Characteristics and Predictive Factors of Food Preference Changes in Post-Bariatric Surgery Patients: Postprint

Authors: Yang Ningli, Hua Hongxia, Xu Qin, Liang Hui

Date: 2022-11-14T00:00:00+00:00

Abstract

Background Changes in food preferences of patients after bariatric surgery are an important factor affecting postoperative weight loss. Objectively assessing the specific characteristics of postoperative food preference changes and analyzing their predictive factors is particularly important. However, there are large discrepancies among existing research results. Objective To investigate the characteristics of food preference changes in patients after bariatric and metabolic surgery and their impact on weight loss outcomes, and to analyze the predictive factors for postoperative food preference changes. Methods Using convenience sampling, 245 post-bariatric surgery patients admitted to the Bariatric Follow-up Clinic of the First Affiliated Hospital of Nanjing Medical University from February 2022 to August 2022 were selected. General information questionnaires and a Food Preference Change Characteristics Questionnaire for post-bariatric surgery patients were used for the survey. Independent samples t-test was used to compare the impact of postoperative food preference changes on weight loss outcomes, and univariate analysis and multinomial Logistic regression analysis were used to explore the predictive factors for postoperative food preference changes. Results A total of 237 valid questionnaires were collected. Approximately 97% of post-bariatric surgery patients experienced changes in food preferences compared with preoperative status. Independent samples t-test results showed that the total weight loss percentage (TWL%), postoperative weight, and body mass index (BMI) reduction values in the postoperative food preference change group were significantly different from those in the food preference unchanged group ($P<0.05$). Multinomial Logistic regression analysis results showed that preoperative comorbidities and postoperative time were predictive factors for changes in preferences for vegetables and fruits ($P<0.05$); preoperative comorbidities were predictive factors for changes in preferences for high-quality protein foods ($P<0.05$); long-term residence location

was a predictive factor for changes in preferences for spicy foods (P<0.05); gender was a predictive factor for changes in preferences for snacks, high-fat meats, and non-alcoholic sweet beverages (P<0.05); surgical procedure was a predictive factor for changes in preferences for refined carbohydrates (P<0.05); gender and postoperative time were predictive factors for changes in preferences for sweets (P<0.05). Conclusion The incidence of food preference changes in patients after bariatric and metabolic surgery is high, characterized by decreased preferences for high-calorie foods and increased preferences for healthy foods. Different surgical procedures, gender, postoperative time, long-term residence location, and the presence of preoperative comorbidities are predictive factors for different characteristics of food preference changes after bariatric surgery. Bariatric specialists and nursing staff need to early identify target populations, strengthen postoperative dietary education and guidance, improve postoperative dietary experience, and effectively ensure the effectiveness of bariatric surgery.

Full Text

Abstract

Background: Changes in food preference after bariatric surgery represent an important factor influencing postoperative weight loss. Objectively assessing the specific characteristics of these changes and analyzing their predictive factors is crucial, though existing research shows considerable heterogeneity in findings.

Objective: To investigate the characteristics of food preference changes and their impact on weight loss outcomes in patients undergoing bariatric surgery, and to analyze predictive factors for these changes.

Methods: Using convenience sampling, 245 post-bariatric surgery patients were selected from the bariatric follow-up clinic of the First Affiliated Hospital of Nanjing Medical University between February and August 2022. Data were collected using a general information questionnaire and a self-developed questionnaire on food preference changes after bariatric surgery. Independent samples t-tests were used to compare weight loss outcomes between groups with and without food preference changes. Univariate analysis and multinomial logistic regression were performed to explore predictive factors.

Results: A total of 237 valid questionnaires were collected (96.7% response rate). Approximately 97% of patients reported changes in food preferences compared to pre-surgery. Independent samples t-tests revealed that patients with altered food preferences showed significantly greater total weight loss percentage (TWL%), weight reduction, and BMI decrease (P<0.05). Multinomial logistic regression identified: preoperative comorbidities and postoperative time as predictors of changes in vegetable and fruit preferences (P<0.05); preoperative comorbidities as a predictor of changes in high-quality protein food preferences (P<0.05); long-term residence location as a predictor of changes in spicy food preferences (P<0.05); gender as a predictor of changes in snack, high-fat meat,

and non-alcoholic sweet beverage preferences (P<0.05); surgical procedure as a predictor of changes in refined carbohydrate preferences (P<0.05); and both gender and postoperative time as predictors of changes in sweet food preferences (P<0.05).

