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Original article

Comparison of unpalatable meal contents between patients who underwent total and distal gastrectomies

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SUMMARY

Background: Unpalatable meal contents have several impacts on the dietary life of patients who undergo gastrectomy. However, few studies have focused on the unpalatable meal contents according to surgical procedure. This study aims to clarify the differences in the unpalatable meal contents between the patients who underwent total and distal gastrectomies (TG and DG, respectively).

Methods: This study involved patients (n = 341) who underwent TG or DG within 5 years, and a questionnaire of unpalatable meal contents was used. The data on the demographics, operation types, Dysfunction After Upper Gastrointestinal Surgery 20 (DAUGS20) scoring system, and nutrition conditions were confirmed. Furthermore, these were analyzed using descriptive statistics and compared between TG (n = 180) and DG (n = 161) groups.

Results: The unpalatable meal contents that were significantly different between two groups were big in size (p = 0.013), solid (p = 0.040), rough (p = 0.041), and dry (p = 0.045), which were more difficulty in the TG group. Furthermore, the strong sour taste was more difficulty in the DG group (p = 0.031).

Discussion: The meals which the TG group had difficulty eating were characteristic of sticking or stagnating in the digestive tract, making the passage of food more difficult in the TG patients. This was because they had a smaller storage for foods and a narrower space at the anastomotic region than those who underwent DG.

Conclusion: The meal contents were assumed to have been influenced by the surgical procedure. We conclude that the patients in the TG group felt more difficulty in eating the meal contents that could stagnate at the anastomotic region than those in the DG group.

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1. Introduction

Recently, the meal contents and nutrition management for early care of patients who underwent gastrectomy have greatly changed because of the popularization of the enhanced recovery after surgery (ERAS) program worldwide. The ERAS protocol in these patients enabled them to recover in the early postoperative period, thereby reducing medical costs and hospitalization stay [1]. Several studies have reported that postoperative complications do not increase even if the patients take meals in the earlier postoperative period [2–5].

Moreover, recent investigations tend to focus on nutrition management for earlier transition to oral intake after surgery. However, the quality of life (QOL) of the patients who underwent gastrectomy was the worst at 1 month after surgery [6]. Additionally, several studies that followed long-term QOL and nutrition for the patients who underwent such procedure have indicated that even 5 years after discharge, the patients have been experiencing fatigue and diarrhea and have a limited amount of meal intake [7,8]. A few studies also demonstrated that the long-term deterioration in the nutrition status causes not only a decline in QOL [9–11] but also in sarcopenia, which increases the mortality rate 1 year after surgery [12]. Thus, continuous support is necessary in the long-term nutrition management of patients who underwent gastrectomy.

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In Japan, the general dietary recommendations for patients who have undergone gastrectomy include eating a small portion often, eating slowly and chewing meals well, and eating meals good for their digestion although any meal content can be chosen [13,14]. In addition, both high-carbohydrate and high-fat foods must be avoided because these items may to cause dumping symptoms and reflex respectively [15]. The instructions in the western countries are similar to those in Japan. However, the proactive inclusion of fats in meals is suggested for a slower digestion process and for preventing malnutrition [16,17]. Thus, the diet instructions after gastrectomy vary depending on the area.

It was reported that "the meal in hospital" after such surgery is the least evidenced and nonscientific postoperative diet [18]. On the contrary, a few studies have described that the patients are having difficulties after discharge, being anxious on what foods to consume and the manner in doing so [19]. Approximately 70% of the patients had experienced early dumping symptoms after discharge [20]. However, in the previous studies, information on the recommended meal contents for patients post gastrectomy is insufficient, it is surmised that the meal content for post gastrectomy is based on experimental rule and conventional. Moreover, the suitability of the meal contents was the focus in a few studies.

The previous study concerning post gastrectomy patients that focused on the meal contents showed that "easiness or difficulty in eating" was associated with five food characteristics: taste, smell, texture, food form, and digestion. Furthermore, these characteristics may be affected by the surgical procedure [21].

Several studies have addressed the difference in the QOL of the patients and symptom appearance depending on the surgical procedure and reconstruction [22,23]. For example, the patients who underwent total gastrectomy (TG) are likely to have reflex, and those who underwent Billroth II (B-2) in distal gastrectomy (DG) have poor QOL related to dumping symptoms [24]. However, little research has been conducted about the difference due to surgical procedure in "easy or difficult to eat" meal contents.

