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Food Tolerance in Patients Submitted to Gastric Bypass: The Importance of Using an Integrated and Interdisciplinary Approach

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Abstract
Background Under the restrictive component, patients undergoing gastric bypass may have food intolerance with or without complications.
Methods This study used quantitative, analytical, observational methodology with patients submitted to Roux-en-Y gastric bypass without the placement of a ring at Hospital Universitário do Rio Grande do Norte in the city of Natal, Brazil between July 2005 and August 2010. Out of 176 patients monitored after surgery by the interdisciplinary team, 47 took part in the study. Two questionnaires were applied to participants: one elaborated by Suter et al. and previously validated for assessment of food tolerance and another to characterize schooling and socioeconomic status. Evaluation of food tolerance considered patient satisfaction with eating, most accepted food types, and frequency of vomiting and/or regurgitation. After application of the first questionnaire, a score was generated, characterizing food intolerance.
Results Of the 47 patients evaluated, 85.1% classified their degree of food satisfaction as good or excellent. Red meat was the most cited as being difficult to ingest (38.3%), representing a significant impact on overall tolerance level ($P<0.001$); 48.9% of participants exhibited rare episodes of vomiting, which resulted in a mean food tolerance score of 23.02 (2.87±SD). Moreover, socioeconomic status showed a significant correlation with tolerance level ($P=0.032$).
Conclusions The degree of food tolerance observed in the study sample was better than that obtained in other investigations using similar methodology. The questionnaire proved to be useful in evaluating food quality and comparing postoperative results. Socioeconomic status was correlated with food tolerance level.

Keywords Bariatric surgery · Food tolerance · Gastric bypass · Eating behavior

Introduction

Food intolerance is relatively frequent after restrictive bariatric surgeries [1, 2]. Food intolerance problems are similar in the short run, regardless of the surgical technique used, but tend to improve over time [3]. On the other hand, persistent long-term food intolerance leads to nutritional deficiencies, mainly in patients submitted to mixed procedures such as Roux-en-Y gastric bypass (RYGB) [4, 5].

With respect to Roux-en-Y gastric bypass, symptoms can occur as a result of surgery complications, such as gastrojejunal anastomosis stenosis, or more frequently, food adaptation difficulties arising from the need for changes in eating techniques imposed by the restrictive component of the operation [6]. This problem may be aggravated by the

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presence of behavioral disorders, such as anxiety and compulsive eating, or alterations in masticatory capacity, requiring an interdisciplinary approach to obtain better postoperative food adaptation.

The aims of this study were to investigate the degree of food intolerance, using a questionnaire validated by Suter et al. [7] in obese patients after bariatric surgery, characterize the main types of foods involved, and correlate them with satisfaction level after gastric bypass in obese patients enrolled in the bariatric surgery program at a public reference center in Northeast Brazil.

Sample and Methods

This is a quantitative, observational study using an analytical approach, conducted with patients submitted to laparoscopic Roux-en-Y gastric bypass surgery as part of the Integrated Bariatric Surgery Program of the Service for Obesity Surgery and Related Diseases at Hospital Universitário Onfre Lopes, Universidade Federal do Rio Grande do Norte (SCODE|HUOL|UFRN), in Northeast Brazil. Patients underwent surgery according to the criteria established by the Ministry of Health of Brazil and in line with the IFSO Statement. All surgeries were performed by the same team, following a technical standard implemented in the service, where the gastric pouch is approximately 20–30 ml and gastrojejunal anastomosis is done manually and calibrated to a diameter of approximately 2 cm.

Assessment, questionnaire application, and analyses were conducted at the Unit of Nutrition and Digestive Tract Surgery (UNICAD), a private service belonging to the same team, and at UNP—Universidade Potiguar do Rio Grande do Norte, located in the city of Natal.

All the patients were assessed, accompanied in the pre- and postoperative period by an interdisciplinary team composed of bariatric surgeons, endocrinologists, psychologists, nutritionists, physical therapists, and speech therapists. The speech therapist assessed anatomical and functional aspects of the oral motor system. Dental status, occlusion capacity, and other aspects of masticatory function and swallowing were also assessed. Alterations observed were treated and functional capacity rehabilitated. Evaluation and rehabilitation sessions were video-recorded and discussed between patients and the team.

