RESEARCH PAPER

The Effect of H. Pylori Infection on Growth and Nutritional Status among Children

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Received: 28th Feb, 2026; Revised: 6th March 2026; Accepted: 7th April, 2026; Available Online: 20th April, 2026

ABSTRACT

Background: Helicobacter pylori infection is an acquired infection in children and most children test positive by adulthood in developing countries. Its effect on growth in children remains unclear and requires evaluation. Our aim is to determine the effect of Helicobacter pylori infection on growth parameters and nutritional status among children with gastrointestinal symptoms.

Subjects and Methods: This hospital-based study was conducted among 100 children younger than 18 years visiting the gastroenterology outpatient clinic at Raparin Pediatric Teaching Hospital. The study was conducted from May 1st 2024 to November 1st 2024. Children were recruited while visiting the outpatient clinic and presenting with signs and symptoms suspicious for H. pylori infection.

Results: Half of the participants showed positive stool results for H. pylori infection, while the other half showed negative results. The prevalence rate increased with age from six to eight years, then declined at nine years. Another decrease in proportion was detected at the age of fourteen years. The proportions of positive and negative test results were 50% each. The first predictor of H. pylori infection was family income, with an odds ratio of five-fold. Poor family income provided no protection against infection. Other factors, such as overcrowding and educational level increased the risk of infection.

Conclusion: The stool H. pylori test was an effective tool for detecting positive cases among children. The infection insignificantly affected height, weight, skinfold thickness, and mid-arm circumference. However, there was a significant reduction in hemoglobin concentration and iron levels in H. pylori-infected children.

Keywords: Children, Growth, Helicobacter Pylori, Infection

How to cite this article: Mustafa SA, Nooruldeen DA, Abdullah MK, Abdullah HK. The Effect of H. Pylori Infection on Growth and Nutritional Status among Children. Int J Drug Deliv Technol. 2026;16(38s): 715-719. DOI: 10.25258/ijddt.16.38s.73

Source of support: Nil.
Conflict of interest: None

INTRODUCTION

H. pylori is a gram-negative, microaerophilic bacterium isolated by Marshall and Warren in 1982 and classified as a class I carcinogen. It infects about 50% of the world's population. 1 Since the infection is acquired early in life, it has many implications. In early childhood, it causes malabsorption and growth retardation. (1) It is associated with hypochlorhydria, which impairs the metabolism and absorption of many micronutrients, thus increasing susceptibility to infections such as giardiasis, cholera, typhoidal and non-typhoidal salmonellosis, and many other microorganisms. This consequently may lead to malabsorption of certain nutrients, such as iron. (2 ,3)

The mechanism of growth failure in children with H. pylori infection remains unclear and requires further evaluation. It is not confirmed whether the cause of growth failure in infected children is a direct effect of H. pylori-induced gastritis or a result of indirect consequences of H. pylori infection, such as anorexia and infection-induced malabsorption. (4)

There are two main hormones produced in the stomach that are important for childhood growth, namely Ghrelin and Leptin. Ghrelin is a potent peptide that stimulates food intake and body weight gain. It is also one of the strongest stimulants of growth hormone and indirectly stimulates IGF-1 secretion. (5) Leptin reduces appetite and increases

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energy utilization. H. pylori infection suppresses circulating Ghrelin levels and increases Leptin levels, and through this mechanism it may affect childhood growth. (6)

METHODS

This cross-sectional, hospital-based study was conducted among children visiting the gastroenterology outpatient clinic at Raparen Pediatric Teaching Hospital from May 1st 2024 until November 1st 2024. Raparen is the only governmental pediatric hospital in Erbil city, Iraq located in north-eastern part of the city providing tertiary care to all referral cases. It has multiple departments including an outpatient clinic, an emergency department, a neonatal care unit, an intensive care unit and pediatric surgery department. The out-patient clinic is by far the busiest department of the hospital where around 500-600 patients are seen in a 24-hour period.

A total of 100 children were included in the study that were recruited while visiting the outpatient clinic and when presented with signs and symptoms raising suspicion for H. pylori infection including abdominal pain, repeated vomiting, epigastric pain… etc. The enrolled children were of school age and younger than eighteen years.