In this study, we focused on the patients who underwent TG and DG to compare the unpalatable meal contents between both groups.

2. Methods

This was an observational, analytic, cross-sectional study that was performed in patients who underwent to total or distal gastrectomy. We conducted a questionnaire survey using the mailing method at the outpatient departments and patients' association from December 2017 to March 2019.

2.1. Definition of terms

"Unpalatable meal contents" were defined as those difficult to swallow or with difficult passage through water or meals, those which don't feel delicious, those which cause anorexia, and those which lead to symptoms during and after food intake.

2.2. Participants

The participants in this study were the patients with gastric malignancy over 20 years old who underwent TG or DG within five years. The exclusion criteria were ① the patients with stage IV neoplasm according to the Japanese Classification of Gastric Carcinoma, 15th Edition [25], and ② those who underwent chemotherapy or radiation therapy for palliative care. Furthermore, all patients who did not continue onco-specific treatment with curative intent were excluded from the present study.

2.3. Research procedure

We performed the survey in the association for gastrectomy which is organized at a national level and three outpatient departments of the general hospitals in west Japan. For the participants belonging to the patient association, we entrusted the secretariats and mailed to the target ones all at once. Furthermore, for the participants at the outpatient departments, the questionnaire was directly delivered to the target ones by the outpatient staff. We then asked all participants to reply to the questionnaire by mail.

2.4. Questionnaire items

We investigated the unpalatable meal contents as well as background and nutrition status of the participants.

2.4.1. Background of the participants

The data regarding the patients' demographics (sex, age, current work) and treatment status (operation type, staging, chemotherapy use, elapsed time after operation, and other dietary cures) were collected from the questionnaire or their medical records.

2.4.2. Symptom, activity, and nutrition status

The QOL of the participants was analyzed using EuroQol 5 dimension 3 level Japanese version (EQ-5D-3L). This questionnaire is a health-related QOL scale that can be measured easily and consists of five items (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). Each dimension has three levels: no problems, some problems, and extreme problems. A combination of answers is scored with 1 being the best health and 0 being the state of death [26]. To assess the postoperative symptoms of gastrectomy, the Dysfunction After Upper Gastrointestinal Surgery 20 (DAUGS20) scoring system was used as a specialized evaluation tool to check the postoperative dysfunction and QOL of patients. This scale consisted of 20 items and 7 sub-domains: diarrhea or soft feces, pain, food passage dysfunction, nausea and vomiting, decreased physical activity, reflux and dumping-like symptoms. A 5-point Likert scale was used to score this, and higher total scores (0–100) indicated more severe dysfunction [27]. Furthermore, in order to evaluate the taste and smell symptoms, those symptoms were scored from 0 to 5 on a Likert scale for each item. In the nutrition status, pre and postoperative weight loss and the Body Mass Index (BMI) reported by the individual at the survey were included.

2.4.3. Unpalatable meal contents

Based on the previous research [21] and the patient experience note [28], we created the draft of the questionnaire about the unpalatable meal contents for the patients postoperatively. It consisted of six categories: taste, smell, texture, food form, digestion, and temperature. Five of these categories were revealed to be associated with unpalatable meal contents in the previous research, while one category was with the patient experience note. Consequently in this questionnaire, a total of 36 items were included: taste, 8; smell, 7; temperature, 2; texture, 5; food form, 8; and digestion, 6. We utilized question expressions such as "I became difficult to eat when you eat bland taste items" in taste and smell categories, "I came to feel discomfort in your abdomen when you eat cold items" in temperature, texture, food form, digestibility categories. Furthermore, for the evaluation, binary variables were used: "I have never eaten after surgery," 0; "I agree," 1, and "I don't agree," 2; 0 was processed as a missing value. To grasp the effect of unpalatable meal contents according to the operation, this questionnaire was emphasized in order to not reflect their preoperative

taste as described below "The unpalatable meal is not a meal which difficult to eat originally, but a meal that you came to feel difficult to eat after surgery." This questionnaire, which included aspects such as easiness in answering, double-barreled question, and overlapping contents, was discussed by six researchers including a digestive surgeon, an administrative dietitian, and a gastrointestinal surgery nurse. The role of each of the six members in the producing of the question was included: laboratory co-members, including the author, create questionnaires and check readability; a digestive surgeon advices on the surgical procedures and treatment methods; an administrative dietitian advices on meal contents; and a gastrointestinal surgery nurse advices on life and work. We verified to determine the number of items and whether questions were easy to understand for the four patients who underwent gastrectomy in the pretest.

