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RESEARCH

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Food Selections of Roux-en-Y Gastric Bypass Patients up to 2.5 Years Postsurgery

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ABSTRACT

Bariatric surgery forces participants to undergo a volatile dietary adjustment. The purpose of this cross-sectional research was to chronicle food selection during the period from when solid food is reintroduced through 2.5 years. Forty-eight postsurgery Roux-en-Y gastric bypass patients participated in the research. Each food item selection was recorded from a list of foods that consisted of 236 individual foods. Food item selection was then categorized into one of nine conventional US Department of Agriculture–based food-groupings (eg, Dairy). No food selection differences were detected between the men and women in the study. Mean weight loss since surgery was 53.6±20.6 kg. Mean time since surgery was 11.1±7.0 months for the 35 female and 13 male patients. The food selection categories ranged from 63.2% for Condiments to 28.3% for Sweets. Next, food selections were reclassified into 31 more specific bariatric subgroups (eg, Cheeses, Milks, Yogurts). Bariatric subgroup intake ranged from 84.2% for Bottled/Tap Water to 4% for Sugared Beverages. Several group homogeneity differences existed between conventional and bariatric subgroups. Subgroup means were statistically different for the conventional categories of Dairy, Sweets, and Beverages ($P>0.05$). These differences demonstrate that the standard benchmarks of conventional food groupings sometimes fail to represent accurately food selection in this population. This type of more specific classification information improves eating recommendations provided by dietetics practitioners. Just as exchange food groups are of great value to patients with diabetes, these more specific bariatric food subgroups represent a needed increase in accuracy in dietary recommendations for patients after Roux-en-Y gastric bypass.

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Gastric bypass surgery, such as Roux-en-Y gastric bypass (RYGB), permanently changes food selection and commonly forces food restrictions for physiological reasons such as food intolerance and altered food perception (1,2). Unpleasant intolerance symptoms include vomiting, esophageal impacted food, nausea, and diarrhea (3). Changes in smell and taste acuity by patients after RYGB also are associated with a modified dietary intake. Some food items and food groups are often avoided because they cause a sour, metallic, or bitter taste (4).

Regardless of time since surgery, patients after RYGB are found to continue experimentation with food selection and to test food tolerance limits (5). Many patients exhibit long-established presurgery dieting behaviors and demonstrate a preference for energy-restrictive so-called diet foods. Among these patients, although some popular lower-fat food items cause intolerance symptoms, intakes of both low-fat and nonfat food items remain significantly higher than regular food items (6). Because of the importance of adequate food selection to overall health, evaluation of food intolerance—and thus food selection—is important as a part of the overall evaluation for potential bariatric surgery patients (7).

Barring any medical complications, nutrition recommendations following bariatric surgery fall into three distinct time periods. Following surgery, there is rapid weight loss, and food intake consists of a liquid or soft diet plus dietary supplements until solid food can be regularly tolerated. Three months postsurgery usually marks a return to solid food. The second phase, identified as the Dietary Adjustment Phase (DAP), begins at 3 months and is characterized by a quasi-normal solid diet with a high degree of intolerance to various quantities and varieties of foods. Intolerances are commonly associated with both individual and whole food groups during the DAP (8). Patients learn symptomatic food items through trial and error. Continued weight loss and/or weight maintenance is typical for approximately 2 to 2.5 years (9). The third postbariatric surgery nutrition phase is associated with weight maintenance as well as potential physiological adaptation to various foods with an ability to tolerate larger portion sizes. These patients are at risk of weight regain unless some form of energy intake control is followed.

This research examined the DAP of patients 3 months to 2.5 years postsurgery. During this period, the main,

but not only reason for dietary adjustment is the physiological intolerance to various foods. Common types of reported intolerances are: food becoming stuck, also known as plugging; dumping syndrome; dizziness; and nausea (10). Regardless of the type of intolerance experienced, these events all influence future food selection.

To date, there exists little empirical research data on which to base food intake recommendations for the bariatric population. Individual problematic food items and large conventional food groups are the only currently available means to counsel bariatric patients in the highly volatile DAP (11,12). By establishing narrow baseline bariatric food subgroups, based on the popularity of food items, dietetics practitioners can better counsel patients with more practical food choice recommendations.

