**Abstract**

The incidence and prevalence of gastro-oesophageal reflux disease is rising. Changing dietary habits and increasing body weight can be held responsible. In several studies a close relation was found between body weight and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease. It may be concluded that there is a definite relation between body mass index and the occurrence of reflux disease.

H. pylori probably also plays a role. H. pylori causes changes in fundic leptin levels and plasma levels of ghrelin. Eradication of H. pylori infection can increase appetite leading to a rise in body mass index due to a higher caloric intake. H. pylori can be a ‘protective’ factor against the development of overweight. Since only a minority of overweight or obese patients with gastro-oesophageal reflux disease will lose weight successfully, medical treatment with effective acid suppression will be the mainstay of the treatment of reflux disease in patients with a high body mass index.

**Keywords**

Gastro-oesophageal reflux disease, ghrelin, H. pylori, leptin, obesity

**Introduction**

Gastro-oesophageal reflux disease is caused by reflux of stomach and duodenal contents into the oesophagus. Reflux can be the result of failure of the natural antireflux barrier between the gastric cardia and the oesophagus. The most important pathophysiological mechanism causing reflux is long-lasting spontaneous relaxation of the lower oesophageal sphincter (LOS) or low pressure in the LOS. A hiatus hernia is an additional risk factor. The incidence and prevalence of gastro-oesophageal reflux disease is rising, at least in the Western world. This will be accompanied by an increasing incidence of the complications of gastro-oesophageal reflux. The incidence of overweight and obesity has also been reported to be rising. It can be expected that complications due to overweight will also rise. Changing dietary habits and the increasing body weight may possibly induce reflux disease.

And finally, the incidence of H. pylori infection in the Western world has been decreasing for almost forty years. It has been reported that following eradication of H. pylori, reflux disease and/or an increase in body weight can develop. In the present paper the possible relations between H. pylori, obesity and reflux disease are discussed.

**References**

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- Is there a relation? A personal view
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more severe forms of reflux oesophagitis do not have reflux symptoms but merely complain of dysphagia.4 

**GASTRO-OESOPHAGEAL REFLUX DISEASE AND OBESITY**

Increased intra-abdominal pressure plays an important role in the mechanism of reflux.3 In several studies no relation was found between body weight and the occurrence of gastro-oesophageal reflux disease.5,7 However, in recent years several studies have been published which show different results. Overweight and obesity go along with an important increase in the occurrence of gastro-oesophageal reflux.8-10 Patients with overweight or obesity suffered more often from gastro-oesophageal reflux than controls with a normal body weight. The pressure in the LOS also appeared to be lower in patients with a higher body mass index.11 Wilson and co-workers studied the relation of body mass index and the presence of a hiatus hernia and reflux oesophagitis.12 A total of 1389 consecutive patients were studied. Oesophagitis was seen in 189 patients; the remainder were used as control group. Patients were divided in three groups according to body mass index: normal weight (BMI 20 to 25), overweight (BMI 25 to 30), and obesity (BMI >30). Reflux oesophagitis was more often present with a hiatus hernia and/or a higher body mass index. There was no difference between men and women or race. Body mass index was also an independent risk factor for development of a hiatus hernia.13 A dose-effect relation was detected.14 Murray and co-workers studied the relation of body weight and reflux symptoms in the Bristol Helicobacter pylori Project. Overweight was a risk factor for developing reflux, but obesity was an even higher risk. The severity of reflux symptoms correlated significantly with body weight.15 The relation of body mass index and reflux was stronger in women, especially in premenopausal women.16 Population-based studies showed that a higher body mass index is not only a risk factor for gastro-oesophageal reflux disease, but also for development of an adenocarcinoma in the oesophagus.16,17 This relation is also present with carcinomas of the gastric cardia but not with squamous cell carcinoma of the oesophagus. El-Seraq and co-workers carried out logistic regression analysis in order to identify risk factors.3 Overweight and obesity were independent risk factors for the more severe forms of reflux oesophagitis according to the Los Angeles classification.1 The pressure in the LOS can be lower in patients with a higher body mass index, but there is no difference in manometric findings in the body of the oesophagus compared with patients with a normal body weight. Oesophageal peristalsis is normal.18 Patients with gastro-oesophageal reflux disease often have intolerance for certain kinds of food. They tend to avoid these foods. Ingestion of food with excess in fat, especially animal fat and cholesterol, increase the risk for gastro-oesophageal reflux disease.19 Food low in fat and high in fibre appears to have a protective effect. Obviously, a high body mass index is the result of a feeding pattern in which the intake of calories exceeds the daily needs. Despite this observation, fat and a high body mass index are independent risk factors for development of gastro-oesophageal reflux disease.20

