Clinical Gastroenterologist International

ISSN: 2691-5642

Research Article

Epidemiology and Risk Factors of *Helicobacter pylori* Infection among Moroccan Children: Comparison between Asymptomatic and Symptomatic Children

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Abstract

Background: Morocco is a country in North Africa where there is limited data about gastric cancer and the epidemiology of *H. pylori* infection in children were not previously examined.

Aim: To conduct retrospective study to examine the prevalence of *H. pylori* infection and associated risk factors in in Moroccan children from two Moroccan University hospitals. Two groups of children participated in the study; asymptomatic and symptomatic groups of children.

Methods: Blood samples from children in both groups were collected after obtaining an informed consent from their parents. Symptomatic children presented with upper digestive symptoms went under gastroduodenal endoscopy with biopsy. Demographic information, parents' income, type of house was collected. All serum samples were tested for *H. pylori* Immunoglobulin G (IgG) by commercial ELISA kits using (VEDALAB, France) and following the manufacturer's recommendations. The Elisa results were compared to the histologic results of the biopsies taken from symptomatic children.

Results: A total of 270 children between the ages of 2 to 16 participated in the study, 164 asymptomatic and 106 symptomatic children. The overall prevalence of *H. pylori* was 53%; 41% in asymptomatic and 72% in symptomatic children (P<0.001). There was a significant difference among the youngest (2 to 5) and oldest (11 to 16) age groups of asymptomatic children (26% *vs.*57%, respectively, (OR=4.0, 96% CI= 1.6-8.2, P=0.02). However, the age difference was not significance among the symptomatic children (60% *vs.* 88%, (OR=2.5, 96% CI= 0.6-12.2, P=0.6). *H. pylori* prevalence was inversely correlated with the socioeconomic conditions measured by the type of house and income for all the studied children and for each group of children independently.

Conclusions: *H. pylori* infection is prevalent among Moroccan children and directly correlated to low socioeconomic status. Our results are important to developing prevention strategies for treating *H. pylori* infection in Morocco.

Keywords: *Helicobacter pylori* infection; Serology; Children; Epidemiology; Risk factors

Citation: Bouihat N, Cheikh A, Mouane N, Smani Y, El Hassani A, El Ouennass M, et al. Epidemiology and Risk Factors of *Helicobacter pylori* Infection among Moroccan Children: Comparison between Asymptomatic and Symptomatic Children Clin Gastroenterol Int. 2020; 2(1): 1011.

Publisher Name: Medtext Publications LLC

Manuscript compiled: May 14th, 2020

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Introduction

Helicobacter pylori (*H. pylori*) infection is etiologically related to gastritis and the gastritis-associated diseases, peptic ulcer, and gastric cancer [1-3]. In 1994, the International Agency for Research on Cancer has categorized *H. pylori* infection as a definite group I carcinogen [4]. The prevalence of *H. pylori* infection varies both among and within populations and the risk of acquiring *H. pylori* infection is related to socioeconomic status and living conditions such as density of housing, overcrowding, number of siblings, sharing a bed, and lack of running water have all been linked to a higher acquisition of *H. pylori* infection [5-8]. Within a particular country, the decline in prevalence of *H. pylori* tends to parallel economic improvement [9-10].

The risk of acquiring H. pylori infection is usually occurs early in life and it is documented the childhood is the critical time of acquisition and the majority of children are infected before the age of 10 years [11-13].

Morocco is located in North Africa where there is limited data to make this generalization to the incidence of gastric cancer in the

country. However, a study by Smith et al reported a higher incidence of gastric cancer in Marrakech than in Casablanca, two different cities within the country concluding that future studies are needed to investigate possible risk factors and to explain the difference in rates [14]. The epidemiology of *H. pylori* infection in Moroccan children was not previously examined. Therefore, we conducted the current study to estimate the prevalence of *H. pylori* among symptomatic and asymptomatic children in Morocco and examine the risk factors associated with the infection. Furthermore, we examined the validity of the serology in the diagnosis of *H. pylori* infection in the studied children.

