INVESTIGATION

Psychometrican analysis and dimensional structure of the Brazilian version of melasma quality of life scale (MELASQoL-BP)*

Camila Fernandes Pollo Maranzatto[1]
Luciane Donida Bartoli Miot[1]
Hélio Amante Miot[1]
Silmara Meneguin[1]

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Abstract: Background: Although asymptomatic, melasma inflicts significant impact on quality of life. MELASQoL is the main instrument used to assess quality of life associated with melasma, it has been validated in several languages, but its latent dimensional structure and psychometric properties haven´t been fully explored.
Objectives: To evaluate psychometric characteristics, information and dimensional structure of the Brazilian version of MELASQoL.
Methods: Survey with patients with facial melasma through socio-demographic questionnaire, DLQI-BRA, MASI and MELASQoL-BP, exploratory and confirmatory factor analysis, internal consistency of MELASQoL and latent dimensions (Cronbach's alpha). The informativeness of the model and items were investigated by the Rasch model (ordinal data).
Results: We evaluated 154 patients, 134 (87%) were female, mean age (± SD) of 39 (± 8) years, the onset of melasma at 27 (± 8) years, median (p25-p75) of MASI scores , DLQI and MELASQoL 8 (5-15) 2 (1-6) and 30 (17-44). The correlation (rho) of MELASQoL with DLQI and MASI were: 0.70 and 0.36. Exploratory factor analysis identified two latent dimensions: Q1-Q3 and Q4-Q10, which had significantly more adjusted factor structure than the one-dimensional model: X2 / gl = 2.03, CFI = 0.95, AGFI = 0.94, RMSEA = 0.08. Cronbach's coefficient for the one-dimensional model and the factors were: 0.95, 0.92 and 0.93. Rasch analysis demonstrated that the use of seven alternatives per item resulted in no increase in the model informativeness.
Conclusions: MELASQoL-BP showed good psychometric performance and a latent structure of two dimensions. We also identified an oversizing of item alternatives to characterize the aggregate information to each dimension.
Keywords: Factor analysis, Statistical; Melanosis; Quality of life

INTRODUCTION

Melasma is a common dyschromia, caused by melanocytic hypertrophy and hyperfunction of epidermo-melanic unit. It is mainly associated with sun exposure and sex steroids (pregnancy and oral contraceptives), with frequent family involvement (40-60%).[1-3]

Although asymptomatic, high prevalence of melasma, involvement of visible areas – such as face, especially in women of childbearing age with darker skin types (III-V) – and resistance to treatment result in significant impact on quality of life (QOL) of patients.[4-6]

The MELASQoL (Melasma Quality of Life Scale) was developed based on SKINDEX-16 and on a questionnaire for skin depigmentation. It consists of 10 graded items (Likert type) and is now the leading psychometric tool for evaluating QOL related to melasma, with validation in several countries, including Brazil, and used in clinical trials (Chart 1).[7-9]

In the validation process for the Arabic, Abou-Taleb *et al* identified three latent dimensions in MELASQoL-A structure: emotional well-being (Q1-Q4), social life (Q5-Q7 + Q10) and recreation and leisure (Q8-Q9), in line with the structure proposed by the original authors.[10]

However, MELASQoL development process did not include all the recommended steps for the construction and validation of a psychometric instrument, and its dimensionality, factor composition and information performance of items have not been adequately explored.[11-13]

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[1] Universidade Estadual Paulista "Júlio de Mesquita Filho" (Unesp) – Botucatu (SP), Brazil.

This study aimed to evaluate the psychometric and information characteristics as well as dimensional structure of the Brazilian version of MELASQoL.

METHODS

A survey was conducted with patients with facial melasma from a private clinic (Laura Buratini Clinic, Botucatu-SP) and public institutions (FMB-Unesp, Botucatu-SP), treated between March/2014 and June/2015. The project was approved by the Ethics Research Board of the institution (no. 476.666).

Individuals older than 18 years, with no other facial dermatoses, included consecutively, were eligible for the study.

