



Psychometric Properties of the Spanish Version of the Sarcopenia and Quality of Life, a Quality of Life Questionnaire Specific for Sarcopenia

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Abstract

The Sarcopenia and Quality of Life questionnaire (SarQoL®) is a self-administered multidimensional sarcopenia-specific tool designed for community-dwelling subjects aged 65 years and older. The purpose of the present study was to evaluate the psychometric properties of the Spanish version of the SarQoL®. A total of 252 participants aged ≥ 65 years voluntarily participated in this cross-sectional study. Handgrip strength and bioelectrical impedance analysis were used for sarcopenia screening. Discriminative power, internal consistency, test–retest reliability, and floor and ceiling effects were analyzed. The generic 36-item Short-Form Health Survey (SF-36), the European Quality of Life 5-Dimension-3 Level (EQ-5D-3L), and the Hospital Anxiety and Depression Scale (HADS) were also used for convergent and divergent validity. Significant differences between sarcopenic ($n = 66$) and non-sarcopenic participants were observed for SarQoL® total score ($p = 0.008$) and for all domains except D2—locomotion. A high internal consistency of SarQoL® total score (Cronbach's $\alpha = 0.904$) was found, and significant domain-to-total score correlations were obtained (all $p < .001$). Test–retest data showed excellent reliability for SarQoL® total score (ICC = 0.99; 95%CI 0.98–0.99) and in all dimensions, except for D6—leisure and D7—fears activities (substantial). No floor and ceiling effects were observed for SarQoL® total score. SarQoL® total score showed good and acceptable correlations ($p < 0.001$) with the selected domains of the SF-36 and EQ-5D-3L which have similar dimensions (convergent validity). Low and non-significant correlations existed with anxiety, depression, and EQ-5D-3L self-care and pain/discomfort domains (divergent validity). The Spanish SarQoL® shows satisfactory general psychometric properties in Spanish-speaking older adults from Spain and is able to discriminate between older adults with and without sarcopenia.

Keywords Sarcopenia · Quality of life · SarQoL® · Spanish · Validation

Introduction

Sarcopenia is the term traditionally used to describe an age-related decrease in muscle mass [1]. In the first definition of sarcopenia, only muscle mass was considered [2], although later definitions included decreased muscle function, and currently, a decline in both muscle mass and muscular function (strength or physical performance) is required before sarcopenia is diagnosed [3, 4].

Sarcopenia has been associated with many adverse effects, such as increased risk of falls and fall-related injuries [5], diminished ability to perform activities of daily living [6], cognitive impairment [7], cardiometabolic disorders [8], or death [9]. For this reasons, sarcopenia is recognized as a major clinical problem for older people and for public health in many countries. The association between sarcopenia and

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quality of life has been studied, but generic questionnaires, such as the generic 36-item Short-Form Health Survey (SF-36) [10], or the European Quality of Life 5-Dimension questionnaire [11], lack in specificity. Therefore, using a quality of life questionnaire specific for people with sarcopenia appears as a reasonable and useful development [12].

In this context, the Sarcopenia and Quality of Life (SarQoL®) questionnaire was developed in 2015 by Beaudart et al. [13]. This is a self-administered multidimensional sarcopenia-specific questionnaire designed for community-dwelling subjects aged 65 years and older. The psychometric properties of the SarQoL® have already been demonstrated [14] and it has been validated for several languages such as English [15], Romanian [16], Hungarian [17], Polish [18], Greek [19], and Dutch [20]. However, and to the extent of our knowledge, no validation of the Spanish version of the SarQoL® psychometric properties has been carried out. In Spain, the number of people over 65 has increased considerably in recent years and there is evidence that this rate will be maintained, reaching 33.2% of the population in the year 2050. This would make Spain the second country with the highest percentage of older people worldwide [21]. Therefore, we consider this to be an important and useful validation of the questionnaire. The goal of the present study was to evaluate the psychometric properties of the Spanish version of the SarQoL® by assessing its discriminative power, internal consistency, test–retest reliability, floor and ceiling effects, and convergent and divergent validity in a Spanish population of 65 years and older. Our hypothesis was that the Spanish SarQoL® is a valid, consistent, and reliable instrument, and that it is able to discriminate between sarcopenic and non-sarcopenic subjects.

