

PSYCHOSOCIAL EFFECTS OF SURGERY AND PHYSICAL ACTIVITY IN BARIATRIC PATIENTS: A SYSTEMATIC REVIEW

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ABSTRACT

Obesity has become one of the major health problems in current industrialized societies. The negative impact of morbid obesity (defined as having a Body Mass Index >40 kg/m²) in the health-related quality of life of patients is significant. Bariatric surgery is currently considered an effective treatment to achieve sustained weight loss in patients with severe obesity, after failure of non-invasive treatments. The role of physical activity for optimizing bariatric surgery outcomes is receiving growing attention. In this sense, the aim of this article was to review the scientific literature concerning the psychosocial effects of surgery and physical activity in bariatric patients. The search was performed using Medline and Scopus databases. From a total of 58 articles, 37 articles were included in the review after the application of exclusion and inclusion criteria. In view of the evidence collected in this review, this article finishes with several conclusions and recommendations linking current knowledge with future research and future health-care interventions with this population.

Key Words: obesity, exercise, health-related quality of life, depression, anxiety, self-esteem

RESUMEN

La obesidad se ha convertido en uno de los principales problemas de salud en las sociedades industrializadas actuales. El impacto negativo de la obesidad mórbida (definida como tener un índice de masa corporal > 40 kg/m²) en la calidad de vida de los pacientes es preocupante. La cirugía bariátrica se considera actualmente un tratamiento eficaz para lograr la pérdida de peso sostenida en pacientes con obesidad severa, tras el fracaso de los tratamientos no invasivos. El papel de la actividad física para la optimización de los resultados de la cirugía bariátrica está recibiendo cada vez más atención. En este sentido, el objetivo de este artículo fue revisar la literatura científica sobre los efectos psicosociales de la cirugía y la actividad física en los pacientes bariátricos. La búsqueda se realizó utilizando las bases de datos Medline y Scopus. De un total de 58 artículos, 37 fueron incluidos en la revisión después de la aplicación de los criterios de exclusión e inclusión. A la vista de las evidencias recogidas en esta revisión, este artículo finaliza con algunas conclusiones y recomendaciones que vinculan el conocimiento científico actual con las futuras investigaciones e intervenciones de atención sanitaria con esta población.

Palabras clave: obesidad, ejercicio, calidad de vida relacionada con la salud, depresión, ansiedad, autoestima

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INTRODUCTION

Obesity has become one of the major health problems of today's society, affecting more than 500 million people worldwide in 2008 (World Health Organization, 2014). Moreover, severe or morbid obesity (defined as having a Body Mass Index [BMI]>40 kg/m²) is increasing at an exponential rate and reaching epidemic proportions (Josbeno, Jakicic, Hergenroeder, & Eid, 2010; Sturm, 2003).

The impact of morbid obesity on the physical, psychological and social health of patients is significant (Costa, Yamaguchi, Santo, Riccioppo, & Pinto-Junior, 2014; van Hout et al., 2006). With regard to physical health, several studies have shown an association between morbid obesity and the manifestation or aggravation of a variety of other health problems such as diabetes mellitus, cardiovascular risk, hypertension, dyslipidemia, cancer, obstructive sleep apnea, or joint disease (Haslam & James, 2005; Kwok et al., 2014; Ricci, Gaeta, Rausa, Macchitella, & Bonavina, 2014; Shetty & Schmidhuber, 2006). Concerning psychological and social health, this condition is also associated with depression, negative body attitude, poor body image, low self-esteem, low health-related quality of life (HRQOL) (de Zwaan et al., 2014; Grilo, Masheb, Brody, Burke-Martindale, & Rothschild, 2005; Hainer, Toplak, & Mitrakou, 2008; Lier, Biringier, Hove, Stubhaug, & Tangen, 2011; Mathus-Vliegen, & de Wit, 2007; Strain et al., 2014), discrimination, stigmatization, dissatisfying relationships, and occupational problems (Chen & Brown, 2005; Puhl & Heuer, 2010; van Hout et al., 2006).

