

# Epidemiological Study of Helicobacter Pylori among Patients Gastroenteritis in Diyala Province – Iraq

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**Abstract:** Infection with Helicobacter pylori bacteria is the most common causes of gastritis and peptic ulcer disease worldwide. This infection is a very common condition that increases with age. this study objective reveal the rates of infection with Helicobacter Pylori in the community of the city of Baquba and of both sexes ,understanding social and demographic factors as well as certain chronic disease, and their role in Helicobacter Poylari .The study was conducted in Diyala Province for the Period from 1 July 2025 to 30 April 2026. 236 stool sample were collected from people suffering from gastritis from the laboratory of Baquba Teaching Hospital and other private laboratories in the city of Baquba. 118 (50 %) male samples 118 (50 %) female samples, ages ranging from 19 to 50 years. Immunochromatographic Assay (ICA) technique was used for direct detection of Helicobacter Pylori antigens, using the kit (H. Pylori Ag Rapid test Cassette. cerTest. BioTEC). Analysis was done using the statistical package for social science version (27) and p value was considered significant whenever it less than (0.05).The study found that the total positivity rate of H. pylori was 122 (51.70 %) they were 55 (46.62 %) males and 67 (56.77 %) females. The study concluded that the rates of infection with H. pylor were high and that there was a significant difference in the rates of infection between males and females.

**Keywords:** Helicobacter Pylori, Epidemiology, Gastroenteritis, Immunochromatographic Assay

## Introduction

Helicobacter pylori is a Gram-negative, spiral, multiflagellated (5-7flagella) bacterium that loves little aeration. It colonizes the mucous layer above the gastric epithelial cells in humans[1]. It is a bacteria A common disease in human, it is considered one of the main factors causing infections diseases such as gastritis and peptic ulcers[2], and it is also described as one of the dangerous factors causing stomach cancer[3]. It is also strongly associated with the development of gastric lymphoma, Mucosa Associated Lymphoid Tissue Lymphoma (MALToma) [4]. The World Health Organization classifies it as a class 1 carcinogen based on the results of epidemiological studies. Eradication of H. pylori infection leads to a reduction in ulcer recurrence. and a reduction in the risk of developing stomach cancer among patients[5-6]. The methods of transmission from one person to another are either the oral-oral mode, which is the most common mode in developed countries due to crowding that has led to a decline in living conditions and the spread of unhealthy habits[7], or the faecal-oral mode, which is the most common mode in developing countries due to poor Cleanliness and lack of

good awareness, the health status of the family plays a major role in this infection [8-9]. these bacteria possess many virulence factors that it is responsible for the pathogenicity of bacteria, and one of these is the gene Associated with cell toxicity (antigen *cagA*), is it the most dangerous factors that is responsible for the development of stomach cancers and the gone that forms vesicles (vacuolating cytotoxin gene *vacA*), it is the worker responsible for the formation of vesicles in epithelial cells, it causes the destruction of epithelial cells and is therefore the factor responsible for the occurrence of Stomach ulcers. Another factor is the promoting duodenal ulcer gene (Duodenal ulcer promoting gone *dupA*), the enzyme urease, which is responsible for neutralizing acidity in the stomach cavity, and the flagella, which are responsible for movement [10-11]. thus, bacteria *H. Pylori* is the main causes of gastritis, stomach and duodenal ulcers, and is associated with causes of Gastric lymphoma, *H. Pylori* is the second most common causes of chronic bacteria infections in humans, Half of the worlds population is infected with the bacteria [12]. Different actual infection rates from country to country.

Be this the differences are noticeable between developed countries. in various developing countries, the rates of infection with *H. Pylori* bacteria are more than 80% even at young ages [13], while the prevalence of *Helicobacter pylori* infection in developed countries in general remains less than 40% and is lower to it occurs to a large extent in children, exhausted adults, and the elderly [14]. As the prevalence of infection among children in developed countries is not currently common, but the infection rate increases with age. About 50% of infection appear at the age of 60 years and 10% of infection appear at the age of 18-30 years[15]. this increase in infection results with advancing age due to the possibility that the *H-Pylori* bacteria were acquired at this age. Immunity also decreases with age, which increases the risk of the body being exposed to infection with pathogen [16]. Bacterial infection occurs *H-pylori* in developing countries increases significantly in the first five years of life and remains constant for the subsequent period of life, this gives the idea that the bacteria are acquired at an early age in childhood, while the prevalence of infection in developed countries is low in early childhood and increases with age [17]. in China, a survey of *H-pylori* infection was carried out on a sample of the general population from areas with high incidence of gastric cancer. A total of 5417 healthy individuals aged between 30 and 69 years. the prevalence of *H-Pylori* infection was 63%[18]. in America, the rate infection with *H-pylori* was 37.9% [19].