From their informed consent agreement, participants underwent evaluation by MELASQoL-BP (validated for Brazilian Portuguese), DLQI-BRA (Dermatology Life Quality Index), MASI (Melasma Area Severity Scale) and by sociodemographic questionnaire.[8,14,15]

The internal consistency of MELASQoL-PB was assessed by Cronbach's alpha, and its latent dimensionality by exploratory factor analysis (Promax rotation with extraction method: factoring of the main axis). The number of factors was estimated by the Kaiser criterion (eigenvalue ≥1), the analysis of Scree plot and the Horn's parallel analysis method, using random matrix (sphericity calculated after Monte Carlo simulation method with 99% reliability).[11,16,17]

The latent factor structure explored was compared to the one-dimensional model and the three-factor model (Abou-Taleb *et al)* by confirmatory factor analysis (asymptotic probability - free distribution after bootstrapping with 1,000 resampling), using as performance the parameters of the model: chi-square reason by degrees of freedom, adjusted goodness of fit index (AGFI), comparative fit index (CFI), root mean square error of approximation (RMSEA) and consistent Akaike information criterion (CAIC).[16,18-20]

The discriminant analysis and the information contained in items were evaluated by the Rasch's model for ordinal data (Samejima's progressive model) with maximum likelihood estimator (MLE) for each identified factor.[21,22]

Quantitative data were expressed as means and standard deviations or medians and quartiles (p25-p75) if normality was not evidenced by the Kolmogorov-Smirnov test (Lilliefors).[23] The correlation between MELASQoL, MASI, DLQI and among the extracted factors of the construct was assessed by the Spearman's coefficient (rho). The correlation between items was estimated by the correlation coefficient for monotonic ordinal data: Kendall tau-b.[16,24]

Data were analyzed in softwares IBM SPSS 22.0, AMOS 22.0 and eIRT 1.3.0, and p value <0.05 was considered significant.[22,25]

Sample size was calculated to contemplate between 10 and 20 cases per item for confirmatory factor analysis, and greater than 150 to meet the Rasch's model for ten items.[11,26-28]

RESULTS

The study evaluated 154 participants. The main clinical and sociodemographic data are shown in table 1. It is highlighted the predominance of females and appearance of melasma in childbearing age.

Chart 1: MELASQoL questionnaire (English version)

Answer:
1. – Not bothered at all
2. – Not bothered most of the time
3. – Not bothered sometimes
4. – Neutral
5. – Bothered sometimes
6. – Bothered most of the time
7. – Bothered all the time

Considering the last week before this consultation, how do you feel about:

1.	The appearance of your skin condition	( )
2.	Frustration about your skin condition	( )
3.	Embarrassment about your skin condition	( )
4.	Feeling depressed about your skin condition	( )
5.	The effects of your skin condition on your interactions with other people (e.g.: interactions with family, friends, close relationships, and so forth)	( )
6.	The effects of your skin condition on your desire to be with people	( )
7.	Your skin condition making it hard to show affection	( )
8.	Skin discoloration making you feel unattractive to others	( )
9.	Skin discoloration making you feel less vital or productive	( )
10.	Skin discoloration affecting your sense of freedom	( )
TOTAL		**( )**

Source: Cestari et al., 2006.[8]

No item of MELASQoL presented normal distribution (p<0.01). Frequencies of the scores of the items are shown in figure 1. Heterogeneous and asymmetric distributions of scores within each issue can be observed.

There was a strong correlation (rho) between MELASQoL and DLQI: 0.70 (p<0.01), but it was only moderate in relation to MASI: 0.36 (p<0.01). The inter-item and item-total correlations are arranged in table 2. There was a significant correlation between all comparisons (p <0.01).