Inclusion Criteria

Children younger than eighteen years of age presenting with symptoms concerning of H. pylori infection, as abdominal pain, epigastric pain, repeated vomiting…etc.

Exclusion Criteria

A. Children with a history of antibiotic use within 4 weeks of presentation

B. Children with history of H2 Blocker or PPI use within 2 weeks of presentation.

C. Children with chronic diseases as Celiac disease and IBD.

D. Children with genetic disorders as Turner, Noonan, and Prader–Willi syndromes.

After thorough history taking and clinical examination, proper anthropometric measurements and nutritional assessment tools (mid-arm circumference and skinfold thickness) were used. Childhood socioeconomic status (SES) was calculated by the sum of parental education, parental occupation, and household income, with higher scores representing higher SES (range 0–5). Children SES was further classified as low, medium, or high based on the calculated score (Modified Kuppuswamy classification).Stool antigen test was used to diagnose active infections. It is an easy and quick test that is non-invasive and relaible.

Ethical approval was obtained from the ethical committee of the Arab Board for Medical Specialization. The investigator approached accompanying parents individually. The aim of the study was thoroughly explained and confidentiality was assured. Informed consent was collected from agreeing parents. There is conflict of interest or funding source to declare.

The data were entered into an Excel sheet and transferred to SPSS version 27. Descriptive and inferential statistical analyses were performed. The Chi-square test was used for categorical variables while t-test used to analyze the numerical variables. The Mann–Whitney U test was used as a non-parametric test. A p-value < 0.05 was considered statistically significant. Z-scores and percentile ranks were calculated for normally distributed numerical variables. Significant variables from univariate analysis were tested using multivariate logistic regression to identify predictors of outcomes.

RESULTS

A total of 104 school-aged children were screened for H. pylori infection. Four children were excluded due to lack of data and consent. Females constituted 51% while males constituted 49% of the subject. Median age was 10 years. Based on stool antigen test results, 50 children tested positive and 50 tested negative. The highest proportion of positive test results (58.3%) were reported in 8 years old children, followed by 55.6% in nine-year-old and 54.5% at ten-, twelve-, and thirteen-year-olds respectively.

Symptoms reported in both groups were: Epigastric discomfort (60% vs 30%), vomiting (52% vs 2%), abdominal pain (52% vs 4%), epigastric pain (32% vs 0%), poor appetite (16% vs 18%), hunger-like pain (50% vs 24%) and halitosis (4% vs 2%).

Most participants were from urban areas, while 32% of positive cases lived in rural areas. This difference was statistically significant ($p = 0.006$). An odds ratio of 1.17 predicted the risk of infection among rural and sub-rural inhabitants. More than half of those with a class II crowding index tested positive, while 48.4% tested negative (Table 1). One-third of class I tested positive, and two-thirds tested negative. This difference was statistically significant ($p = 0.039$). Approximately 70% of positive cases were from lower socio-economic class while the rest 30% were from higher socio-economic class. Less negative cases were reported in those with lower socioeconomic class as compared to the higher socioeconomic class (Figure 1).

In Table 2, the Mann–Whitney U test was used to evaluate the significance of selected variables by comparing medians between positive and negative groups. There was no significant association between weight, height, BMI, mid-upper arm circumference, or skinfold thickness. However lower levels of hemoglobin, vitamin D3, serum ferritin, and iron were observed among infected children compared to non-infected children, although the values remained within the normal range (Table 3).