During postoperative follow-up, researchers applied a form to investigate food tolerance in patients who gave their written informed consent. This study was approved by the Research Ethics Committee of Universidade Potiguar, in the city of Natal, Brazil, under protocol number 078/2010.

Inclusion criteria were patients submitted to laparoscopic Roux-en-Y gastric bypass without placement of a ring, a surgery standardized by SCODE, between the ages of 18 and 50 years. Exclusion criteria were patients submitted to the same surgery, but with complications that could account for food intolerance, such as stenosis following gastroenteroanastomosis or marginal ulcers and/or refused to give their written informed consent.

Data were collected in interviews conducted at UNICAD, applying the questionnaire to a convenience sample of 47 patients in October and November 2010. The questionnaire consisted of a form with open and closed questions elaborated by Suter et al. [7] and validated in order to investigate food tolerance and quality in patients submitted to bariatric surgery. This form is composed of four parts: (1) questions related to satisfaction and food quality, (2) meal frequency during the day, (3) tolerance to various types of foods, and (4) frequency of vomiting or regurgitation. A score was tabulated from the results of parts 1, 3, and 4. In part 1, patient satisfaction with food quality, items were assigned scores ranging from 1 (very poor) to 5 (excellent). In part 3, food tolerance to various types of foods (red meat, white meat, salad, vegetables, bread, rice, pasta, and fish), scores varied between 2 (no difficulty) and 0 (did not eat). In part 4, occurrence of vomiting or regurgitation, points ranged between 0 (vomited or regurgitated daily) and 6 (never vomited or regurgitated). Final score was between 1 and 27 points, the latter representing the maximum value for excellent food tolerance. In addition to questionnaire information, anthropometric data such as age, sex, and socioeconomic status were included, as well as schooling level, in which individuals were classified according to the Brazilian Ministry of Education (Appendix).

Descriptive and inferential statistical analyses were carried out. Pearson's correlation was used to test inter-variable correlation when parametric assumptions were met; otherwise, Spearman's correlation test was employed. The Student's *t* test was used for group comparisons when assumptions were met and the Mann–Whitney or Kruskal–Wallis tests when assumptions of normality and homogeneity were not met. A significance level of 5% ($P<0.05$) was set for all the tests.

Results

Of the 176 patients submitted to surgery at SCODE/HUOL/UFRN and accompanied at UNICAD, 47 participated in the study. Of these, 31 were women. At postoperative reassessments, mean age was 40.16 years (10.82±SD), weight 89.65 kg (16.39±SD), height 1.62 m (0.08±SD), and BMI 34.24 kg/m^2 (5.55±SD). With respect to schooling, 40.4% concluded secondary school, and as to socioeconomic status, 76.6% were middle class. At the time of question-

naire application, mean postoperative time was nearly 2 years (22 months). These data are presented in Table 1.

Results on the food quality form showed that postoperative satisfaction was excellent and good for 34% and 51% of patients, respectively. The mean number of meals consumed daily was approximately 5 (1.15±SD), where 95.7% had breakfast, lunch, and dinner and 76.6% snacked, most in the morning and afternoon (51.4%). When questioned about their ability to eat any type of food, 70.2% of patients reported being able to do so. These data (except the number of meals consumed) are given in Figs. 1, 2, 3, 4, and 5.

With respect to the type of food, red meat was the most difficult to ingest (38.3% of patients). With regard to frequency of vomiting or regurgitation, 48.9% reported it being a rare occurrence and 42.6% never vomited or regurgitated (Figs. 6 and 7). The mean final score was 23.02 (2.87±SD), indicating a good level of food tolerance for these patients.

Inferential analyses revealed that food tolerance was significantly correlated with the following variables: socioeconomic status (U=113.5; Z=−2.14; P=0.032; N=47), in which middle class individuals showed better tolerance (median score=24) than their lower class counterparts (median score=21); red meat ($t(44)$=−4.73; P<0.001), white meat ($t(44)$=−4.30; P<0.001), bread ($t(44)$=−2.07; P=0.044), and rice (U=73.5; Z=−2.59; P=0.009; N=47), where patients who ate these foods easily showed better food tolerance.

Discussion

The present study assessed the degree of food tolerance in obese patients after Roux-en-Y gastric bypass surgery and correlated the findings with the socioeconomic profile of patients submitted to laparoscopic gastric bypass at a public university facility in Northeast Brazil. Tolerance level was good and above that obtained in other investigations using the same methodology.