## Materials and Method

### Study Design

This study was conducted in Diyala city, for the period from 1 July 2025 to 30 April 2026 . A total of 236 stool sample were collected from people suffering from gastritis from the laboratory of Baquba Teaching Hospital and other private laboratories in the city of Baquba. 118 (50%) male sample and 118 (50%) Female Samples. 118 samples of people residence in urban areas and 118 samples of people residence in rural areas ages ranging from 19 to 50 years. Immunochromatographic Assay (ICA) technique was used for direct detection of *Helicobacter Pylori* antigens, using the kit (*H.Pylori* Ag Rapid test-Cassette. CerTest BioTEC).

### Test Procedure

Was taken from each patients A stool sample and it was placed in a sterile container. 100 grams of stool sample was taken and added to the collection tube containing. the diluent (Extraction Buffer) the tube was shaken to mix the sample well. Remove the tube cap, then placed 2 drops in the circular window, leave the test card at room temperature, and read the result after 15 minutes where the red color line appears in the rectangular windows the results is considered positive. while the red color line does not appear, the results is negative.

## Statistical Analysis

Analysis was done using the statistical packages social science version (27) and P value was considered significant whenever it less than (0.05). A questionnaire form was prepared that included information about age, gender, residence, social status and the presence or absence of chronic diseases.

## Ethical Considerations

The study received approval from the Ethics committee at Baguba Teaching Hospital, affiliated with the General Directorate of Health in Diyala. Approval was obtained before starting to collect sample from patients suffering from gastroenteritis after informing them of the study's objectives and the questionnaire form. Participation was voluntary and the privacy of the participants was maintained.

## Results

As shown in Table (1), in 236 Stool sample, there were 122(51.70%) positivity cases, the positivity rate in males was 55(46.62%) while the rate in Females was 67(56.77%). Although the positivity rate was higher among females, there is statistically not significant difference between males and females.

**Table 1.** Association of H-pylori antigen and gender

| Gender | Test No (%)  |              | Total     | P value |
|--------|--------------|--------------|-----------|---------|
|        | Positive (%) | Negative (%) |           |         |
| Male   | 55 (46.62%)  | 63(53.38%)   | 118(50%)  | P=0.071 |
| Female | 67(56.77%)   | 51(43.23%)   | 118(50%)  |         |
| Total  | 122(51.70%)  | 114(48.30%)  | 236(100%) |         |

Table (2) The results of the current study showed that the age group (41-50) Years is the most affected age group with H. pylori bacteria, as the percentage reached (60.71%). followed by the age group (31-40) years approximately (51.02%) the age group older than 50 years is approximately (50%), the group (20-30) Years is approximately (48%). and finally the age group is younger than 19 years, as the percentage reached (46.35%) statistical analysis showed that there was not significant difference between the age groups.

**Table 2.** Association of H. pylori antigen and age group

| Age groups<br>(years) | Test No (%)  |              | Total      | P value |
|-----------------------|--------------|--------------|------------|---------|
|                       | Positive (%) | Negative (%) |            |         |
| <19                   | 19(46.35%)   | 22(53.65%)   | 41(17.79%) | P=0.482 |
| 20 - 30               | 24(48%)      | 26(52%)      | 50(21.62%) |         |
| 31 - 40               | 25(51.02%)   | 24(48.98%)   | 49(20.76%) |         |
| 41 - 50               | 34(60.71%)   | 22(39.29%)   | 56(23.71%) |         |
| 50>                   | 20(50%)      | 20(50%)      | 40(16.94%) |         |
| Total                 | 122(51.70%)  | 114(48.30%)  | 236(100%)  |         |

The results of the current study showed that the rate of infection with *Helicobacter pylori* among individual who live in rural areas is higher than the rate of infection among people who live in urban areas The Percentage of infection was 68 (57.62%) and 54 (45.76%) respectively. statistical

showed that there was not significant difference between the H. pylori antigen and residency. Table (3).

