

## Impairment of gastrointestinal quality of life in severely obese patients

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### Abstract

**AIM:** To investigate the common gastro-intestinal symptoms and quality of life in severely obese subjects.

**METHODS:** We prospectively recruited 340 severely obese patients [mean age  $30.5 \pm 7.8$  years; mean body mass index (BMI)  $42.9 \pm 6.1$  kg/m<sup>2</sup>] and 340 healthy persons (mean BMI  $23.1 \pm 3.8$  kg/m<sup>2</sup>) matched in sex, age, marriage and education. The quality of life was studied using a specific gastrointestinal quality of life index (GIQLI) questionnaire. The 36 items and four functional domains of the GIQLI were compared and analyzed between the groups. The possible correlation of GIQLI scores with specific clinical variables in severely obese patients was assessed by measuring Pearson's coefficient of correlation.

**RESULTS:** The mean GIQLI score of severely obese patients was lower than the normal control group ( $108.5 \pm 17.1$  vs  $123.2 \pm 14.8$ ,  $P < 0.01$ ). Severely obese patients had decreased scores in the domains of general

health, including physical ( $17.3 \pm 6.0$  vs  $22.4 \pm 3.1$ ,  $P < 0.01$ ), emotional ( $12.6 \pm 4.3$  vs  $16.6 \pm 3.1$ ,  $P < 0.01$ ) and social function ( $14.7 \pm 3.9$  vs  $17.9 \pm 2.5$ ,  $P < 0.01$ ), and in the domain of gastrointestinal symptoms ( $63.9 \pm 6.7$  vs  $66.3 \pm 7.2$ ,  $P < 0.05$ ). A significantly decreased score was found in nine items, and there was an increased score in one out of the 19 items in the domain of symptoms of the GIQLI questionnaire. The decreased score in the domain of symptoms was correlated with increasing glycosylated hemoglobin (HbA1c) levels.

**CONCLUSION:** Severe obesity resulted in a significant impairment of the quality of life and caused specific gastrointestinal symptoms compared with normal controls. The development of gastrointestinal symptoms is correlated increasing HbA1c, suggesting that a poor control of hyperglycemia might be the etiology.

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**Key words:** Severe obesity; Quality of life; Gastro-intestinal symptoms; Glycosylated hemoglobin

**Core tip:** This study found that the severely obese patients had a significant impaired general quality of life, including social, emotional and physical domain. This finding is similar to previous studies and supports the role of bariatric surgery in treating this group of patients. Although the impairment of the specific gastrointestinal quality of life is not as high as the general quality of life, this study did detect a significant impairment in 9 (47%) out of 19 specific gastrointestinal symptoms. The arousing of these annoying gastrointestinal symptoms is interesting and deserves further investigation.

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## INTRODUCTION

Obesity is becoming a pan-endemic health problem in the United States and worldwide<sup>[1,2]</sup>. It increases the risk for many common diseases, including coronary artery disease, type 2 diabetes, dyslipidemia, hypertension, gall-bladder disease and osteoarthritis, thus increasing the risk of death<sup>[3,4]</sup>. It is likely that severe obesity surpasses smoking as the number one cause of preventable death in the United States<sup>[5]</sup>. Because severe obesity causes a great deal of suffering related to these co-morbidities, a reduction in the general quality of life is well documented and well understood in previous reports<sup>[6,7]</sup>. Obesity is known to be an important risk factor for some gastro-intestinal diseases, such as gastro-esophageal reflux disease and non-alcoholic steatohepatitis and gall bladder disease<sup>[8-10]</sup>. Gastrointestinal complaints are common in the severely obese, but there is little data specifically evaluating the impairment of gastrointestinal function in these patients or the possible etiology. A possible investigation tool, the gastrointestinal quality of life index (GIQLI), is a well-validated tool for assessing the specific quality of life and gastrointestinal symptoms in patients with various gastrointestinal diseases<sup>[11]</sup>. This questionnaire was used for many gastrointestinal diseases to investigate the changes before and after surgical treatment, including gastric cancer, reflux disease, achalasia, obesity and diabetes<sup>[12-17]</sup>. Data from the GIQLI in severely obese patients compared with the normal population is lacking. These data are very important for investigating the etiology and therapeutic effect of associated gastrointestinal disease in severely obese patients. In this study, we examine the differences in the GIQLI between severely obese patients and normal controls, and evaluate the relationship of various clinical parameters with the difference in GIQLI.

