Al-Kindy College Medical Journal (KCMJ)

Research Article

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

Marwa Dhari Alewi*, Ahlam Taha Mohammed

Department of Preventive Dentistry, College of Dentistry, University of Baghdad, Baghdad, Iraq.
* Corresponding author's email: marwadhari1989@gmail.com

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

https://doi.org/10.47723/jxnybz47

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

ABSTRACT

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 ($P<0.05$).

Introduction

In adults, particularly the elderly, periodontitis is a commonly occurring oral disease that leads to tooth loss (1,2). While plaque biofilm is believed to be the primary cause in vulnerable individuals, other factors also play a role in its advancement (3). Results in the dental structure, including gingivitis that affects the gums exclusively and periodontitis that deals with the tooth-supporting tissues such as periodontal ligament, alveolar bone, and cementum. In many cells throughout the body, alkaline phosphatase (ALP) is found on their membranes (4). Various periodontal diseases and healthy individuals are both monitored using alkaline phosphatase, an element that numerous cells - like osteoblasts, (5) macrophages, fibroblasts, and

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-oral, oral-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 (PlI) (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 micropipette 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.

Variables	Groups Study		Control			
	Mean	±SE	Mean	±SE	T-test	P- value
PlI	1.584	0.093	1.016	0.024	5.910*	0.0001
BOP	39.829	2.974	9.314	0.901	9.820*	0.0001
PPD	5.195	0.130	4.621	0.192	2.539	0.014

*=significant at p<0.05

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

Variables	Groups Study		Control			
	Mean	±SE	Mean	±SE	T-test	P- value
PH	6.050	0.066	6.618	0.053	6.686	0.0001
FR	0.363	0.021	0.808	0.022	14.639	0.0001
ALP	41.888	0.511	33.518	0.866	8.327	0.0001

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 PlI in the control group and salivary pH and BOP in the study group. These exceptions showed weak negative correlation, which was significant

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

	PII				BOP				PPD			
	Groups				Groups				Groups			
	Study		Control		Study		Control		Study		Control	
	r	P	R	P	r	p	r	p	r	P	R	P
PH	-0.176	0.277	-0.373*	0.018	-0.317*	0.046	-0.066	0.685	-0.018	0.914	0.004	0.982
FR	-0.098	0.547	-0.246	0.125	0.001	0.995	-0.086	0.598	-0.300	0.060	0.000	0.999
ALP	0.311	0.051	0.054	0.739	0.059	0.719	0.021	0.900	0.135	0.405	0.004	0.981

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 periodontitis (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.

ORCID

Marwa Alewi 0009-0008-4544-1236
Ahlam Mohammed 0000-0002-7351-1018

References

[1] Henshaw MM, Karpas S. Oral health disparities and inequities in older adults. Clinics in Geriatric Medicine. 2023;39(2):207-23. https://doi.org/10.1016/j.cden.2020.11.004

[2] Chan AKY, Tsang YC, Jiang CM, Leung KCM, Lo ECM, Chu CH. Integration of oral health into general health services for older adults. Geriatrics. 2023;8(1):20. https://doi.org/10.3390/geriatrics8010020

[3] Bertolini M, Costa RC, Barão VAR, Villar CC, Retamal-Valdes B, Feres M, et al. Oral microorganisms and biofilms: new insights to defeat the main etiologic factor of oral diseases. MDPI; 2022. p. 2413. https://doi.org/10.3390/microorganisms10122413

[4] Tsuchida S, Nakayama T. Recent clinical treatment and basic research on the alveolar bone. Biomedicines. 2023;11(3):843. https://doi.org/10.3390/biomedicines11030843

[5] Alarcón-Sánchez MA, Heboyan A, Fernandes GVdO, Castro-Alarcón N, Romero-Castro NS. Potential impact of prosthetic biomaterials on the periodontium: a comprehensive review. Molecules. 2023;28(3):1075. https://doi.org/10.3390/molecules28031075

[6] Ameer LRA, Ali BG. Effects of light smoking on salivary levels of alkaline phosphatase and osteocalcin in chronic periodontitis patients. Journal of Baghdad College of Dentistry. 2015;27(2):110-4.

[7] Ameer LRA, Ali BG. Effects of light smoking on salivary levels of alkaline phosphatase and osteocalcin in chronic periodontitis patients. Journal of Baghdad College of Dentistry. 2015;27(2):110-4

[8] Rimbara E, Mori S, Kim H, Shibayama K. Role of γ-glutamyltranspeptidase in the pathogenesis of Helicobacter pylori infection. Microbiology and immunology. 2013;57(10):665-73. https://doi.org/10.1111/1348-0421.12089

[9] Ahmed RF, Jabber WF, Aldelaimi AAK. The Salivary Secretion and Biochemical Composition Analysis in Patients with Helicobacter pyloriInfection. Journal of Research in Medical and Dental Science. 2018;6(2):148-53. https://doi.org/10.24896/jrmds.20186223

[10] Almashhadany DA, Zefenkey ZF, Zaki AM. Dental risk factors associated with oral Helicobacter pylori infection: a cross-sectional study based on saliva antigen test. The Journal of Infection in Developing Countries. 2022;16(03):516-21. https://doi.org/10.3855/jidc.15420

