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Original Article

Psychosocial Status and Mental Health in Adolescents before and after Bariatric Surgery: A Systematic Literature Review

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Key Words

Adolescent bariatric surgery · Pre-operative mental health · Post-operative mental health · Depressive disorders · Eating disorders

Abstract

Objective: As long-term results of conservative treatment for obesity are discouraging, bariatric surgery is becoming a treatment option for extremely obese adolescents. However, mental and behavioral problems need to be respected when treating this vulnerable target group. **Methods:** A detailed systematic literature review on pre- and post-operative depressive, anxiety and eating disorder symptoms of adolescent patients was performed in PsychINFO, PubMed and Medline electronic databases. **Results:** Twelve studies met the inclusion criteria. Although strength of evidence was limited, results suggested that pre-operatively a third of adolescents suffered from moderate to severe depressive disorder symptoms and a quarter from anxiety disorder symptoms, while a substantial number showed eating disorder symptoms. Post-operatively, levels of depressive disorder symptoms significantly improved. Original articles on outcomes of eating and anxiety disorder symptoms after weight loss surgery were not found. **Conclusions:** Further attention is needed on consistent clinical assessment of mental health disturbances and their consecutive treatment in adolescents. Future research should also focus on psychological and psychosocial predictors of weight loss after bariatric surgery.

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Introduction

Obesity is one of the most serious global public health problems in the 21st century. Currently more than 1.4 billion adults are obese, and already 40 million children suffer from overweight and obesity worldwide [1]. Among children and adolescents, overweight and obesity are defined based on nationally representative data sets and expressed in percentiles. According to the International Obesity Task Force (IOTF), overweight in childhood and adolescence is classified as a BMI value between the 85th and the 95th percentile, and obesity is defined by BMI values above the 95th percentile [2, 3]. To date, overweight and obesity prevalence among children and adolescents is stabilizing, albeit at an alarmingly high level [4, 5].

Obesity correlates with a plethora of comorbidities which range from serious metabolic and cardiovascular disorders, severe sleep apnea or hypertension to psychiatric problems such as depression, anxiety and a low quality of life [6, 7]. Lifestyle interventions, which are termed as the conservative treatment for overweight and obesity, have shown limited long-term efficacy for severely obese adolescents [8–11]. Therefore, bariatric surgery is increasingly regarded as a suitable treatment option for severely obese adolescents, in whom conservative weight loss treatment approaches have failed [12].

Bariatric surgery has been established as the most successful and cost-effective treatment for adult patients with severe obesity that significantly minimizes metabolic comorbidities such as type 2 diabetes and maximizes long-term weight loss [13, 14]. Bariatric surgery procedures are either based on a restriction of the capacity of the stomach or on the creation of a malabsorptive environment. Four procedures are typical, comprising two restrictive methods (i.e., laparoscopic adjustable gastric banding (LAGB) and laparoscopic sleeve gastrectomy (LSG)), and two combined restrictive-malabsorptive methods (biliopancreatic diversion (BPD), Roux-en-Y gastric bypass (RYGB)) [15]. To date, only limited data are available on bariatric surgery in adolescent patients, but significant post-operative weight loss and remarkable improvements of metabolic and cardiovascular comorbidities have been reported by several groups [16–20].

However, all procedures imply specific medical and psychological problems which may even increase in adolescent patients due to longer post-operative life expectancy compared to adult patients [21]. From a psychosocial point of view, adolescent bariatric surgery candidates represent an especially vulnerable group of patients as they are still in a phase of development of self-concept, influenced by peer relationships and their social and educational environment [22, 23]. Empirically, psychopathology of obese adolescents includes externalizing and internalizing behavioral problems, depressive, anxiety and eating disorder symptoms [24]. Obese adolescents more often suffer from body dissatisfaction, anhedonia, low self-esteem, and depressive disorder symptoms than their normal-weight peers [25]. Studies on adult bariatric surgery candidates have demonstrated conflicting results on association between pre-surgery psychopathology and post-operative outcome. Some studies report no psychological or behavioral predictors of weight loss [26, 27]. Others, however, document that pre-operative psychopathology can interfere with post-operative outcomes, suggesting the need for an extensive pre-operative psychosocial assessment and treatment [28–30]. It is absolutely necessary to further describe the mental health status of adolescents who consider bariatric surgery procedure in order to offer appropriate patient education and establish suitable medical and psychological pre- and post-operative guidelines. A protocol for a comprehensive mental health assessment for adolescent bariatric surgery candidates has recently been published, briefly indicating prevalence rates of mental health disorders, but pointing to the need for more emphasis on this critical topic [31]. Furthermore, a recent review by Kubik et al. [32] briefly touched the topic regarding the impact of bariatric surgery

in childhood, but did not focus in detail on severity, prevalence and outcomes of mental health disorders in these patients.