Materials and Methods

Study Population

This is a retrospective study that was conducted between the periods of 2015 to 2016 in two university hospitals; Cheikh Zaid University Hospital and Rabat Children's Hospital in Rabat, Morocco. The studied population consisted of Moroccan children attended both hospitals and were classified into two groups at the time of recruitment. The first group included asymptomatic children who were consulted for non-digestive symptoms and the second group consisted of children complained with upper gastro-intestinal symptoms and were referred for upper endoscopic examination with biopsies.

Parents completed a questionnaire regarding demographic information, environmental factors such as type of house, monthly income of the household that was classified into 3 categories based on that the Minimum Inter-professional Guaranteed Wage (MIGW) by Euros in Morocco: Low<200, average 200 to 500, good >500 Euros. The family history of peptic ulcer and gastric cancer was reported from all participated children.

Blood samples from all participated children were drawn for serologic examination and the results of the histological examinations collected from the symptomatic children were collected from the patient's medical record. Ethical approval was obtained from Ethics Committee of Faculty of Medicine and Pharmacy, Mohammed V University. Written consent was obtained from the parents of study children. The study methods were carried out in accordance with the approved guidelines.

Serologic Methods

Sera were stored at - 20°C until analysed. Evaluation of IgG antibody to the *H. pylori* was determined by using *H. pylori* IgG (VEDALAB, France) and following the manufacturer's recommendations. Positive reaction was measured by the spectrophotometer at 450 nm and the threshold of the reaction was 20 IU/mL.

We examined the correlation between the serological and the histologic results of the biopsies taken from the symptomatic children who went under endoscopic examination.

Statistical Analysis

The Mantel-Haenszel *X2* test was used to assess the associations between each independent factor of the study and the prevalence of H. pylori infection. Univariate and multivariate analyses, ORs, and 95% CI were calculated for *H. pylori* seropositivity associated with the study variables. Risk factors that were significant in the univariate analysis were used in the multiple logistic regression models using the level of type I error=0.05. These models help to assess the relative importance of risk factors while controlling for other factors. The SPSS (version 13.0) statistical package was used (SPSS Inc.).

Results

The histologic results of the biopsies taken form symptomatic children were used as gold standard for comparison of the serological test performed by ELISA. The ELISA showed sensitivity of 89% (95% CI=80%-95%), specificity 70% (95% CI=55%-80%); positive predictive values 80% (95% CI=71%-84%), and negative predictive value 83% (95% CI=71%-90%).

Prevalence and risk factors of *H. pylori* infection among the total studied children

A total of 270 children between the ages of 2 and 16 participated in the study; the overall prevalence of *H. pylori* among the total studied children was 53% that increased by age with no difference between boys and girls (Table 1). Age adjusted ORs were calculated for *H. pylori* sero-positivity in relation to the study variables (Table 1). There was an inverse correlation between *H. pylori* prevalence and the type of house. Children lived in houses below modest had higher prevalence of *H. pylori* infection than those lived in good houses (63% vs. 30%, respectively, OR=2.6; 95% CI=1.4-2.8), p<0.005. That significant inverse trend was also noted based on the income of the family (Figure 1 and Table 1).

Comparison between asymptotic and symptomatic Moroccan children

The total studied children consisted of 164 asymptomatic children and 106 symptomatic children with a significant difference of the prevalence of *H. pylori*; 41% in asymptomatic and 72% in symptomatic (P<0.001). The prevalence of *H. pylori* infection increased by age among both asymptomatic and symptomatic children, however, the age specific distribution differed between both groups. While there was a significant difference among the youngest (2-5) and oldest age group (11-16) of asymptomatic children (26% *vs.* 57%, (OR=4.0, 96% CI= 1.6-8.2, P=0.02), that difference was not significance among the symptomatic children (60% *vs.* 88%, (OR=2.5, 96% CI= 0.6-12.2,

Table 1: Risk factors of *H. pylori* infection among the total studied Moroccan children.