Table 1: Clinical data, MELASQoL-PB, and demographic data of the studied sample

Variable	Values
N	154
Age (years)*	39 (8)
Gender	**N (%)**
Female	134 (87)
Male	20 (13)
Marital status	**N (%)**
Single	42 (27)
Married	93 (61)
Widow	19 (12)
Education	**N (%)**
Elementary	28 (18)
High school	50 (33)
Higher education	76 (49)
Family income	**N(%)**
<R$ 1,000	20 (13)
R$ 1,000-3,000	51 (33)
R$ 3,000-5,000	36 (23)
>R$ 5,000	47 (31)
Age of onset of melasma (years)*	27 (8)
Disease duration (years)**	10 (6-16)
MASI**	8 (5-15)
DLQI-BRA**	2 (1-6)
MELASQoL-PB**	30 (17-44)

* Mean (standard deviation); ** Median (p25-p75)

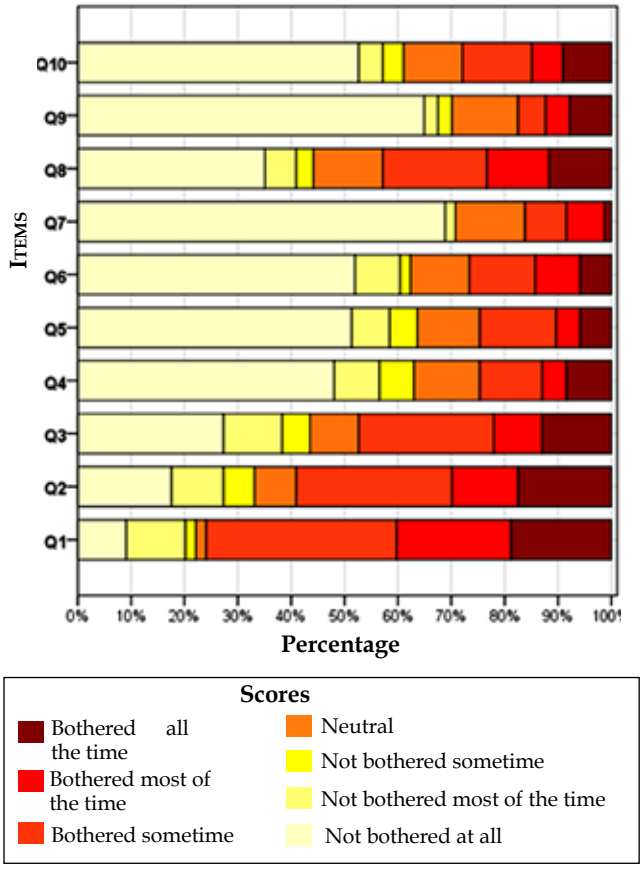

Figure 1: Distribution of scores of items in the studied sample (n=154)

The correlation between MELASQoL and DLQI showed no linear distribution (Figure 2). Based on an adjustment of quadratic regression type (y=-0.06x2+3.29x+19.32; R2=0.56; p<0.01), the equivalence between mild (≤5), moderate (6-10) and severe (11-20) DLQI scores can be designed as MELASQoL scores: ≤34, 35-46 and 47-61. [29,30]

Table 2: Correlation coefficients (Kendall tau-b) between items, correlation coefficients (Spearman's rho) between items, and MELASQoL-PB total score. All comparisons resulted p<0.01 (n = 154).

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1	-	0.75	0.71	0.59	0.48	0.52	0.38	0.62	0.44	0.53
Q2		-	0.70	0.57	0.52	0.52	0.41	0.61	0.48	0.55
Q3			-	0.66	0.52	0.59	0.39	0.68	0.51	0.56
Q4				-	0.61	0.62	0.48	0.61	0.53	0.62
Q5					-	0.75	0.55	0.63	0.53	0.60
Q6						-	0.56	0.63	0.60	0.57
Q7							-	0.46	0.58	0.49
Q8								-	0.58	0.66
Q9									-	0.69
MELASQoL	**0.83**	**0.85**	**0.87**	**0.84**	**0.81**	**0.82**	**0.66**	**0.88**	**0.75**	**0.83**

Exploratory factor analysis identified two oblique factors with eigenvalues greater than or equal to 1, confirmed by the analysis of the Scree plot and to parallel analysis (Table 3 and Figure 3). The default matrix identified loads positive and greater than 0.5 for the items independently distributed on factors: Factor 1 (Q4 to Q10) and factor 2 (Q1 to Q3) (Table 4). All items commonalities were greater than 0.53; meanwhile there was adequate sample for analysis: Kayser-Meyer-Olkin measure = 0.92; and Barlett's test of sphericity = 1346, p<0.01. The correlation between scores of the two extracted factors resulted 0.74.