In order to avoid these issues and achieve a healthy condition, people suffering from morbid obesity need to follow medical treatment, including changes in their diet and physical activity habits (Avenell et al., 2004). However, sometimes, these methods are not sufficient for people who suffer this type of obesity, and they must resort to others methods such as bariatric surgery. Bariatric surgery is currently considered the most effective treatment to achieve sustained weight loss in patients with severe obesity (Buchwald et al., 2004). In its various procedures, this surgery can either involve stomach restriction alone or combine stomach restriction with intestinal diversion (Padwal et al., 2010) in order to reduce calorie intake and minimize or eliminate the numerous consequences of obesity through sustained weight loss. In this way, bariatric surgery can decrease obesity-associated diseases and lead to physical, psychological and social benefits (Mathus-Vliegen & de Wit, 2007). Several studies have shown a remission of Type 2 diabetes, a reduction of musculoskeletal pain, hypertension, and lipid disturbances, and a decrease of mortality from diabetes, cardiovascular diseases and cancers after bariatric surgery (Moya et al., 2014; Svane & Madsbad, 2014). Moreover, improvements after surgery have also been found in HRQOL, body image, anxiety, depression

and other mental health disorders (Greenberg, Sogg, & Perna, 2009; Lier, Biringer, Hove, Stubhaug, & Tangen, 2011; Madan, Beech, & Tichansky, 2008; Mathus-Vliegen & de Wit, 2007; Strain et al., 2014).

Nevertheless, the surgery will not succeed if it is not followed by a change in the patients' lifestyle, including an appropriate diet and sufficient participation in physical activity. The role of physical activity for optimizing bariatric surgery outcomes has been receiving growing attention, and it is considered an important adjunct to bariatric surgery in the treatment of severe obesity (Herman, Carver, Christou, & Andersen, 2014). Physical activity has been found to be a determinant of the long-term maintenance of weight loss after bariatric surgery (Jakicic, Clark, & Coleman, 2001; Moya et al., 2014), avoiding weight regain and the return of comorbidities associated with this condition (Sjöström et al., 2004). Physical activity is also an important contributor to the prevention or treatment of psychological disorders such as depression or anxiety, and it is associated with improved quality of life after surgery (Bond et al., 2009; King et al., 2013). Moreover, physical activity can serve as an intermediary to enhance the participation of bariatric patients in social activities (Wiklund, Olsén, Olbers, & Willén, 2014), to reduce their feelings of embarrassment and to increase their self-confidence (Wouters, Larsen, Zijlstra, & van Ramshorst, 2011).

In the scientific literature, there are already reviews focused on the psychosocial effects of surgery in bariatric patients (Livhits et al., 2011; Pataky, Carrard, & Golay, 2011; Sarwer et al., 2008). However, these reviews do not include either the most recent studies about this topic or studies based on qualitative methodology, which can contribute to understand in depth the psychosocial effects of surgery in these patients. In addition, although there are reviews about the physical effects of physical activity in bariatric patients (Egberts, Brown, Brennan, & O'Brien, 2012; Gourland, Trouilloud, & Sarrazin, 2011), there are no studies reviewing the psychosocial effects of physical activity in this population.

Therefore, the aim of this study was to perform a systematic review of the scientific literature concerning the psychosocial effects of surgery and physical activity in bariatric patients. This review collects the information provided by the most recently published articles and studies based on both quantitative and qualitative methods. In view of the evidence collected in this review, this article finishes with several conclusions and recommendations linking current knowledge with future research and future health-care interventions with this population.

METHOD

Data sources and search terms

The electronic search was performed using the MEDLINE and SCOPUS databases up to March 2015. Searches included various combinations of five sets of terms: 1) Terms concerning surgery: bariatric surgery; 2) Terms concerning physical activity: physical activity, exercise; 3) Terms concerning psychological effects: psychological changes, psychological outcomes, self-esteem, self-efficacy, depression, anxiety, body image; 4) Terms concerning social effects: social isolation, discrimination, social relationships, social support; 5) Terms concerning general psychosocial effects: psychosocial factors, mental health, quality of life. Complete search strategies can be obtained from the authors.

Literature screening and catalogue construction

The selection of studies focused on the psychosocial effects of surgery and physical activity in bariatric patients was carried out through two levels of screening, represented in Figure 1. At Level one screening, abstracts were reviewed for the following exclusion criteria: publication of abstracts only, case reports, letters, guides or guidelines, comments, and reviews. Eleven out of 58 articles were rejected after reviewing the abstracts for meeting these exclusion criteria established at Level one. Full articles were then obtained for the remaining 47 studies accepted at Level one. For Level two screening, inclusion required the studies to deal with the following categories of information: longitudinal, cross-sectional or qualitative studies with patients who underwent bariatric surgery (regardless of the surgery method performed), studies analysing psychosocial effects of surgery and/or physical activity in bariatric patients. In this case, 10 studies did not meet inclusion criteria for the catalogue: 6 studies contained samples of patients who were candidates for surgery, but had not yet undergone bariatric surgery (Boeka, Prentice-Dunn, & Lokken, 2010; Friedman, Ashmore, & Applegate, 2008; Hübner et al., 2014; King et al., 2013; Sarwer, Fabricatore, Eisenberg, Sywulak, & Wadden, 2008; Sierra-Murguía et al., 2012); 1 study analysed whether weight discrimination was associated with becoming and remaining obese over a four-year period, but participants did not undergo bariatric surgery (Sutin & Terracciano, 2013), 2 studies compared psychological effects of patients who had undergone bariatric surgery and then underwent another surgery, such as body contouring surgery, so they did not exclusively assess, in any participant or group of participants, the psychological effects of bariatric surgery (Aldaql et al., 2013; Gilmartin, Long, & Soldin, 2014); and 1 study examined the habits making the operation successful, without assessing psychosocial effects (Cook & Edwards, 1999). Finally, 37 articles were selected: 29 of them analysed the

