Nutritional Intake of Post Bariatric Surgery Patients in an Urban Population

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Abstract: Obesity increases morbidity and mortality rates and decreases the quality of life. Surgical approach of weight management induces sustained weight loss contributed by the reduction in gastrointestinal anatomy with alteration in metabolic physiology and dietary habits. With restricted eating capacity, having nutritionally balanced diet may be challenging. Thus nutrition plays the key role in overall well being of the post bariatric patients. A facility based retrospective study was conducted at Apollo Hospitals, Bangalore, India, on 31 bariatric patients, between the duration of 2014 to 2016. A structured questionnaire was used to elicit information on socio demographic information, anthropometry, dietary history (food frequency, 24 hrs recall method), medical conditions & physical activity level. The data was tabulated and appropriate statistical tests were applied. On analyzing, a significant weight loss of 36.16 ±15.97 kgs was observed with 12.64 kg/m² reduction in BMI. The observed population had sub optimal protein intake of 41.04g ±3.36 g, additionally they were deficient in vital micronutrients such as Calcium, Iron & Fiber. Pre Operative BMI significantly associated with post surgery weight loss (p=0.008). Energy consumption negatively correlated with the observed weight loss (r = - 0.060).

Keywords: Bariatric nutrition, nutritional intake, Obesity surgery, nutrition post bariatric surgery, post bariatric weight loss

1. Introduction

Obesity is now one of the major public health concerns worldwide. Global prevalence of obesity is showing an overall increasing trend. According to WHO, prevalence of obesity has more than doubled since 1980. According to WHO report, 2016, Globally 39% of adult population aged 18 years and above were overweight in 2014, and 13% were obese.

According to a study published in the British medical journal, the Lancet, India saw a more significant rise in obesity from its 19th position for both men and women in 1975 to rankings 5th and 3rd respectively in 2014, reflecting increasing obesity rates among women worldwide [1].

Obesity leads to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (BMI). Raised BMI also increases the risk of certain cancers especially of breast, colon, prostate, endometrium, kidney and gall bladder [2]. Therefore maintaining a healthy body weight is prerequisite for a healthy life.

Conservative treatment of patients with morbid obesity is difficult and prolonged. While attempting to lose weight is common, but actually losing weight and maintaining lost weight is difficult. The patients have to be promptly monitored and followed up on a regular basis to sustain weight loss Therefore surgical management may become necessary. According to a study published on “Videosurgery and Other Minimvasive Techniques 1” on March 2015, “Currently, surgical treatment is considered to be the most efficient method of dealing with morbid obesity”.

Surgical treatment is recommended for patients between 18 and 60 years old with BMI ≥ 40 kg/m² or BMI ≥ 35 kg/m² with obesity related co-morbidities. According to available data from 2011, 340768 bariatric procedures have been performed worldwide [3]. Apparently about 18,000 weight-loss surgeries were conducted in India in 2014 [4].

Bariatric surgeries not only induce the sustained weight loss, but there is a reduction in the gastrointestinal anatomy, also change the metabolic physiology and dietary habits. As a consequence, there is improvement in insulin resistance in type 2 Diabetes Mellitus, reduction in cardiovascular risk factors and decrease in mortality (23% from 40%), have been documented [5].

With the decreased meal portion, having a nutritionally balanced diet may be a challenge for the bariatric patients. The most commonly reported nutritional deficiencies following a bariatric surgery includes iron, calcium, vitamin D, copper, zinc and B12 which can lead to secondary problems, such as osteoporosis, anaemia etc [6,7,8]. Therefore post bariatric nutrition plays a crucial role for successful outcome of surgery & to achieve the long term benefits of the procedure such as reduction in the risk of metabolic diseases & improved quality of life.

Objectives

This study aims to observe the weight loss following bariatric surgery & assess the nutritional intake in terms of quality and quantity.

2. Literature Survey

The prevalence of obesity is increasing globally for decades [1] and consistent evidence are there that obesity increases the morbidity & mortality rates & decreases the quality of life.