**H. Pylori and Reflux Disease**

Despite the fact that there is an ongoing discussion in the literature as to whether or not *H. pylori* protects against development of reflux disease and eradication causes reflux disease,19-22 it is clear that *H. pylori* has definite effects on gastric acid production.23,24 The effect depends on the distribution of the *H. pylori*-associated gastritis. Patients with an antral predominant gastritis have an elevated maximal stimulated acid production. Patients with a corpus predominant gastritis or a pangastritis have a lower acid production. With effective acid suppressive therapy a shift occurs from antral predominant gastritis to corpus predominant gastritis or pangastritis.25,26 Patients included in clinical trials are not allowed to take acid suppressive drugs prior to inclusion. But the majority had already been treated with acid suppressive drugs in the past; naive patients are seldom included in trials. One can assume that the effects of acid suppressive therapy on the *H. pylori*-associated gastritis will not subside in a short period of time. Hence presence or absence of *H. pylori* can have a major effect on the results of studies evaluating gastro-oesophageal reflux disease. In duodenal ulcer disease, if *H. pylori* has been successfully eradicated, reflux oesophagitis has been reported to occur.27 The patients who actually developed reflux oesophagitis also had a significant increase in body weight. The dietary habits must have changed, otherwise this weight gain would not have occurred!

**H. Pylori and Obesity**

Recent research can explain the effect of *H. pylori* eradication on body weight. Identification of ghrelin has revealed complex interactions in regulation of food intake.28 Ghrelin is an important factor in appetite and satiety. Plasma ghrelin concentrations, gastric ghrelin mRNA, and ghrelin positive cell numbers in gastric mucosa are significantly lower in *H. pylori*-positive subjects.29,30 However, this finding has not been invariably confirmed.31 After successful eradication of *H. pylori* the number of ghrelin positive cells increases significantly irrespective of the presence of gastric atrophy.32 This could lead to increased appetite and weight gain. Also, in an experimental study in which *H. pylori*
acid suppression therapy is generally available. Even if reflux disease does develop, then treatment with weight gain, due to normalisation of ghrelin and leptin, after suc
terium is absolutely the cause of major morbidity. Weight Should the stomach be colonised by 'protective' factor? Should obesity in the youngsters in part caused by the lack of this possibly leading to a loss of this 'protective' factor. Young The prevalence of large amount of calories in these patients.
due to effects on leptin and ghrelin protects against intake of increased energy expenditure and increased thermo-
genesis.34 Leptin is produced in the fundus of the stom-
ach. Stretching of the fundus due to food intake probably leads to a decrease in fundic leptin, an increase in plasma level of leptin, and to a feeling of satiety. H. pylori infection significantly increases gastric leptin expression.35 Eradication of H. pylori decreases gastric leptin expres-
sion. The plasma leptin levels do not change, but there is a significant decrease in immunoreactivity of leptin in mucosa of the fundus.31 This decrease was accompanied by an increase in body mass index in the studied patients. Because the serum levels of leptin did not change, this weight gain must be due to a local effect in the fundus. The effects of H. pylori on ghrelin and leptin strongly suggest that the bacterium 'protects' against obesity. The decreasing incidence of this infection may be contributing to an increase in appetite and food intake.

CONCLUSION

From the presented data it can be appreciated that there is a certain relation between body mass index and reflux disease, H. pylori and reflux disease, and H. pylori and obesity. The exact relation and the consequences are not yet entirely clear. The primary cause of the rising body weight is the changes in lifestyle, at least in the Western world. The intake of fat and carbohydrates increases, while physical activity clearly decreases. It can be postulat-
ed that body weight can increase after eradication of the bacteria, and that reflux disease can develop in patients who had a H. pylori-associated pangastritis due to acid sup-
pressive therapy. It can be postulated that H. pylori infection due to effects on leptin and ghrelin protects against intake of large amount of calories in these patients. The prevalence of H. pylori infection is decreasing, possibly leading to a loss of this 'protective' factor. Young people in the Netherlands no longer acquire H. pylori. Is obesity in the youngsters in part caused by the lack of this 'protective' factor? Should H. pylori not be eradicated? Should the stomach be colonised by H. pylori? The bacterium is absolutely the cause of major morbidity. Weight gain, due to normalisation of ghrelin and leptin, after suc-
sessful eradication can be controlled by dietary measures. Even if reflux disease does develop, than treatment with acid suppressive therapy is generally available. The increasing body weight can be held responsible for at least a major part of the rising incidence of gastro-
oesophageal reflux disease. Whether all these assumptions are true should be the goal of future studies.

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