ORIGINAL ARTICLE

# Paediatric Halitosis and *Helicobacter pylori* Infection

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## ABSTRACT

**Objective:** To compare the presence of *Helicobacter pylori* (*H. pylori*) infection by stool antigen test in children with and without halitosis.

**Study Design:** Comparative study.

**Place and Duration of Study:** Department of Paediatrics, Fatih University Hospital, Ankara, Turkey, between December 2008 and June 2009.

**Methodology:** Fifty-three patients aged between 3-15 years who presented to paediatrics outpatient clinic with halitosis and 55 healthy children aged between 4-15 years without halitosis were included in the study. Halitosis was confirmed with organoleptic test. Stool antigen test was performed in both groups. Intergroup proportions were compared using chi-square and Fisher exact tests with significance at $p < 0.05$.

**Results:** The *H. pylori* stool antigen test was positive in 11 out of 53 patients (20.8%) with halitosis and 12 of 55 healthy controls (21.8%). The rate of positive *H. pylori* stool antigen test results were similar between two groups ($p > 0.05$). Two-weeks eradication treatment was administered to 11 patients with *H. pylori* infection and halitosis. After treatment, the symptoms of 8 patients with halitosis (72.7%) completely resolved and persisted in 3 patients (27.3%). Seven of the 11 patients who were administered eradication treatment also had abdominal pain along with halitosis. Both symptoms completely resolved in all those patients after treatment.

**Conclusion:** Although no statistically significant difference existed between the rate of *H. pylori* infections among those with and without halitosis. Eradication treatment was found beneficial in the treatment of children with halitosis and positive *H. pylori* stool antigen test.

**Key words:** *Halitosis. Helicobacter pylori. Child.*

## INTRODUCTION

Halitosis affects a large proportion of the global population and may be the cause of a significant social or psychological handicap. Studies worldwide indicate a high prevalence of moderate halitosis, whereas severe cases are restricted to around 5% of the population.[1] Its prevalence among primary school students is reported to be around 14.5%.[2] Though halitosis is generally caused by intraoral disease, it can also be due to extraoral causes.

The dorsal side of tongue provides a suitable environment for the proteolytic and anaerobic bacteria that are responsible for halitosis. Proteolytic and anaerobic bacteria localized between the tongue papilla leads to the formation of volatile sulphur compounds (VSC), such as hydrogen sulfide, methyl mercaptan and dimethyl sulfide, which produces halitosis. Hydrogen sulfide and methyl mercaptan accounts for 90% of the VSC causing halitosis. A variety of microorganisms, *Proteus* species, *Lactobacillus*, oral *Bacteriodes*, and *Porphyromonas gingivalis* have been shown to be related to halitosis. Bacteria localized in the tongue base have been determined to transform the amino acid cysteine into hydrogen sulfide, through the enzymatic effects of 1-cysteine desulphatase, and the amino acid methionine into methyl mercaptan through the catalytic effects of L-methionine-α-deamino-ψ-mercaptomethanelyase.[3] Lee *et al.* established in their study that three different strains of *H. pylori* (*H. pylori* ATCC 43504, *H. pylori* SS 1, and *H. pylori* DSM 4867) transformed methionine and cysteine to different specific amounts of methyl mercaptan and hydrogen sulphite.[4]

Halitosis is clinically classified into three groups, which are real halitosis, pseudohalitosis and halitophobia.[5] Real halitosis is a problem that can be chemically or organoleptically diagnosed. Majority of the patients with real halitosis have a bad odour due to intraoral causes.[3] Psychological halitosis is a complain of bad odour in the absence of halitosis. Some patients do not have halitosis but have a fear of halitosis.[6]

Organoleptic, sulphite monitoring and gas chromatographic methods are frequently used in the diagnosis of halitosis. Organoleptic methods are based on smelling the air exhaled by the patient. Despite the availability more objective mechanical methods, the organoleptic

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method is the gold standard in the diagnosis of halitosis, due to its easy application and common use.[3,7] It has been shown to yield results comparable to gas chromatographic methods.[8,9] With this method, halitosis is scored on a scale of 0-5 points depending on the severity of the odour. Scores of two or above are diagnosed as halitosis.[5]

Since *H. pylori* infection is implicated in the causation of halitosis, its treatment is likely to improve the symptoms.

This study is aimed to investigate the association between halitosis and *H. pylori* infection in children with halitosis complaint and its resolution with eradication therapy.

## METHODOLOGY

This study was planned as a case control study. It prospectively examined 72 paediatric patients with complaints of bad mouth odour, who consulted with the Children's Health and Disease Polyclinics between December 2008 and June 2009. Sixty healthy children of the same age with no chronic disease (diabetes mellitus, renal or hepatic failure etc.) were followed in healthy children polyclinics. Age, height, gender and weight of all the children included in the study were recorded. Nineteen children from the halitosis group and 6 children from the control group were found to have sinusitis, adenoid vegetation, postnasal flow and tooth decay, and were excluded from the study. The study was carried out with 53 children with halitosis and 55 children in the control group. Children were divided into three age groups: 2-6, 7-10 and 11-15 years of age.

