Research Article

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INCIDENCE AND KEY HISTOLOGICAL FINDINGS OF HELICOBACTER PYLORI INFECTION AMONG JORDANIAN CHILDREN

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ABSTRACT
Background: Helicobacter pylori (H. pylori) infection is a common condition worldwide, with higher prevalence in developing countries. In children, it is associated with both gastrointestinal and extra-gastric complications, yet data on its prevalence and histopathological impact in Jordanian pediatric populations are limited. **Objective:** This study aimed to assess the prevalence of H. pylori infection among symptomatic pediatric patients in Jordan, evaluate histopathological findings in gastric biopsies, investigate associations between demographic factors and infection severity, and determine the diagnostic accuracy of stool analysis. **Methods:** A retrospective study was conducted at Queen Rania AlAbdullah Hospital for Children, including 172 symptomatic patients. Data on age, sex, stool analysis for H. pylori, and gastric biopsy histopathology were collected. Statistical analyses included logistic regression to assess associations and evaluate diagnostic model performance. **Results:** The prevalence of H. pylori infection was 46%, with no significant differences in age, sex, or histopathological findings between infected and non-infected patients. Severe chronic gastritis was observed exclusively in H. pylori-positive patients. Logistic regression revealed no significant association between demographic variables and infection severity but showed high model accuracy (77%) and sensitivity (100%), albeit low specificity. **Conclusion:** H. pylori infection is prevalent among symptomatic Jordanian children, with histopathological severity not significantly associated with demographic factors. Non- invasive stool testing demonstrated limitations due to high false-positive rates. Improved diagnostic models incorporating additional biomarkers are recommended for accurate identification.

KEYWORDS: Helicobacter pylori, pediatric gastritis, Jordan, stool analysis, histopathology, diagnostic accuracy.

INTRODUCTION
Helicobacter pylori (H. pylori) infection is one of the most widespread human infections globally, affecting around 50% of the world's population, and humans serving as the primary reservoir.[1] In developing countries, H. pylori infection typically begins in early childhood, affecting 30%-50% of children, and rises to over 90% by adulthood. This high prevalence is largely attributed to poor socioeconomic conditions and overcrowding.[2,3]

H. pylori infection primarily affects the gastric mucosa and is associated with a range of gastrointestinal disorders, including chronic gastritis, peptic ulcers, and, in some cases, gastric carcinoma.[4] Although H. pylori infection is prevalent worldwide, its impact is particularly significant in developing countries, where it affects a large proportion of the pediatric population. In children, the infection may persist into adulthood if left untreated, leading to potential long-term health complications.[5,6] In addition to its gastrointestinal effects, H. pylori has been linked to various extra-gastric manifestations, including iron deficiency anemia and growth retardation, making its early diagnosis and treatment crucial.[7]

The histopathological findings in children with H. pylori infection typically include chronic gastritis, which can range from mild to severe, and the presence of inflammatory infiltrates in the gastric mucosa.[8] While several studies have investigated the prevalence of H. pylori infection in pediatric populations, there is limited data on its incidence and the associated histological changes in Jordanian children.[9] Furthermore, the relationship between demographic factors, such as age and sex, and the severity of gastric changes remains unclear in the local context.

Therefore, in this study we aim to assess the prevalence of H. pylori infection among symptomatic pediatric patients in Jordan and examine the histopathological findings in gastric biopsies focusing on the severity of chronic gastritis. In addition, we aim to investigate the potential associations between demographic factors such age and sex and the presence and severity of H. pylori infection and related histopathological changes. Furthermore, we aim to evaluate the diagnostic accuracy of non-invasive stool analysis in predicting H. pylori infection in pediatric patients.

METHODS
Study design: We carried out a retrospective, single-center observational study conducted at Queen Rania AlAbdullah Hospital for Children, King Hussein Medical Center, Jordan, during the period of January to December 2023 to assess the prevalence of Helicobacter pylori (H. pylori) infection in symptomatic Jordanian children and examine the histopathological impact of the infection on gastric mucosa. Ethical approval for the study was obtained from the relevant institutional review board (IRB).

