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# Nutrition Knowledge, Behaviors and Attitudes of Post-Bariatric Weight loss Individuals

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**A B S T R A C T**

Bariatric surgery is one way of achieving sustained weight loss. However, success is dependent on the individual's willingness to make lifelong habit changes. The purpose of this study was to determine if bariatric surgery patients' nutrition knowledge, behaviors and attitudes influenced weight loss. Four hundred and sixty two individuals who had undergone laparoscopic banding or gastric bypass at a major medical center were mailed a survey. Sixty-three surveys were returned out of 462 mailed. The survey included questions on nutrition knowledge, behaviors and attitudes. Also, data on anthropometric and demographic were collected. Results showed that the mean pre-operative weight was 284.33 lbs., while mean post-operative weight was 200.45 lbs. Positive nutrition behaviors of participants who experienced successful weight loss were higher than those who were not successful with weight loss. Thirty-two individuals achieved high nutrition knowledge scores (50.8%), with a mean score of 28.68. All participants indicated positive nutrition attitudes, with a mean score of 19.49. Nutrition behavior was found to be the only significant predictor of weight loss *at* $p<0.05$. Nutrition knowledge was significantly higher amongst the laparoscopic banding group at $p<0.05$, but the gastric bypass group had a higher percentage of success at $p<0.05$.

## Introduction

Obesity is of great concern in the United States with 33.8% of all individuals classified as obese (Body Mass Index (BMI) ≥30) (Flegal, et al. 2010). Obesity has been linked to a variety of different disease states that can include diabetes, heart disease, osteoarthritis, and certain types of cancer, among many others (DeMaria, et al. 2001; Karlsson, et al. 2007; Shah, et al. 2006; Virji and Murr 2006)

Bariatric surgeries have been utilized as a method to treat obesity for over 50 years

(Odom, et al. 2010). Studies have shown that the weight loss achieved with these surgeries can be effective at alleviating co-morbidities such as diabetes and hypertension (Patel 2014; White, et al. 2010). Although these surgeries have been shown to produce an average weight loss of approximately 35%, this weight loss is not always achieved or sustained by all individuals (Sjöström, et al. 2004; White, et al. 2010).

Bariatric weight loss surgeries are defined as surgeries that are performed on the obese and severely obese to assist in weight loss (U.S. Department of the Health and Human Services 2011). These procedures are categorized as restrictive and malabsorptive with or without restriction(Sandoval 2011). Restrictive procedures decrease the size of the stomach and lead to early satiety and decreased caloric intake. Malabsorptive procedures primarily cause maldigestion and malabsorption. There are also surgeries that are a combination of restrictive and malabsorptive procedures (McMahon 2006).

The two surgeries that were examined in this research study included gastric bypass and laparoscopic banding. Gastric bypass involves creating a small pouch from the stomach with an outlet to the small intestine. This procedure is a combination of restrictive and malabsorptive. The small pouch size limits the amount of food that can be consumed at one time, therefore inducing satiety with a smaller quantity. In addition, because this procedure bypasses the duodenum, a section of the small intestine, less energy and nutrients are absorbed (Sandoval 2011).

In comparison, the insertion of an inflatable ring, which can be adjusted via a subcutaneous access point is strictly restrictive as it reduces the size of the stomach. It is similar to the gastric bypass procedure in that respect, but laparoscopic banding does not include the malabsorptive characteristic. This procedure can also be reversed as needed (Paul 2010).

In order to achieve significant and sustained weight loss, individuals will need to comply with a large number of permanent lifestyle changes. These include consuming smaller portion sizes, eating regular schedule meals and snacks, consuming protein rich foods first, taking a vitamin and mineral supplement, abstaining from consuming carbonated beverages, consuming alcohol, and smoking, among many others (do Rego Furtado 2010; Kulick 2010; McMahon, et al. 2006). The largest challenges can come from an individual's failure to follow these necessary lifestyle changes (Odom, et al. 2010). One possible explanation for lack of adherence may stem from nutrition knowledge. Much research in nutrition education has focused on the association between nutrition knowledge, attitudes and behaviors. Nutrition knowledge has been seen to influence behaviors through attitudes; therefore increasing nutrition knowledge may be beneficial in achieving desired behaviors (Odom, et al. 2010).