All cases with halitosis complains were evaluated by one specialist doctor using an organoleptic method. Patients were asked not to use oral spray, mouthwash or cosmetic products within the previous 24 hours, and in addition, not to eat anything, smoke or perform daily tooth care for 6 hours before the test. The specialist doctor did not drink tea, coffee or fruit juice, did not smoke or use any cosmetic products before the test. Patients were asked to exhale into a tube 2.5 cm in diameter and 10 cm in length, located 10-15 cm away from the nose of the doctor. Subsequently, the odour of the breath exhaled was scored by one doctor. No odour was marked as 0 points, a very slight odour as 1 point, a slight odour as 2 points, a mild odour as 3 points, an intense odour as 4 points and a very intense odour was given 5 points.[11] Fifty three patients with halitosis that had scores of two or above and 55 children in the control group were investigated.

A detailed physical examination was performed for all children; in addition, complete blood count, blood glucose, liver and kidney function tests were carried out. Patients who used antibiotics in last 3 months, had chronic disease and any local or systemic disease that could lead to halitosis were excluded from the study.

The "Immuna Card STAT, HpSA" (Meridian Bioscience, Ohio, USA) test was used to investigate *H. pylori* antigen in faeces. This test determines *H. pylori* proteins in faeces using a qualitative immunochromatography-based immunoassay method. In this method, IgG-marked conjugate and monoclonal antibodies were used to determine *H. pylori*.[12]

An approval was obtained from the Medicine Faculty in June 2009. In addition, written approvals of the parents were collected from the families of the participants.

The sample size of the study was calculated with the G*Power (G*Power ver. 3.0.10, statistical packages. The required sample size for 95% power, $\alpha$=0.05 (type I error), $\beta$= 0.05 (type II error), and w=0.40 effect size was calculated as 88. It was planned to include 44 patients in each group. To protect the study from potential loss to follow-up, 20% more patients (9 for each groups) were scheduled to enroll in each group. The study was considered to be completed with a sample size of 106.

Statistical analysis was performed by using Statisitcal Package for Social Sciences (SPSS) for Windows, Ver. 15.0 (SPSS Inc., Chicago, IL., USA) statistical software. The Shapiro-Wilk test was used to test the normality of age. Age data was skewed, so median (IQR) values notation were used for age and categorical data were shown with the number and percentage. The age of the groups was compared by the Mann-Whitney test and gender distribution of the groups was compared by chi-square test. Any differences between the rates of positivity of *H. pylori* infection for intra- and inter-groups were compared by chi-square (Pearson, Likelihood or Fisher's exact) test. Spearman rank correlation co-efficient was calculated for relation between age groups and *H. pylori* infection. The levels of significance were set at $p < 0.05$.

## RESULTS

The study included 53 patients (28 girls and 25 boys) who consulted at the clinic with bad mouth odour and were diagnosed with halitosis using the organoleptic method. Fifty-five children (26 girls and 29 boys) were in the control group. The age range of the patient group, composed of 52.8% girls and 47.2% boys, was 3-15 years, with a median age of 8 (IQR=5.5) years. The control group consisted of 47.7% girls and 52.3% boys with an age range of 4-15 years. The median age was 8 (IQR=5.0) years. Sex distribution and median age were not statistically different between groups ($\chi^2$=0.333, p=0.564 ve Z=1.056; p=0.291 respectively). Positive *H. pylori* antigen was detected in the faeces of 11 out of 53 patients (20.8%) in the halitosis group, while it was detected in 12 of 55 children (21.8%) in the control group (Table I). No statistically significant difference was detected between the two groups with respect to positive *H. pylori* infection ($\chi^2$=0.018, p=0.893 Table I).

**Table I:** Distribution of positive helicobacter pylori infection with respect to the age of patients in the halitosis and control groups.

| Age (years) | Control | | Halitosis | | Control vs. Halitosis (between groups) | |
|---|---|---|---|---|---|---|
| | Number of cases n | Positive of H. pylori infection (%) | Number of cases n | Positive H. pylori infection (%) | $\chi^2$ | p |
| 3-6 years of age | 09 | 02 (22.2) | 20 | 02 (10.0) | 0.568 | 0.364 |
| 7-10 years of age | 27 | 07 (25.9) | 20 | 06 (30.0) | 0.095 | 0.758 |
| 11-15 years of age | 19 | 03 (15.8) | 13 | 03 (23.1) | 0.666 | 0.470 |
| Overall | 55 | 12 (21.8) | 53 | 11 (20.8) | 0.018 | 0.893 |
| *Test statistics (intra-groups)* | *$\chi^2$=0.694; p=0.707* | | *$\chi^2$=2.650; p=0.266* | | | |

Positive *H. pylori* infection was more frequently seen in the halitosis group children (7-10 years of age); however, no statistically significant age distribution difference was detected between the control and the halitosis groups (intra-groups). There was no statistically significant difference between control and halitosis (inter-groups) regarding age groups (Table I). No statistically significant relation was detected between positive *H. pylori* infection and age in the Spearman rank correlation analysis of both groups, (for the age of patients with halitosis r=0.136, p=0.331, for the age of control group children r=-0.071, p=0.605).

