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Psychometric Properties of Quality of Life Assessment Tools in Morbid Obesity: A Review of Literature

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Abstract

Background: Since studies have demonstrated that morbid obesity can exponentially impair quality of life, the measurement of quality of life is paramount to monitoring the effects of treatment and influences the development of clinical pathways, service provision, healthcare expenditures, and public health policy. Accordingly, clinicians, researchers, and policy makers must rely on valid instruments.

Aim: This study aimed to review and critique the psychometric properties of some specific tools by COSMIN checklist and their application among morbidly obese individuals.

Method: We searched PubMed, Web of Science, PsycINFO, Ovid, Elsevier, and ScienceDirect by using the keywords related to the Quality of Life Questionnaire, namely “morbid obesity”, “tool”, and “scale”, to retrieve articles published during 1989-2017. Then, the psychometric properties of the selected tools were assessed using the COSMIN checklist.

Results: Most of the tools had not reported complete and desirable psychometrics properties. Demonstration of responsiveness from independent randomized controlled trials was not available in two of the eight questionnaires. These tools also did not report proper definition of interpretability. However, the data obtained by COSMIN checklist showed that Laval questionnaire is a proper scale for measuring quality of life in obese individuals, which can be recommended to researchers.

Implications for Practice: Although Laval questionnaire was found a proper tool for measuring the quality of life among morbid obese patients, developing an instrument suitable for different societies with varied cultural and social characteristics is suggested because socio-cultural factors can influence the quality of life.

Keywords: Checklist, Obesity, Morbid, Psychometric, Quality of life, Review of literature

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Introduction

Obesity is a complex metabolic disease caused by excessive accumulation of fat (1). It is usually defined by body mass index (BMI) (2); $BMI \geq 40$ or $BMI > 35$, which are associated with comorbidities, are defined as morbid obesity (3).

The universal prevalence of obesity has been alarmingly increasing. World Health Organization (WHO) in 2015 reported that more than 1.9 billion people are overweight and 600 million suffer from obesity (4). In Iran (2010), the prevalence rates of overweight, obesity, and morbid obesity were 28.6%, 10.8%, and 3.4%, respectively (5).

Obesity, particularly morbid obesity, imposes significant health risks to the lives of patients with physical, psychological, socioeconomic, familial, or behavioral problems (6) and undermines their quality of life (QOL). Based on the definition put forth by WHO, QOL is an individual's perception of their position in life in the context of the culture and value systems in which they live. QOL is affected in a complex way by social relationships, personal beliefs (e.g., connectedness to a spiritual being, meaning of life, wholeness, and spiritual strength), and relationship to the environment (7). Spirituality and religiousness have also become a major component of QOL (8).

In a QOL study, an overall outcome index encompassing physical, psychological, social, spiritual, and financial aspects of a certain health state and medical interventions is added to the conventional clinical indices studied. For most patients, including morbid obese patients because of poor QOL (9), QOL is more important than the traditional outcome measures in medical care (10).

The increasing number of studies on the impact of therapeutic interventions on QOL shows that researchers and clinicians tend to have a holistic attitude toward the patient (11). Numerous studies also showed that the measurement of QOL in obese patients is useful to evaluate the effects of treatment (12, 13) and may influence the development of clinical pathways, service provision, healthcare expenditures, and public health policy. Hence, clinicians, researchers, and policy makers must rely on valid measurement instruments (14).

Although generic instruments for measuring QOL, such as the Short Form-36 (SF-36) (15), provide useful information, they are not designed to measure the specific range of health-related problems experienced by individuals with morbid obesity. A recent study by Kolotkin et al. (16) found differences between weight-related and generic measures of health-related QOL in a one-year weight loss trial, emphasizing on the potential value of using more than one measure in a trial including a disease-specific questionnaire.

For the specific measurement of health-related patient-reported outcomes such as QOL, it is important to evaluate the methodological quality of studies in which the measurement properties of these instruments are assessed. When studies on measurement properties have high methodological quality, their conclusions are more reliable. A checklist containing standards for design requirements and preferred statistical methods is a beneficial tool for this purpose. Former studies developed the Consensus-based Standards for the selection of health status Measurement INstruments (COSMIN) checklist for evaluating the methodological quality of studies on measurement properties (17, 18). The checklist can be used, for instance, in a systematic review of measurement properties, through which the quality of studies on measurement properties of instruments with a similar purpose is assessed, and results of those studies are compared to select the best instrument (19). In the present study, we attempted to review and critique the psychometric properties of some specific tools by COSMIN checklist and their utility for morbidly obese individuals.

