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Research Article

Epidemiology of *Helicobacter pylori* Infection in Children of Kinh and Thai Ethics in Dien Bien, Vietnam

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Abstract

Helicobacter pylori (H. pylori) infection varies among ethnic or racial groups. This study aimed to evaluate the seroprevalence and factors associated with *H. pylori* infection among Thai and Kinh children living in the same natural and social conditions in north-western mountainous region in North-West of Vietnam (Dien Bien province). In this cross-sectional study conducted in 3 communes from Muong Ang district (Dien Bien), information on socio-economic status as well as on health, style and living conditions of individuals and households of 952 children aged from 6 months to 18 years and 1,097 adults from 489 families were collected through household interview. *H. pylori* infection was determined by ELISA. Data were analyzed using χ^2-test and logistic regression. The overall prevalence of *H. pylori* infection was 42,6% in the study population; it was 42.5% (466/1,097) in adults >18 years and 42.8% (407/952) in children from 6 months to 18 years old. *H. pylori* infection in mothers, in 2 siblings and feeding children with chewed foods were identified as risk factors for *H. pylori* infection [OR (95% CI): 1.96 (1.24-3.11), 3.12 (1.34-5.46) and 1.81 (1.08-3.03); respectively]; and blood group O as well as owing latrine in the family as protective factors [OR (95% CI): 0.39 (0.18-0.83) and 0.49 (0.28-0.87); respectively]. Results of our study showed low and indifferent rates of *H. pylori* seropositivity in Kinh and Thai children. Data from this study strongly suggest that environmental and individual hygiene and some lifestyle practices should be improved to lower *H. pylori* infection in this population.

Keywords: Children; Dien Bien; H. Pylori Infection; Risk Factors; Thai; Kinh; Ethnicity

Introduction

Helicobacter pylori (*H. pylori*) infection is considered as a major cause of chronic gastritis, peptic ulcer, and gastric cancer [1]. *H. pylori* infection is less frequent in developed countries and the overall infection rate is declining worldwide [2,3]. However, *H. pylori* infection is prevalent around 75% of the population in developing countries [3]. Southeast Asia is the region where gastric cancer is the most frequent in the world, probably related to highly oncogenic characteristics of *H. pylori* isolates prevailing in this region [4]. Racial and ethnic differences in *H. pylori* infection in adults and in children had been reported and described worldwide [5-11]. To find explanatory reasons of this phenomenon, numerous putative factors had been hypothesized and studied in relation to either socioeconomic status [3-11] or characteristics of the host (human genetic and geographic distribution, migration) [12-14] or the bacterium (*H. pylori* genome evolution, genetic affinities, changes during chronic infection) [13]. In looking for preventive measures of *H. pylori* infection, it is reasonable for low-income nations to invest their modest resources in identifying risk factors for the infection in relation to the socioeconomic status of their own population.

Vietnam, a tropical country situated in South East of Asia, consisted of 54 ethnic groups with different cultures among 86 million inhabitants, of which 75-80% living in rural or remote areas [15-16]. So far in Vietnam, several institution-based and community-based studies have shown high seroprevalence of *H. pylori* infection, varying between 50 and 80% in adults and around 26 to 71.4% in children [17-21]. Different risk factors for *H. pylori* infection had been identified in Kinh ethnic majority [17-21] and in some among 53 other ethnic minorities [22,23]. As the socioeconomic level and lifestyle vary considerably among ethnic groups of the country, the prevalence of *H. pylori* infection and particularly risk factors for this infection were different in previous studies [17-23]. Thai people**,** the second largest minority ethnic among 53 other ethnical minority groups, settle in the mountainous northern region of Vietnam. Although living together with Kinh people for centuries, Thai people have their economic conditions as well as their own habits, customs and cultural practices that differ from those of Kinh co-habitants [15]. That made it appealing to study the prevalence of *H. pylori* infection and risk factors for this infection in purpose of shaping appropriate measures for preventing and managing the infection in such a subpopulation. The aim of the present study was then to evaluate the seroprevalence of *H. pylori* infection and factors associated with the *H. pylori* infection among Thai and Kinh children and adults living in the same natural and social conditions in Dien Bien.

Population and methods

Study population

Thai ethnic, the second largest minority group living in the in the mountainous northern region of Vietnam, was reported 1,550,423 at the 2009 consensus [16]. One of the most important aggregations of Thai was found in Muong Ang district, Dien Bien province where we carried out this cross-sectional community-based study. After obtaining written consent from local administrative and health authorities we collected data from 2,049 members of all generations living together in the same home (952 children under 18 years old and 1,097 adults) of 489 households in three communes where Thai and Kinh people lived together for long time. To avoid a selection effect, children under 6 months old were excluded due to the likelihood of residual maternal *H. pylori* antibody, as well as those with severe diseases or immuno-compromised status due to a possibly altered immune response. A verbal consent was obtained for each household member involved in the study. The study protocol had been approved by the ethics committee of Hanoi Medical University.