## MATERIALS AND METHODS

This study was conducted in the Endoscopic Bariatric Center of the Min-Sheng General Hospital of the National Taiwan University from October, 2007 to September 2011. The study was approved by the human-research review board at Min-Sheng General Hospital. This prospective study of 340 consecutive patients was part of an extensive preoperative evaluation and data collection on patients with severe obesity referred for laparoscopic bariatric surgery for weight reduction in Min-Sheng General Hospital, Taiwan. The inclusion criteria were essentially the same as the NIH Consensus Development Panel of 1991 recommended, but with a modification for Asians, including a history of obesity of > 5 years' duration, body mass index (BMI) > 37 kg/m<sup>2</sup> or BMI > 32 kg/m<sup>2</sup> with co-morbidities, documented weight-loss attempts in the past and good motivation for surgery<sup>[18,19]</sup>. Another

340 normal healthy subjects matched by age and sex were included as the normal control group. The subjects in the normal control group were volunteers who had no symptoms and received an annual health check-up at this hospital. The obesity-related co-morbidities were recorded, and the presence of metabolic syndromes was documented. Demographic and laboratory data were collected at the pre-operative evaluation. Metabolic syndrome was defined according to the ATP III definition<sup>[20]</sup>.

All of the patients and normal controls received a life quality questionnaire evaluation using the GIQLI, a 36-item-questionnaire<sup>[11]</sup>. The GIQLI explores the patient's self-evaluation of the 2-wk period before the questionnaire is filled out. It includes 36 items covering four domains. Three domains belong to the general quality of life: physical function (7 questions), emotional function (5 questions) and social function (5 questions). One domain is specific to gastrointestinal symptoms (19 questions). Each question is scored from zero to four (zero being the worst and four being the best). The maximum score is 144.

### Statistical analysis

SPSS version 12.01 for Windows (SPSS Inc, Chicago, IL, United States) was used for all of the statistical analyses. The results for all of the items were expressed as the mean  $\pm$  SD of the mean or median as appropriate. The paired Student's *t* test was used to compare each item between the study and control groups. A two-tailed *t* test was used for comparison of the total scores and the scores in each subgroup of items between the two groups. Values of *P* < 0.05 were considered statistically significant. The GIQLI scores of the severely obese patients were assessed for possible correlation by measuring Pearson's coefficient of correlation, which was evaluated for significance within the 95% confidence interval. All of the data were recorded on standardized data collection forms, which were transferred into a commercially available electronic database system for personal computers and analyzed.

## RESULTS

The demographic data regarding the study and control groups are given in Table 1. The mean age and BMI of the severely obese patients were  $30.5 \pm 7.8$  years and  $42.9 \pm 6.1$  kg/m<sup>2</sup>. There was no difference in the age, sex ratio, education level and marital ratio between the two groups, but the mean BMI was significantly higher in the severely obesity group ( $42.9$  kg/m<sup>2</sup> *vs*  $23.1$  kg/m<sup>2</sup>, *P* < 0.01). The majority of the severely obese patients had more than one abnormal criteria of metabolic syndrome as shown in Table 2. Hypertension, followed by hyperglycemia, was the most common abnormal criteria in the severely obese patients. Type 2 diabetes [glycosylated hemoglobin (HbA1c) > 6.5%] was found in 64 (18.8%) of the severely obese patients. Among these patients, 34% were taking anti-lipid medication, 18% took anti-hyper-

**Table 1** Demographics of patients and normal controls *n* (%)

Demographics	Severe obesity ( <i>n</i> = 340)	Normal control ( <i>n</i> = 340)	<i>P</i> value
Age (mean ± SD)	30.5 ± 7.8	31.6 ± 8.6	NS
Sex ratio (F/M)	270:70	270:70	NS
BMI (kg/m <sup>2</sup> )	42.9 ± 6.1	23.1 ± 3.8	< 0.001
Marriage (Y/N)	159:181	163:177	NS
Education (College)	238 (70)	252 (74)	NS

BMI: Body mass index; NS: Not significant; BP: Blood pressure; F: Female; M: Male.