Methods

This literature review was performed in 2017 by searching PubMed, Web of Science, PsycINFO, Ovid, Elsevier, ScienceDirect, and google scholar databases. The search terms were “morbid obesity”, “scale”, “instrument”, “questionnaire”, and “index”, “quality of life”, combined with search terms for morbid obesity. We retrieved English-language articles published from 1989 to 2017.

In the sampling stage, the research team selected all the studies reporting validation of morbid obesity QOL-specific questionnaires or their use in clinical trials. The inclusion criteria were

inclusion of at least one measure of reliability or validity as defined by the COSMIN criteria (complete reporting of validity, reliability, responsiveness, and interpretability) (20). Articles without available full-texts and with incomplete psychometric properties and non-English publications were excluded (Figure 1).

For each psychometric property defined by the COSMIN criteria, the relevant data were extracted by two independent researchers. The relevant data included the type of psychometric measurement.

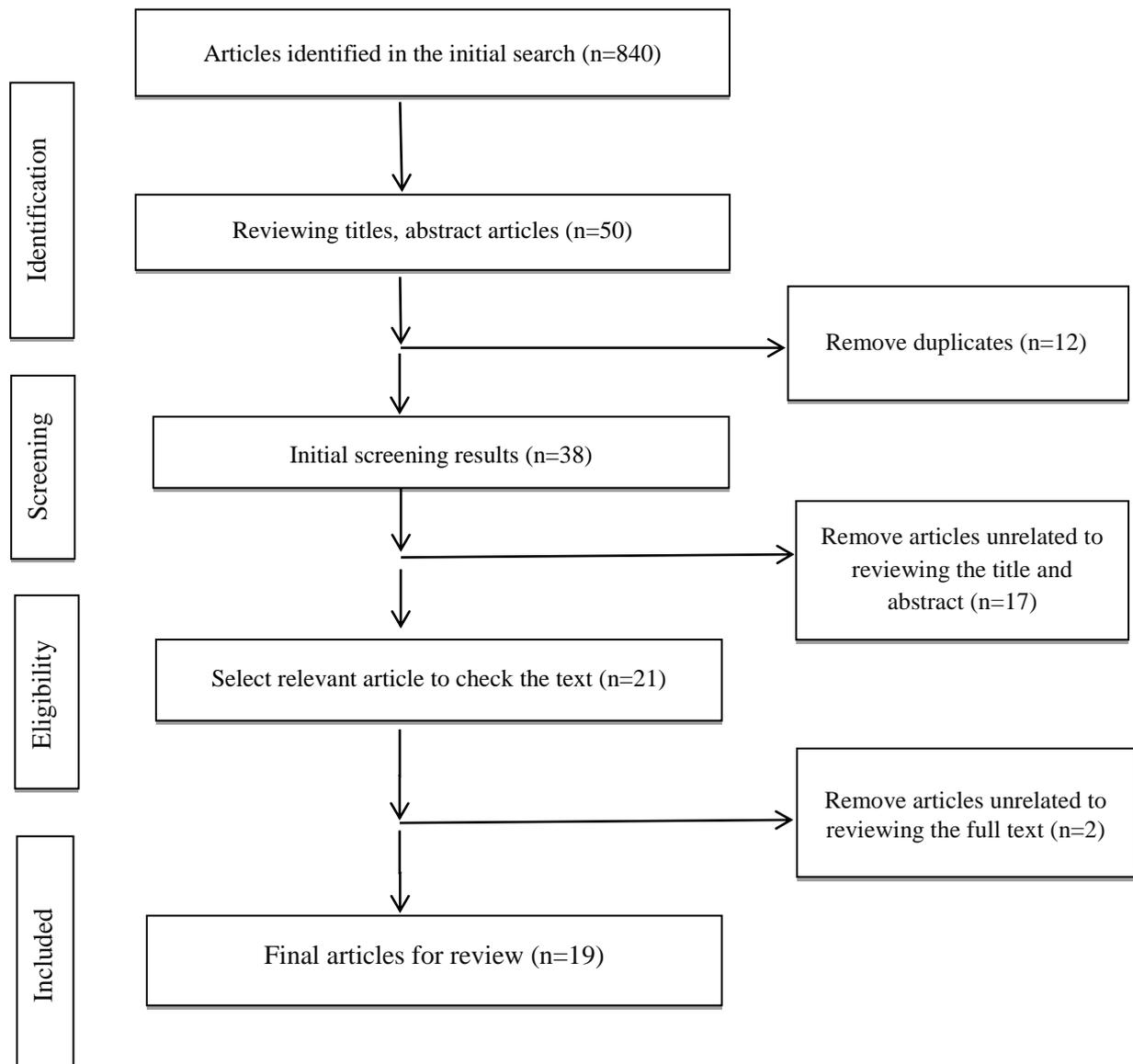


Figure 1. Chart of the study process

Results

The initial search yielded 840 articles, after the second evaluation, 50 more relevant articles were obtained. Then, duplicate articles were excluded, and the number of articles decreased to 38. In the review of the articles, only the articles on design, complete psychometric measures of tools, and construction of QOL-related tools were retained in the study (n=21). Finally, the full texts of 19 articles were considered for the evaluation and psychometric properties of eight morbid obesity QOL tools were analyzed using the COSMIN checklist (Table 1).