Conclusions: Food preference changes occur at high frequency after bariatric surgery, characterized by decreased preference for high-calorie foods and increased preference for healthy foods. Different surgical procedures, gender, postoperative time, residence location, and presence of preoperative comorbidities are predictive factors for specific food preference changes. Bariatric healthcare professionals should identify target populations early, strengthen postoperative dietary education and guidance, improve dietary experiences, and effectively ensure surgical weight loss outcomes.

Keywords: Bariatric surgery; Obesity; Food preference; Predictive factors; Nursing care

Introduction

Bariatric surgery is the most effective treatment for moderate to severe obesity and its comorbidities, producing significant and sustainable weight loss [1,2]. With widespread adoption, China performed 25,280 bariatric procedures in 2021 alone [3]. Bariatric surgery achieves weight loss through gastrointestinal reconstruction that restricts intake and absorption while reducing hunger and enhancing satiety. Additionally, changes in food preferences after surgery may importantly influence dietary intake and weight loss outcomes [4]. Research indicates that approximately 97% of post-bariatric patients experience changes in preference for at least one type of food [5].

Accurately assessing the specific characteristics of postoperative food preference changes and designing dietary interventions based on these preferences represents a crucial measure for ensuring weight loss outcomes and improving postoperative dietary experiences. However, current studies employ diverse methodologies, resulting in substantial heterogeneity in findings [6]. Furthermore, different surgical procedures and individual characteristics may influence specific patterns of food preference change [7,8]. Therefore, this study aims to objectively evaluate the characteristics of food preference changes after bariatric surgery, examine their impact on weight loss outcomes, and explore predictive factors for different patterns of change, providing a basis for healthcare professionals to anticipate and address these changes.

Methods

Study Participants

Using convenience sampling, we selected patients from the bariatric follow-up clinic at the First Affiliated Hospital of Nanjing Medical University between February and August 2022.

Inclusion criteria: (1) Age $ $18 years; (2) Primary bariatric surgery performed according to the "Chinese Guidelines for Surgical Treatment of Obesity and Type 2 Diabetes (2019 Edition)" [9]; (3) Postoperative period $ $3 months; (4) No severe cognitive or communication impairments; (5) Willingness to participate and provide informed consent.

Exclusion criteria: (1) Severe primary diseases of the heart, brain, lungs, kidneys, blood system, or malignant tumors; (2) Severe postoperative complications.

Elimination criteria: (1) Patterned or random questionnaire responses; (2) Incomplete questionnaires or mid-survey withdrawal.

Survey Instruments

General Information Questionnaire: Developed by the researchers, including age, gender, education level, monthly income, marital status, surgical procedure, employment status, long-term residence location, preoperative BMI, presence of preoperative comorbidities, postoperative time, postoperative weight loss, postoperative BMI reduction, and total weight loss percentage (TWL%). Calculations: BMI (kg/m^2) = weight (kg)/height $(m)^2$; postoperative weight loss (kg) = preoperative weight (kg) - current weight (kg); postoperative BMI reduction (kg/m^2) = preoperative BMI (kg/m^2) - current BMI (kg/m^2); TWL% = [(preoperative weight (kg) - current weight (kg))/preoperative weight (kg)] × 100%.

Food Preference Change Questionnaire: Based on the definition from the National Committee for Terms in Sciences and Technology and Kent Berridge' s food reward theoretical model (1996) [10], which identifies core elements of food preference as enjoyment (including sensory properties and physiological states) and craving (direct impulse or need for target food stimuli). We defined "food preference change after bariatric surgery" as alterations in food liking (including enjoyment and craving) compared to preoperative status. The questionnaire was developed through reference to post-bariatric dietary guidelines and the Chinese Dietary Guidelines [11-14], supplemented by semi-structured interviews with 12 post-bariatric patients about their changed food preferences. The final instrument contains 8 items assessing changes in preference for 8 food categories compared to pre-surgery (unchanged, decreased, or increased). Content validity was evaluated by clinical experts (2 bariatric surgeons, 2 case managers, 2 dietitians), yielding a content validity index of 0.92.

Survey and Quality Control

The questionnaire was published on Wenjuanxing platform, generating a QR code. Research team members received standardized training to ensure consistent understanding of instrument content. After explaining the study purpose and obtaining consent, investigators presented the QR code for participants to

complete via WeChat. Participants completed questionnaires independently; investigators clarified item wording when needed. For calculated variables (BMI, TWL%), participants provided required values (height, preoperative weight, current weight) while investigators performed calculations and verification. Investigators reviewed completed questionnaires before submission. Data were exported directly from Wenjuanxing in Excel format.