Therefore, the objective of this paper was to conduct a detailed systematic review of the literature concerning psychosocial status and mental health in adolescent bariatric surgery patients. Because a significant number of adolescent bariatric surgery candidates reported mental and general health problems [33], this review focuses on prevalence rates of common pre- and post-operative mental health problems (i.e., depressive, anxiety and eating disorder symptoms) in adolescent patients, who are presenting for being accepted into a bariatric surgery program.

Material and Methods

Relevant articles were identified through search of PsychINFO, PubMed and Medline electronic databases including combinations of the following search terms: weight loss surgery, surgical weight loss, bariatric surgery, gastric bypass, gastric banding plus adolescents, adolescence, youth plus psychosocial, psychological, mental health, behavioral disorders or depressive disorder, anxiety disorder, eating disorders. Furthermore, relevant papers were extracted from reference lists of retrieved articles, and pertinent journals were searched by hand to identify additional studies.

Inclusion criteria were as follows: studies published in English language in peer-reviewed journals prior to February 2014 examining the psychosocial status and mental health of adolescent patients before and after bariatric surgery. Thus, observational studies and scientific reports were included when they assessed mental health and psychosocial outcome variables in adolescent patients (age 12.5 to <18 years) before and/or after bariatric surgery. Discussion papers, reviews, and comments were excluded. Authors removed duplicates among the identified studies, independently screened titles and abstracts for relevance, and if necessary reviewed full-text for inclusion and exclusion criteria. Subsequently, information on mental health in adolescent patients before and after bariatric surgery were extracted and tabulated.

Results

Description and Content of Included Studies

After removal of duplicates and exclusions, a total of 12 studies that assessed psychosocial status and mental health before and after bariatric surgery and that met all criteria for inclusion in our review were identified. The selection process is illustrated in figure 1.

The majority of studies were from the USA, only three were from Europe, i.e., Austria [34], Portugal [35], and Sweden [36]. Six studies reported data on 173 adolescent patients before bariatric surgery with the number of patients ranging from 10 to 40 [34, 36–40]; six studies reported data on 227 adolescent patients after bariatric surgery with the number of patients ranging from 10 to 101 [35, 36, 41–45]. The gender in all studies was predominantly female, except for one [34]. BMI values ranged from 46.1 to 64.5 kg/m².

The study designs varied between retrospective reviews of clinical charts of patients [37–40, 45], clinical follow-ups after examinations have been carried out [34, 41], and prospective feasibility, safety or observational studies [35, 36, 42–44]. Surgical procedures were either LAGB [34, 35, 37, 41–42] or RYGB [36, 39, 43–45] or were not specified [38, 40]. Most studies dealt with depressive disorders and depressive disorder symptoms in bariatric surgery patients, while one [36] described depressive and anxiety disorder symptoms from a pre- and post-operative point of view and another reported on pre-operative eating disorder symptoms [34]. The summarized characteristics of pre- and post-operative findings are presented in table 1 and 2, respectively.