We identified these assessment tools with varying psychometric properties reported two to eight domains of QOL. While some domains (e.g., sexual life, social health, and eating) have too many assessment tools, other domains have many (e.g., psychological, self-esteem, activity, and work), few

Table 1. Summary of the final articles reviewed

Authors	year	The purpose of Study	Principal findings
Kolotkin et al.	1995	Development of a new instrument, the Impact of Weight on Quality of Life (IWQOL) questionnaire	Adequate psychometric properties with test-retest reliabilities averaging 0.75 for single items, and 0.89 for scales. Scale internal consistency averaged 0.87. Post-treatment scores differed significantly from pre-treatment scores on all subscales, indicating that treatment produced positive changes in the impact of weight on quality of life.
Kolotkin et al.	2001	Describing the development of a 31-item version of the IWQOL	The results showed the adequacy of the scale structure and excellent psychometric properties: good construct validity of the IWQOL-Lite, sensitivity to change, and supporting the utility of the IWQOL-Lite.
Kolotkin et al.	1997	Exploring IWQOL construct validity and provides new information on internal consistency, treatment effects, and differences between men and women	The results showed high internal consistency for the IWQOL subscales, treatment differences for men were significant in all scales, except for Work, and clinical and research utility as a quality-of-life outcome measure for clinical trials.
Kolotkin et al.	2001	Reporting health-related QOL changes in obese patients completing at least 1 year of outpatient treatment in a weight reduction program combining phentermine fenfluramine and dietary counseling	The results indicated a significant improvement in all five IWQOL-Lite scales and total score, significant correlations with percentage of weight loss for all the subscales and total score, correlations of subscale with weight loss. Physical Function and Self-esteem were most strongly affected by weight loss.
Ronette et al.	2002	Psychometric evaluation of impact of weight on quality of life	ANOVA revealed significant main effects for BMI on all IWQOL-Lite scales and total score. Females showed greater impairment than males on all scales, except for public distress. Internal consistency ranged from 0.816 to 0.944 for IWQOL-Lite scales and was 0.958 for total score. Test-retest reliability ranged from 0.814 to 0.877 for scales and was 0.937 for total score.
Sullivan et al.	1993	Baseline evaluation of health and psychosocial functioning in Swedish obese subject	The obese reported distinctly poorer current health and less positive mood states than the reference subjects, women were worse than men were. Anxiety and/or depression level indicated that psychiatric morbidity was more often seen in the obese and again women reported more affliction than men.
Karlsson et al.	2003	Evaluation of the construct validity and responsiveness of the OP scale	The results showed that psychometric testing provided strong support for the construct validity of OP. Reliability coefficients were high. Obese women reported more weight-related psychosocial problems than obese men did ($P < 0.0001$). OP is a psychometrically valid obesity-specific measure suitable for evaluating health-related quality of life effects of obesity interventions.