Data collection

In this cross-sectional study, data had been consecutively collected from the first household of the study community to the next one to accomplish full sample size. We used a structured questionnaire, as in previous studies [18-23] for data collection on socio-demographic, health status and potential exposure. The questionnaires were completed by the study investigators and information was collected from the head of the households. Blood samples were collected from all participants (i.e. *all members of each household*) by venous puncture and were immediately centrifuged. Sera were separated and preserved in vaccine thermos, then sent to the reference laboratory (Microbiology Division of Digestive Diseases, National Institute of Epidemiology and Hygiene) on the same day where sera were stored at -20°C and processed as previously described [24].

Variable definitions

H. pylori infection was determined by in-house ELISA for dosage of *H. pylori* IgG antibody against specific *H. pylori* antigen. The ELISA was carried out in the reference laboratory (Microbiology Division of Digestive Diseases, National Institute of Epidemiology and Hygiene) using sonicated Swedish and Vietnamese *H. pylori* strains as antigens prepared and validated in the Microbiology Department, Karolinska Institute, Stockholm for use in Vietnamese adults and children (sensitivity of 99.6%, and specificity of 97.8%) [24]. Children's sera with a value equal to or over 0.18 optical density (OD) unit were classified positive.

Socio-demographic variables consisted of age and sex of all children and adults in every household, monthly family income classified into three categories (i.e. < 500.10^3 VND, actual national minimal monthly income, 500-1,000, and > $1,000.10^3$

VND), household space (in 3 categories, i.e. up to 10m^2/capita according to national mean standard, 10-20 and > 20 m^2/capita), parents' occupation and parents' education level [16].

Potential exposure variables were divided into three major subgroups: (1) *Environmental, individual hygiene and life-style* including water sources classified in 2 main sources (family well and others such as streams, raining or collective well), latrine in 2 main types (existence or not), pet (dog or cat) in the house in 2 categories (presence or not), behavior of children on hand washing before meal and after toilet in 2 categories (*not regular* for those who practiced less frequently than one per twice, and *regular* for those who practiced every time or every of other time), mouth-to-mouth feeding from mothers or caregivers to child in 2 categories (*regular* or not), breast feeding duration in 2 categories (*shorter* or *longer* than 12 months of age). (2) *Promiscuity* including sibling size in 2 categories (≤ 2 or ≥ 3), sharing a bed in 2 categories (with 1 and with ≥ 2 persons), collective life initiation in 2 categories (< 3 years and ≥ 3 years of age). *(3) Health status variables* consisted of *H. pylori* infection status in parents and sibling (*H. pylori* seropositivity or seronegativity), *g*astro-duodenal history of child and parents (defined as having had a gastro-duodenal disease if this disease was diagnosed and treated by health-givers from district health center or higher levels) in 2 categories (presence or absence), and history of child's antibiotic use during the previous 6 months determined from individual health booklets or in-depth interviews of the main caregivers, in 2 categories (absence or presence).

Statistical analysis

First, study population characteristics were compared according to their *H. pylori* infection status using the Chi square (χ^2) test. As one of the major aims of our study was to detect the factors potentially influencing *H. pylori* infection in this subpopulation, the appropriate strategy of analysis must be able to control for mutual confounding, point out the risk factors and avoid overlooking important associated variables. We then analyzed separately the associations between *H pylori* infection status with the demographic and socio-economic variables and with variables related to potential exposure. Analysis was performed firstly by univariate technique, by adjusting in each group on every variable, and finally by using backward stepwise conditional logistic regression to select variables importantly associated with *H. pylori* infection within each group, including all variables significantly associated with *H. pylori* seropositivity after adjustment and those with *p* values less than 0.20 by Chi square test. Associations were expressed as odds ratio (OR) and their confidence intervals (95% CI). Finally, backward stepwise conditional procedures were used again to include in the final model not only variables independently associated with *H. pylori* serological status in each group, but also those known to be important for transmission pathways. Statistical significance was set up at the 0.05 level. All *p* values were 2-tailed. Data were analyzed using SPSS software (SPSS® for Windows™ version 16.0 Copyright SPSS Inc.).

Results

In this cross-sectional community-based study, data from 2,049 members (Kinh accounting for 1,058 or 51.6% and Thai 991 or 48.4%) of all generations living together in the same home (952 children under 18 years old and 1,097 adults) of 489 households (Thai accounting for 43% or 209 households) were collected. Among 2,049 individuals enrolled in the study, 873 were positive for *H. pylori* infection (42.6%) (Table 1).