Statistical Analysis

SPSS 22.0 was used for data analysis. Categorical data were described using frequencies and percentages; continuous data using means and standard deviations. Independent samples t-tests compared continuous variables between groups, with $P<0.05$ considered statistically significant. For univariate analysis, chi-square tests compared rates across multiple groups, and Kruskal-Wallis H tests compared ranked data. To ensure all potential predictive variables were included in multivariate models, $P<0.20$ was considered statistically significant for univariate screening. Multinomial logistic regression analyzed predictive factors for food preference changes, with $P<0.05$ considered statistically significant.

Results

General Characteristics

Of 245 distributed questionnaires, 237 valid responses were collected (96.7% response rate). The sample included 216 participants aged 18-45 years (91.1%), 55 males (23.2%), 159 married individuals (67.1%), and 153 with college education or higher (64.6%). Monthly income distribution: <3000 yuan (13.5%), 3000-5000 yuan (27.4%), 5000-8000 yuan (29.5%), >8000 yuan (29.5%). Surgical procedures: sleeve gastrectomy (94.1%) and gastric bypass (5.9%). Employment status: 194 employed (81.9%). Preoperative comorbidities: present in 119 (50.2%). Preoperative BMI: 28-31.9 kg/m^2 (20.7%), 32-36.9 kg/m^2 (30.4%), >37 kg/m^2 (48.9%). Postoperative time: 3-6 months (48.1%), >6 months (51.9%). Residence: northern China (21.5%), southern China (78.5%).

Food Preference Changes

Approximately 97% (230/237) of patients reported changes in preference for at least one food type compared to pre-surgery. Decreased preference for high-calorie foods was most common: refined carbohydrates (72.5%), sweet foods (52.3%), spicy foods (52.3%), high-fat meats (49.8%), non-alcoholic sweet beverages (48.1%), and snacks (46.4%). Increased preference for healthy foods was also notable: high-quality protein foods (41.8%) and vegetables/fruits (32.9%) . Patients with altered food preferences demonstrated significantly superior TWL%, weight reduction, and BMI decrease compared to those without changes ($P<0.05$) .

Univariate Analysis

Using general characteristics as independent variables and food preference changes (1=unchanged, 2=decreased, 3=increased) as dependent variables, univariate analysis revealed: marital status, preoperative comorbidities, and postoperative time influenced vegetable/fruit preference changes; marital status and preoperative comorbidities influenced high-quality protein food preferences; gender, surgical procedure, and residence location influenced spicy food preferences; gender, age, preoperative BMI, and residence influenced snack preferences; procedure and age influenced refined carbohydrate preferences; gender influenced high-fat meat preferences; gender, preoperative BMI, procedure, comorbidities, and postoperative time influenced sweet food preferences; and gender, marital status, employment, and residence influenced non-alcoholic sweet beverage preferences ($P<0.20$) .

Multivariate Analysis

Multinomial logistic regression using food preference changes as dependent variables and significant univariate factors as independent variables (see variable coding in) revealed: preoperative comorbidities and postoperative time predicted vegetable/fruit preference changes; preoperative comorbidities predicted high-quality protein food preference changes; residence location predicted spicy food preference changes; gender predicted snack, high-fat meat, and non-alcoholic sweet beverage preference changes; surgical procedure predicted refined carbohydrate preference changes; and both gender and postoperative time predicted sweet food preference changes ($P<0.05$) .

Discussion

Characteristics of Food Preference Changes and Impact on Weight Loss Outcomes

This study found that approximately 97% of patients experienced food preference changes after bariatric surgery, consistent with international reports [5]. These changes result from altered gastrointestinal anatomy affecting postprandial hormones such as peptide YY (PYY) and glucagon-like peptide-1 (GLP-1) that regulate hunger and satiety [15]. Additionally, surgery affects brain centers involved in food reward, reducing reward activation when consuming certain foods and thereby altering previous preferences [16].

