

ALTERED SENSORY PERCEPTION: THE EFFECTS OF BARIATRIC SURGERY ON TASTE AND SMELL

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ABSTRACT

Introduction: The most effective as well as long-lasting treatment option for obese patients is bariatric surgery. The general practice and some previous literature show that there are changes in perception of taste and smell following such operations. Hence, this study was conducted to take into account this effect of bariatric surgery.

Methods: Our study was cross-sectional and conducted in Surgery Department of Jinnah Hospital, Lahore from January 2023, to December, 2024 over two years' time. After taking the consents of patients who have undergone bariatric surgery, they were questioned regarding altered taste and smell after the surgery. Then the data collected through the interviews on questionnaire was fed into and analyzed using Statistical Package of Social Sciences (SPSS) Version 20. The continuous data was analyzed with the help of Student's t-test while Pearson's Chi-square was applied on nominal data. Significance was considered when p-value was <0.05.

Results: A total of one hundred and sixty-eight patients were evaluated. Almost twenty-eight percent of the patients who underwent the bariatric surgery had experienced changes in smell while twenty-four percent experienced changes in the taste perception. Almost forty-one percent patients agreed that they ate less because of the altered sensory perception. The things which caused most aversion were meat and perfumes.

Conclusion: There are changes in the sensory perception especially taste and smell after bariatric surgery. This also helps in maintenance of body weight after the initial weight loss.

Key words: Bariatric surgery, taste, smell, obesity

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INTRODUCTION

The abnormal or uncontrolled aggregation of adipose tissue inside the human body is called obesity.¹ The

classification of obesity can be done on grounds of body mass index (BMI). The BMI of 18.5 kg/m² to 24.9 kg/m² is considered to lie within normal range while obesity starts from 30 kg/m².² It has multifactorial etiology including genetics, environment, socioeconomic status, behavior and even psychological influences. The underlying pathophysiology is the chronic positive energy balance which is controlled by a complicated interaction of endocrine glands as well as the central nervous system.³ The complete clinical assessment includes gender, age, ethnicity, hormonal balance, associated comorbidities, bone density as well as lean body weight; it also includes the distribution and type of fat tissue.⁴ A study showed 16.71% of the total study population in Pakistan were

obese. Out of these obese patients, maximum patients had class I obesity i.e. BMI 30-34.9 kg/m²). The age group most affected by obesity is 26-39 years (42%). The prevalence in adult population may vary from 15% to 60%. Similar findings have also been noted in China, Canada, the USA, Greece, Korea, Turkey, and England.⁵ The management of obesity is usually done conservatively utilizing lifestyle modifications including diet and exercise and medications. However, their results are limited. Bariatric and metabolic surgeries are backed by international societies as an effective management option for weight loss.^{6,7} The bariatric surgeries either induce a restrictive state or a state of malabsorption. This limits intake of calories intake culminating in sustained weight loss after bariatric surgery. Restrictive bariatric surgeries include adjustable gastric banding (AGB) and laparoscopic sleeve gastrectomy (LSG). The malabsorptive bariatric surgeries include Roux En-Y Gastric Bypass (RYGB) and Biliopancreatic Diversion with Duodenal Switch (BPD/DS).⁸ The changes of bariatric surgery which result in weight loss may be summarized as BRAVE effect (alteration of Bile flow, Reduction of size of stomach, Anatomical rearrangement of gut and Altered nutrient flow, manipulation of Vagus nerve, and modulation of Enteric hormones).⁹ The re-routing of nutrients changes the hormones after ingestion like peptide YY (PYY) and glucagon-like peptide-1 (GLP-1). Other hormones which regulate hunger and satiety are also altered. Hence, patients undergoing such surgeries may have changes in appetite, preferences for food and perception of flavor.¹⁰ A study by Tichansky et al. showed that 82% of gastric bypass patients and 46 % of patients who underwent gastric banding faced changes in their food and drinks.¹¹ Harris and Griffin hypothesized that vagal influence may play a role in taste change after bariatric surgery.¹²

The changes in taste and smell perception after bariatric surgery have not been explored locally to date despite several studies internationally. Hence this study was undertaken to assess the altered sensory perception of taste and smell after bariatric surgery.

METHODS

The topic was reviewed from multiple databases including Google scholar, PubMed and ScienceDirect. The data collection tool of this study was a questionnaire (Annexure) developed based on the literature search. The questionnaire had three sections; each section had a particular objective. The first section collected demographic data (gender, age, co-morbidities) and body weight and height. The second section had questions on

patients' alterations in the taste and smell. The questionnaire was validated by a panel of community medicine experts.