**Table 2** Distribution of co-morbidities in severely obese patients *n* (%)

Distribution	Severe obesity ( <i>n</i> = 340)
Hypertension	
SBP > 130 mmHg	221 (65.1)
DBP > 85 mmHg	170 (50.0)
Hyperglycemia (FPG > 100 mg/dL)	148 (43.5)
Hyper TG (TG > 150 mg/dL)	162 (47.0)
HDL-C (male) < 40 mg/dL	28 (40.5)
HDL-C (female) < 50 mg/dL	175 (64.8)
Diabetes (HbA1c > 6.5)	64 (18.8)

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FPG: Fasting plasma glucose; TG: Triglycerides; HDL-C: High-density lipoprotein cholesterol.

tension medication and 11% took hypoglycemic agents. Approximately half of them were married.

Severely obese patients have a significant deterioration in the GIQLI score compared with the normal control group (108.5 ± 17.1 *vs* 123.2 ± 14.8, *P* < 0.01). The decreasing scores are observed in all four domains, as shown in Table 3. Severely obese patients had decreased scores in the domains of general health, including physical (17.3 ± 6.0 *vs* 22.4 ± 3.1, *P* < 0.01), emotional (12.6 ± 4.3 *vs* 16.6 ± 3.1, *P* < 0.01) and social function (14.7 ± 3.9 *vs* 17.9 ± 2.5, *P* < 0.01), and in the domain of gastrointestinal symptoms (63.9 ± 6.7 *vs* 66.3 ± 7.2, *P* < 0.05). Severely obese patients had the highest defect in the social domain (29%), followed by the emotional (24.1%) and physical (22.8%) domains. Severely obese patients had decreased scores in 14 of the 17 items of general health, including all five items in the domain of social function, four out of five items in emotional function and five out of seven items in physical function (Table 4). In the domain of gastrointestinal symptoms, severely obese patients had a decreased mean score of 3.6% and a decreased score in nine out of the 19 items, but had an increased score in one item. Severely obese patients had more frequent heart burn (3.6 ± 0.8 *vs* 3.7 ± 0.8, *P* < 0.05) and regurgitation (3.5 ± 0.8 *vs* 3.7 ± 0.7, *P* < 0.05) than the normal control. In eating, severely obese patients more frequently needed selective food restriction (2.9 ± 1.1 *vs* 3.4 ± 0.9, *P* < 0.01) and felt less pleasure with eating (2.0 ± 1.1 *vs* 2.5 ± 1.1, *P* < 0.01). They were troubled by a low speed of eating (3.6 ± 0.7 *vs* 3.8 ± 0.5, *P* < 0.01).

**Table 3** Total gastrointestinal quality of life and domain scores *n* (%)

GIQLI	Severe obesity	Normal control	Difference	<i>P</i> value
Overall	108.5 ± 17.1	123.2 ± 14.8	14.7 (11.9)	< 0.01
Symptoms	63.9 ± 6.7	66.3 ± 7.2	2.4 (3.6)	< 0.05
Physical	17.3 ± 6.0	22.4 ± 3.1	5.1 (22.8)	< 0.01
Emotional	12.6 ± 4.3	16.6 ± 3.1	4.0 (24.1)	< 0.01
Social	14.7 ± 3.9	17.9 ± 2.5	5.2 (29.0)	< 0.01

GIQLI: Gastrointestinal quality of life.

Severely obese patients were also more troubled with functional gastrointestinal symptoms, including abdominal fullness (2.7 ± 1.0 *vs* 3.1 ± 0.9, *P* < 0.01), urgent bowel movement (3.7 ± 0.6 *vs* 3.8 ± 0.5, *P* < 0.05), diarrhea (3.3 ± 0.8 *vs* 3.5 ± 0.8, *P* < 0.01), and incontinence (3.9 ± 0.2 *vs* 4.0 ± 0.2, *P* < 0.05) than normal person. Severely obese patients were less troubled by gurgling abdominal noises than the normal persons (3.6 ± 0.6 *vs* 3.4 ± 0.8, *P* < 0.01).

In the correlation analyses, the deterioration of the total score of GIQLI in severely obese patients was correlated with female patients, increasing age and lower BMI (Table 5). The subgroup analyses showed that the deterioration of the scores in the domains of general life quality including physical, emotional and social function had similar results to the total score, but the deterioration of the symptoms score was only correlated with the HbA1C level.

