Health-Related Quality of Life, Anxiety, and Depression in Bariatric Surgery Candidates Compared to Patients from a Psychosomatic Inpatient Hospital

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Abstract
Background and Aim Past research indicated high psychiatric comorbidity and poor health-related quality of life (HRQOL) in patients seeking surgical treatment for obesity. This study investigated if preoperative bariatric surgery patients perceive equally poor HRQOL and increased levels of anxiety and depression as mentally ill patients.

Methods The study included four groups: 192 bariatric surgery candidates (PRE, 71% women, BMI 48.35 ± 8.98 kg/m²), 96 psychotherapy inpatients with mental disorders (PSY, 77% women, BMI 27.12 ± 9.17 kg/m²), 103 postoperative bariatric surgery patients (POST, 78% women, BMI 30.38 ± 2.88 kg/m²), and a convenience sample of 96 non-clinical volunteers with pre-obesity or obesity grade 1 (CG, 52% women, BMI 29.22 ± 2.64 kg/m²). HRQOL was measured using the 12-item short form health survey (SF-12), and psychopathology was assessed with the hospital anxiety and depression scale (HADS).

Results The PRE group exhibited the lowest physical HRQOL, and the PSY group the lowest mental HRQOL. The highest mental/physical HRQOL was reported by the POST group and the CG, without significant differences between these two groups. While the PSY group scored higher on HADS-anxiety scale than the PRE group, neither group differed with regards to symptoms of depression. The lowest levels of HADS-depression were found in the POST group and the CG.

Conclusions The present findings suggest that bariatric surgery candidates may suffer from equally high levels of depression as psychotherapy inpatients, but they perceive better mental well-being. Routine mental health evaluation should incorporate assessments for both psychopathology and HRQOL.

Trial Registration DRKS00009901

Keywords Health-related quality of life · Anxiety · Depression · Bariatric surgery · Obesity

Introduction

Obesity is a rising public health problem worldwide which is related to increased morbidity and mortality [1, 2]. With regards to morbid obesity, bariatric surgery is the most effective treatment resulting in sustained weight loss and improved physical health [3, 4]. Guidelines have recommended surgical treatment for individuals with a body mass index (BMI) of 40 kg/m² and more (obesity grade 3) or for those with a BMI at a minimum of 35 kg/m² (obesity grade 2: BMI 35 to 39.99 kg/m²) and obesity-related somatic comorbidities
In addition to somatic comorbidities, mental disorders are a burden to individuals with morbid obesity seeking surgical treatment [7–12]. According to a recent meta-analysis, the most common mental conditions among patients seeking and undergoing bariatric surgery are depression, anxiety, and binge eating disorder [13]. Several controlled studies have shown that psychiatric comorbidity in bariatric surgery candidates is higher than that in community samples or in obese patients in conventional weight loss treatments [10, 11, 14–16].

Past research further indicated impaired physical and mental health-related quality of life (HRQOL) in preoperative bariatric surgery patients [15–20]. This is not surprising given that obesity impacts not only physical and mental health but also subjective well-being and functioning in physical, psychological, and social domains inherent in HRQOL [21, 22]. Accordingly, HRQOL is often considered an endpoint of bariatric surgery [18, 23–26].

Longitudinal studies have indicated that the majority of patients exhibit improvements of mental conditions and HRQOL following surgery to levels comparable to those of the general population [27–29]. Hence, bariatric surgery is not contraindicated for those with anxiety, depression, or binge eating disorder [6, 30]. However, some patients suffer from deteriorated mental HRQOL and from (re-)increased anxiety and depression up to preoperative levels, or even worse, after initial improvements [15, 29, 31–33]. This highlights the need for postoperative psychological assessments in addition to preoperative evaluations by mental health professionals in order to timely detect worsening mental health, and to refer to appropriate treatment if required [15, 34–36].