Currently, there is a lack of research that examines the relationship between nutrition knowledge, behaviors and attitudes and post-surgery weight loss. This study is beneficial in that it adds to current research on the topic of bariatric surgery and provides a possible explanation for success or lack of success seen after surgery. The purposes of this study were (1) to determine the nutrition knowledge, behaviors and attitudes of post-bariatric surgery individuals, (2) to determine if there is a difference in nutrition knowledge, behaviors and attitudes between individuals who were successful and unsuccessful with weight

loss, (3) to determine if there is a difference in nutrition knowledge, behaviors and attitudes between individuals who have undergone gastric bypass surgery versus laparoscopic banding, and (4) to determine if there is a difference in the success rate between individuals who have undergone gastric bypass surgery versus laparoscopic banding.

## Materials and Methods

### Sample

Data were collected from 462 individuals who had undergone a bariatric weight loss surgery one to nine years prior, from 2002 to 2010, at a medical center in a Midwestern area, utilizing a convenience sampling approach. Of which, 63 responses were obtained, which equated to a 14% response rate. The two bariatric weight loss surgeries that qualified individuals as potential participants were gastric bypass and laparoscopic banding. Participants were identified through the medical records of the bariatric program. They were deemed eligible for participation if they were aged 18 years or older and had undergone gastric bypass or laparoscopic banding from 2002 to 2010. Participants were excluded if they had undergone a surgical revision of the initial bariatric weight loss surgery or had not undergone surgery from 2002 to 2010.

### Design and Procedure

After receiving Institutional Review Board approval, eligible participants were identified with the assistance of the manager of the bariatric services program at the medical center. The manager provided a list of potential participant's names, addresses and demographic information. Each participant was assigned an individual number to ensure confidentiality of the participants and their responses. This number was then recorded on the questionnaire, which was mailed to the patient's home address. The names and addresses were deleted from the Microsoft Excel spreadsheet after the questionnaires were mailed. When the questionnaires were returned, the number on the questionnaire was matched with the number in the Microsoft Excel spreadsheet, and the responses were recorded.

Successful weight loss after bariatric surgery was classified in the following ways. Participants' post-surgery weight loss was deemed successful if they had lost greater than or equal to 50% of their Excess Body Weight (EBW). In comparison, participants' post-surgery weight loss was deemed unsuccessful if they had lost less than 50% of their EBW. Excess Body Weight was calculated by taking the participant's pre-surgery weight and subtracting it from their Ideal Body Weight (IBW). IBW was calculated using Hamwi equation formulas: Men: 106 + 6 pounds per inch over five feet and women: 100 + 5 pounds per inch over five feet.

The participants were contacted by mail to complete the survey. They received a letter of explanation, which was used in place of informed consent form, and a copy of the survey. The participants who chose to participate in the study completed the survey and returned it in the enclosed, pre-addressed envelope.

### Measure

A validated survey tool was utilized to measure nutrition knowledge, behaviors and attitudes of the participants. It was adapted from a general nutrition knowledge questionnaire developed by Parmenter and Wardle (2000) and (do Rego Furtado 2010).

The survey tool had high internal reliability, high test-retest reliability and good construct validity. The questionnaire was modified to include relevant questions to bariatric surgery participants with the assistance of two Registered Dietitians (RD) in the bariatric program at the medical center. For instance, questions regarding appropriate portion size would not be suitable for this population because bariatric surgery patient's portions are drastically smaller than the portion recommended for the general public. The questionnaire also included educational elements utilized by the bariatric services program. In addition, the questionnaire was modified based on the educational tools and nutrition recommendations that were utilized to educate the participant on an adequate post-operative diet. Questions about nutrition attitudes were also included in the questionnaire. These questions were obtained from a survey tool utilized by Nnakwe and Kies (Nnakwe and Kies 1985).