Variable	Total (Hp% positive)	Crude OR (95% CI)	Age Adjusted OR (95% CI)
Age			
02-May	91 (44%)	Ref	
06-Oct	104 (54%)	1.45 (0.6-4.2)	
Nov-16	75 (65%)	2.57 (1.4-6.4)	
Total	270 (53%)		
Gender			
Males	130 (53%)	Ref	Ref
Females	140 (53.5%)	1.1 (0.2-2.0)	1.1 (0.6-3.1)
Type of House			
Good	40 (30%)	Ref	Ref
Modest	129 (53%)	2.6 (0.6-3.5)	2.0 (0.5-2.1)
Below Modest	101(63%)	3.0 (1.8-5.8)**	2.6 (1.4-2.8)*
Family Income			
High	26 (27%)	Ref	Ref
Moderate	51 (47%)	2.1 (0.8-5.8)	1.8 (0.3-1.2)
Low	193(59%)	4.0 (1.3-3.4)**	2.6 (1.2-.2.0)*
Family History (Peptic ulcer/Gastric Cancer)			
No	145 (36.5%)	Ref 5.0 (2.7-12.3)**	Ref 3.8 (2.0-8.0)**
Yes	125 (72%)		

Significant statistical level *P <0.05
Significant statistical level **P <0.05

P=0.6) (Figure 2). The trend of the inverse correlation between *H. pylori* infection and the type of house and family income hold its significance among asymptomatic and symptomatic children independently (Table 2). Symptomatic children infected with *H. pylori* had family history of peptic ulcer and/or gastric cancer compared to the asymptomatic children (100% vs. 57%, respectively, p<0.00 (Table 1).

When logistic regression analysis was applied with all the variables in the model, family income and type of housing hold their significate level.

Discussion

To our knowledge, this is the first study to report the results of the epidemiology and the risk factors of H. pylori infection among Moroccan children. Several interesting results emerged from our study. First, the overall high prevalence among the Moroccan children was very high, as more than half of the studied children were infected with *H. pylori*. The high prevalence among the Moroccan children is

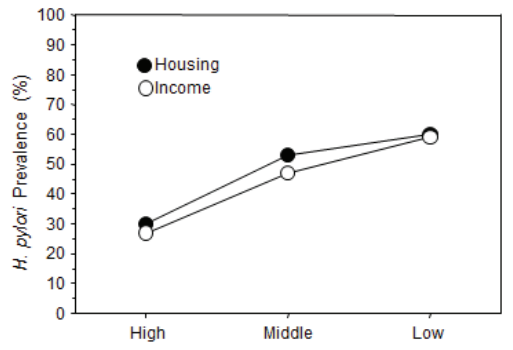

Figure 1: Shows the correlation between the type of house and family income to the prevalence of *H. pylori* infection in the studied children.

Table 2: Distribution of *H. pylori* infection by the study variables in Moroccan children: Comparison between the asymptomatic and symptomatic Children.

Variables	Asymptomatic (#164) Total (+ve Hp)	Symptomatic (#106) Total (+ve Hp)	Odds OR (95% CI)	P
Age Group				
02-May	43 (26%)	48 (60%)	4.4 (1.9-9.0) 6.7 (2.1-12.5) 6.7 (2.1-12.5)	<0.005
06-Oct	67 (39%)	37 (81%)		<0.005
Nov-16	54 (57%)	21 (86%)	3.7 (1.8-7.4)	<0.05
Total	168 (41%)	106 (72%)		<0.05
Gender				
Boys	77 (35%)	53 (79%)	7.7 (2.0-22.5)	<0.05
Girls	87 (41%)	35 (66%)	3.5 (1.5-15.5)	<0.05
Habitat				
Good	12 (31%)	1 (0%)		
Modest	19 (29%)	64 (77%)	7.9 (1.8-22.5)	<0.05
Below Modest	60 (62%)	41 (66%)	2.0 (0.6-20.5)	0.2
Family Income				
High	26 (27%)	0		
Moderate	23 (43%)	28 (50%)	2.4 (0.7-28.5) 4.6 (2.1-16.0)	0.6
Low	115 (44%)	78 (80%)		<0.05
Family History **(Peptic ulcer/GG)**				
No	79 (43%)	66 (55%)	1.8 (0.7-28.5)	0.6
Yes	85 (59%)	40 (100%)	3.2 (1.6-18.5)	<0.005