Taken together, research has consistently shown that bariatric surgery candidates have lower HRQOL and more symptoms of anxiety and depression than community controls, obese patients undergoing non-surgical interventions, and postoperative patients [18]. An interesting question, which to our knowledge is as yet unanswered, is if preoperative patients exhibit equally poor HRQOL and increased levels of anxiety and depression as mentally ill patients. Therefore, the current study investigated HRQOL, anxiety, and depression in bariatric surgery candidates and inpatients with mental disorders from a psychosomatic medicine department [37–39]. For means of comparison, the study also included a group of postoperative patients as well as a non-clinical community control group with persons exhibiting pre-obesity or obesity grade 1. The four groups were compared with regards to (1) physical HRQOL, (2) mental HRQOL, (3) anxiety, and (4) depression. Our hypotheses were fourfold:

1. Preoperative patients exhibit poorer physical HRQOL than inpatients with mental disorders, whereas postoperative patients and non-clinical control participants with pre-obesity or obesity grade 1 show higher physical HRQOL than the first two groups while not differing between each other;
2. Preoperative patients report better mental HRQOL than inpatients with mental disorders, and postoperative patients and non-clinical control participants with pre-obesity or obesity grade 1 show higher mental HRQOL than the first two groups while not differing between each other;
3. Preoperative patients show less anxiety than inpatients with mental disorders, and postoperative patients and non-clinical control participants with pre-obesity or obesity grade 1 show less symptoms of anxiety than the first two groups while not differing between each other.
4. Preoperative patients show less depression than inpatients with mental disorders, and postoperative patients and non-clinical control participants with pre-obesity or obesity grade 1 show less symptoms of depression than the first two groups while not differing between each other.

Furthermore, this study aimed to explore the correlation between measures of HRQOL and those of anxiety/depression symptoms in order to clarify if clinicians should include both assessments or either one of the two within pre- and postoperative bariatric surgery evaluations.

Materials and Methods

Participants

Data for this multi-group case-control study were collected between September 2015 and March 2016. The total sample included four groups: preoperative bariatric surgery patients (PRE), postoperative bariatric surgery patients (POST), inpatients with mental disorders (PSY), and a convenience sample of non-clinical volunteers (non-clinical control group, CG). For all the groups, the inclusion criterion was 18 years of age or older, and exclusion criteria were cognitive impairments, psychological, and insufficient German language skills. An additional inclusion criterion for the PRE group was obesity grade 2 or 3 (BMI ≥ 35 kg/m²), and for the CG pre-obesity or obesity grade 1 (BMI 25 to 34.99 kg/m²). Individuals with past, scheduled, or intended bariatric surgery were excluded from the PSY and the non-clinical control group.

Figure 1 shows the patient flow. Initially, 527 persons agreed to participate in the study. The PRE group was recruited within routine preoperative evaluations at Hannover Medical School (n = 204), and most patients of the POST group were recruited within routine postoperative surgical care at Nordstadt Hospital Hannover (n = 86). Additional postoperative patients were recruited within bariatric surgery self-help groups (n = 19). The PSY group (n = 107) was recruited within routine preoperative evaluations at Hannover Medical School (n = 204), and most patients of the POST group were recruited within routine postoperative surgical care at Nordstadt Hospital Hannover (n = 86). Additional postoperative patients were recruited within bariatric surgery self-help groups (n = 19). The PSY group (n = 107) was
recruited at the Department of Psychosomatic Medicine and Psychotherapy of Hannover Medical School. According to patients’ charts, they suffered from the following primary diagnoses: somatic symptom disorder (29.0%), any eating disorder (22.4%, consisting of 29.2% with anorexia nervosa, 16.7% with bulimia nervosa, and 54.2% with binge eating disorder), depressive disorder (19.6%), any anxiety disorder (13.1%), posttraumatic stress disorder (7.5%), borderline personality disorder (7.5%), or any impulse control disorder (0.9%). The inpatient treatment program represents a multimodal therapy program that combines psychodynamic and cognitive-behavioral therapy in individual and group formats [38]. Based on the leading psychiatric diagnosis and comorbid somatic disorders, additional treatments (e.g., medication, body psychotherapy, physiotherapy, creative therapies) were part of the combined treatment package. At the time of assessment, mean treatment duration was 2.5 weeks (SD = 2.6). The CG was recruited through a circle of bariatric surgery patients’ acquaintances and friends (n = 111).

