East African Medical Journal Vol. 83 No. 9 September 2006
PREVALENCE OF *HELICOBACTER PYLORI* IN CHILDREN LESS THAN THREE YEARS OF AGE IN HEALTH FACILITIES IN NAIROBI PROVINCE
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A.C. LANGAT, E. OGUTU, R. KAMENWA and D.E. SIMIYU

ABSTRACT

Objectives: **To determine the prevalence of *Helicobacter pylori* in children less than three years of age and to determine socio-demographic correlates of *Helicobacter pylori* infection in these children.**
Design: **Cross sectional study.**
Setting: **The "well baby clinics," in Nairobi Province.**
Subjects: **Children less than three years of age.**
Results: **A total of 195 children were analysed in the study. There were 103 (52.8%) males and 92(47.2%) females giving a male to female ratio of 1.1:1. The mean age was 17.7 months and the median age was 16 months (range 2 weeks to 36 months). *H. pylori* antigen was found in stool of 89(45.6%) of the children. Low socio-economic status, crowding in the homes and poor sanitation were associated with *H. pylori* infection.**
Conclusion: **There is a high prevalence rate of *H. pylori* infection in children less than three years as found in this study which is in agreement with studies done in other developing countries. Family income is associated with *H. pylori* infection and families with low income are at higher predisposition to *H. pylori* infection when compared to families with high income.**

INTRODUCTION

Helicobacter are gram-negative, spiral, flagellate bacilli which were first described by Warren and Marshall in 1983 (1). In colonised subjects, *Helicobacter pylori* is present within the gastric mucus layer and on the gastric mucosa.

It is now recognised that infection with *H. pylori* is associated with some of the most common clinical problems in medicine including chronic active gastritis, peptic ulcer disease, non-ulcer dyspepsia and duodenitis. Colonisation is currently classified as a pre-malignant condition for MALT lymphoma (mucosal associated lymphoid tissue) and gastric adenocarcinoma by the World Health Organisation (2).

It is also now recognised that *H. pylori* is mainly acquired in childhood. However, the prevalence, timing of acquisition, symptoms, and sequelae of infection differ in developed compared to developing countries. In developed countries infection during childhood is uncommon. It is estimated that less than 5% of children under five years of age in United states are infected with *H. pylori* and by adolescence only about 10%, and this peaks to about 50-60% by 60 years of age (3). In contrast, *H. pylori* infection in the developing world

occurs earlier in life with a higher frequency. Approximately half of the children living in developing countries are seropositive by five years of age and seroprevalence rates as high as 90% have been reported in early adulthood (3).

In Kenya, a study of school going children from age 3-15 years by Nabwera *et al* (4) found a prevalence of 80.7% *H. pylori* infection.

Lower socio-economic status is associated with a higher prevalence of *H. pylori* infection (5). *H. pylori* tends to cluster in families and in people living in crowded conditions (6,7). Studies have demonstrated an inverse relationship between *H. pylori* prevalence and the educational level of the population studied (7). Environmental factors such as general level of hygiene, source of water supply and sanitation have been linked to higher seroprevalence of *H. pylori* (6). The two modes of transmission that have been proposed are faecal-oral and oral-oral transmission (8).

H. pylori infection is a major cause of type B gastritis and was found in 90% of children with duodenal ulcers and in 25% with gastric ulcers (9). In most children the presence of *H. pylori* infection does not usually lead to symptomatic disease even when the organism colonising the mucosa causes chronic active gastritis (10). A study done in Finland, which followed children who had *H. pylori* by use of endoscopy for two years found that there was progressive inflammatory changes (nodular gastritis) with deterioration in histological features of the gastric mucosa of infected children (30% - 100%) despite stable *H. pylori* colonisation and absence of symptoms (11).

Mucosal inflammatory changes seen in early childhood has an impact on the type of gastroduodenal disease one develops later on in adulthood (12). The most effective approach to reducing the incidence of gastroduodenal disease secondary to *H. pylori* would then be the prevention of childhood *H. pylori* acquisition.