The questionnaire was divided into three sections as follows: nutrition knowledge, nutrition behaviors and nutrition attitudes. For this study, nutrition knowledge was defined as the level at which an individual understands and comprehends current dietary recommendations for overall health and also for health post-bariatric surgery. Nutrition behaviors included the individual's actions in relation to their overall nutrition. Examples of this may be consuming a variety of fruits and vegetables daily, eating three consistent meals during the day, and others. Nutrition attitudes were defined as the personal feelings an individual has to the topic of nutrition and nutrition professionals. These attitudes can affect how an individual receives nutrition education and how well they retain the information received.

These sections were scored separately. The nutrition knowledge and nutrition behaviors sections were scored based on percentage of questions answered correctly. The nutrition knowledge had a total of 36 possible points. Scores ≥ 29 (≥ 80%) were considered high nutrition knowledge, 22-28 (60-79%) were considered medium nutrition knowledge and scores <22 (<60%) were considered low nutrition knowledge. The nutrition behaviors section had a total of 45 possible points. Scores ≥ 36 (≥ 80%) were considered compliant to recommended nutrition behaviors, 27-35 (60-79%) were considered semi-compliant to nutrition behaviors and ≤ 26 (<60%) were considered non-compliant to nutrition behaviors. The nutrition attitudes section was scored based on percentage of questions answered positively. The four attitudes questions were measured using Likert scales design. The nutrition attitudes section had a total of 20 possible points. Scores ranging from ≥ 16-20 (≥ 80%) were considered positive nutrition attitude, scores ranging from 12-15 (60-79%) were considered indifferent nutrition attitude, and scores ranging from ≤ 11 (<60%) were considered negative nutrition attitude.

In addition to the nutrition components, the questionnaires included questions on the participant's age, sex, race/ethnicity, marital status, height, pre- and post-surgery weights, type and date of bariatric surgery, any revisional procedures and any other procedures undergone since the bariatric surgery. This self-reported information was compared against the same information obtained from the medical record.

## Statistical Analysis

The three sections of the questionnaire; nutrition knowledge, behaviors and attitudes, were then scored and entered into the spreadsheet as well as the demographic data. Predictive Analytics Software for Windows (PASW) Version 18.0 was used to analyze the data. The analyses included

descriptive statistics, frequencies, and independent samples t-tests.

Initially, descriptive analyses were conducted to provide the means, standard deviations and range of scores for the demographic information, which included age, height, pre-surgery weight, post-surgery weight, and success rate. In addition, frequencies were conducted for sex, marital status, and race/ethnicity, type of surgery and year of surgery. This provided a general picture of the characteristics of the study participants. Descriptive analysis and frequencies were also conducted for the success rate of all participants and nutrition knowledge, behaviors and attitudes survey scores and specific answers.

An independent samples t-test was used to determine if there was a significant difference in nutrition knowledge, behaviors and attitudes between participants who were successful or unsuccessful with weight loss. Also, an independent samples t-test was used to determine if there was a significant difference in nutrition knowledge, behaviors and attitudes between the two types of surgery, gastric bypass and laparoscopic banding. In addition, the same analysis was conducted to determine if there was a difference in the success rate between individuals who have undergone gastric bypass surgery versus laparoscopic banding.

## Results and Discussion

Out of the 63 respondents, the sample was primarily female (n=55, 87.3%). The mean age of the respondents was 50 years, with a range from 31 to 64 years. The participants' marital statuses were as follows: married (66.7%), divorced (15.9%), single (12.7%), and widowed (4.8%). The majority of the participants identified themselves as Caucasian (93.7%). The remaining participants' race/ethnicities were as follows: American Indian/Alaskan native 1.6%, African American 1.6%, Hispanic 1.6%, and Asian/Pacific Islander 0%.

