An association between obesity and gastro-esophageal reflux disease (GERD) has been frequently reported in western societies. A recent study conducted by Corley et al. in the United States of America showed that the association between body mass index (BMI) and reflux-type symptoms was partially mediated through abdominal diameter and there was a consistent association between abdominal diameter and reflux-type symptoms in the white population, but no consistent association in the black population or Asians. It is not known whether an association persists after adjusting for known risk factors of GERD among Asian populations. We did a population-based, cross-sectional interview study to estimate the strength of association between body mass and symptoms of reflux. During interviews, participants completed a valid gastro-esophageal reflux questionnaire. Odds ratio (OR) with 95% confidence interval (CI), calculated by logistic regression with multivariate adjustments for covariates, were the measures of association. Symptoms of reflux at least once a week over the past 3 months were reported by 522 (9.1%) of the 5733 interviewees. Among those who were overweight or obese (BMI >25 kg/m²), the OR of having symptoms of reflux was 0.88 (95% CI: 0.66–1.16) compared with those who were not overweight or obese. Thus, among Asians, symptoms of GERD occur independently of body mass index.


A n association between obesity and gastro-esophageal reflux disease (GERD) has been frequently reported in western communities. A recent study conducted by Corley et al. in the United States of America showed that the association between body mass index (BMI) and reflux-type symptoms was partially mediated through abdominal diameter and there was a consistent association between abdominal diameter and reflux-type symptoms in the white population, but no consistent association was found in the black population or Asians. It is not known whether an association exists among people of Asian origin after adjusting for other known risk factors of GERD. This study aimed to determine whether there is any relationship between BMI and symptoms of reflux in our community and compare our results with those reported from western countries.

Methods

We designed this as a cross-sectional and population-based interview study which was conducted from May through December 2006 in Firoozkouh city and Damavand city, located in the northeast region of Tehran province, Iran. Out of a population of 1,00,000, we randomly selected a total of 6325 subjects on the basis of the number of their health dossiers. Following the postal codes and addresses recorded in the dossiers, trained health personnel went to their houses, door-to-door and face-to-face and asked them to participate in the first interview. This interview was designed on the basis of the first part of our questionnaire which consisted of 22 questions dealing mainly with personal and family characteristics. In addition, health personnel asked about 11 gastrointestinal (GI) symptoms including acid regurgitation and heartburn.

Those participants who reported at least one of these 11 GI symptoms including heartburn and acid regurgitation were selected for the second interview which was conducted by gastroenterologists. Subjects were excluded if they were pregnant, had records of experiencing major psychotic episodes, mental retardation or dementia, hiatal hernia, or if they had significant illness. The response rates for the first and second interviews were 90.6% and 92.2%, respectively.

The survey instrument related to GERD was derived from a valid questionnaire designed by Lock et al. in 1994. Questions were added on the basis of our demographic conditions and some minor corrections were made after pilot testing.
Gastro-esophageal reflux disease and body mass index

GERD was defined in a subject who had heartburn and/or acid regurgitation at least once a week for the past 3 months. All who reported regular use of antireflux medication also reported symptoms of reflux occurring often enough to be included among the patients with reflux. BMI, a validated measure of body mass independent of height, was calculated as body weight divided by the square of body height in meters (kg/m²).

To qualify as members of the control group, we selected from among those who did not have any GI complaints and did not use any GI medication at the time and during the past one year before the start of the survey.

The group of subjects with normal BMI (BMI<25) was selected as reference group. In the baseline model, adjustments were made for age and sex, while in multivariate analyses we adjusted for all four covariates including: age, sex, tobacco smoking and physical activity. SPSS software version 13.0 was used and all p-values were two-tailed with the level of statistical significance specified at 0.05.

Results

From among the selected 6325 subjects, 5733 (90.6%) participated in the first interview. The mean age of these subjects was 34.8 years (SD =16.6; range, 10–80); 2798 (48.8%) were women.

Among 522 subjects with GI symptoms, 442 subjects who had accurate measurement of BMI were selected for comparison with 444 selected subjects as a control group. Although the number of subjects with accurate BMI was higher than 444, we selected these 444 subjects among them, since these 444 subjects were adjusted with GERD patients on the basis of several demographic factors. There were no differences in the frequency of tobacco smoking or alcohol consumption, marital status, income and educational level between the two groups. Age and sex distributions were also similar.

