

## Original Article

### Does the presence of the *Helicobacter pylori* in the dental plaque associate with its gastric infection? A meta-analysis and systematic review

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#### ABSTRACT

**Background:** There is a great deal of studies on the relationship between the existence of *Helicobacter pylori* (*H. pylori*) in oral cavity (dental plaque) and in stomach of patients, with conflicting results worldwide. The purpose of this study was to systematically review the existing literature to assess if the dental plaque could be a source of gastric *H. pylori* infection and to explore the source of heterogeneity around it.

**Methods:** We searched all the papers published since 2000 on international (Medline, ISI, Embase) databases using standard keywords. Two researchers evaluated the articles with standard critical appraisal form independently and those articles with the quality acquired greater than 70% were included in the study. The combined results were calculated with weighted average and the source of heterogeneity was tested by meta-regression (random) model.

**Results:** Finally, 23 studies were included (1861 patients). The prevalence of co-infection of gastric and dental plaque *H. pylori* was 49.7% (95% CI 16–83.4%) and the percent of agreement between the dental plaque *H. pylori* status and the gastric *H. pylori* was estimated as 82%. Only one study has reported that dental treatment has a preventive effect on the recurrence of gastric *H. pylori* infection.

**Conclusion:** Co-infection of gastric *H. pylori* and dental plaque is reported by half of the studies. However, there is not enough evidence for the efficacy of dental treatment on prevention of recurrent gastric *H. pylori* infection.

**Key Words:** *Helicobacter pylori*, meta-analysis, systematic review

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## INTRODUCTION

Nowadays, *Helicobacter pylori* (*H. pylori*) is known as a risk factor for chronic gastritis and peptic ulcer.<sup>[1,2]</sup> *H. pylori* infection is one of the most common bacterial infections in humans,<sup>[3,4]</sup> and on an average, 50% of people in the world are infected by this microorganism.<sup>[5-7]</sup> This digestive infection is successfully curable by systematic antibiotic therapy and can be highly (up to 80–90%) eradicated after

a therapeutic period called “Triple Therapy”.<sup>[4,7,8]</sup> However, this infection can be observed again in people who have been previously treated and this reappearance is a very challenging obstacle concerning peptic ulcer treatment.<sup>[9,10]</sup> Thus, the hypothesis arises that this microorganism remains in some parts of patients' bodies as a re-colonization etiology.<sup>[1,6]</sup> Observing *H. pylori* in patients' saliva, tongue dorsum and dental plaque, many researchers introduced the mouth cavity as a suitable place for *H. pylori* and thus recurrence of gastric infection.<sup>[9,10]</sup> Since dental plaque can create an ideal micro-aerophilic environment and can form a matrix of glycolproteins for reproduction and protection of microbial population, it is regarded as the most probable place for *H. pylori*;<sup>[8]</sup> it is likely that when *H. pylori* goes to this place, it can be immune to antibiotics and can cause the gastric infection to return. However, in various studies,

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inconsistent results have been reported concerning the appearance of *H. pylori* in dental plaque.<sup>[3]</sup> Therefore, the question, "can mouth cavity act as a store for this pathogen?" has remained unanswered. Although a series of studies have reported the simultaneous appearance of *H. pylori* in mouth and stomach samples of patients, other attempts have failed to find *H. pylori* in the mouth of patients with gastric infection.<sup>[1,2,7-9]</sup>

Based on the literature review on *H. pylori* in dental plaque and its relation to peptic ulcer, we found that the results are somehow heterogeneous and mainly inconsistent. So, we decided to systematically review the existing evidence to assess if the dental plaque could be a source of gastric *H. pylori* infection and to explore the sources of heterogeneity around it.

## MATERIALS AND METHODS

### Searching

The present study was a systematic review and meta-analysis. All articles published in Farsi or English from January 2000 to December 2008 were reviewed. To do this, ISI web of science, EMBASE and Medline Digital Library Electronic Databases were used. In this case, the medical keywords of *Helicobacter*, *Helicobacter pylori* and *H. pylori* were searched in combination with the words Dental plaque, Dyspepsia, Peptic ulcer and gastritis. In addition, summaries of all articles presented in congresses were used. After searching the electronic resources, we started searching non-electronic resources including all handbooks presented in seminars related to mouth health. References of the papers found were used for finding other related papers.

### Selection

All related original articles published during the above-mentioned period in the Farsi or English language were reviewed. The outcome was the *H. pylori* testing results in both dental plaque and the stomach.