Methods

Participants

Out of 315 community-dwelling subjects who were initially contacted, 252 finally participated in this study, which was conducted from September 2018 to December 2018. Recruitment was carried out by contacting the staff of two centers of active participation of older adults of Jaén (Spain). The sample size of this study was considered appropriate according to psychometric recommendations described by Terwee et al. [22]. Inclusion criteria were as follows: 65 years of age or older, community-dwelling, native Spanish speaker, able to understand and complete the study-related questionnaires, and willing to provide their written informed consent to participate in the study. Participants were excluded if they were immobilized, had an amputated limb or any electronic implant (for which bioelectrical impedance analysis is contraindicated), suffered from a chronic and/or severe medical disease, or from any neuropsychiatric disorder that could influence their responses to

the questionnaire. All participants gave their written informed consent to participate in this study, which was conducted in accordance with the Declaration of Helsinki, good clinical practices, and all applicable laws and regulations. Before filling out the questionnaires, all participants were interviewed to collect certain demographic data such as age, smoking habits, and occupational, educational, and marital status. Body mass index was calculated by dividing an individual's weight (kg) by his/her height (m²) [23]. Participants were classified as physically active if they regularly performed moderate-intensity exercise (more than 30 min, three times per week) [24]. This study was approved by the Ethical Committee of the University of Jaén, Spain (NOV.18/2.TES). "Informed consent was obtained from all individual participants included in the study."

Assessment of Sarcopenia

Sarcopenia was defined according to the operational definition recently proposed by the European Working Group on Sarcopenia in Older People, and revised in early 2018 (EWGSOP2) [4]. Sarcopenia diagnosis was confirmed by the presence of low muscle strength together with low muscle mass. All participants were assessed for muscle strength and mass.

Bioelectrical impedance analysis (BIA) was used to assess skeletal muscle mass (InBody 720, Biospace Co., Ltd.; Seoul, Korea). Participants stood upright with their arms abducted apart from their trunk and legs slightly spread. Skeletal muscle mass (SM) was calculated using the BIA equation from a previous study [25] ($SM(kg) = [0.401 \times (\text{height}^2/\text{resistance}) + (3.825 \times \text{gender}) - (0.071 \times \text{age}) + 5.102]$), where height and resistance were assessed in cm and ohms, respectively. The gender was zero for women, and one for men. The height-adjusted Skeletal Muscle Mass Index (SMI) was calculated by dividing SM by height in meters squared (kg/m²), and a cutoff point of 6.42 and 8.87 kg/m² was used to determine a low muscle condition in women and men, respectively [26]. According to the recently launched consensus by the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases [27], handgrip strength (TKK 5001, Grip-A, Takei, Tokyo, Japan) was employed to assess muscle strength. Participants were asked to apply their maximum grip strength. The maximal measured effort was regarded as their grip strength, and low muscle strength was defined as grip strength values of < 16 kg (women) and < 27 kg (men) [28].

Questionnaires

The SarQoL® questionnaire consists of 22 questions encompassing 55 items. All questions except 7, 14, and 22 use a Likert scale of frequency or intensity. These questions are

summarized into 7 domains of dysfunction: D1—physical and mental health (8 items), D2—locomotion (9 items), D3—body composition (3 items), D4—functionality (14 items), D5—activities of daily living (15 items), D6—leisure activities (2 items), and D7—fear (4 items). Each domain, as well as the total score, ranges from 0 to 100, where higher scores indicate better quality of life. The analysis of the psychometric properties of the Spanish version of the SarQoL® was performed after receiving official permission from the questionnaire developer, Dr Beaudart. For the purpose of this study, the Spanish version of the SarQoL® was used (downloadable at the official site: https://www.sarqol.org/sites/sarqol/files/Questionnaire_SarQoL_ES-2017-06_0.pdf). In order to analyze test–retest reliability, the Spanish version of the SarQoL® was again completed by all participants with sarcopenia two weeks later.

The SF-36 is a valid and reliable instrument that is widely used to measure generic health-related quality of life [29]. The Spanish version of the SF-36 was translated and validated in the Spanish population by Alonso et al. [30]. It consists of 36 items classified into eight scales or domains: physical functioning, role limitation due to physical problems, bodily pain, general health, vitality, social functioning, role limitation due to emotional problems, and mental health. The SF-36 also provides two summary measures: a Physical Component Summary (PCS) and a Mental Component Summary (MCS). Total score ranges from scale from 0 (worst quality of life) to 100 (best quality of life).