Even though bariatric surgery has shown good results in controlling obesity, patients undergoing this procedure may have difficulty in adapting to food after surgery. In patients submitted to adjustable gastric band surgery, Evans et al. reported that the main early postoperative problems were nausea, gagging, and vomiting, attributed to edema around the prosthesis [8]. This can be compounded by behavioral problems such as compulsive eating, given that the volume ingested is less than in the preoperative period, requiring changes in technique and food habits.

Pedrosa et al. [9] investigated the clinical nutritional profile and occurrence of food intolerance in 205 patients submitted to RYGB, observing that vomiting was the main symptom associated with food intolerance. This occurred in the first six postoperative months, mainly in women, a prevalence also found by other authors [10]. At the Medical Center of the University of Minnesota, Kellogg et al. [11] followed up 1,222 patients submitted to gastric bypass for 3 years and observed that 58% of individuals were readmitted within 3 months of surgery. One of the reasons for readmission was the lack of proper eating habits, which led to more frequent episodes of dumping, intolerance to medication, vitamin B_1 deficiency, gagging, and vomiting.

Suter et al. [7] developed a questionnaire to investigate food quality in patients submitted to bariatric surgery. The prospective study was conducted with four groups of

Table 1 Socioeconomic data

Variable	Number (%)
Schooling	
Unfinished elementary	6 (12.8%)
Finished elementary	4 (8.5%)
Unfinished secondary	6 (12.8%)
Finished secondary	19 (40.4%)
Unfinished university	4 (8.4%)
Finished university	8 (17.0%)
Socioeconomic level	
Lower class	11 (23.4%)
Middle class	36 (76.6%)

