Research Article

Evaluation of Periodontal Status among Patients with Helicobacter Pylori and Determination of Salivary PH, Flow Rate, and Alkaline Phosphatase Level

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ABSTRACT

Article history:
Received 17 January 2024
Accepted 10 April 2024
Available online 1 August 2024

Keywords: Alkaline phosphatase, Helicobacter pylori, Periodontal condition, Salivary variables.

Background: Up to 50% of people worldwide are infected with Helicobacter pylori, a bacterium with a spiral shape and a negative Gram stain. Negative impacts on oral health, including bad breath, dental caries, recurrent aphthous stomatitis, and glossitis, are caused by this particular pathogen.

Objective: This study aimed to evaluate the correlation between saliva pH, flow rate, alkaline phosphatase and periodontal status in patients with Helicobacter pylori.

Subjects and Methods: From December 2021 to July 2022, a case-control study was undertaken consisting of a group of 80 participants, consisting of both H. pylori-positive individuals as the study group (40) and healthy, H. pylori-uninfected individuals as the control group (40), all between the ages of 30 and 40. Both groups provided unstimulated saliva for the study. Alkaline phosphatase levels, pH, and flow rate are all measured during saliva analysis. Upon completing this routine, an assessment of periodontal pocket depth, bleeding on probing, and plaque is conducted.

Results: During the study, it was observed that the control group had lower plaque index, percentage of probing bleeding, and periodontal pocket depth compared to the study group. The difference between the two groups was statistically significant (p<0.05). The control group also had higher salivary pH and flow rate compared to the study group. Conversely, the study group had higher alkaline phosphatase levels than the control group. This difference was also statistically significant (p<0.05). Moreover, weak and non-significant correlations were found between the periodontal parameters and salivary pH and flow in both groups. The correlation was negative and statistically significant (P<0.05). The salivary pH of the BOP and the control group had a significant negative correlation as well.

Conclusions: Due to its status as a significant exterior origin of Helicobacter pylori, the oral cavity could hold significance in the periodontal health of those affected by Helicobacter pylori disease. In reference to the study group, the PH and flow rate of saliva were less than that of the control group, while alkaline phosphatase displayed higher levels, attaining statistical significance (P<0.05).
polymorphonuclear leukocytes - create in the gingival and periodontal crevices (6).

During periodontitis' active phase, the alveolar bone's osteoblasts and fibroblasts are ruined, rupturing the cell membrane and exposing the cell contents. This damage results in the release of alkaline phosphatase and GCF in the saliva, which spikes the saliva's ALP level (7). H. pylori presence in the oral cavity may be affected by saliva pH (8). As reported in one study. Additionally unstimulated saliva has an acidic pH value of 5.75 to 7.05, the pH value increases with an increase in flow rate and can reach a maximum of 7.8 at a high salivary flow rate, as was documented in a separate investigation of individuals with H. pylori infection (9). H. pylori is a helical, microaerophilic, Gram-negative bacillus that has stringent growth prerequisites (10). Studies have backed gastro-intestinal, periodontal status, and some saliva method. (17) The subject's advice was to include gingival bleeding and periodontal pockets, was assessed using the Plaque Index according to the criteria of Silliness examination of the third molars using a dental chair. Plaques were each tooth were checked. All teeth are covered except for an oral and fecal-oral spread of H. pylori, as evidenced by epidemiological findings (11). Attention has been increasingly directed towards the connection of Helicobacter pylori infection and periodontitis. While most research examines the dental plaque's pathogenicity (12,13), The correlation between H. pylori infection and periodontal health has received little attention. For example, Zhu et al. (14). suggested the possibility that gastric H. pylori could be connected to chronic periodontal disease. Among older adults with periodontitis, H. pylori infection was detected in both the oral cavity and the stomach, with analysis of the correlation between gastric H pylori infection and periodontal health being discussed. Prior research has suggested that dental plaque in the mouth is the primary location for the aggregation of bacteria including H. pylori enclosed in an intracellular matrix made of inorganic components such as calcium as well as other minerals and organic components such as glycoproteins (15) Additionally, Tongtawee proposed that supplementary periodontal therapy increases H. pylori treatment efficacy and reduces the recurrence of stomach infection (16). Thus, identifying the risk factors for oral H. pylori infection is vital for controlling and avoiding the subsequent consequences of the infection. This study was conducted because there were no previous studies in Iraq on the association between periodontal health status and certain salivary variables in H. pylori-infected patients.

Subjects and Methods

This research uses a case-control design. Prior to gathering data, this study received ethical approval from the Faculty of Dentistry, Baghdad University Ethical Approval Committee, Ref.number:479.