The European Quality of Life 5-Dimension-3 Level questionnaire (EQ-5D-3L) is a widely used standardized generic measure of health-related quality of life developed in 1990 [31]. The Spanish version of the EQ-5D-3L scale was used in this study [32]. It comprises five items referring to five domains (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), as well as the visual analogue scale (EQ-VAS), as a measure of overall self-rated health status recorded on a vertical scale going from the best (100) to the worst imaginable health status (0). Each item is scored as presenting no problems, moderate problems, or severe problems. The answers provided for the five items are converted into an index score, which indicates the overall utility.

The Hospital Anxiety and Depression Scale (HADS) [33] is a questionnaire widely used for detecting anxiety and depressive disorders. It consists of 14 items, 7 related to anxiety symptoms and 7 to depressive symptoms. The total HADS score ranges from 0 to 21 for both depression and anxiety, and greater scores indicate a greater symptom load. The Spanish version was employed in the present study [34].

Statistical Analysis

Normality of continuous variables was tested with the Kolmogorov–Smirnov test. Data were described using mean and standard

deviation (SD) for the continuous variables with a normal distribution, while variables that showed a non-normal distribution were reported as a median (25th percentile–75th percentile). Frequencies and percentages were used for the categorical variables. Regarding descriptive characteristics of the participants, Student's *t* test was used for continuous variables with a normal distribution, Mann–Whitney *U* test for those that did not follow a normal distribution, and Chi squared for categorical variables. Cronbach's α coefficient was used to assess the internal consistency of the Spanish SarQoL®. Values greater than 0.70 indicate a high level of internal consistency [35]. The correlation between each domain and the total score of the SarQoL® was tested using Spearman's correlations. A correlation above 0.81 is considered as excellent, between 0.61 and 0.80 as very good, between 0.41 and 0.60 as good, between 0.21 and 0.440 as acceptable, and, finally, below 0.20 as insufficient [36]. Test–retest reliability was determined using Intraclass Correlation Coefficients (ICC) by Shrout and Fleiss [35]. Reliability was considered poor when the ICC was < 0.40 , moderate between 0.40 and 0.75, substantial between 0.75 and 0.90, and excellent when $ICC > 0.90$ [37]. Floor and ceiling effects were assessed by determining the proportion of subjects scoring the minimum (0) or maximum (100). These effects were considered to be present when 15% or more of the subjects obtained either the minimum or maximum possible score. Finally, Spearman's correlation coefficient was employed to analyze convergent and divergent validity in sarcopenic participants. For convergent validity, SF-36 domains that are similar were used (physical functioning, role limitation due to physical problems, general health, bodily pain, and vitality). EQ-5D-3L's utility score and its dimensions mobility, usual activities, and EQ-5D-3L visual analogue scale score were also used for convergent validity. For divergent validity, we considered HADS scores, and EQ-5D-3L dimensions of self-care, pain/discomfort, and anxiety/depression. For the discriminant validity analysis, and assuming that quality of life is worse in persons with sarcopenia, Student's *t* test and Mann–Whitney *U* test were used to assess differences of the SarQoL® total score and domains between sarcopenic and non-sarcopenic participants. Data management and analysis were performed using the SPSS 20.0 statistical package (SPSS Inc., Chicago, IL, USA). The level of statistical significance was set at $p < 0.05$.

Results

Subjects

In all, 252 participants completed all the questionnaires included in this study and were screened for sarcopenia, A flowchart with the study participants is presented in Fig. 1. The time required to complete the SarQoL® questionnaire was 10 and 15 min. Their descriptive characteristics are shown in Table 1. Most of the participants were retired