Knowledge of the prevalence of *H. pylori* in children less than three years will help our understanding of how early this infection is acquired locally. It will also alert health workers to the possibility of *H. pylori* infection when faced with young children with dyspeptic symptoms. These children may then be evaluated further for *H. pylori* with the background knowledge of the prevalence in this geographical region. On a wider scale such knowledge can lead to better planning of health service provision specifically making available the diagnostic tests used to identifying *H. pylori* at the regional health referral facilities and also providing *H. pylori* eradication drugs for those who are symptomatic. Public health measures can also be instituted to prevent the transmission of *H. pylori* once the associated factors are known and hence reduce the disease burden.

There is no local data on the prevalence of *H. pylori* in children less than three years of age, nor is there any data on associated factors of *H. pylori* infection in our population. This study aims to obtain this information. This study proposes to determine the prevalence of *H. pylori* infection in children less than three years of age in health facilities in Nairobi Province and to determine if the following are correlated with *H. pylori* infection: - age, socio-economic status, household crowding and *H. pylori* seropositivity of the mother.

MATERIALS AND METHODS

This was a descriptive cross sectional study conducted on children seen in four study centres namely; AMREF, Kibera, Mater Hospital, Kayole health centre and Dagoretti health centre. The study was carried out between 1st October and 31st December 2004.

The parents were given information on the study and signed consent obtained. Demographic data were recorded in a coded closed questionnaire.

A physical examination was done on the child and stool samples were collected in plastic polypot containers provided to the parent. The polypots were carried in a cooler and transported to the department of paediatrics laboratory where they were stored frozen (at -20^{0}C to -80^{0}C) until tested. Children who were unable to provide the stool specimen at the site were allowed to go home with the polypot and mother asked to bring a stool specimen to the health centre the next day so long as the specimen was collected within 24 hours (Antigen remains viable for 24 hours).

Whole blood from a prick on the left hand middle finger tip of the mother was used to do the test at the site of data collection for those who accepted.

Inclusion criteria: All children aged less than three years and their mothers.

Exclusion criteria. Children with a watery stool, and those who had been on antimicrobials, proton pump inhibitors, bismuth preparation two weeks prior to testing as these drugs are known to suppress *H. pylori* and may give false negative results.

Laboratory procedure:

a) *Stool antigen test for the child:* The Rapid Strip HPSA (Meridian Diagnostics, Ohio) test utilises a monoclonal anti-*H. pylori* antibody. It's based on a lateral flow chromatography technique that detects *H. pylori* antigens in stool. The test kit used in this study had a sensitivity of 96.1% and a specificity of 90.6 %.
b) *Serology test:* Acu-check *H. pylori* test for the mother: This was a rapid chromatographic immunoassay test for the detection of *Helicobacter pylori* antibodies in whole blood.

Data analysis. The data were analysed using the standard software package SPSS (Statistical Package for Social Sciences) 11.0 software. Data were summarised into frequency tables, charts and graphs. The prevalence of *H. pylori* was computed according to the age. Correlates of *H. pylori* were evaluated by a comparison of proportions of children with and without infection using chi-square test and Fischer's exact test as appropriate.

Ethical considerations: The study was approved by the ethical boards of Kenyatta National Hospital, Nairobi City council and the private institutions.

RESULTS

A total of 375 children were given polypots and only 215 returned stool samples.

Twenty samples were rejected due to various reasons: nine had watery stool, six had missing labels and five had indeterminate results on the test strip. Therefore only 195 samples were analysed in the study.

Of the study subjects, males were 103 (52.8%) while the females were 92 (47.2%), giving a male to female ratio of 1.1:1. The mean age was 17.7 months, median 16 months (range 2 weeks to 36 months).
Prevalence of Helicobacter pylori: Of the 195 children recruited for the study, 89 were found to have the antigen for *Helicobacter pylori* positive in their stool. The prevalence of *H. pylori* in children less than three years was 45.6% (95% C1 = 40.6 - 50.6) (Table 1).