The sample for this study included 80 participants. 40 subjects (study group) tested positive for H. pylori by laboratory tests (stool antigen test or antibody rapid test), and 40 healthy subjects (control group) who were not infected with H. pylori; this The research subjects of the study were patients from the Department of Gastroenterology, Al Kadhimiya Teaching Hospital in Baghdad. The oral examination was performed according to the basic method of the WHO Oral Health Survey (2013), and four surface examinations of each tooth were checked. All teeth are covered except for an oral examination of the third molars using a dental chair. Plaques were assessed using the Plaque Index according to the criteria of Silliness and Leo's Plaque Index (PII) (1964). In contrast, periodontal status, including gingival bleeding and periodontal pockets, was assessed according to the criteria of the World Health Organization Oral Health Survey (2013). Unstimulated saliva samples were collected from both groups using the saliva method. (17) The subject's advice was to remain calm and relaxed. They are then instructed to minimize movement and collect saliva on the floor of the mouth, which is then spit into a sterile disposable cap. Participants spit saliva into a sterile container every 30 seconds for 5 minutes. The saliva was sent to the laboratory in a refrigerator and centrifuged at 3000 rpm for 10 minutes. The supernatant was then removed using a microcette and stored deep-frozen at -20°C. (18) FOR ANALYSIS. Saliva pH was measured directly with a digital pH meter, and the flow rate was estimated in ml/min. Alkaline phosphatase was measured using a spectrophotometer, according to the kit manufacturer's instructions (BIOLABS SA, France).

The data were described, analyzed, and presented using the statistical software package for the social sciences (SPSS Version -22, Chicago, IL, USA).

Results

Table (1) revealed a notable statistical difference (p < 0.05) between the study group and control group in terms of average plaque index score, probing bleeding percentage, and periodontal pocket depth. Specifically, the study group exhibited a higher level than the control group.

### Table 1: Plaque index, bleeding on probing, and periodontal pocket depth in the study and control groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Study Groups</th>
<th>Control Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SE</td>
<td>T-test P-value</td>
<td>Mean ± SE</td>
</tr>
<tr>
<td>PII</td>
<td>1.58 ± 0.093</td>
<td>1.016 ± 0.024</td>
</tr>
<tr>
<td>BOP</td>
<td>39.82 ± 2.974</td>
<td>9.314 ± 0.901</td>
</tr>
<tr>
<td>PPD</td>
<td>5.19 ± 0.130</td>
<td>4.621 ± 0.192</td>
</tr>
</tbody>
</table>

*significant at p<0.05

### Table 2: Saliva pH, flow rate, and alkaline phosphatase in study and control groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Study Groups</th>
<th>Control Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SE</td>
<td>T-test P-value</td>
<td>Mean ± SE</td>
</tr>
<tr>
<td>PH</td>
<td>6.05 ± 0.066</td>
<td>6.618 ± 0.053</td>
</tr>
<tr>
<td>FR</td>
<td>0.36 ± 0.021</td>
<td>0.808 ± 0.022</td>
</tr>
<tr>
<td>ALP</td>
<td>41.888 ± 0.511</td>
<td>33.518 ± 0.866</td>
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</table>

However, when examining the salivary variables of pH, flow rate, and alkaline phosphatase, the study group had lower levels than the control group, as shown in Table (2).

This difference was also statistically significant (p < 0.05). Despite some statistically weak and non-significant correlations between periodontal parameters and salivary pH and flow velocity in both groups, there were notable exceptions such as salivary pH and PII in the control group and salivary pH and BOP in the study group. These exceptions showed weak negative correlation, which was significant.

https://doi.org/10.47723/jxnybz47
at a P value of less than 0.05. Additionally, the study found that salivary alkaline phosphatase exhibited significant positive correlation as well as weak and non-significant correlations with periodontal parameters. The specifics of these findings can be seen in Table (3).

### Table 3: Correlations between plaque index, bleeding on probing, periodontal pocket depth, and salivary variables in study and control groups

<table>
<thead>
<tr>
<th></th>
<th>PH</th>
<th>FR</th>
<th>ALP</th>
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<tbody>
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<td>Study</td>
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<td>Control</td>
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#### Discussion

Reportedly, there is controversy about *H. pylori*’s role and manifestations in the oral cavity. People between the ages of 30–40 often consume a higher volume of fast food and restaurant meals. Your likelihood of contracting *H. pylori* infection is increased. Researchers have explored the use of multiple molecular techniques to determine *H. pylori* infection in saliva, as it is an ideal breeding ground for the microbe. Although *H. pylori* could potentially be a reinfection source following eradication, various studies demonstrate that the detection of the infection in the mouth does not necessarily correspond with its colonization in the stomach (19).