2.5. Sample size calculation

This study is a comparison between the two groups. However, we are planned making groups on unpalatable meals using an exploratory factor analysis to create the food selection criteria in the future. Therefore, the sample size was calculated on the basis of the techniques used in scale development assuming 70% response rate; approximately 600 patients were planned to adjust for missing values.

2.6. Statistical analysis

All items were analyzed using descriptive statistics. Subsequently, regarding continuous data, Student's t-test was used with normal distributions, whereas Mann–Whitney U test was used for variables with non-normal distribution. Categorical data were used for $\chi 2$ test or Fisher's exact test to compare the differences between the TG and DG groups.

Fisher's exact test and one-way analysis of variance (ANOVA) with normal distributions were used to clarify the difference among the three group regarding the surgical procedures where the reconstruction method differs in DG. In the latter, Tukey's multiple comparison test was performed. p values <0.05 were considered statistically significant. Furthermore, data analysis was performed using IBM SPSS Statistics for Macintosh, version 25.0 (IBM Corp., Armonk, NY). To compare the differences between the TG and DG groups, Student's t-test with parametric data or Mann–Whitney U test with non-parametric data were used for continuous variables. Categorical variables were used by $\chi 2$ test or Fisher's exact test. To clarify the difference among the three-group concerning reconstructive surgery differs in DG, for continuous variables One-way analysis of variance (ANOVA) with parametric data or Kruskal–Wallis test with non-parametric data were used, for categorical variables Fisher's exact test was used. If a data was statistically significant, the post-hoc Tukey test with parametric data or Dann–Bonferroni test with non-parametric data were performed as a post-hoc test.

2.7. Ethical considerations

This study was approved by the Institutional Review Board of Kobe University (approval number, 361) and the ethics committees or meetings in the relevant research facilities. Moreover, the data were collected in accordance with the recommended ethical principles, and all individuals who agreed to participate in the study provided data in an intentional, anonymous, voluntary, and informed manner. While acquiring information from the patients' medical records, written informed consent was obtained from the participants.

3. Results

3.1. Background of the participants

The questionnaire survey was distributed to 620 participants, and 432 responded (response rate, 69.6%). The patient association (331, 76.6%) and outpatient departments (101, 23.4%) were the classifications of the participants in this study. Also, a total of 180 (52.8%) and 161 (47.2%) participants underwent TG and DG respectively. Furthermore, in the DG group, 89 (55.3%), 14 (8.7%), and 58 (36.0%) participants underwent Billroth I (B-1), Billroth II (B-2), and Roux-en-Y (R–Y), respectively. The results of the background of the participants are shown in Table 1.

3.1.1. Comparison between the demographics and treatment situations

In this study, the comparison between the participants who underwent TG (TG group) and those who underwent DG (DG group) was determined. Consequently, age, adjuvant chemotherapy, frequency of operation, elapsed time after operation, other dietary cures, and current work were not significant. However, the ratios of men ($p = 0.017$) and those who had open surgery ($p < 0.001$) were higher in the TG group, and that of stage I was higher in the DG group ($p = 0.019$). Additionally, on comparison of the three groups in DG, none of the items showed a significant difference according to the reconstructive surgery.