psychosocial effects of bariatric surgery, 7 of them analysed the psychosocial effects of physical activity on bariatric patients, and 1 of them (Wiklund, Fagevik, Olbers, & Willén, 2014) analysed the psychosocial effects of both bariatric surgery and physical activity on this population.

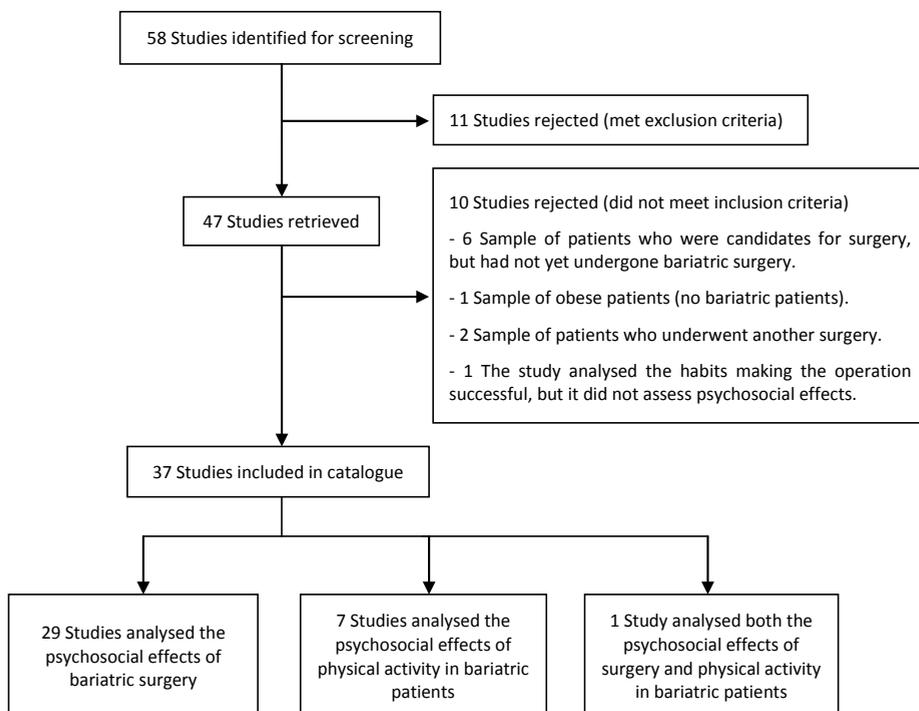


FIGURE 1: Literature screening and catalogue construction.

Data analysis

The information collected in this review was analysed following a conventional content analysis (Hsieh & Shannon, 2005). First, all the articles selected for the review were read to get a sense of the whole. Second, the text fragments or concrete results of each article which represented important ideas or concepts for the aim of this review were copied, pasted and coded in a text editor file. Each code was composed of the text fragment or concrete result and a label identifying its content and corresponding bibliographic reference. Third, in another text editor file, all the codes were classified, using inductive reasoning, in a system of categories and subcategories which provided meaning to the data and supported the writing of the findings described in the next section and the elaboration of Tables 1 and 2.

RESULTS AND DISCUSSION

Psychosocial effects of surgery in bariatric patients

Thirty studies were included in this review (Table 1). The information about the different psychological and social effects identified in the review is presented in the following sections.

TABLE 1
Studies that analyse psychosocial effects of surgery in bariatric patients.