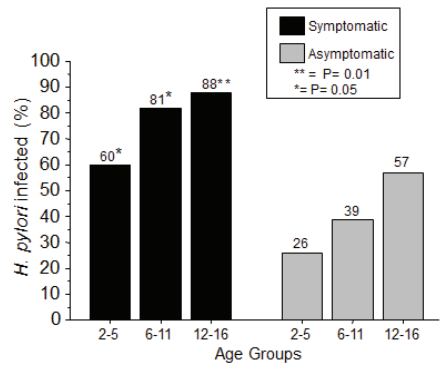

Figure 2: Shows the age specific prevalence of *H. pylori* infection among symptomatic and asymptomatic children independently.

comparable to what was reported among children from neighbouring countries such Iran, Jordan, Egypt, and Turkey where the prevalence of *H. pylori* was reported as 50, 55%, 72%, and 44%, respectively [15-17]. Our results showed an increase in the prevalence of *H. pylori* infection by age among asymptomatic and symptomatic children which are constant with cross-sectional studies have consistently shown a gradual increase in *H. pylori* prevalence with age. These results have been interpreted as a birth cohort effect reflecting a decrease in the rate of acquisition in successive generations of children as sanitation improved and standards of living increased [18-19].

The second interesting finding of our study is the difference of the age specific distribution between asymptomatic and asymptomatic children. While there was a significant difference between the youngest and oldest age groups of the asymptomatic children, that difference was not noticed among the symptomatic children. This finding emphasis the importance of early childhood acquisitions of *H. pylori* infection that is most likely occurs before the age of ten [20] and accordingly causes symptoms to children. Most children are colonized in early childhood, and in large number of the infected cases could last many years unless the child is treated with appropriate antibiotics [21]. Cohort studies examined children at entry and at follow-up periods reported high persistence rate of infection among children [22-24]. In a cohort of 5 to 13-year-old Mexican students, 38% were tested positive at enrolment of which a great majority remained positive during follow-up [22]. A study from Brazil examined children of a low-income community reported that 47.4% of infected children at baseline remained infected eight years later [23]. Another study from Portugal examined the prevalence of *H. pylori* infection among healthy children reported that the highest acquisition rate of *H. pylori* occurs at young age, but also showed that older children can also acquire *H. pylori* infection at a rate similar to that of young children [24].

It has been also established that the prevalence of *H. pylori* is inversely related to socioeconomic status [6-10]. However, for populations in which the social class is relatively homogeneous, such as China and Russia, density of living has been shown to be the most significant risk factor [25,26]. Morocco socioeconomic levels seem to differ markedly as many others developing countries. Therefore, we used the type of housing and income as markers for socioeconomic condition. In the current study, we found *H. pylori* prevalence was inversely correlated with the type of house and the total family income which is consistent with several previous studies that reported similar findings [25-27].

Although our current study is the first study examined several variables in Morocco, it has some shortcomings. First, the sensitivity of the Elisa was only 89%, however *H. pylori* prevalence among the Moroccan children was very high and adjusting that high prevalence with 89% Elisa sensitivity will not alter the outcomes of the results.

In conclusions, the high prevalence of *H. pylori* among the Moroccan children emphasizes the importance for implementation and eradication of *H. pylori* [28]. The current results should not be underestimated, because if childhood period is the critical time for developing gastric cancer later in life, prevention through early detection and treatment of infected children should be considered. Our results are important to developing surveillance and prevention strategies for gastric cancer in Morocco.

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