In the National Health and Nutrition Examination Study (NHANES) III, obesity was associated with an increased prevalence of type 2 diabetes, gallbladder disease, coronary heart disease (CHD), hypertension, osteoarthritis (OA), and high blood cholesterol among > 16 000 participants [9].
Increasing BMI is further associated with increased risk of all cancers combined in addition to endometrial cancer, adenocarcinoma of the esophagus, kidney cancer, leukemia, multiple myeloma, pancreatic cancer, non-Hodgkin lymphoma, ovarian cancer, breast cancer in postmenopausal women, and colorectal cancer in premenopausal women [10].

Moreover Obesity is associated with non alcoholic fatty liver Disease (NAFLD), obstructive sleep apnea, depression. Obesity is consider as the predictor for NAFLD [11,12]. In a cross-sectional study of 326 Israelis who participated in a National Health survey, the prevalence of NAFLD was 30%; NAFLD was more common in men (38%) than in women (21%), and obesity (BMI ≥ 30 kg/m²) was independently associated with NAFLD (odds ratio 2.9)[13].

The effect of weight gain on sleep-disordered breathing was determined in a prospective study of 2968 men and women in the United States. Baseline mean BMI was approximately 29 kg/m², mean age was 62 years, and participants were examined at baseline and 5 years. An increased number of respiratory events was associated with weight increases. Men with a 10-kg increase in weight had 5.21-fold increased risk of developing > 15 events/hour and women had a 2.5-fold increased risk [14].

A systematic review published on Annals of Translational Medicine, stated that the morbidity and increased mortality of overweight and obesity are substantial and should prompt further attention towards the need for appropriate weight management in health care [15].

Primary principal of losing weight is maintaining a negative energy balance. Unfortunately it is not so easy as it sounds. Losing weight is difficult & further maintaining the lost weight is another challenge. The initial approach for the weight loss is generally the behavioural modification that includes counselling the patients on low calorie balanced diet, encourage physical activity and over all lifestyle changes. A study conducted on post menopausal women for 12 months duration concluded that, lifestyle change involving diet, exercise, or both combined over 1 year improves body weight and adiposity, with the greatest change arising from the combined intervention. Among 399 participants, who followed a log calorie low fat diet observed a weight loss of 8.5% over 12 months period, people who followed moderate-intensity, facility-based aerobic exercise program alone had weight loss of 2.4% while the diet + exercise group observed a weight loss of 10.8% [16].

Although behavioural intervention is successful and upto 10% weight loss can be expected over the period of one year, in long run the lost weight may not be sustained, there exist significant relapse rate. One study with a 42-month follow-up duration, the mean weight reduction was about 7.3 kg, with a mean weight regain of about 62% [17]. A review of long term outcomes of calorie restricting diets, found that as many as two thirds of the dieters weighed more than when they had started dieting 2 years earlier[18]. Another meta analysis published on Journal of Clinical Outcome Management (JCOM) which included 37 studies concluded that there was a pattern whereby weight reduction was effective during the initial 6 to 12 months, followed by a period of gradual weight regain in a large proportion of patients. The effectiveness of long-term weight reduction was dependent on ongoing treatment with a phamaco-logic agent or dietary or behavioural counselling. Surgical therapy is the most effective weight reduction intervention, with results usually sustained over the long term [19].

Until now, individuals with Class III obesity (BMI of 40 or greater) or Class II (BMI of 35 or greater) with co-morbid medical conditions, who have prior unsuccessful weight loss attempts, were considered for surgical treatment of obesity. Recently, a change was made in the consideration of candidacy for weight loss surgery. After reviewing studies on the results of lap band surgery, the FDA lowered the minimum BMI to be eligible for bariatric surgery from 35 to 30, if the patient has a co-morbid obesity-related condition (U.S. Department of Human Services, 2011) [20,21].