**Table 3.** Association of H. pylori antigen and residency.

| Residency | Test No (%)  |              | Total     | P value |
|-----------|--------------|--------------|-----------|---------|
|           | Positive (%) | Negative (%) |           |         |
| Urban     | 54(45.76%)   | 64(54.24%)   | 118(50%)  | P=0.076 |
| Rural     | 68(57.62%)   | 50(42.38%)   | 118(50%)  |         |
| Total     | 122(51.70%)  | 114(48.30%)  | 236(100%) |         |

Table (4) the results obtained in the current study showed that there was not a significant difference ( $P=0.086$ ). between the rates of infection with *Helicobacter pylori* in Patients with a previous infection 70(57.37%) Compared with patients who did not have a previous infection 52(45.62%) statistical analysis showed that there was not significant difference between the *Helicobacter Pylori* antigen and previous infection.

**Table 4.** Association of H. Pylori antigen and previous infection

| Previous infection | Test No (%)  |              | Total       | P value |
|--------------------|--------------|--------------|-------------|---------|
|                    | Positive (%) | Negative (%) |             |         |
| Yes                | 70(57.37%)   | 52(42.63%)   | 122(51.70%) | P=0.086 |
| No                 | 52(45.62%)   | 62(54.38%)   | 114(48.30%) |         |
| Total              | 122(51.70%)  | 114(48.30%)  | 236(100%)   |         |

Table (5) The results of the current study showed that There was a significant difference between infection with *Helicobacter Pylori* and individuals with diabetes, as the infection rates was 88(75.21%) in individuals with diabetes, while the infection rate with *Helicobacter pylori* 34(28.57%) in individuals without diabetes. Statistical showed that there was significant difference between the *Helicobacter pylori* and diabetes.

**Table 5.** Association of H. Pylori antigen and diabetes.

| Diabetes | Test No (%)  |              | Total       | P value |
|----------|--------------|--------------|-------------|---------|
|          | Positive (%) | Negative (%) |             |         |
| Yes      | 88(75.21%)   | 29(24.79%)   | 117(49.57%) | P=0.018 |
| No       | 34(28.57%)   | 85(71.57)    | 119(50.43%) |         |
| Total    | 122(51.70%)  | 114(48.30%)  | 236(100%)   |         |

## Discussion

The results of the current study found that the total infection rate with *Helicobacter pylori* was 122(51.70%). The results of our study agree with many other studies such as, a study conducted in Basra, the infection rate was 54.5 [20]. in a study conducted in Erbil, the infection rate was 55.8 [21]. in Mosul, the infection rate was 61.32 [22]. in Turkiye, the infection rate was 55.8 [23].

The rate of infection with *Helicobacter pylori* in female 67(56.77%) and is non- significant higher in male patients 55(46.62). Compared with the results of other studies, the results of the current study consistent with many studies. A study conducted in Erbil among patients with gastritis. the infection rate for females was 57.8% while the infection rate for male was 42.2% [21]. another study