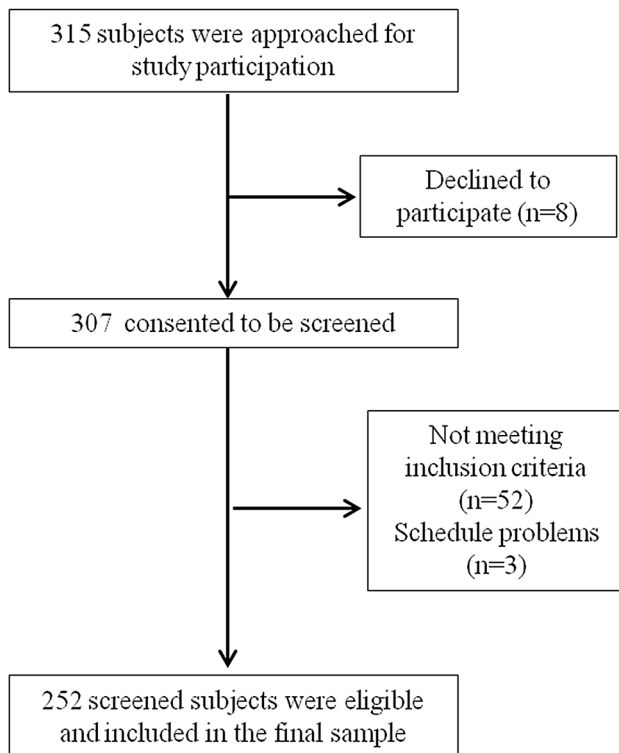


Fig. 1 Flowchart of the validation study of the Spanish version of the SarQoL®

(82.93%) women (82.54%), 95.23% were non-smokers, 7.14% were physically active, and 65.08% had either no formal education at all or only primary education. A total of 66 subjects presented sarcopenia (74.24% women). Differences regarding sarcopenia groups are shown in Table 1.

Internal Consistency

In the analysis of internal consistency, the Cronbach's alpha value of the Spanish version of the SarQoL® questionnaire was 0.904, which indicates a high degree of internal consistency. When any of the domains were deleted, the alpha value ranged between 0.870 when deleting D4—functionality and 0.911 without D6—leisure activities. When comparing each domain with the SarQoL® total score (Table 2), a significant positive correlation for all domains was observed (all $p < 0.001$) with values ranging from good (0.57, D6—leisure activities) to excellent (0.94, D4—functionality).

Test–Retest Reliability

As for reproducibility (test–retest reliability), from the 66 participants with sarcopenia, 44 completed the Spanish SarQoL® again after a two-week interval. The test–retest data showed excellent reliability for the Spanish SarQoL® total score (ICC = 0.99; 95% CI 0.98–0.99) and all dimensions,

Table 1 Descriptive data of the sample

	All ($n = 252$)	No sarcopenia ($n = 186$)	Sarcopenia ($n = 66$)	p value
Age (years)	74.00 (70.00–78.00)	73.00 (69.75–77.25)	76.50 (71.00–82.00)	0.001
Gender				0.058
Women	208 (82.54)	159 (85.48)	49 (74.24)	
Men	44 (17.46)	27 (14.52)	17 (25.76)	
Occupational status				0.462
Retired	209 (82.9)	151 (81.18)	58 (87.88)	
Working	11 (4.37)	9 (4.84)	2 (3.03)	
Unemployed	32 (12.70)	26 (13.98)	6 (9.09)	
Marital status				0.727
Single	19 (7.54)	15 (8.06)	4 (6.06)	
Married/cohabitating	124 (49.21)	89 (47.85)	35 (53.03)	
Divorced/separated/widowed	109 (43.25)	82 (44.09)	27 (40.91)	
Educational status				0.243
No formal education	39 (15.48)	24 (12.90)	15 (22.73)	
Primary education (6–14 years)	125 (49.60)	93 (50.00)	32 (48.48)	
Secondary education (14–18 years)	68 (26.98)	54 (29.03)	14 (21.21)	
University	20 (7.94)	15 (8.06)	5 (7.58)	
Smoker				0.737
No	240 (95.24)	176 (94.62)	64 (96.97)	
Yes	12 (4.76)	10 (5.38)	2 (3.03)	

Values are expressed as median (25th percentile–75th percentile) for quantitative variables that did not follow a normal distribution and frequencies (percentages) for the categorical variables

Table 2 Intercorrelations between the SarQoL® questionnaire total and domains scores (*n* = 252)

SarQoL® questionnaire	D1—physical and mental health		D2—locomotion		D3—body composition		D4—functionality		D5—activities of daily living		D6—leisure activities		D7—fears		Total score
	Rho	95% CI	Rho	95% CI	Rho	95% CI	Rho	95% CI	Rho	95% CI	Rho	95% CI	Rho	95% CI	
D1—physical and mental health	1														
D2—locomotion	0.74*	0.66–0.80	1												
D3—body composition	0.76*	0.72–0.82	0.57*	0.47–0.66	1										
D4—functionality	0.80*	0.73–0.85	0.80*	0.74–0.84	0.72*	0.64–0.78	1								
D5—activities of daily living	0.70*	0.62–0.77	0.69*	0.61–0.75	0.58*	0.48–0.66	0.79*	0.73–0.84	1						
D6—leisure activities	0.47*	0.37–0.56	0.50*	0.41–0.60	0.42*	0.31–0.52	0.52*	0.41–0.61	0.48*	0.37–0.58	1				
D7—fears	0.57*	0.46–0.66	0.58*	0.49–0.66	0.47*	0.35–0.57	0.62*	0.53–0.69	0.45*	0.34–0.55	0.37*	0.25–0.48	1		
Total score	0.86*	0.81–0.89	0.87*	0.83–0.90	0.72*	0.65–0.79	0.94*	0.92–0.95	0.92*	0.89–0.94	0.57*	0.47–0.65	0.61*	0.51–0.68	1

