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Helicobacter pylori Infection (*Hp*) among Children in the Northern Benin in 2018

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Abstract

Background: *Hp* infection is the most common chronic bacterial infection in developing countries and is contracted especially in childhood where it remains silent. Because of its involvement in the genesis of certain cancers, the WHO has classified *Hp* in the category of carcinogen class I. The aim of this study was to determine the prevalence of *Hp* infection among children from a District in Northern Benin, and to identify the factors associated with it. **Patients and methods:** This scientific investigation is a cross-sectional, descriptive, and analytical study based on a prospective collection of data carried out from July to September 2018. Recruitment was probabilistic; it was based on the WHO cluster sampling technique implemented among children aged 3 to 10 years without recent history of antibiotic treatment and proton pump inhibitors. *Hp* infection was diagnosed during the search for bacteria antigen in the feces through a quick Elisa test which proved positive. **Results:** We included 250 children in the study. Among them, 151 (60.4%) had *Hp* infection. 79 (52.3%) out of the 151 infected children were female, *i.e.* a sex ratio of 0.91. Mean age for those infected children was 6 ± 2.3 years. Among the 151 children infected with *Hp*, 98 (64.9%) were asymptomatic. Factors associated with that infection were: children's age > 5 years ($p = 0.0461$), use of contaminated drinking water ($p = 0.0001$), meals away from home ($p = 0.0039$), mothers' low educational status ($p = 0.0137$) and low monthly income ($p = 0.0116$) as well as household size > 3 ($p = 0.0002$). **Conclusion:** *Hp* infection is common among children aged 3 to 10 years in Northern Benin. Often asymptomatic, it is facilitated and exacerbated by unsanitary conditions and low socioeconomic status.

Keywords

Helicobacter pylori, Child, Northern Benin

1. Introduction

Helicobacter pylori (*Hp*) infection is one of the most common and widespread infections in humans worldwide [1]. In fact, more than half of the global population is infected with *Hp* [2] [3]. It is a chronic bacterial infection that is the most common in developing countries [1]. The proportion of *Hp* infection acquired by children varies from 30% to 50%, whereas it reaches a limit of more than 90% at adult age in developing countries [2] [4]. Low socioeconomic status is a major risk factor in the acquisition of *Hp* infection [5]. Many studies have shown that parents' educational status and a large number of siblings were the main enabling factors for *Hp* infection in children [5] [6]. Other risk factors such as sources of drinking water, type of housing, presence or absence of sewage system and waste management and disposal method were also related to this infection [2]. Transmission from one person to another may be through fecal-oral route or from mouth to mouth [3] [7]. This infection usually goes unnoticed in most affected persons since it is asymptomatic. In children, its manifestations are limited to chronic gastritis (often asymptomatic), and infrequently to a duodenal or sometimes gastric ulcer [2]. It is well known that *Hp* infection may be associated with the pathogenesis of some gastrointestinal diseases such as type B chronic antral gastritis, gastric or duodenal ulcers, lymphoid tissue lymphoma associated with mucosa and gastric adenocarcinoma [8] [9] [10]. In addition, possible associations have been reported between *Hp* infection and some extra-digestive diseases (cardiovascular, dermatological, neurological, immunological, hematological, respiratory, metabolic and endocrine diseases) [11]. Due to its involvement in pathologies such as gastric adenocarcinoma, extra-ganglion lymphoma of marginal areas of mucosa annex lymphoid tissues (MALT), gastric or duodenal ulcer, gastric atrophy, the WHO has classified it in the category of class 1 carcinogens [12] [13].

In Northern Benin, the epidemiology of this disease is still poorly known among children; hence, the relevance of this research work is to determine the prevalence of *Helicobacter pylori* infection among children aged 3 to 10 years in the city of Parakou and to identify the factors related to the infection.

2. Patients and Study Methods

This research work is a cross-sectional study with descriptive and analytical purposes based on prospective collection of data, which was carried out from June to September 2018. The source-target population consisted of all the children aged 3 to 10 years in the city of Parakou. Parakou is the largest city in North Benin with 255,478 inhabitants in 2013 according to the 4th General Population and Housing Census in 2013 and is the third city with special status after Cotonou and Porto-Novo. The primary target was all the children aged 3 to 10 years and the secondary target consisted of the parents (mothers, fathers and legal guardians) of included children. This study included children aged 3 to 10 years from selected households. Excluding children whose parents did not give consent to participate in the survey. It also excluded those who did not attend the

survey for any reason or children on antibiotics during the four weeks and/or on proton pump inhibitors during the two weeks preceding the collection of feces.

