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SURGERY FOR OBESITY AND RELATED DISEASES

Original article

The association between number of children and weight loss outcomes among individuals undergoing bariatric surgery

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Abstract

Background: Existing research demonstrates that parity is associated with risk for obesity. The majority of those who undergo bariatric surgery are women, yet little is known about whether having children before bariatric surgery is associated with pre- and postsurgical weight outcomes.
Objectives: We aim to evaluate presurgical body mass index (BMI) and postsurgical weight loss among a racially diverse sample of women with and without children.
Setting: Metropolitan hospital system.
Methods: Women (n = 246) who underwent bariatric surgery were included in this study. Participants self-reported their number of children. Presurgical BMI and postsurgical weight outcomes at 1 year, including change in BMI (ΔBMI), percentage excess weight loss (%EWL), and percentage total weight loss (%TWL) were calculated from measured height and weight.
Results: Those with children had a lower presurgical BMI ($P = .01$) and had a smaller ΔBMI ($P = .01$) at 1 year after surgery than those without children, although %EWL and %TWL at 1 year did not differ by child status or number of children. After controlling for age, race, and surgery type, the number of children a woman had was related to smaller ΔBMI at 1 year post surgery ($P = .01$).
Conclusions: Although women with children had lower reductions in BMI than those without children, both women with and without children achieved successful postsurgical weight loss. Providers should assess for number of children and be cautious not to deter women with children from having bariatric surgery. (Surg Obes Relat Dis 2021;17:1127–1131.) © 2021 American Society for Bariatric Surgery. Published by Elsevier Inc. All rights reserved.

Key words: Parity; Number of children; Bariatric surgery; Postsurgical weight loss; Pregnancy; Racial differences

Although weight gain is a natural part of pregnancy, the majority of women gain more weight than recommended by their physician [1]. Moreover, many women continue to gain and retain weight after pregnancy, increasing their overall body mass index (BMI) and the risk for developing obesity [2]. Additionally, obesity risk increases with the number of child births (parity) [3]. When examining the relationship between parity and obesity in a large cohort of women over a span of 5 years, women who had given birth more than once (multiparous) were at greatest risk for developing obesity, followed by women with 1 childbirth (primiparous), compared with women who had never had children (nulliparous) [3]. This is of particular concern for women with a higher BMI before pregnancy, as they are more likely to gain excessively during pregnancy [4].

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Following pregnancy, most women retain weight 1 year after delivery, and a subset of women go on to meet criteria for obesity [5]. Because bariatric surgery is the most effective treatment for severe obesity and the associated medical co-morbidities [6] and the majority of patients who opt for surgery are middle-aged women [7], it is important to evaluate how pregnancy may influence bariatric surgery outcomes. There is some evidence that women who become pregnant following bariatric surgery may have similar weight loss outcomes as those who do not become pregnant. According to Yang et al. [8], postsurgical weight loss outcomes remain relatively robust to pregnancies after surgery. Women who became pregnant within 12 months after surgery had similar weight loss outcomes compared with nonpregnant women at 2 years after bariatric surgery [9].

Although postsurgical pregnancy may not significantly impact weight loss success, little is known about whether pregnancy before bariatric surgery affects presurgical BMI and postsurgical weight loss outcomes. Presurgical weight at baseline and type of bariatric surgery account for the most variance (65.8%) in postsurgical weight loss [7], thus it is important to evaluate whether pregnancy is associated with presurgical BMI. Given that parity is associated with weight gain, it would be expected that those with more children would present with a higher presurgical BMI. In the only existing study to examine pregnancy before bariatric surgery, there was no significant difference in presurgical BMI between those who were never pregnant and those who were pregnant within 3 years before or after bariatric surgery [2]. Yet, those who were pregnant before bariatric surgery lost significantly less weight following surgery compared with nulliparous women. However, this study only measured pregnancies 3 years before bariatric surgery and did not consider total number of pregnancies [2]. It is pertinent to know about all potential pregnancies before bariatric surgery because women gain weight with each pregnancy and because higher BMI is linked with poorer postsurgical weight loss outcomes [10].

