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Short-Term Pilot Study of the Effect of Sleeve Gastrectomy on Food Preference

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Abstract

The effect of vertical sleeve gastrectomy (VSG) on food preference has not been examined in humans, but VSG decreases preference for fat and calorically dense foods in rodents. A validated Food Preference Questionnaire (FPQ) assessed food preference changes before and 6-weeks after VSG in humans. The FPQ was completed before and 43 ± 19 days (Mean ± SD) after VSG. Fifteen subjects (14 females) completed the study. Hedonic ratings decreased for foods high in fat and sugar ($p = 0.002$) and high in fat and complex carbohydrate ($p = 0.007$). Fat preference ($p = 0.048$) decreased, VSG reduced preference for calorically dense foods high in fat, sugar and complex carbohydrate, and these changes may contribute to the weight loss with VSG.

Keywords

Food Preference; Obesity Surgery; Sleeve Gastrectomy

Background

Calorie intake is reduced after bariatric surgery. Roux-en-Y gastric (RYGB) reduces preference and consumption of sucrose in rodents and humans (1). A rodent study documented a reduction in fat and calorically dense food intake after vertical sleeve

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Conflict of Interest Statement

Conflicts of interest for Frank Greenway and Paula Geiselman are included on the attached ICMJE Form for Disclosure of Potential Conflicts of Interest. Brandon Ammon, Drake Bellanger, Stephany Primeaux, and Ying Yu have not conflicts of interest to report.

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study.

Statement of Human and Animal Rights

The studies have been approved by the Pennington Biomedical Research Center Institutional Review Board and have been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

gastrectomy (VSG), but the effect of VSG on food preference has not been evaluated (2). We hypothesize that short-term change in human food preferences after vertical sleeve gastrectomy will mirror changes seen in rodents.

Palatability is a major determinant of food selection and total caloric intake, and dietary-induced obesity in both humans and animals has been attributed to enhanced responsiveness to palatable foods (3). Significantly more food is ingested when it is highly palatable than when it is less palatable, and obese individuals ingest significantly more in response to highly palatable food stimuli than do normal-weight people (3).

In comparison with other macronutrients, dietary fats have greater energy density, and this is thought to be another contributing factor to the hyperphagia, or passive overconsumption, which can occur with exposure to high-fat foods (3). Bray and Popkin conducted an extensive review of both the clinical and the animal literature and concluded that higher dietary fat consumption is associated with higher total caloric intake and the development of obesity (4). If subjects undergoing vertical sleeve gastrectomy shift their preference from foods with high energy density macronutrient profiles to foods with lower energy density, this could add to the calorie decrement associated with the surgically induced reduction in food volume consumed. These changes in food preference would lead to a reduction in energy intake and bodyweight, although additional effects of mechanical restriction provided directly by sleeve gastrectomy may also play a role in weight loss (5).

Methods

This study included male and female subjects over 18 years of age and scheduled to undergo a vertical sleeve gastrectomy for obesity. All sleeve gastrectomy operations were performed between July 2013 and September 2013 by a single community surgeon (DEB).

The study consisted of a pre-operative and a six-weeks post-operative visit to a community bariatric surgery practice. After giving informed consent and providing demographic information subjects rated their hunger on a 9-point Likert scale with the following anchors: 1 = not at all hungry and 9 = extremely hungry at each visit so that hunger could be related to food preference ratings. At each visit, patients completed a validated Food Preference Questionnaire (FPQ) (6). A Likert scale is a rating scale with check-box rankings that, in this case, ranged from 1 to 9. The FPQ was developed using a 2 (Fat: High Fat and Low Fat) $\times$ 3 (Carbohydrates (CHO): High Simple Sugar, High Complex CHO, and Low CHO/High Protein) design. This instrument contains a total of 72 foods with 12 foods in each of the six categories listed in random order. Subjects rated each food hedonically on a 9-point Likert scale with the following anchors: 1 = dislike extremely; 5 = neutral, neither like nor dislike; 9 = like extremely. The FPQ also yields a fat preference score (mean rating for high-fat foods divided by mean rating for low-fat foods on the FPQ). Participants received a \$5 gift card after each administration of the FPQ as compensation for their time. Data was analyzed using paired students-t tests performed using SAS (SAS Institute Inc, Cary, North Carolina). Statistical significance was set at $p < 0.05$. The study was approved by the Pennington Biomedical Research Center IRB and registered on [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT02124993).

Results

Twenty-seven subjects participated in the study and completed a pre-operative questionnaire. Twenty-two subjects underwent sleeve gastrectomy, but only 15 subjects (4 African-American and 10 Caucasian) returned a post-operative questionnaire. Results were analyzed using the 15 subjects (14 females, 1 male) who underwent the operation and completed both questionnaires.

The age of the 15 subjects who completed the study was (Mean $\pm$ SD) 45 ± 10 years, and their body mass index (BMI) was 44.85 ± 10.37 kg/m². The post-operative questionnaire was completed 43 ± 19 days after the sleeve gastrectomy. Subjects achieved a percent excess weight loss of 22.14 ± 10.33 ($p < 0.0001$), a percent weight loss of 10.13 ± 3.95 % ($p < 0.0001$), and a percent excess BMI above 25 kg/m² loss of 26.39 ± 13.42 ($p < 0.001$) at the time of the second questionnaire.