Table 1

Age distribution of the study population (n = 195)

Age group (months)	No. of cases	(%)
0-6	34	17.4
7 -12	46	23.6
13 -18	33	16.9
19 -24	39	20.0
25 -30	7	3.6
31 -36	36	18.5
Total	195	100

The mean age for the children with HPSA was 17.7 months with a median of 15 months (range 2 weeks to 36 months). Prevalence among the male subjects was 46/103 (45%) and that among the females was 43/92 (46%). The difference between the sex was not statistically significant (p = 0.776). There was also no difference in the age (Figure 1).

Figure 1

Prevalence of Helicobacter pylori by age

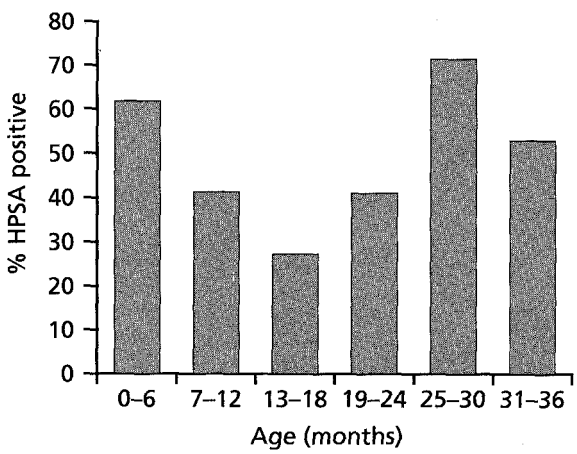

Table 2

Associations of Helicobacter Pylori and some correlates (univariate analysis)

Correlate	Stool HPSA positive		Stool HPSA negative		P-value	OR	(CI 95%)
	No.	(%)	No.	(%)			
Mothers education primary	48	*58*	34	42	0.001	2.48	1.33 -4.64
Mothers occupation manual	68	61	43	39	0.001	4.74	2.43 -9.32
Family income<Ksh 50,000 (US$ 695)	72	61	47	39	<0.001	5.32	2.64 -10.80
Place of residence-slum*	63	62	38	38	<0.001	4.34	2.27- 8.33
Sharing of bed-shared*	71	58	51	42	0.001	0.22	0.11-0.44
No. of rooms in the house							
Excluding bathroom/kitchen <1	59	58	42	42	0.001	3.0	1.60 -5.64
Toilet facilities-outside	68	61	44	39	0.001	0.22	0.11 - 0.43
Where do you dispose of the child's excreta?							
Flush	38	34	74	66	0.001		
Pit	26	61	17	40			
Other*	25	63	15	38			
Is child still breastfeeding?							
Yes	58	50	59	50	0.114	1.49	0.8 -2.78
If yes duration of exclusive breastfeeding <4 months	45	52	41	48	0.116	1.78	0.16 -5.30
Premastication-No	76	45	94	55	0.525	1.34	0.54 - 3.36
Mothers *H. pylori* status							
Positive	48	49	97	100	0.373	0.80	
Negative	16	55	29	100		0.32-1.98	

* Slum = a heavily populated urban area characterised by substandard, poor housing.

* Sharing of bed = mother sharing bed with child

* Other = places like into the sewer, a nearby river or just on the grass.

The occurrence of *H. pylori* infection was positively associated with low mothers education (p = 0.001, OR = 2.48 (1.33 - 4.64), unemployed or mother who did manual labour (p = 0.001, OR = 4.74 (2.43 - 9.32), a low family income (p = 0.001, OR = 5.32 (2.64 - 10.80), Children living in the slums 63/101 (62%) (p = 0.001, OR = 4.34 (2.27 - 8.33)), children sharing beds with their mother and 71/122 (58%) p = 0.001, OR = 0.22 (0.11 - 0.44)), those children living in crowded houses (1 room per house) 59/101 (58%) (p = 0.001, OR = 3.0 (1.60 - 5.64)),those who toilet facilities which were outside (p = 0.001), those who used pit latrines (p = 0.007) (Table 2).