conducted in Sulaymanyah, the infection rate for females 64%, while the infection rate for males was 36%. [24]. A study conducted in Africa showed that the infection rate for females was 16.8% and for males 10.7% [25]. This may explain the difference between infection rates between females and male due to the difference in lifestyle, such as smoking, drinking alcohol, and hormonal differences, and it may be related Social reasons, as females are responsible for raising and cleaning children [26]. According to age, the current study found no significant difference between the rate of *Helicobacter pylori* infection and age groups ( $P=0.482$ ). the study found that the age group (40-50) years has the highest positivity rate (60.71%). the lowest percentage of positivity was in the age group (19) years. This results is consistent with the results of other previous studies. In a study conducted in Baghdad-Iraq, the positivity rate 20% for individual under 30 years of age. but the percentage increases to more than 50% after the age of 60 years [27]. Another study in Baghdad showed the highest infection rate in the age group (30-50) years at a rate of (41.27%). But it differs from the results of other studies. A study conducted in Mosul-Iraq had the highest infection rate in age group of 20-40 years, at rate of (44.33%) [22]. In another study in Baghdad, the highest rate of infection with *Helicobacter pylori* was in the age group of 11-16 years at a rate of 54.72 [28]. Differences between the results of the current study and other studies may be attributed to economic status, social status, inadequate sanitation, water supply, environment status and nutrition status. Regarding residence, our current study showed that the rate of infection with *Helicobacter pylori* was higher, but not significantly, ( $P=0.076$ ). among individual with gastritis who residents in rural areas (57.62%) compared to those who residents in urban areas (45.76%) These results are consistent with the results of other studies. in a study conducted in Erbil-Iraq the infection rate for individual who residents in rural areas was (42.5%). compared to (41%) for individual who residents in urban areas [29] in another study conducted in Southern Ethiopia, the infection rate was (71.2%) and (28.8%) among individual who residents in rural and urban areas respectively [30]. The results of the study disagree with a study conducted in Maysan as the infection rate among individual who residents in urban areas was (62.22%) while infection rate among individual who residents in rural areas was (37.78%) [31]. This difference between infection rates among individual who residents in rural areas and urban areas may be due to Poor water supply, poor sewage drainage, and the social habits of the population regarding previous infection, the current study showed that the rate of infection with *H. Pylori* was higher, but not significant, ( $P=0.086$ ) between individual who had a previous infection and individual who did not have a previous infection. The positivity rate was higher among Patients with a previous infection (57.37%) compared to those without a previous infection (45.62). the result of this study are this study are consistent with a study conducted in Erbil-Iraq where the infection rate for patients who had a previous infection was (78.5%) compared to (23.6%) for individual who did not have a previous infection [32] what explains this is that infection with this bacterium dose not give immunity in the future, and just as the infection occurred the first time, it can occur a second time, and the majority of those infected do not show any symptoms and this bacterium is easy to spread through fecal contamination in food and which it is easy to get injured again. regarding the relationship between diabetes and *Helicobacter Pylori* infection, the study showed a significant difference ( $p=0.018$ ) between infection individual who have diabetes and individual who are infection and do not have diabetes, the positivity rate was higher significant among patients who had diabetes (75.21) compared to those who did not have diabetes (28.57) results of the study are consistent with a study conducted Nigeria where the positivity rate for Individual infection with *Helicobacter pylori*, and who have diabetes was (35%) compared to (28%) who did not have diabetes [33], the explanation for these results is that diabetes causes a weakness in cellular and humoral immunity, which increases a person's sensitivity to infection with *H. pylori*, Diabetes also causes a reduction in intestinal motility

and acid secretion, which increases the rate of infection [34]. Likewise a change sugar metabolism may cause chemical changes to occur in the intestinal mucosal layer, which encourages the colonization of *H. Pylori*, finely the individual with diabetes are also more susceptible to infection with pathogens than healthy individual as a result of their continuous and Periodic presence in the hospital[35].

### Study Limitations

the study included severat limitations that must be considered when interpreting the results. First, the Sample was of medium size. Second, most of the Participants were residents of Baquba district and its affiliated village and the visted one hospital, which is Baquba Teaching Hospital - Third, the study Period was eight months and not a full year, and the examination was limited to stool Sample through the we of direct immunoassay. Nevertheless. The study is important and usful in providing preliminary data on Hipylori and the relationship between the diseases and a group of variables.

### Conclusion

The rate of positive infection with *H. pylori* was high among surveyed population in Diyala city, and the study showed that there was no significant difference between males and females, as well as people who residents in urban areas and people who residents in rural areas, the study also showed that the age group(41-50) is positive, as the study showed a significant different in positivity rates between people with diabetes compared to those without.

