted for the measurement of intensity in a treadmill or cycle ergometer than the measurement of VO_{2peak}[14].

When comparing the results obtained with the Portuguese version of the VSAQ (Tables 2 and 3), one can observe that

Table 1 - **Clinical characterization and exercise response**

Weight (kg)	77.8 ± 11.6
Height (cm)	169.7 ± 8.2
Body mass index (kg/m²)	27.0 ± 3.3
VSAQ	4.6 ± 1.2
HR at rest (bpm)	65.2 ± 9.9
Systolic BP at rest (mmHg)	129.4 ± 20.2
Diastolic BP at rest (mmHg)	73.4 ± 9.7
$VO_{2\ peak}$ (ml/kg/min)	20.3 ± 6.8
Maximum measured met	5.8 ± 1.9
Maximum estimated met	6.0 ± 1.7
Maximum HR (bpm)	125 ± 24.7
Maximum systolic BP (mmHg)	186.1 ± 29.3
Maximum diastolic BP (mmHg)	78.8 ± 13.1
Maximum absolute workload (Max Watts)	100.6 ± 41.4
Test time (minutes)	9.6 ± 1.8
Smoking	11.6%
Hypertension	43.2%
Diabetes	7.4%
Dyslipidemia (> 220 mg/dl)	18.9%
History of acute myocardial infarction	41%
Medications	
Beta-blockers	65.3%
Calcium antagonist	22.1%
Diuretics	21%
Vasodilator	37.9%
Antiaggregant agent	89.5%

HR - heart rate; BP - blood pressure; VSAQ - Veterans Specific Activity Questionnaire

Table 2 - **Coefficients of correlation between VSAQ scores and maximum measured MET**

Authors	Sex	n	Age	Sample Characteristic	Ergometry	r
Present study	M F	87 08	69 ± 7	Heart disease patients	Cycle ergometer	0.64
Rankin et al[17]	M F	85 12	59 ± 10	Heart disease patients	Treadmill	0.57
Myers et al[14]	M F	324 13	58 ± 12	Healthy and heart disease patients	Treadmill	0.42
Pierson et al[9]	M F	146 52	63.4 ± 9.4	Revascularized patients	Treadmill	0.66
Maeder et al[18]	M F	31 10	29.5-41	Healthy patients	Cycle ergometer	0.46*
Myers et al[19]	M	41	68.3 ± 12	Heart failure patients	Treadmill	0.37
Maeder et al[20]	M F	33 10	30-41	Healthy patients	Treadmill	0.47*
Mc Auley et al[10]	NR	321	NR	Healthy and heart disease patients	Treadmill	0.56

*M - male; F - female; NR - not reported; * Spearman's correlation.*

Table 3 - **Coefficients of correlation between VSAQ scores and maximum estimated MET**

Authors	Sex	n	Age	Sample Characteristic	Ergometry	r
Present study	M F	87 08	69 ± 7	Heart disease patients	Cycle ergometer	0.67
Myers et al[7]	M F	207 05	62 ± 8	Healthy and heart disease patients	Treadmill	0.79
Myers et al[14]	M F	324 13	58 ± 12	Healthy and heart disease patients	Treadmill	0.59
Maeder et al[18]	M F	31 10	29.5-41	Healthy patients	Cycle ergometer	0.52*
Myers et al[19]	M	41	68.3 ± 12	Heart failure patients	Treadmill	0.73
Maeder et al[20]	M F	33 10	30-41	Healthy patients	Treadmill	0.61*
Mc Auley et al[10]	NR	321	NR	Healthy and heart disease patients	Treadmill	0.68