Of the total sample, 19 persons did not meet the inclusion criteria or met exclusion criteria, and another 21 persons did not fill-out questionnaires assessing HRQOL or psychopathology resulting in a final sample of 487 participants for analysis (for details see Fig. 1).

Participation in the study was completely voluntary. Assessments were independent of pre- and postoperative evaluation, inpatient psychotherapy, or other treatments. In all cases, a doctoral student (A. O.), who was not included in any kind of clinical care, informed the patients and the non-clinical volunteers about the study and asked them to participate before the assessment for the present study took place. According to the research protocol approved by the institutional ethics committee, all participants were assured that information provided for the present research project will be strictly held in confidence, will not be shared with health care providers, and will not influence the recommendation for bariatric surgery, the postoperative care, or any other treatments.

Written informed consent was given from all participants according to procedures approved by the institutional ethics committee of the Hannover Medical School on August 27, 2015. All participants received a compensation of 10€. The study was registered as a clinical trial in the German Clinical Trials Register (trial registration DRKS00009901).

Assessments

In all the groups, age, weight, height, sex, educational level, nationality, partnership status, and information about bariatric surgery were self-reported. Information regarding psychiatric diagnoses in the PSY group was taken from patients’ charts.

HRQOL was measured using the German version [40] of the 12-item short form health survey (SF-12) [41]. The SF-12 is a 12-item subset of the well-validated SF-36 [42] that has
two summary measures: the Physical Component Summary (PCS; six items) and the Mental Component Summary (MCS; six items) scores. Higher PCS/MCS scores indicate higher self-perceived physical/mental quality of life.

Psychopathology was assessed with the German version [43] of the hospital anxiety and depression scale (HADS) [44]. The HADS is a 14-item self-report screening scale that is widely used to assess symptoms of anxiety and depression. The questionnaire does not include items referring to symptoms that may have a physical cause and is therefore considered to be unconfounded by medical conditions. It contains the two HADS-subscases: anxiety (HADSAnx, seven items, Cronbach’s $\alpha$ in all the groups $\geq .74$) and depression (HADSDepr, seven items, Cronbach’s $\alpha$ in all the groups $\geq .77$), each ranging from 0 to 21. According to the literature, the cutoff score for each subscale to define clinical relevant anxiety/depression is HADSAnx/Depr $\geq 8$ [43, 45].

Statistical Analysis

Statistical analyses were performed using the IBM® SPSS® Statistics Version 23.0. Descriptive statistics were generated for all variables. The four groups were compared with regards to sociodemographic variables, weight status, SF-12, and HADS by using $\chi^2$ tests for categorical variables (exact Fisher test was reported if the observed values were $\leq 5$) and $t$ tests and univariate analysis of variance (ANOVA) for continuous variables. Univariate analysis of covariance (ANCOVA) with group as the between-subject-factor and age/gender/education as covariates was used to adjust for possible confounders.

Relationships between SF-12 and HADS scores were determined by calculating two-tailed Spearman’s rank-order correlations. Partial correlations were performed to adjust for age effects. To explore possible gender effects, correlations were repeated for men and women separately within each group and compared between male and female subsamples using $z$-values. In the POST group, SF-12 and HADS scores were correlated with weight loss and duration since surgery.

The statistical significance level for all tests was set at $\alpha$ of $p < .05$.