The sample was almost even with respect to surgery type; 49.2% (n=31) of participants underwent laparoscopic banding and 50.8% (n=32) underwent gastric bypass. Mean pre-operative and post-operative weights, weight loss percentages, and success rate for all participants are presented in Table 1.

The majority of participants achieved high nutrition knowledge scores (50.8%, *n*=32). Out of all the participants, 42.9% (*n*=27) achieved medium nutrition knowledge scores and 6.3% (*n*=4) achieved low nutrition knowledge scores. The mean score for nutrition knowledge was 28.68 ± 4.31, which is considered medium nutrition knowledge. The scores ranged from 17 to 36. The nutrition knowledge had a total of 36 possible points. Out of the participants who underwent laparoscopic banding, 54.8% (*n*=17) achieved high nutrition knowledge scores with a mean score of 30.06 $\pm$3.32, which is considered high nutrition knowledge. In comparison, 46.9% (*n*=15) of the participants who underwent gastric bypass, with a mean score of 27.34, which was considered medium nutrition knowledge.

The majority of participants were able to identify recommendations for foods that should be eaten more often, the same frequency, or less often, although 69.8% (*n*=44) of all participants were unable to indicate that it is recommended to consume less meat. Out of all participants, 55.6% (*n*=35) were able to correctly answer that fat is the highest in calories per gram compared to protein, carbohydrate and alcohol. Eighty-four percent (*n*=54) of all participants were able to correctly identify that health experts

recommend reducing saturated fat over monounsaturated and polyunsaturated fats. The majority of all participants were able to identify foods that are high or low in protein, although only 61.9% (*n*=39) were able to correctly indicate that milk is high in protein, with 23.8% (*n*=15) of participants indicated that there is more protein in a glass of whole milk than in a glass skim milk. Only 39.7% (*n*=25) of responders were able to identify raisins as the best low fat, high fiber snack when compared to light strawberry yogurt and whole grain crackers and cheese.

Consistent with the nutrition knowledge scores, the majority of participants have compliant nutrition behavior scores (61.9%, *n*=39). Semi-compliant nutrition behavior scores were achieved by 33.3% (*n*=21) and non-compliant nutrition behaviors were achieved by only 4.8% (*n*=3). The mean score for nutrition behaviors was 36.40 ± 4.97, which is considered compliant nutrition behaviors. The scores ranged from 23 to 44. The nutrition behaviors section had a total of 45 possible points. The majority of participants in the laparoscopic banding group had compliant nutrition behaviors (58.1%, *n*=18), while an even higher percentage of participants in the gastric bypass group had compliant nutrition behaviors (65.6%, *n*=21). The mean nutrition behavior scores for laparoscopic banding and gastric bypass were 36.16 and 36.62 respectively, which are both considered compliant.

Out of all participants, only 46.0% (*n*=29) stated they consumed regular, scheduled meals every day and 96.8% (*n*=61) reported that they ate unscheduled snacks during the day. In addition, 93.7% (*n*=59) of responders stated they do other activities while eating, such as watch TV, work on the computer or drive. Forty-three percent of all participants reported that their meals normally consisted of protein, non-starchy vegetable and whole grain, which is the recommended meal composition post-surgery. Out of all responders, 69.8% (*n*=44) took a vitamin and mineral supplement each day, while 60.3% (*n*=38), 69.8% (*n*=44), and 93.7% (*n*=59) did not consume alcohol, carbonated beverages or smoke, respectively. Finally, only 47.6% (*n*=30) indicated that they attended all follow-up appointments with 31.7% (*n*=20) missing two or more appointments. The summary of the nutrition behavior findings are presented in Table 2.