SarQoL, Sarcopenia and Quality of Life, CI confidence interval

**p* < 0.001

Table 3 Test–retest reliability of the Spanish SarQoL® questionnaire using intraclass correlation coefficient (*n* = 44)

SarQoL® questionnaire	ICC	95% CI	<i>p</i> value	Reliability
D1—physical and mental health	0.98	0.96–0.99	< 0.001	Excellent
D2—locomotion	0.99	0.98–0.99	< 0.001	Excellent
D3—body composition	0.99	0.98–1.00	< 0.001	Excellent
D4—functionality	0.98	0.97–0.99	< 0.001	Excellent
D5—activities of daily living	0.96	0.92–0.98	< 0.001	Excellent
D6—leisure activities	0.88	0.80–0.93	< 0.001	Substantial
D7—fears	0.84	0.72–0.91	< 0.001	Substantial
Total score	0.99	0.98–0.99	< 0.001	Excellent

SarQoL Sarcopenia and Quality of Life, ICC intraclass correlation coefficient, CI confidence interval

except for D6—leisure activities and D7—fears, that showed substantial reliability (Table 3).

Floor and Ceiling Effects

No floor and ceiling effects were observed for the Spanish SarQoL® total score, since no participants scored either the minimum (0) or the maximum (100) scores.

Convergent and Divergent Validity

Results regarding convergent validity are shown in Table 4. Good and acceptable significant correlations were observed between the Spanish SarQoL® total score and the selected domains of the SF-36 and EQ-5D-3L questionnaires, which have similar dimensions to the SarQoL® questionnaire. SF-36 physical functioning ($\rho = 0.53, p < 0.001$), vitality ($\rho = 0.50, p < 0.001$), and general health ($\rho = 0.42, p < 0.001$) domains, as well as EQ-5D-3L-mobility ($\rho = 0.50, p < 0.001$) and EQ-5D-3L-VAS score ($\rho = 0.49, p < 0.001$) showed the highest Spearman’s correlation coefficients. As for divergent validity, the HADS was used, and non-significant correlations were found between the SarQoL® questionnaire and anxiety ($\rho = -0.11, p = 0.378$) and depression ($\rho = -0.18, p = 0.149$), as well as with EQ-5D-3L-self-care ($\rho = -0.16, p = 0.199$) and EQ-5D pain/discomfort ($\rho = -0.17, p = 0.162$).

Discriminant Validity

Finally, to evaluate discriminative power, scores for the Spanish version of the SarQoL® and its dimensions were compared between sarcopenic and non-sarcopenic participants. Table 5 presents the total score and the individual domain scores of the SarQoL questionnaire for subjects with

Table 4 Convergent and divergent validity of the Spanish SarQoL® questionnaire total score ($n=66$)

Convergent validity	Rho	95% CI	<i>p</i> value	Divergent validity	Rho	95% CI	<i>p</i> value
SF-36 Physical functioning	0.53	0.30–0.71	<0.001	HADS-anxiety	–0.11	–0.35 to 0.14	0.378
SF-36 Role limitation due to physical problems	0.38	0.12–0.59	0.002	HADS-depression	–0.18	–0.39 to 0.05	0.149
SF-36 General Health	0.42	0.19–0.62	<0.001	EQ-5D-3L Self-care	–0.16	–0.34 to 0.08	0.199
SF-36 Body pain	0.36	0.11–0.59	0.003	EQ-5D-3L Pain/discomfort	–0.17	–0.40 to 0.10	0.162
SF-36 Vitality	0.50	0.26–0.69	<0.001	EQ-5D-3L Anxiety/depression	–0.31	–0.51 to –0.06	0.013
EQ-5D-3L Mobility	–0.50	–0.65 to –0.28	<0.001				
EQ-5D-3L Usual activities	–0.40	–0.58 to 0.14	0.001				
EQ-5D-3L -VAS	0.49	0.26 to 0.67	<0.001				
EQ-5D-3L Utility score	0.41	–0.64 to –0.17	0.001				