MATERIALS AND METHODS

Study Sample

Participant selection was obtained from a single Long Island, NY, office of two bariatric surgeons over a period of several months. This sample of convenience was collected from August 2005 through March 2006. Data were collected during routine postsurgery office visits. Only bariatric surgery patients receiving the RYGB procedure were considered. Age and sex were not determining factors in selection. People experiencing postoperative complications such as anemia and infection were excluded from consideration. All participants were required to be least 3 months postsurgery and no more than 2.5 years postsurgery. An open-ended bariatric food item inventory list was administered to 48 participants, all in the DAP and meeting basic criteria. In pretest–posttest results on 12 individuals, separated by 2 weeks, all food selection lists reported Cronbach's α coefficient of test reliability acceptable at above .80. The authors' attest that all applicable regulations concerning the ethical use of human volunteers were followed during this research. The C.W. Post Institutional Review Board of Long Island University and North Shore Long Island Jewish Health System evaluated, edited, and approved this project as ethical and both maintain records of its approval.

Procedures

Qualifying bariatric surgery patients arriving for a routine postsurgery office visit were asked by their doctors whether they would participate in this project. All eligible patients asked to participate in this study agreed, reflecting 100% participation. The RYGB procedure participants provided basic demographic- and surgery-related information. In addition, participants answered a current consumption food inventory list. This consisted of self-reported yes or no responses to a series of food items that make up their current dietary intake. The food item list contained numerous foods and food preparation method items. To account for unusual, ethnic, or cultural food consumption, blank food-selection item space was provided at the end of each food category. The final food item count was 236 distinct food items. The aim of the inventory was to capture all possible food items that were commonly eaten in the population of patients having undergone RYGB. This inventory list with demographics was reviewed for completeness and content by experts in bariatric surgery, clinical bariatric nutrition, nutrition, and nutritional research.

Table 1. Demographic characteristics of Roux-en-Y gastric bypass patients who completed a postsurgery food selection inventory

Characteristic (n=48)	Mean±standard deviation	Range
Age (y)	42.6±7.1	32-59
Time since surgery (mo)	11.1±7.0	3-29
Weight lost (kg)	53.0±20.6	18.4-72.8

Conventional Food Group Arrangement

All food item selection responses from the inventory were initially grouped into one of nine different broad categories called conventional food groups. These were based on the US Department of Agriculture's MyPyramid (13). The Grain, Fruit and Vegetable, Dairy (milk), Meat and Bean, and Oil (plus fats) groups were unaltered categories from MyPyramid. In addition, Condiment, Sweet, Beverage, and Mixed Dish (eg, casseroles) groups completed the categories. These conventional food groups ranged in size from five to 54 food items.

Bariatric Food Group Arrangement

To clarify food choices, each food item was classified not only to a larger conventional food group but also to a smaller subgroup (eg, Fruits and Vegetables contained cooked vegetables, raw vegetables, fresh fruit, and canned fruit). Each food was included in one of these 31 subgroups, which were based on headings found in Bowes & Church's *Food Values of Portions Commonly Used* (14). These more specific subgroups were called bariatric food subgroups and ranged in size from two to 13 food items.

STATISTICAL ANALYSIS

Statistical analysis was completed using the Statistical Package for the Social Sciences (version 15.0.1, 2006, SPSS Inc, Chicago, IL). An item selection frequency percentage was calculated for each conventional food group and for each of the bariatric food groups. After correction for duplicate foods in the conventional food group, statistical analysis using unpaired student t tests compared each conventional food group with the applicable bariatric subgroupings. A significant difference between the means would provide support toward the use of smaller bariatric food groups to elucidate food choices for patients with RYGB. Statistical significance was set at the $P<0.05$ level.

RESULTS

Table 1 illustrates the demographic data of participants. The mean age was 42.6±7.1 years with 73% female and 27% male. The time since surgery ranged from 3 to 29 months, mean 11.1±7.0 months. Mean weight loss since surgery was 53.6±20.6 kg, in concurrence with other reported RYGB surgeries (9). Table 2 includes the average food group selection frequency by participants for both the conventional food groups and the bariatric food

Table 2. Self-reported mean food group selection rates for conventional food groups and the more specific bariatric food subgroups of patients having had Roux-en-Y gastric bypass (N=48)