The dimensional structure with two factors identified by the exploratory factor analysis, and with three factors, as indicated by Abou-Taleb et al, was compared by confirmatory factor analysis and its internal consistency was tested (Table 5). The standardized coefficients of each item for the two-dimensional structure were ≥0.71 in two- and three-dimensional models.

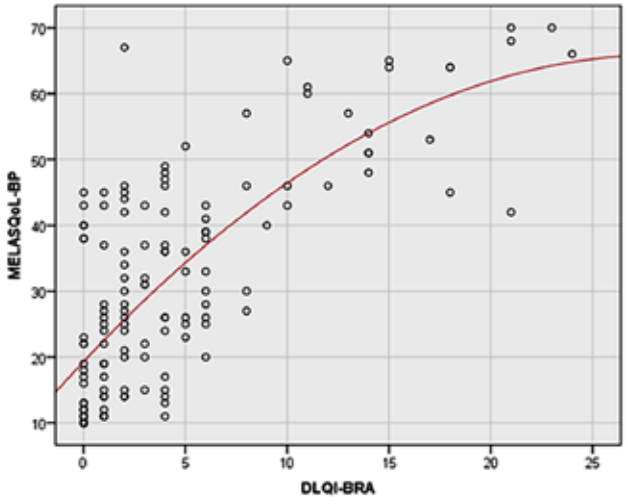

Figure 2: Diagram of DLQI-BRA and MELASQoL-PB points (n=154). Quadratic regression (y= -0.06x2+3.29x+19.32; R2=0.56; p<0.01)

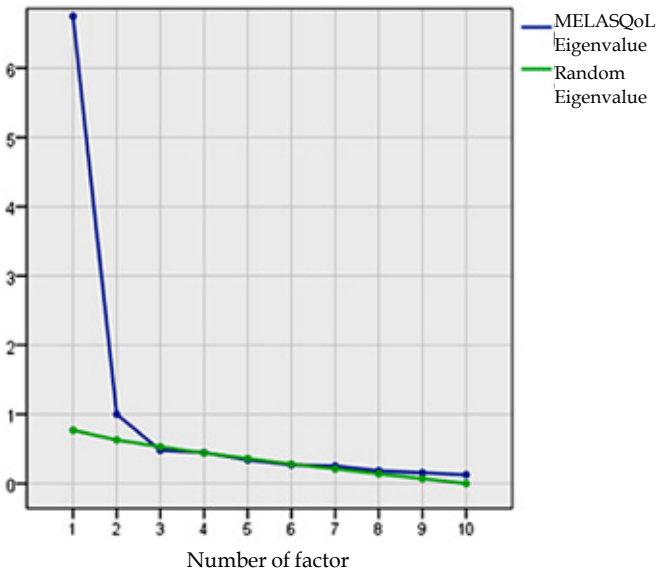

Figure 3: Diagram of the eigenvalues versus number of factors, showing two factors to the point of inflection and stabilization of the curve: analysis of Scree plot; and before the crossing of parallel analysis with random spherical matrix: Horn's parallel analysis (n=154)

Table 4: Default matrix derived from the extraction of two factors by the method of main axis factorizing and Oblimin type of rotation (n=154).

	Factor	
	1	**2**
Q1	-0.14	**0.98**
Q2	0.00	**0.91**
Q3	0.14	**0.79**
Q4	**0.58**	0.31
Q5	**0.86**	-0.01
Q6	**0.81**	0.06
Q7	**0.81**	-0.11
Q8	**0.50**	0.42
Q9	**0.85**	-0.03
Q10	**0.74**	0.13

Table 3: Eigenvalues and percentage of variance explained by exploratory factor analysis (n = 154). Extraction method: factoring of main axis. Oblique rotation Promax type (Kappa 4).