## DISCUSSION

This study is the first to examine the impairment of specific gastro-intestinal quality of life in severely obese patients in a large cohort. This study found that the severely obese patients had a significantly impaired general quality of life, including social, emotional and physical domain. This finding is similar to previous studies using a general quality of life questionnaire<sup>[6,7]</sup> and supports the role of bariatric surgery in treating this group of patients<sup>[17-24]</sup>. This study detected a significant impairment in gastrointestinal symptoms in this group of severely obese patients using a specific GIQLI questionnaire. Although the impairment of the specific gastrointestinal quality of life is not as high as the general quality of life, this study did detect a significant impairment in nine (47%) out of 19 specific gastrointestinal symptoms. These data are important for clinicians to understand the impairment and manage these symptoms in clinical practice. These annoying gastrointestinal symptoms are interesting and deserve further investigation.

Two gastroesophageal reflux disease (GERD)-related symptoms (regurgitation, heart burn) in this study were significantly worse in severely obese patients. These symptoms, in combination with obstructive sleep apnea, might result in insomnia in these patients. The score of the item “wake-up at night” in the physical function domain was significantly lower in the severely obese patients

**Table 4** Items in the questionnaire of gastrointestinal quality-of-life index and scores in each item

Item	Morbid obesity	Normal control	P value
Symptoms			
Abdominal pain	3.4 ± 0.7	3.4 ± 0.7	NS
Feeling of abdominal fullness <sup>b</sup>	2.7 ± 1.0	3.1 ± 0.9	
Abdominal bloating (too much gas)	3.2 ± 0.9	3.1 ± 1.0	NS
Trouble with flatulence	3.1 ± 1.0	3.1 ± 0.9	NS
Trouble with burping or belching	3.4 ± 0.8	3.5 ± 0.8	NS
Trouble with gurgling abdominal noises <sup>b</sup>	3.6 ± 0.6	3.4 ± 0.8	
Trouble with bowel frequency	3.4 ± 0.8	3.5 ± 0.8	NS
Enjoyed eating <sup>b</sup>	2.0 ± 1.1	2.5 ± 1.1	
Need for restricted eating <sup>b</sup>	2.9 ± 1.1	3.4 ± 0.9	
Regurgitation <sup>a</sup>	3.5 ± 0.8	3.7 ± 0.7	
Trouble with slow speed of eating <sup>b</sup>	3.6 ± 0.7	3.8 ± 0.5	
Trouble with dysphagia	3.8 ± 0.5	3.9 ± 0.1	NS
Trouble with bowel urgency <sup>a</sup>	3.7 ± 0.6	3.8 ± 0.5	
Trouble with diarrhea <sup>b</sup>	3.3 ± 0.8	3.5 ± 0.8	
Trouble with constipation	3.4 ± 0.9	3.5 ± 0.8	NS
Trouble with nausea	3.5 ± 0.7	3.6 ± 0.7	NS
Trouble with blood in stool	3.8 ± 0.5	3.8 ± 0.5	NS
Trouble with heartburn <sup>a</sup>	3.6 ± 0.8	3.7 ± 0.8	
Trouble with incontinence <sup>a</sup>	3.9 ± 0.2	4.0 ± 0.2	
Emotional items			
Coping with every day stress	2.5 ± 0.8	2.6 ± 0.8	NS
Sadness about illness <sup>b</sup>	2.5 ± 1.2	3.4 ± 1.1	
Nervousness or anxious about illness <sup>b</sup>	2.8 ± 1.1	3.3 ± 0.8	
Happiness with life in general <sup>b</sup>	2.3 ± 1.1	2.8 ± 1.0	
Frustration about illness <sup>b</sup>	2.5 ± 1.2	3.5 ± 0.8	
Physical items			
Trouble with fatigue	2.7 ± 1.1	2.8 ± 1.0	NS
Feeling unwell	2.8 ± 0.9	2.9 ± 0.9	NS
Wake-up at night <sup>b</sup>	3.1 ± 1.1	3.4 ± 0.9	
Trouble with changes in appearance <sup>b</sup>	2.1 ± 1.4	3.6 ± 0.7	
Loss of physical strength <sup>b</sup>	2.1 ± 1.2	3.4 ± 0.8	
Loss of endurance through illness <sup>b</sup>	2.1 ± 1.2	3.1 ± 1.0	
Feeling unfit <sup>b</sup>	2.2 ± 1.2	3.2 ± 1.0	
Social items			
Coping with daily activities <sup>b</sup>	2.8 ± 1.1	3.5 ± 0.8	
Taking part in leisure activities <sup>b</sup>	2.8 ± 1.1	3.3 ± 1.0	
Bothered by medical treatment <sup>b</sup>	2.8 ± 1.0	3.7 ± 0.6	
Trouble of personal relationship <sup>b</sup>	3.3 ± 1.0	3.6 ± 0.7	
Sexual life impairment <sup>b</sup>	3.0 ± 1.2	3.8 ± 0.6	