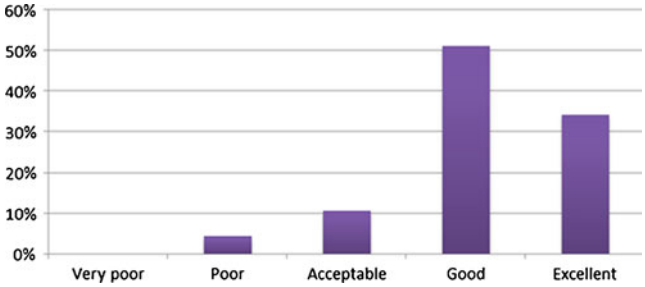

Fig. 1 Participant satisfaction with food

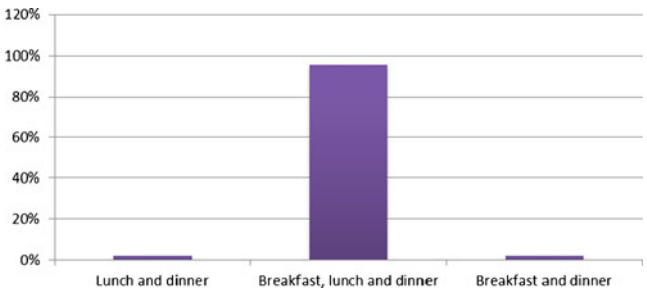

Fig. 2 Meals per day

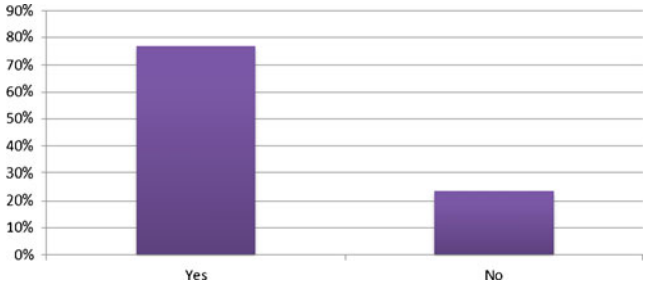

Fig. 3 Participant response when asked if they ate between meals

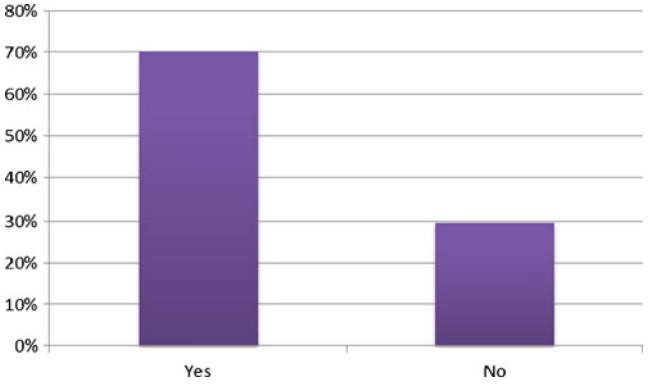

Fig. 5 Patient response when asked if they were able to consume any type of food

patients. Two groups underwent bariatric surgery using the restrictive and mixed techniques. Of the two restrictive techniques used, 300 patients were submitted to gastric banding and around 600 to RYGB. The other two groups were controls, with 55 non-operated morbidly obese patients and 75 non-obese patients. Data were collected and questionnaire applied for 5 years, a period in which it was validated. At the end of the investigations, patients with RYGB showed food intolerance in the first months and decreasing symptoms after 3 months. After 12 months, food intolerance in these patients was similar to that observed in the general population. In gastric band patients, food intolerance symptoms worsened over time.

Schweiger et al. [3] evaluated the impact of four different surgical procedures, including RYGB, on tolerance and food quality, using the same questionnaire as the present study and found that food tolerance improves over time and is related to surgical procedure. They also observed that patients with a gastric band had the lowest score, characterizing poor food adaptation. Of the foods mentioned, those most associated to low tolerance were meat, chicken, rice, and fish, and overall food tolerance score was 16 points, as opposed to the 23 points obtained in our study. Valezi et al. [12] investigated the degree of preference and food tolerance according to the gender of patients after RYGB and observed that the only significant difference was in fruit consumption, which was higher in women. Meal duration was less than 15 min, ranging between four and five meals per day, without concomitant fluid intake.

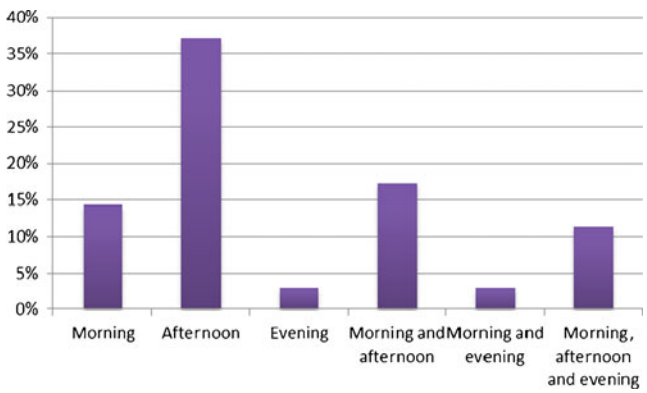

Fig. 4 Snack times

Food intolerance, characterized by nausea, regurgitation, and vomiting, is more common in the first months after RYGB surgery and tends to improve with time. However, it may persist for more than 1 year in some patients, even when accompanied by a multidisciplinary team, causing long-term nutritional complications [3]. According to Dias et al., the frequency of nausea and vomiting can decrease provided postoperative care is intensified, mainly in relation to eating techniques such as cutting food into small pieces and chewing slowly, habits that could avoid gagging and vomiting. Moreover, certain vegetables, bread, red meat, and derivatives were poorly tolerated by the study population, and the dietary intake investigated was insufficient to achieve macro- and micronutrient recommendations after 1 year of postoperative follow-up [13]. Another study analyzed 1-year postoperative protein intake of RYGB patients and found that, despite having increased over 12 months, remained lower than the intake goals for this population, possibly mediated by intolerance to food with high protein content, such as meat, eggs, and dairy products [14]. Alvarez-Leite and Bloomberg et al. [4, 5] showed that the main nutritional deficiencies in these patients are proteins, vitamin B_{12}, iron, thiamine, calcium, and vitamin D, due to low intake caused by the nutritional quality of the foods consumed or intolerance, and reduced absorption capacity. In the case of iron deficiency, Love and Billet [14] believe that reduced gastric secretion contributes to a deficiency of this micronutrient in addition to excluding the duodenum from intestinal transit. Furthermore, meat,