Sampling was probabilistic; it was performed using the WHO two-stage cluster sampling method. Cluster unit consisted of one group of children aged 3 to 10 years and living in an area of the city of Parakou. The statistical unit was represented by one child aged 3 - 10 years meeting the inclusion criteria. Areas were randomly selected; and the cluster interval, the number of clusters as well as the number of children per cluster were computed. The expected minimal size of the study sample was 240 with a prevalence of 14.2% in accordance with a study conducted in Ghana in 2017 [14]. In each selected household, only one child whose age oscillated between 3 and 10 years was retained for the study. In a case where a household had many children aged 3 to 10 years, the selection technique consists of taking census of all the children aged 3 to 10 years and randomly selecting one only. For each child included, a structured "face to face" (interviewer/respondent) interview was done to gather data with mothers or babysitters, using a survey form.

Hp infection was considered as diagnosed when the search for bacteria antigen in the feces resulted in positive. We used One Step *H. pylori* Antigen Test Device (Feces) of Abon Biopharm Lot HP7010011, which is a rapid chromatographic immunoassay for the qualitative detection of *Hp* antigen in human feces samples.

The variable under study was *Helicobacter pylori* infection. The independent variables were sociodemographic, socioeconomic, cultural, and clinical, as well as variables related to hygiene, water, food, environment, and solid waste management.

The entry, processing, and analysis of data were performed using software Epi Data 3.1fr and Epi Info version 7.2. The quantitative variables were expressed as average and standard deviation; and qualitative variables as population size and percentage. Pearson's Khi^2 $\left(\mathcal{X}^2\right)$ statistical tests or Fisher's exact test were used for comparisons. The Prevalence Rate (RP) was computed in order to identify the relationship existing between dependent variable and independent variables. The difference was statistically significant for p-value < 0.05.

This research work was carried out in compliance with the relevant ethical and professional standards. It was conducted with the oral and informed consent of the parents of included children. The research protocol was approved by the local ethics committee for biomedical research of the University of Parakou. All the children with positive test benefitted from a free of charge medical consultation simultaneously conducted by a pediatrician and a gastroenterologist, and followed by a treatment for the eradication of *Hp.* All the parents of included children were informed of the basic hygiene measures to comply with.

3. Results

3.1. Prevalence of *Hp* Infection in Children

Among the 250 samples of children's feces included in the study, 151 proved to

be positive at the presence of *Hp* antigen, *i.e.* a prevalence of 60.4%.

3.2. Characteristics of Children Included in the Study and Their Parents

✓ *Data related to included children*

We included 250 children in the study. Their mean age was 5.82 ± 2.44 years. The predominant age group was those under 5 years of age (50.8%). One hundred and thirty-three (53.2%) were female.

As regards a healthy lifestyle, 190 children (76%) do not wash their hands before eating and 191 (76.4%) do not wash hands after toilets. Concerning the source of drinking water supply for those children, 64 households (25.6%) reported using non-potable or unclean well water. Nineteen households (7.6%) did not have latrine. Among them, 14 (5.6%) used to defecate in neighbors' latrine, and 5 (2%) did it outdoors or in the open air. Besides, 195 children (78%) do buy food from roadside vendors.

The average size of the households of included children was 10.36 ± 5.44 individuals with extremes from 1 to 24 persons. In those households, the average number of children was 4.64 ± 2.54 with extremes ranging from 1 to 15 children. Fifty-six percent (56%) of the households had a population size higher than 8.

✓ *Data related to parents of children included in the study and data related to parents of infected children*

Concerning the parents of children included in the study, the mean age for mothers was 32.84 ± 6.33 years. The mean age for fathers was 40.46 ± 8.26 years. Among the mothers, 97 (38.8%) had secondary or higher education level and 140 fathers (56%) received secondary or higher education. Two hundred and three mothers (81.2%) and 130 fathers (52%) had poorly paid jobs. Fifty mothers (20%) and three (03) fathers (1.2%) had a monthly income lower than 10,000 FCFA (15.25 Euros).

As regards the parents of *Hp* infected children, the mean age for mothers was 32.80 ± 6.62 years, and for fathers was 40.82 ± 8.48 years.

Among the mothers of infected children, 66 (43.7%) had no educational background and 74 fathers (49%) had secondary or higher education.

Among the parents of infected children, 126 mothers (83.5%) and 102 fathers (70.9%) had poorly paid jobs. Thirty-eight mothers (25.2%) and 3 fathers (2%) had a monthly income lower than 10,000 F CFA (15.25 Euros).

3.3. Characteristics of *Hp* Infected Children

Among the 151 children infected with *Hp*, 79 (52.3%) were female *i.e.* a sex ratio of 0.91. The mean age for those infected children was 6 ± 2.3 years. The predominant age group was children under 5 years (45.7%).

As far as hygiene is concerned, among the 151 children infected with *Hp*, 36 (23.8%) do not wash their hands before meal, 34 (22.5%) do not wash their hands after toilets, 57 children (37.7%) drink unclean or non-potable well water and 12 (7.9%) did not have latrine. Moreover, 127 (84.1%) out of those 151

children infected with *Hp* were used to buying food from roadside vendors.