### REFERENCES

- [1] L. Hong and S. D. Xiao, "New ideas for future studies of *Helicobacter pylori*," J. Dig. Dis., vol. 15, pp. 1–4, 2014.
- [2] E. A. Kalaf, "Molecular Study for Detection of CagA Genotype of *Helicobacter pylori* from Endoscopic Biopsies of Iraqi Patients," M.S. thesis, Univ. of Baghdad, Baghdad, Iraq, 2013.
- [3] S. F. Ali, "Detection of *Helicobacter pylori* in saliva from some Iraqi patients in comparison with other methods," M.S. thesis, Univ. of Baghdad, Baghdad, Iraq, 2013.
- [4] A. Kumar and I. Khan, "Detection of *Helicobacter pylori* in gastroduodenal diseases by real-time PCR," pp. 170–178, 2010.
- [5] V. Zsikla, S. Hailemariam, and M. Baumann, "Increased rate of *Helicobacter pylori* infection detected by PCR in biopsies with chronic gastritis," Am. J. Surg. Pathol., vol. 30, no. 2, pp. 242–248, 2006.
- [6] P. E. Arkkila, K. Seppälä, T. U. Kosunen, P. Sipponen, J. Mäkinen, H. Rautelin, and M. Färkkilä, "Helicobacter pylori eradication as the sole treatment for gastric and duodenal ulcers," Eur. J. Gastroenterol. Hepatol., vol. 17, pp. 93–101, 2005.
- [7] B. C. Wong, S. K. Lam, W. M. Wong, J. S. Chen, T. T. Zheng, R. E. Feng, K. C. Lai, W. H. Hu, S. T. Yuen, S. Y. Leung, D. Y. Fong, J. Ho, C. K. Ching, and J. S. Chen, "Helicobacter pylori eradication to prevent gastric cancer in a high-risk region of China: A randomized controlled trial," JAMA, vol. 291, pp. 187–194, 2004.
- [8] B. C. Wong, L. Zhang, J. L. Ma, K. F. Pan, J. Y. Li, L. Shen, W. D. Liu, G. S. Feng, X. D. Zhang, J. Li, A. P. Lu, H. H. Xia, S. Lam, and W. C. You, "Effects of selective COX-2 inhibitor and *Helicobacter pylori* eradication on precancerous gastric lesions," Gut, vol. 61, pp. 812–818, 2012.
- [9] L. M. Brown, "Helicobacter pylori: Epidemiology and routes of transmission," Epidemiol. Rev., vol. 22, pp. 238–297, 2000.
- [10] W. A. Bakir, "Immunological and Molecular Studies on Gastroduodenal Diseases Caused by *Helicobacter pylori*," Ph.D. dissertation, Univ. of Anbar, Ramadi, Iraq, 2007.

- [11] S. Suerbaum and P. Michetti, "Helicobacter pylori infection," *N. Engl. J. Med.*, vol. 347, pp. 1175–1186, 2002.
- [12] L. Boyanova, *Helicobacter pylori*. Norfolk, U.K.: Caister Academic Press, 2011. ISBN: 978-1-904455-84-4.
- [13] K. Fock and T. Leong Ang, "Epidemiology of Helicobacter pylori infection and gastric cancer in Asia," *Gastroenterol. Hepatol.*, vol. 25, pp. 479–486, 2010.
- [14] J. Atherton, "The pathogenesis of Helicobacter pylori-induced gastroduodenal diseases," *Annu. Rev. Pathol. Mech. Dis.*, vol. 1, pp. 63–96, 2006.
- [15] M. Konno, S. Fujii, K. Yokota, E. Takahashi, and T. Sugiyama, "Five-year follow-up study of mother-to-child transmission of Helicobacter pylori infection detected by a random amplified polymorphic DNA fingerprinting method," *J. Clin. Microbiol.*, vol. 43, pp. 2246–2250, 2005.
- [16] J. Kusters, A. van Vliet, and E. Kuipers, "Pathogenesis of Helicobacter pylori infection," *Clin. Microbiol. Rev.*, vol. 19, pp. 449–490, 2006.
- [17] Y. Yamaoka, "Helicobacter pylori typing as a tool for tracking human migration," *Clin. Microbiol. Infect.*, vol. 15, pp. 829–834, 2009.
- [18] Y. Zhu, X. Zhou, J. Wu, J. Su, and G. Zhang, "Risk factors and prevalence of Helicobacter pylori infection in persistent high incidence area of gastric carcinoma in Yangzhong city," *Gastroenterol. Res. Pract.*, vol. 2014, Art. no. 481365, 2014.
- [19] C. Porras, J. Nodora, R. Sexton, et al., "Epidemiology of Helicobacter pylori infection in six Latin American countries (SWOG Trial S0701)," *Cancer Causes Control*, vol. 24, no. 2, pp. 209–215, 2013.
- [20] A. N. Amer, J. G. Hassan, and I. E. Al-Saimary, "Is Helicobacter pylori infection in immunocompromised children a risk factor for cancer?" *Med. J. Islamic World Acad. Sci.*, vol. 22, no. 1, pp. 36–41, 2014.
- [21] B. M. Hussen, S. S. Qader, H. F. Ahmed, and S. H. Ahmed, "The prevalence of Helicobacter pylori among university students in Iraq," *Indian J. Sci. Technol.*, vol. 6, no. 8, pp. 5019–5023, 2013.
- [22] A. J. Ali, "Prevalence of Helicobacter pylori infection in patients complaining of epigastric pain and dyspepsia, Mosul, Iraq," *Sci. J. Med. Res.*, vol. 2, no. 8, pp. 187–188, 2018.
- [23] A. M. Alsamarai, F. Thegeal, and A. H. A. Alobaidi, "Frequency of biomarkers positivity in Iraqi subjects with gastritis," *Sci. Int.*, vol. 5, no. 2, pp. 68–83, 2017.
- [24] M. O. Mohammed, H. H. Bayz, and F. B. Maarouf, "Clinical, endoscopic and urea breath test among dyspeptic patients referred to Kurdistan Center for Gastroenterology and Hepatology in Sulaimani," *Kurd. J. Appl. Res.*, vol. 2, no. 2, pp. 89–95, 2017.
- [25] Y. A. Awuku, D. L. Simpong, I. K. Alhassan, D. A. Tuoyire, T. Afaa, and P. Adu, "Prevalence of Helicobacter pylori infection among children living in a rural setting in Sub-Saharan Africa," *BMC Public Health*, vol. 17, no. 1, pp. 360–365, 2017.
- [26] Y. N. Haggag, H. A. Samaha, M. A. Nossair, and S. A. Al-Aswally, "Epidemiological studies on Helicobacter pylori in some animals and humans," *Alex. J. Vet. Sci.*, vol. 51, no. 2, pp. 275–281, 2016.
- [27] S. S. Al-Jubori, I. M. S. Al-Kademy, M. R. Ali, and A. S. M. Ali, "Helicobacter pylori among Iraqi patients with suspected gastric ulcer: Histopathological study for gastric mucosal biopsies," vol. 10, no. 7, pp. 224–230, 2016.
- [28] W. F. Tawfeeq, M. F. Ibraheem, and Z. G. Kadhem, "Clinico-epidemiological study of peptic ulcer disease among children in three tertiary health care centres in Baghdad," *Iraqi J. Med. Sci.*, vol. 11, no. 4, pp. 381–387, 2013.
- [29] H. Jaka, M. F. Mushi, M. M. Mirambo, L. Wilson, J. Seni, M. Mtebe, and S. E. Mshana, "Sero-prevalence and associated factors of Helicobacter pylori infection among adult patients with dyspepsia attending the gastroenterology unit in a tertiary hospital in Mwanza, Tanzania," *Afr. Health Sci.*, vol. 16, no. 3, pp. 684–689, 2016.

