

## ORIGINAL ARTICLE

# Validation of the Korean translation of obesity-related problems scale assessing the quality of life in obese Korean

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**Purpose:** The objective of this study was to translate the obesity-related problems (OP) scale for Koreans and to validate it for use in Korean populations. **Methods:** Translation and back-translation of the OP scale was performed and a pilot test was conducted. Following this, patients who had received treatment at the Obesity Center of Inha University Hospital were selected for participation in the field test. Cronbach's alpha ( $\alpha$ ) was used for assessment of the internal consistency of the OP scale. Spearman's correlation coefficients were used to assess the concurrent validity between the OP scale, the EuroQoL-5D (EQ-5D), and the Beck depression inventory (BDI) scale. One-way analysis of variance and t-test were used to assess the factors associated with the OP scale. **Results:** A total of 67 individuals participated in the field study. The standardized Cronbach's  $\alpha$  of the OP was 0.913. A significant negative correlation was observed between the OP scale and the EQ-5D and a positive correlation was observed between the OP scale and the BDI (the correlation coefficient with EQ-5D = -0.316, and the BDI = 0.305,  $P < 0.05$ ). **Conclusion:** The results of this study prove that the Korean version of the OP has been translated and adapted correctly in order to meet the standard of its use.

**Key Words:** Obesity, Quality of life, Questionnaires, Validity, Obesity-related problems scale

## INTRODUCTION

In March 2011, the World Health Organization reported that obesity has more than doubled worldwide since 1980 [1] and public healthcare spending on obesity has also risen significantly worldwide, including Korea [2]. Obesity is known to be related to a variety of health problems, including type 2 diabetes, hypertension, dyslipidemia, and

sleep apnea [3-5]. Besides physical health problems, it has been reported that obese persons have a lower quality of life (QoL) than their normal weight counterparts [6]. The lower QoL of obese patients is caused by psychosocial functioning as well as impaired physical status [7-10]. Obese persons are more likely to be concerned about their weight and body shape and they have tendency to avoid public places or group activities [11]. In addition, mental

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distress is observed in patients who have difficulty managing the hardship of obesity [12]. Therefore, assessment of QoL and psychosocial functioning is a key factor in evaluation of psychosocial health in obese patients [13].

There are several well-established questionnaires for evaluation of QoL for the general and the disabled population, however, they only focus on broad dimensions of health problems and cannot identify obesity-specific QoL problems. Therefore, various obesity-specific health-related QoL questionnaires have been developed and published during the last few decades. Among them, an obesity-related problems (OP) scale developed from the Swedish obese subjects (SOS) study group assesses QoL of obese persons, mainly focusing on the impact of obesity on psychosocial functioning [13-15]. This self-assessed module is comprised of eight questions concerning how bothered the person is by obesity in everyday life. The OP scale assesses psychosocial health status of obese persons, and long-term effects of weight loss achieved either by a bariatric operation or medication, and may also be applicable in nonobese populations [14-16]. The OP scale has been validated in various languages for diverse obese populations and it is also available for use in epidemiological studies which include nonobese populations for comparison of obesity-related QoL between groups [16-18]. For these reasons, we decided to translate and validate the Korean version of the OP scale on a preferential basis.

## METHODS

### Validation process

The validation procedure is composed of three steps: translation-back translation procedure, pilot study, and field study and verification of internal consistency is needed.

Translation was performed according to the standards outlined by the Reports of the International Society for Pharmaco-Economics and Outcomes Research Task Force for Translation and Cultural Adaptation [16]. The OP scale was translated from the original language (English) into Korean by two native speakers of Korean who were fluent and have a clear understanding of conceptual meanings in

both English and Korean. The translations were compared by the coordinator (YJL) of the study and discrepancies were resolved by discussion, and a provisional single forward translation was generated. This version was then back translated by two native independent English speakers who were also fluent in Korean. These were evaluated by the coordinator and compared with the original version to ensure conceptual equivalence of the translation.

The second step was the pilot study. The Korean version of the OP was tested on a sample of 20 overweight patients. The pilot test was conducted in order to identify and solve any potential problems in the translations, such as wording that might be confusing or difficult to understand. After administration of the translated questionnaire, a structured interview was conducted with each patient, individually. In order to ensure that questions were answered properly, the structured interview was directed toward each item separately and queried by concerning its thoroughness and its difficulty with regard to answering and comprehending. A final text with all forward and backward translations accompanied any key memoranda relevant to the process of translation and the procedure followed, yielding a final translation. The final translation was summarized and sent to the authors of the original questionnaire for review and approval of the questionnaire.