The study was approved from the Institutional Ethical Review Board. The sample size of one hundred and sixty-eight was calculated with confidence level at 80%, absolute precision at 5% and by taking expected percentage of changes in taste after bariatric surgery as 48.6% respectively using the formula $n = Z^2 \cdot 1-\alpha / 2P(1-P) / d^2$. The inclusion criteria of our study were patients who had weight loss surgery in our hospital and were on regular follow up and consented to the study while the exclusion criteria were non-consenting patients. The patients were chosen using non-probability convenient sampling technique. The patient's consent was taken before filling the questionnaire. They were informed that data would be confidential. The patients filled questionnaire about their sensory perception at 6 and 12 months of surgery. A language interpreter was provided when needed.

	Male	Female	Total
	26	142	168
Age	40.2±9.6	39.5±9.5	39.62±9.48
Body mass index	47.4±7.8	44.6±6.8	45.01±6.98
Sleeve	23(88.5)	126(88)	149(88.69)
SPJB	3(11.5)	16(11.3)	19(11.31)
Diabetes mellitus	7(26.9)	27(19)	34(20.24)
Hypertension	3(11.5)	22(15.5)	25(14.88)
SA	4(15.4)	4(2.8)	8(4.76)
Gout	0(0)	1(0.7)	1(0.60)
Joint Pain	2(7.7)	1(0.7)	3(1.79)
MI	0(0)	1(0.7)	1(0.60)

All the data was entered into and analyzed using SPSS Statistics for Windows, Version 20. Frequency and percentages were used to represent qualitative data. The comparison of these proportions was done using chi-square analysis. Mean + standard deviation was used to present quantitative variables. The means were compared using independent sample t-test. These comparisons were considered significant when p-value was ≤ 0.05 . Confounders like gender and type of surgery were ruled out using stratification. The whole process of this study was carried out from January, 2023 to December, 2024 in the surgical ward of Jinnah Hospital, Lahore.

RESULTS

In this study mean age of patients was 39.62±9.48 years. Mean body mass index of patients was 45.01±6.98. Among patients 142 were female and 26 were male. There were 88.69% patients who underwent sleeve gastrectomy and 11.31% underwent SPJB (Sleeve plus jejunal by-pass). Among these patients 34(20.24%) were diabetic, 25(14.88%) were hypertensive, 8(4.76%) had SA, 1(0.60%) patient had Gout, 3(1.79%) had joint pain and 1(0.60%) patient had MI.

Figure-1 describes the changes in taste, smell, things causing aversion and eating less due to changes in taste and smell post-surgery. Figure-2 shows the percentage for food causing aversion at 6- and 12-months post-surgery. As per given trend all foods

(mutton, beef, fish fried food and perfumes) showed increasing trend at 12th month post-surgery. The highest frequency of food causing aversion was beef followed by fish and mutton at 6- and 12-month post-surgery.