The effects of surgical procedures on the patient’s nutritional status are due to the anatomical and physiological changes which decrease the food intake & impair the nutrient absorption. The poor nutrient absorption is one of the explanations for the weight loss reached by using dysabsorptive techniques, such as the bilipancreatic diversion with duodenal switch (BPD), with 25% of protein and 72% of fat no longer being absorbed [22].

Obesity is a complex disease for which traditional treatment has limited success. On average, individuals who have bariatric surgery lose approximately 25% of excess bodyweight within the first 12 months postoperatively [20, 23].

The meta analysis published on PCOM evaluated four randomized controlled trials and 1 prospective cohort study. All studies reported long-term weight reduction observed during the initial 3 to 6 months after surgery. In studies that reported mean weight loss in the study population, the mean weight loss was between 28.4 and 44.2 kg. In these studies, postoperative mortality was low, with one surgery-related death in all studies [24-28].

Data on post bariatric surgery nutritional follow up are limited till date. One study concluded that the median energy intake 3 months after surgery was very low (2971 KJ/day or 710.08 kcal/day), but was significantly increased after 12 months (3840 KJ/day or 917.8kcal/day) in patients had undergone laparoscopic gastric sleeve gastrectomy [29]. Another small study (N = 21) reporting a median intake of 3266 KJ/day (780.6Kcal/day) three months after longitudinal gastrectomy [30]. The study further suggested that one year after Laproscopic Sleeve Gastrectomy, the glycemic control was significantly improved, with lower fasting glucose, insulin, insulin c-peptide, and HbA1c and increased prevalence of patients within the normal range of these parameters except for insulin c-peptide. The circulating level of HDL cholesterol was significantly increased and that of triacylglycerol was significantly decreased. These effects are probably observed secondary to the lost weight.

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In spite of the above mentioned physiological benefits, nutritional deficiencies being the potential complication among post bariatric surgery patients. Anaemia, excessive hair loss, decreased bone mineral density, hypoalbuminemia are some of the commonly observed deficiencies. Another common observation is constipation attributed by insufficient fiber and fluid intake. One study found that 3 years after gastric bypass surgery, even with multivitamin supplementation, as many as 50% of patients had iron deficiency, while nearly 30% had cobalamin deficiency [6, 32].

3. Methodology

A facility based retrospective study conducted at Apollo Hospitals, Bangalore, India on patients who had undergone bariatric surgery between the duration of 2014 to 2016. Total 31 subjects were recruited in the study.

Inclusion Criteria
All the willing morbidly obese patients aged 18–60 years with BMI ≥ 40, or BMI ≥ 35 with co-morbidities such as diabetes mellitus type 2 (DM2), sleep apnoea, or hypertension who had undergone any of the bariatric surgery procedure at Apollo Hospitals between the year of 2014-2016.

Exclusion Criteria
Patients who did not co-operate

Data collection
Firstly, the patients contact details and pre operative anthropometric data were obtained from the Medical Record Department of the hospital and recorded. Secondly, all the patients were contacted via telephonic conversation and the patients who were willing to participate were included in the study after taking written consents.

The recruited subjects were interviewed with a structured questionnaire consisting questions on demographic information, current body weight, dietary pattern, physical activity and post operative health status in terms of co-morbid conditions. Two different approaches were employed to assess the dietary pattern of the subjects i.e. Food Frequency Questionnaire & 24 hours Recall Method. Food Frequency was used to get a fair idea about the dietary attitudes and practices. The nutritive value of the consumed diet (in 24 hrs recall) was calculated using “Indian Food Composition Table” by National Institute of Nutrition, 2017 and obtained data was tabulated to compare with recommended intake.

Analysis was done using SPSS 20 applying Appropriate Statistical Tests to analyse the data.

4. Results & Discussion

The study was conducted on 31 participants of higher middle to higher socio economic group belonging age group between 20-70 years who had undergone bariatric surgery between the duration of 2014 to 2016.