Table 1. Continued

Nicareta et al.	2015	Critical analysis of BAROS constitution and method	The results revealed that BAROS has some drawbacks and few studies show results on the use of this instrument, although it is still considered a standard tool. Several authors that used it found imperfections in its methodology and suggested some changes to improve its acceptance, showing the need of developing new methods to qualify the bariatric surgery results.
Oria et al.	1998	Validation of bariatric analysis and reporting outcome system	The results showed that the Bariatric Analysis and Reporting Outcome System (BAROS) analyze outcomes in a simple, objective, unbiased, and evidence-based fashion. It can be adopted to evaluate other forms of medical interventions for the control of obesity.
Oria H	1996	Evaluation of the opinions of surgeons in order to establish a baseline in the quest to standardize the analysis and reporting outcome of obesity operations	The results showed that when expressing weight loss, percentage of excess weight lost and body mass index were found to be most widely accepted. Quality of life measures and improvement of medical conditions are important in evaluating the results. There was a lack of consensus in the best classification of obesity and super obesity, as well as the definition of success and failure.
Ardelt et al.	1999	The validation of the Moorehead-Ardelt Quality of Life Questionnaire	The results reported that the questionnaire was found to be both valid and reliable.
Therrien et al	2011	Validation of a new self-administered questionnaire specific to morbid obesity to be used in clinical trials	The results showed moderate to high correlations between the scores in each domain of our instrument and the corresponding questionnaires, and significant differences in score changes between patients with bariatric surgery and those without, and moderate to high correlations between the changes in scores in the new instrument and the changes in the corresponding questionnaires.
Tayyem et al.	2014	Development and validation of a new Bariatric-specific 81-item self-report HRQOL instrument called BOSS	Exploratory factor analysis revealed a multidimensional instrument consisting of 42 items distributed over six domains, and psychometric analysis showed that BOSS has adequate internal consistency reliability (Cronbach's $\alpha = 0.970$), test re-test reliability (ICC = 0.926), construct validity, criterion validity, face validity, and acceptability.
Baltasar A	1999	Congratulate Horacio Oria for setting a standard for bariatric surgery results	BAROS is already present as a valuable tool to assess results as shown by a paper on obesity surgery and the national and international meetings. Bariatric organizations should convene conferences on reporting results before the already valuable BAROS system requires annual changes.
Moorehead et al.	2003	The evaluation of the validity of the improved instrument M-A QoLQII	The results showed satisfactory internal consistency, and M-A QoLQII had significant correlation with (P <0.01) 7 of the 8 SF-36 scales, the Beck Depression Inventory-II (r=0.317), the 'Disinhibition' (r=-0.307) and 'Hunger' (r=-0.254) factors of the Stunkard and Messick Eating Inventory.

Table 1. Continued

Ziegler et al.	2005	Development and validation of a new health-related quality of life (HRQOL) questionnaire specific to obesity and its management	Data analyses revealed the construct validity and internal reliability (Cronbach's alpha > 0.7) of the questionnaire and its concurrent validity in relation to summarized SF-12 scores and its clinical validity. The "physical impact" dimension was significantly influenced by body mass index and age and the "sex life" and "diet experience" dimensions were influenced by the factors gender and body mass index, while "psycho-social impact" was influenced by the three cited factors.
Fontaine et al.	2001	Reviewing the impact of obesity on functional status and health-related quality of life (HRQL)	The majority of the published studies indicate that obesity impairs health-related quality of life (HRQL) and that higher degrees of obesity are associated with greater impairment. Obesity-associated decrements on HRQL tend to be most pronounced on physical domains of functioning. Studies of the effect of obesity surgery among morbidly obese patients indicate that this procedure produces significant and sustained improvements in the majority of HRQL indices; among mild-to-moderately obese persons, modest weight reduction derived from lifestyle modification also appears to improve HRQL, at least in the short term.
Larsson et al.	2002	Investigation of the impact of overweight and obesity on health-related quality-of-life in the general population in western Sweden	The results showed that the level of obesity affects QOL; the impacts of overweight and obesity also differ according to age and sex. Obese women aged 35-64 y rated their health worse on all scales than normal-weight women did, while obese men in this age group rated their health worse on only two SF-36 subscales, that is, physical functioning and general health perception.
Weiner et al.	2005	Validation of bariatric Quality of Life (BQL) questionnaire.	The results showed that BQL had internal consistency, good correlation with SF12 (Pearson's $r = 0.86$), GIQLI (0.68), BAROS (0.71), and excess weight loss (0.55).

(e.g., physical appearance), or no (spiritual, religious and cultural) tools. The number of items contained in the questionnaires ranges from 6 to 74, and all the questionnaires are self-administered. These tools were criticized in detail based on the COSMIN checklist in Table 2, and their psychometric properties were explained as follow:

Impact of Weight on Quality of Life Questionnaire (IWQOL)

The IWQOL was the first specific questionnaire to assess QOL in obese individuals. The initial version of IWQOL is a self-report tool rated using a 5-point Likert scale (never correct to always correct) with 74 items (21). In this questionnaire, individuals are asked to describe the effects of weight gain on their performance in eight areas of health, social/interpersonal, work, mobility, self-esteem, sexual life, daily activities, and comfort with food (22). This tool was designed by clinicians for obesity treatment based on patients' concerns about their weight. Its completeness and accuracy were approved by the patients. Its construct validity, as well as test-retest and internal consistency reliability were approved (21, 23).