Our survey revealed that 72.5% of patients decreased their preference for refined carbohydrates (rice, porridge, steamed buns, noodles), and approximately 50% decreased preference for spicy foods, sweet foods, high-fat meats, snacks, and sweet beverages. These findings align with Coluzzi and Sarwer' s research [17-19], likely because surgery reduces reward center activation for high-calorie foods, diminishing hedonic responses to high-fat meats and desserts and consequently reducing preferences. Conversely, increased preference for healthy foods

like high-quality protein and vegetables/fruits was relatively common, consistent with post-bariatric dietary recommendations [20] and potentially important for weight loss. This study confirms that food preference changes significantly increase TWL%, weight reduction, and BMI decrease, demonstrating their critical role in weight loss outcomes. Clinicians should attend to patient reports of food preference changes, explain their significance, and advise reduced intake of high-calorie foods to minimize gastrointestinal discomfort and enhance weight loss.

Predictive Factors for Food Preference Changes

Numerous studies indicate that food preference changes after bariatric surgery are influenced by surgical procedure and individual characteristics, though findings remain heterogeneous [6]. This study found that gastric bypass patients were more likely than sleeve gastrectomy patients to decrease refined carbohydrate preferences, similar to Lewis et al.'s findings [7]. They reported that gastric bypass more significantly reduces preferences for refined carbohydrates, high-fat meats, and sweet foods. Possible mechanisms include more pronounced and sustained satiety through bile acid production and delivery to the distal ileum, and lower reward center activation for high-calorie foods after gastric bypass [21]. These differences may contribute to superior weight loss outcomes with gastric bypass. However, we did not find predictive effects of surgical procedure on high-fat meat or sweet food preferences, possibly due to limited sample size, particularly the small number of gastric bypass patients.

Postoperative time also emerged as an important predictor. Patients >6 months post-surgery showed greater likelihood of increased vegetable/fruit preferences, likely because prolonged exposure creates more distinct sensory experiences and internal perceptions, leading to greater self-reported changes. Interestingly, patients >6 months post-surgery also showed higher likelihood of increased sweet food preferences compared to those 3-6 months post-surgery. This may reflect that while taste sensitivity and reduced hedonic response to sweet stimuli initially increase after surgery, gradually diminishing preferences at 3-6 months, taste alterations and digestive function recovery over time may gradually restore sweet preferences. However, our sample included relatively few long-term postoperative patients (mean postoperative time: 9.06$\pm$12.53 months), necessitating further follow-up to characterize complete trajectories and durability of food preference changes. Bariatric teams should emphasize capitalizing on this critical window of altered preferences and intensify dietary assessment and counseling during follow-up visits, particularly for long-term postoperative patients.

Preoperative comorbidities also predicted increased preferences for vegetables/fruits and high-quality protein foods. Reportedly, 30.1% of pre-bariatric patients have type 2 diabetes, 70.4% have obstructive sleep apnea, and 22.5% have polycystic ovary syndrome [22]. Bariatric surgery effectively treats obesity-related metabolic diseases, with diabetes remission rates up to 80% and significant improvement in other comorbidities [23,24]. Reiber et al. [25] suggest

that patients with preoperative comorbidities have greater awareness of health deficits and consequences, leading to better postoperative compliance and increased preference for healthy foods. This highlights the need for enhanced preoperative dietary education for patients without comorbidities.

Gender differences were notable, with women more likely than men to decrease preferences for snacks, high-fat meats, sweet foods, and sweet beverages, consistent with Pepino et al. [26]. This suggests clinicians should intensify preoperative dietary education for male patients and encourage healthy food choices while reducing high-calorie food intake postoperatively.

Geographic differences also emerged, with northern Chinese patients more likely to increase spicy food preferences compared to southern patients. Geographic environment fundamentally shapes dietary culture, with China' s most significant differences being "southern rice vs. northern wheat" and "southern sweet vs. northern salty" [27]. Southerners consume rice-based diets with mild, slightly sweet flavors, generally avoiding chili, scallions, and raw garlic, while northerners favor wheat-based diets with heavy oil, salt, and spicy foods like scallions, soybean paste, and hot pot. Post-bariatric dietary recommendations for high-protein, low-fat, light, and easily digestible foods contrast sharply with northern dietary traditions, potentially increasing cravings for spicy foods among northern patients. This suggests dietary counseling should be personalized according to regional dietary culture.

Innovations and Limitations

This study evaluated characteristics of food preference changes after bariatric surgery, their impact on outcomes, and predictive factors for different change patterns, facilitating early prediction and targeted education. However, limitations include: (1) Limited sample size for certain subgroups, particularly gastric bypass patients, potentially affecting accuracy; (2) Lack of long-term follow-up preventing complete characterization of preference change trajectories; (3) Self-reported questionnaire data cannot distinguish whether reported changes reflect alterations in food enjoyment, craving, or tolerance, requiring objective experimental validation.