There was also stomach pain in 7 out of 11 patients with halitosis diagnosed with positive *H. pylori* antigen in the faeces. The eradication treatment for *H. pylori* infection consisted of two doses of clarithromycin 15 mg/kg/7 days, two doses of amoxicillin 50 mg/kg/day and one dose of lansoprazole 0.5-1 mg/kg/day were prescribed for 2 weeks to 11 patients determined to have positive *H. pylori* antigen in the faecal examination. However, no eradication treatment was administered to asymptomatic children determined to have *H. pylori* infection in the control group. Following the treatment, patients were called for follow-up. At that time, the examination performed by the same doctor demonstrated that halitosis disappeared in 8 of 11 patients (72.7%), but the complaints of 3 patients (27.3%) continued. In 7 patients who had halitosis accompanied by stomach pain, both disorders disappeared.

## DISCUSSION

This study investigated the possibility of a treatment indication for halitosis and stomach pain based on *H. pylori* infection in faeces. The possible relationship between *H. pylori* infection and halitosis was first suggested by Marshall *et al.* in 1985.[13]

There has been an increasing number of studies reporting a relationship between *H. pylori* infection and halitosis. Many studies performed on adult populations demonstrated that *H. pylori* infection could be a risk factor for halitosis.[14,15] However, a few studies reported that *H. pylori* infection was not a risk factor for halitosis.[16,17] Contrary to the studies with adults, the number of studies performed on children is quite limited.[18] Tiomy *et al.* determined that eradication treatment of *H. pylori* was beneficial for patients with halitosis.[15] Adler *et al.* reported that 88.1% of adult cases with halitosis and *H. pylori* infection had endoscopic proof of gastric disease and claimed that the mouth was the primary site for *H. pylori*.[14] Similarly, Ierardi *et al.* demonstrated that halitosis disappeared with eradication treatment of *H. pylori* in adult patients with *H. pylori* infection and halitosis.[19] Due to the effective response to the treatment, a relationship was alleged to exist between *H. pylori* infection and halitosis. Ierardi *et al.* also determined that patients negative for *H. pylori* and halitosis benefited from mouth care with chlorhexidine. On the other hand, Serin *et al.* carried out a study on non-ulcer dyspeptic patients and Katsinelos *et al.* on functional dyspeptic patients with halitosis and positive *H. pylori* infection and they suggested that bacterial eradication treatment was effective in dyspeptic complaints and the treatment of halitosis, which they claimed demonstrated the presence of a strong relationship between *H. pylori* infection and halitosis.[20,21] In addition, they argued that *H. pylori* infection could be an indication for treatment in cases of halitosis . Chen *et al.* carried out a study on 50 children with positive *H. pylori* and determined the prevalence of halitosis was higher than in the control group.[18]

No statistically significant difference was determined between patient and control groups, however, both stomach pain and halitosis disappeared with eradication treatment, suggesting that *H. pylori* could have a role in the etiopathogenesis of both disorders. It is not known for sure why halitosis is seen in some of the children with *H. pylori* infection, and not seen in some others.[21] On the other hand, strains of *H. pylori* have different potential to form VSC, which could explain the difference in halitosis occurrence in children having *H. pylori*.[4]

In the studies carried out in Turkey, *H. pylori* prevalence was determined to increase with age, ranging between 19.6 - 43.9%. In addition, the structure of crowded families had an important role in contamination and increased rate of infection with *H. pylori*.[21,23] Positivity of *H. pylori* was found to be lower in the present study compared to the findings of previous studies, which could be due to the selected patient population that consulted at a private university hospital.

Early detection and treatment of *H. pylori*, which is a bacteria causing many diseases and having carcinogenic potential, are highly important for preventing

possible complications. Positivity of *H. pylori* is quite high in asymptomatic children; for this reason, it is a controversial issue which raises the question whether such children should be treated.[22] The present study indicates that cases with halitosis and stomach pain could be indications for treatment.

## CONCLUSION

Eradication treatment of *H. pylori* could be useful for the treatment of halitosis in children who have complaints of bad odour and are qualitatively or quantitatively diagnosed with halitosis. *H. pylori* was found in patients with stomach pain, which could be considered as a treatment indication as well. These findings should be supported with further studies, including a higher number of cases.

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