Several factors may be responsible for the potential association between parity status (i.e., number of children) and pre- and postsurgical weight outcomes. Age, for example, is pertinent in that younger women (aged 20–45 yr) have superior weight loss outcomes compared with older women (aged 55–65 yr) following bariatric surgery [11]. Additionally, it is rather intuitive that age is positively associated with potential number of children. Race may also explain this association, as there are significant differences in postsurgical weight loss between black and white individuals [12], and black women are more likely to be primiparous and multiparous [13]. Additionally, surgery type is known to be associated with postsurgical weight outcomes, such that sleeve gastrectomy (SG) has less expected weight loss than Roux-en-Y gastric bypass (RYGB) [14]. Therefore, in examining associations between parity and pre- and postsurgical weight outcomes, it is pertinent to examine age, surgery type, and race. Notably, the existing study examining pregnancy before bariatric surgery did not report on racial/ethnic differences in their sample and the majority of patients underwent RYGB [2].

Thus, it remains unknown whether women who have had children before bariatric surgery present for surgery at a higher BMI, whether the number of children is associated with poorer postsurgical weight outcomes, and whether parity may explain racial differences in postsurgical weight loss. Therefore, the purpose of this study was to expand upon the existing findings in the area of pregnancy before bariatric surgery [2] by examining presurgical BMI and postsurgical weight loss outcomes among women with and without children among a racially diverse sample of women pursuing SG or RYGB while considering factors which may be associated with weight loss (e.g., surgery type, race, and age). It was hypothesized that women with children would present for surgery at a higher BMI and experience poorer weight loss outcomes than those without children.

Methods

Participants and procedure

This study included women (n = 246) who underwent a psychosocial evaluation for bariatric surgery between July 2016 and June 2017 and subsequently underwent SG or RYGB. This was derived from a larger sample of women (n = 315), 69 of whom were excluded due to lack of available 1-year postsurgical weight data. Retrospective medical-record reviews were conducted to gather the number of children reported during the required presurgical psychosocial evaluation and presurgical height and weight at the required consult with the surgeon and 1-year postsurgical weight. Postsurgical weight information was calculated from according to recommendations for standardized reporting weight loss outcomes after bariatric surgery, including change in BMI, percent total weight loss (%TWL) and percent excess weight loss (%EWL) [15]. This study was approved by the institutional review board at the health system, and informed consent was waived due to the retrospective nature of the study.

Statistical analyses

Prevalence rates were calculated using descriptive statistics. First, associations between demographic (e.g., age, race) and surgery-related variables (e.g., surgery type) were evaluated to evaluate potential covariates with having children, the number of children, and weight loss outcomes . An independent samples *t* test was used to evaluate whether age was associated with having children. Chi-square analyses were used to evaluate the association between surgery type (RYGB versus SG) and having children, as well as between race (black versus white) and having children. A *t* test

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was conducted to examine whether number of children differed by race. Next, we used independent samples *t* tests and correlations to evaluate whether these demographic variables (i.e., age and race) and surgery type were associated with 1-year postsurgical weight outcomes (i.e., ΔBMI, %EWL, and %TWL). An independent sample's *t* test was conducted to evaluate whether presurgical or 1-year postsurgical weight outcomes differed among those with and without children. Analysis of covariance was used to examine weight loss outcomes between those with and without children after controlling for age, race, and surgery type. Correlations were also used to evaluate whether the number of children was associated with presurgical BMI as well as weight loss outcomes. Lastly, multiple regression was used to evaluate whether weight loss outcomes could be predicted by number of children after accounting for age, race, and surgery type. Analyses were conducted using SPSS version 25 [16].

Results

The sample was primarily multiparous, middle-aged, and relatively evenly split between black (48.8%) and white (42.3%). The mean presurgical BMI was 46.46 (SD = 7.74), and the majority of the sample underwent sleeve gastrectomy (Table 1). The individuals who were excluded (i.e., those without a 1-year weight available) did not differ from the current sample regarding age, race, surgery type, presurgical BMI, child status, or number of children ($P > .05$).

Because we were interested in examining whether there were factors that could explain the relationship between parity and postsurgical weight loss, we examined whether age, race, or surgery type were related to child status (i.e., having versus not having children) and 1-year weight loss outcomes. Age was associated with having children, such that those with children (mean [M] = 46.96, SD = 9.19) were older than those without children (M = 41.65, SD = 12.41; $t = -2.81$, $P = .007$; Cohen $d = .49$). However, race (black versus white) was not associated with having children, $x^2 = 2.68$, $P = .10$, $\Phi = .11$, nor did the number of children differ by race, $t = -.92$, $P = .36$, Cohen $d = .12$. Surgery type was not associated with having children ($x^2 = 1.52$, $P = .21$, $\Phi = -.08$).