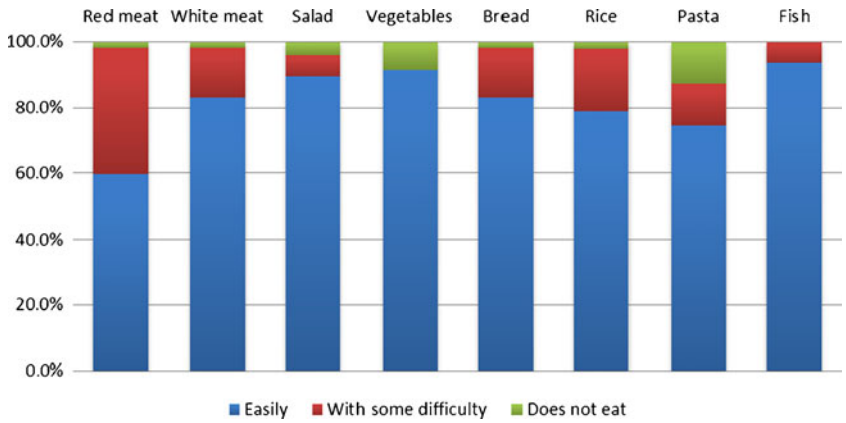

Fig. 6 Degree of difficulty in ingesting food

an important source of iron and B_{12}, is difficult to digest, and most patients cannot ingest it due to anatomical and physiological changes that take place in the gastrointestinal tract [15, 16]. Vitamin B_1 deficiency, although infrequent, can occur owing to pre-existing deficiency, low intake or absorption, and primarily to vomiting episodes. Acute or chronic thiamine deficiency may manifest itself as a symptom of peripheral neuropathy or Wernick–Korsakoff encephalopathy. Early diagnosis of signs and symptoms of this condition is extremely important because aggressive treatment may avoid or reduce long-term sequelae [17]. This evidence justifies the use of systematic supplementation of these nutrients in addition to measures aimed at optimizing the food quality of these patients.

Difficulty in ingesting some food groups due to frequent vomiting may cause more prolonged consumption of semiliquid and soft food items to avoid gagging and vomiting. This may cause weight loss and nutritional deficiencies since processed or liquid foods have a greater carbohydrate than protein content [7]. In the present study, 85% of patients described their food satisfaction as "good" or "excellent" (able to eat anything or satisfied with what they are able to eat), while no individual reported only being able to consume liquids or soft food.

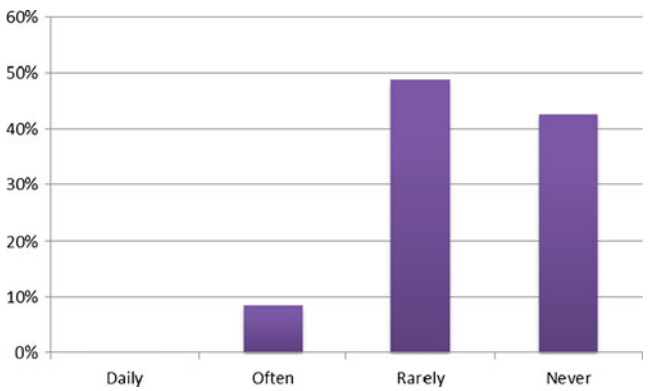

Fig. 7 Occurrence of regurgitation and vomiting among participants

Among specific recommendations for patients submitted to bariatric surgery, red meat consumption is a priority since it is a highly bioavailable protein source containing important micronutrients such as vitamin B complex and minerals such as iron and zinc [18]. However, most studies report that difficulty eating red meat is a limiting factor that hinders better adaptation of these patients in both the short and long term [18]. Thus, an integrated and interdisciplinary follow-up with nutritionists, speech therapists, and psychologists that focus on evaluating mastication and eating techniques seems to reduce nutritional risks.

With respect to meal patterns of patients submitted to RYGB, Wardé-Kamar et al., in an investigation of calorie intake, nutrient composition, and meal models, found a mean daily consumption of three meals and three snacks and that calorie intake at dinner and afternoon snack accounted for 40% of daily calorie ingestion [19]. Given that this recommendation was not achieved in the present study (mean of 4.94 meals/day), this population should be targeted for specific nutritional management, in order to prevent and/or treat possible nutritional deficiencies.