The field study was approved by the Ethics Committee at Inha University Hospital (Inha 11-56) and patients were previously informed about the study and its voluntary nature. Informed consents were obtained prior to administration of the questionnaires. The questionnaires were administered once, when eligible participants visited the obesity center of Inha University Hospital between August 2011 and November 2011. A total of 71 patients who were received treatment at the obesity center were asked to fill out a self-questionnaire of the Korean OP scale; four patients declined. A total of 67 subjects were finally included in the analysis; age of subjects was  $43 \pm 12.14$  years old. All participants completed the OP scale, a validated Korean version of EuroQoL-5D (EQ-5D), a Beck depression inventory (BDI), and study-specific questionnaires on current and past health status, use of medical care and medications, socioeconomic status, dietary habits, phys-

ical activity habits, weight history, and familial history of obesity. In addition, comorbidity and clinical data were also collected from the patients' medical records. Baseline characteristics are shown in Table 1.

### Questionnaires for validation

We compared the OP scale [11-18] (appendix 1 for translated Korean version) with the EQ-5D [19,20] and BDI [21-23] in order to evaluate the external validity.

The OP is a brief condition-specific measurement comprising eight questions on a four-point scale concerning how bothered subjects are by their obesity in relation to social activities: private gatherings at home or at a friend's or relative's home, going to restaurants, participation in community activities (courses, etc.), holidays away from home, trying on and buying clothes, bathing in public places, and intimate relations. Answers ranged from "definitely bothered" to "definitely not bothered" with two intermediate states, "mostly bothered" and "not so bothered". Responses were aggregated to a total scale score and transformed to a 0 to 100 scale. Higher scores indicate more psychosocial dysfunction (appendix 2 for OP general scoring instruction).

The EQ-5D is a generic questionnaire, which can be applied to a wide range of patient populations for assessment of multiple domains of functioning. The EQ-5D questionnaire includes five questions about the subjects' state of health for measurement of mobility, self-care, performance of usual activities, pain or discomfort, and anxiety or depression. Each dimension is rated on a three-level scale from 1 (no problem) to 3 (inability to perform or extreme problem). The combined dimensions describe 243 theoretically possible states of health that can be converted into a weighted health index score in which the higher the score the better the QoL. We used the weights published by Lee et al. [19] to calculate a single summary score from the five descriptive items of the EQ-5D. Details have been reported elsewhere [19,20].

The BDI, which consists of 21 items, is the most widely used instrument for identification of depression. It uses depression criteria in line with the Diagnostic and Statistical Manual of Mental Health Disorders (4th edition) [21]. The BDI is easy to complete, score, and interpret,

**Table 1.** General characteristics of the study population (n = 67)

Characteristic	Value
Age (yr)	43 ± 12.14
≤ 35	18 (26.9)
36-45	21 (31.3)
≥ 46	28 (41.8)
Sex	
Male	17 (25.4)
Female	50 (74.6)
BMI at initial visit to the clinic (kg/m <sup>2</sup> )	31.74 ± 5.43
< 25	7 (10.4)
25-29	27 (40.3)
≥ 30	33 (49.3)
BMI on questionnaire (kg/m <sup>2</sup> )	27.90 ± 4.49
< 25	17 (25.4)
25-29	32 (47.8)
≥ 30	18 (26.9)
BMI losses during follow-up (kg/m <sup>2</sup> ) <sup>a)</sup>	2.84 ± 4.03
Gain or no loss	13 (19.4)
0-2	22 (32.8)
> 2	32 (47.8)
Follow-up weeks to the clinic (weeks)	35.7 ± 33.0
≤ 8	22 (32.8)
9-52	22 (32.8)
≥ 53	23 (34.3)
Current marital status <sup>b)</sup>	
Married	41 (61.2)
Unmarried	20 (29.9)
Education (yr)	
≤ 12	28 (41.8)
> 12	23 (34.3)
Method of obesity management	
Bariatric operation	11 (16.4)
Lifestyle modification with medication	56 (83.6)
Hypertension	20 (29.9)
Type 2 diabetes mellitus <sup>c)</sup>	21 (31.3)
Dyslipidemia <sup>d)</sup>	28 (41.8)
Coronary artery disease	4 (6)
Snoring <sup>e)</sup>	22 (32.8)
Arthralgia <sup>f)</sup>	23 (34.3)
Hypothyroidism	6 (9)
Depressive mood <sup>g)</sup>	21 (31.3)

Values are presented as mean ± standard deviation or number (%). BMI, body mass index.