3.1.2. Comparison of the episode of symptoms and nutrition status of the participants (Table 2)

In EQ-5D-3L, which was a comprehensive QOL questionnaire, the TG and DG groups had almost the same QOL score ($p = 0.815$). Furthermore, in the DAUGS20 scoring system, which indicated the status of postgastrectomy disorders, the total score was significantly worse in the TG group ($p < 0.001$). No significant difference in the diarrhea symptoms was noted in the subscales in the DAUGS20 scoring system between two groups. However, the following had significantly worse scores in TG group: gastroesophageal reflux ($p < 0.001$), deglutition dysfunction ($p = 0.011$), limited activity due to decreased food consumption ($p = 0.001$), dumping syndrome symptoms ($p < 0.001$), transfer dysfunction ($p < 0.001$), and hypoglycemic symptoms ($p = 0.002$). In addition, no significant difference was noted in taste and smell symptoms. Regarding the nutrition status, the average BMIs at the survey were 18.93 ± 2.4 and 20.06 ± 2.7 in the TG and DG groups, respectively. TG group had significantly lower average BMI than DG group ($p < 0.001$). Also, weight loss after surgery was 11.17 ± 5.6 kg in the TG group, while that in the DG group was 7.48 ± 4.9 kg. With respect to weight loss, TG group showed significant decrease than DG group ($p < 0.001$).

No significant difference was observed in any items in the three reconstructions in the DG group.

3.1.3. Unpalatable meal contents for the participants (Table 3)

Compared with the DG group, the TG group had difficulty with the following meal contents: big in size ($p = 0.013$), solid food form ($p = 0.040$), rough texture ($p = 0.041$), and dry texture ($p = 0.045$). However, the DG group had more difficulty with the strong sour taste than the TG group ($p = 0.031$).

In DG, the B-1 group in DG felt that it was significantly difficult to eat the meals with high fat for digestion as compared with the other groups ($p = 0.012$).

Table 1
Demographic characteristics and medical background (n = 341).

Characteristic	TG (n = 180)	DG (n = 161)	p value
Age[a]	69.69 ± 10.1 (41–88)	68.37 ± 9.9 (37–88)	0.223
Sex (male/female)[b]	121/59	88/73	0.017
Stage (1/2/3/not sure)[b]	82/54/24/11	103/30/19/8	0.019
Adjuvant chemotherapy (engaged/never used/previously)[b]	8/135/31	6/134/18	0.226
The operation number of times (once/twice)[b]	150/30	146/15	0.054
Operative method (open/laparoscopic surgery)[b]	121/59	55/106	<0.001
Elapsed time after operation (month)[a]	33.74 ± 15.25 (2–70)	29.98 ± 15.94 (2–68)	0.070
Other dietary cure (yes/no)[b]	28/148	36/125	0.132
Current work (yes/no)[b]	60/120	58/103	0.602

Stage: Japanese Classification of Gastric Carcinoma (The 15th Edition).
Continuous data is shown as mean ± SD (minimum–maximum range).
[a] Student's t-test.
[b] $\chi 2$ test.

Table 2
Comparison of the episode of symptoms and nutritional status between TG and DG (n = 341).

Factors	Point range	TG (n = 180)	DG (n = 161)	p value
EQ-5D-3l Ver.J[b,d]	(0–1)	1 [0.734–1]	1 [0.734–1]	0.815
Weight loss after surgery (pre − after of weight) (kg)[c]		11.17 ± 5.6 (0–20)	7.48 ± 4.9 (−1 to 21)	<0.001
BMI at the time of the survey[c]		18.93 ± 2.4 (14.22–24.78)	20.06 ± 2.7 (14.67–27.01)	<0.001
DAUGS20 total score[a,c]	(0–100)	42.32 ± 13.7 (6–79)	34.97 ± 14.0 (3–72)	<0.001
DAUGS gastroesophageal reflux	(0–20)	5.79 ± 3.5 (0–15)	3.97 ± 3.2 (0–16)	<0.001
DAUGS deglutition dysfunction	(0–20)	5.39 ± 3.5 (0–17)	4.47 ± 3.1 (0–13)	0.011
DAUGS limited activity due to decreased food consumption	(0–15)	8.70 ± 2.9 (0–15)	7.59 ± 3.2 (1–15)	0.001
DAUGS diarrhea symptoms	(0–10)	5.12 ± 2.5 (0–10)	4.70 ± 2.4 (0–10)	0.110
DAUGS dumping syndrome symptoms	(0–15)	9.29 ± 2.9 (1–15)	8.02 ± 3.2 (0–15)	<0.001
DAUGS transfer dysfunction	(0–10)	3.68 ± 2.19 (0–10)	2.67 ± 1.71 (0–8)	<0.001
DAUGS hypoglycemic symptoms	(0–10)	4.34 ± 2.3 (0–10)	3.56 ± 2.3 (0–10)	0.002
Taste symptom[a,c]	(0–5)	1.72 ± 1.3 (0–5)	1.5 ± 1.3 (0–5)	0.156
Smell symptom[a,c]	(0–5)	1.42 ± 1.2 (0–5)	1.21 ± 1.2 (0–5)	0.114