[11] Duan M, Li Y, Liu J, Zhang W, Dong Y, Han Z, et al. Transmission routes and patterns of helicobacter pylori. Helicobacter. 2023;28(1):e12945. https://doi.org/10.1111/hel.12945

[12] Zhang L, Chen X, Ren B, Zhou X, Cheng L. Helicobacter pylori in the oral cavity: current evidence and potential survival strategies. International journal of molecular sciences. 2022;23(21):13646 https://doi.org/10.3390/ijms232113646

[13] Lopez-Valverde N, Macedo de Sousa B, Lopez-Valverde A, Suarez A, Rodriguez C, Aragoneses JM. Possible association of periodontal diseases with Helicobacter pylori gastric infection: A systematic review and meta-analysis. Frontiers in Medicine. 2022;9:822194. https://doi.org/10.3389/fmed.2022.822194

[14] Zhu L, Long B, Luo J, Jiang R, Fang H. Construction of a recombinant Lactobacillus acidophilus expressing high levels of Helicobacter pylori adhesin Hp0410. Nan Fang yi ke da xue xue bao= Journal of Southern Medical University. 2010;30(2):334-7

[15] Rasmussen LT, Labio RWd, Gatti LL, Silva LCd, Queiroz VFd, Smith MdAC, et al. Helicobacter pylori detection in gastric biopsies, saliva and dental plaque of Brazilian dyspeptic patients. Memorias do Instituto Oswaldo Cruz. 2010;105:326-30. https://doi.org/10.1590/s0074-02762010000300015

[16] Tongtawee T, Wattanawongdon W, Simawaranon T. Effects of periodontal therapy on eradication and recurrence of Helicobacter pylori infection after successful treatment. Journal of International Medical Research. 2019;47(2):875-83 https://doi.org/10.1177/0300060518816158

[17] Khurshid Z, Zohaib S, Najeeb S, Zafar MS, Slowey PD, Almas K. Human saliva collection devices for proteomics: an update. International journal of molecular sciences. 2016;17(6):846. https://doi.org/10.3390/ijms17060846

[18] Carvalho SPM, Sales-Peres A, Ribeiro-Bicudo LA, Silva RHAd. Quality evaluation of DNA obtained from stored human saliva and its applicability to identification in Forensic Dentistry. Revista Odonto Ciência. 2010;25:48-53. https://doi.org/10.1590/S1980-65232010000100010

[19] .Boghori M, Aghamaali M, Sariri R, Mohamadpour F, Ghafouri H. Salivary enzymes and flow rate: Markers of peptic ulcer. Journal of oral biology and craniofacial research. 2014;4(1):24-9. https://doi.org/10.1016/j.jobcr.2013.12.001

[20] .Iwai K, Watanabe I, Yamamoto T, Kuriyama N, Matsui D, Nomura R, et al. Association between Helicobacter pylori infection and dental pulp reservoirs in Japanese adults. BMC Oral Health. 2019;19(1):1-8. https://doi.org/10.1186/s12903-019-0967-2

[21] Liu Y, Li R, Xue X, Xu T, Luo Y, Dong Q, et al. Periodontal disease and Helicobacter pylori infection in oral cavity: a meta-analysis of 2727 participants mainly based on Asian studies. Clinical oral investigations. 2020;24:2175-88. https://doi.org/10.1007/s00784-020-03330-4

[22] Dye BA, Kruszon-Moran D, McQuillan G. The relationship between periodontal disease attributes and Helicobacter pylori infection among adults in the United States. American journal of public health. 2002;92(11):1809-15. https://doi.org/10.2105%2Fajph.92.11.1809

[23] Silva DG, Stevens RH, Macedo JM, Albano RM, Falabella ME, Fischer RG, et al. Presence of Helicobacter pylori in

supragingival dental plaque of individuals with periodontal disease and upper gastric diseases. archives of oral biology. 2010;55(11):896-901. https://doi.org/10.1016/j.archoralbio.2010.06.018 .

[24] Ding Y-J, Yan T-L, Hu X-L, Liu J-H, Yu C-H, Li Y-M, et al. Association of salivary Helicobacter pylori infection with oral diseases: a cross-sectional study in a Chinese population. International journal of medical sciences. 2015;12(9):742. . https://doi.org/10.7150/ijms.11050

[25] Aksit Bıcak D, Akyuz S, Kıratlı B, Usta M, Urganci N, Alev B, et al. The investigation of Helicobacter pylori in the dental biofilm and saliva samples of children with dyspeptic complaints. BMC oral health. 2017;17:1-12. https://doi.org/10.1186/s12903-017-0361-x

[26] Min H, Zhu S, Safi L, Alkourdi M, Nguyen BH, Upadhyay A, et al. Salivary diagnostics in pediatrics and the status of saliva-based biosensors. Biosensors. 2023;13(2):206. https://doi.org/10.3390/bios13020206

[27] Cui Y, Yang M, Zhu J, Zhang H, Duan Z, Wang S, et al. Developments in diagnostic applications of saliva in human organ diseases. Medicine in Novel Technology and Devices. 2022;13:100115. https://doi.org/10.1016/j.medntd.2022.100115

[28] Moonla C, Lee DH, Rokaya D, Rasitanon N, Kathayat G, Lee W-Y, et al. Lab-in-a-mouth and advanced point-of-care sensing systems: detecting bioinformation from the oral cavity and saliva. ECS Sensors Plus. 2022;1(2):021603. 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