References	Number of patients	Assessment methods	Follow-up months	Variables analysed	Results
Batsis et al. (2009)	296	WEL	48	HRQOL	↑
Canetti et al. (2013)	44	SF-36, MHI, RSE	12	HRQOL	↑
				Self-esteem	↑
Clark et al. (2014)	361	Surveys	-	Psychological distress	-
				Psychological wellbeing	↑
Costa et al. (2014)	143	SF-36, BAROS	12-24-34-48 or + 48	Relationship stability and quality	↑
De Carvalho et al. (2014)	8	Semi-structured interviews	36-132	HRQOL	↑
De Zwaan et al. (2011)	107	Clinical interviews (SCID)	6-12 and 24-36	Psychological factors involved in weight regain	↓
De Zwaan et al. (2014)	252	IWQOL-Lite, MBSRQ, PHQ-9, GAD-7	12	Anxiety	-
				Depression	↓
Dixon et al. (2003)	487	BDI	12	HRQOL	↑
				Body image	↑
Ferreira et al. (2013)	20	Clinical interviews	25	Depression	↓
				Psychiatric disorders	-
Hayden et al. (2010)	32	Focus groups	18	Perceived discrimination and stigmatisation	↑
Järholm et al. (2012)	37	BDI-II, BYI	4	Depression	↓
				Anxiety	↓
Kim et al. (2008)	25	BDI-II	36	Self-concept	↑
				Depression	#
Kinzl et al. (2006)	176	Clinical interviews, GSE	30-84	Depression	↓
				Psychiatric disorders	↑
Kruseman(2010)	80	NHP, Hospital Anxiety and Depression Scale	60	Childhood experiences	↑
				Self-efficacy	↑
Lier et al. (2011)	87	SF-36, MINI, SCID-II	12	HRQOL	↑
				Self-esteem	↑
Magdaleno et al. (2010)	7	Semi-directed interviews	18-36	HRQOL	↑
				Anxiety	-
Madan et al. (2008)	27	BESAA	-	Depression	↓
				Body image	↑
Magdaleno et al. (2010)	7	Semi-directed interviews	18-36	Self-esteem	↑
				Social discrimination	↑
Magdaleno et al. (2010)	7	Semi-directed interviews	18-36	Acceptance and social reinsertion	↑
				Acceptance and social reinsertion	↑

TABLE 1 (Continuation)

References	Number of patients	Assessment methods	Follow-up months	Variables analysed	Results
Martínez et al. (2010)	100	NHP	12	HRQOL Self-esteem Social relationships	↑ ↑ ↑
Muñoz et al. (2010)	57	SFRS	12	Desired body shape	↑
Nadalini et al. (2014)	110	SF-36	36	HRQOL	↑
Ogle et al. (2015)	13	In-depth interviews	36	Social support	↑
Rutledge et al. (2011)	60	History and physical exam	24	Psychiatric disorders	↑
Sarwer et al. (2008)	200	SF-36, BIQLI, Body Shape Questionnaire, IWQOL	5-10-20	HRQOL Body image Body shape	↑ ↑ ↑
Schwalter et al. (2008)	248	BDI, SESA	60-84	Depression Self-acceptance	↓ ↑
Shiri et al. (2007)	57	SF-36, Perceived Social Support Scales - Family	12 or +12	HRQOL Family support	↑ ↑
Strain et al. (2014)	105	SF-36, BDI, IWQOL-Lite	25	HRQOL Depression	↑ ↓
Tae et al. (2014)	32	BDI, STAI, BITE, WHOQOL	6	HRQOL Depression Anxiety	↑ ↓ ↓
Warholm et al. (2014)	2	In-depth interviews	12	Movement and activity Appearance Social relations	↑ ↑ ↑
Wiklund et al. 2014	24	Semi-structured interviews	12	Physical, mental and social hindrances	↑
Zeller et al. (2009)	31	BDI, PedsQL, IWQOL-Kids	6-12	HRQOL Depression	↑ ↓

↑ : an increment was found after bariatric surgery; - : no differences were found after bariatric surgery; ↓ : a decrease was found after bariatric surgery; # : the study offers prevalence data after bariatric surgery.

Health-related quality of life

Thirteen studies (Batsis et al., 2009; Canetti et al., 2013; Costa et al., 2014; de Zwaan et al., 2014; Kruseman et al., 2010; Lier et al., 2011; Martínez et al., 2010; Nadalini et al., 2014; Sarwer et al., 2008; Shiri et al., 2007; Strain et al., 2014; Tae et al., 2014; Zeller et al., 2009) found positive changes in several or all domains of the patients' HRQOL after bariatric surgery. These enhancements included both physical and emotional aspects of HRQOL, such as physical functioning, general health, vitality, or mental health, and they were usually related to weight loss after the operation (Canetti et al., 2013; Costa et al., 2014; Martínez et al., 2010; Nadalini et al., 2014; Sarwer et al., 2008), although not all the studies found this relationship with weight loss (Lier et al., 2011; Strain et al., 2014). These gains were particularly significant in certain areas of HRQOL, especially in physical functioning, understood as the patients' perceived limitations in physical activities due to their health problems (Canetti et al.,