In terms of weight loss outcomes, age was significantly correlated with ΔBMI ($r = -.23$, $P < .001$), and %TWL ($r = -.18$, $P < .01$), but not %EWL ($P > .05$). There were racial differences in weight loss, such that black patients had poorer weight loss outcomes at 1 year than white patients. Independent samples *t* tests showed that black patients (M = 26.3, SD = 7.38) had significantly lower %TWL than white patients (M = 30.19, SD = 8.37; $t = -3.70$, $P < .001$, Cohen $d = .49$); black patients (M = 58.43, SD = 18.48) also had significantly lower %EWL compared with white patients (M = 71.40, SD = 22.50; $t = -4.67$, $P < .001$, Cohen $d = .63$). Change in BMI did not differ by race, $P = .057$. Weight loss outcomes differed by surgery type for ΔBMI and %TWL, but not for %EWL ($P > .05$). Specifically, those who underwent RYGB had greater ΔBMI (M = 15.49, SD = 5.05) and %TWL (M = 30.43, SD = 7.37) than those who underwent sleeve gastrectomy ([ΔBMI, M = 12.48, SD = 4.41; $t = -4.03$, $P < .001$, Cohen $d = .63$]; [%TWL, M = 27.47, SD = 8.13; $t = -2.25$, $P = .03$, Cohen $d = .38$]).

Table 1
Demographic characteristics of the sample

Characteristic	Mean (SD)
Age, mean (SD), yr	45.91 (10.11)
Consult BMI, mean (SD)	46.46 (7.74)
Number of children, mean (SD)	1.82 (1.39)
Children, n (%)	
No	49 (19.9)
Yes	197 (80.1)
Number of children, n (%)	
0	49 (19.9)
1	53 (21.5)
≥2	144 (58.5)
Surgery type, n (%)	
Sleeve gastrectomy	201 (81.7)
Roux-en-Y gastric bypass	45 (18.3)
Race, n (%)	
Black	120 (48.8)
White	104 (42.3)
Other or ≥2 races	9 (3.7)
Other Pacific Islander	1 (.4)
Missing/unknown	12 (4.9)

BMI = body mass index.

Women without children had a higher presurgical BMI than those with children (Table 2). Those without children had greater ΔBMI than those with children at 1 year post surgery, although there were no differences in %TWL and %EWL between the groups (Table 2). Those without children had a greater ΔBMI at 1 year after surgery controlling for age, race, and surgery type, although there were no group differences in %TWL or %EWL (Table 3). The number of children was inversely correlated with presurgical BMI ($r = -.20$, $P = .001$), as well as with ΔBMI ($r = -.19$, $P = .004$), but was not associated with %TWL or %EWL (both $P > .05$). Lastly, multiple regressions showed that number of children predicted ΔBMI but not %EWL or %TWL at 1 year post surgery controlling for age, race, and surgery type (Table 4).

Discussion

The aim of this study was to evaluate associations between child status and presurgical BMI and 1-year postsurgical weight loss outcomes among women undergoing bariatric surgery. It appears that women who had children before having bariatric surgery presented for surgery with a lower BMI than those without children, which was a small effect. In contrast to previous research [2], we found

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Table 2
Pre- and postsurgical weight among those with and without children

	No children (n = 49) mean (SD)	With children (n = 197) mean (SD)	*t* test	*P* value	Cohen *d*
Presurgical BMI	49.61 (8.97)	45.67 (7.21)	2.85	**.01**	**.48**
Δ BMI	14.70 (4.79)	12.61 (4.56)	2.84	**.01**	**.45**
% Total weight loss	29.51 (6.56)	27.64 (8.37)	1.69	.10	.25
% Excess weight loss	63.57 (18.71)	64.32 (21.44)	−.23	.82	.04

BMI = body mass index.

differences in presurgical BMI based on child status. Although this finding is not consistent with evidence that parity is positively associated with BMI [17], it may be the case that time since pregnancy is pertinent to consider or that this may not be the case among those with severe obesity. The average age of a woman at the time of her first birth is 26.3 years [18], and in our sample, the mean age of women with children was nearly 47 years. Thus, many of the pregnancies may have occurred years before bariatric surgery. While metabolic changes associated with weight, fat-free mass, insulin response, and insulin sensitivity do occur during pregnancy, there is evidence that these parameters return to prepregnancy levels within the first year postdelivery, but this effect may be conditional upon achieving prepregnancy weight status [19]. As such, it may be the case that subsequent pregnancies without first achieving prepregnancy weight may contribute to future obesity and the need for bariatric surgery.