<sup>a</sup>P < 0.05, <sup>b</sup>P < 0.01 *vs* preoperative data. NS: Not significant.

than the normal controls. Obesity is a well-known precipitating factor of GERD<sup>[8,9]</sup>. There are several possible patho-physiologic mechanisms responsible for the development of GERD in severely obese patients, including

a lower pressure of the esophageal sphincter, esophageal motor disorders and hiatal hernia secondary to increased intra-abdominal pressure<sup>[25-27]</sup>. Medical therapy, along with weight reduction, is generally agreed to help alleviate GERD in obese patients. Laparoscopic Nissen fundoplication is a safe and effective treatment option for GERD, but studies have demonstrated that obesity adversely affects the long-term success of the anti-reflux operation<sup>[28]</sup>. Previous studies showed an improvement of GRED-related symptoms in severely obese patients after significant weight loss following bariatric surgery<sup>[29,30]</sup>, and this might be recommended as the procedure of choice for severely obese patients suffering from GERD<sup>[31]</sup>.

Another cluster of gastrointestinal symptoms in severely obese patients can be classified as symptoms of irritable bowel syndrome, including abdominal fullness, bowel urgency, diarrhea and incontinence. The proposed etiology of irritable bowel symptoms in severely obese patients has been related to increased intra-abdominal pressure<sup>[32]</sup>. This increased pressure causes a chronic abdominal compartment syndrome that can produce marked irritable bowel type symptoms. These symptoms are expected to improve significantly after bariatric surgery and weight reduction<sup>[30,33]</sup>. The proposed mechanism of increased intra-abdominal pressure is only a hypothesis. The findings in this study that the deterioration of the symptoms score in severely obese patients did not relate to the BMI or waist circumference did not support the hypothesis. The only significant factor correlated with the development of GI symptoms is the HBA1c concentration. This finding implies that the diabetic associated autonomic neuropathy, rather than the increased intra-abdominal pressure, is the principle cause of the development of irritable bowel symptoms in severely obese patients.

Another possible explanation for the development of gastrointestinal symptoms in severely obese patients is the change in the intestinal microbiota in obese patients. Recent studies have shown that the gut microbiome of obese human beings is distinct from healthy-weight individuals<sup>[34,35]</sup>. Changes in the gut microbiota might be responsible for the development of non-alcoholic fatty liver disease and gastrointestinal symptoms<sup>[36]</sup>. Probiotic agents were found to be helpful in treating irritable bowel syndrome and improving outcomes after gastric bypass surgery<sup>[37,38]</sup>. The development of some gastrointestinal symptoms might be related to the change of the gut microbiota in obese patients.

Severely obese patients had a lower score in enjoying eating and the need for restricted eating. These are likely a psychological complication of obesity. In addition to many physical co-morbid conditions, there are significant psychopathologic factors affecting the morbidly obese. Depression, low self-esteem and poor body image are common in obese persons<sup>[39,40]</sup>. This altered self-image might cause severely obese patients to feel guilty and restrict their eating. These symptoms are expected to improve with the improved self-image and self-esteem that

**Table 5** Pearson correlation coefficients analysis between clinical and laboratory data and scores of different domains in the gastrointestinal quality-of-life index

Clinical and laboratory items	Total Score (36 items)	Physical domain (7 items)	Emotional domain (5 items)	Social domain (5 items)	Symptoms (19 items)
Age (yr)	-0.135 <sup>3</sup>	-0.126 <sup>2</sup>	-0.154 <sup>3</sup>	-0.177 <sup>3</sup>	NS
Sex	0.147 <sup>2</sup>	0.152 <sup>3</sup>	0.198 <sup>3</sup>	0.189 <sup>3</sup>	NS
BMI (BMI > 35 kg/m <sup>2</sup> )	0.115 <sup>1</sup>	NS	0.144 <sup>2</sup>	0.122 <sup>1</sup>	NS
Weight (kg)	NS	NS	NS	NS	NS
Waist circumference (cm)	NS	NS	NS	NS	NS
Waist:hip ratio	NS	NS	NS	NS	NS
Systolic blood pressure	NS	NS	NS	NS	NS
Diastolic blood pressure	NS	NS	NS	NS	NS
Fasting glucose (mmol/L)	NS	NS	NS	NS	NS
HbA1c	NS	NS	NS	NS	-0.176 <sup>2</sup>
Fasting insulin (mU/L)	NS	NS	NS	NS	NS
C-Peptide (pmol/mL)	NS	NS	NS	NS	NS
Total cholesterol (mmol/L)	NS	NS	NS	NS	NS
HDL cholesterol (mmol/L)	NS	NS	NS	NS	NS
Fasting triglyceride (mmol/L)	NS	NS	NS	NS	NS
Total protein (g/L)	NS	NS	NS	NS	NS
Albumin (g/L)	NS	NS	NS	NS	0.094 <sup>1</sup>
ALT	NS	NS	NS	NS	NS
AST	NS	NS	NS	NS	NS
Alkaline phosphatase	NS	NS	NS	NS	NS
HSCRP	NS	NS	NS	NS	NS
WBC	NS	NS	NS	NS	NS
Hemoglobin	NS	NS	NS	NS	NS
MCV	NS	NS	NS	NS	NS