There was no relation between demographic factors and GERD, except for age (Table 1). We found that the prevalence of GERD increased with age. We found no association between overweight and/or obesity and GERD (Table 2). Among those who were overweight (BMI=25–30) or obese (BMI >30), the adjusted odds ratio (OR) was 0.88 (95% CI: 0.66–1.16) compared with those who were not overweight or obese. Multifactor adjustments for potential confounding factors did not substantially alter any of the age- or sex-adjusted estimates.

Discussion

Our population-based, cross-sectional study revealed no evidence of an association between BMI and symptoms of GERD. Compared with lean subjects, those who were obese had no greater propensity for symptoms of reflux. Our findings were consistent with the results of four previous studies in massively obese subjects. On the other hand, our results were in variance with some previous studies, two of which were case series consisting of patients referred for endoscopy. In these studies, the average BMI was significantly higher among patients with reflux esophagitis than in those without and the other studies indicated significant relationship between BMI and prevalence of gastro-esophageal symptoms in different communities. Each of the above studies considered few variables as potential confounders. Age, sex, smoking, alcohol use, meal size, physical activity, hiatal hernia, life stress, high cholesterol diet and frequency of consumption of various foods such as chocolates, coffee, onions, citrus fruits, tomatoes and mints were known as potential confounders.

We found that the occurrence of GERD increased with age, but there was no relationship with gender, tobacco smoking, physical activity, education, and income. These findings are consistent with some previous studies.

Potential limitations of this study need to be considered. First, we did not evaluate subjects at the onset of their symptoms and thus we cannot tell what factors were

Table 1: Relation between various factors and gastroesophageal reflux

<table>
<thead>
<tr>
<th>Factor</th>
<th>Gastro-esophageal reflux*</th>
<th>OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>274</td>
<td>1.12 (0.85–1.48)</td>
<td>0.41</td>
</tr>
<tr>
<td>No</td>
<td>292</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobacco smoker</td>
<td>27</td>
<td>0.95 (0.55–1.67)</td>
<td>0.87</td>
</tr>
<tr>
<td>Physical activities</td>
<td>20</td>
<td>1.75 (0.99–3.01)</td>
<td>0.054</td>
</tr>
<tr>
<td>Education (diploma of high school or less)</td>
<td>345</td>
<td>1.05 (0.76–1.44)</td>
<td>0.78</td>
</tr>
<tr>
<td>Income (&gt;Rs 15,00,000/month)</td>
<td>247</td>
<td>1.01 (0.77–1.31)</td>
<td>0.95</td>
</tr>
<tr>
<td>Age (as continuous variable)</td>
<td>442</td>
<td>1.01 (1.00–1.02)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Gastro-esophageal reflux was defined as recurrent and regular heartburn and/or regurgitation occurring at least once a week
important for the initiation of symptoms. Second, we did not consider dietary components (high dietary fat intake, macro- and micronutrients), and life stress as risk factors or potential confounders in our study while adjusting for multiple potential confounders. It could have led to an underestimate of confounding by these variables.

We conclude from this population-based study that there is no relationship between BMI and symptoms of GERD in a community of Asia. It seems that high BMI plays a more important role to cause symptoms of GERD among western population in comparison with Asian populations. Therefore, further study in Asian communities is required.

References


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Acknowledgments

The authors wish to express their gratitude to the Research Center for Gastroenterology and Liver Diseases, Shahid Beheshti University of Medical Sciences, Tehran, Iran, for kindly funding and supporting this survey.

Received September 5, 2007. Received in final revised form June 28, 2008. Accepted July 12, 2008

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**Table 2: Association of body mass index (BMI) with risk of gastro-esophageal reflux**

<table>
<thead>
<tr>
<th>Gastro-esophageal reflux*</th>
<th>Yes</th>
<th>No</th>
<th>OR (95% CI)</th>
<th>p value</th>
<th>OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &lt; 25</td>
<td>249</td>
<td>237</td>
<td>1.00 (reference)</td>
<td>1.00 (reference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI 25–30</td>
<td>142</td>
<td>151</td>
<td>0.87 (0.64–1.18)</td>
<td>0.38</td>
<td>0.86 (0.64–1.18)</td>
<td>0.38</td>
</tr>
<tr>
<td>BMI &gt;30</td>
<td>51</td>
<td>56</td>
<td>0.83 (0.53–1.30)</td>
<td>0.42</td>
<td>0.89 (0.64–1.18)</td>
<td>0.48</td>
</tr>
</tbody>
</table>

* BMI was calculated as body weight divided by the square of body height in meters
* Gastro-esophageal reflux was defined as recurrent and regular heartburn and / or regurgitation occurring at least once a week. Adjustments were made for age, sex, tobacco smoking, and physical activity.