Conclusion

Food preference changes occur at high frequency after bariatric surgery and significantly impact weight loss outcomes. Healthcare professionals should recognize these changes, provide anticipatory dietary education and guidance, and improve postoperative dietary experiences. Surgical procedure, postoperative time, gender, residence location, and preoperative comorbidities predict specific food preference changes. Bariatric teams must early identify target populations, strengthen dietary education, improve quality of life, and ensure optimal surgical outcomes.

Author Contributions: Yang Ningli, Hua Hongxia, Xu Qin, and Liang Hui

conceived the study and designed the methodology. Yang Ningli and Hua Hongxia drafted the manuscript, analyzed results, and created tables. Xu Qin provided quality control and critical revision. Liang Hui supervised final version preparation.

Conflict of Interest: The authors declare no conflicts of interest.

References

[1] Phelan S, Wing R R, Loria C M, et al. Prevalence and predictors of weight-loss maintenance in a biracial cohort: results from the coronary artery risk development in young adults study[J]. Am J Prev Med, 2010, 39(6): 546-554. DOI: 10.1016/j.amepre.2010.08.008.

[2] Avenell A, Robertson C, Skea Z, et al. Bariatric surgery, lifestyle interventions and orlistat for severe obesity: the REBALANCE mixed-methods systematic review and economic evaluation[J]. Health Technol Assess, 2018, 22(68): 1-246. DOI: 10.3310/hta22680.

[3] Yang H, Chen Y, Dong Z Y, et al. Chinese obesity and metabolic surgery database: 2021 annual report[J]. Chinese Journal of Obesity and Metabolic Diseases, 2022, 8(1): 15-23. DOI: 10.3877/cma.j.issn.2095-9605.2021.01.001.

[4] Althumiri N A, Basyouni M H, Al-Qahtani F S, et al. Food taste, dietary consumption, and food preference perception of changes following bariatric surgery in the Saudi population: a cross-sectional study[J]. Nutrients, 2021, 13(10): 3401. DOI: 10.3390/nu13103401.

[5] Jennifer T R. Taste changes after bariatric surgery: what to do when your patients cannot stand the taste of their food[J]. Bariatric Times, 2012, 9: 14-15.

[6] Primeaux S D, de S T, Tzeng T H, et al. Recent advances in the modification of taste and food preferences following bariatric surgery[J]. Rev Endocr Metab Disord, 2016, 17(2): 195-207. DOI: 10.1007/s11154-016-9365-0.

[7] Lewis K H, Ji M, Bai Y, et al. Bariatric Surgical Alterations in Tolerability, Enjoyment and Cravings in the Diet (BSATED) instrument: A new scale to measure food preferences following bariatric surgery[J]. Appetite, 2021, 162: 105151. DOI: 10.1016/j.appet.2021.105151.

[8] Ahmed K, Penney N, Darzi A, et al. Taste changes after bariatric surgery: A systematic review[J]. Obesity Surgery, 2018, 28(10): 3321-3332. DOI: 10.1007/s11695-018-3420-8.

[9] Wang Y, Wang C C, Zhu S H, et al. Guidelines for surgical treatment of obesity and type 2 diabetes in China (2019 edition)[J]. Chinese Journal of Practical Surgery, 2019, 39(4): 301-306. DOI: 10.19538/j.cjps.issn1005-2208.2019.04.01.

[10] Berridge K C. Food reward: brain substrates of wanting and liking[J]. Neurosci Biobehav Rev, 1996, 20: 1-25. DOI: 10.1016/0149-7634(95)00033-b.

[11] Mechanick J I, Apovian C, Brethauer S, et al. Clinical practice guidelines for the perioperative nutrition, metabolic, and nonsurgical support of patients undergoing bariatric procedures-2019 update: cosponsored by American Association of Clinical Endocrinologists/American College of Endocrinology, the Obesity Society, American Society for Metabolic and Bariatric Surgery, Obesity Medicine Association, and American Society of Anesthesiologists[J]. Obesity (Silver Spring), 2020, 28(4): 1-58. DOI: 10.1002/oby.22719.

[12] Fried M, Yumuk V, Oppert J M, et al. Interdisciplinary European guidelines on metabolic and bariatric surgery[J]. Obes Surg, 2014, 24(1): 42-55. DOI: 10.1007/s11695-013-1079-8.