Figure-1: Change in taste and smell after surgery

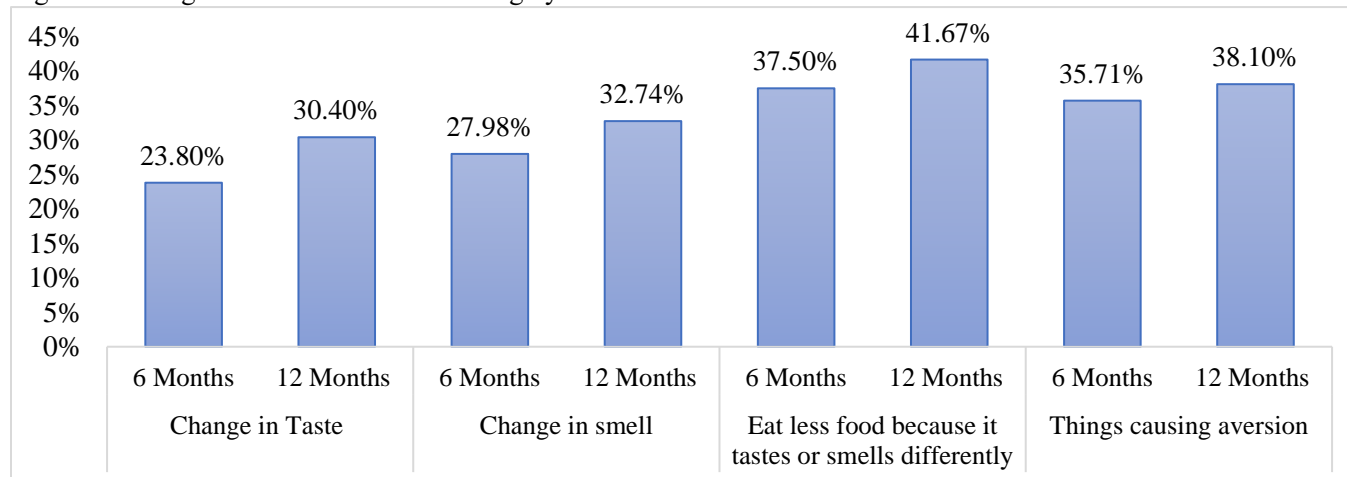
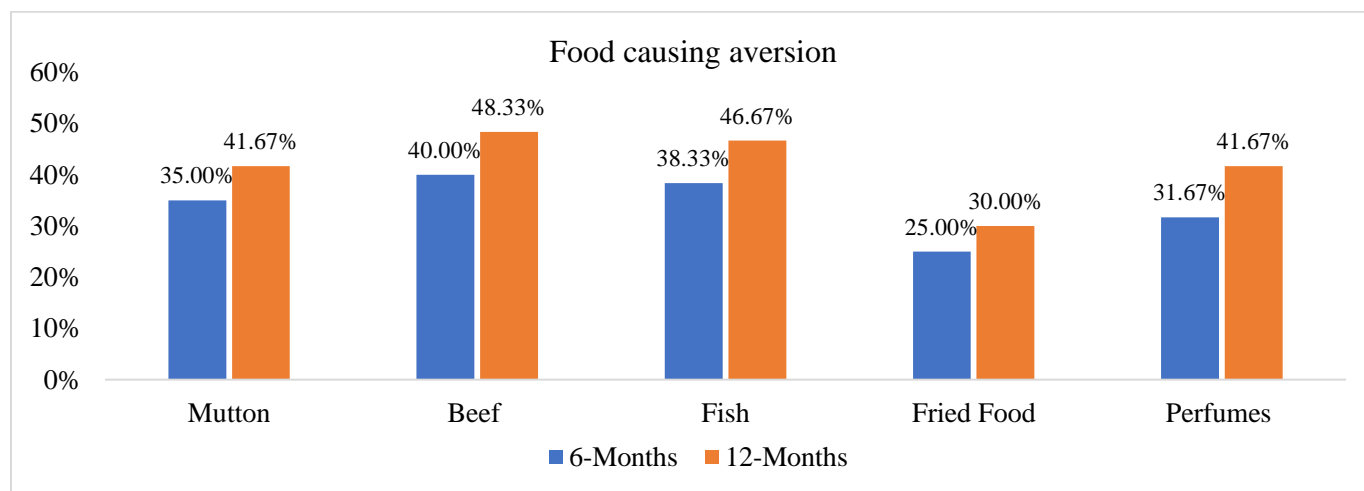


Table-2: Change in Taste & Smell after 6 months and 12 months post procedure

	Months	Type of Surgery		p-value ^(c)	Gender		p-value ^(c)
		Sleeve	SPJB		Male	Female	
Change in Taste	6	35(23.5%)	5(26.3%)	0.787	8(30.8%)	32(22.5%)	0.365
	12	46(30.9%)	5(26.3%)	0.684	9(34.6%)	42(29.6%)	0.608
Change in smell	6	42(28.2%)	5(26.3%)	0.864	10(38.5%)	37(26.1%)	0.195
	12	49(32.9%)	6(31.6%)	0.909	10(38.5%)	45(31.7%)	0.499
Food aversion	6	55(36.9%)	5(26.3%)	0.364	10(38.5%)	53(37.3%)	0.750
	12	59(39.6%)	5(26.3%)	0.262	11(42.3%)	59(41.5%)	0.630
Eat less food because it tastes or smells differently	6	58(38.9%)	5(26.3%)	0.285	10(38.5%)	50(35.2%)	0.912
	12	64(43%)	6(31.6%)	0.344	11(42.3%)	53(37.3%)	0.943

Note: (c) Chi square test

Table-2 describes the changes in taste and smell in relation to type of surgery and gender of patients at 6 months and 12 months' post-surgery. Type of surgery and gender of patients had no significant impact on change in taste, smell, food aversion and eating less food due to its taste or smells differently



DISCUSSION

Bariatric surgeries are a group of surgical procedures performed for helping in facilitating weight loss. The commonly performed bariatric procedures include Roux-en-Y gastric bypass (RYGB) performed laparoscopically or open, sleeve gastrectomy (SG) and adjustable gastric banding (AGB). They have proven their effectiveness over lifestyle modifications and other conservative methods of weight loss for morbid obesity. They also help in maintenance of weight loss over longer periods of time.¹³ The major mechanism by which sleeve gastrectomy and banding play role in weight loss is by restricting food intake while RYGB or bypass impacts by losing calories in the feces inducing a malabsorptive state.¹⁴ The mechanisms for weight loss after bariatric procedures include changes in satiety pattern, preferences for food and energy utilization.¹⁵ It is also believed that GLP-1 signaling increases after bariatric surgery causing a decreased intake of food and decreased body weight after RYGB.¹⁶