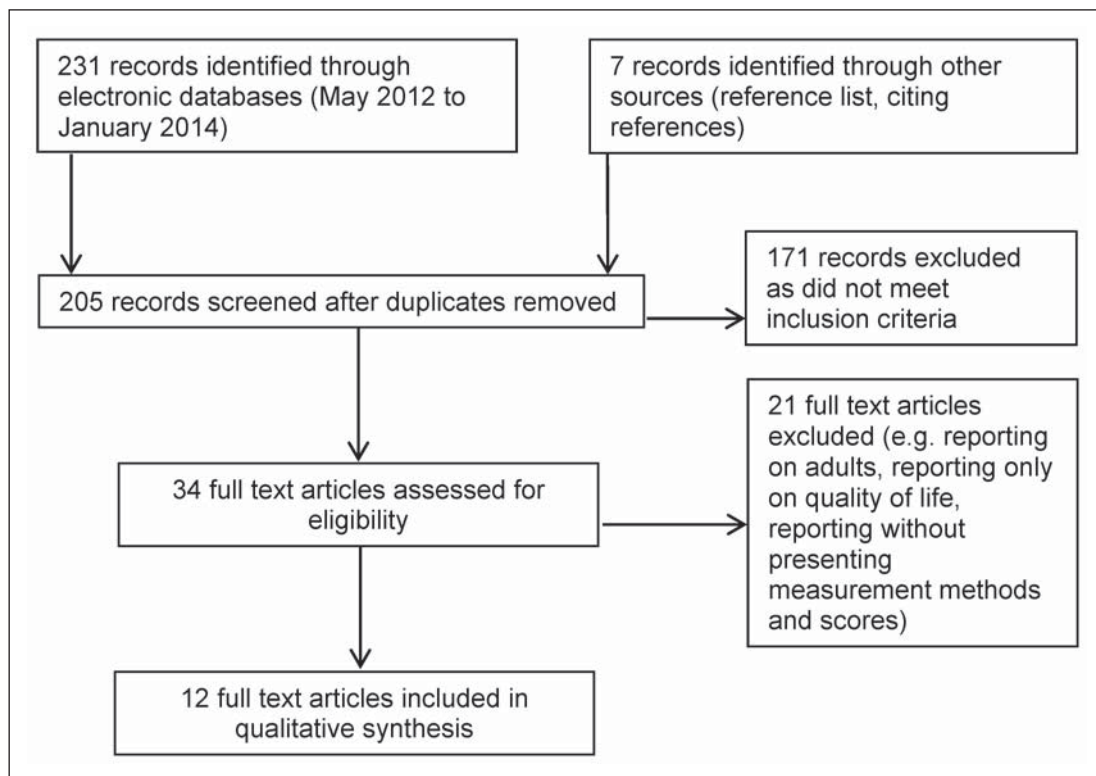


Fig. 1. Flowchart of literature search performed. Articles found and selected for review using PsychINFO, Pubmed and Medline electronic databases.

Preoperative Mental Health of Adolescent Bariatric Surgery Candidates

Six articles addressed mental health problems and behavioral disorders in adolescent bariatric surgery candidates. Depressive disorders, anxiety and eating disorders as well as respective symptoms were among the most common psychiatric phenomena documented.

Depressive Disorders and Depressive Disorder Symptoms

Four studies examined patients' baseline characteristics in relation to depressive disorders and depressive disorder symptoms by retrospectively analyzing clinical patient charts [37–40] (table 1). Medical information and psychosocial evaluation prior to surgery were used to assess adolescent mental health status. Only two studies reported on clinical interviews by mental health professionals [37, 38]; however, all four studies showed results of responses to the Beck Depression Inventory (BDI) [46] or its revised version (BDI-II) [47]. Both are quantitative self-report questionnaires with 21 questions assessing the severity of depressive symptoms on a 4-point Likert scale ranging from 0 to 3. The sum score of the BDI-II indicates minimal ($BDI \leq 13$), mild ($14 \leq BDI \leq 19$), moderate ($20 \leq BDI \leq 28$), or severe ($29 \leq BDI \leq 63$) depressive symptoms. Clinically relevant depressive symptoms are commonly defined by moderate or severe scores.

From the two studies that also reported on clinical interviews, one did not specify diagnoses [37]. The other revealed that two thirds of the bariatric surgery candidates were clinically diagnosed with depressive disorders [38]. Similar results were found in studies using the BDI, reporting moderate and severe depressive disorder symptoms in up to 15% of the patients [40]. In another study, depressive disorder symptoms were assessed twice before bariatric surgery. Moderate and severe depressive disorder symptoms were reported in

Table 1. Studies addressing psychopathology in adolescent patients (depressive disorder symptoms, anxiety and eating disorder symptoms) before undergoing bariatric surgery