- [30] E. Tadesse, D. Daka, D. Yemane, and S. Techalew, "Seroprevalence of *Helicobacter pylori* infection and its related risk factors in symptomatic patients in southern Ethiopia," *BMC Res. Notes*, vol. 7, Art. no. 83, 2014. doi: 10.1186/1756-0500-7-83.
- [31] R. A. H. Alhashimi, R. K. A. Alsaad, H. S. Q. Alhilfi, and S. M. J. Althaalibi, "Helicobacter pylori infection, epidemiology, endoscopic findings and associated socio-demographic factors in uninvestigated dyspepsia in the people of Misan, Iraq," *J. Gastrointest. Disord. Liver Funct.*, vol. 3, no. 2, pp. 109–113, 2017.
- [32] M. Pshtewan and J. Karim, "Seroprevalence of *Helicobacter pylori* infection among patients with gastroduodenal disorder in Erbil city," *Duhok Med. J.*, vol. 18, no. 1, pp. 91–101, 2020.
- [33] A. Oluyemi, E. Anomneze, S. Smith, and O. Fasanmade, "Prevalence of a marker of active *Helicobacter pylori* infection among patients with type 2 diabetes mellitus in Lagos, Nigeria," *BMC Res. Notes*, vol. 5, Art. no. 284, 2012.
- [34] C. Y. Jeon, M. N. Haan, C. Cheng, E. R. Clayton, E. R. Mayeda, J. W. Miller, and A. E. Aiello, "Helicobacter pylori infection is associated with an increased rate of diabetes," *Diabetes Care*, vol. 35, pp. 520–525, 2012.
- [35] Y. Kayar, H. Eroğlu, K. K. Erol, A. İlhan, and O. Kocaman, "Relationship between *Helicobacter pylori* infections in diabetic patients and inflammations, metabolic syndrome, and complications," *Int. J. Chronic Dis.*, vol. 2015, Art. ID 290128, 2015. doi: 10.1155/2015/290128.