### Paper selection and data extraction

All the selected articles and studies were separately and critically analyzed by two researchers. To do this, they used a standard checklist according to Cochrane site guide to evaluate the main characteristics of these studies like sampling method and reliability of evaluations ([www.equator-network.org](http://www.equator-network.org)). Therefore, the articles which could not obtain the minimum quality

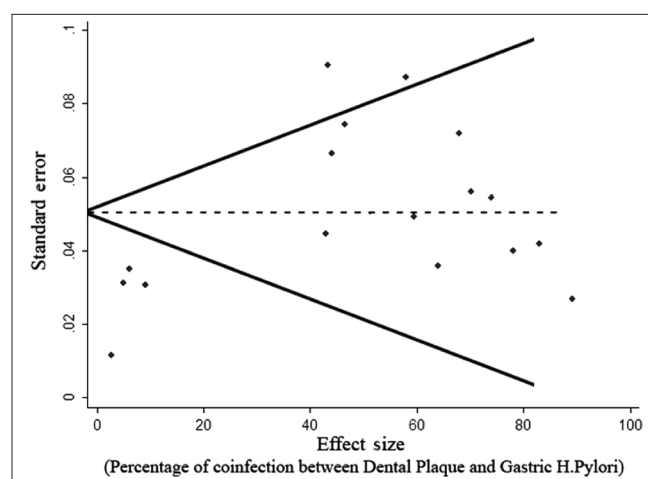
score (8 out of 14) were excluded. Also, studies that reported some special cases or a special diagnostic technique instead of studying the given relationship were excluded too. In case these two researchers did not agree about accepting or rejecting the quality of an article, a third researcher made the final decision.

### Quantitative data synthesis

Data from the well-qualified studies were extracted into an Excel worksheet. Publication year, research location, sample size, diagnostic methods and the percentage of co-infection were calculated [Table 1]. As the results were significantly heterogeneous, we calculated the random effect confidence interval 95% in Stata v. 10. Sex, age and diagnostic method were tested in meta-regression of being as a possible source for publication bias. Publication bias was assessed by funnel plot illustration [Figure 1].

## RESULTS

Finally, 23 articles (20 English and 3 Farsi) were included in the study.<sup>[1-23]</sup> The study by Chitsazi *et al*,<sup>[9]</sup> was conducted in Iran but published in an English language Journal. All studies were critically appraised. All articles were reviewed and data were extracted and stratified. The details of the 23 studies are shown in Table 1. The average correlation coefficient between the reviewers was (0.9). The total quality score of each study was calculated but was not significant. The results of 12 articles showed a significant correlation between the occurrence of *H. pylori* in the stomach and in the oral cavity. Generally, the aggregated data of 1861 patients were reviewed. In five studies, results were not reported by sex. In other 18 studies, totally



**Figure 1:** Funnel plot for the association between the reported effect size and the standard error in each study

**Table 1: The description of studies that met our eligibility criteria**

Author	Publication year	Country	Sample size	Diagnostic method for <i>H. pylori</i>	Correlation between gastric and dental plaque <i>H. pylori</i>
Gebara	2006	Brazil	30	PCR	+
Guzik	2004	Poland	100	Culture, UBT	-
Kingel	2005	Brazil	49	RUT	-
Guzik	2005	Poland	100	Serology, culture, UBT	-
Umeda	2003	Japan	45	Histology, UBT, culture, RUT	+
Anand	2006	India	134	Histology	+
Berroteran	2002	Venezuela	32	Histology, PCR	+
Chitsazi	2006	Iran	88	RUT	-
Ozdemir	2001	Turkey	81	Histology, RUT	+
Gebara	2004	Brazil	30	PCR	+
Namiot	2007	Poland	137	Histology, RUT	-
Choudhury	2003	India	124	RUT	+
Young	2001	England	5	PCR	+
Avcu	2001	Turkey	108	RUT	+
Butt	2001	England	90	Cytology smear	+
Kim	2000	South Korea	46	PCR, UBT, RUT, culture, cytology smear	+
Lin	2003	Taiwan	56	Histology, culture, UBT, RUT	+
Song	2002	Germany	21	PCR, UBT, RUT	-
Song	2000	Germany	42	PCR, histology	-
Teoman	2007	Turkey	67	PCR, UBT, RUT, culture	-
Abdolsamadi	2005	Iran	96	PCR	-
Nasrolahei	2004	Iran	180	UBT, culture, RUT	-
Goudarzi	2000	Iran	200	Culture, RUT	-

PCR: Polymerase chain reaction, UBT: Urease breath test, RUT: Rapid urease test

745 male and 790 female patients were studied; their ages varied between 9 and 90 years, and the average age was  $42.8 \pm 7.4$  years. Co-infection of *H. pylori* in dental plaque and stomach was estimated as 49.7% (95% CI 16–83.4%). Only 32.3% (95% CI 0.1–73%) of the reported cases were infected whether by dental plaque or gastric *H. pylori*. *H. pylori* was diagnosed in 37.2% (95% CI 33.5–49.9%) of patients only in stomach but not in dental plaque (33.5–49.9%). *H. pylori* was diagnosed in 24.7% (95% CI 21.3–28.0%) of patients only in dental plaque. The percent of agreement between the dental plaque *H. pylori* status and the gastric *H. pylori* was estimated as 82% (range of 16–100%).