Study	Sample	Study design and surgical procedure	Method	Prevalence (%) and severity
<i>Depression</i>				
Duffecy et al., 2008 [37]	N = 40; age = 15 years; BMI = 50 kg/m ² ; 60% female; USA	retrospective review psychological data LAGB	BDI (clinical interview)	32%: moderate to severe depressive symptoms (BDI)
Kim et al., 2008 [38]	N = 25; age = 18.8 ± 1.5 years; BMI = 50.6 kg/m ² ; 76% female; USA	review of clinical charts procedure not specified	BDI-II (clinical interview)	mean BDI = 10.4 ± 10.4 68% of sample: clinical depression
Ratcliff et al., 2011 [39]	N = 30; age = 16.5 ± 1.4 years; BMI = 64.5 kg/m ² ; 60% female; USA	retrospective chart review prospective, controlled longitudinal study	BDI-II	47%: minimal depressive symptoms 13%: mild depressive symptoms 20%: moderate depressive symptoms 20%: severe depressive symptoms 52%: minimal depressive symptoms 21%: mild depressive symptoms 12%: moderate depressive symptoms 15%: severe depressive symptoms
Zeller et al., 2006 [40]	N = 33; age = 16.3 ± 1.2 years; BMI = 58.8 kg/m ² ; 55% female; USA	retrospective review clinical data procedure not specified	BDI-II	
<i>Anxiety</i>				
Duffecy et al., 2008 [37]	N = 40; Age = 15 years; BMI = 50 kg/m ² ; 60% female; USA	retrospective review psychological data LAGB	clinical interview	25% anxiety disorder symptoms 15% panic disorder symptoms
Jarvholm et al., 2012 [36]	N = 35; BMI = 46.5 kg/m ² ; age = 16.6 ± 1.3 years; 67.6% female; Sweden	prospective feasibility and safety study RYGB	BYI	22%: score ≥ 90th percentile (highly elevated) anxiety disorder symptoms 43%: score ≥ 75th percentile (average range) anxiety disorder symptoms
Kim et al., 2008 [38]	N = 25; BMI = 50.6 kg/m ² ; age = 18.8 ± 1.5 years; 76% female; USA	review of clinical charts procedure not specified	clinical interview	18% history of anxiety disorder symptoms

Table 1 continued on next page

Table 1. Continued

Study	Sample	Study design and surgical procedure	Method	Prevalence (%) and severity
<i>Eating disorder symptoms</i>				
Kim et al, 2008 [38]	N = 25; age = 18.8 ± 1.5 years; BMI = 50.6 kg/m ² ; 76% female; USA	review of clinical charts procedure not specified	WALI	48%: eating large amounts of food in 2 h 44%: eating rapidly 36%: guilt associated with eating 36%: eating uncomfortably full 24%: loss of control feeling when eating large amount of food 24% eating without hunger 20% eating alone 70%: emotional eating over life course
Widhalm et al, 2008 [34]	N = 10; age = 17.3 ± 3 years; BMI = 49.1 kg/m ² ; 30% female; Austria	clinical follow-up of patients LAGB	EWI	

BDI = Beck Depression Inventory; BYI = Beck Youth Inventory; WALI = Weight and Lifestyle Inventory; EWI = Eating Behavior and Weight Problems Inventory for Children; LAGB = laparoscopic adjustable gastric banding; RYGB= Roux-en-Y gastric bypass.

Table 2. Studies addressing depressive disorder symptoms in adolescent patients after undergoing bariatric surgery

Study	Sample	Study design, follow-up, and surgical procedure	Method	Percentage/severity T ₀	Percentage/severity T ₁	Δ change in clinical depressive symptoms
Cozacov et al, 2014 [45]	N = 18; age = 17.5 years; BMI = 47.2 kg/m ² ; 72.2% female; USA	retrospective review of prospectively collected data 12 months	?	22 % clinical depression	5.5% clinical depression	-75% clinical depression
Holterman et al, 2007 [41]	N = 10, age = 16 ± 0.8 years; BMI = 50 ± 13 kg/m ² ; 100% female; USA	RYGB, LSG clinical follow-up 9 months LAGB	BDI-II	30%: severe depressive symptoms mean BDI = 11 ± 8	30%: mild/ minimal depressive symptoms mean BDI = 2.2 ± 2.7	-100 % clinical depression) depressive symptoms BDI reduction: -80%
						BDI 6 months: 5.4 ± 6.2 BDI 3 months: 9.8 ± 10.5