2013; Costa et al., 2014; de Zwaan et al., 2014; Tae et al., 2014; Nadalini et al., 2014; Zeller et al., 2009). As a result of the weight loss obtained after surgery, perceived physical functioning improved, and patients became physically more active and capable of working and engaging in different social and physical activities (Costa et al., 2014; Nadalini et al., 2014). In addition, the study of Nadalini et al. (2014) also found that perceived physical functioning, when HRQOL was measured prior to surgery, is a positive predictor of weight loss after surgery, independently of age, sex and type of surgery.

Depression

Ten studies (De Zwaan et al., 2011; De Zwaan et al., 2014; Dixon et al., 2003; Järholm et al., 2012; Kinzl et al., 2006; Kruseman et al., 2010; Schowalter et al., 2008; Strain et al., 2014; Tae et al., 2014; Zeller et al., 2009) found a decrease in depression or depressive symptoms after bariatric surgery. These improvements were found, depending on the study, between 4 months (Järholm et al., 2012) and 8 years after the operation (Kruseman et al., 2010).

Typically, patients seeking bariatric surgery have a high depressive profile that correlates with poorer physical and mental HRQOL scores. This profile improves after surgery, because weight loss is associated with a significant and sustained drop in depression (Dixon et al., 2003). In this way, patients who lost more weight usually achieved higher reductions of depressive symptoms (Dixon et al., 2003; Schowalter et al., 2008), although BMI is considered a poor predictor of the presence of depressive symptoms in these patients (Tae et al., 2014). Nevertheless, depressive disorders may not completely remit after surgery, and may attenuate the improvements that occur postoperatively, requiring clinical attention (De Zwaan et al., 2011; Kim et al., 2008; Kinzl et al., 2006).

There were also studies comparing groups of patients who underwent different bariatric surgery methods, such as gastric bypass, adjustable gastric band, biliopancreatic diversion with duodenal switch or sleeve gastrectomy (Strain et al., 2014) and studies that compared bariatric patients to bariatric patients who also underwent body contouring surgery (De Zwaan et al., 2014). In both cases, though all the groups improved depressive symptomatology after surgery, no group differences were found.

Anxiety

One of the most prevalent clinical syndromes before and after surgery was anxiety (Ferreira et al., 2013). Like depression, patients usually have a profile with symptoms of anxiety at moderate levels before the operation, while these symptoms tend to decrease postoperatively. Two studies (Järholm et al., 2012; Tae et al., 2014) found a reduction in anxiety symptoms after the operation,

although 3 studies (de Zwaan et al., 2011; de Zwaan et al., 2014; Kruseman et al., 2010) did not find improvements. De Zwaan et al. (2011) found that preoperative anxiety significantly predicted postoperative anxiety disorders at 6, 12, 24 and 36 months. The same authors found that symptoms of anxiety may persist after surgery. Besides, postoperative anxiety disorder was not associated with the degree of weight loss at any follow-up time-point or with BMI, which is considered, as in the case of depression, a poor predictor of the presence of anxiety symptoms in these patients (Tae et al., 2014).

Psychiatric symptoms

Apart from depression and anxiety, a decrease in other psychiatric symptoms such as personality disorders, adjustment disorders and eating disorders was observed after bariatric surgery (Kinzl et al., 2006; Lier et al., 2011; Rutledge et al., 2011). However, it is important to emphasise that psychiatric symptoms often persist, although to a lesser extent, after surgery. Ferreira et al. (2013), in an observational longitudinal study, found that the most prevalent clinical psychological disorders after bariatric surgery were bipolar disorders, dysthymia disorders, delusional disorders, and personality disorders such as histrionic personality, compulsive personality, and paranoia.

In this regard, Lier et al. (2011) found that patients without postoperative psychiatric disorders achieved a HRQOL comparable to the general population one year after bariatric surgery; whereas patients with postoperative psychiatric disorders showed impaired HRQOL compared to the population norm. Moreover, 2 studies (Kinzl et al., 2006, Rutledge et al., 2011) showed that patients with two or more psychiatric disorders after surgery (such as adjustment disorders and/or personality disorders) experienced less weight loss than patients with one or no psychiatric disorder.