Food tolerance is also related to weight gain. Moize et al. [18] state that one of the motives of unsuccessful bariatric surgery is the consumption of simple carbohydrates rather than protein-rich foods, since the latter are generally more difficult to ingest. This habit could lead to long-term excessive weight regain, a problem that affects up to 20% of surgery patients [20]. Odom et al. [21] reported that self-monitoring and follow-up by an interdisciplinary team are important factors related to preventing postoperative weight regain.

This study found a significant correlation between socioeconomic status and degree of food tolerance. However, this relationship was not observed in other studies. Durkin et al. [22] investigated if the socioeconomic level of patients in California would influence surgery results, since it was thought that patients with less purchasing power would obtain worse results, causing many health insurance plans to deny them coverage. Although patients with better socioeconomic status also had higher education levels and more access to surgical treatment, results were similar to those observed in the less economically privileged group. In another study carried out in Canada [23], it was observed that low income individuals faced barriers to maintaining weight loss due to difficulties in acquiring healthy foods, scheduling clinical visits, limited access to health services, and greater social acceptance of obesity. Furthermore, these individuals demonstrated less adherence to the preoperative preparation program, an important requirement for surgical approval. In this study, we found a significant relationship between socioeconomic level and food tolerance with economically privileged patients exhibiting better postoperative adaptation.

A number of studies [9, 10] have proven the importance of assessment and interdisciplinary follow-up. According to the Brazilian Society of Bariatric and Metabolic Surgery [24], the team must consist of a surgeon, clinician (general practitioner, endocrinologist, intensivist, or cardiologist), psychiatrist, psychologist, and nutritionist. The present study included a speech therapist, who evaluated, oriented, and rehabilitated patients with functional difficulties in the oral motor system such as altered mastication and/or swallowing. In most articles, these professionals are not part of the interdisciplinary team nor do the main bariatric societies recommend their inclusion. However, his specific task of optimizing food tolerance in this series certainly contributed to the excellent degree of adaptation observed.

Even though a number of literature studies discussed the determining factors of postoperative results and identified food adaptation difficulties, there is still a lack of standard evaluation methods, hindering systematization of team practices and result comparison. Thus, more studies are needed to identify and characterize these intolerances and perfect the health care provided to this population.

Conclusion

Under our study conditions, at a confidence level of 95%, the use of a selective questionnaire allowed us to evaluate indicators and compare results, which showed that patients with lower socioeconomic status exhibited a significant reduction in food tolerance.

Conflicts of interest None.

Appendix

Food tolerance of patients submitted to bariatric surgery

General data form

Name:

Sex: Age:

Weight: Height: BMI:

Schooling:

( ) Illiterate

( ) Unfinished Elementary

( ) Finished Elementary

( ) Unfinished Secondary

( ) Finished Secondary

( ) Unfinished University

( ) Finished University

Socioeconomic Status:

( ) Lower Class

( ) Middle Class

( ) Upper Middle Class

( ) Upper Class

Food Quality

Months since surgery.....months

What is your satisfaction level with what you are able to eat now?

Excellent ( )

Good ( )

Acceptable ( )

Poor ( )

Very poor ( )

Why?

.....

.....

.....

How many meals per day do you eat?.....

Which of the following meals do you eat? Breakfast ( )

Lunch ( )

Dinner ( )

Which is your main meal?.....

Do you eat between meals? Yes ( ) No ( )

If yes, when? In the morning ( )

In the afternoon ( )

At night ( )

Are you able to eat anything? Yes ( ) No ( )

More specifically, what are you able to eat?

Red meat ( ) Easily ( ) With some difficulty ( ) Do not eat

White meat ( ) Easily ( ) With some difficulty ( ) Do not eat

Salad ( ) Easily ( ) With some difficulty ( ) Do not eat

Vegetables ( ) Easily ( ) With some difficulty ( ) Do not eat

Bread ( ) Easily ( ) With some difficulty ( ) Do not eat

Rice ( ) Easily ( ) With some difficulty ( ) Do not eat

Pasta ( ) Easily ( ) With some difficulty ( ) Do not eat

Fish ( ) Easily ( ) With some difficulty ( ) Do not eat

(Points: 2 points with difficulty / 1 point with a little difficulty / 0 do not eat)

Is there any other type of food that you cannot eat?

.....

.....

Do you vomit or regurgitate?

( ) Daily

( ) Frequently (> 2x/week)

( ) Rarely

( ) Never

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