The meta-regression coefficient of the relationship between age and the percentage of infection in dental plaque, stomach or both was not statistically significant.

The funnel plot [Figure 1] indicated that although some publication bias might have happened in this study, the effect is not too much and it is not statistically significant ( $P=0.256$ ).

## DISCUSSION

The results showed that the co-infection of dental

plaque and gastric *H. pylori* is about 50%. Out of the 23 reviewed papers, 12 were inconsistent with this co-occurrence and 11 disagreed to this hypothesis. Difference in disease diagnostic indices in mouth, *H. pylori* diagnostic methods, *H. pylori* antibiotic treatments and criteria for selecting the patients are among the causes of inconsistency.

As shown in Table 1, a total of 23 studies reviewed have used seven different diagnostic methods to determine the presence of *H. pylori*. Among them, rapid urease test (RUT) and polymerase chain reaction (PCR) were the ones mostly used (in 10 and 13 studies, respectively). The researchers preferred RUT and PCR significantly because these methods have high level of accuracy. However, they are not unanimous concerning the priority of PCR over other methods. Some believe that since PCR is very sensitive, it can cause a series of pseudo-positive answers in some cases. In eight studies, microbial culture method was used as a gold standard to determine the presence of *H. pylori*. Since some types of this bacterium cannot be cultured, it was not used frequently in these studies. It seems that using different tests such as PCR or microbial culture is one of the serious factors involved in the lack of agreement between the results

of different researchers. Finding a correlation between *H. pylori* diagnostic method and its occurrence in the dental plaque was also not possible because almost all of the researchers used more than two tests in each study.

In some studies like those of Gebara and Ozdemir, the method was different; in these studies, the patients were studied before and after the three-medicine treatment.<sup>[2,10]</sup> Carrying out these studies seems very applicable. In all reviewed studies, totally five three-medicine treatments were used with Omeprazol being similar in all five regimes and Clarithromycin and Amoxicillin being prescribed in three and four regimens, respectively.

In almost all studies, the criterion for entering the study was similar. Most studies examined the patients with dyspeptic symptoms referred to digestive specialty wards. These patients were supposed to undergo endoscopy of their upper digestive system. Only two studies, i.e. Kim and Guzik studies, did not mention the criterion for choosing the patients.<sup>[5,17]</sup>

The data from some relevant studies such as what has been reported in Song *et al*, cannot be pooled with other data due to the very different method used for *H. pylori* diagnosis and different inclusion criteria.<sup>[18]</sup>

Avcu has also divided the patients into three groups as good, moderate and poor concerning oral health. Thus, it was not easy to pool this subgroup analysis with the findings from other studies.<sup>[11]</sup>

One of the limitations of such a study was that dental plaque is not the only source of *H. pylori* and tongue dorsal and saliva of patients should also be taken into consideration. However, studies like those of Gebara and Guzik have examined the presence of *H. pylori* in saliva.<sup>[1,3]</sup> Since the present research shows a high agreement upon the simultaneous presence of *H. pylori* in dental plaque and stomach of patients, it can be concluded that these two conditions occur and come together; however, it does not mean that dental plaque can be a suitable place for *H. pylori* infection return.

Butt's study was the only one to review the therapeutic effect of dental treatment on removing dental plaque to prevent gastric *H. pylori* re-infection.<sup>[12]</sup>

Although three of four Iranian researchers used the most reliable methods (PCR and culture), all of these four studies have shown that Hp could not play a role in the recurrence or incidence of dyspepsia in the

studied patients, hence the results of Iranian studies support the hypothesis that Hp may belong to the normal microflora of the oral cavity.<sup>[9,21-23]</sup>

Results of this study suggest that periodontal treatment, removal of dental plaque and thus promotion of patients' oral health can be used as a complementary method for the usual triple therapy for patients with *H. pylori* gastritis. But we still do not have enough evidence in this field, So, carrying out further interventional studies to prove that dental care after *H. pylori* eradication including bacterial plaque control procedures such as chlorhexidine irrigation and mechanical dental plaque removal is a critical step for preventing recurrence of *H. pylori* seems very essential. The serotype similarity between *H. pylori* in dental plaque and stomach should also be investigated.

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