On tabulating the collected data, it was observed more than half of the participants belonged to the age group of 20 to 40years with a figure of 58% and the least amount of participants aged more than 61 years ( 6.5 % ). Therefore , younger obese population was more likely to undergo weight loss surgeries, compared to elder obese population. A surprising difference was seen in gender wise distribution, where percentage of female participants was more than double of male participants. The pre operative BMI of 1/3rd of studied participants was between 45-49.99 kg/m² , followed by 1/4 th of the participants falling under 40-44.99 kg/m² BMI category and only 1 among all patients was having BMI <30. 58% of participants in this study, had undergone sleeve gastrectomy (N= 18) contrary to 40 % patients on whom gastric bypass surgery was performed (12 mini gastric bypass, 1 Roux en Y gastric bypass surgery).

**Table 1:** Distribution of the participants according to demographic characteristics, Pre operative BMI & type of surgery

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Sleeve Gastrectomy</th>
<th>Gastric Bypass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>58.1</td>
<td>41.9</td>
</tr>
</tbody>
</table>

Nutritional profile of the diet consumed was assessed using Food Frequency and 24 hrs recall method. Mean energy and protein intake in the studied population was 977.08kcal±189.84Kcal & 41.04±13.36g respectively, protein being far bellow than the recommended level. Mean energy consumption was similar to the other study [29] where the sleeve gastrectomy patients had a mean energy intake of 917.8kcal/day after 12 months of study. Although, 77.4 % of the participants were non vegetarian (including ovo-vegetarians), only 16.1% of the studied subjects were having adequate protein intake whereas 83.9% were not able to achieve the recommended protein intake, in spite of, Consumption of other vital nutrients such as Calcium, Iron was also compromised with mean intake of 566.7±271.07 and 10.86±4.05 respectively. 60% of participants had insufficient Calcium intake whereas 93.5 % of participants had inadequate Iron intake. The suboptimal intake of iron and calcium probably explain why these two are reported to be some of the most commonly encountered nutritional deficiencies following bariatric surgery. For fiber, the scenario was worst where none of the participants met the daily recommended intake.
The effect of two different bariatric procedures on weight loss and nutritional intake was evaluated. Mean energy consumption of Sleeve gastrectomy and Gastric bypass patients was 1070.83 Kcal ±135.24 Kcal, 894.99 Kcal ±211.51 Kcal respectively & Mean protein consumption 42.78 g ±11.85 g, 38.62 g ±15.37 g. There was no significant association in mean protein intake among two different surgery type groups where as the difference in mean calorie consumption among these two groups were statistically significant with p value of 0.008. Patients who underwent gastric bypass was consuming significantly fewer calories than sleeve gastrectomy patients; may be due to the variation in stomach capacity after these two different procedures.

Table 2: Energy and Nutrient intake by the participants & comparing the actual nutrient intake with recommendation:

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Mean ± SD</th>
<th>Comparison with RDA</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>977.08 ± 189.84</td>
<td>Adequate</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>41.04 ± 13.36</td>
<td>Adequate</td>
<td>5</td>
<td>16.1</td>
</tr>
<tr>
<td>Fiber</td>
<td>11.18 ± 3.37</td>
<td>Adequate</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Calcium</td>
<td>566.72 ± 271.07</td>
<td>Adequate</td>
<td>12</td>
<td>38.7</td>
</tr>
<tr>
<td>Iron</td>
<td>10.86 ± 4.05</td>
<td>Adequate</td>
<td>2</td>
<td>6.5</td>
</tr>
</tbody>
</table>

#Recommended intakes are based on revised RDA, 2011 by Indian Council of Medical Research

Mean energy consumption among female was observed to be lesser than male participants, though the difference was not statistically significant. Consumption of protein, Calcium, Iron & fiber in both gender groups was lower than the recommended level except for calcium in female.

A statistically significant difference was observed in mean calcium intake among two groups with P value 0.031.