Results

Descriptive Characteristics

Participants without available information on HRQOL and psychopathology ($n = 21$) did not differ from those who filled-out the SF-12 and the HADS ($n = 468$) with regards to age ($M = 44.62$ years, SD = 12.05 vs. $M = 40.90$ years, SD = 12.40, $t_{(506)} = 1.34, p = .178$), sex (female 76.2 vs. 69.8%, $\chi^2 = 0.39, p = .532$), or education ($\geq$12 school years 19.0 vs. 33.1%, $\chi^2 = 1.82$, exact Fisher test $p = .236$). Below, we report sociodemographic characteristics for the final total sample of 487 participants (with available information on SF-12 and HADS).

Group comparisons on sociodemographic characteristics and BMI are presented in Table 1. As expected, the groups differed in BMI. The PRE group had a higher BMI than the POST, PSY, and control group. Furthermore, BMI among postoperative patients was higher than that in psychosomatic inpatients. The majority of preoperative patients (91.1%) were affected by obesity grade 3. Participants of the non-clinical control group were either pre-obese or had obesity grade 1. This also applies to the postoperative group (see Table 1). Most patients of the PSY group had normal weight (35.8%) or pre-obesity/obesity grade 1 (36.8%).

Time since surgery in the POST group ranged between 1 and 200 months (median = 19) and % total weight loss after surgery was $M = 37.05$ (SD = 8.70). Postoperative patients had undergone the following surgical procedures: Roux-en Y gastric bypass (28.2%), sleeve gastrectomy (62.1%), or gastric banding (9.7%).

As can be seen in Table 1 as well, the POST group was on average older than the PSY group. There were less women in the CG than in the PRE, POST, and PSY groups. The CG had a higher educational level (≥12 school years) than the PRE, POST, and PSY groups; and the PSY group reported more school years than the PRE group. No between-group differences were found with respect to nationality (mostly German). In terms of partnership status, no differences emerged between the three clinical groups (PRE, POST, and PSY), while participants of the CG were more often living with a partner than patients in the POST and the PSY group.

Health-Related Quality of Life

Table 2 lists the results of the between-group comparisons for the SF-12 PCS ($F_{(3, 483)} = 146.17, p < .001$) and MCS ($F_{(3, 483)} = 70.49, p < .001$) scores. As can be seen in the table, preoperative patients exhibited the lowest SF-12 PCS scores but they scored higher on the SF-12 MCS than the PSY group. Both the highest PCS and MCS scores, indicating more favorable physical/mental HRQOL, were reported by postoperative patients and non-clinical control participants, without significant differences between these two groups. ANCOVAs adjusted for age, gender, or education did not reveal different findings (not shown).

Anxiety and Depression

Table 2 also presents the results of the between-group comparisons with respect to the HADS-anxiety ($F_{(3, 483)} = 54.48, p < .001$) and depression ($F_{(3, 483)} = 89.94, p < .001$) scales.
Table 1  Group comparisons of sociodemographic variables and weight status