SarQoL Sarcopenia and Quality of Life, *Rho* Spearman's Correlation Coefficient, *CI* confidence interval, *SF-36* Generic 36-item Short-Form Health Survey, *EQ-5D-3L* European Quality of Life 5-dimension three-level questionnaire, *VAS* visual analogue scale, *HADS* Hospital Anxiety and Depression Scale

Table 5 Discriminative power of the Spanish SarQoL® questionnaire,

SarQoL® questionnaire	No sarcopenia ($n=249$)	Sarcopenia ($n=52$)	<i>p</i> value
D1—physical and mental health	72.20 (62.20–83.30)	68.87 (58.87–75.81)	0.016
D2—locomotion	75.00 (61.11–92.36)	72.22 (57.64–86.11)	0.074
D3—body composition	75.00 (62.50–83.33)	70.83 (62.50–79.17)	0.033
D4—functionality	78.85 (65.11–92.31)	73.08 (59.62–80.36)	0.011
D5—activities of daily living	75.00 (58.33–93.33)	67.27 (48.30–83.93)	0.012
D6—leisure activities	66.50 (33.25–66.50)	55.34 (33.25–66.50)	0.025
D7—fears	87.50 (87.50–100.00)	87.50 (87.50–87.50)	0.030
Total score	76.04 (64.83–87.07)	71.19 (57.51–78.89)	0.008

Variables are expressed as a median (P25–P75)

SarQoL Sarcopenia and Quality of Life

and without sarcopenia. Statistically significant differences between the two groups were observed for the Spanish SarQoL total score ($p=0.008$) and for all domains except for D2—Locomotion.

Discussion

The aim of the present study was to assess the psychometric properties of the Spanish version of the SarQoL®, a specific quality of life questionnaire developed for sarcopenia, in people aged 65 years and older. Our results showed that the Spanish SarQoL® is a valid and reliable instrument for assessing quality of life in Spanish-speaking older adults from Spain, particularly those who present sarcopenia, and it is able to discriminate between sarcopenic and non-sarcopenic groups.

The present study was performed following a standardized validation protocol reported by the creators of the original SarQoL® questionnaire, thus ensuring that the results from the validation are comparable to other validation studies [14, 22]. The time required to complete the Spanish SarQoL® was between 10 and 15 min, longer than the time

reported by Beudart et al. [13] (around 10 min). Since not only the nature of the questionnaire's items but also the person to whom they are administered can influence the probability of a particular response [38], this may be related to the fact that in the present study a 65.08% of the participants had primary school education or less.

In this study, to assess sarcopenia, the recent criteria described by the EWGSOP2 have been followed [4]. This revised definition of sarcopenia has been reported to better reflect clinical outcomes and adverse events of sarcopenia, addressing in part the disconnect between low muscle mass and outcomes [39–41], although research by Cruz-Jentoft et al. [4] did not describe any cutoff points for the use of BIA to determine muscle quantity. For this reason, we have used other cutoff points previously accepted in EWGSOP1 [3]. According to the validation protocol, the study sample size should consist of at least 50 sarcopenic patients for validation [22]. In our study, 252 subjects were initially screened, out of which 66 were sarcopenic according to the EWGSOP2 criteria. This sample size is larger than other used in previous validations such as those of the Dutch [20], Romanian [16], or English versions [15].

As for the internal consistency analysis, Beaudart et al. [14] described a high degree of internal consistency in the original validation, with Cronbach's alpha values of 0.87 for the total score. The results of the present study also showed a high degree of internal consistency (0.90), comparable with that described in other versions [15, 18]. Moreover, good reliability values were also observed with the deletion of one domain at a time. The analysis of the intercorrelations between the Spanish SarQoL® total score and the domain scores revealed strong and positive correlations for all, with the lowest (although good) intercorrelation being observed for D6—leisure activities and the strongest correlation for D4—functionality. These results are in agreement with previous validations [14, 15].

