Indonesian Journal on Health Science and Medicine Vol 2 No 2 (2025): October
ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

Histological Evaluation of Gastric Mucosa in Individuals with Gastric Ulcers and Its Association with Kidney Function

Ruqayya Saad Hamid[1], Raghad Hazem Alabbasy[2], Azhar Khalaf Alazzawi[3]
[1]Collage of applied science, Department of pathological analysis: st.aps4@uosamarra.edu.iq
[2]Collage of education , Department of biology : raghad.h@uosamarra.edu.iq

Abstract. Gastric ulcers remain a major gastrointestinal disorder with significant global morbidity, frequently linked to hematological disturbances and systemic complications. While Helicobacter pylori infection and non-steroidal anti-inflammatory drug (NSAID) use are the leading causes of gastric ulcers, less attention has been given to their systemic impact, particularly on renal function and hematological status. Limited studies have explored the combined histological, hematological, and renal alterations in gastric ulcer patients, especially in developing regions. This study aimed to evaluate gastric mucosal histopathology in ulcer patients and investigate its association with hemoglobin levels, packed cell volume, and kidney function. Ninety participants were studied, including 60 with gastric ulcers and 30 controls. Patients demonstrated significantly reduced hemoglobin (11.55 ± 2.31 g/dL) and packed cell volume (36.37 ± 7.51%) compared with controls ($p \leq 0.05$). Kidney function analysis revealed elevated urea (32.93 ± 9.41 mg/dL) and creatinine (0.816 ± 0.205 mg/dL) in patients versus controls ($p \leq 0.05$). Histological examination of 100 gastric biopsies showed inflammation in 93% of cases, with active chronic inflammation in 59%, and H. pylori infection in 66% of samples. This is one of the first studies in Iraq to link histological gastric ulcer findings with both hematological parameters and renal function, providing an integrative view of disease impact. The findings highlight the need for comprehensive management of gastric ulcer patients, including regular monitoring of hematological and renal markers, alongside histopathological evaluation, to prevent systemic complications and improve outcomes.

Highlights:

1. Gastric ulcer patients showed significantly lower hemoglobin and packed cell volume compared to healthy controls.
2. Kidney function was impaired in gastric ulcer patients, with elevated urea and creatinine levels.
3. Histological analysis revealed high prevalence of chronic inflammation (93%) and Helicobacter pylori infection (66%) in gastric ulcer tissues.

Keywords: Gastric ulcer, kidney function, histological study, hemoglobin.

Introduction

Gastric ulcers are common diseases that affect millions of people around the world[1] . They are erosions that affect the mucosa layer that lines the gastric wall and may extend through the muscularis mucosa and exceed 5 mm in diameter. These ulcers arise as a result of a malfunction in the natural defense mechanisms of the stomach, which leads to

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

gradual changes in the mucous membrane starting with erosion (Erosion) and ending in the form of an ulceration [2]

Gastric ulcers are caused by several causes, including primary and secondary causes that are not very common. The most common and widespread cause is infection with Helicobacter pylori, which colonizes the mucous membrane of the stomach wall and triggers an inflammatory response in the stomach. [3] The prevalence of H. pylori is higher in developing countries [4] [5], and it is transmitted by several routes including oral, fecal-oral, and sexual [5].

The second most common cause is the overuse of non-steroidal anti-inflammatory drugs (NSAIDs), as these drugs are weak acids when exposed to gastric acid and remain in the epithelial cells and lead to increased cell permeability leading to cell damage [6], while other causes, which are less common, include alcohol, stress, and free radicals [7]. Other less common causes include alcohol consumption, psychological stress, and free radicals [7], and there are some factors that aggravate stomach ulcers but are not considered risk factors but rather predisposing factors, such as swallowing foods that are extremely hot or extremely cold, as well as caffeine and alcohol [8].

Patients with gastric ulcers suffer from pain in the epigastric area [9], which is the most common diagnostic characteristic, and this pain is accompanied by dyspeptic symptoms such as fullness, bloating, early satiety, and nausea. [10] This pain is often described as sharp or burning and accompanied by a bad feeling, and with these severe symptoms, bleeding is the most serious and severe symptom and occurs most frequently in people over 60 years of age [11].

As for the diagnosis of gastric ulcers, a clear and accurate history must be obtained and the presence of any complications must be noted, and endoscopy of the oesophagus, stomach and duodenum is the best and most accurate criterion for the diagnosis of gastric ulcers [12].