Findings showed an association between race, age, and surgery type with postsurgical weight outcomes. Specifically, white patients had greater weight loss at 1 year compared with black patients. The effect size for these associations is considered medium. This supported the wider literature on the racial disparities in weight loss following bariatric surgery [12]. Additionally, the majority of the sample undergoing sleeve gastrectomy (81.7%) reflects current trends which show SG represents approximately two-thirds of the bariatric procedures performed in the United States [20]. However, weight loss outcomes were poorer with the SG than with the RYGB. After accounting for age, race, and surgery type, the number of children predicted change in BMI at 1 year, which was a medium effect. These results partially supported our hypotheses that women with children will lose less weight postsurgically. Although change in BMI was smaller among those with children, %TWL and %EWL were similar among women with and without children; therefore, it seems both nulliparous and multiparous women are likely to benefit from bariatric surgery in terms of its effect on their overall and excess weight. This finding is in contrast to the previous study examining weight loss outcomes by parity status [2] which found poorer weight loss outcomes among women pregnant 3 years before or after bariatric surgery compared with women who had never been pregnant. It may be the case that pregnancies within several years of bariatric surgery impair weight loss, but that having

Table 3
Postsurgical weight outcomes in relation to child status*

	No children (n = 45)		≥1 Child (n = 179)		*F* (1219)	*P* value	η^2_P
	Mean	SD	Mean	SD			
Δ BMI	14.74	4.91	12.72	4.56	**4.25**	**.04**	**.02**
% Total weight loss	29.38	6.68	27.79	8.38	1.05	.31	.01
% Excess weight loss	63.18	19.34	64.77	21.93	.001	.98	<.001

BMI = body mass index.
Bold values indicate statistical significance at $P < .05$.
* Analysis of covariance was performed with age, race, and surgery type as covariates.

Table 4
1-Year postsurgical weight outcomes predicted by number of children*

	Δ BMI $R^2 = .14$			%EWL $R^2 = .09$			%TWL $R^2 = .11$		
	β coefficient	*P* value	f^2	β coefficient	*P* value	f^2	β coefficient	*P* value	f^2
Number of children	−.54	**.01**	.16	−.20	.85	.10	−.60	.11	.12

BMI = body mass index.
Bold value indicates statistical significance at $P < .05$.
* Multiple regression was performed with age, race, and surgery type as covariates.

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children many years before surgery does not adversely impact postsurgical weight loss.

To our knowledge, this is the first study to examine number of children as it relates to weight loss following bariatric surgery. However, there are several limitations to note. First, because this was a retrospective review, we are not able to confirm the number of pregnancies. It is possible that there may have been additional pregnancies unaccounted for (i.e., adoption, loss of a child) or that some of the children may have not been biological (i.e., adopted a child, counted a stepchild). However, we attempted to account for this by only including the number of biological children (and excluding the number of stepchildren, adopted children, etc.) when this information was available in the electronic medical record. Second, we did not know the timing of each pregnancy. Having this information would have allowed us to discern whether pregnancy within a particular time frame before bariatric surgery is associated with suboptimal postsurgical weight loss. Additionally, because we excluded 69 women who did not have a 1-year weight available, this could have influenced our findings. However, those with and without 1-year weight outcomes did not differ in terms of demographic characteristics (e.g., age and race), surgery type (e.g., RYGB versus SG), or child-related variables (e.g., child status and number of children). Lastly, the follow-up period in the study was only 1 year. Given that the majority of postsurgical weight is lost within the first year [21], it remains unknown how child status or number of children affects weight loss outcomes beyond that time.

Conclusions

In conclusion, this study found that having children before undergoing bariatric surgery is associated with a smaller change in BMI at 1 year after surgery, yet no significant differences were found for %TWL and %EWL. It is important to note that women with and without children lost significant amounts of weight, thus clinicians working with those considering bariatric surgery should not deter women with children from having bariatric surgery.

Disclosure

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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