The average size of the households where children were *Hp* infected was 10.24 ± 5.33 individuals, with extremes ranging from 1 to 15 people. One hundred and forty-four children *i.e.* 95.4% of the children infected with *Hp* came from households with size higher than or equal to 4.

Regarding the clinical features due to *Hp* infection, the clinical signs found out or identified in those children are recorded in Table 1. For instance, among the 151 children infected with *Hp*, 64.9% were asymptomatic. Cases of recurrent abdominal pain were found out in 24.5% of them.

3.4. Factors Associated with *Hp* Infection among Children Aged 3 to 10 Years in Parakou in 2018

Table 2 shows the factors associated with *Hp* infection among children aged 3 to 10 years in Parakou in 2018.

4. Discussion

4.1. Prevalence of *Helicobacter pylori* Infection

In our study, the prevalence of *Hp* infection was 60.4%. This prevalence is similar to those reported in other developing countries. For instance, Salih *et al.* [15] in 2011 in Sudan, Atégbo *et al.* [7] in Gabon in 2011, Senbanjo *et al.* [16] in 2013 in Nigeria had respectively obtained prevalence rates of 56.3%, 62%, and 63.6%. The high prevalence of *Hp* infection in this study must draw the attention of the Benin health authorities on the urgent need to carry out a multicenter study across the country in order to better understand the extent and spread of the infection. In fact, it is demonstrated through the literature data, that the chronic carriage of that bacteria in the crypts of intestinal and gastric wills is the cause of gastric and/or duodenal ulcers which are chronic gastritis. Most often, the latter is located on the other side but sometimes spread over the fundus. Chronic carriage of *Hp* bacteria is also responsible for cases of atrophic gastritis, thus causing hypochlorhydria, malabsorption of vitamin B12 and intestinal metaplasia

Table 1. Distribution of children infected with *Hp* according to clinical signs found out (Parakou 2018, N = 151).

	Population size	(%)
Asymptomatic	98	64.9
Recurrent abdominal pain	37	24.5
Cases of recurrent diarrhea	7	4.6
Poor nutritional status	5	3.3
Nausea	2	1.4
Vomiting	2	1.3
Total	151	100

Table 2. Factors associated with Hp infection among children aged 3 to 10 years in Parakou in 2018.

	Helicobacter pylori infection							
		Yes		No				
	Total	n	%	n	%	PR	95% CI	*p*
Age (years)								**0.0461**
<5	127	69	54.3	58	45.7	1		
≥5	123	82	66.7	41	33.3	1.23	[1.01 - 1.50]	
Mother's educational status								**0.0137**
Educated	156	85	54.5	71	45.5	1		
Uneducated	94	66	70.2	28	29.8	1.29	[1.06 - 1.56]	
Mother's monthly income (in Francs CFA)								**0.0116**
≥10,000	200	113	56.5	87	43.5	1		
<10,000	50	38	76.0	12	24.0	1.34	[1.10 - 1.66]	
Household size								**0.0206**
<4	26	07	26.9	19	73.1	1		
≥4	224	114	50.89	110	49.11	1.89	[1.13 - 3.61]	
Taking meal away from home								**0.0039**
No	55	24	43.6	31	56.4	1		
Yes	195	127	65.1	68	34.9	1.49	[1.08 - 2.05]	
Source of drinking water								**0.0001**
Tap water	186	94	50.6	92	49.4	1		
Well water	64	57	89.1	07	10.9	1.76	[1.49 - 2.08]	

which reflect a precancerous condition and cancers (stomach cancer, adenocarcinoma, and MALT lymphoma) [8] [9] [10]. On this basis, it is urgent to reduce the spread of that infection among the population. Therefore, it is necessary to focus actions on the factors that influence contamination.

4.2. Clinical Features of *Helicobacter pylori* Infection

Concerning the functional signs, in this research work, cases of recurrent abdominal pain (23.6%) were the symptom mostly reported by children. Among those who had recurrent abdominal pain, 62.7% were *Hp* infected. Even if in our study the presence of recurrent abdominal pain in children was not statistically associated with *Hp* infection, in our environment, any practitioner must suspect infection when facing any recurrent abdominal pain in children. In Cotonou (Republic of Benin), Sagbo *et al.* [17] had found out that cases of recurrent abdominal pain were statistically associated with *Hp* infection. This difference between results found in the same country may be due to the fact that the study of Cotonou was conducted in hospital settings among symptomatic children whereas ours was carried out among the general population in apparently healthy children.