The new version of the questionnaire is available with 31 items and 5 domains including physical performance, self-confidence, sexual life, public distress, and job. The correlation between the original version and its short form is considerably high (from 0.948 [sexual life] to 0.974 [total score]). The short form has also powerful psychometric properties (22). Its internal consistency

Table 2. Tools measuring quality of life in morbid obesity patients

Test	Country of origin	Scaling	Domains	Number of items	Validity			Reliability		Interpretability	Responsiveness
					V1	V2	V3	R1	R2		
IWQOL-Lite	USA	Five-point Likert Scale: (0:never true to 4:always true)	Physical function (11 items), Self-esteem (7 items), Sexual life (4 items), Public distress (5 items), Work (4 items)	31	-	-*	√**	√	√	-	-
OP Scale	Sweden	Four-point Likert scale: (4: Definitely bothered to 1: Definitely not bothered)	Psychosocial functioning : Private gatherings in my own home, in a friend's or relative's home, going to a restaurant, going to community activities, vacations away from home, trying on and buying clothes, bathing in public places, intimate relations (each question was one item).	8	-	-	√	-	√	-	√
BAROS	USA	Five-point Likert scale: (0: failure to 4:Excellent)	Weight loss, Medical conditions, Self-esteem, Physical, Social, Labor, Sexual (each domain including one item)	7	-	-	-	-	√	-	√
Laval	French	Seven-point Likert scale: (1: All the time to 7: Never and 1: Extremely to 7: Not at all)	Symptoms (10 items), Activity/Mobility (9 items), Personal hygiene/Clothing (5 items), Emotions (11 items), Social interactions (7 items), Sexual life (2 items)	44	√	√	√	√	√	-	√

Table 2. Continued

BOSS	UK	Five-point Likert scale (0: poor to 4: Excellent)	Incapacity, Work And Wellbeing, Social Function, Appearance And Health, Eating Patterns , Sexual health	42	-	√	√	√	√	-	√
M-A QOL	USA	Five-point Likert scale: (0: Much less to 4: Much more)	General self-esteem (1 item), Physical activity (1 item), Social contacts (1 item), Satisfaction concerning work (1 item), Pleasure related to sexuality (1 item), Focus on eating behavior (1 item)	6	-	√	√	√	√	-	√
QOL OD	French	Five-point Likert scale : (1: always to 5 :never)	Physical impact (11 items), Psycho-social impact (11 items), Sex life (4 items), Comfort with food (5 items) and Diet experience (5items).	36	-	√	√	-	√	-	-
BQL	Germany	Five-point Likert scale: (1: absolutely wrong to 5: absolutely right)	QOL subscale (14 Items), non-QOL subscale (16 Items)	30	-	√	√	-	√	-	√

IWQOL: Impact of Weight on Quality of Life; OP: Obesity-Related Problem; BAROS: Bariatric Analysis and Reporting Outcome System; BOSS: Bariatric and Obesity-Specific Survey; M-A QOL: Moorehead-Ardelt Quality of Life; QOL OD: Quality Of Life, Obesity and Dietetics; BQL: The Bariatric Quality of Life. V1 - Content Validity; V2 - Criterion Validity; V3 - Construct Validity; R1 – Stability; R2 - Internal Consistency.

*Dash (-): It means that the property is not checked in the tool

**Checkmark (√): It means that the property is checked and is properly evaluated in the tool.

reliability coefficients range from 0.90 to 0.94 for the five sub-scales and 0.96 for the total score. Confirmatory factor analysis confirmed the adequacy of the scaling of the tool (24). The scoring of the questionnaire has been calculated from 0 to 100. The initial data indicated that both types of questionnaires have good test-retest and internal consistency reliability (25).

Obesity-Related Problem (OP) Scale

OP scale as a specific tool designed for Swedish obese individuals. This study evaluates the long-term weight loss effects resulting in bariatric surgery and the impact of diet on the psychosocial

function. OP scale consists of eight items rated using a 4-point Likert scale. This scale requires the individuals to express their suffering from obesity in special situations such as private parties at their home, friends' or relatives' homes, restaurants, social activities, holidays, clothes shopping, swimming in public places, and having intimate relationships (26). The responses are computed as a total score ranging from 0 to 100. The higher scores indicate more optimum psychosocial function (27).

This scale is valid and responsive to weight loss due to surgery and other treatments. There is a dose-response relationship between weight loss and changes in OP scale scores. The function of this scale has been tested in several large samples (obese and non-obese) and in different gender, age, and BMI subgroups. The validity of the assumptions of the scale provided strong support for its construct validity. Homogeneity and dimensionality of this scale were confirmed by exploratory factor analysis (64%). Multi-trait/multi-item analysis test showed the convergent validity of the item, and its item-total correlation was 0.4. The evaluation of OP divergent validity with other QOL tools indicated that the OP scale items have more correlation with their own scale than the other tools ($r=0.06-0.54$). Its internal consistency reliability was confirmed with $\alpha>0.90$ (28).