When evaluating where the child's excreta was disposed, pit latrine and flush toilet were compared and the OR = 0.34 (0.15 - 0.74) while looking at flush toilet and "other" the OR = 0.54 (0.38 - 0.77).

H. pylori infection was not associated with breastfeeding nor duration of breastfeeding or premastication of food.

The mothers who were still breastfeeding at the time of the study were 55% (107/195) of those recruited into the study, with 86 mothers exclusively at three months. For the children who had stopped breast feeding it was assumed that they were already on the family diet whereby the preparation of the food was influenced by a number of hygienic factors and an increased risk faecal oral route transmission. Out of the 195 mothers who had their children recruited into the study only 66%(126/195) consented to their *H. pylori* status being checked. There was no significant association between mother's serology and their children's *H. pylori* stool prevalence.

When the following variables (mothers education, mothers occupation, family income. place of residence, type of house, sharing of bed and toilet facilities) were put into a logistic regression model (multivariate analysis), family income was the only variable that remained significantly associated with the presence of *H. pylori* infection after controlling for the other variables in the model.

DISCUSSION

This study revealed a very high prevalence rate of *Helicobacter pylori* of 45.6% (89/195) in the under three years which mirrored that of many other countries in the developing world. A study carried out in Nigeria among children aged six months to two years showed a seroprevalence of 57% (13). In a study done in Gambia using serology among children less than five years of age the prevalence was between 15-46% (14). In contrast a study in the United States found that the prevalence of *H. pylori* infection was much lower with only 5% of the under five years old positive for *H. pylori* antibody (3).

Our study results compare favourably with a study done in Cameroon where they used the same method (stool *H. pylori* antigen) in asymptomatic children and found a prevalence of 37.5% for those less than three years of age (15). In both studies the prevalence may have been low because the stool antigen test indicates active infection while the other studies (13,14) may have had a high prevalence because they used serology which test antibodies (immunoglobulin G) which continues to be positive for several months after the organism has been eradicated, leading to decreased specificity (16).

We found that the prevalence in the age groups 0-6 months (61.8%) and 7-12 months (41.3%) was high, and then declined in ages 13-18 months (27.3%) and 19-24 months (41%); and then rose again in ages 25 –30 months (71.4%) and 31-36 months (52.8%). Similar trends were found in Egypt when they studied children less than three years. Their overall prevalence was 10% with age specific prevalence ranging from 5%-15%. The prevalence of the age groups 6-11 months (14%), 12-17 months (15%) was high and it declined in the age groups 18-23 months(5%),24-29 months(7%) and rose again in the age group 30-35 months to 12% (17). A cohort study in Peru looking at children less than two years and used the C 13 Urea breath test, the prevalence rates were seen to decrease from 71% at six months to 48% at 18 months (18).

Many theories have been used to explain the trend that was observed in this study and other studies done on children. It is generally thought that following the acquisition of *H. pylori* in the absence of treatment; infection would persist through out life however based on the seroepidemiologic studies in adults and children in both the developing and developed countries it appears that spontaneous elimination of *H. pylori* infection may occur (17). Loss of infection might be related to the widespread use of antimicrobial drugs that are used for other common infections (19).

It is also thought that in young children relative protection from the pathogenic effects of *H. pylori* infection may be derived from a predisposition to T-helper cell type. TH-2 rather than a T-helper cell type, TH-1 immune response. Relative to the TH-1 response, which is associated with release of pro-inflammatory cytokines, the TH-2 response is dominated by anti-inflammatory effects. This varying immune response of the host may make the gastrointestinal tract less accommodating to the *H. pylori* survival and this may lead to spontaneous clearance of *H. Plori* in young children, a rare event in the adults (20). This may explain the trend that was seen in this study.

Education and occupation are closely linked to socio-economic status (7). This study showed that there was a high prevalence of *H. pylori* in children whose mothers had a low education level and with mothers who were unemployed or were manual workers and this was statistically significant.