Data collection: Data were retrospectively collected from patient records. Demographic information such as age and sex was retrieved for all included patients. Additionally, clinical data including stool analysis results for H. pylori infection and histopathological findings were gathered. Stool samples were analyzed for H. pylori infection using appropriate diagnostic methods. Histopathological examination of gastric biopsies was performed to assess the presence and severity of gastritis, classified as mild, moderate, or severe chronic gastritis.

Statistical analysis: Categorical data, such as sex and histopathological findings, were described using frequencies and percentages. Continuous data, including age, were summarized using medians and interquartile ranges due to the non-normal distribution of the data. Differences between groups (H. pylori positive vs. negative) in terms of demographic characteristics and histopathological findings were analyzed using the Wilcoxon Rank Sum test for non-normally distributed data and the T-test for normally distributed data. A logistic regression model was employed to investigate the potential association of demographic variables (age, sex) and histopathological findings with the prevalence of H. pylori infection. The model's predictive performance was evaluated using accuracy, sensitivity, specificity, and the area under the curve (AUC). All statistical analyses were performed using R statistical software, and a p-value of <0.05 was considered statistically significant.

RESULTS
A total of 172 patients with a median age of 10.0 (7.0, 12.0) years were included, 94 (55%) of which were females (**Table 1**). Stool analysis showed positive H. pylori in 79 (46%) of patients, and histological analysis showed that 23 (52%) of patients had moderate chronic gastritis, 19 (43%) of patients had mild chronic gastritis and only 2 (4.5%) of patients had severe chronic gastritis.

When comparing between patients with positive and negative H. pylori infection, there was no significant difference in age (median: 10.0 [7.0, 12.0] vs. 10.0 [8.0, 12.0]), sex, or histopathological findings (p-values >0.05) as shown in **Table 2**. Patients with severe chronic gastritis had positive H. pylori status. Logistic regression model did not show any significant association between age, sex, or histopathological findings with H. pylori status (**Table 3**). The model predicted H. pylori status with high accuracy of 0.77 and AUC of 0.66. The model had high sensitivity of 100% but very low specificity (**Table 4**).

Table 1: Demographic and clinical characteristics of included patients.

Characteristic	N = 172
Age	10.0 (7.0, 12.0)
Sex	
Female	94 (55%)
Male	78 (45%)
H pylori	
Negative	93 (54%)
Positive	79 (46%)
Histopathology	
Mild chronic gastritis	19 (43%)
Moderate chronic gastritis	23 (52%)
Severe chronic gastritis	2 (4.5%)
Unknown	128

Table 2: Comparison of demographic and histopathology between patients with H. pylori infection.

Characteristic	Negative, N = 93	Positive, N = 79	p-value
Age	10.0 (7.0, 12.0)	10.0 (8.0, 12.0)	>0.9
Sex			0.5

Female	53 (57%)	41 (52%)	
Male	40 (43%)	38 (48%)	
Histopathology			0.6
Mild chronic gastritis	6 (60%)	13 (38%)	
Moderate chronic gastritis	4 (40%)	19 (56%)	
Severe chronic gastritis	0 (0%)	2 (5.9%)	
Unknown	83	45	

Table 3: Logistic regression model for prediction of H. pylori infection.

Predictor	Odds ratio	95% CI		P- value
		Lower	Upper	
Age	1.05	0.87	1.26	0.610
Sex				
Male ─ Female	0.69	0.15	3.13	0.634
Histopathology				
Moderate chronic gastritis ─ Mild chronic gastritis	2.37	0.53	10.54	0.257
Severe chronic gastritis ─ Mild chronic gastritis	0.00	0.00	0.00	0.995

Table 4: Prediction accuracy of logistic regression model.