Bariatric Analysis and Reporting Outcome System (BAROS)

The BAROS tool was designed by Oria Moorehead with the goal of universal assessment and standardization of the same reports in bariatric surgery (29), which includes five dimensions of weight, related illnesses, QOL, complications, and new surgeries. The final score classifies the results into five levels from excellent to insufficient (30).

For designing the BAROS, at first seven dimensions were selected by the American Society of Obesity based on the health risks, list of complications for bariatric surgery, and hospital admission. Then, several psychologists were asked to design a simple, short, and easy-to-respond test to assess QOL after weight loss.

At first, the three dimensions of weight loss, improvement of medical conditions, and QOL were considered. Then, they were upgraded to five dimensions. For global evaluation of the results by this tool and its clinical application, the tool was reformulated and the sixth question about eating behaviors was added to it, and its analysis method was restructured (31).

Laval Questionnaire

The 44-item Laval questionnaire was designed in France (32). Its items were categorized into six dimensions: symptoms, activity/mobility, personal hygiene/clothing, emotions, social interactions, and sexual life. Each dimension was scored on a 7-point Likert scale with higher scores meaning better QOL.

In this questionnaire, the patients were asked to report that during the recent four weeks, how obesity has affected their lives (15). The validation of this questionnaire was performed at the French Laval Hospital, the busiest bariatric surgery center for adult patients.

At first, all patients completed the Laval questionnaire, SF-36, IWQOL-Lite, Beck Depression Inventory (BDI-II), and Rosenberg Self-Esteem Scale (SES). After two weeks, in case of clinical stability and before any interventions, Laval questionnaire was given again to the patients. One year after the surgery, this set of questionnaires was completed again by the intervention group.

The test-retest reliability was significant in all dimensions (symptoms: $r=0.93$, activity/mobility: $r=0.90$, personal hygiene/clothing: $r=0.85$, emotion: $r=0.90$, social interactions: $r=0.87$, and sexual life: $r=0.84$; $P>0.01$). Cronbach's alpha was above 0.7 in all the dimensions, indicating good internal consistency for all the aspects: (symptoms=0.84, activity/ mobility=0.78, emotions=0.90, social interactions=0.86, and sexual life=0.65).

There was a high correlation between Laval's questionnaire and other questionnaires, except for the SES (construct validity). In assessing the known-groups validity of Laval's questionnaire, at first the questionnaire did not have the ability to distinguish between the two groups (treatment and non-treatment), but it showed a significant difference during follow up. For item reduction and item clustering, the impact method was used instead of factor analysis (15).

Bariatric and Obesity-Specific Survey

Various methods such as literature review, other general and specific tools of diseases, patient and

participation's comments, and discussion with health care professionals were used to generate this questionnaire's items, which led to the generation of a 200-item pool. These items were selected by a multidisciplinary team consisting of a surgeon, two psychiatrists, an instrument developer, a nurse, and a nutritionist.

To assess the validity of the initial questionnaire, the questionnaire was administered as a pilot to a small group of patients (12 persons), and each item was evaluated in terms of legibility, relevance to obesity and bariatric surgery, and effect on obesity-related QOL. The items with higher scores were selected in each dimension. Finally, 81 items in 10 dimensions were selected based on the experts' comments and the pilot group.

For scoring, the Likert scale was used ranging from 0 (zero) to 4 (100%). To perform factor analysis, 200 adults were selected and then divided into three groups: patients with BMI ≥ 35 who visited the bariatric clinic, patients under bariatric surgery, and normal weight persons from the hospital staff. The participants were asked to complete SF-36, Moorehead-Ardelt II Questionnaire (M-AQOL), Hospital Anxiety and Depression Scale (HADS), and BOSS-81. After two weeks, the participants were asked to complete BOSS-81 again. By factor analysis, the items that were not loaded on any of the extraction factors or were not included in any particular factor were removed, and the extracted factors comprising less than 3 items or those that were incomprehensible were deleted.

Finally, the matrix pattern showed 42 items with six factors (incapacity, work/wellbeing, social function, appearance/health, eating patterns, and sexual health). Factor analysis also indicated that this tool had general (factors 1, 2 and 3) and specific (factors 4, 5 and 6) subcategories.

The Cronbach's alpha ($\alpha > 0.7$) indicated acceptable internal reliability. Pearson correlation coefficient reflected that BOSS-42 dimensions were significantly and positively correlated with the dimensions of SF-36 ($P < 0.001$; $r = 0.36-0.77$), HADS ($P < 0.001$; $r = 0.41-0.78$), M-AQOLII ($r = 0.38-0.84$; $P = 0.20-0.92$), but it had a non-significant correlation with the participants' feedback scores ($r = 0.009-0.127$; $P = 0.20-0.92$) (33).