<sup>a)</sup>Change of BMI between initial check up and at the time of questionnaire was taken. <sup>b)</sup>If the patient is divorced or bereaved, this is considered unmarried. <sup>c)</sup>Considered to have diabetes if the patient meets the 2010 criteria outlined by the American Diabetes Association or is taking a diabetic medication or on insulin. <sup>d)</sup>Considered to have dyslipidemia if the patient meets the criteria outlined by the National Cholesterol Education Program expert panel III or is taking lipid lowering medication. <sup>e)</sup>Reported to snore by self or by a third member. <sup>f)</sup>Difficulties exercising due to pain on movement of any joints or muscles. <sup>g)</sup>More than five depressive episodes outlined in Diagnostic and Statistical Manual of Mental Health Disorders (4th edition) for more than two weeks.

and its internal consistency, test-retest reliability, and validity are well established. We used a Korean translation version of the BDI published by Lee and Song [23]. Details have been reported elsewhere [21-23].

### Statistical analysis

Frequency tables, means, and standard deviations were used for statistical descriptions of the clinical and socio-demographic variables. The OP scale score was computed to either a final item value or a transformed score for

**Table 2.** Item descriptions and the number and percent of responses to each item score (n = 67)

Item description & response options (final item value) <sup>a)</sup>	No. (%)	Final item score <sup>b)</sup> (mean ± SD)
Q1. Private gatherings in my own home		2.54 ± 0.93
Definitely bothered (4)	8.0 (11.9)	
Mostly bothered (3)	32.0 (47.8)	
Not so bothered (2)	15.0 (22.4)	
Definitely not bothered (1)	12.0 (17.9)	
Q2. Private gatherings in a friend's or relative's home		2.75 ± 0.93
Definitely bothered (4)	13.0 (19.4)	
Mostly bothered (3)	33.0 (49.3)	
Not so bothered (2)	12.0 (17.9)	
Definitely not bothered (1)	9.0 (13.4)	
Q3. Going to a restaurant		2.49 ± 0.91
Definitely bothered (4)	8.0 (11.9)	
Mostly bothered (3)	28.0 (41.8)	
Not so bothered (2)	20.0 (29.9)	
Definitely not bothered (1)	11.0 (16.4)	
Q4. Going to community activities, courses etc.		2.70 ± 0.95
Definitely bothered (4)	15.0 (22.4)	
Mostly bothered (3)	25.0 (37.3)	
Not so bothered (2)	19.0 (28.4)	
Definitely not bothered (1)	8.0 (11.9)	
Q5. Vacations away from home		2.75 ± 0.99
Definitely bothered (4)	18.0 (26.9)	
Mostly bothered (3)	22.0 (32.8)	
Not so bothered (2)	19.0 (28.4)	
Definitely not bothered (1)	8.0 (11.9)	
Q6. Trying on and buying clothes		3.45 ± 0.82
Definitely bothered (4)	41.0 (61.2)	
Mostly bothered (3)	18.0 (26.9)	
Not so bothered (2)	5.0 (7.5)	
Definitely not bothered (1)	3.0 (4.5)	
Q7. Bathing in public places (beach, public pool, etc.)		3.36 ± 0.81
Definitely bothered (4)	37.0 (55.2)	
Mostly bothered (3)	18.0 (26.9)	
Not so bothered (2)	11.0 (16.4)	
Definitely not bothered (1)	1.0 (1.5)	
Q8. Intimate relations		3.09 ± 0.93
Definitely bothered (4)	28.0 (41.8)	
Mostly bothered (3)	21.0 (31.3)	
Not so bothered (2)	14.0 (20.9)	
Definitely not bothered (1)	4.0 (6.0)	

SD, standard deviation.

<sup>a)</sup>Responses are recoded for final item value before calculating the sum of the responses to the eight items included in the scale. <sup>b)</sup>Sum of final item value.

analysis. Internal consistency was assessed using Cronbach's alpha ( $\alpha$ ), and an item-total correlation coefficient (Appendix 3). Factor analysis was performed for examination of constructive validity. For examination of external validity, Spearman's correlation coefficients were used to assess the relationship between the OP scale and EQ-5D or BDI. To identify the factors associated with the OP scale (transformed scale score), two-group comparisons were performed using t-test and analysis of variance was used in comparisons of three or more groups. PASW ver. 18.0 (IBM Co., Armonk, NY, USA) was used in performance of all analyses.

