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Original Research Article

Analysis of the effect of weight loss through bariatric surgery on depression

Krishna Mohandas^{1,*}, Prema Lalitha², S Krishna Kumar³, K P Haridas⁴¹Dept. of Home Science (Food and Nutrition), Kerala University, Thiruvananthapuram, Kerala, India²Dept. of Home Science (Food and Nutrition), College of Agriculture, Vellayani, Kerala, India³Dept. of Home Science (Food and Nutrition), Various Hospitals, Trivandrum, Kerala, India⁴Dept. of Home Science (Food and Nutrition), Lords Hospital, Trivandrum, Kerala, India

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ABSTRACT

Introduction: Bariatric surgery results in significant improvement in health related quality of life and depressive symptoms irrespective of the wide range of weight change. This experiment was planned to assess the incidence of depression in obese respondents and to analyse the change in depression after weight loss through bariatric surgery.

Objectives: To analyse the incidence of depression in obese individuals undergoing bariatric surgery and the significance of change in depression status after weight loss.

Materials and Methods: The study was conducted in a multispecialty hospital having obesity clinic and bariatric surgery unit. The depression level before the study and at six months post surgery was assessed using a standard tool named Beck's inventory. Study period was from 2015 to 2017.

Inclusion and exclusion criteria: Respondents having BMI of 33-50 Kg/m² belonging to both the genders in the age range of 18-65 years. The respondents having BMI more than 50Kg/m² were excluded in this study.

Sample size: 18 respondents who underwent bariatric surgery were included in the study. Percentage distribution, Pearson correlation coefficient, ANOVA, and Paired t test were the tools utilised in statistical analysis of the data.

Tools used: Schedule to assess change in nutritional status using a structured questionnaire considering anthropometric, biochemical, clinical and dietary parameters, and standard tool named Beck's Depression Inventory, which is a tool for depression status.

Results: The surgery patients had initial Beck Score ranging from 1 to 14 indicating mild depression which on follow up reduced to 0 to 7. The weight loss in both genders were similar to each other. The change in intake of nutrients and the scores of depression were more prominent in men than that of women. Respondents pre operatively had mild mood disturbances which after weight loss, became a normal mood.

Conclusion: Thus it can be concluded that weight loss through bariatric surgery is effective in reducing depression.

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1. Introduction

A person who is obese often faces social stigmatisation in the society and even within families. Social issues and

health problems could affect their life to such an extent that they may develop depression. An Indian cross sectional study by Agarwal, et al (2016)¹ analysed the incidence of metabolic syndrome and central obesity in depression and demonstrated significantly more incidence of metabolic syndrome and central obesity in patients of depression than

* Corresponding author.

E-mail address: krishnamohandas@yahoo.co.in (K. Mohandas).

age and sex matched controls.

If they are able to lose excess weight, their outlook can turn positive and they might get relieved out of depression. Compared to conventional diet and lifestyle modifications, bariatric surgery is a rapid method to induce weight loss. According to Strain, et al (2014),² bariatric surgery results in significant improvement in health related quality of life and depressive symptoms irrespective of the wide range of weight change. Tae, et al (2014)³ also concluded the same and documented the reduction in the use of psychoactive substances too. This experiment was planned to assess the incidence of depression in obese respondents and to analyse the change in depression after weight loss through bariatric surgery.

2. Objectives

To analyze the incidence of depression in obese individuals.

To analyze the significance of change in depression status after weight loss.

3. Materials and Methods

The study was conducted in a multispecialty hospital having obesity clinic and bariatric surgery unit. Respondents who had higher grades of obesity had the opportunity to opt bariatric surgery for weight loss. Many studies have indicated that obese people tend to have depression associated with obesity. The depression level before the study and at six months after the weight loss surgery was assessed using a standard tool named Beck's inventory.

3.1. Inclusion and exclusion criteria

Respondents from both the genders in the age range of 18-65 years having BMI 33-50 Kg/m² were included in this experiment. The respondents having BMI more than 50Kg/m² were excluded in this study.

3.2. Sample size

The sample size aimed was 10. During the study period, ie, from 2015 to 2017, 21 respondents underwent bariatric surgery in the centre, of which two persons were foreigners and one person had BMI of 56 Kg/m². The remaining 18 respondents were included in the study. Percentage distribution, Pearson correlation coefficient, ANOVA, and Paired t test were the tools utilised in statistical analysis of the data.

