


Association of *Helicobacter pylori* infection with olfactory function using smell identification screening test

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Abstract The aim of the present study is to investigate the role of *Helicobacter pylori* in olfactory function. Thirty-six patients (mean age 38.5) aged between 18 and 55 years who were diagnosed with *H. pylori* by gastric biopsies and age- and sex-matched 30 healthy adults (mean age 33.6) were included in the study. All participants underwent a detailed ear–nose–throat examination including endoscopic examination of the nasal cavity and laryngeal area, and olfactory tests were performed using the Sniffin’ Sticks, a 12-item screening test (Sniffin’Sticks; Burghart, Wedel, Germany) and odor scores were recorded. The mean odor score was 7.9 ± 1.7 (range 2–10) in the patient group and 10.3 ± 1.4 (range 6–12) in the control group. There were significant lower scores in the patient group compared to the control group ($p < 0.05$). In conclusion, it is apparent that there is an association of *H. pylori* infection with olfactory dysfunction. *H. pylori* infection should be considered as possible etiological factors in patients with olfactory dysfunction.

Keywords *Helicobacter pylori* · Olfactory function · Sniffin’ sticks

Introduction

Helicobacter pylori is a mobile, microaerophilic and Gram-negative bacteria, and are the most frequent cause of chronic infections in humans [1]. The prevalence of *H. pylori* ranges from 10 to 20% in developed countries and from 80 to 90% in developing countries [2]. *H. pylori* infection is thought to be transmitted from person to person through oral–oral, fecal–oral, gastric–oral, and medical intervention routes [3]. It is particularly colonized in the stomach; however, it can be detected in areas including oral cavity, saliva, dental plaques, tonsil and adenoid tissue, middle ear, sinus mucosa and nasal cavity [4–8].

There are studies suggesting an association between *H. pylori* infection and various nasal pathologies such as nasal polyps and chronic rhinosinusitis [4, 5, 9, 10]. However, except for a case reported [11], the association of *H. pylori* with olfactory functions has not been studied in the large series of patients up to date. In this study, we aimed to investigate the association of *H. pylori* infection with olfactory functions.

Materials and methods

The study was approved by the Clinical Research Ethics Committee (Approval No: 2015.13.2). A written informed consent was obtained from the participants. The study was conducted in accordance with the principles of the Declaration of Helsinki.

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This study included a total of 32 patients aged between 18 and 55 years, referred to gastroenterology polyclinics with dyspeptic complaints, diagnosed with *H. pylori* infection by gastric biopsies during upper gastrointestinal endoscopy between January 2016 and September 2016, and scheduled to receive medical treatment. The control group consisted of age- and sex-matched 30 healthy adults who were admitted to the ear–nose–throat outpatient clinic. Smokers, patients with a sinonasal pathology, acute/chronic infection, neurodegenerative, psychiatric, systemic, autoimmune, and chronic diseases, nasal pathologies were excluded from the study.

All participants underwent a detailed ear–nose–throat examination including endoscopic examination of the nasal cavity and laryngeal area, and olfactory tests were performed using the Sniffin' Sticks, a 12-item screening test (Sniffin' Sticks; Burghart, Wedel, Germany) as described previously [12, 13], and odor scores were recorded. The highest score in the Sniffin' Sticks, 12-item screening test, is 12. A score less than 10 is defined as hyposmia, and a score less than 6 is defined as anosmia [14].

Statistical analysis was performed using the SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean \pm standard deviation. The Mann–Whitney *U* test was used to compare test scores of the patients and controls. A *p* value of <0.05 was considered statistically significant.

Results

In the group with *H. pylori* infection, there were 16 males and 16 females with a mean age of 38.5 ± 9.2 years. In control group, there were 12 males and 18 females with a mean age of 33.6 ± 8.4 years. The mean odor score was 7.9 ± 1.7 (range 2–10) in the patient group and 10.3 ± 1.4 (range 6–12) in the control group (Table 1). The odor scores of the patients were statistically significantly lower compared to the control group ($p < 0.05$) (Table 2).