## RESULTS

At the beginning of the study, we sent an email message to Dr. Karlsson, who is the author, and obtained the author's permission for creation of a Korean version of the OP scale. We performed translation and back translation and reported the draft to the author. The pilot study of the Korean translation of the OP scale conducted on 20 patients provided evidence of the acceptability and comprehensibility of the OP scale's questionnaire. As a result of the pilot study, we changed four words for the final version that would be evaluated.

### General characteristics of the study population

A total of 67 patients,  $43 \pm 12.14$  years old, were enrolled in this study; 50 patients (74.6%) were female. Mean body mass index (BMI of the study sample was  $31.74 \pm 5.43$

kg/m<sup>2</sup> when patients visited the obesity center for the first time (initial visit to the clinic). At the time of the study, they had a reduced BMI of  $2.84 \pm 4.03$  kg/m<sup>2</sup> and their mean BMI on the questionnaire was  $27.90 \pm 4.49$  kg/m<sup>2</sup>, with a mean follow up period of  $35.7 \pm 33.0$  weeks. Only 16.4% of the patients had chosen a bariatric operation, and they had all undergone a gastric bypass in the obesity center of Inha University Hospital; 61.2% of patients were married and 41.8% had an education of 12 years or under. The socio-demographic and clinical data of the patients who participated in the field study are shown in Table 1.

Table 2 shows the concrete contents of the OP and responses of our study population. Among eight items, our population reported the highest final item score, and more than 88% were mostly or definitely bothered when they were trying on and buying clothes. In addition, the mean transformed OP score of the total population was  $63.0 \pm 23.90$ , suggesting severe psychosocial impairment.

### Reliability and constructive validity (Table 3)

The standardized Cronbach's  $\alpha$  of the OP scale was 0.913. Item to total correlation coefficients were all statistically significant ( $P < 0.05$ ), and ranged from 0.74 to 0.81. The exploratory factor analysis of the eight items in the questionnaire showed factor loading from 0.75 to 0.83 with high homogeneity.

### External validity (Table 4)

The correlation coefficient between the OP scale and EQ-5D index was -0.316, while domains of the EQ-5D

**Table 3.** Internal consistency and constructive validity of the obesity-related problems scale<sup>a)</sup> (n = 67)

Item description	Item-total correlation coefficient <sup>b)</sup>	Alpha if item deleted	Exploratory factor analysis <sup>c)</sup>
Private gatherings in my own home	0.757	0.900	0.801
Private gatherings in a friend's or relative's home	0.756	0.901	0.795
Going to a restaurant	0.786	0.899	0.812
Going to community activities, courses	0.812	0.897	0.832
Vacations away from home	0.752	0.905	0.757
Trying on and buying clothes	0.752	0.904	0.759
Bathing in public places	0.744	0.904	0.766
Intimate relations	0.753	0.902	0.780

<sup>a)</sup>Standardized Cronbach's  $\alpha$  of obesity-related problems scale = 0.913. <sup>b)</sup>Statistically significant correlation: level of significance  $P < 0.05$ .

<sup>c)</sup>Extraction method was principal component analysis.

**Table 4.** Obesity-related problems (OP) scale correlations with EuroQol-5D and Beck depression inventory scale domains

Domain	OP scale
EuroQol-5D	-0.316 <sup>a)</sup>
Mobility	0.097
Self-care	0.126
Usual activities	0.299 <sup>a)</sup>
Pain/discomfort	0.292 <sup>a)</sup>
Anxiety/depression	0.242 <sup>a)</sup>
Beck depression inventory	0.305 <sup>a)</sup>

Values are presented as Spearman correlation coefficients.

<sup>a)</sup>P < 0.05.

ranged from 0.097 to 0.299, but was only statistically significant (P < 0.05) with usual activities, pain/discomfort, and anxiety/depression. OP's correlation coefficient with the BDI was 0.305, which was statistically significant (P < 0.05).

### Obesity-related QoL impairment measured by the OP (Table 5)

Female participants had a higher OP score than males and 66% of females showed severe psychosocial QoL impairment. Participants with a BMI of 25 to 30 on the first visit or at the time of administration of the questionnaire reported a higher OP score than any other BMI range. Participants' OP scores showed no association with how much they had reduced their weight. No difference was observed between groups through administration of the method of obesity management.

