

Association of body mass index with digestive symptoms and signs in northwest of Iran

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ABSTRACT

Aim: To evaluate the association between body mass index (BMI) and certain digestive symptoms and signs.

Background: Obesity is of substantial health significance all over the world, and it is categorized by the world health organization among top ten global health problems. There is much evidence that indicates a higher prevalence of digestive symptoms in obese people.

Patients and methods: This cross-sectional study was conducted in city of Tabriz in north-west of Iran. One-thousand and seventy-one families with 4225 members were randomly selected. The association of digestive symptoms and signs with BMI was assessed.

Results: Of 4225 family members, 2485 who were above 18 years old agreed to participate in the study. The prevalence of obesity was 20.1%, and 33.3% were overweight. There was a positive relation between increased BMI and specific digestive symptoms. Constipation ($P=0.043$), bloating ($P=0.03$), dysphagia ($P=0.024$), protruding anal mass ($P<0.001$) were more prevalent among the obese compared to normal weight participants and significant associations were found between high BMI and these symptoms. Hepatomegaly ($P=0.017$), abdominal tenderness ($P=0.004$) and tenderness on deep abdominal palpation ($P=0.013$) were positively associated with increased BMI in the obese. No participant was taking any anti-obesity medication.

Conclusion: In our community, increased BMI is associated with increased digestive symptoms and signs such as constipation, bloating, dysphagia, anal mass, hepatomegaly, and abdominal tenderness in deep palpation.

Keywords: *Body mass index, Digestive signs and symptoms, gender*

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INTRODUCTION

While many parts of the world still suffer from food scarcity, obesity is of substantial health significance all over the world, and it is categorized by the world health organization among the top ten global health problems (1). It is now well determined that food may modulate gastrointestinal (GI) function, and on the other hand, GI symptoms

may also alter food intake patterns (2). Moreover, deregulation of the mechanisms that control food intake and energy expenditure, and the decreased satiation response to food intake are key mechanisms that contribute to the development of obesity (3, 4); however, it is not established yet whether or not obese people experience more digestive symptoms than others (2).

While some reports indicated that up to 70% of general population has one or more chronic GI complaints annually (5, 6), there is much evidence

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that indicates a higher prevalence of digestive symptoms in obese people. Several cross-sectional studies and meta-analyses have demonstrated a positive association between elevated BMI – the weight in kilogram divided by the square of the height in meter – and symptoms of GERD (7). A report from Olmsted County, Minnesota, has identified a number of upper and lower GI symptoms that were significantly associated with increased BMI, including frequent vomiting, upper abdominal pain, bloating and diarrhea, but not lower abdominal pain or constipation (8). In addition, an increased prevalence of different GI symptoms has been reported in obese patients seeking treatment in a tertiary care center compared to community controls (9), and a recent report in a population of young adults in Sydney has shown an association between increased BMI and abdominal pain and nausea/vomiting (10). This population-based study was aimed at evaluation of the relationship between BMI and gastrointestinal symptoms and signs in a population of a developing country.

PATIENTS and METHODS

This cross-sectional study was performed among approximately 70000 families (nearly 230,000 members) in the northwestern region of Tabriz, a large city in northwest of Iran. Of these, 1017 families with 4225 members were randomly selected and 2485 who were above 18 years old agreed to participate.

General physicians examined participants and completed a checklist about GI symptoms and signs occurred in the two weeks preceding the study. Those who had any GI symptoms or signs were referred to a certain gastroenterologist for further evaluation. The checklist inquired about frequency and duration of heartburn, dysphagia, odynophagia, hematemesis, diarrhea, constipation, melena, abdominal discomfort/pain, bloating, and

anorexia. We defined symptoms of GERD as the presence of recurrent heartburn and/or regurgitation at least 3 times in the last 2 weeks. Participants were also asked whether they were taking anti-obesity drugs. Eight gastrointestinal tract signs were examined by physicians: hepatomegaly, splenomegaly, abdominal tenderness, abdominal hernia, jaundice, icteric sclera, abdominal pain in deep palpation and abdominal mass. Participants' height and weight were directly measured by "Seca" measurement tools while they were wearing light clothing. BMI was calculated as body weight (kg) divided by the square of height (m²).