Self-esteem

Bariatric surgery provides a significant improvement in patients' self-esteem (Canetti et al., 2013; Kruseman et al., 2010; Madan et al., 2012; Magdaleno et al., 2010; Martínez et al., 2010). However, the evidence suggests that moderate weight loss is insufficient for improvements in self-esteem. Canetti et al. (2013) compared a post-surgery group of patients to a group of patients who did not undergo bariatric surgery but who followed a specific diet. Although both groups lost weight significantly, results showed that patients with a greater weight loss (post-bariatric patients) improved self-esteem, whereas the diet group did not report improvements.

Other psychological variables

Other psychological variables which improved after surgery were body image or the perception of body shape (de Zwaan et al., 2014; Kruseman et al., 2010; Muñoz et al., 2010; Sarwer et al., 2008), self-concept (Järholm et al., 2012), and self-acceptance (Schowalter et al., 2008).

Social relationships

Other quantitative studies also examined social variables, finding an improvement in the stability and quality of social relationships after bariatric surgery (Clark et al., 2014; Martínez et al., 2010). These improvements were related to weight loss and the maintenance of health behaviours associated with weight management in bariatric patients.

Psychosocial effects of bariatric surgery from a qualitative perspective

The psychosocial effects of bariatric surgery were also analysed in the 6 qualitative studies described in this section. Carvalho et al. (2014) analysed the meanings of weight regain after surgery among women. A feeling of defeat and failure emerged in patients with weight regain after surgery, with a loss of self-esteem. This situation led to an exacerbated sensitivity to criticism (a feeling of rejection greater than the actually existing rejection), contributing to their social isolation.

In this line, Hayden et al. (2010) assessed patients' perceptions of weight-related stigma and discrimination, comparing a younger (18-35 years) and an older (36-65 years) group of obese women with a younger and an older group of women who had undergone bariatric surgery. The findings showed that the women who had undergone surgery realised that they had contributed to their own social isolation, due to their own withdrawal and closed behaviour derived from their lack of self-esteem and poor self-confidence. However, the obese women felt that other people excluded them socially, mainly because of their weight. Interestingly, this study found that the bariatric groups reported more discrimination after the bariatric surgery. According to their perceptions, they were viewed as having taken the easy way to lose weight, and felt judged when people found out that they had undergone bariatric surgery. Moreover, younger women were more worried about their body shape and reported greater discrimination than older women because of their weight, whereas older women were more focused on health, improvements in physical function and the fact that their families no longer had to worry about their health and wellbeing.

Magdaleno et al. (2010), also with a sample composed exclusively of women, carried out a qualitative investigation to understand the significance of bariatric surgery for these patients. The results showed that bariatric surgery

was perceived by these women as an option to restart the process of an active social life. They experienced a strong sensation of acceptance and social reinsertion that led to a significant improvement of their self-esteem. This fact was a motivating factor to face the challenge of weight loss. On the contrary, according to the participants, social discrimination against obese people represented a risk factor leading to a loss of self-esteem and a lack of motivation for weight loss. Warholm et al. (2014), in line with the above-mentioned results, also found an increase in participation in social activities and social relations after surgery. Participants were also excited about the fact that they were able to participate in activities and everyday tasks which were difficult or impossible for them before. The improvement in their perceived appearance due to weight loss also enhanced their self-assurance. However, weight loss concurrently increased their worries about the excess of skinfolds, and women anxiously showed their interest in the available opportunities to correct them.

Ogle et al. (2015) studied the role played by social support in the lives of women who have undergone bariatric surgery. They analysed the social support provided to participants by health professionals, other bariatric patients, and spouses, family members, and friends. The findings pointed out that participants perceived more social support after surgery, an aspect that enhanced their well-being. Participants especially valued the information they received about how to maintain a healthy lifestyle, as well as the empathy, concern and care shown by others.

Finally, Wiklund et al. (2014) explored patient's perceived barriers to physical activity participation one year after bariatric surgery. Physical side-effects of surgery, such as excessive skin folds, prevented them from being as physically active as they would have liked. These obstacles made some participants show a low motivation for exercise and express unwillingness to expose themselves to others. For this reason, some participants avoided exercising at the gym, swimming pools or other exercise facilities. However, this study showed that the patients' perception of the benefits of physical activity increased after surgery. Participants declared that physical activity was essential to achieve and maintain weight loss after surgery, but they still needed the social support of family and friends to achieve and maintain an adequate level of physical activity.

Psychosocial effects of physical activity in bariatric patients

Eight studies were included in this part of the review (Table 2). The collected information is structured and presented in this section.

TABLE 2
Studies that analyse psychosocial effects of physical activity in bariatric patients.