## DISCUSSION

Despite the availability of various obesity specific instruments for measuring QoL [22-28], we decided to translate and validate the Korean version of the OP scale on a preferential basis because the OP has strong advantages. First, the OP is simply constructed and the questions are easily answered. Second, it is easily computed and the score is easy to understand; for example, a transformed OP score of more than 60 indicated severe obesity-related psychosocial impairment, while an OP score less than 40 indicated mild impairment. Third, even when half of the questions were unanswered, its transformed score could

**Table 5.** Obesity-related QoL impairment measured by OP (n = 67)

Variable	Transformed scale <sup>a)</sup>	P-value	Severe impairment <sup>b)</sup>
Age (yr)		0.21 <sup>c)</sup>	
≤35	64.12 ± 26.20		12 (66.7)
36-45	69.44 ± 17.25		14 (66.7)
≥46	57.44 ± 26.04		14 (50.0)
Sex		0.03 <sup>d)</sup>	
Male	52.70 ± 24.34		7 (41.2)
Female	66.50 ± 22.95		33 (66.0)
BMI at initial visit (kg/m <sup>2</sup> )		0.04 <sup>c)</sup>	
<25	42.86 ± 26.43		1 (14.3)
25-29	68.21 ± 18.82		18 (66.7)
≥30	63.01 ± 25.45		21 (63.6)
BMI on questionnaire (kg/m <sup>2</sup> )		0.066 <sup>c)</sup>	
<25	55.64 ± 26.35		7 (41.2)
25-29	70.05 ± 19.56		23 (71.9)
≥30	57.41 ± 26.18		10 (55.6)
BMI changes in tertile <sup>e)</sup>		0.246 <sup>f)</sup>	
1st	60.42 ± 28.86		13 (59.1)
2nd	59.66 ± 21.49		11 (50.0)
3rd	68.66 ± 20.64		16 (69.6)
Follow-up weeks to the clinic (wk)		0.053 <sup>f)</sup>	
≤8	69.89 ± 24.16		13 (72.7)
9-52	63.27 ± 24.62		12 (63.6)
≥53	56.16 ± 21.94		10 (43.5)
Current marital status		0.73 <sup>f)</sup>	
Married	62.30 ± 22.82		13 (65.0)
Unmarried	64.58 ± 26.88		23 (56.1)
Education (yr)		0.223 <sup>f)</sup>	
≤12	2.26 ± 2.81		14 (50.0)
>12	3.81 ± 5.92		15 (65.2)
Method of obesity management		0.924 <sup>f)</sup>	
Bariatric operation	63.64 ± 26.88		34 (60.7)
LSM with medication	62.87 ± 23.53		6 (54.5)

Values are presented as mean ± standard deviation or number (%). QoL, quality of life; OP, obesity-related problems; BMI, body mass index; LSM, lifestyle modification.

<sup>a)</sup>OP scale score transformed to a 0 to 100 scale. Higher the score, higher the psychosocial impairment. <sup>b)</sup>OP scale score is categorized by the degree of impairment in psychosocial functioning and a score of ≥60 indicates severe impairment.

<sup>c)</sup>Analysis of variance was performed for statistical analysis.

<sup>d)</sup>t-test was performed for statistical analysis. <sup>e)</sup>BMI change over the initial visit and the time of the questionnaire taken. <sup>f)</sup>P for trend was performed for statistical analysis.

be calculated. Fourth, the OP captures frequently reported psychosocial difficulties in the daily life events of obese individuals, such as discomfort in social activities, shop-

ping, or swimming. Assessment of daily difficulties has special meaning in obese patients because it examines the risk of social marginalization [15]. The fifth advantage of the OP scale is that it can be applied to evaluation of improvement in patients who have undergone bariatric surgery or other weight reduction treatments; it is also available for use in epidemiological studies that include non-obese populations for comparison of obesity-related QoL between groups [16-18].

Findings of this study showed constructive validity of the OP and external validity with the EQ-5D and BDI. The OP score showed significant negative correlation with three of five EQ-5D domains, including usual activity, pain or discomfort, and the anxiety or depression domain. Although mobility and self-care domains of the EQ-5D did not show significant correlation with the OP, this could be explained by the OP's purpose of design, which focuses on burdens of obesity on quality of psychosocial function in life, not on physical aspects, and which has also been reported in another study [29]. Conversely, this insignificant correlation or discrepancy between some domains of the EQ-5D and the OP may raise the necessity for instruments for measuring obesity specific QoL.