In this study, the histological evaluation of the gastric wall was carried out to find out the most important changes that occur after a gastric ulcer, as well as the measurement of blood levels and hemoglobin as one of the most common parameters that are prone to decrease due to bleeding that occurs during a gastric ulcer, in addition to studying the extent of change in kidney function in people with gastric ulcers.

Method

This study was performed on people with gastric ulcer aged between 20-70 years, after being diagnosed by endoscopy by the specialist doctor, where 90 blood samples were collected over a period of six months.

The samples were divided into two groups, the first group included 60 blood samples of people with gastric ulcer and the second group included 30 blood samples of healthy

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

people (control group), and the blood level and hemoglobin and kidney function ratio were measured for both groups.

Collection of blood samples

Blood samples were collected using 5 ml syringes where 5 ml of venous blood was withdrawn from each patient, with strict adherence to sterile procedures during the withdrawal process.

Each sample was then divided into two parts:

The first part was placed in tubes containing EDTA anticoagulant, to be used for the complete blood count (CBC) analysis.

The second part of the blood was placed in a tube containing a separating gel, then left at room temperature for 10 minutes, after which the blood was separated using a centrifuge at 6000 rpm for 5 minutes to extract the serum for later use in chemical analyses.

After separation, the serum was extracted using a micropipette and transferred to 2ml Eppendorf tubes. The tubes were then numbered and labelled with patient names using tape and stored in a freezer at -20°C until the required laboratory analyses were performed.

Measurement of PCV and hemoglobin

Packed cell volume (PCV) and hemoglobin were measured using a CBC device from SYSMEX, Japan.

Measurement of kidney function

Urea and creatinine were measured using a BIOLABO kit (BIOLABO, France) according to the manufacturer's written instructions.

Histological sections

The study was performed on 100 reports of histological biopsies taken from the stomach wall, obtained through the Gastroenterology Department at Tikrit Teaching Hospital, based on the mission facilitation letter No. 2497/40/7 issued on 8/9/2024.

Statistical analysis

The present results were analyzed using t-test at a significance level of $P \leq 0.05$ using SPSS version 20 [13].

Indonesian Journal on Health Science and Medicine Vol 2 No 2 (2025): October
ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

Results and Discussion

The results of the statistical analysis of the present study showed a significant decrease in the total volume of red blood cells in patients with gastric ulcer compared to the control group, where it reached (36.37±7.51) and (42.83±3.91) at a significance level of P≤0.05.

This decrease may be attributed to the occurrence of bleeding, which is a common and serious complication of peptic ulcer, as continuous bleeding, even if minor, can lead to anemia in the long term. This decrease may also be related to age, as studies have shown that the majority of patients with gastric ulcers are over 60 years of age, and this age group is more prone to general weakness and nutrient deficiency, including iron, which increases the likelihood of anemia.

There was a significant decrease in hemoglobin level in patients (11.55±2.31) compared to the control group (13.42±1.44) at P≤0.05, which supports our hypothesis that gastric ulcer directly affects the total volume of the patient's erythrocytes either as a result of chronic bleeding or as a result of the malabsorption of food associated with the condition, the results are summarized in the table below:

Table 1: PCV and hemoglobin levels in patients with gastric ulcer and control group.

Parameters	PCV	Hb
Patient	36.37±7.51*	11.55±2.31*
Control	42.83±3.91	13.42±1.44

The asterisk (*) indicates to a significant difference at P≤0.05 level.

The results of our current study confirm and agree with Jiao & Zhang, 2021, which showed a decrease in hemoglobin in patients with gastric ulcers [14].

In this study, kidney function was also measured by analyzing urea and creatinine levels in order to explore the possible relationship between gastric ulcer and kidney function.

The results showed significant differences between the gastric ulcer patients and the control group, with a significant increase in urea and creatinine levels in the patients, at a significance level of P≤0.05, the results are summarized in the table below:

Table 2: Kidney function levels in the blood serum of both gastric ulcer patient and control group.

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

Parameters	Urea	Creatinine
Patient	32.93±9.41*	0.816±0.205*
Control	25.20±5.73	0.678±0.125

The asterisk (*) indicates to a significant difference at P≤0.05 level.