References	Number of patients	Assessment methods	Follow-up months	Variables analysed	Results
Bond et al. (2009)	199	SF-36	12	HRQOL	↑
Forbush et al. (2011)	265	SF-36	12-60	HRQOL	↑
Josbeno et al. (2010)	20	SF-36, PASES, Physical Activity Barriers and Outcome Expectations Questionnaire	3	HRQOL Self-efficacy	↑ -
King et al. (2012)	310	SF-36, BDI, IWQOL-Lite	12	HRQOL Depression	↑ -
Mathus-Vliegen & de Wit (2007)	50	HRQL Questionnaire	12-24-60	HRQOL	↑
Rosenberger et al. (2011)	131	SF-36 BDI	12	HRQOL Depression	↑ ↓
Tompkins et al. (2008)	25	SF-36	3-6	HRQOL	↑
Wiklund et al. (2014)	24	Semi-structured interviews	12	Physical, mental and social achievements	↑

↑: an increment was found after bariatric surgery; -: no differences were found after bariatric surgery; ↓: a decrease was found after bariatric surgery

Five studies (Bond et al., 2009; Forbush et al., 2011; Josbeno et al., 2012; Rosenberger et al., 2011; Tompkins et al., 2008) found that patients' physical activity level increased after bariatric surgery. This increase in physical activity was related to better scores in vitality, social functioning, role limitations due to emotional problems, and mental health.

Forbush et al. (2011) found that bariatric patients have to do more than 1.5 hours per day of physical activity to significantly reduce bodily pain and role limitations due to physical health problems, and improve physical functioning and general health (Physical Component Summary [PCS], SF-36). However, this study also pointed out that more than 1 hour per day of physical activity would be enough to achieve improvements in vitality, social functioning, role limitations due to personal or emotional problems, and mental health (Mental Component Summary [MCS], SF-36).

The findings of Tompkins et al. (2008) showed that higher physical activity levels after surgery were associated with improvements both in the PCS and the MCS of the SF-36. King et al. (2012) also found that performing more physical activity was related to lower scores on the factor "role limitations due to emotional problems" 6 months after surgery.

Several studies analysed differences in psychosocial variables between active and inactive bariatric patients. Concretely, Bond et al. (2009) compared

different groups of bariatric patients. A group of patients who were inactive before surgery and active after surgery (Inactive/Active), a group of patients who were active before and after surgery (Active/Active), and a group of patients who were inactive before and after surgery (Inactive/Inactive). Inactive/Active and Active/Active participants reported greater improvements than Inactive/Inactive participants on the MCS score and the general health, vitality and mental health domains. These findings suggested that bariatric patients who become active postoperatively achieve HRQOL improvements that are greater than those experienced by patients who remain inactive and similar to those attained by patients who stay active. In this sense, Forbush et al. (2011) also indicated that patients who reported more hours of physical activity and energy expenditure per day after surgery showed significantly better HRQOL, both in the MCS and the PCS, than those patients who were less active.

Mathus-Vliegen and de Wit (2007) analysed the differences in HRQOL between bariatric patients and individuals with a normal bodyweight. This comparison was made before surgery and 1, 2.5, and 5 years after surgery. After surgery, bariatric patients participated in a weight loss program that included physical activity and diet. The program consisted of performing biweekly visits to the physician and dietician, behavioural therapy, and aerobic classes during 2.5 years. As a result of the weight loss program, improvements in general wellbeing, health distress, depression, perceived attractiveness and self-worth were noted in the first year postoperatively. Moreover, patients perceived less negative influence of their body size on work performance. Over the following 4 years, health distress, depression, physical appearance and self-regard improved progressively. Compared with individuals with a normal bodyweight, the degree of final overweight played an important role, as patients with a final BMI below 35 kg/m² had values equivalent to those of normal-weight subjects for depression and self-regard, and only those with a BMI below 30 kg/m² were at the normal reference level for all scores. The results of this study showed that a program for bariatric patients, with intense and prolonged support of a physician and dietician and with easy access to physical exercise, can be useful to achieve remarkable and sustained improvements in HRQOL.

Rosenberger et al. (2011) examined how frequency and intensity of physical activity were associated with improvements in psychosocial scores in bariatric patients. Levels of physical activity were measured before and 12 months after surgery. Both frequency and intensity levels of physical activity increased significantly from preoperative to postoperative time points, and these changes correlated with better psychosocial outcomes, in depression and

physical and mental well-being (PCS and MCS in the SF-36), 12 months after surgery.