Based on their BMI, the participants were categorized into underweight (BMI<18.5 kg/m²), normal weight (BMI between 18.5 and 24.9 kg/m²), overweight (BMI between 25 and 29.9 kg/m²), and obese (BMI>30 kg/m²) groups. Symptoms and signs were gathered to find correlation between certain individual signs, symptoms and BMI (11, 12). Data were analyzed by using the chi-square test and p value less than 0.05 was assigned to be statistically significant.

RESULTS

Of 2485 participants whose checklists were completed, 53% were female and about half were aged between 18 and 34 years old. Based upon their BMI score, male and female participants were categorized in 4 groups (table 1).

Table 1. BMI status of 2485 participants

BMI (kg/m ²)status	Total (%)	Male (%)	Female (%)
Underweight (<18.5)	4.2	4.2	4.1
Normal (18.5-24.9)	42.3	51.3	34.5
Overweight (25-29.9)	33.3	34.5	32.4
Obese (BMI ≥30)	20.1	10	29

The symptoms of GERD were found in 116 (4.2%), dysphagia in 11 (0.4%), odynophagia in 4

(0.1%), hematemesis in 3(0.1%), diarrhea in 2 (0.1%), constipation in 133 (4.9%), melena in 1 (0.06%), abdominal pain in 133 (4.9%), abdominal discomfort in 108 (4.0%), bloating in 57(2.1%), and anorexia in 11 participants (0.4%). In addition, Hepatomegaly was found in 11 participants (0.4%), splenomegaly in 2 (0.1%), abdominal tenderness in 73 (2.7%), abdominal hernia in 45 (1.6%), jaundice in 7 (0.3%), icteric sclera in 11 (0.4%), abdominal pain in deep palpation in 82 (3.0%), and abdominal mass in 18 (0.7%).The associations of these GI symptoms and signs with BMI status were assessed accordingly (Table 2).

Table 2. Frequencies of gastrointestinal symptoms and signs and their association with BMI status

Symptoms	Normal Obese Overweight			p-value
Abdominal pain	61	43	28	NS*
Abdominal discomfort	41	33	30	0.069
Diarrhea	0	2	0	NS
Intermittent diarrhea and constipation	5	1	1	NS
Constipation	54	41	38	0.043
Steatorrhea	3	4	0	NS
Bloating	14	24	18	0.003
Anorexia	10	0	0	NS
Heartburn	46	43	26	NS
Dysphagia	1	4	5	0.024
Odynophagia	0	1	2	NS
Hematemesis	0	1	2	NS
Melena	1	0	0	NS
Fresh Blood	12	13	14	0.03
Anal protruding mass	21	30	28	NS
Signs				
Hepatomegaly	3	2	6	0.017
Splenomegaly	2	0	0	NS
Abdominal tenderness	27	18	25	0.004
Hernia	17	15	13	NS
Jaundice	2	2	3	NS
Icteric sclera	5	2	4	NS
Abdominal pain	25	30	24	0.013
Abdominal mass	4	8	6	NS

*NS=Non significant

Although some participants with normal BMI appeared to have symptoms of GERD, frequent

symptoms of GERD were more likely to be found in overweight (43) and obese (26) persons. Results indicated that abdominal pain, bloating, constipation, recurrent heartburn, dysphagia, melena, and anal protruding mass were more likely to be seen in females and abdominal discomfort in males (Table 3). Abdominal tenderness in deep palpation was also more common in females. There were also statistically significant associations between hepatomegaly, abdominal tenderness in deep palpation, and abdominal pain with high BMI.