These findings can be explained by several factors, the most important of which is the common use of non-steroidal anti-inflammatory drugs (NSAIDs), which are the second most common cause of gastric ulcers after H. pylori infection [6]. These drugs not only affect and damage the gastric mucosa, but also affect the kidneys. Therefore, the high levels of urea and creatinine in the patient sample may be attributed to the cumulative effect of the use of these medications in addition to aging and comorbidities that may affect both the gastrointestinal and renal systems simultaneously. The results of Wang et al. 2023 study (which is consistent with the results of our current study) revealed that there are significant differences in renal function and other studied variables in relation to peptic ulcer and patients in the early stages of chronic renal failure [15].

In this study, the gastric wall was also analyzed histologically to determine the most prominent changes that may occur as a result of a gastric ulcer. This part of the study was based on the review and analysis of 100 histological reports of biopsies taken from the gastric wall by a gastroenterologist through an endoscopic procedure. The results showed the presence of inflammation in 93% of the studied samples, indicating a high incidence of inflammation among patients with gastric ulcers. The severity of inflammation varied between cases and was histologically classified as follows:

- Active chronic inflammation was present in 59 per cent of samples and is the most severe form of inflammation.

-Mild inflammation was recorded in 23 per cent of samples, indicating a relatively limited inflammatory response.

-minimal inflammation was found in only 2% of the samples, indicating a relatively limited inflammatory response.

-Paucity of inflammation was observed in 9% of the samples, indicating ulcerative changes and limited inflammation.

These results reflect the prevalence of inflammatory changes in the gastric wall in patients with ulcers and show that the severity of the immune response varies between patients.

The results also showed the presence of H. pylori infection in many patients with gastric ulcers, which reached 66% of the total studied samples, confirming that it is one of the most common causes of gastric ulcers. This study also confirms what Toktay and Selli

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

reported during their study in 2022, where their study showed that 60% of gastric ulcers are caused by this bacterium [16].

Inflammation and abscesses in the gastric pits were found in 9% of cases.

The results are better summarized in the table below:

Table 3: Result of histological examination of the gastric wall.

Result	Percentage
Active chronic inflammation	**59%**
Mild inflammation	**23%**
Minimal inflammation	**2%**
Paucity of inflammation	**9%**
H.pylori	**66%**
Pititis and pit abscess	**9%**

This large proportion of lesions indicates the prevalence of the inflammatory condition in affected patients. Inflammation in the gastric wall occurs as a result of an imbalance between factors present in the stomach such as pepsin enzyme and gastric acid (HCL) and defense factors such as mucus secretion, prostaglandins and blood perfusion to the mucous membrane, where gastric acid causes degradation of epithelial cell membranes and leads to the release of inflammatory factors such as histamine and prostaglandins. the histological examination results of the present study are consistent with Toktay & Selli, 2022), confirming the presence of inflammation in almost all patient .[16]

The results of the study and statistical analysis showed the presence of Helicobacter pylori in 66% of the studied samples, which confirms that it is one of the main causes of gastric ulcers, as these bacteria secrete enzymes and toxins that damage the epithelial cells in the stomach wall and increase the secretion of inflammatory cytokines such as (IL-1ß) and (TNF- α), which leads to the activation of the inflammatory response in the gastric mucosa. This activates the inflammatory response in the gastric mucosa, which leads to the recruitment of immune cells such as neutrophils and lymphocytes to the site of infection, causing acute and chronic inflammation in the gastric wall. This inflammation may be accompanied by other histological changes including edema, lymphocyte proliferation and epithelial erosion [17].

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

The results of our current study agree with the results of (Toktay & Selli, 2022), which confirms that 80% of duodenal ulcers are caused by H. pylori and 60% of gastric ulcers are associated with H.pylori[16] .

The results of the current study also showed the presence of inflammation in the gastric pits in 9% of the studied samples, where the presence of this inflammation indicates the presence of inflammatory infiltration within the gastric pits, which form the upper part of the gastric glands in the mucous membrane, and this pattern of inflammation is a characteristic sign in active gastritis It is characterized histologically by the presence of acute inflammatory cells, especially neutrophils, within the epithelial pits, reflecting an effective inflammatory response against bacterial antigens. Histological sections of samples of patients with gastric ulcers were made and examined under a microscope, and the results are shown in the Figures below:

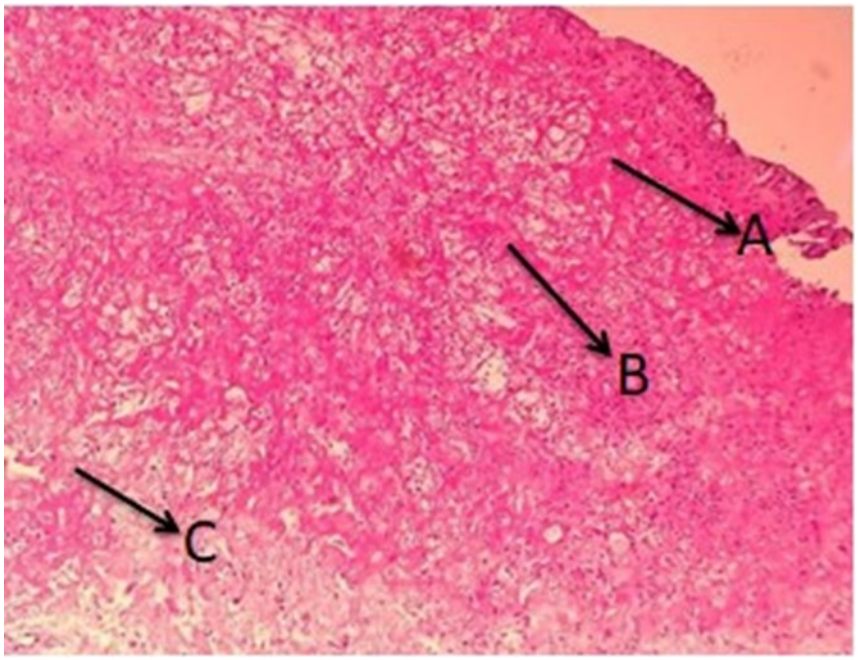

Figure 1: A section of the gastric walls of a person with gastric ulcer: Gastric wall mucosa erosion (A), healing granulation tissue (B), inflammatory cell infiltration (C), H&E staining, X400.

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

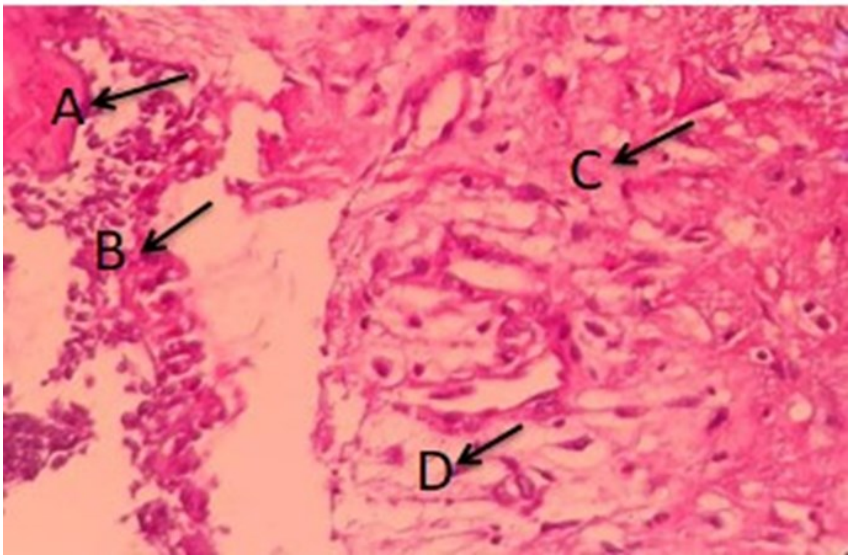

Figure 2: A section of the gastric wall of a patient with a gastric ulcer: Hemorrhage and red blood cell clumping (A), disorganized connective tissue in the healing phase (B), fibrosis (C), necrosis in several areas of the tissue (D), H&E staining, X400.