Table 2 continued on next page

Table 2. Continued

Study	Sample	Study design, follow-up, and surgical procedure	Method	Percentage/severity T ₀	Percentage/severity T ₁	Δ change in clinical depressive symptoms
Jarvholm et al., 2012 [36]	N = 37; age = 16.6 ± 1.6 years; BMI = 46.5 kg/m ² ; 67.6% female; Sweden	prospective feasibility and safety study 6 months RYGB	BYI BDI-II	49% score ≤ 75th percentile (average range) 27%: score ≥ 90th percentile (highly elevated) 28%: severe depressive symptoms	68% ≤ 75th percentile (average range) 11%: score ≥ 90th percentile (highly elevated) 21%: severe depressive symptoms (reactive depressive symptoms)	-60.3% clinical depressive symptoms
Osorio et al., 2011 [35]	N = 14; age = 16 ± 1.3 years; BMI = 46.1 ± 3.1 kg/m ² ; 71.4% female; Portugal	prospective study 9 years LAGB	BDI?			-25% clinical depressive symptoms
Sysko et al., 2012 [42]	N = 101; age = 15.8 ± 1.1 years; BMI = 47.2 ± 0.9 kg/m ² ; 72.3% female; USA	prospective study 1 year LAGB	BDI clinical interview	minimal depressive symptoms mean BDI = 7.5 ± 1.1	BDI 1 month: 6.7 ± 1.2 BDI 3 months: 5.4 ± 1.0 BDI 6 months: 4.2 ± 1.2 BDI 9 months: 4.0 ± 1.0	clinical range depressive symptoms not documented BDI reduction: -37.1%
Zeller et al., 2009 [43]	N = 31; age = 16.4 ± 1.4 years; BMI = 63.5 ± 10.6 kg/m ² ; 64.5% female; USA	prospective study 1 year RYGB	BDI-II	38.7%: clinical range depressive symptoms mean BDI = 15.2 ± 12.4	6.9%: clinical range depressive symptoms BDI 6 months = 7.3 ± 9.0	-75% clinical depressive symptoms BDI reduction: -65.1%
Zeller et al., 2011 [44]	N = 16; age = 16.2 years; BMI = 59.9 ± 3.1 kg/m ² ; 62.5% female; USA	prospective observational study 2 years RYGB	BDI-II	62.5%: clinical elevated depressive symptoms mean BDI = 7.7 ± 9.7	14.3%: clinical range depressive symptoms BDI 6 months = 8.6 ± 11.5 BDI 12 months = 6.2 ± 5.0 BDI 18 months = 9.3 ± 8.0	-77.2% clinical depressive symptoms 2011 BDI reduction: -62.4%

BDI = Beck Depression Inventory; BYI = Beck Youth Inventory; WALI = Weight and Lifestyle Inventory; EWI = Eating Behaviour and Weight Problems Inventory for Children; LAGB = laparoscopic adjustable gastric banding; RYGB = Roux-en-Y gastric bypass; LSG = laparoscopic sleeve gastrectomy.

almost half of the patients 6 months before surgery, and the rates remained stable immediately before surgery [39]. Information on the application of any antidepressant medication before surgery was not available in the studies included.

Anxiety Disorders and Anxiety Disorder Symptoms

Anxiety disorder symptoms have rarely been focused on when reporting patient characteristics before bariatric surgery. So far, only three studies reported rates of anxiety disorder symptoms in adolescent bariatric surgery candidates [36–38]; however, all used different methods. One study applied a validated clinical interview to diagnose a lifetime history of anxiety disorders [38], and another used a semi-structured clinical interview to report anxiety disorder symptoms rather than diagnoses [37]. In a third study, anxiety disorder symptoms were reported by using the Beck Youth Inventory (BYI) [36]. This questionnaire was developed to assess emotional and social impairment in childhood and adolescence with validated cut-off levels [48]. In summary, a lifetime history of anxiety disorders was found in 18% of bariatric surgery candidates, and anxiety disorder symptoms were found in 22% according to BYI reports and in 33% of adolescents according to clinical interviews before bariatric surgery.