On the other hand, the sense of taste is an immensely complicated performance produced by a combination of multimodal neurons located in the orbitofrontal cortex of the brain where all the gustatory, smell and sensory information is integrated centrally. In addition, taste is affected by metabolism as well as hunger which are regulated by two systems i.e. homeostatic and hedonic systems. Bariatric surgeries affect these systems. The hedonic system has showed lesser activation after bariatric surgery demonstrated by magnetic resonance imaging (MRI) as well as a lesser preference for high-energy food ingestion. Some studies have showed better satiety and decreased hunger after such surgeries.¹⁷

Our study concluded that 23.8% of patients had changes in sense of taste while 28% had changes in sense of smell following bariatric surgery. These findings were more profound at twelve months. Our study contradicts study of Lopes et al who showed in a study that 76% of patients who underwent bariatric surgeries had changes in appetite while 48.6% had taste alterations. They also inferred from their study that these findings were similar in patients undergoing sleeve gastrectomy and RYGB. They were also of the opinion that bariatric procedures make changes in the central nervous system, fat tissue and gastrointestinal tract leading to weight loss. Some critical changes also take place in the peptides of gastrointestinal tract like glucose-dependent insulinotropic polypeptide (GIP), glucagon-like peptide-1 (GLP-1), peptide YY (PYY), ghrelin, and cholecystokinin (CCK), and leptin. Some of these chemicals may also interact with the taste receptors of the tongue as well as smell receptors changing the perception of taste and smell. This in turn causes change in taste perceptions. Therefore, our observation is comparable to previous studies in the conclusion that bariatric surgery has critical influences on the peptides of gastrointestinal

tract culminating in weight loss.¹⁸ The difference from the other countries' statistics lies in difference of genetics and environmental factors. A previous study by Pepino et al found no changes in sensitivity to taste sensitivity in patients who received RYGB despite altered food preferences.¹⁹ Melis M et al had contradictory findings to our study. They showed that there were enhanced taste and smell perception after bariatric surgery. According to their study, there was enhanced perception of sweet, umami and fat. This was coupled with enhanced restriction by brain and less disinhibition and hunger. This led to lesser preference and consumption of high calorie food.²⁰

Walmsley R, et al did a systematic analysis for the changes in taste perception after bariatric surgery. They concluded that bariatric surgery resulted in a change in mRNA (messenger Ribonucleic acid) and expression of protein of the intracellular taste (i.e. α -gustducin) as well as amino acid receptor LPAR5 (GPR92/93) changed with this surgery.²¹ This explains the aversion of meat encountered in our study. Our study showed that almost 35% of patients had aversion to mutton and beef after bariatric surgery. The only drawback to such aversions is potential nutrient deficiencies which may result due to excessive deprivation and may need a specialist nutritionist intervention to manage such problems. Our study is consistent with findings of Kitrell et al that before bariatric surgery meat especially red meat was referred to be a favourite food. This preference mounted to almost 68%. After surgery, however, favorite meat was mostly grilled or baked chicken.²² A study by Jurowich et al was carried out to assess the changes in olfactory perception after bariatric surgery. Sniffing test-based scores were calculated. The results of the study report improved olfaction after sleeve gastrectomy but not RYJB.²³

Our study is first of its kind to study the effect of bariatric surgery on taste and smell perception in Pakistani population.

The limitations of our study include that it is a single center study evaluating short term effects of bariatric procedures. Hence, this study opens venue for further studies with more objectified assessment of perception as well as long term effects in this regard.

CONCLUSION

Bariatric surgery's ability to alter taste and smell perception is a testament to its far-reaching benefits. By not only facilitating weight loss but also transforming the way patients experience food, bariatric surgery offers a comprehensive solution for those struggling with obesity. A drawback to such side effect might present a nutrient deficiency in which case nutritionist intervention must be acquired.

ETHICAL APPROVAL

Ethical approval was granted by the Ethical Review Board of Allama Iqbal Medical College/ Jinna Hospital, Lahore vide reference No ERB181/8/16-01-2025/SI

CONFLICT OF INTEREST:

Authors declare no conflict of interest.

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AUTHOR'S CONTRIBUTIONS

MUJ: Supervision, critical review and data collection

GEL: Concept design and manuscript writing

SMM, MTN, MSA: Data analysis and critical revision

KK: Manuscript writing

ALL AUTHORS: Approval of the final version of the manuscript to be published

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