Moorehead-Ardelt II Questionnaire

The M-AQOL, as a part of the BAROS, has been specifically designed for obese patients (30). BAROS includes three domains including weight loss, improvement of medical conditions, and QOL. Points are assigned based on changes in these domains. A maximum of three points is given to each dimension to evaluate the changes after surgical and medical interventions. Each point is defined in five groups from failure to excellent (32).

The original M-AQOL is single-page and easy-to-use with simple drawings and items on all the five dimensions of QOL including self-confidence, physical activity, social life, work condition, and sexual activity. A European study showed that M-AQOL is valid and reliable (32). Since this questionnaire was kept open to receive surgical community suggestions (34), the sixth question related to food perception was added. For scoring, all the questions are scored based on a 10-point Likert scale. This change makes the tool more sensitive (35).

The high Cronbach's alpha coefficient (0.84) indicates good internal consistency of the instrument and its reliability. The obtained scores had a significant correlation with all aspects of the SF-36, except for the performance domain ($P < 0.01$), which marks its construct validity. The negative correlation between M-AQOL and BDI-II indicates that higher depression diminishes QOL (36).

Quality of Life, Obesity, and Dietetics rating scale

This questionnaire was originally designed through qualitative assessment and face-to-face interviews with obese patients. In these interviews, 31-questions are asked about the relationship between QOL and overweight. This questionnaire is able to identify the points that were poorly recognized by the French translation of the IWQOL, including attitude towards food, diet-related problems, feeling guilt, embarrassment, and functional barriers associated with lower back pain. In this regard, a 17-item scale has been developed to cover these specific points. Therefore, a new combination of the IWQOL and the 17-point scale was generated with 91 items. Due to the large number of items, lack of clinical application, and the shortage of access of physicians and patients, the number of the items was reduced (37).

For the validation of the questionnaire, it was compared with SF-12 (38). Physical dimension of the

tool had a significant correlation with SF-12 physical score ($r=0.72$) and psychological dimension with SF-12 psychic score ($r=0.64$) (38, 39).

The final version of the questionnaire constitutes 36 items with five domains of physical impact, psychosocial impact, sex life, comfort with food, and diet experience. This questionnaire has an appropriate construct validity and internal consistency reliability (37).

The Bariatric Quality of Life (BQL) Index

Despite evaluation of the psychometric properties of the 31-items IWQOL, this questionnaire is inefficient for evaluating gastrointestinal symptoms after obesity surgery. Therefore, BQL was designed to evaluate weight-related QOL and digestive gastrointestinal symptoms related to the gastrointestinal system.

For the initial design, SF-36 and BAROS were given to 50 patients. They were asked to provide their suggestions about the usefulness of various items. Based on these suggestions and opinions of various surgeons about its face validity, the items were incorporated for designing a new BQL. The new questionnaire was evaluated among 110 patients and modified again. Finally, 19-items were distributed over five factors of psychological well-being, social function, physical function, problems with bariatric surgery, and obesity-related co-morbidities. This questionnaire was scored from 0 to 78.

To evaluate its construct validity, the correlation of this questionnaire with other questionnaires was used. In this regard, six months after surgery, there was a significant correlation between BQL and SF-12 ($r=0.79$), Gastrointestinal QOL Index, ($r=0.52$), and BAROS ($r=0.64$). This tool had good internal consistency reliability ($\alpha=0.71-0.86$). Factor analysis suggested that BQL includes bariatric QOL items and a secondary section in relation to associated complications and gastrointestinal symptoms (40).

Discussion

In this study, the psychometric properties of QOL assessment tools were investigated in obese, especially morbid obese, individuals. The results showed that although several tools have been designed for measuring QOL, based on the COSMIN criteria, it seems that some of them completely reported dimensions of the concept (OP scale and BQL), the number of items (OP scale), and their psychometric properties such as validity (BAROS).

With respect to usability, some tools required little time and were easy to complete. For example, although M-AQOL is user-friendly, easy, short, simple to evaluate and score, independent from the interviewer, and cost-effective, some graphical symbols of the tool have adjusted its culture sensitivity and the intercultural and linguistic factors affecting on the tool's reliability. Nevertheless, it seems that this tool does not have good content validity due to the limited number of items (35), while content validity is the main basis and foundation for other psychometric properties of tools, especially for strong construct validity. This drawback is an important area for future tool development.