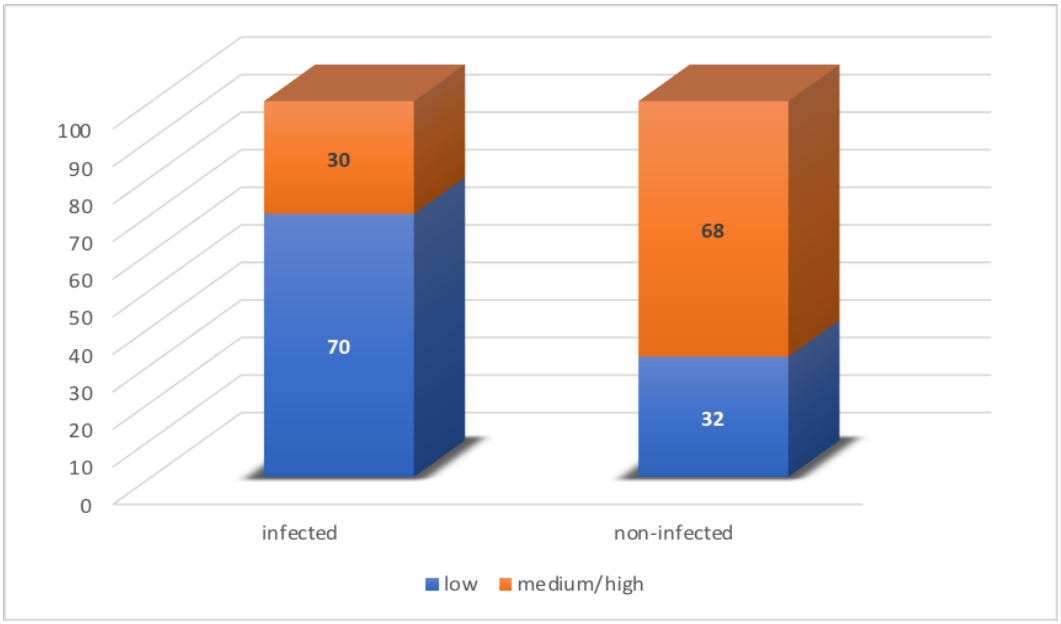

Figure 1: percentage (%) of low and medium/high socioeconomic status among infected and non-infected children.

Table 1: Sociodemographic characteristics of studied sample

Variable	Test Results		P value
	Positive n=50	Negative n=50	
Gender			0.8876
Female	51%	49%	
Male	49%	51%	
Age	10.18 ± 2.55	10.03±2.61	0.742
Residency			0.006
Urban	23(46)	36(72)	
Rural	16(32)	4(8)	
Suburban	11(22)	10(20)	
Crowding index			0.039
Class 1	3(33.3)	6(66.7)	
Class 2	47(51.6)	44(48.4)	

Table 2: The median difference in the characteristics of the studied sample by H. pylori test results.

Variables	Positive group Median (IQR)	Negative group Median (IQR)	Total Median (IQR)	P value
Height	142(125-155)	141.50(125.75-155.25)	142(125.25- 155)	0.725
Weight	32.5(24.5- 45.25)	35(25.75-45)	34(25.25-45)	0.603
BMI	17.80(15- 19.21))	17.30(16.07-19)	17.80(16.02- 19.07)	0.072
Mid-upper arm circumference	18(15.15- 19.62)	17(16.50-19)	18(16.50-19)	0.694
Skin fold	11.25(10- 12.62)	11.50(10.50-13)	12(10-13)	0.480
BMI for Age Z score (Median)	0.3	0.5	0.4	0.199
Height for Age Z score(Median)	-2.1	-2.4	-2.2	0.168

Table 3: The relation between H. Pylori test results and Hb, V. D, serum ferritin and Iron level.

Variable	Positive group Mean ±Sd	Negative group Mean ±Sd	Total Mean ±Sd	P value
Hemoglobin g/dl	11.92 ± 2.15	12.47±1.44	12.20±1.84	0.009
Vitamin D ng/ml	36.96±12.67	41.40±18.73	39.18± 16.07	0.015
Serum ferritin	39.56± 18.47	54.54± 28.70	47.05±25.16	0.012
Iron level mcg/dl	67.36± 23.39	72.50± 28.94	69.93±26.31	0.025

DISCUSSION

This cross-sectional study is the first of its kind to be conducted in Erbil City, Iraq, to assess H. pylori infection risk factors, prevalence, risk factors and subsequent effect on children's growth and nutritional status. A cross-sectional study conducted in Egypt reported an overall prevalence of 64.6%, with slightly higher prevalence among males.(7) The current study revealed a prevalence of 50% among children in Erbil City, with females constituting 51% and males 49%. This prevalence is similar to that reported in Saudi Arabia (49.8%). (8) An Iranian study reported a stool antigen positivity rate of 37.8%, with 56.4% females and 43.6% males. (9) A study conducted in Basra, southern Iraq, showed a higher prevalence of 58%, attributed to water pollution. (10)

The frequency of infection increased to a maximum of 58% at eight years of age and 54% at ten years, then decreased to 50% at fifteen years. Similar trends were reported in Saudi Arabia and Iran. (8, 11) Differences in prevalence across countries may be attributed to variations in screening methods and study designs. Gender variation was observed but was not statistically significant.