Low socio-economic status has been associated with a high prevalence of *H. pylori* in many studies worldwide in North America, South America, Europe, Asia and also Africa (5). The association between infection with *H. pylori* and socioeconomic status in this study is demonstrated using the variables of mother's level of education, mother's occupation and family income. There is a strong relation between these variables and when put in a logistic regression model (multivariate analysis), family income was the only significant factor that influenced infection after controlling for the other variables. Family income determines the level of education and also where one resides. Those living in the slums live in very crowded conditions and these places have poor sanitation facilities.

In this study there was an increased risk of acquiring the infection for those who shared beds. Though in this study the serostatus of the mother was not matched with that of the child, an association between bed sharing and *H. pylori* infection was demonstrated by Duggan *et al* (2) in a study, which showed a "dose-response" effect, as the risk of infection increased significantly with the length of time of childhood bed sharing. This observation further supports the importance of close personal contact for the transmission of *H. pylori* infection. Those who lived in a one-roomed house, stayed in the slums and in semi permanent houses also had an increased risk of acquiring the infection. *H. pylori* infection tends to cluster in families and in people living in crowded close conditions (8). For this reason it is widely believed that impoverished children may acquire *H. pylori* in this manner (7,8).

Having a toilet outside, a pit latrine or communal toilets were all associated with a higher prevalence of *H. pylori* infection and these were all statistically significant. This could be explained by the poor state of hygiene. It is harder to keep a communal pit latrine clean at all times. Poor hygiene which includes poor faecal matter disposal contributes to the spread of diseases especially those that are spread through faecal-oral route. In Kenya most communities have believed that the young child's matter is safe, consequently not much effort is made to ensure safe disposal of the child's faeces.

Breastfeeding was found not to be statistically significant nor was the duration of exclusive breastfeeding. This was not in keeping with some of the other studies that had been done. Okuda in his study showed that breastfeeding protects from *H. pylori* infection in early childhood. He found that the mean period of breast-feeding of those who were *H. pylori* positive was 5.3 mo while that for the negative group was 7.8 mo ($p = 0.02$). He speculated that breastfeeding offers some protection from *H. pylori* infection in early childhood due to the high levels of lactoferrin in the human milk (22). In this study most mothers' did not practise exclusive breast-feeding for six months as recommended by the Kenyan Ministry of Health guidelines on infant feeding. In this study though the adequacy of water was not assessed, water supply in the slums is usually limited and clean running water for domestic use is a problem including hand washing. Mitchell and Megrand (23) showed that if mothers did not wash their nipples and hands prior to breastfeeding, horizontal transfer of infection might occur.

This study showed that majority of the mothers did not premasticate the food for their children. Most of the mothers mashed the food or passed it through a sieve before giving it to the babies. They considered premastication to be an outdated activity. The prevalence of *H. pylori* compared to the premastication of food was not statistically significant. A study in Bolivia found that consumption of premasticated food was not statistically significant in the transmission of *H. pylori* from mother to child (24).

H. pylori occurs in clusters and it is for this reason that it is widely believed that impoverished children may acquire *H. pylori* through contact with their mothers (6,7).

H. pylori serology status of the mothers of children recruited in this study was compared to that of their child's *H. pylori* status.

Most mothers in our study declined to have their blood taken to test for *H. pylori* despite adequate explanation. They feared that their HIV status was being evaluated and hence many declined the test. The sample size (66% of expected) was not statistically powerful to conclude that mother's serology status was not an associated factor. So our results were inconclusive.

From the findings from this study we conclude that the prevalence of *H. pylori* in children less than three years is very high, and that low-income earning families have a higher predisposition to acquiring the infection as compared to high-income families. There is a direct relationship between acquiring *H. pylori* infection and overcrowding, bed sharing and unhygienic sanitary conditions.

We recommend that improving environmental sanitation (especially cleaner toilets) and providing better housing standards at the community level would help in the reduction of acquisition of *H. pylori* infection in childhood and children with *H. pylori* infection should be followed up so as to describe the natural history of the disease in our set up (the characteristics of the children who end up having gastroduodenal disease).

ACKNOWLEDGEMENTS

To Astra Zeneca and Meridian Diagnostics of Belgium for providing kits for this study.

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