There was no significant difference in hunger rating among 15 subjects who completed both the pre-operative and postoperative FPQs between the two time points. There was -0.27 ± 1.03 ($p = 0.7995$) in hunger ratings making it unnecessary to adjust the results of the FPQ for changes in hunger. FPQ results are detailed in Table 1. Postoperative hedonic ratings were significantly decreased for foods high in fat and sugar content ($p = 0.002$) and for foods high in fat and complex carbohydrate content ($p = 0.007$). The fat preference score decreased ($p = 0.048$) following surgery. There were also non-significant statistical trends for decreased ratings of high-fat ($p = 0.087$) and high-complex carbohydrate ($p = 0.056$) foods postoperatively.

Discussion

Six weeks following VSG, patients' hedonic ratings were significantly decreased ($p < 0.01$) for foods high in both fat and sugar content as well as for foods high in both fat and complex carbohydrate content. Fat preference was also significantly decreased postoperatively. These results, showing a decrease in palatability of foods with a specific macronutrient content, may have important implications for the control of appetite, food intake, and body weight in these patients.

Previous studies show food preferences in rodents after sleeve gastrectomy increased for low fat and less calorically dense foods (2). Our human study demonstrated, in addition to decreased preference for foods high in fat in combination with complex carbohydrates, subjects also showed decreased preference for foods high in fat in combination with high sugar. A previous study in humans noted a decreased preference for starch based products and an increased preference for semi-solid milk products and eggs 18 months after sleeve gastrectomy (7). This study seems to agree with some of the findings we observed.

Vertical sleeve gastrectomy may provide an additional benefit over other restrictive and restrictive/malabsorptive bariatric operations by decreasing preference for foods high in fat in combination with high complex carbohydrates. Human studies show that food preferences after Roux en Y gastric bypass operation are decreased for foods high in fat and sugar. A decreased preference for foods high in fat combined with carbohydrate was not reported (1).

Jejunioileal bypass operations in humans showed that changes in taste were limited to a decrease in preference for foods high in sugar (8).

A potential weakness of this study is the short-term follow-up of the study population, since it is not known whether the changes in food preference extend further than 6-weeks post-op, whether the immediate post-operative period affected food preference and/or whether these changes in food preference exist when weight loss has plateaued. The questionnaire, however, measures what subjects want to eat, not what they are eating which may still be restricted at 6 weeks post-operatively. Another potential weakness of the study is the largely female population. It has been reported that obese men's favorite foods are high in fat and protein such a meat while women prefer high fat and high sweet foods like chocolate (9). Thus, unrelenting preferences for high fat/high sugar foods may contribute to the difficulty obese women have in the control of appetite, food intake, and body weight. These differences in food preference could indicate the findings observed in our study are limited to the female population. However, it should be noted that females comprise 79% of the patients undergoing bariatric operations (10).

Although the findings from this study suggest a reduction of energy intake will be associated with a reduction in preference for high calorically dense food, this presumption should be verified by measuring food intake with an accurate method of assessing food intake such as remote food photography, since self-reported food intake is inaccurate (10). Also, future studies should take greater efforts to control for hunger, because it is recognized that changes in hunger could pose a potential confounding variable.

Conclusions

The vertical sleeve gastrectomy produces mechanical restriction that will reduce food intake. In addition, our results suggest that this bariatric procedure may also be effective in controlling appetite by producing a decrease in perceived palatability of foods with a specific macronutrient content that may be problematic with respect to the control of appetite and, thus, food intake. This may be especially true with respect to obese women who tend to prefer high-fat/high-sugar foods. Based on the literature, one would expect that a perceived decrease in palatability of these foods would be associated with a decreased appetite for these foods. As 14 of our 15 patients were women, our results suggest that the vertical sleeve gastrectomy may be very effective in appetite control, especially in women. Further studies to confirm this hypothesis, following food preferences over a longer post-operative period and using an accurate method of assessing food intake like remote food photography are indicated.

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Table 1
Average changes in hedonic ratings of foods and fat preference scores after vertical sleeve gastrectomy (n=15)

Macronutrient Content of Foods	Pre-op	SD	Post-op	SD	Change	SD	p-value
HS	6.17	0.89	5.73	1.70	-0.44	1.41	0.243
HCCHO	6.06	0.86	5.05	1.77	-1.01	1.88	0.056
HP	6.50	0.89	6.34	1.35	-0.16	1.38	0.668
HF	6.34	1.07	5.60	1.64	-0.74	1.54	0.087
LF	6.10	0.81	5.95	1.36	-0.15	1.41	0.696
HF/HS	5.99	1.65	4.50	2.22	-1.47	1.28	**0.002
LF/HS	6.36	1.24	6.29	1.51	-0.07	1.52	0.861
HF/HCCHO	6.26	1.23	4.87	1.79	-1.47	1.72	**0.007
LF/HCCHO	5.86	0.93	5.19	1.65	-0.65	1.83	0.209
HF/LCCHO/HP	6.82	1.04	6.43	1.34	-0.38	1.49	0.335
LF/LCCHO/HP	6.12	1.13	6.23	1.50	0.12	1.57	0.778
FPS	105.68	22.20	94.52	19.07	-11.17	19.93	*0.048

HS – High Sugar, HCCHO – High Complex Carbohydrate, HP – High Protein, HF – High Fat, LF – Low Fat, HF/HS – High Fat and High Sugar, LF/HS – Low Fat and High Sugar, HF/HCCHO – High Fat and High Complex Carbohydrates, LF/HCCHO – Low Fat and High Complex Carbohydrate, HF/LCCHO/HP – High Fat, Low Complex Carbohydrate, and High Protein, LF/LCCHO/HP – Low Fat, Low Complex Carbohydrate, and High Protein, FPS – Fat Preference Score.

* indicates significance of $p < 0.05$.

** indicates significance of $p < 0.01$