Conventional food group	Food group mean selection rate (%)	Bariatric food subgroup	Food group mean selection rate (%)
Condiments (5 items)	63.2		
Fruits and Vegetables (40 items)	53.5	Vegetables, cooked (11 items)	56.7
		Fruits, fresh (13 items)	55.5
		Vegetables, raw (13 items)	52.6
		Fruits, canned (3 items)	36.8
Fats and Oils (13 items)	48.8	Light, low-fat, nonfat (7 items)	50.0
		Regular (6 items)	47.4
Dairy (18 items)	45.5	Cheese (4 items)	69.1*
		Cottage cheese (2 items)	44.7
		Yogurts (4 items)	43.4
		Ice creams (3 items)	39.0
		Milks and creams (5 items)	38.4
Meats and Beans (54 items)	42.9	Beef (5 items)	60.5
		Poultry (12 items)	51.5
		Deli meat (4 items)	44.1
		Seafood (12 items)	43.9
		Pork (5 items)	33.2
		Legumes (8 items)	41.5
		Eggs (8 items)	37.5
Beverages (24 items)	34.2	Water, bottled/tap (2 items)	84.2*
		Coffee and teas (5 items)	46.3
		Low-energy beverages (5 items)	45.8
		Juices, 100% (4 items)	25.0
		Juices, diluted 50/50 (4 items)	19.1
		Sugared beverages (4 items)	04.0*
Mixed Dishes (16 items)	33.6	—	—
Grains (43 items)	30.2	Breads, toasted (7 items)	36.8
		Grain-based snacks (9 items)	31.3
		Breads, untoasted (13 items)	29.2
		Pasta and rice (4 items)	27.3
		Cereals (4 items)	26.6
Sweets (23 items)	28.3	Artificial sweets (7 items)	42.9
		Sweets (16 items)	21.9*
Mean study food selection (236 items)	41.0	—	—

*Indicates a significant student's unpaired *t* test for conventional food groups against bariatric food subgroups ($P<0.05$).

subgroups. Single food items not consumed by any study participants included heavy cream, regular caffeinated and noncaffeinated colas, regular fruit-flavored drinks, and Pedialyte (Abbott Laboratories, Columbus, OH). Almost all participants consumed bottled water (98%). The average selection rate for the nine conventional food groups ranged from a high of Condiments (63.2%) to a low selection of Sweets at 28.3%. The bariatric food subgroup frequency ranged from a high of 82.4% for bottled/tap water to a low of 4% for sugared beverages. Using unpaired Student *t* tests, several significant observations between bariatric food subgroup frequencies and their corresponding larger conventional food groups were drawn from the data (Table 2).

There were no differences between the conventional food group of Fruits and Vegetables and the bariatric subgroups. Despite numerous nutrition professional recommendations for all bariatric patients to cook vegetables for increased tolerance, no significant food selection difference was reported between raw vegetables (56.7%, 13 food items) and cooked vegetables (52.6%, 11 food items) in the bariatric subgroups.

There also was no difference between average food selection rate for the conventional food group of Fats and Oils and the bariatric subgroups. There was a 45.5% average selection rate for the conventional Dairy group (18 foods). Within the Dairy group, cheese was the most frequently selected item with 69.1% of participants. This difference was significant from the other subgroups at $t=3.42\pm6.78$; $P=0.003$, degrees of freedom (df)=20.

The average food selection for the conventional group of Meat and Beans (54 food items) was 42.9%. Although not significantly different, the bariatric subgroup of beef (60.0%) was selected nearly twice as often as the bariatric subgroup eggs (37.5%). A larger study would improve the sensitivity of the statistics and likely determine such differences as significant. The average selection rate for the conventional Beverage group, including water (24

food items), was 34.2%. The bariatric subgroup bottled/tap water, at 84.2%, was statistically different from the other bariatric subgroup frequencies ($t=3.75\pm9.09$; $P=0.001$, df=26). In addition, the 4% selection rate for sweetened beverages was dissimilar from the conventional Beverage group ($t=-2.51\pm9.71$; $P=0.019$, df=25).

Toasting food is recommended for bariatric patients to decrease the likelihood of bread products becoming obstructive in the digestive tract. Based on the selection of toasting bread products (36.8%, seven items), no meaningful difference against untoasted bread products (29.2%, 13 items) was seen for these bariatric subcategories. The conventional group of Sweets consisted of 23 food items with an average consumption rate of 28.3%. The bariatric subgroup of artificial sweeteners was significantly different and twice as popular at 42.9% (seven items) as the bariatric subgroup sweets at 21.9% (16 items) ($t=4.86\pm3.62$; $P=0.0001$, df=21).

DISCUSSION

The conventional food groups of Condiments and Mixed Dishes had no corresponding bariatric subgroups. For three of the remaining seven conventional groups there was a significant difference in the average food selection rate for the overall food group and at least one of the bariatric subgroups. These differences were found in the Dairy, Beverages, and Sweets conventional groups. Cheeses and bottled water were more frequently chosen whereas sweets and sugared beverages were less or, as in the case of sugared beverages, rarely chosen. This observation demonstrates that more accurate food selection information is obtainable when the conventional food groups are subdivided into smaller more specific groupings. The more specific bariatric subgroup classification system provides a means to better interpret both healthful and harmful eating behaviors in this population.