In patient group, the odor scores were less than or equal to 6, between 6 and 10, and greater than or equal to 10 in 12.5, 75 and 12.5%, respectively. In controls, the odor scores were less than or equal to 6, between 6 and 10, and greater than or equal to 10 in 3, 20 and 77%, respectively (Fig. 1).

Discussion

Helicobacter pylori may be associated in nasal disorders as evidenced by its presence in the nasal mucosa in cases of rhinosinusitis [4, 9] and nasal polyposis [5, 10]. While nasal cavity is thought to be a reservoir for *H. pylori*, it is

Table 1 Descriptive statistics of the odor scores of the patient and control groups

Group	Statistics	Standard error
Odor score		
Control		
Mean	10.333	0.2507
Median	10.500	
Std. deviation	1.3730	
Minimum	6.0	
Maximum	12.0	
Patient		
Mean	7.906	0.3122
Median	8.000	
Std. deviation	1.7663	
Minimum	2.0	
Maximum	10.0	

Table 2 Comparison of the odor score between the patient and control groups

	Patient	Control	<i>P</i> value
Odor score	7.90 ± 1.76	10.33 ± 1.37	0.000

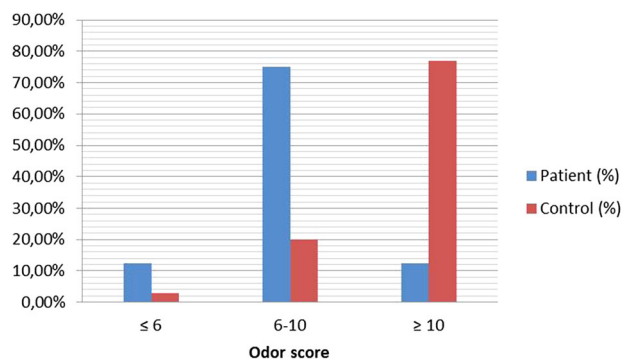


Fig. 1 Percent distribution of the odor score in the patient and control groups

also hypothesized that *H. pylori* can reach the nasal cavity through an oronasal route or gastroesophageal reflux (GER) [15]. The bacteria reaching the nasal cavity directly or via reflux may cause some inflammatory changes that might lead to nasal disorders.

Cecchini et al. [11] reported a case of cacosmia/caco-geusia that was diagnosed as having chronic active gastritis due to *H. pylori* infection on endoscopic biopsy examination in the absence of gastroesophageal reflux. The authors assessed olfactory and gustatory performances before and after treatment using Sniffin' Sticks expanded test. While the odor scores were within the normal limits, an increase in the scores was reported after the treatment of *H. pylori*

infection. The complaints of cacosmia and cacogeusia disappeared after 6 months. The authors hypothesized that inflammatory mechanisms induced by *H. pylori* infection could lead to abnormal chemosensory perception and cause gustatory cell dysfunction.

Recently, Altundag et al. [16] evaluated olfactory functions in patients with laryngopharyngeal reflux (LPR), and reported significantly decreased odor threshold and Sniffin' Sticks composite scores (TDI) in the patients.

In our study, we investigated the role of *H. pylori* in olfactory function. We found that patients infected with *H. pylori* had significantly lower odor scores than healthy controls. In 75% of the *H. pylori* positive patients, the odor scores ranged between 6 and 10, which complied primarily with hyposmia. This can be attributed to the fact that *H. pylori* in the nasal cavity or near the nasal cavity via oronasal or GER route may affect olfaction by damaging olfactory receptors through the inflammatory events.

To understand better the association of *H. pylori* and smell disorders, the olfactory function should be evaluated after the treatment of *H. pylori* in the further studies. The impact of *H. pylori* positivity in nasal mucosa on olfaction should be evaluated. In addition, association with the laryngopharyngeal reflux should be investigated.

In conclusion, it is apparent that there is an association of *H. pylori* infection with olfactory dysfunction. An *H. pylori* infection should be investigated in patients with olfactory dysfunction to make an appropriate treatment plan. On the contrary, the olfactory function should be evaluated when a *H. pylori* infection was diagnosed to find out a subtle olfactory disorder.