Factor		Initial eigenvalues			Extraction sums of squared loadings	
	Eigenvalues	**% of variance**	**% cumulative**	**Total**	**% of variance**	**% cumulative**
1	6.75	67.50	67.50	6.48	64.78	64.78
2	1.00	10.00	77.51	0.74	7.39	72.17
3	0.48	4.79	82.30			
4	0.45	4.47	86.77			
5	0.34	3.39	90.16			
6	0.27	2.67	92.83			
7	0.25	2.53	95.36			
8	0.18	1.83	97.19			
9	0.15	1.54	98.73			
10	0.13	1.27	100.00			

The discriminating capacity and the information of each item and its ordinal scores are arranged in table 6. The scores presented distribution of information linked to its associated factor at the further ends of the scale (alternatives 1 and 7), and the number 3 intermediate alternative ("not bothered most of the time") presented insufficient information for most items.

DISCUSSION

Psychometric measures usually differ from the clinical severity by presupposing the subjective perception of the disease. This study identified poor correlation between MELASQoL and MASI, as identified by the authors of the construct and by several investigations in which the correlation coefficient ranged between 0.17 and 0.36. [7,9,10,31-36] Moreover, there was a strong correlation with other quality of life instrument (DLQI), confirming the concurrent validity of the questionnaire.

MELASQoL overall score did not present a normal distribution in this sample, which can represent a selection bias or signify that the main questionnaire informativeness focus on lower scores, as occurred with MASI and DLQI. Other studies, in addition to the authors of the construct, have identified more significant distribution of lower scores, which may suggest a non-linear behavior for the interpretation of the scale, as shown in figure 2.[10,31,37] This non-parametric aspect, associated with the great heterogeneity of scores within the items, requires special treatment in data analysis and exploration of the psychometric characteristics.[38]

In developing the original construct, men were not interviewed, as well as aspects related to extrafacial melasma were not explored. The process of items selection was based on the composition of other questionnaires and not on individual symbolic perception of patients. There was no impact scaling on quality of life or even a categorization of severity based on the scores behavior. The temporal stability of the questionnaire was not measured, and the dimensionality was not adequately explored.[7]

This study proposed a categorization of impact on quality of life based on the correlation between MELASQoL and DLQI scores. However, investigations with appropriate methodologies should be conducted to better define the cutoffs.

Our investigation revealed a latent two-dimensional structure and indicated alternatives with low intrinsic information in scores composition of most items, suggesting that, instead of seven options, the same information could be incorporated into items with six alternatives. It should also be highlighted the dissociative behavior of the items scores (frequent extreme alternatives: 1-2 vs. 5-7). In

Table 5: Confirmatory factor analysis parameters and internal consistency for models with different dimensional structures

	One-dimensional model	Two-dimensional model		Three-dimensional model		
Items	Q1-Q10	Q1-Q3	Q4-Q10	Q1-Q4	Q5-Q7+Q10	Q8-Q9
Cronbach's alpha	0.95	0.92	0.93	0.91	0.89	0.80
X^2/gl*	15.43	2.03 (p<0.01)			3.68 (p<0.01)	
AGFI**	0.51	0.94			0.88	
CFI***	-	0.95			0.87	
RMSEA#	0.31	0.08			0.13	
CAIC##	754.80	211.91			259.06	

* Chi-square ratio for degrees of freedom; ** Adjusted goodness fit index *** Comparative fit index; # Root mean square error of approximation; ## consistent Akaike information criterion.