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>POST</th>
<th>PSY</th>
<th>CG</th>
<th>Group comparison</th>
<th>Significant between-group differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 192</td>
<td>n = 103</td>
<td>n = 96</td>
<td>n = 96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>M (SD)</td>
<td>40.72 (11.42)</td>
<td>43.30 (11.69)</td>
<td>37.71 (12.50)</td>
<td>41.85 (14.30)</td>
<td>F(3,483) = 3.67, p = .012</td>
</tr>
<tr>
<td>Sex, female</td>
<td>n (%)</td>
<td>136 (70.8)</td>
<td>80 (77.7)</td>
<td>74 (77.1)</td>
<td>50 (52.1)</td>
<td>χ²(3) = 19.84, p &lt; .001</td>
</tr>
<tr>
<td>≥12 school years</td>
<td>n (%)</td>
<td>41 (21.5)</td>
<td>28 (27.2)</td>
<td>38 (39.6)</td>
<td>54 (56.3)</td>
<td>χ²(3) = 38.34, p &lt; .001</td>
</tr>
<tr>
<td>Nationality, German</td>
<td>n (%)</td>
<td>167 (87.0)</td>
<td>93 (90.3)</td>
<td>80 (83.3)</td>
<td>92 (95.8)</td>
<td>χ²(3) = 8.46, p = .037</td>
</tr>
<tr>
<td>Currently living with partner</td>
<td>n (%)</td>
<td>142 (74.3)</td>
<td>69 (67.0)</td>
<td>61 (64.2)</td>
<td>80 (83.3)</td>
<td>χ²(3) = 10.84, p = .013</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>M (SD)</td>
<td>48.35 (6.98)</td>
<td>30.38 (2.88)</td>
<td>27.12 (9.17)</td>
<td>29.22 (2.64)</td>
<td>F(3,482) = 378.46, p &lt; .001</td>
</tr>
<tr>
<td>BMI categories²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>n (%)</td>
<td>–</td>
<td>–</td>
<td>12 (12.6)</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>n (%)</td>
<td>–</td>
<td>–</td>
<td>34 (35.8)</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Pre-obesity or obesity grade 1</td>
<td>n (%)</td>
<td>–</td>
<td>103 (100.0)</td>
<td>35 (36.8)</td>
<td>96 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Obesity grade 2</td>
<td>n (%)</td>
<td>17 (8.9)</td>
<td>–</td>
<td>7 (7.4)</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Obesity grade 3</td>
<td>n (%)</td>
<td>174 (91.1)</td>
<td>–</td>
<td>7 (7.4)</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

PRE preoperative group, POST postoperative group, PSY inpatients psychosomatic medicine, CG non-clinical control group

²χ² tests were not performed given that for some groups the observed values were zero
The lowest levels of both anxiety and depression were found in postoperative patients and non-clinical control participants. While the PSY group scored higher on HADS-anxiety scale than the PRE group, both groups did not differ with regards to symptoms of depression. Adjusting the analyses for age, gender, or education revealed similar results (not shown). With regards to the POST group, no HADS-anxiety/depression differences emerged related to the surgery type.

In the next step, prevalence rates of a probable anxiety or depressive disorder were calculated based on HADS cutoff scores (HADSAnx/Depr \( \geq 8 \)) [43, 45]. The results resembled the aforementioned between-group comparisons of the continuous HADS scores. With respect to symptoms of anxiety, 58.3% of the PRE, 24.3% of the POST, 83.3% of the PSY, and 18.8% of the non-clinical control group reported HADS-anxiety scores above the suggested cutoff \( (\chi^2_{(3)} = 112.31, \ p < .001; \ PSY > PRE > POST,CG) \). In terms of depressive symptoms, 60.4% of the PRE, 9.7% of the POST, 69.8% of the PSY, and 12.5% of the CG had HADS-depression scores above the suggested cutoff \( (\chi^2_{(3)} = 135.47, \ p < .001; \ PRE,PSY > POST,CG) \). No significant difference was found between the PRE and the PSY groups.

**Relationship Between HRQOL and Symptoms of Anxiety and Depression**

Table 3 displays the two-tailed Spearman’s rank-order correlations between the SF-12 and the HADS within the four groups. The results indicate that the correlations between symptoms of anxiety and depression with mental HRQOL \( (.57 \leq r_{s} \leq .74, \ all \ p.s < .001) \) were stronger than with physical HRQOL (differences between correlations: all \( p.s < .05 \)).