[13] Heber D, Greenway F L, Kaplan L M, et al. Endocrine and nutritional management of the post-bariatric surgery patient: an endocrine society clinical practice guideline[J]. J Clin Endocrinol Metab, 2010, 95(11): 4823-4843. DOI: 10.1210/jc.2009-2128.

[14] Group of Nutrition and Metabolism, Society of Parenteral and Enteral Nutrition, Chinese Medical Association. Expert consensus on nutrition and multidisciplinary management of weight loss surgery[J]. Chinese Journal of Surgery, 2018, 56(2): 81-90. DOI: 10.3760/cma.j.issn.0529-5815.2018.02.001.

[15] De S A, Salem V, Long C J, et al. The gut hormones PYY3-36 and GLP-17-36 amide reduce food intake and modulate brain activity in appetite centers in humans[J]. Cell Metab, 2011, 14: 700-706. DOI: 10.1016/j.cmet.2011.09.010.

[16] Morínigo R, Moizé V, Musri M, et al. Glucagon-like peptide-1, peptide YY, hunger, and satiety after gastric bypass surgery in morbidly obese subjects[J]. J Clin Endocrinol Metab, 2006, 91: 1735-1740. DOI: 10.1210/jc.2005-0904.

[17] Coluzzi I, Raparelli L, Guarnacci L, et al. Food intake and changes in eating behavior after laparoscopic sleeve gastrectomy[J]. Obes Surg, 2016, 26: 2059-2066. DOI: 10.1007/s11695-015-2043-6.

[18] Sarwer D B, Dilks R J, Spitzer J C, et al. Changes in dietary intake and eating behavior in adolescents after bariatric surgery: an ancillary study to the Teen-LABS consortium[J]. Obes Surg, 2017, 27: 3082-3091. DOI: 10.1007/s11695-017-2764-9.

[19] Pepino M Y, Bradley D, Eagon J C, et al. Changes in taste perception and eating behavior after bariatric surgery-induced weight loss in women[J]. Obesity (Silver Spring), 2014, 22(5): E13-E20. DOI: 10.1002/oby.20649.

[20] Zhu H F, Xu Q, Zhao K, et al. Evidence summary for nutrition management of patients after bariatric surgery[J]. Chinese Nursing Management, 2021, 21(06): 874-879. DOI: 10.3969/j.issn.1672-1756.2021.06.015.

[21] Ahmed B, King W C, Gourash W, et al. Long-term weight change and health outcomes for sleeve gastrectomy (SG) and matched Roux-en-Y gastric bypass (RYGB) participants in the Longitudinal Assessment of

Bariatric Surgery (LABS) study[J]. Surgery, 2018, 164(4): 774-783. DOI: 10.1016/j.surg.2018.06.008.

[22] Li M Y, Liu Y, Liu Y J, et al. Greater China metabolic and bariatric surgery database registry report 2021[J]. Chinese Journal of Practical Surgery, 2022, 42(05): 550-560. DOI: 10.19538/j.cjps.issn1005-2208.2022.05.16.

[23] Golombl, Bendavid M, Glass A. Long-term metabolic effects of laparoscopic sleeve gastrectomy[J]. JAMA Surg, 2015, 150(11): 1051-1057. DOI: 10.1007/s11695-018-3153-8.

[24] Marceau P, Biron S, Marceau S, et al. Long-term metabolic outcomes 5 to 20 years after biliopancreatic diversion[J]. Obes Surg, 2015, 25: 1584-1593. DOI: 10.1007/s11695-015-1599-5.

[25] Reiber B M M, Leemeyer A R, Bremer M J M, et al. Weight loss results and compliance after bariatric surgery[J]. Obes Surg, 2021, 31(8): 3606-3614. DOI: 10.1007/s11695-021-05450-6.

[26] Pepino M Y, Bradley D, Eagon J C, et al. Changes in taste perception and eating behavior after bariatric surgery-induced weight loss in women[J]. Obesity (Silver Spring), 2014, 22(5): E13-E20. DOI: 10.1002/oby.20649.

[27] Ma P F. An analysis of the influence of geographical environment on the differences of food culture between the north and the south in China[J]. Journal of Kaili University, 2010, 28(01): 128-132. DOI: 10.3969/j.issn.1673-9329.2010.01.35.

Note: Figure translations are in progress. See original paper for figures.