Regarding test–retest reliability, the questionnaire was administered again to the sarcopenic participants two weeks later, a time interval that has been employed in previous validations [12, 14]. An excellent degree of reliability was obtained for the Spanish SarQoL® total score, which is comparable to that of the English [15] (ICC = 0.95; 95% CI 0.92–0.97) and Greek [19] (ICC = 0.96; 95% CI 0.95–0.97) versions. In the present study, ICC were excellent for all domains except for D6—leisure activities and D7—fears, results that have been also observed in previous studies and could be partly attributed to the low number of items included in these domains [14, 19]. The proportion of subjects reporting the lowest or the highest SarQoL® total score did not exceed 15%, and therefore, no floor or ceiling effects were observed. These findings are in agreement with those described in previous validations [14, 15, 20].

In the analysis of the convergent and divergent validity, sarcopenic subjects also completed three other questionnaires [14]. For convergent validity, the SarQoL® total score was compared with questionnaires that were supposed to have similar dimensions. In the original validation, Beaudart et al. [14] obtained strong correlations with SF-36 vitality and general health domains, as well as with EQ-5D-3L-usual activities. However, they found a lower correlation than expected with the EQ-5D-3L question concerning mobility. As expected, our results indicated positive and negative significant correlations with the selected domains of the SF-36 and EQ-5D-3L questionnaires, respectively. More specifically, and taking into account that sarcopenia involves a decrease in strength and muscle function, good correlations were found with the SF-36 physical functioning, general health, and vitality domains, as well as with the EQ-5D-3L item related to mobility, in addition to those linked to VAS and the utility score. A significant correlation was also observed with the EQ-5D-3L question about usual activities. These results are in accordance with those reported in other validations [15, 16, 20]. As for divergent validity (low association with a test that measures a different domain), we

found low and non-significant correlations with depression and anxiety as assessed with HADS, as well as with the EQ-5D-3L questions related to self-care, pain–discomfort, and anxiety–depression.

Finally, in the analysis of discriminant validity, our analysis showed that the non-sarcopenic group had significantly higher values (and thus better quality of life) in the Spanish SarQoL® total score. Similar results were reported in other validated versions of the SarQoL® [14–16] concerning domain-by-domain analysis. Previous validations reported significant differences among people with and without sarcopenia [14, 42], while Ildiko et al. [16], in the Romanian validation, could not find differences with respect to D6—Leisure activities, just as Konstantynowicz et al. [18], who were also unable to find such differences concerning D4—functionality. Our analysis showed significantly lower values in sarcopenic participants for all domains except D2—locomotion.

Some limitations of the present study should be considered. We were not able to use dual-energy X-ray absorptiometry for our research. However, BIA has been recommended for muscle evaluation in previous studies [4]. Besides, although all participants were evaluated for muscle strength and mass, we did not use the SARC-F questionnaire, which has been recently validated in Spanish population [43], and it is recommended by the EWGSOP2 as a convenient method for sarcopenia risk screening. On the other hand, the Spanish SarQoL® has been validated in Spanish population, but these results may not be generalizable to other Spanish-speaking countries since there are grammatical and socio-cultural differences, particularly for older people, and thus, future studies should be conducted on people from other Spanish-speaking countries. Finally, we could not assess sensitivity to change over time, since this is a cross-sectional study and longitudinal design is required to evaluate this aspect. Regarding this, the authors of the original validation study have recently evaluated its ability to detect change over time, concluding that the SarQoL® questionnaire has good responsiveness [42].

In conclusion, the results of the present study confirm that, in Spanish-speaking older adults from Spain aged 65 years and over, the Spanish version of the SarQoL® shows high internal consistency and excellent test–retest reliability, as well as good convergent and divergent validity for a sarcopenic population. Moreover, the Spanish SarQoL® is able to discriminate between older adults with and without sarcopenia.

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Author Contributions Authors RFC and FHC designed the study and prepared the first draft of the paper. Authors RFC, AMA, DCD, AAA, and FHC contributed to the experimental work. Author FHC and RFC was responsible for statistical analysis of the data. All authors revised the paper critically for intellectual content and approved the final version. All authors agree to be accountable for the work and to ensure that any questions relating to the accuracy and integrity of the paper are investigated and properly resolved.

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Compliance with Ethical Standards

Conflict of interest Raquel Fábrega-Cuadros, David Cruz-Díaz, Antonio Martínez-Amat, Agustín Aibar-Almazán and Fidel Hita-Contreras declare that they have no conflict of interest.

Ethical Approval The study had ethical approval from Ethical Committee of the University of Jaén, Spain (NOV.18/2.TES).

Human and Animal Participants All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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