More than half of positive cases in this study lived in rural and sub-rural areas. Poor hygiene, lack of clean water, low socioeconomic status, political instability, and internal displacement may contribute to these findings. As a public hospital, most attendees belonged to middle- and low-income groups.

A recent study in Jordan among children revealed the rate of infection declined among Jordanian children (12) with more than half of the cases in the Jordan study were males (54.2%) vs. 45.8% females; 66.7% had low family income, and 54.2 % of positive cases were from public schools. In the current study, 78% were from public schools, and 84% had low family income (Table 2.B). Far East, 234 children tested for H. pylori in Xuzhou Children's Hospital (13), and 73 test results were positive (31.2%). More than one-third (39.36%) of families of positive cases had low income in China study, which is lower than the current study figure (84%). People in China currently have better living conditions than those in our region. A family history of gastric problems in positive cases was reported in 84% of the present study. Fathers and mothers gave a history of gastropathy in 41% and 42%, respectively. The present study showed a significant correlation between H. Pylori-positive cases with family income, the father's and the mother's educational level, living in crowded homes, and water sources. (13)

Gastrointestinal symptoms were more prevalent in the positive group. Epigastric discomfort was the most common symptom, while halitosis was the least frequent. These findings are consistent with studies conducted in Jordan and Iran. (11 ,12)

No statistically significant differences were found in weight, height, BMI, arm circumference, or skinfold thickness between infected and non-infected children. However, iron and ferritin levels were significantly lower in infected children, consistent with other studies linking H. pylori infection to iron deficiency anemia. Vitamin D levels also showed a mild deficiency among infected children, supporting findings from other clinical studies. Wei S et al (14) revealed the same findings; the differences in mean anthropometric measures did not reach a significant level while Taye B et al (15) revealed that H. pylori infection is inversely correlated with child growth. This longitudinal design of the study helped them to prove that and children were monitored from birth to the age of six. The H. pylori infection was not significantly associated with body weight; there were no statistically significant differences in the positive and negative groups' body weight.

The prevalence of anemia in the infected vs. uninfected participants in a Saudi study (16) was 78% vs. 21% ($p < 0.001$). The mean differences in the Hb and ferritin levels reached a significant level: 13.26 ± 2.92 vs 14.42 ± 1.75, $p < 0.001$) and Ferritin (infected vs uninfected: 48.11 ± 63.75 vs 71.17 ± 71.14, $p < 0.001$). In the current study, the Hb mean difference with ferritin reached a significant level. Many reports (13, 16, 17) support such findings and anemia may be the only manifestation of H. pylori infected children especially iron deficiency anemia.

In the recent study vitamin D level shows a mild deficiency, The status of 25 hydroxyvitamin D > 20 ng/mL was regarded as vitamin D sufficiency and the level < 20 ng/mL was defined as vitamin D deficiency.(18) Evidence from the clinical studies of Ting Gao et al and Peng-Fei Ma et al, about the relationship of vitamin D level with H. pylori infection in children suggests that serum vitamin D are significantly lower in the H. pylori-infected children which supports our findings. (18 ,19)

Study Limitations

Children's nutritional habits and hygienic practices were not assessed.

Asymptomatic individuals were not included, limiting estimation of true prevalence.

And the sample size was relatively small. Also cross-sectional design does not allow determination of temporal relationships between exposure and outcome.

CONCLUSION

The Stool H. Pylori test was an effective tool in detecting positive cases among children. The infection causes a delay in growth parameters among children, significant reduction in hemoglobin concentration and iron levels in H.pylor infected children compared to controls, and there is mild deficiency in vitamin D levels in infected children. A vaccine strategy for the prevention of H. pylori infection in children is required in this community.

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