Finally, only 1 qualitative study (Wiklund et al., 2014) examined the psychosocial effects of physical activity in bariatric patients. One year after surgery, these patients reported that they felt better, more satisfied and relieved when finding that they were able to walk without feeling exhausted or afraid of falling. As a consequence of being active and improving their physical functioning, patients were more able to participate in social and family activities, such as playing with their young children or helping other relatives with their jobs. They also realised that they could face daily-life tasks and housework by themselves. All these changes increased their feelings of independence and competence, and improved their social and family life.

CONCLUSIONS AND RECOMMENDATIONS

In view of the information collected in this review, this article presents the following conclusions and recommendations:

- Bariatric surgery had positive psychosocial effects on patients, such as improvements in HRQOL, depression, anxiety, psychiatric symptoms, self-esteem, body image and social relationships. Many of these psychological and social improvements were usually associated with weight loss after surgery and the increasing effects of weight loss on perceived physical functioning, physical activity levels and social life.
- Some negative consequences were reported after bariatric surgery. Some patients felt judged by others and thought that they were viewed as having taken the easy way to lose weight. Others reported feelings of failure and defeat with weight regain after surgery, and were more focused on body shape than on health and wellbeing. Moreover, weight loss was also related to excessive skinfolds, which represented an important body concern for bariatric patients. Future interventions with bariatric patients should be focused on the promotion of health, wellbeing, healthy habits and inclusive social activities, avoiding an excessive weight-management approach, which can be negative for these patients. In addition, these patients should be informed in depth about the different available alternatives to reduce skinfolds. Future studies should analyse whether exercise before and after surgery can reduce skinfolds in bariatric patients.
- Physical activity was also related to psychosocial improvements in bariatric patients, and higher levels of physical activity participation were associated with more benefits. Therefore, the promotion of physical activity should be a fundamental aim among this population. According to the findings of this review, the following recommendations

for the promotion of physical activity in bariatric patients could be made. 1) To carry out pre- and post-surgery interventions to reinforce patients' perception of the benefits of physical activity. 2) To offer specific physical activity programs for these patients before and after surgery. The collaboration between health and sport science professionals would be desirable for the design and implementation of these programs. 3) To guarantee inclusive physical activity contexts in which participants can feel respected and valued. The support by health professionals, family, friends, other patients, other exercisers and society in general is very relevant for them to maintain an active and healthy lifestyle. 4) Sport facilities should possess specific designs and physical structures to preserve patients' privacy if they have some complex about their body shape, weight or skinfolds, and do not want to feel observed by others. In this sense, the availability of individual showers, and swimming pools or fitness rooms closed to external observers would be desirable. 5) To encourage active daily life activities like walking, not only moderate and vigorous exercise, because these low intensity activities are also related to improvements in patients' HRQOL and are also a way to increase energy expenditure and lose weight. 6) To enhance participation in physical activity with family and friends, as a way to stay active and improve family and social life at the same time. This can be especially relevant when leisure time is scarce.

- This review has identified a lack of knowledge about the type, frequency, duration, and intensity of physical activity which is necessary to optimise the physical and psychosocial benefits for bariatric patients. Future intervention studies should tackle this issue, as this information is necessary for an appropriate design and implementation of physical activity programs for this population.
- Patients seeking bariatric surgery tend to show a depressive profile, anxiety and low HRQOL, aspects that can last even after surgery. Pre- and post-surgery interventions to enhance psychological wellbeing are necessary in these patients. These interventions could be reinforced with physical activity programs including psychological intervention through physical activity (for instance, to improve perceived competence by proposing tasks with adequate difficulty for the participants and by providing them with positive feedback about their performance; to improve social relationships with group and collaborative activities; or to reduce anxiety with relaxing physical activities).
- Future reviews should collect specific information about the behavioural effects of surgery (for instance, concrete effects on physical activity, eating behaviours, or social life). This review refers to the increase of

- physical activity after bariatric surgery to explain the emergence of some psychosocial benefits, but the behavioural effects of surgery were beyond the scope of this article and should be addressed in future research.
- There is a lack of qualitative studies analysing in depth the psychosocial effects of physical activity in bariatric patients. Moreover, to our knowledge, there are no qualitative studies evaluating the psychosocial effects of group-based physical activity programs designed for this population. Future qualitative studies should contribute to palliate these gaps in the literature, as a more holistic and complete understanding of these issues is necessary to design and implement appropriate physical activity programs for these patients.
 - Finally, although bariatric patients must be resilient against disrespectful people, a more respectful society towards obese people is necessary. Health professionals, teachers, sport science professionals, journalists and other social agents should collaborate to promote health, wellbeing and healthy habits without promoting intolerant attitudes towards people with specific body shapes.

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