Partial correlations to control for the effect of age did reveal similar results (not shown). In separate analyses for men and women within each group, the only significant differences between correlation coefficients were found in postoperative patients. In this group, the associations between SF-12 MCS scores and HADS-anxiety and -depression scores were stronger in women than those in men (MCS and HADSAnx: \( z = -2.81, \ p = .005 \); MCS and HADSDepr: \( z = -2.07, \ p = .04 \)).
Table 3  Bivariate correlations between SF-12 and HADS-depression/anxiety

<table>
<thead>
<tr>
<th>Group</th>
<th>Total sample N = 487</th>
<th>Men n = 147</th>
<th>Women n = 340</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-12 PCS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRE (n = 192)</td>
<td>-.12</td>
<td>-.34***</td>
<td>-.16</td>
</tr>
<tr>
<td>POST (n = 103)</td>
<td>-.08</td>
<td>-.32***</td>
<td>-.37***</td>
</tr>
<tr>
<td>PSY (n = 96)</td>
<td>-.15</td>
<td>-.27**</td>
<td>-.13</td>
</tr>
<tr>
<td>CG (n = 96)</td>
<td>-.26*</td>
<td>-.42**</td>
<td>-.41**</td>
</tr>
<tr>
<td>SF-12 MCS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRE (n = 192)</td>
<td>-.71***</td>
<td>-.74***</td>
<td>-.70***</td>
</tr>
<tr>
<td>POST (n = 103)</td>
<td>-.66***</td>
<td>-.61***</td>
<td>-.64***</td>
</tr>
<tr>
<td>PSY (n = 96)</td>
<td>-.57***</td>
<td>-.63***</td>
<td>-.54***</td>
</tr>
<tr>
<td>CG (n = 96)</td>
<td>-.64***</td>
<td>-.65***</td>
<td>-.58***</td>
</tr>
</tbody>
</table>

SF-12 12-item short form health survey, PCS physical component summary, MCS mental component summary, HADS hospital anxiety and depression scale, PRE preoperative group, POST postoperative group, PSY inpatients psychosomatic medicine, CG non-clinical control group

*p < .05, **p < .01, ***p < .001

Relationship Between HRQOL/Psychopathology and Weight Loss, and Time since Surgery in Postoperative Patients

No significant correlations (p.s ≥ .28) were found between weight loss and SF-12 PCS (r = .05), MCS (r = .04), HADSAnx (r = .03), or HADSDep (r = -.05). Also, time since surgery was not related to SF-12 PCS (r = -.11), MCS (r = .04), HADSAnx (r = -.06), or HADSDep (r = -.01). A closer look at time since surgery data indicated four outliers with months since surgery ranging from 112 to 200 months. Dropping these cases from the analyses did not change the results.

Discussion

To our knowledge, this is the first study that compared HRQOL and psychopathology between bariatric surgery candidates and patients with mental disorders. In line with our first hypothesis, results indicate lower physical HRQOL among patients admitted for bariatric surgery compared to that in patients who were currently in psychotherapeutic hospital treatment. This is plausible given the high somatic comorbidity in patients with morbid obesity who seek surgical treatment [6, 15, 18, 19]. As expected in the second and third hypotheses, preoperative patients reported higher mental HRQOL and less anxiety than mentally ill inpatients. Conversely, in contrast to our fourth hypothesis, the level of depression did not differ between these two groups. The elevated depression scores among preoperative patients were generally consistent with past research [12, 13, 46]; however, the rate of those with probable depression (60.4%) exceeded those from earlier studies reporting HADS-based depression rates of about 40% among patients admitted for bariatric surgery [47, 48], which is difficult to explain. Unfortunately, no information was available with regards to psychiatric diagnoses, psychotherapy, or psychopharmacological treatment in the preoperative group, which poses limits to interpretation. Nonetheless, the result that outpatients seeking surgical treatment for morbid obesity seem to be as depressed as psychotherapy-seeking inpatients signifies the extent to which the former group is mentally affected.

Guidelines recommend routine mental health evaluation prior to surgery in order to review motivation for and expectations regarding surgery, and to screen patients for whom surgery is contraindicated due to an unstable or inadequately managed mental health condition [5, 6, 36, 49]. There exists a general consensus on clinically relevant depression in that it should not per se be an exclusion criterion for surgery, and that instead surgery candidates with psychiatric disorders should be given particular attention and care postoperatively [6, 30, 50]. Some authors have even claimed that patients with depression might be prioritized for bariatric surgery [17], given that past studies demonstrated that postoperative weight loss was related to a decrease of depressive symptoms following surgery [16, 28, 46, 51].