3.3. Tools used

Schedule to assess change in nutritional status using a structured questionnaire considering anthropometric, biochemical, clinical and dietary parameters, and standard tool named Beck's Depression Inventory,⁴ which is a simple self assessment tool for depression status, was used for

analysing depression score. With this tool, a score less than or equal to 10 is considered normal, 11-16 as mild mood disturbance, 17-20 as borderline clinical depression, 21-30 as moderate depression, 31-40 as severe depression, and over 40 as extreme depression. A score above 17 warrants clinical attention.

4. Results

While examining the demographic profile, it was seen that their age ranged from 24-58 years with a mean value of 39.4±8.7 years (6 male and 12 female respondents). Monthly income ranged from 3750-75000 rupees and the mean income was 22692± 20279 rupees. The education level ranged from senior secondary to professional degree.

Table 1: Anthropometric parameters of the respondents

Parameter (n=18)	Mean ± SD
Weight in Kg	108.06±15.83
BMI in Kg/m ²	40.93±4.12
Body fat percentage	41.19±5.27
Visceral fat percentage	24.63±5.7
Neck circumference (cm)	40.47±3.95
Waist circumference (cm)	120.72±10.97
Waist to Hip ratio	0.93±0.08

All the parameters corresponded to the picture of obesity grade 2 and above. The body fat and visceral fat percentages, neck circumference and waist circumference data clearly depicts the excessive accumulation of fat in the body. Rather than BMI alone, these parameters directed higher risk for impending health problems and undergoing bariatric surgery was a good option to lose weight for them.

The biochemical profile were analysed in depth by the physician and surgeon for assessing the metabolic profile through cortisol, growth hormone, thyroid function test, vitamin D level and ferretin. The results usually expressed an inflammatory profile and sufficient vitamin D level was seen only in one respondent who was already on supplements. The deficient respondents had started to receive supplements pre operatively.

Post bariatric surgery patients face risk for deficiency of iron, thiamine, B12, folate, calcium, vitamin D, protein, fat soluble vitamins and essential fatty acids (IDF, 2011).⁵ Similar observation was made by Al-Mutawa, A et al (2018)⁶ and reported pre op deficiency of Vitamin D, B12, anaemia, and hypervitaminosis B6 and hence advocated a close monitoring and tailored supplementation pre- and post-bariatric surgery. Xanthakos, (2009)⁷ investigated the nutritional status of paediatric and adolescent bariatric candidates and observed that they are at risk of deficiency of several micronutrients including iron, Vitamin D, B12, Vitamin E and Vitamin C before surgery itself and bariatric surgery lead to predictable nutritional deficiencies and can worsen pre existing ones. Hence it is critical to

screen for deficiencies and correct before and after surgery.

The clinical signs and symptoms associated with obesity were analysed and produced a mixed picture. Rather than obesity per se, higher morbidity scores exhibited corresponding lower quality in clinical score.

A study by George, et al (2014)⁸ which assessed the relation between obesity and osteo arthritis concluded that obese persons with osteoarthritis had 10 times more chances of restricting leisure activities and were 15 times more stressed than their non-obese counterparts. A 2016 study by Krishnan, et al.⁹ revealed that the prevalence of definite CAD increased nearly three times since 1993 without any difference in rural and urban areas.

A Netherland study by Libeton, et al (2004)¹⁰ analysed the patient motivation for bariatric surgery and pointed out that health issues dominate the motivation for bariatric surgery but the weight outcome is not affected by these factors.

In 2011, IDF⁵ released a position statement on the role of bariatric surgery which highlighted that it can improve or normalise hyperglycemia, effectively prevent progression of impaired glucose tolerance to diabetes, sustained diabetes remission, reduce diabetes related mortality, substantially improve hypertension, dyslipidemia, and sleep apnoea, and reduce cancer incidences in women.

A 2013 review by Kubik, et al.¹¹ revealed overall improvements in psychopathology, depressive symptoms, eating behavior, body image, and Health Related Quality of Life following bariatric weight loss surgery.

Similarly initial dietary intake was widely varying. The quality of diet was analysed using Alternate healthy eating index which indicated a better diet quality when the score was high. The average intake of important nutrients and the AHEI scores obtained are presented in the following table.

Table 2: Comparison of diet quality and macro nutrient intake of respondents

Parameters (n=18)	Mean ± SD
Energy intake in Kcals	1730.64±827.26
Protein in gm	69.42±32.63
Fat in gm	39.83±15.99
Carbohydrates in gm	276.08±158.73

The diet quality was poor. Though the energy intake was not very high, the intake of protein and fat were notably high. The major variable for this experiment was the depression score which generated a mean value of 7.4±3.9.