Eating Disorders and Eating Disorder Symptoms

Eating disorders (e.g., binge eating disorder) and eating disorder symptoms (e.g., loss of control eating) are both essential when assessing eligibility of bariatric surgery patients. Studies on adult patients show inconsistent findings regarding eating behavior pathology and weight loss surgery outcomes. Some studies reported that pre-operative eating disorders were not reliable predictors of excessive weight loss [49, 50]. Other studies, however, claim that they might interfere with adherence to post-operative lifestyle recommendations [51]. So far, only two studies reported on pre-operative eating disorder symptoms in adolescent bariatric surgery patients [34, 38].

Both studies examined patients' life records for eating disorders and eating disorder symptoms retrospectively. In one study [38], patients did not meet criteria for any eating disorder; however, almost half of them either showed symptoms of loss of control eating or symptoms of binge eating disorder (e.g., eating unusually large amounts of food, experiencing guilt during the episode, eating until uncomfortably full and eating without being hungry). The other study found that 70% of adolescent patients reported eating disorder symptoms (e.g., emotional eating) [34].

Combined Psychopathology

The study of co-occurrence of mental disorders in adolescent patients has only been examined in one scientific report, which describes latent classes of psychopathology in detail [52]. 25% of all adolescent bariatric surgery candidates had depressive symptoms in the clinical range and a high probability for suffering from binge eating episodes (73.2–100%), bulimic episodes (73.1%), or night eating episodes (52.1%).

Effects of Bariatric Surgery on Post-Operative Mental Health Status

Studies examining symptoms of anxiety and eating disorders in adolescents before and after bariatric surgery were not identified. Six studies reported on the course of depressive disorder symptoms in adolescent bariatric surgery patients [35, 36, 41–44] (table 2).

All studies reported on the use of either the BDI or the BDI-II, while only one study stated the use of a clinical interview [42]. Studies considerably differed with regard to the time point at which post-operative psychopathology was measured [36, 43, 44]. Use of antidepressants was not reported.

Six months and 9 months after surgery, improvements of mean levels of depressive symptoms were observed in all studies [36, 41–44]. In two studies, the lowest level of depressive symptoms was reported 1 year after surgery [43, 44]. Another study documented improvement of clinical depression in 75% of all affected patients [45]. Tendencies towards an increased level of depressive disorder symptoms were observed 18 to 24 months after surgery [44]. One study, however, reported lowest levels of depressive disorder symptoms 9 months after bariatric surgery with an increase afterwards [42]. In general, prevalence of post-operative depressive disorders or depressive disorder symptoms was higher in female than in male adolescents [43]. Studies primarily reporting weight loss after bariatric surgery showed inconsistent findings on depressive symptoms of adolescent patients as secondary outcomes [35, 41]. Nine months after LAGB, depressive disorder symptoms were completely resolved in one study [41].

In contrast, a long-term follow-up of 9 years after bariatric surgery revealed that 21.4% of all patients were still suffering from clinical depressive symptoms. However, in follow-up interviews most patients reported depressive symptoms due to other causes than obesity (e.g., death of a relative) [35, 45].

Discussion

The present study is a detailed systematic literature review and identified 12 studies that comprehensively focused on psychosocial status and mental health among adolescents before and after bariatric surgery.

Findings documented that adolescent bariatric surgery patients suffered from psychopathologies such as depressive disorders, anxiety disorders, and eating disorders. Before bariatric surgery, prevalence rates of depressive disorder symptoms ranged from 15% to almost 70%, anxiety disorder symptoms were reported in 15–33% of the adolescents, and eating disorder symptoms were present among 48–70%.

Severe depressive disorder symptoms in adolescents indicate the need for clinical attention and clearance before surgery. In comparison with recent studies that reported a major depressive disorder in 3.2% of all adolescents in the USA [53, 54], the results of our review emphasize the high prevalence of depressive disorder symptoms in adolescent bariatric surgery patients. Similarly, mental health problems and disorders were found to be elevated among adult patients seeking bariatric surgery as compared with national surveys [55]. However, in contrast to adult bariatric surgery, no changes in levels of depressive disorder symptoms were reported from adolescents who were evaluated twice before bariatric surgery [39]. Socially desirable responding has been repeatedly found in adult patients, who indicated lower depressive symptoms in psychosocial assessments before bariatric surgery, termed as ‘impression management’ [56, 57].