All of the participants indicated positive nutrition attitudes, with a mean score of 19.49 ± 0.88, and a range from 16 to 20. The participants in the laparoscopic banding group had a mean score of 19.61, while the participants in the gastric bypass group had a mean score of 19.37. The nutrition attitude had a total of 20 possible points.

Results also show that those who experienced successful weight loss had more compliant nutrition behaviors (M=37.91, SD=4.84) than those who were not successful with weight loss (M=34.84, SD 4.67). The difference between the two means was statistically significant at $p< 0.05$. Results of the independent samples t-tests are presented in Table 3.

In addition, results show that participants who had undergone laparoscopic banding had high nutrition knowledge mean scores 30.06 $\pm$3.32 than those who had undergone gastric bypass 27.34 $\pm$4.76. The difference between the two means was statistically significant at the $p<0.05$ level. Results of the independent samples t-test are presented in Table 4.

Results also showed that participants who had undergone gastric bypass had higher percentage of EBW loss with mean score of

61.44± 17.35; than those who had undergone laparoscopic banding with a mean score of 44.90 ± 20.13. The difference between the groups was significant at $p<0.05$.

Approximately half (50.8%, n=32) of the participants in this research study were successful with weight loss post-surgery, by achieving greater than or equal to 50% loss of EBW. This is comparable to the results reported by (Kruseman, et al. 2010). They stated that an excess weight loss greater than or equal to 50% was seen in 59% (n=49) of participants in their research study, which is only slightly higher than the results reported for this study.

The results of this study showed that individuals can be successful in losing weight with the assistance of laparoscopic banding or gastric bypass bariatric surgery. (Sjöström, et al. 2007) reported similar findings with a percentage weight change of 8% in 2 years and 11% in 10 years for bypass surgery and 10% in 2 years and 14% in 10 years for laparoscopic banding. In another study, (Sjöström, et al. 2004) found that bariatric surgery resulted in long-term weight loss and improved lifestyle when compared to a control group who did not undergo bariatric surgery. The majority of participants had high nutrition knowledge scores (50.8%, n=32). These findings show approximately half of the individuals were knowledgeable of general nutrition recommendations related to health and wellness.

The majority of participants in this study were compliant (61.9%, n=39) or semi-compliant (33.3%, n=21) with nutrition recommendations reporting a mean nutrition behaviors score of 36.4, which was considered compliant in the context of this study. Parmenter, Waller and Wardle (2000) indicated that the majority of their participants were able to use nutrition knowledge to make healthful choices. Their findings are similar to that of this study. Results of this study showed that participants who had a greater percent excess body weight loss were more compliant with nutrition behaviors. All of the participants indicated positive nutrition attitudes, with a mean score of 19.49. This result may indicate that the bariatric surgery participants at this medical center have positive attitudes towards nutrition and nutrition professionals.

**Table.1** Pre- and post-operative weight data for all participants*

| | All participants (*n*=63) | Laparoscopic banding (*n*=31) | Gastric bypass (*n*=32) |
|---|---|---|---|
| Mean Pre-Surgery Weight (pounds) | 284.33 ± 53.48 | 279.35 ± 48.66 | 289.16 ± 58.14 |
| Mean Post-Surgery Weight (pounds) | 200.45 ± 40.25 | 211.41 ± 42.31 | 189.84 ± 35.67 |
| Mean EBW Lost (percent) | 53.30 ± 20.40 | 44.90 ± 20.13 | 61.44 ± 17.35 |
| Successful Weight Loss (% of participants) | 50.8 | 29.0 | 71.9 |
| Unsuccessful Weight Loss (% of participants) | 49.2 | 71.0 | 28.1 |