EQ-5D-3l, EuroQol 5 Dimension 3 level Japanese version.
BMI, body mass index.
DAUGS20, Dysfunction After Upper Gastrointestinal Surgery short version.
[a] Higher scores indicated more severe symptoms.
[b] Lower scores indicated more severe symptoms.
[c] Student's t-test: mean ± SD (minimum–maximum range).
[d] Mann–Whitney U-test: median [IQR].

4. Discussion

The participants in the TG group felt difficulty in eating foods which were solid and big in size, with dry and rough texture, compared with the DG group. These results indicate that TG group is likely to stagnate meals due to a narrow digestive tract than DG group.

In previous studies, food stasis was more frequent in a group with delayed gastric emptying in the remaining stomach [29]. Especially, it has been shown that for patients undergoing TG, much time is required for transition of food through the small intestine [30]. The patients who underwent TG had a very narrow inside diameter in the anastomotic region, they took a prolonged time for swallowing foods according to anastomotic stenosis compared with the ones who underwent DG [31]. The DAUGS20 results of this study indicated that deglutition dysfunction and transfer dysfunction were also significantly worse in the TG group. In the case of TG, dumping syndrome, which is an overaction of emptying function is the most common [32], the complete loss of reservoir capacity increases meal-related distress and dissatisfaction [33]. However, the ones who underwent TG felt difficulty when eating foods as mentioned above. Therefore, it was assumed that the characteristics of the meals which are easy to stagnate in the narrow spaces are that they have poor fluidity, high density, and are not digestible enough because of the nothing gastric juice.

The DG group felt difficulty in eating foods with strong sour taste. The appearance in taste symptoms was not significantly different between the two groups. According to the previous study, the sour taste was significantly worse than the other tastes in the long-term postoperative period after gastrectomy [34]. However, little previous research has been conducted about the difference owing to the surgical procedure in the taste threshold. In addition, considering the difference in the digestive fluid between TG and DG, reflux symptom was worse in the TG group than the DG group in the DAUGS20 scoring system in this study. In addition, secretions leading to postoperative esophagitis tended to be alkaline because of removal of the gastric acid and pepsin secretion region in the case of TG, to be acidic if the gastric acid secretory region remains in the case of DG [35]. Thus, while this study could explain that even if the TG group was worse, the DG group felt worse because of the strong sour taste due to the difference in the secreted digestive fluid juice. Consequently, these findings suggested that the TG group had difficulty in eating meals due to the narrow digestive tract and the DG group difficulty in eating meals because of the strong sour taste. Therefore, it needs different dietary support based on the characteristics in surgical procedure.

A previous study indicated that B-1, in which the meals pass through the duodenum, was better than other DGs in evaluating the fat absorption in the DG reconstruction [36]. However, the participants in the B-1 group felt more difficulty in eating high-fat

Table 3
Comparison between TG and DG with respect to unpalatable meal contents (n = 341).