*M - male; F - female; NR - not reported; * Spearman's correlation.*

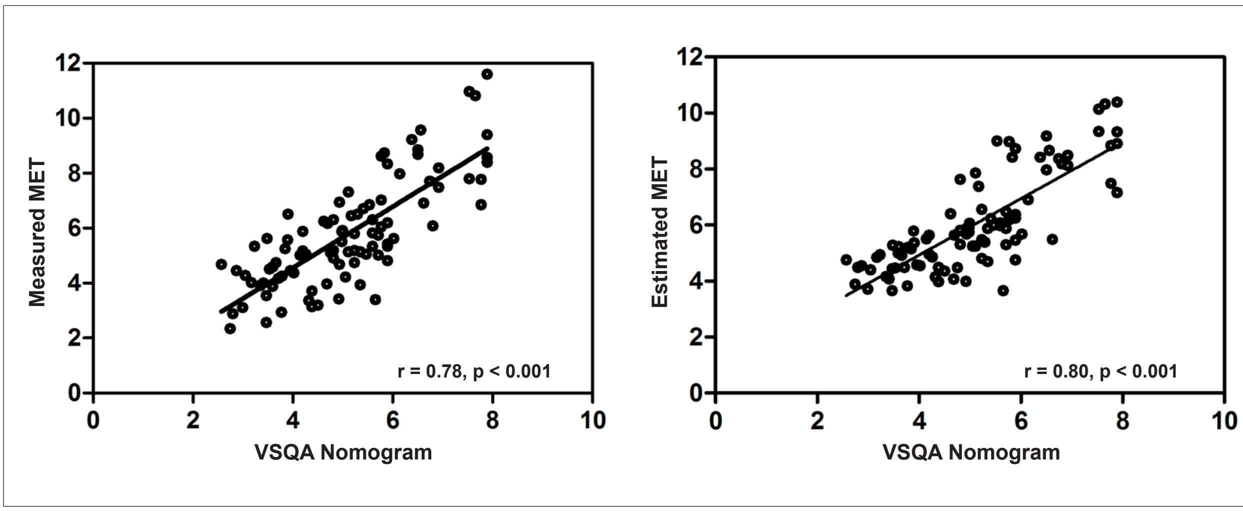

Figure 1 - Scatter plot with identity line between VSAQ nomogram and maximum measured and estimated MET.

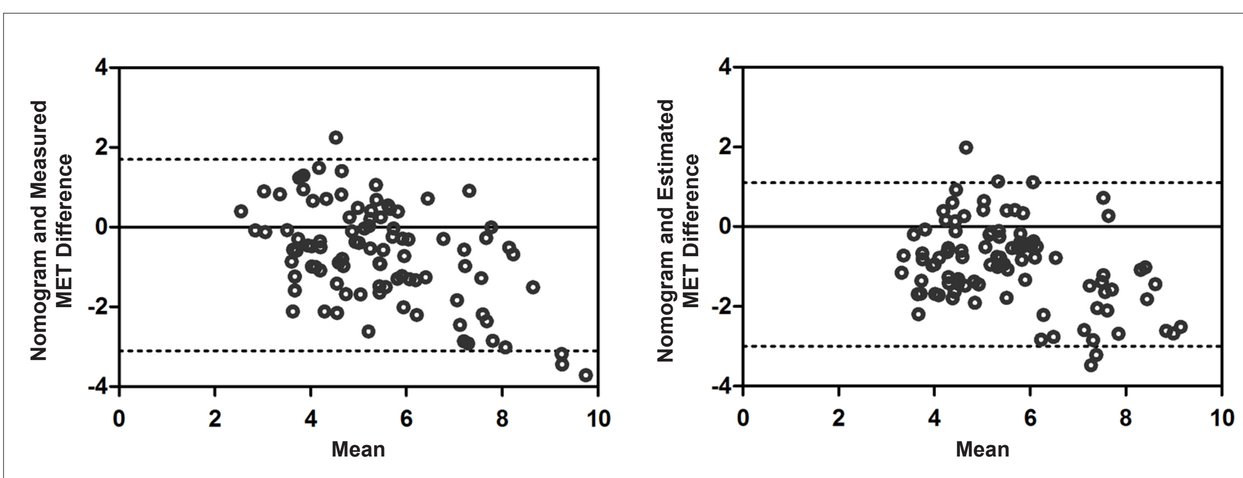

Figure 2 - Bland-Altman plot between VSAQ nomogram and maximum measured and estimated MET.

they are very similar to those obtained with the original version of the tool, including individuals with similar characteristics of that of the present study (individuals with heart disease and elderly). Such evidence suggests the measurement equivalence of the Portuguese version, presently assessed.