*Statistics expressed as mean ± SD

**Table.2** Nutrition behaviors off all participants*

| Nutrition Behavior Questions | All participants (*n*=63) | Laparoscopic Banding (*n*=31) | Gastric Bypass (*n*=32) |
|---|---|---|---|
| Eat regular scheduled meals everyday | 46.0% (*n*=29) | 41.9% (*n*=13) | 50.0% (*n*=16) |
| Eat unscheduled snacks during the day | 96.8% (*n*=61) | 100% (*n*=31) | 93.7% (*n*=30) |
| Do other activities while eating such as watch TV, work on the computer or drive | 93.7% (*n*=59) | 93.5% (*n*=29) | 93.7% (*n*=30) |
| Meals typically consist of protein, non-starchy vegetable and whole grain | 42.9% (*n*=27) | 35.5% (*n*=11) | 50.0% (*n*=16) |
| Take a vitamin and mineral supplement daily | 69.8% (*n*=44) | 67.7% (*n*=21) | 71.9% (*n*=23) |
| Do not consume alcohol | 60.3% (*n*=38) | 71.0% (*n*=22) | 50.0 (*n*=16) |
| Do not consume carbonated beverages | 69.8% (*n*=44) | 77.4% (*n*=24) | 62.5% (*n*=20) |
| Do not smoke | 93.7% (*n*=59) | 90.3% (*n*=28) | 96.9% (*n*=32) |
| Attended all follow-up appointments | 47.6% (*n*=30) | 48.4% (*n*=15) | 46.9% (*n*=15) |

*Statistics expressed as percentage of participants answering out of each group

**Table.3** Differences in nutrition knowledge, behaviors and attitudes between participants with successful and unsuccessful weight loss

| | Successful (*n*=32) | Unsuccessful (*n*=31) | *t*-value |
|---|---|---|---|
| Nutrition Knowledge Score (up to 36) | 28.0 ± 3.45 | 29.39 ± 5.01 | -1.278 |
| Nutrition Behavior Score (up to 45) | 37.91 ± 4.84 | 34.84 ± 4.67 | 2.558* |
| Nutrition Attitude Score (up to 20) | 19.44 ± 0.95 | 19.55 ± 0.81 | -0.498 |

**p*-value <0.05

**Table.4** Differences in nutrition knowledge, behaviors and attitudes between laparoscopic banding and gastric bypass

| | Laparoscopic banding (*n*=31) | Gastric bypass (*n*=32) | *t*-value |
|---|---|---|---|
| Nutrition Knowledge Score (up to 36) | 30.06 ± 3.32 | 27.34 ± 4.76 | 2.623* |
| Nutrition Behavior Score (up to 45) | 36.16 ± 5.25 | 36.63 ± 4.74 | -0.368 |
| Nutrition Attitude Score (up to 20) | 19.61 ± 0.67 | 19.38 ± 1.04 | 1.084 |

*$p$-value <0.05

Finally, this study found that gastric bypass participants had a higher percentage of EBW loss than the laparoscopic banding participants. In this study, it can be stated that gastric bypass was more successful at producing weight loss than laparoscopic banding. This finding is similar to that of (Sjöström, et al. 2007), who found that the participants who underwent gastric bypass had a higher percentage of weight loss than those who had laparoscopic banding.

## Limitations

This study had limitations that are commonly seen in small, survey-based studies that involved participants receiving specific medical care. The sample may be biased because participants were identified through one medical center and were only accepted if they fit the criteria for type of surgery. In addition, the sample size does not represent the general population of bariatric surgery participants.

## Conclusion

This study was one of few to look at nutrition knowledge, behaviors and attitudes of bariatric surgery participants in relation to post-surgery weight status. The results of this study are beneficial to healthcare professionals in the bariatric surgery field by providing the relationship between nutrition behavior and successful weight loss.

Nutrition behaviors were found to be a significantly higher in those who were successful with weight loss. Although, nutrition knowledge was not significantly higher in those with successful weight loss, gastric bypass produced the highest percentage of weight loss amongst this sample, but laparoscopic banding participants had significantly higher nutrition knowledge.

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