Category	Question items		Total (%)	TG (n = 180)	DG (n = 161)	p value
Taste	Bland	Agree	48 (14.5%)	23 (13.1%)	25 (16%)	0.532
		Disagree	284 (85.5%)	153 (86.9%)	131 (84%)	
	Strong sourness	Agree	99 (30%)	43 (24.7%)	56 (35.9%)	0.031
		Disagree	231 (70.0%)	131 (75.3%)	100 (64.1%)	
	Strong sweetness	Agree	65 (19.7%)	33 (19.1%)	32 (20.4%)	0.783
		Disagree	265 (80.3%)	140 (80.9%)	125 (79.6%)	
	Bitterness	Agree	85 (27.9%)	47 (29.0%)	38 (26.6%)	0.701
		Disagree	220 (72.1%)	115 (71.0%)	105 (73.4%)	
	Complicated	Agree	65 (21.7%)	35 (21.7%)	30 (21.7%)	1.000
		Disagree	234 (78.3%)	126 (78.3%)	108 (78.3%)	
	Umami	Agree	23 (7.0%)	14 (8.1%)	9 (5.8%)	0.517
		Disagree	306 (93.0%)	159 (91.9%)	147 (94.2%)	
	Spicy hot taste	Agree	145 (48.2%)	75 (46.9%)	70 (49.6%)	0.645
		Disagree	156 (51.8%)	85 (53.1%)	71 (50.4%)	
	Rich	Agree	124 (37.8%)	62 (36.5%)	62 (39.2%)	0.645
		Disagree	204 (62.2%)	108 (63.5%)	96 (60.8%)	
Smell	Steamy	Agree	32 (9.7%)	15 (8.6%)	17 (10.8%)	0.578
		Disagree	299 (90.3%)	159 (91.4%)	140 (89.2%)	
	Roasted aromatic	Agree	13 (4.0%)	7 (4.1%)	6 (3.9%)	1.000
		Disagree	313 (96.0%)	165 (95.9%)	148 (96.1%)	
	Fishy raw	Agree	86 (26.4%)	40 (23.1%)	46 (30.1%)	0.168
		Disagree	240 (73.6%)	133 (76.9%)	107 (69.9%)	
	Fermented	Agree	34 (10.6%)	20 (11.8%)	14 (9.3%)	0.586
		Disagree	287 (89.4%)	150 (88.2%)	137 (90.7%)	
	Strong sweet	Agree	73 (23.5%)	33 (20.8%)	40 (26.3%)	0.285
		Disagree	238 (76.5%)	126 (79.2%)	112 (73.7%)	
	Flavored vegetable	Agree	46 (14.7%)	27 (16.3%)	19 (13.0%)	0.430
		Disagree	266 (85.3%)	139 (83.7%)	127 (87.0%)	
	Oily	Agree	205 (62.3%)	103 (59.9%)	102 (65%)	0.364
		Disagree	124 (37.7%)	69 (40.1%)	55 (35.0%)	
Temperature	Cold	Agree	107 (32.4%)	51 (29.5%)	56 (35.7%)	0.241
		Disagree	223 (67.6%)	122 (70.5%)	101 (64.3%)	
	Hot	Agree	67 (20.0%)	38 (21.6%)	29 (18.2%)	0.495
		Disagree	268 (80.0%)	138 (78.4%)	130 (81.8%)	
Texture	Spreading in mouth	Agree	32 (10.1%)	17 (10.2%)	15 (10.1%)	1.000
		Disagree	284 (89.9%)	150 (89.8%)	134 (89.9%)	
	Chewy	Agree	184 (57.5%)	94 (56.6%)	90 (58.4%)	0.821
		Disagree	136 (42.5%)	72 (43.4%)	64 (41.6%)	
	Tough	Agree	171 (52.8%)	86 (50.6%)	85 (55.2%)	0.436
		Disagree	153 (47.2%)	84 (49.4%)	69 (44.8%)	
	Dry	Agree	147 (44.8%)	87 (50.0%)	60 (39.0%)	0.045
		Disagree	181 (55.2%)	87 (50.0%)	94 (61.0%)	
	Smooth	Agree	101 (31.2%)	61 (35.3%)	40 (26.5%)	0.094
		Disagree	223 (68.8%)	112 (64.7%)	111 (73.5%)	
Food form	Small form like grain and powder[a]	Agree	10 (3.0%)	4 (2.3%)	6 (3.8%)	0.531
		Disagree	320 (97.0%)	167 (97.7%)	153 (96.2%)	
	Big in size	Agree	133 (41.2%)	82 (47.7%)	51 (33.8%)	0.013
		Disagree	190 (58.8%)	90 (52.3%)	100 (66.2%)	
	Sticky	Agree	79 (24.4%)	45 (26.5%)	34 (22.1%)	0.368
		Disagree	245 (75.6%)	125 (73.5%)	120 (77.9%)	
	Rough	Agree	83 (26.2%)	52 (31.1%)	31 (20.7%)	0.041
		Disagree	234 (73.8%)	115 (68.9%)	119 (79.3%)	
	Solid	Agree	154 (50.2%)	92 (55.8%)	62 (43.7%)	0.040
		Disagree	153 (49.8%)	73 (44.2%)	80 (56.3%)	
	Expansive	Agree	188 (59.5%)	105 (61.8%)	83 (56.8%)	0.421
		Disagree	128 (40.5%)	65 (38.2%)	63 (43.2%)	
	Watery	Agree	92 (27.6%)	41 (23.4%)	51 (32.3%)	0.086
		Disagree	241 (72.4%)	134 (76.6%)	107 (67.7%)	
	Chopped ingredients[a]	Agree	10 (3.0%)	4 (2.3%)	6 (3.8%)	0.530
		Disagree	320 (97.0%)	167 (97.7%)	153 (96.2%)	
Digestion	Many fibers	Agree	114 (34.7%)	62 (35.8%)	52 (33.3%)	0.645
		Disagree	215 (65.3%)	111 (64.2%)	104 (66.7%)	
	Dairy products	Agree	89 (27.0%)	49 (28.3%)	40 (25.5%)	0.620
		Disagree	241 (73.0%)	124 (71.7%)	117 (74.5%)	
	High fat	Agree	180 (55.4%)	92 (54.4%)	88 (56.4%)	0.739
		Disagree	145 (44.6%)	77 (45.6%)	68 (43.6%)	
	High carbohydrate	Agree	89 (26.7%)	41 (23.4%)	48 (30.4%)	0.173
		Disagree	244 (73.3%)	134 (76.6%)	110 (69.6%)	
	Spicy hot	Agree	130 (41.9%)	67 (41.1%)	63 (42.9%)	0.818
		Disagree	180 (58.1%)	96 (58.9%)	84 (57.1%)	
	Perishable items	Agree	76 (23.8%)	41 (24.1%)	35 (23.3%)	0.896
		Disagree	244 (76.3%)	129 (75.9%)	115 (76.7%)	