Except for the study by Myers et al[19] carried out in individuals with heart failure, which found a correlation of 0.37 between the VSAQ and the $VO_{2\,peak}$, the values depicted in Tables 2 and 3 show that higher correlations are usually observed when the VSAQ is applied to older populations with some cardiovascular impairment.

The results of the present study are in accordance with such evidence and additionally suggest that the use of the cycle ergometer did not seem to affect the association between the VSAQ and the $VO_{2\,peak}$. Previous studies had used the cycle ergometer only in studies with healthy and younger individuals, obtaining coefficients of correlation that varied from 0.46 to 0.52[18], which ratifies the idea that the VSAQ might not be so adequate for this population[10].

The VSAQ Nomogram to estimate CRF (Figure 1) showed very similar values, both in the measured and estimated MET assessment. The result of 0.80 is very similar to that found by the original study, in which the Nomogram was proposed, and which was developed only from the estimated MET[7] ($r = 0.81$, $p < 0.001$).

To date, only two studies, which are shown in Tables 2 and 3, had analyzed the Nomogram validity. Myers et al[14] reported correlations of 0.50 and 0.63 for measured and estimated MET. Maeder et al[20], in turn, found results of 0.56 for measured MET and 0.76 for estimated MET. A probable explanation for the higher similarity between the results of the present study and the original one might be the presence of individuals at very similar age ranges in both studies.

The results demonstrated by the Bland Altman graph analysis (fig. 2) show few values outside the ranges established by the 95%LC, which suggests good precision between the result obtained through the Nomogram and the estimated and measured MET values. Nevertheless, it can be observed that the VSAQ Nomogram tended to underestimate the CRF, especially when the individuals had higher functional capacity (approximately > 6 METs). Further conclusions are limited by the sample size; however, the findings are noteworthy, especially considering that this graph analysis was not carried out in any of the original studies.

Additional studies must be performed to detect which levels of functional capacity the VSAQ would more adequately assess. Larger sample sizes would also help to establish cutoffs and to detect diagnostic criteria, such as sensitivity and specificity.

It is worth mentioning that the results shown in the present study were obtained in individuals with heart disease, mostly of the male sex and older than 60 years. Thus, the VSAQ version would have lower external validity for the assessment of samples consisting of younger individuals and a majority of female individuals.

It is important to mention that the small number of female individuals in the sample was a consequence of the studied period and the established selection criteria. The proportion in the present study (9%) is quite similar to that of other studies, such as the ones by Myers et al[7] (2%), Myers et al[14] (4%) and Rankin et al[17] (14%). Myers et al[19] did not include women in their sample and the study with the highest proportion was the one by Maeder et al[18] (36%). This evidence suggests that the VSAQ is not often studied in women, even in its original version. Hence, there is a lack of studies on the difference between the sexes regarding the scale criterion validity.

Conclusion

In conclusion, our findings confirm the criterion validity of the Portuguese version of the VSAQ, previously demonstrated by Maranhão Neto et al[11], as well as its measurement equivalence. The results obtained in the tool validity were similar to those found for the original version, especially in samples similar to that of the present study (individuals with heart disease and the elderly).

The criterion validity of the Nomogram was also demonstrated and the results obtained were similar to those of the original article, which confirms its applicability, especially in individuals with low CRF.

Thus, the use of the analyzed Portuguese version of the VSAQ is suggested, as it is originally an important tool of clinical and epidemiological significance. As the tool is easy to understand and simple to fill out, it can be used by health professionals to help individualize the ET. In situations where the ET cannot be performed, the VSAQ can replace it in the CRF assessment, both to follow up the physical fitness evolution as well as to detect the morbimortality risk, especially in individuals with cardiopathies.

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Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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