Table 6: Discrimination and information values for each MELASQoL-PB item and score alternatives (1-7) according to the analyzed dimension (n=154). Bold: items and alternatives with low intrinsic information related to the factor

Items	Discrimination	Item	Information score alternative						
			1	2	3	4	5	6	7
Q1	5.6	170.3	21.1	4.2	**0.6**	**0.5**	7.7	5.0	24.9
Q2	5.1	150.4	24.2	3.0	1.5	1.6	5.5	3.5	24.5
Q3	4.2	**108.2**	26.9	2.8	**1.0**	1.7	5.9	3.4	22.2
Q4	3.7	**78.2**	30.4	1.8	1.3	2.6	3.5	2.2	22.2
Q5	4.3	101.7	31.0	1.4	**1.0**	2.4	4.6	2.6	20.9
Q6	4.8	117.2	31.3	1.7	**0.4**	2.0	3.4	4.4	20.8
Q7	3.0	**63.9**	33.6	**0.4**	**0.0**	3.6	3.6	8.2	13.7
Q8	4.0	92.2	27.7	1.4	**0.7**	2.6	3.9	3.8	23.8
Q9	4.2	80.7	33.7	**0.5**	**0.5**	3.0	2.1	2.4	21.7
Q10	4.1	85.6	31.5	**0.9**	**0.8**	2.2	3.6	2.7	22.4

these terms, despite the frequent reference to high internal construct consistency (Cronbach's alpha ≥0,9) for MELASQoL, the division of the total score in independent dimensions (with independent scores) and the suppression of alternative items may impact negatively on the dimension of this coefficient, which should alert for the possibility of its potential inflation in clinical, translation and validation studies already published, which considered it as one-dimensional structure with seven alternatives per item. [7,9,10,31,34,35,37,39-41]

Between the two factors identified in this study, aspects connected preferably to intrapersonal relationship and feelings linked to the disease can be identified (Q1-Q3), as well as the individual relationship with the external environment, interpersonal, leisure and work (Q4-Q10). The authors of the original construct did not investigate the dimensional structure of MELASQoL, but correlated its items to the structure of the original questionnaires (e.g.: SKINDEX-16), suggesting a three-dimensional structure. [7] Later, Abou-Taleb *et al* corroborated such structure in a survey with 65 Egyptian women, from exploratory analysis.[10]

Our study showed that the two-dimensional structure presents clear superiority of model adjustment to three-dimensional hypothesis, which has not reached the minimum acceptable criteria for adequacy: AGFI ≥0.9; CFI ≥0.9; RMSEA ≤0.8.[42] Furthermore, the use of exploratory techniques of latent dimensions based on parametric data, such as those used by Abou-Taleb (main component analysis), associated with the studied sample size restriction and with the use of visual analysis of scree plot as definer of the number of extractable factors, may have promoted an erroneous estimation of latent structure. [43,44]

MELASQoL uses few items (Q2-Q3-Q4) to represent aspects exclusively psychological arising from melasma in comparison to the approach of social relationships, physical appearance, and recreational and professional aspects of the disease. Despite the simplicity and applicability of an instrument of only ten items, the representation of the dimension of feelings and perceptions related to self-esteem was less regarded by the authors, potentially compromising the instrument's accuracy. Moreover, just like this research, items related to the emotional well-being are identified as the ones with higher significance in studies of the quality of life in melasma.[7,9,10,13,31,33-35,37,39]

The exploration of the psychometric and structural properties of MELASQoL should be performed in other languages and socio-cultural realities, with appropriate analytical tools for the statistical characteristics of the measures, in order to identify the characteristics and weaknesses of the construct in the investigation of quality of life in melasma. Furthermore, new specific instruments for evaluating the quality of life related to melasma should be developed and validated in order to compare their properties with MELASQoL and characterize more precisely the aspects related to the impact inflicted by melasma in patients.

CONCLUSIONS

MELASQoL-PB showed good psychometric performance and latent two-dimensional structure. An excess of alternative in items to characterize the aggregated information to each dimension was identified.❑

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MAILING ADDRESS:
Silmara Meneguin
Departamento de Enfermagem da FMB-Unesp, s/n
18618-000 - Botucatu - SP
Brazil
Email: silmeneguin@fmb.unesp.br

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