For responsiveness (sensitivity to changes), six of the eight tools tested responsiveness, which is required to evaluate the impact of clinical trials and interventions. For example, the most important feature of the Laval questionnaire, in addition to having good psychometric properties, is its sensitivity to changes in treatment (15). In addition, the IWQOL, indicated the clinical indicators in their performance in each dimension (responsiveness) (25). These results were consistent with those of the COSMIN checklist, where responsiveness is defined as the ability of an instrument to detect change over time in the construct to be measured and it is related to validity.

For interpretation (qualitative significance of minimal changes with importance in tool score), no tool had testing of interpretability. For instance, although OP scale is responsive to clinical changes over time and it is appropriate for assessing the effects of QOL in obesity interventions, it is unable to recognize clinical indicators and recovery in weight loss function and evaluate all the aspects of QOL (28), which renders an inappropriate interpretation. Despite simplicity, evidence-based nature, and the objectivity of BAROS, it was not able to properly analyze before and after implementation of several clinical, surgical, and endoscopic interventions related to the treatment of obesity. It can also evaluate a few changes in surgical patients pre- and post-operation, and it does have poor responsiveness (29). However, these criteria for the COSMIN's checklist are the main basis and foundation for assessing the applications of tools. These shortcomings in these

tools suggest that it is an important area for the improvement of future tool developments. For assessing reliability, four of eight tools had both good stability and internal consistency (i.e., IWQOL, Laval, BOSS, and M-AQOL). However, others had only internal consistency, while reliability is more related to stability.

In evaluation of domains of morbid obesity QOL, few tools address cultural domain. QOL of obese people should be considered in interpersonal, cultural, and religious contexts in which obesity occurs (41, 42). The cultural features of each society are expressed as the values, beliefs, and unique functions of each group that has specific strategies for promoting or maintaining health and preventing diseases. Culture is an important factor in QOL because it defines the purpose of life in health and illness and affects the person's perception of health and illness, QOL, thoughts, and feelings. Adaptation of health So cultural adaptation is significant in the use and design of tools, because a tool that is designed for a social or cultural group cannot be applied to another group in another culture. for a social or cultural group cannot be applied to another group in another culture (43, 44).

Currently, some tools have been adjusted to the cultural, religious, and social conditions of certain communities. For example, (i) the Laval questionnaire is only designed for the French community and cannot be easily applied in other cultures (15). Although (ii) QOLOD has good psychometric properties, this questionnaire can be used in clinical trials in French-language countries and cultural adaptation must be made for using it in another country (35). Since the analysis of bariatric surgery has several variables, a multi-dimensional scale is needed to evaluate all its aspects; therefore, (iii) BAROS must be adapted to all the bariatric communities (29). The (iv) psychometric evaluation of BQL is performed for the German version and its English version needs to be validated for clinical application. Its limitations are lack of suitability for other cultures (40).

Since the meaning of a concept may vary from one culture to another (45), experts in questionnaire development agree that the tool should be directly derived from the target population and should be appropriate for the culture and lifestyle of the countries where it is used. This criterion should be considered in item generation, as well. Nevertheless, in designing most of the mentioned tools, obese patients' views were not considered and the tools were created by deductive method. Moreover, in translated questionnaires attention was not paid to the translation process, cultural adaptation, and linguistic differences, hence the obtained results are not generalizable (46). Therefore, valid and reliable tools, acceptable for the target population and able to measure the concept and identify its differences in the studied population, should be applied.

In addition to neglecting the culture domain in QOL tools development, they have not considered spiritual and religion dimensions. QOL is influenced by complex factors such as relation to the environment, spiritual beliefs, and religion (47). Because religious beliefs can influence QOL, designing tools with acceptable psychometric properties is recommended for assessing the QOL of obese patients based on the religious features of different societies.

Limitations of this literature review were incomplete information regarding the item generation process in some of the tools and limited information on their usability, reliability, validity, interpretability, and responsiveness. Although we did not find much information on responsiveness, a more detailed literature search for each tool would help find evidence for their responsiveness. Finally, some tools included in this review have multiple versions that were not always noted in our sources. Future users of these tools should search for and study different versions that might be more appropriate.

Implications for Practice

Our results revealed that some of the tools focused on the cultural domain, while no tool has considered the spiritual and the religious domains. Despite the lack of a complete and appropriate scale for the measurement of morbidly obese individuals' quality of life; Laval questionnaire is a proper scale that can be recommended to researchers. However, a vital need is felt for developing an instrument based on cultural and social characteristics of different societies with acceptable psychometrics properties and evaluating responsiveness and interpretability of these tools for measuring quality of life in morbid obese patients. In addition, we suggest designing a valid and reliable tool for research in different age groups and evaluating other tools in patients with morbid obesity in the future studies.

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Conflicts of Interest

None declared.

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