Measure	Value
Accuracy	0.773
AUC	0.659
Sensitivity	1.00
Specificity	0.00

DISCUSSION

Our findings showed a high prevalence (46%) of H. pylori infection among 172 pediatric patients, with no significant differences in age, sex, or histopathological findings between infected and non-infected groups. The epidemiology of H. pylori varies between countries, with higher prevalence rates in developing countries such as Africa and South America occurring in children less than five years of age.[10,11] The higher prevalence of H. pylori infection in developing countries if often attributed to the low socioeconomic status and population density as shown in a study by Urita et al. in rural areas of Japan, that H. pylori infection could be transmitted from mother to child or from grandmother to grandchildren, but not from grandfather to grandchildren while larger family size was not a risk factor for H. pylori infection.[12] Various factors have been reported to increase the risk of H. pylori infection and contribute to differences in its prevalence and include older age, poor hygiene, sharing a room or bed, consuming untreated water, and low socioeconomic status.[13,14]

Although severe chronic gastritis was only observed in H. pylori-positive patients, the overall association between infection status and histopathological severity was not statistically significant. Several studies have shown that the most common endoscopic findings with H. pylori infection is chronic gastritis, and a study by Cardos et al. showed that in H. pylori infection, chronic gastritis was the cause in 83% of patients.[15] In Kirdy et al. study investigating the prevalence and histopathological features of H. pylori infection showed that the prevalence of H. pylori infection was 16.5% and 43% in children between 6-10 years of age, and 27.4% of patients With H. pylori infection had moderate gastritis compared to 2.4% of patients without H.pylori infection.[16]

The predictive findings of the logistic regression model demonstrated high accuracy (0.77) and sensitivity (100%) but suffered from low specificity, indicating a high rate of false positives. These findings suggest that while H. pylori screening is important due to its association with severe gastritis, relying solely on current non-invasive tests may lead to over-diagnosis. Future research should consider additional risk factors to improve the specificity of predictive models. In a study conducted by Seo et al. developed a scoring system using endoscopic features for the prediction of H. pylori infection showed that the validation set demonstrated excellent discrimination, with a C statistic of 0.951 indicating a strong agreement between predicted and observed event rates across risk deciles.[17]

Our study provides valuable insights into the prevalence of Helicobacter pylori infection and its histopathological impact in pediatric patients in Jordan. The retrospective, single-center design allows for the collection of detailed demographic and clinical data from a large sample size (172 patients). The use of both stool analysis and histopathological examination enhances the robustness of the findings, allowing for a comprehensive assessment of the infection's impact on gastric mucosa. The logistic regression model used to predict H. pylori infection demonstrated high sensitivity (100%) and accuracy (0.77), highlighting the potential utility of non-invasive diagnostic models in identifying H. pylori infection. Despite its strengths, our study has several limitations.

First, the retrospective design limits the ability to establish causality, and the single-center nature may reduce the generalizability of the findings to other populations or healthcare settings. Second, the lack of specificity in the logistic regression model suggests that false positives may have influenced the results, particularly since the model demonstrated very high sensitivity. Additionally, the histopathological analysis did not include more granular subtypes or further classification of gastritis, which could provide additional insights into the relationship between infection and gastric mucosa damage. Finally, our study did not include data on potential risk factors such as socioeconomic status, family history, and environmental factors, which could further explain variations in infection rates. Future larger, multi-center cohorts are needed to increase the generalizability of the findings. Additionally, prospective studies would allow for the establishment of causal relationships between H. pylori infection and gastritis severity. To enhance diagnostic accuracy, future research could explore the incorporation of additional biomarkers or diagnostic methods, such as endoscopic findings or serological tests, alongside stool analysis.

In conclusion, our findings revealed a high prevalence of H. pylori infection (46%) among symptomatic pediatric patients in Jordan, with no significant differences in age, sex, or histopathological findings between infected and non-infected groups. While severe chronic gastritis was only observed in H. pylori-positive patients, the association between infection status and gastritis severity was not statistically significant. The predictive model showed high sensitivity and accuracy, although its low specificity suggests the need for further refinement. These findings highlight the importance of H. pylori screening, particularly in regions with high infection rates, and suggest that non-invasive diagnostic methods may need improvement to reduce false positives. Future research should focus on expanding the sample size, exploring additional risk factors, and improving diagnostic techniques to better understand the full scope of H. pylori infection in pediatric populations.

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