4.1. Peri operative nutrition support

Respondents opting for bariatric surgery attended the obesity clinic of the institute. The respondents who were selected for bariatric surgery had to consult the physician, the dietician, and the physiotherapist on the day they consulted the bariatric surgeon. They were evaluated in

detail by the physician before certifying fit for bariatric surgery. The physiotherapist prescribed exercise plan for weight reduction and improvement of respiratory health. The dietician's role was to help achieve weight loss pre operatively and post operatively. As per the hospital policy, preferred procedure is Sleeve Gastrectomy and Mini Gastric Bypass is done in very high BMI, usually near or greater than 40 Kg/m². After surgery, patients are usually started on clear liquids, then slowly progress to liquid diet, full fluid diet and soft diet before progressing to regular consistency diet which provide maximum 1200 kcals daily. It is advised to follow maximum calorie restriction till desired target weight is achieved. (Current Topics in Nutrition, 2021.)¹²

4.2. The depression status

The surgery patients had initial Beck Score ranging from 1 to 14 indicating mild depression which on follow up reduced to 0 to 7 with only one respondent retaining the initial score of 14.

Paired t test was conducted to analyse the significance of change in anthropometric parameters, dietary intake of macronutrients and depression score. The change in weight, excess weight, BMI, body fat percentages, neck circumference and waist circumference were highly significant. The reduction in intake of major nutrients were significant and the reduction of depression score was highly significant. Before surgery scores indicated mild depression with Beck's inventory which lowered to less than 7 after six months.

Ancova analysis shows that the change in anthropometric parameters among both the genders were not statistically different from each other indicating that the weight loss in both genders were similar to each other. The change in intake of energy, protein, fat and carbohydrate were statistically significant and the change in intake of nutrients were more prominent in men than that of women. Same observation was seen in the case of depression score too. The change in body weight and appearance helped in reducing the psychological stress which in turn resulted in the reduction in depression score.

According to Zeller, et al (2009),¹³ adolescent Roux en Y Gastric By Pass results in significant improvement in Health Related Quality of Life and depressive symptomatology over the first postoperative year. Hsu, (2012)¹⁴ highlighted that baseline depression and baseline anxiety were not predictive of weight loss but baseline anxiety was predictive of post surgical depression, anxiety and quality of life.

Similar analysis was carried out based on the type of surgery namely, mini gastric bypass in 6 respondents and 12 in sleeve gastrectomy. Next table shows the Ancova analysis of the significance of change based on the type of surgery.

The weight loss was obviously more with mini gastric bypass compared to sleeve gastrectomy and hence the change in weight and excess weight was statistically

Table 3: Statistical analysis comparing the change in parameters after surgery

Variable	Mean value before surgery	Mean value after surgery	P value
Weight (Kg)	108.7±16.29	85±15.00	<0.0001
Excess weight (Kg)	45.73±13.49	22.64±12.29	<0.0001
BMI (Kg/m ²)	40.93±4.24	31.94±4.25	<0.0001
Body fat percentage (%)	41.19±5.43	35.38±6.44	<0.0001
Visceral fat percentage (%)	24.63±5.89	17.4±6.63	<0.0001
Neck circumference (cm)	40.47±4.07	36.56±2.85	<0.0001
Waist Circumference (cm)	120.72±11.29	107.33±9.37	<0.0001
Waist to Hip Ratio	0.93±0.08	0.92±0.05	0.5493
Protein intake (g)	69.42±33.57	38.77±7.91	0.0009
Fat intake (g)	39.83±16.45	18.69±8.82	0.0001
Carbohydrate intake (g)	276.07±163.33	108.31±25.42	0.0005
Energy intake (Kcals)	1730.63±851.24	757.09±157.98	0.0001
Depression score	7.44±4.06	3.17±3.2	<0.0001

Table 4: Gender-wise comparison of the significance of change

Variable	Males (n=6)		Females (n=12)		P value
	Mean value before surgery	Mean value after surgery	Mean value before surgery	Mean value after surgery	
Weight (Kg)	124.15±15.46	98.87±14.11	100.17±9.47	78.07±10.01	0.2823
Excess weight (Kg)	51.98±15.42	26.7±14.15	42.6±11.89	20.61±11.36	0.2114
BMI (Kg/m ²)	41.93±5.29	33.37±4.75	40.42±3.77	31.23±4.01	0.3881
Body fat percentage (%)	36.45±5.43	27.97±3.87	43.78±3.42	39.08±3.51	0.0027
Visceral fat percentage (%)	26.2±6.61	20.43±6.56	23.91±5.72	15.88±6.39	0.1184
Neck circumference (cm)	45±3.35	39.17±2.56	38.21±1.92	35.25±2.01	0.0024
Waist Circumference (cm)	127±10.32	111±11.82	117.58±10.78	105.5±7.82	0.0575
Waist to Hip Ratio	0.99±0.07	0.94±0.03	0.89±0.07	0.91±0.06	<0.0001
Protein intake (g)	85.56±36.06	38.32±5.14	61.35±30.63	38.99±9.19	<0.0001
Fat intake (g)	57.13±14.91	15.71±6.95	31.17±8.49	20.19±9.54	<0.0001
Carbohydrate intake (g)	276.19±105.31	118.46±26.49	276.01±190.23	103.24±24.41	<0.0001
Energy intake (Kcals)	1964.43±613.74	778.76±178.46	1613.74±950.75	746.26±153.99	<0.0001
Depression score	9.5±5.01	4±5.4	6.42±3.26	2.75±1.42	<0.0001