The BDI showed a significant positive correlation with the OP in Koreans. Because the BDI was essentially developed and validated for assessment of depression risk and obese people frequently showed social withdrawal and depressive moods, it was assumed that the BDI had significant correlation with the OP, especially in cases of women, and younger adults who were unhappy in their social life because of obesity.

As shown in Table 5, in practice, participants younger than 45 years of age showed a higher OP score than older participants; this higher OP score can be interpreted as indicating that obesity has a greater impact on their psychosocial functioning. It is assumed that members of the younger generation are more socially active and they are often expected to be physically well-fitted to various social events. In the same vein, it is understandable that QoL of women was more negatively influenced by an obese status than men.

Even though the group of patients who had undergone bariatric surgery for treatment of obesity had reduced

-7.26 kg/m<sup>2</sup> of their original BMI and those in the medication group had lost only a BMI of -1.97 kg/m<sup>2</sup> ( $P < 0.03$ ) from their original measurement, the OP scale showed no statistical difference between the two groups at the time of administration of the questionnaire. This supports the idea that how much weight is lost is not an adequate measurement of success in treatment of obesity [24,25]. With this point, the amount of weight loss could only be the surrogate end point that allows for an understanding of the progress of the treatment, and the final goal in treatment of obesity should focus on improvement of QoL as well as reduction of mortality.

Results of the current study demonstrated successful cultural adaptation, translation, and subsequent validation of an instrument for measuring obesity-related QoL in Koreans. However, a small sample size created some limitations in analysis of further studies.

In conclusion, the Korean translation of the OP scale is a valid and reliable instrument for measuring QoL in obese Koreans.

## CONFLICTS OF INTEREST

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

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**Appendix 1. Korean obesity-related problems (OP) scale**

당신은 체중이나 체형 때문에 다음과 같은 상황에서 신경 쓰였던 적이 있습니까?  
 다음 질문을 읽고 당신에게 가장 적합하다고 생각하는 곳에 표시해 주십시오.

	매우 신경 쓰임	약간 신경 쓰임	별로 신경 쓰이지 않음	전혀 신경 쓰이지 않음
1. 당신의 집에서 친한 사람들과 만날 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
2. 친구 또는 친척의 집에서 친한 사람들과 만날 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
3. 식당에서 외식을 할 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
4. 지역행사에 참여 하거나 공연을 관람 할 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
5. 멀리 떨어진 곳으로 여행을 가려 할 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
6. 옷 가게에서 옷을 입어보거나 구매 할 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
7. 수영장이나 해변에서 물놀이를 할 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
8. 친밀한 신체 접촉이 있을 때	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>

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## Appendix 2. Obesity-related problems scale (OP)

### Obesity-related Problems scale (OP)

#### General scoring information

The OP scale comprises 8 items, which are aggregated to a total scale score.

#### 1. Data entry

A. Responses to each item should be entered as coded in the questionnaire (number beside the response box):

<i>Response choice</i>	Definitely bothered	Mostly bothered	Not so bothered	Definitely not bothered
<i>Data entry</i>	1	2	3	4

B. After data entry, out-of-range values should be checked for.

#### 2. Item recoding

Items need recoding before computing scale scores.

<i>Item no.</i>	<i>Precoded item value</i>		<i>Final item value</i>
1-8	1	→	4
	2	→	3
	3	→	2
	4	→	1

#### 3. Computing raw scale scores (range 8-32)

After recoding items a raw scale score is obtained by calculating the sum of the responses to the eight items included in the scale:

$$\text{Raw scale score} = \text{Mean of (item1, item2, item3, item4, item5, item6, item7, item8)} * 8$$

#### 4. Computing transformed scale scores (range 0-100)

The next step involves transforming the raw scale score to a 0-to-100 scale. Transformed scale scores represent the percentage of the total possible raw scale score. We recommend that transformed scale scores be used in presenting results since they are easily understood and facilitate comparisons.

$$\text{Transformed scale score} = [ (\text{Raw scale score} - \text{lowest possible raw score}) / \text{possible raw score range} ] * 100$$

#### Scoring formula

Number of items in scale	Lowest / highest possible raw scores	Possible raw score range	Scoring formula for computing transformed scale scores
8	8-32	24	OP = [(OP_raw <sup>1</sup> -8) / 24] * 100

<sup>1</sup>Raw scale score

#### 5. Missing data

Sometimes respondents leave one or more of the items blank. One important advantage of multi-item scales is that a scale score can be estimated although responses to some items are missing. We recommend that a scale score be calculated according to the “half-scale” method, i.e. a scale score is computed if at least half of the items in the OP questionnaire is answered. This means that the missing item value(s) is replaced with the average value of the completed items. If the respondent has failed to answer more than half of the items no scale score should be computed.