Compliance with ethical standards

Conflict of interest No conflict of interest was declared by the authors.

Ethics committee approval The study was approved by the Kanuni Sultan Süleyman Training and Research Hospital Clinical Research Ethics Committee, University of Health Ministry, Union General Secretariat of Public Hospitals, Istanbul Cekmece Region. (Approval Number: 2015.13.2).

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Informed consent A written informed consent was obtained from each participant. The study was conducted in accordance with the principles of the Declaration of Helsinki.

References

- Czinn SJ (2005) Helicobacter pylori infection: detection, investigation, and management. *J Pediatr* 146:21–26
- Kariya S, Okano M, Nishizaki K (2014) An association between Helicobacter pylori and upper respiratory tract disease. *World J Gastroenterol* 20(6):1470–1484
- Hardo PG, Tugnait A, Hassan F, Lynch DA, West AP, Mapstone NP et al (1995) Helicobacter pylori infection and dental care. *Gut* 37:44–46
- Ozdek A, Cirak MY, Samim E et al (2003) A possible role of Helicobacter pylori in chronic rhinosinusitis: a preliminary report. *Laryngoscope* 113:679–682
- Koç C, Arıkan OK, Atasoy P, Aksoy A (2004) Prevalence of Helicobacter pylori in patients with nasal polyps: a preliminary report. *Laryngoscope* 114:1941–1944
- Bayındır T, Toplu Y, Otlu B, Yakupogulları Y, Yıldırım O, Kalcıoğlu MT (2015) Prevalence of the Helicobacter pylori in the tonsils and adenoids. *Braz J Otorhinolaryngol* 81(3):307–311
- Morinaka S, Ichimiya M, Nakamura H (2003) Detection of Helicobacter pylori in nasal and maxillary sinus specimens from patients with chronic sinusitis. *Laryngoscope* 113(9):1557–1563
- Saki N, Nikakhlagh S, Ahmadi K (2009) Comparison of PCR assay and culture for detecting bacteria in middle ear fluid of children with otitis media with effusion. *Int Adv Otol* 5(1):31
- Kim HY, Dhong HJ, Chung SK, Chung KW, Chung YJ, Jang KT (2007) Intranasal Helicobacter pylori colonization does not correlate with the severity of chronic rhinosinusitis. *Otolaryngol Head Neck Surg* 136:390–395
- Bansal D, Sharma S, Agarwal S, Saha R, Gupta N (2016) Detection of Helicobacter pylori in nasal polyps. *Head Neck Pathol* 10:306–313
- Cecchini MP, Pellegrini C, Bassetto MA, Osculati F, Sbarbati A, Marcolini L, Pegoraro M, Fontana R, Franchesci LD (2013) Might Helicobacter pylori infection be associated with distortion on taste perception? *Med Hypotheses* 81:496–499
- Hummel T, Konnerth CG, Rosenheim K, Kobal G (2001) Screening of olfactory function using a 4 minute odor identification test: reliability, normative data and investigations in patients with olfactory loss. *Ann Otol Rhinol Laryngol* 110:976–981
- Hummel C, Zucco GM, Iannilli E, Maboshe W, Landis BN, Hummel T (2012) OLAF: standardization of international olfactory tests. *Eur Arch Otorhinolaryngol* 269:871–880
- Antsov E, Moriyama S, Kilk S, Eerme LK, Toomsoo T, Lees A, Taba P (2014) Adapting the Sniffin' sticks olfactory test to diagnose Parkinson's disease in Estonia. *Parkinsonism Relat Disord* 20:830–833
- Dinis PB, Subtil J (2006) Helicobacter pylori and laryngopharyngeal reflux in chronic rhinosinusitis. *Otolaryngol Head Neck Surg* 134:67–72
- Altundağ A, Cayonu M, Salihoğlu M, Yazıcı H, Kurt O, Yalçınkaya E, Sağlam O (2016) Laryngopharyngeal reflux has negative effects on taste and smell functions. *Am Acad Otolaryngol Head Neck Surg* 155(1):117–121