With a reported history of dieting behavior, it was expected that this population would select more fat/oil grouped foods that were low-fat or nonfat than regular fat/oil group foods. This research showed the subgroup choice of regular fat/oils was almost identical (47.4%) to the reduced fat/oil subgroup of low-fat or nonfat foods at 50.0% selection. These types of unexpected food selection findings point dietetics practitioners to dietary areas that are highly problematic for this population. With this type of information, nutrition practitioners can more easily pursue individual dietary resolution.

Increasing numbers of people have had RYGB surgery. The American Society for Metabolic & Bariatric Surgery estimated that more than 205,000 people in the United States had some form of bariatric procedure in 2007. With such a large and growing population, the reintroduction of a normal diet to these patients is clearly of importance. Establishing and maintaining proper nutritional status and avoiding maladaptive eating habits remain a challenge for dietetics practitioners (12). Complicating matters is that almost all clients suffer multiple food item intolerances (5,7). Previously, bariatric research focused its efforts simply on maintaining adequate nutritional status during the time of rapid weight loss with little or no individual regard to the importance of long-term food choice behaviors (5,15).

This research emphasizes a specific food selection classification system to enumerate and, thus, improve dietary recommendations during the DAP. An additional benefit of more detailed food item recommendations may be an increase in compliance.

Typical US Department of Agriculture–based conventional food groups are useful in a general nutrition practice. Typical nutrition clients do not require food substitution on such a precise scale. Their need for counseling varies greatly, favoring the general, more flexible conventional food grouping system. However, these extended food groups do not adequately meet the specific food selection needs of a patient who has had RYGB.

Before this project began, questions persisted about the willingness of bariatric surgery participants to give the time and effort to complete a food item inventory of more than 12 pages. Given the eagerness and 100% compliance seen in this sample, a lengthy inventory list is not a concern for future research in the bariatric population. Through examination of food selections of RYGB patients, a better understanding of food variety can be determined. Change in food variety has been associated with maintaining weight loss in patients with RYGB (16). Therefore, a thorough examination of food selection variety over time can be used as an indicator of relative risk of regaining weight in this population.

Conventional food category Dairy's selection rate was 45.5%. The bariatric subgroups of cottage cheese, yogurts, ice creams, and milks/creams all fell within similar selection rates of Dairy. However, cheese was selected at a significantly greater rate of 69.1%. This type of information can better tailor nutrition recommendations toward foods a patient with RYGB is likely to actually consume.

This baseline information is limited by subject number and should be reproduced in larger, well-controlled clinical research to verify the findings. Nonetheless, the various intake differences demonstrate the value of a food grouping system tailored to bariatric surgery patients. To optimize nutrition, of which this group has a less than optimal status (17), recommendations based on self-reported food consumption logically improve dietary compliance and, thus, nutritional status. This study did not address long-term dietary intake in bariatric surgery patients, defined here as being 2.5 or more years since surgery. That limit on postsurgery is by no means to be treated as a finite end to the dietary adaptation phase. The relative youth of this type of bariatric food intake research and large degree of individuality in timing of food adaptations make the 2.5-year limit only a reasonable approximation. The upper time frame limit for this study was based on reported changes to food intolerance and energy intake noted at 3 years postsurgery and viewed as confounding variables in previous research (8,17). Future studies that manipulate food group variety are needed to understand the relationship between weight loss/maintenance and dietary variety. Additional research would clearly benefit the differentiation and exploration of the three distinct dietary intake phases mentioned in this research. Furthermore, reasons for the popularity of some food items over others are beyond the scope of this study but are likely to be the result of previous eating behaviors, dietary counseling recommendations, and especially food intolerances.

CONCLUSIONS

RYGB remains a popular yet dramatic solution with permanent life-changing consequences. For the general population, food groups commonly in use today such as those from MyPyramid adequately inform and educate individuals about the balance and overall health of their diets. However, for RYGB patients the need for a more specific food selection system is highly desirable.

This research has clinical applications for both bariatric surgery professionals and dietetics practitioners in preparing a diet that is nutritious and acceptable to patients who have had bariatric surgery. These bariatric food subgroups are based on empirical, not anecdotal evidence, and are practical in this period of dietary adjustment and adaptation for RYGB patients. A more specific food subgroup system provides detailed, practical information, and improves counseling opportunities. Just as exchange groups are of value to clients with diabetes so should bariatric food subgroups be applied to patients who have had RYGB.

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