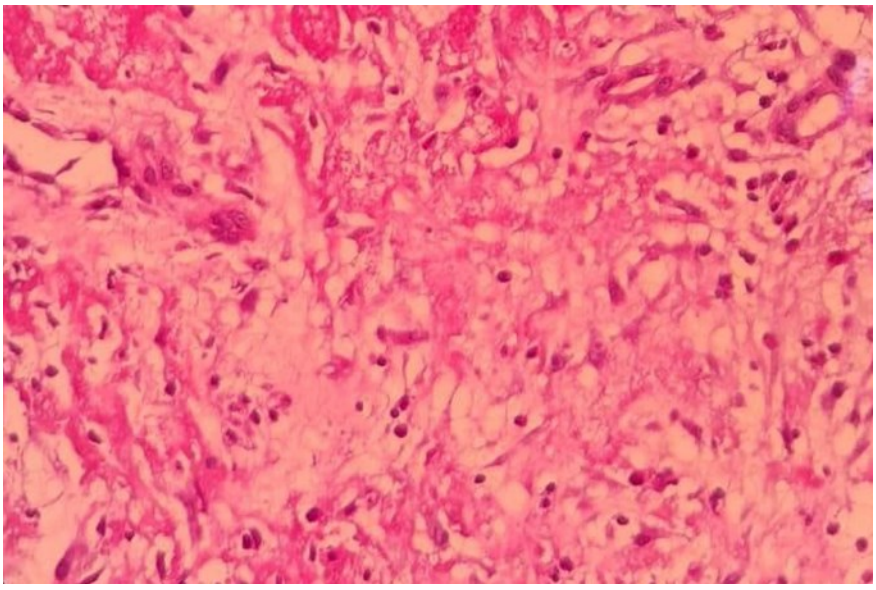

Figure 3: A section of the gastric walls of a person with gastric ulcer: Shows the predominance of scar tissue throughout the tissue, H&E stain, X400.

The results of the histological examination showed necrosis and erosion in the mucosal layer of the gastric wall and the tissue appears fibrotic as a result of the inflammatory

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

response, while the granulation tissue appeared to be in the process of healing, in addition to the infiltration of several areas of the tissue with inflammatory cells, as in Figure (1), while Figure (2) of the stomach of a patient with ulcer shows severe necrosis, bleeding and erosion in large areas of gastric tissue and loss of the cellular pattern of the intestinal tissue structure that indicates the decay of the stomach lining, and the tissue appeared fibrotic as a result of an irregular regeneration process, in addition to the loss of the cellular pattern of the tissue of the intestinal tissue structure indicating the decay of the gastric lining and the appearance of the tissue The results of the histological examination showed an activity in the formation of granulation tissue after necrosis and erosion of the normal layers of the stomach wall tissues, and the beginning of its transformation into scar tissue, which indicates the activity of fibroblast cells and their production of collagen fibers significantly in an attempt by the tissue to recover the organized cellular pattern and progress in the stages of healing, as in Figure (3).

Conclusion

The present study demonstrates that gastric ulcers are strongly associated with hematological alterations, particularly reduced hemoglobin and packed cell volume, as well as impaired kidney function reflected by elevated urea and creatinine levels. Histological analysis further confirmed a high prevalence of chronic inflammation and Helicobacter pylori infection, underscoring their role as primary pathogenic factors in ulcer development and progression. These findings highlight the clinical importance of monitoring both hematological and renal parameters in patients with gastric ulcers to prevent long-term complications. The implications of this research emphasize the need for integrated management strategies that address not only gastric pathology but also systemic effects, particularly renal impairment. Future studies should expand to larger and more diverse populations, employ longitudinal designs to clarify causal relationships, and explore molecular mechanisms linking gastric mucosal damage to systemic alterations, thereby contributing to improved preventive and therapeutic approaches.

Recommendations

Patients with ulcers are advised to be careful with their diet by eating small and frequent meals during the day, and avoid eating foods that irritate the stomach such as spicy foods, alcohol, and spices as they may further irritate the stomach mucosa and worsen the symptoms.

Regular check-ups including blood tests, kidney function and gastric bacterial tests should be carried out to monitor the condition.

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

Also, all individuals should avoid stress, as it plays an important role in the development of stomach ulcers, as well as caution when taking painkillers, especially non-steroidal anti-inflammatory drugs (NSAIDs), as they are one of the main causes of gastric ulcers.

References

[1] H. Gong, N. Zhao, C. Zhu, L. Luo, and S. Liu, "Treatment of gastric ulcer, traditional Chinese medicine may be a better choice," J. Ethnopharmacol., vol. 324, p. 117793, 2024, doi: 10.1016/j.jep.2024.117793.

[2] A. H. Khan, M. A. Dar, and M. A. Mir, "Gastric ulcer: an overview," Int. J. Curr. Res. Physiol. Pharmacol., vol. 7, no. 1, pp. 1–7, 2023. [Online]. Available: http://ijcrpp.com

[3] A. Barchi, C. Miraglia, A. Violi, G. Cambiè, A. Nouvenne, M. Capasso, G. Leandro, T. Meschi, G. L. De' Angelis, and F. Di Mario, "A non-invasive method for the diagnosis of upper GI diseases," Acta Biomed., vol. 89, no. 8-S, pp. 40–43, 2018.