Table 3. Gastrointestinal symptoms and their association with gender

Symptoms	Male	Female	p-value
Abdominal pain	25	108	<0.001
Abdominal discomfort	2	0	NS
Diarrhea	2	5	NS*
Intermittent diarrhea & constipation	42	91	<0.001
Constipation	3	3	NS
Steatorrhea	17	40	0.002
Bloating	5	6	NS
Anorexia	37	79	<0.001
Heartburn	2	9	0.035
Dysphagia	1	3	NS
Odynophagia	1	2	NS
Hematemesis	1	0	NS
Melena	0	0	NS
Recrorrhagia	7	34	<0.001
Signs			
Abdominal tenderness	30	43	NS
Hernia	33	22	NS
Jaundice	3	4	NS

*NS=Non significant

DISCUSSION

We found a strong positive association between BMI and gastrointestinal symptoms and signs. This association extended across all categories of BMI, which suggests that the risk of GI symptoms rises with increase of BMI in normal weight, overweight, and obese persons. Previous studies have led to the conclusion that overweight status and obesity are risk factors for gastrointestinal

symptoms and signs. According to a recent report, moderate weight gain can result in aggravation or development of GERD symptoms even in normal weight population (7).

One limitation of this study was its cross-sectional nature. The second limitation was our use of a checklist to define symptoms and signs. Others have observed in community-based studies that BMI was an independent risk factor for the presence of self-reported heartburn and regurgitation (10). However, a study from Sweden and a birth cohort study in Dunedin, New Zealand (13) failed to find any such association (14). We also found no association between BMI and heartburn and regurgitation though it is believed that obesity could directly predispose to anatomical or physiological changes, such as the formation of hiatal hernia and increased transient lower esophageal sphincter relaxation that might predispose to GERD (15).

We found no association between increased BMI and chronic/recurrent diarrhea, and constipation. However, in a population-based study in Olmsted County, Minnesota, an association between diarrhea and BMI was observed (12). For some reasons that are not still clear, obesity can cause slow gastric emptying in some cases (16, 17). Moreover, loss of the normal postprandial gastric feedback mechanisms in obesity may lead to increased pain and nausea. This might partly explain the cause of the increase in prevalence of upper abdominal pain in obese individuals.

Bloating also showed a positive association with increased BMI. This may be related to delayed gastric emptying described in obese patients (18-20). Nevertheless, other studies report normal or even rapid gastric emptying in obese subjects (9, 21, 22). The frequencies of hemorrhage, protruding anal mass, and constipation also increased with increasing BMI. These symptoms may be related to eating and food habits which could presumably provoke these GI symptoms in these patients. Our checklist did not

include questions to detect eating disorders. Olmsted County, Minnesota, study found that constipation was more common in the obese (12), a finding that our study also confirmed.

Our study showed a positive association between obesity and hepatomegaly, abdominal tenderness, pain in deep abdominal palpation. This could be related to association between obesity or increase in symptoms such as bloating and constipation. It is worth mentioning that the diseases that might be associated with obesity or GI symptoms themselves could confound any observed association. For example, both type 2 diabetes mellitus (23), and chronic GI symptoms are associated with obesity (24).

Obesity has a substantial impact on the quality of life (25, 26) and is associated with increased psychological burden (27) as well as increased morbidity (28). A team of researchers studying nearly 1,000 men and women participating in a randomized trial evaluating three weight-loss programs in Minnesota found that associations between gastrointestinal symptoms, diet and exercise may have implications for the treatment of both obesity and gastrointestinal problems. People in this study reported experiencing a variety of problems such as abdominal pain (19%), irritable bowel syndrome (13%), diarrhea (25%), and bloating (20%). The data in this US study has been collected from a larger two-year study evaluating telephone- and mail-based interventions for weight loss. Seventy percent of the 983 participants (ranging from 20 to 89 years of age) were women and all were classified as obese or overweight (29).

It is noteworthy that we did not evaluate whether psychological factors modulated the presence of GI symptoms in obesity but this is worth considering in future studies. We also did not evaluate recent weight change that theoretically may alter GI function and lead to intermittent GI symptoms. Sullivan reported that recent weight gain was associated with an increased visible abdominal distention (32), but no other data are

available. In conclusion, our data indicate that there is a positive relation between BMI and GI symptoms and signs.

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