Gender wise difference in Nutritional intake

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>1010.83</td>
<td>990.54</td>
</tr>
<tr>
<td>Calcium</td>
<td>416.68</td>
<td>638.14</td>
</tr>
</tbody>
</table>

Figure 1: Energy and Calcium Intake

Mean lost weight was 36.16 kg ±15.97 kg with 12.64 kg/m² reduction in BMI. The observed weight loss was more or less similar to previous research articles where the mean weight loss was between 28.4 and 44.2 kg [24-28]. However, significant statistical difference was not there in the amount of weight loss among two different procedure groups ( p value =0.110 ). The comparison of weight loss in these two bariatric procedures was contradictory than a recent study result on body composition and weight loss in 4 different bariatric procedures, where gastric bypass was observed to be much more effective in losing weight compared to sleeve gastrectomy [33]

Table 3: Comparison of mean energy, protein Intake and weight loss among the participants undergone two different bariatric surgery procedures:

<table>
<thead>
<tr>
<th>N=31</th>
<th>Type of Surgery</th>
<th>N</th>
<th>Mean ±SD</th>
<th>T</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy intake</td>
<td>977.07 ± 189.84</td>
<td>18</td>
<td>1070.83 ± 135.24</td>
<td>2.826</td>
<td>0.008*</td>
</tr>
<tr>
<td>Protein intake</td>
<td>41.04 ± 13.36</td>
<td>18</td>
<td>42.78 ± 11.85</td>
<td>0.852</td>
<td>0.401</td>
</tr>
<tr>
<td>Mean weight loss</td>
<td>36.16 ± 15.97</td>
<td>18</td>
<td>40.07 ± 18.16</td>
<td>1.615</td>
<td>0.110</td>
</tr>
</tbody>
</table>

There was statistically significant difference in weight loss among participants belonging to different pre operative BMI categories. Participants having BMI 40-44.99 had achieved highest level of weight loss post operatively.

Table 4: Effect of Pre operative BMI on the weight loss:

<table>
<thead>
<tr>
<th>Pre operative BMI</th>
<th>F</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss</td>
<td>4.08</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Duration post surgery was highly significantly associated with mean energy consumption by the subjects ( P value = 0.000). Participants who had undergone the surgery within 6 months had less energy intake, which gradually increased as the duration of surgery progresses. Previous literature has also found similar results where median energy intake 3 months after surgery was very low 710.08 kcal/day, but was significantly increased after 12 months [29].

Table 5: Association of energy consumption with duration post surgery:

<table>
<thead>
<tr>
<th>Duration post surgery</th>
<th>F</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy intake</td>
<td>16.37</td>
<td>0</td>
</tr>
</tbody>
</table>

On comparing weight loss with energy intake, a negative correlation was observed with correlation co-efficient of -0.060 i.e. with comparative more calorie consumption lesser weight loss was observed and vice-versa. However the correlation was statistically insignificant.

Table 6: Association of energy consumption with total lost weight

<table>
<thead>
<tr>
<th>Correlation co-efficient</th>
<th>-0.060</th>
</tr>
</thead>
<tbody>
<tr>
<td>P value (2 tailed)</td>
<td>0.747</td>
</tr>
</tbody>
</table>
Meeting protein requirement post surgery was a challenge because of the restricted portions sizes. Therefore 100% of patients were advised on additional low calorie protein supplementation. 83.9% of the participants were not continuing on additional protein supplementation after 6 months of surgery.

![Figure 3: Compliance to dietary supplementation:](image)

5. Conclusion

Bariatric surgery induces significant weight loss with reduction in BMI and thus improves quality of life. However meeting nutritional requirement within restrictive quality is a challenge increasing vulnerability to nutritional deficiencies. Regular nutritional assessments, post surgical follow ups, oral nutritional supplementation, evaluating the adherence to recommendations are effective strategies to meet up the nutritional requirement and is indispensable for successful post surgical outcome.

6. Future Scope

The current study was performed on 31 study subjects- 10 males & 21 female participants and interviewed at one point of time post operatively on their nutritional intake and weight loss. Another similar study may be planned with bigger sample size and the participants can be followed up from pre surgical counselling to post surgery longitudinally along with the biochemical reports to correlate nutrition with sub clinical deficiencies.

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