[4] J. K. Y. Hooi, W. Y. Lai, W. K. Ng, M. M. Y. Suen, F. E. Underwood, D. Tanyingoh, P. Malfertheiner, D. Y. Graham, V. W. S. Wong, J. C. Y. Wu, F. K. L. Chan, J. J. Y. Sung, G. G. Kaplan, and S. C. Ng, "Global prevalence of Helicobacter pylori infection: Systematic review and meta-analysis," Gastroenterology, vol. 153, no. 2, pp. 420–429, 2017.

[5] A. Ceylan, E. Kirimi, O. Tuncer, K. Türkdoğan, S. Ariyuca, and N. Ceylan, "Prevalence of Helicobacter pylori in children and their family members in a district in Turkey," J. Health Popul. Nutr., vol. 25, no. 4, pp. 422–427, 2007.

[6] S. Scida, M. Russo, C. Miraglia, G. Leandro, L. Franzoni, T. Meschi, G. L. De' Angelis, and F. Di Mario, "Relationship between Helicobacter pylori infection and GERD," Acta Biomed., vol. 89, no. 8-S, pp. 40–43, 2018.

[7] M. Aburaya, K. Tanaka, T. Hoshino, S. Tsutsumi, K. Suzuki, M. Makise, R. Akagi, and T. Mizushima, "Heme oxygenase-1 protects gastric mucosal cells against nonsteroidal anti-inflammatory drugs," J. Biol. Chem., vol. 281, pp. 33422–33432, 2006.

[8] M. B. Eswaran, S. Surendran, M. Vijayakumar, S. K. Ojha, A. K. Rawat, and C. Rao, "Gastroprotective activity of Cinnamomum tamala leaves on experimental gastric ulcers in rats," J. Ethnopharmacol., vol. 128, pp. 537–540, 2010.

[9] P. Sipponen and H. I. Maaroos, "Chronic gastritis," Scand. J. Gastroenterol., vol. 50, no. 6, pp. 657–667, 2015.

ISSN 3063-8186. Published by Universitas Muhammadiyah Sidoarjo
https://doi.org/10.21070/ijhsm.v2i2.250

[10] P. Malfertheiner, J. Dent, L. Zeijlon, P. Sipponen, S. J. Veldhuyzen Van Zanten, C. F. Burman, T. Lind, M. Wrangstadh, E. Bayerdörffer, and J. Lonovics, "Impact of Helicobacter pylori eradication on heartburn in patients with gastric or duodenal ulcer disease—Results from a randomized trial programme," Aliment. Pharmacol. Ther., vol. 16, no. 8, pp. 1431–1442, 2002.

[11] J. P. Gisbert and J. M. Pajares, "Helicobacter pylori infection and perforated peptic ulcer: Prevalence of the infection and role of antimicrobial treatment," Helicobacter, vol. 8, no. 3, pp. 159–167, 2003.

[12] L. Agréus, N. J. Talley, and M. Jones, "Value of the 'test & treat' strategy for uninvestigated dyspepsia at low prevalence rates of Helicobacter pylori in the population," Helicobacter, vol. 21, no. 3, pp. 186–191, 2016.

[13] T. J. Cleophas and A. H. Zwinderman, SPSS for Starters and 2nd Levelers, 20th ed. Cham, Switzerland: Springer, 2016, p. 375.

[14] J. Jiao and L. Zhang, "Liver involvement by perforated peptic ulcer: A systematic review," J. Clin. Transl. Pathol., vol. 1, no. 1, pp. 2–8, 2021, doi: 10.14218/jctp.2021.00007.

[15] X. Wang, Z. Wright, J. Wang, W. M. Frandah, and G. Song, "Chronic kidney disease linked to higher incidence of gastric diseases," Gastrointest. Disord., vol. 5, no. 3, pp. 329–339, 2023, doi: 10.3390/gidisord5030027.

[16] E. Toktay and J. Selli, "Histopathological overview of experimental ulcer models," Eurasian J. Med., vol. 54, Suppl. 1, pp. S120–S126, 2022, doi: 10.5152/eurasianjmed.2022.22312.

[17] J. G. Kusters, A. H. M. van Vliet, and E. J. Kuipers, "Pathogenesis of Helicobacter pylori infection," Clin. Microbiol. Rev., vol. 19, no. 3, pp. 449–490, 2006, doi: 10.1128/CMR.00054-05.