<sup>1</sup>Correlation is significant at 0.05 level (2-tail); <sup>2</sup>Correlation is significant at 0.01 level (2-tail); <sup>3</sup>Correlation is significant at 0.001 level (2-tail). HSCRP: High sensitive C-reactive protein; MCV: Mean cellular volume; HDL: High-density lipoprotein; WBC: White blood cells; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; BMI: Body mass index; HbA1c: Hemoglobin A1c.

occur after significant weight loss<sup>[41]</sup>.

In this study, the deterioration of the total score of the GIQLI and the deteriorations in the domains of general quality of life, including psychological, physical and social function were correlated with increasing age, female gender, and lower BMIs. The inverse relationship with age reflects the chronic deterioration effect of obesity on a patient's health. The relationship with female gender and the BMI might be because of the bias of patient selection. The BMI is an objective measurement of general obesity and might not reflect the quality of life in obese patients, which is a subjective measurement. Severely obese patients who felt higher impairment in quality of life might seek surgical treatment earlier, when they have a lower BMI. In previously reported bariatric surgery studies, females are almost always predominant because female patients have more psychological and social pressure than male patients in our society<sup>[20-24]</sup>. The significance of gender and BMI might be a result of the bias of patient selection, but this study did confirm an impaired general quality of life in these patients compared with normal persons.

A limitation of this study is that this is not a general population survey but a prospective study of severely obese patients who were seeking bariatric surgery. A severe selection bias might exist because only patients who felt the most deterioration in their quality of life might seek an interventional treatment. In a relatively large

number of severe patients compared with a matched group, this study provides very useful knowledge about the gastrointestinal symptoms in severely obese patients.

Our study has proven that severely obese patients who seek bariatric surgery had significant impairment of their general and specific gastrointestinal quality of life. The deterioration of the gastrointestinal life quality is not related to the degree of obesity but is related to age, female gender and increasing of HbA1c, suggesting a poor control of hyperglycemia might be the principle etiology.

## COMMENTS

### Background

It has been frequently reported that bariatric surgery results in the resolution of obesity-related co-morbidities and improves the quality of life in severely obese patients. Little is known about the impairment of the gastro-intestinal quality of life in severely obese patients. In this study, the impairment of the gastro-intestinal quality of life in severely obese patients was studied and compared with normal controls.

### Research frontiers

This is a prospective study with a large-scale population.

### Innovations and breakthroughs

Severe obesity is well known to be associated with many co-morbidities, including type 2 diabetes, dyslipidemia, hypertension, sleep apnea, hypoventilation syndrome, cardiovascular diseases, gout, non-alcoholic steato-hepatic disease, degenerative arthritis, incontinence, gastro-esophageal reflux disease, incontinence and cancer. In this study, the authors evaluated the impairment in specific gastro-intestinal quality of life in severely obese patients. The authors demonstrated a significant and wide impairment of the specific gastro-intestinal

quality of life in severely obese patients, and the impairment is correlated with impaired glycemic control.

### Applications

The results of this study can be used as reference data for caring for severely obese patients and for further study about the effects of bariatric surgery.

### Terminology

The gastro-intestinal quality of life was used to investigate the specific gastrointestinal symptoms using a scoring system to represent the quality of life in study subject. Severely obese patients are those with a body mass index > 35 kg/m<sup>2</sup>.

### Peer review

The paper contains interesting data on a specific gastrointestinal quality of life index questionnaire.

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