significant.

In the opinion of Sait, et al (2014),¹⁵ the post bariatric surgery prevalence of anxiety and depression is high compared to general population and recommended pre- and postoperative psychiatric assessment for all bariatric surgery patients. According to Booth, et al. (2014)¹⁶ bariatric surgery may be associated with a modest reduction in clinical depression over the initial post-operative years but this is not maintained. Dawes, et al (2016)¹⁷ had opined that mental health conditions are common among bariatric surgery patients and moderate-quality evidence supports an association between bariatric surgery and lower rates of depression postoperatively.

Susmallian, et al. (2019)¹⁸ pointed out that laparoscopic sleeve gastrectomy is successful and leads to weight loss even in subjects who are affected by depression syndrome

but the loss is lesser compared to those without depression. Mitchell, et al (2014)¹⁹ observed that bariatric surgery has a positive impact on depressive features but data also suggest some deterioration in improvement after the first postoperative year.

According to Yuvan, et al (2019),²⁰ in individuals without a history of depression, bariatric surgery is associated with subsequent diagnosis of depression and pre-surgical psychiatric screening had a reduced depression hazard ratio.

Elkins, et al. (2005)²¹ studied the adherence to recommendations and observed that noncompliance with behavioural recommendations is pervasive following bariatric surgery, with lack of exercise being the most likely area of noncompliance.

Table 5: The change of variables based on the type of surgery

Variables	Mini Gastric Bypass (n=6)		Sleeve gastrectomy (n=12)		P value
	Mean value before surgery	Mean value after surgery	Mean value before surgery	Mean value after surgery	
Weight (Kg)	116.13±18.91	90.2±10.39	104.02±13.93	82.4±16.64	<0.0001
Excess weight (Kg)	55.13±13.59	29.12±9.02	41.03±11.19	19.4±12.73	<0.0001
BMI (Kg/m ²)	43.68±3.82	34.2±2.74	39.55±3.87	30.81±4.52	0.4984
Body fat percentage (%)	42.42±4.11	37.37±6.29	40.68±5.99	34.38±6.54	0.8990
Visceral fat percentage (%)	26.75±3.77	21.43±5.78	23.92±6.42	15.38±6.29	0.3845
Neck circumference (cm)	39.17±1.72	35.5±0.84	41.13±4.78	37.08±3.37	0.0022
Waist Circumference (cm)	122.3±11.20	109±5.29	119.92±11.73	106.5±10.98	0.0582
Waist to Hip Ratio	0.91±0.11	0.90±0.07	0.94±0.06	0.93±0.04	0.0003
Protein intake (g)	77.16±43.13	38.88±8.05	65.55±29.11	38.71±8.19	<0.0001
Fat intake (g)	44.35±18.64	21.87±8.39	37.57±15.61	17.11±8.95	<0.0001
Carbohydrate intake (g)	314.91±269.78	105.01±30.08	256.66±83.15	109.96±24.06	<0.0001
Energy intake (Kcals)	1955.91±1280.14	779.98±190.65	1617.99±577.45	745.66±147.05	<0.0001
Depression score	10.17±4.58	4.67±4.71	6.08±3.14	2.42±1.98	<0.0001

The reduction in food intake induced by mini gastric bypass was greater than that induced by sleeve gastrectomy. The change of nutrient intake among both the groups was statistically significant.

5. Conclusion

Bariatric surgery induced significant weight loss in the respondents at the end of six months and improved the body fat percentages and body circumferences. The respondents who turned up for bariatric surgery did not have clinical depression but only mild mood disturbances which after weight loss, became very low correlating with a normal mood. Thus it can be concluded that weight loss through bariatric surgery is effective in reducing depression.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

Krishna Mohandas, Research Scholar

Prema Lalitha, Former HOD. Department of Home Science

S Krishna Kumar, Consultant Physician & Nephrologist

K P Haridas, Chairman & Managing Director General, Laparoscopic. and Bariatric surgeon

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