$\chi 2$ test.
[a] Fisher's exact test.

meals than other DGs. “Unpalatable meal content” is the subjective to the patient and may be influenced by other factors. Therefore, in future investigations, the related factors in high-fat meals may possibly be developed.

The present study demonstrated the differences in the unpalatable meal contents between TG and DG group. Using these findings for patients who underwent TG and DG, medical staffs can provide information as well as use dietary support methods. Therefore, the results of this study may contribute to improving dietary-associated QOL in patients. Regarding specific dietary support, because the meals are more likely to cause stagnation in passing through narrow spaces in the patients who underwent TG, it is necessary for them to pay particular attention to the meals of dry texture, food forms big in size, and ones that are rough and solid. Therefore, we advise them to eat meals that are smaller in size, boiled well, with adequate moisture, and thick enough for a smooth passage so as to not cause stagnation. The patients who underwent DG must be provided with a suggestion like cooking methods that refrain or neutralize strong sour meals, and those who underwent B-1 should be instructed not to overeat high-fat meals.

This study has some limitations. First, it was a retrospective study and the patient sample was in a limited area. Therefore, a certain degree of selection bias could not be avoided. Second, we can find the evidence that the meal contents that are likely to cause passage stagnation could not suggest the association with other symptoms such as dumping symptoms. Thus, further research is required on the cause of the relationship between the symptoms and unpalatable meal contents.

5. Conclusion

The participants who underwent TG felt difficulty in eating the food form with big in size ($p = 0.013$), solid food form ($p = 0.040$), rough food form ($p = 0.041$), dry texture ($p = 0.045$) compared with those who underwent DG. The DG group also felt difficulty in eating foods with a strong sour taste compared with the TG group ($p = 0.031$). Therefore, further investigation is necessary to discuss the dietary instructions owing to the characteristics in surgical procedure and reconstruction.

Author agreement

All authors made substantial contributions and approve of the conception, drafting, and final version of the manuscript.

Author contributions

M. Kitagawa performed the study as a principal investigator and drafted the study design, collected and analyzed the data, interpreted the results, wrote the manuscript and a corresponding author.

Y. Uesugi contributed significantly to study planning, result interpretation, and manuscript preparation and revision.

N. Kawata and Y. Shimamura participated in the data collection and interpreted the results of study.

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Declaration of Competing Interest

M. Kitagawa, Y. Uesugi, N. Kawata and Y. Shimamura have no conflicts of interest or financial ties to disclose.

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