Prevalence of anxiety was rarely systemically examined. As indicated by few studies, approximately one quarter of the adolescent bariatric surgery candidates seemed to suffer from anxiety disorder symptoms. Further research is warranted to examine type, severity, and duration of anxiety disorder symptoms and to delineate possible treatment options if this shows to be associated with reduced weight loss success after surgery. 18% of adult patients before bariatric surgery were diagnosed with a current anxiety disorder, such as generalized anxiety disorder [58, 59]. Anxiety has been associated with low weight loss in adults [51].

Among the few available studies on eating disorder symptoms in adolescent bariatric surgery patients, the prevalence for binge eating according to self-reports ranged from 25 to 48%. In adult bariatric surgery candidates, 10–16% of patients suffered from binge eating disorder [60, 61]. Combined psychopathology (depressive, anxiety and eating disorder

symptoms) was only reported in one study [52] and needs further attention to delineate risk profiles of adolescent bariatric surgery patients.

With regard to post-operative psychosocial status and mental health, the present review documents positive effects of levels of depressive disorder symptoms associated with adolescent bariatric surgery. According to the studies reviewed, depressive disorder symptoms either remitted or improved after bariatric surgery. Overall, depressive symptoms tended to decrease towards a milder symptomatology after the first 12 months following surgery. However, some evidence exists from adult bariatric surgery populations that persisting or re-occurring psychopathology regularly becomes apparent at the end of the post-operative 'honeymoon' phase following surgery [62, 63]. Furthermore, in adolescents correlations between weight loss success and improvement of depressive disorder symptoms were not reported as they have been in adults before [59].

This review was limited by several methodological issues in the studies themselves. First, sample sizes were small and ranged from 10 to a hundred patients. Thus, larger sample sizes are necessary to document accurate prevalence rates of psychopathology. Furthermore, sociodemographic and ethnic characteristics as well as family background of patients were not examined in detail and need to be further elucidated.

Second, pre- and post-operative assessments of depressive, anxiety and eating disorder symptoms were inconsistent in the studies reviewed. Standardized clinical interviews with adolescent surgery candidates were only reported in some studies [37, 38], and, if applied, cut-off points for the definition of clinically relevant depressive disorder symptoms varied. For better comparability of the studies and their outcomes, documentation of consistent cut-off values is inevitable. Also, four studies were retrospective chart reviews and are limited regarding their explanatory power of severity and causes for mental health disorders. According to the current bariatric surgery guidelines, a comprehensive assessment should incorporate documentation of both standardized questionnaires and clinical interviews [64]. Additionally, suicidal ideation, substance abuse, and impulse control disorders have not yet been examined in the adolescent population although they were documented in adult bariatric surgery patients [55, 60, 65].

Our review has pointed out that depressive disorder symptoms are likely to be present in adolescents and that pathological eating patterns (e.g., loss of control eating) also emerged after bariatric surgery in adolescents. Among adult bariatric surgery patients, post-operative depressive disorders and eating disorder symptoms were associated with less favorable post-operative weight loss outcome [59, 66]. Thus, assessment may improve the choice of patients suited for surgery, while treatment of pre- and post-operative depressive and eating disorder symptoms can have an impact on successful weight loss after surgery. As has been shown recently, post-operative behavioral management has a positive effect on weight loss among adult bariatric surgery patients [66].

The effect of psychopathology changes before and after bariatric surgery on outcomes of adolescent bariatric surgery has rarely been studied. Pre-operative depressive disorder symptoms neither predicted initial BMI nor rate of BMI change after bariatric surgery [42]. Previously, associations between depressive disorder symptoms and poor adherence to conservative obesity treatment in adolescents were documented [67]. To further analyze this association, more studies are needed focusing on long-term follow-up of surgery outcomes and their correlation with development of psychopathology over the course of weight loss treatment of adolescents.

In conclusion, our review highlights the prevalence and severity of mental health disorders before and after bariatric surgery. Future research needs to focus on establishing valid and standardized clinical assessment procedures of psychopathology in adolescent bariatric surgery patients. By further examining the mental health status of the adolescent

bariatric surgery patients and its effect on long-term outcomes of bariatric surgery, the safety and effectiveness of bariatric surgery programs for adolescents as well as pre- and post-operative care can be improved.

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Disclosure Statement

The authors declare that they have no conflicts of interests.

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