4.3. Factors Associated with *Hp* Infection

Concerning the age of children included in this study, children above 5 years presented with a high risk for *Hp* infection had a statistically significant difference. We observed that the prevalence gets increased with children's age; especially children aged 5 to 7 years. In Gabon, Atègbo *et al.* [7] had reported that ages above 5 years are significantly associated with *Hp* infection. Other studies conducted in Cotonou by Sagbo *et al.* [17] and in Sudan by Salih *et al.* [15] had noted that the prevalence of *Hp* infection increases with age. This remark confirms the existence of family risk factors that facilitate chronic carriage of *Hp* infection.

As regards the source of drinking water, this study has proved that using unclean or non-potable water was statistically associated with *Hp* infection. In the same vein, the risk of contracting *Hp* infection was multiplied by 1.76 in children whose source of drinking water is a well. This situation, which is of great concern in relation to the non-supply of clean drinking water to the population of Parakou as a whole, must be raised. Water is an important source of spread of *Hp* and many studies have duly confirmed it. Awuku *et al.* [14] had made the same remark in Ghana. In this respect, Yanez *et al.* [18] in Spain and Rami *et al.* [19] in Egypt had found out that contaminated water would be the vector of *Hp* infection. Rodrigues *et al.* [20] in Brazil, as well as, Ravelomanana *et al.* [21] in Madagascar had equally proved that the type of drinking water used by the households is a risk factor for *Hp* infection.

Concerning the environmental and behavioral characteristics, this research work has highlighted that children who do not have latrines at their disposal were more exposed to *Hp* infection. However, the risk of being infected with *Hp* among children living in households with latrines is not different from the one of those without latrines. Contrary to this research work, Awuku *et al.* [14] had reported that the non-existence of latrines was a factor associated with *Hp* infection in Ghana. This remark has been confirmed by Atègbo *et al.* [7] in Gabon where *Hp* infection was more common. Improving the living conditions of children should induce a decline in the prevalence of that infection in hyper-endemic areas as in Africa.

As regards taking meals away from home, our research work has pointed out the fact that buying food from roadside vendors has some influence on the presence of *Hp* infection. Sagbo *et al.* [17] had made the same observation in 2016 in Cotonou. As a matter of fact, in their study, they had reported that children whose parents had a good practice of food hygiene were not infected with *Hp*.

This study has just confirmed that the prevalence of *Hp* infection increases according to household size. Household size of more than four people was associated with *Hp* infection. The higher the number of subjects, the higher the ratio of *Hp* infected children. This reflects the role of promiscuity in the risk of occurrence of *Hp* infection in children. Atègbo *et al.* [7] in Gabon, as well as, Ro-

drigues *et al.* [20] in Brazil have proved that overcrowding and regular contacts in the households are risk factors for *Hp* infection. Other studies conducted by Siai *et al.* [22] in Tunisia and by Hasosah *et al.* [23] in Saudi Arabia had made it clear that a significant number of people in a house and/or per room are associated with *Hp* infection.

As far as mothers' educational status is concerned, our study has proved that there was an inversely proportional relationship between *Hp* infection and mothers' educational status. The lower the mothers' educational status was, the higher the risk for *Hp* infection in children. These findings are comparable to those found out by Sagbo *et al.* [17] in Cotonou, as well as, Salih *et al.* [15] in Sudan noted that the higher a mother's educational status, the less susceptible the children are to *Hp* infection. Laszewizc *et al.* [24] in Polonia, Asim *et al.* [25] in Libya had also made the same remark according to which parents' lower educational status was a factor associated with *Hp* infection. This may be due to the fact that parents with low educational status will be less informed of the basic hygiene rules.

This study also established how a mother's income relates to *Hp* infection in children. Therefore, socioeconomic status plays a significant role in the occurrence of *Hp* infection. Other authors have reported results similar to ours. For instance, Awuku *et al.* [14] in Ghana, Laszewicz *et al.* [24] in Polonia as well as Atégbo *et al.* [7] in Gabon had reported that low socioeconomic status was a risk factor for *Hp* infection. The same applies for Hasosah *et al.* [23] in Saudi Arabia, Koffi *et al.* [26] in Côte d'Ivoire, Asim *et al.* [25] in Libya, as well as Salih *et al.* [15] in Sudan had noted that there is a relationship between parents' low monthly income and *Hp* infection.

Concerning functional signs, this study has noted the predominance of cases of recurrent abdominal pain but the latter was not statistically associated with *Hp* infection. On the contrary, Hasosah *et al.* [23] in Saudi Arabia, Sagbo *et al.* [17] in Cotonou (Benin) had found out that recurrent abdominal pains are statistically associated with *Hp* infection.

5. Conclusion

This study points out that six out of ten children were infected with *Helicobacter pylori* in the District of Parakou in 2018. Often, they were asymptomatic. The factors associated with that infection were child age above five years, non-potable or unclean drinking water, meals away from home, household size consisting of more than four people, mothers' low educational status as well as mothers' low monthly income. The findings of this study summarized just above require that population be made aware of the basic hygiene rules.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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