It is worth considering that preoperative patients in the present study perceived better subjective mental well-being...
surgery [13]. In line with our hypotheses, the results of the
sents a main outcome of bariatric surgery [6]. The high inverse
target corresponding but diverse aspects. Quality of life repre-
interpretation reflects the fact that the HADS and the SF-12
in the routine preoperative evaluation process. An alternative
ative patients were assured that the information provided for
surgery candidates in order to enhance their chances of receiv-
(i.e., suppressing or exaggerating symptoms) among bariatric
patients. This could be attributed to impression management
scores and poorer physical HRQOL than psychotherapy inpa-
(i.e., better mental HRQOL) despite similarly high depression
pathology and HRQOL.

Past longitudinal studies have shown a decrease in psycho-
pathology and bettering of HRQOL following bariatric sur-
gery [27, 28, 46, 53–55], at least during the first 3 years after
surgery [13]. In line with our hypotheses, the results of the
present study suggest less symptoms of anxiety/depression and
better physical and mental HRQOL in the POST group
compared to those in preoperative patients and mentally ill
patients, and no differences compared to volunteers with
pre-obesity or obesity grade 1. However, it is important to note
that the present data are not longitudinal. Due to the cross-
sectional study design, we are not able to evaluate the effect of
postoperative weight loss and biological changes on psycho-
pathology in bariatric surgery patients.

There are several limitations that have to be considered
when interpreting the results. First, the cross-sectional design
prevents any causal interpretation. Second, the data are limited
by the use of self-ratings and the lack of pertinent data to
confirm the questionnaire-based diagnoses of probable anxi-
ety or depression. Unfortunately, we had no information about
psychiatric diagnoses in the bariatric surgery groups and in the
CG. As mentioned above, some bariatric surgery patients may
have withheld psychiatric symptoms or engaged in
“impression management” resulting in a social desirability
bias [52]. Future studies should make use of structured inter-
views in order to provide a valid assessment of psychopathol-
y. Third, no information was available about psychotherapy in
three of the four groups which is another shortcoming,
given that psychotherapy might have interfered with the re-
results. Fourth, the non-clinical control group differed in age,
gender distribution, and education from the other three groups
which may have biased the group comparisons. Fifth, finan-
cial compensation for study participation may have attracted
individuals with specific pattern of psychopathology or
HRQOL resulting in a selection bias. Last but not the least,
the generalizability of our findings needs to be considered.
The results might be typical for Germany, with respect to the
PSY group particularly for inpatients treated in a psychoso-
matic hospital. Future studies are warranted to explore if our
interpretations also apply to other samples.

Despite its limitations, this study has several strengths in-
cluding the comparison of bariatric surgery candidates with
patients with severe mental disorders and the relatively large
sample sizes. In summary, the present findings suggest that
patients seeking bariatric surgery may suffer from equally
high levels of depression as psychotherapy inpatients, but they
perceive better mental health than the latter group. At present,
no formal standard exists concerning the use of questionnaires
in bariatric surgery samples, leading to inconsistency across
centers and potential information bias [56]. The present study
suggests that routine mental health evaluation pre- and possi-
bly also postoperatively should incorporate assessments for
both psychopathology and HRQOL.

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Biostatistics, Hannover Medical School, for his statistical support during
the course of the study, and the two anonymous reviewers for their con-
structive comments.

Compliance with Ethical Standards

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Foundation” as part of the structured doctoral program “ClinStrucMed”.

Conflict of Interest The authors declare that they have no conflict of
interest.

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

Ethical Approval All procedures were in accordance with the ethical
standards of the institutional research committee of the Hannover Medical
School and with the 1964 Helsinki declaration and its later amendments
or comparable ethical standards.

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