The study group showed a statistically significant increase in mean plaque index and percentage of bleeding on probing compared to the control group, as indicated in the data. Similar findings were shown in a previous study by Iwai et al., where they noted a correlation between *H. pylori* infection and higher percentages of bleeding on probing and plaque index. Nonetheless, their research also showed that there wasn’t a meaningful association between *H. pylori* infection and the severity of periodontal disease (20).

Additionally, another study found that there were more instances of periodontal disease manifestations and bleeding on probing among patients with *H. pylori* infection than those without. Despite these observations, a definite consensus hasn’t been reached concerning *H. pylori* infection and its connection to periodontal disease (21).

Periodontal disease is believed to be associated with *H. pylori* infection, as indicated by multiple studies including this one. The study group had noticeably deeper pockets than the control group, which is in line with previous research by Dye et al (22).

Furthermore, Silva et al. and Ding et al. have also supported the notion that *H. pylori* and periodontal disease are linked. This evidence points to the conclusion that the presence of *H. pylori* may exacerbate periodontal problems (23,24). The control group showed higher saliva pH and flow rate than the research group in this study, with the difference being statistically significant. This can be attributed to the acidic nature of saliva, which is disrupted by carbohydrate fermentation and favorable for *H. pylori* growth. Despite a rich bacterial flora, it is suspected that the oral cavity’s acidic pH creates a suitable microenvironment for *H. pylori*. Furthermore, reduced saliva flow rate leads to increased plaque buildup in the oral cavity due to weaker cleaning properties (25). The salivary pH is influenced by various factors like salivary proteins, phosphate, and bicarbonate concentration, which help maintain a stable pH level. One notable finding in our study was that the study group had a significantly higher ALP level than the control group.

This could be due to the activity of alanine aminotransferase, which was found to be slightly elevated in gastric ulcer patients. The elevated level of these enzymes in saliva and blood is likely caused by the cellular damage resulting from stomach ulcers. Previous studies have linked a high level of ALP in saliva to dental and oral health issues (26). The cell membranes of alveolar bone osteoblasts and periodontal ligament fibroblasts may be home to ALP. In instances of inflammation, the cell membranes of alveolar bone and their respective osteoblasts and fibroblasts undergo destruction, thus allowing for the release of intracellular components outside the cell. ALP is among the component released and can be found in both GCF and saliva. The results from a European study by Baghori et al. (19) are in line with these findings, showing that levels of ALP in saliva are increased in patients with gastric ulcer compared to healthy individuals.

However, no statistically significant differences were detected. It has been determined from the data mentioned above that an early diagnosis and screening of peptic ulcer disease could be executed by analyzing the concentration and activity of salivary enzymes, henceforth making saliva an effective diagnostic sample (26,27). There was negative correlation observed between the periodontal parameters in the two groups and the saliva PH and flow velocity, except for the saliva PH and PII of the control group and the saliva PH and BOP of the study group. Although weak correlation was found, the results hold statistical significance. The latter research report proposes alkaline phosphatase as a marker worth using for detection and monitoring of periodontal disease across all age groups. This study had some limitations The data poll that has been used for the age analysis strictly followed the availability of patient at the selected institute. Also, not taking x-rays can affect the rate of caries.

### Conclusion

Playing a crucial role as a source of *Helicobacter pylori* outside the body, the oral cavity has the potential to affect the periodontal status of patients diagnosed with *Helicobacter pylori* disease. The study group exhibited lower values for saliva variables (flow rate, PH) than the control group. As for alkaline phosphatase, the study group had higher values than the control group, with a statistically significant difference (P<0.05).

### Funding

This study received no special funding.

### Conflict of Interest

No conflict of interest.

### Data availability

Data are available upon reasonable request.

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https://doi.org/10.47723/jxnybz47
References


[23] Silva DG, Stevens RH, Macedo JM, Albano RM, Falabella ME, Fischer RG, et al. Presence of Helicobacter pylori in...
https://doi.org/10.1016/j.archoralbio.2010.06.018.

https://doi.org/10.7150/ijms.11050

https://doi.org/10.1186/s12903-017-0361-x

https://doi.org/10.3390/bios13020206

https://doi.org/10.1016/j.medntd.2022.100115

http://doi.org/10.1149/2754-2726/ac7533

To cite this article: Alewi MD, Mohammed AT. Evaluation of Periodontal Status among Patients with Helicobacter Pylori and Determination of Salivary PH, Flow Rate, and Alkaline Phosphatase Level. Al-Kindy College Medical Journal. 2024;20(2):130-134.
https://doi.org/10.47723/jxnybz47