#### 6. Interpreting scores

A higher score indicates more psychosocial problems. The OP scale score can be used to categorize patients according to the degree of impairment in psychosocial functioning:

- a score < 40 indicates *mild impairment*
- a score from 40 to 59 indicates *moderate impairment*
- a score ≥60 indicates *severe impairment*.

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### SAS\* code for computing OP scale scores

\*SAS IS A REGISTERED TRADEMARK OF SAS INSTITUTE, INC., CARY NC.

```

*****
*
* Obesity-related Problem scale (OP)
*
* Creating OP scale score
* Data entry: item1-item8
* Response format: 1-4;
*****;

Data OP;
  set dl(keep=patID item1-item8);

**** Deleting out-of-range values;
array arr1 item1-item8;
do over arr1;
  if arr1 lt 1 then arr1=.;
  else if arr1 gt 4 then arr1=.;
end;

**** Item recoding;
array rec item1-item8;
do over rec;
  rec=5-rec;
end;

**** Creating OP scale score;
array ar1 item1-item8;
array ar2 OP1-OP8;
do over ar1;
  ar2=ar1;
end;

OPn=n(of OP1-OP8);
if OPn ge 4 then OPraw=mean(of OP1-OP8)*8;
else if OPn lt 4 then OPraw=.;
OP=((OPraw-8)/24)*100;

Label
  OPraw='OP raw score'
  OP='Obesity-related Problems scale'
;

run;

```

---

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## Appendix 3. Statistical notes for evaluating reliability and constructive validity

### 1. Cronbach's alpha ( $\alpha$ )

According to classical test theory, Cronbach's  $\alpha$  is a coefficient of reliability which is commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees.

In statistics, Cronbach's  $\alpha$  is defined as

$$\alpha = \frac{K}{K-1} \left( 1 - \frac{\sum_{i=1}^k \sigma_{Y_i}^2}{\sigma_x^2} \right)$$

where  $K$  is the number of components ( $K$ -items or testlets),  $\sigma_x^2$  is the variance of the observed total test scores, and  $\sigma_{Y_i}^2$  is the variance of component  $i$  for the current sample of persons.

The word "people" might also be used here.

The *standardized Cronbach's  $\alpha$*  can be defined as

$$\alpha_{\text{standardized}} = \frac{K\bar{r}}{(1 + (K-1)\bar{r})}$$

Theoretically,  $\alpha$  varies from zero to 1, since it is the ratio of two variances. Higher values of  $\alpha$  are more desirable. When  $\alpha$  is greater than 0.9, it is usually assumed that internal consistency of the new instrument is excellent.

Cronbach's  $\alpha$  statistic is used widely in the social sciences, business, nursing, and other disciplines, as well as medicine. Because intercorrelations among test items are maximized when all items measure the same construct, Cronbach's  $\alpha$  is widely believed to indirectly indicate the degree to which a set of items measures a single one-dimensional latent construct.

### 2. Item-total correlation coefficient

An item-total correlation coefficient is one of two statistics in classical test theory, of which the aim is generally to understand and improve the reliability of psychological tests. Even though Cronbach's  $\alpha$  provides a convenient index of the total test quality in a single number and reliability, it cannot provide any information for evaluation of single items. Therefore, an item-total correlation coefficient is an index of the discrimination or differentiating power of the item, and is a method used for examining convergent validity, which is part of the analysis to confirm the constructive validity of an instrument.

### 3. Factor analysis [30]

Factor analysis is a statistical method used for describing variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. Exploratory factor analysis, the most common form of factor analysis, is used to identify the underlying relationships between measured variables. It is commonly used by researchers when developing a scale to confirm dimensionality, which is part of the construct validation of an instrument. Factor loadings are numerical values that indicate the strength and direction of a factor on a measured variable and indicate how strongly the factor influences the measured variable.