H. pylori seropositivity rates in adults and in children up to 18 years old were respectively 42.5% (466/1,097) and 42.8/% (407/952). Either in adults or in children, there was no significant difference in *H. pylori* seropositivity between male and female (*p> 0.05*) or between Kinh and Thai (*p> 0.05*). *H. pylori* seropositivity in children in relation to socio-demographic variables was presented in Table 2.

No statistically significant relationship was found between *H. pylori* seropositivity and sex, ethnicity, age groups of children or variables related to socio-economic status of their household. Nevertheless, the rate of *H. pylori* seropositivity in children with blood group O was significantly lower than those in children with other ABO blood groups (*p< 0.001*). *H. pylori* seropositivity in children in relation to environmental, individual hygienic status and children life style was reported in Table 3.

Children living in families utilizing water from home well were lower rate of *H. pylori* seropositivity than those using water from spring or other sources (*p=0.015*). Children of families without latrine were more likely to be far higher *H. pylori* seropositive than others (*p<0.001*). Moreover, children with bad practice of hand toilet (irregular hand washing after making stool) and those who regularly received chewing food from care-givers seemed likely more *H. pylori* positive than others (*p<0.001*). *H. pylori* seropositivity in children in relation to variables related to promiscuity, health status in parents as well as antibiotic use in children was presented in Table 4.

No relationship between the rate of *H. pylori* seropositivity in children and variables related to promiscuity, *H. pylori* infection in fathers, gastroduodenal disease, allergic history in parents and history antibiotic use within 12 months in children was observed. However, children whose mother or sibling were infected by *H. pylori* were further higher *H. pylori* seropositive than others (*p< 0.005* and *p< 0.001*, respectively). Results of final model analyzing association between *H. pylori* seropositivity in children and variables that were statistically significant in univariate analysis were presented in Table 5.

Table 1. *H. pylori* seroprevalence in study population in relation to sex, age and ethnicity.

Variables	Overall		Adults (≥ years)		Children (< 18 years)	
	N (%)	HP(+)	n (%)	HP(+)	n (%)	HP(+)
Sex **Male**	1004 (49.0)	420 (41.8)	504 (45.9)	219 (43.5)	500 (52.5)	211 (42.2)
Female	1045 (51.0)	453 (43.4)	593 (54.1)	247 (41.7)	452 (47.5)	196 (43.4)
p	0.488		0.968		0.896	
Ethnic **Kinh**	1058 (51.6)	458 (43.3)	562 (51.2)	238 (42.3)	496 (52.1)	220 (44.4)
Thai	991 (48.4)	415 (41.9)	535 (48.8)	228 (42.6)	456 (47.9)	187 (41.0)
p	*0.518*		*0.876*		*0.297*	

Table 2. *H. pylori* seropositivity in children in relation to demographic and socioeconomic variables.

Variables		***H. pylori* infection in children**			
		N	**HP(+) n (%)**	**P**	**OR (95% CI)**
Sex	Male	500	211 (42.2)		1.00
	Female	452	196 (43.4)	*0.717*	1.05 (0.81-1.42)
Age group (year)	≤3	110	51 (46.4)		1.00
	3-6	274	121 (44.2)		0.92 (0.82-1.49)
	6-10	236	95 (40.3)	*0.786*	0.71 (0.45-2.14)
	10-18	332	140 (42.2)		0.79 (0.52-2.38)
ABO blood group	A	187	84 (44.9)		1.00
	B	342	166 (48.5)	*<0.001*	1.15 (0.84-1.72)
	O	*338*	*115 (34.0)*		*0.63 (0.41-0.92)*
	AB	85	42 (49.4)		1.2 (0.72-2.24)
Ethnic	Kinh	496	220 (44.4)		1.00
	Thai	456	187 (41.0)	*0.297*	0.88 (0.71-1.12)
Monthly income (10^3 VND/capita)	< 500	668	291 (43.6)		1.00
	500-1.000	232	75 (35.7)	*0.88*	0.83 (0.72-1.32)
	> 1.000	52	20 (38.5)		0.96 (0.61-1.82)
House space (m^2/person)	< 10	411	159 (38.7)		1.00
	10-20	489	219 (44.8)	*0.03*	1.29 (0.92-1.75)
	>20	52	29 (55.8)		2.00 (1.12-3.61)

Father occupation	Farmer	355	157 (44.2)	*0.59*	1.00
	Other	271	114 (42.1)		0.92 (0.73-1.32)
Mather occupation	Farmer	412	173 (41.9)	*0.75*	1.00
	Other	301	130 (43.2)		1.05 (0.81-1.42)
Father education level	> secondary	389	145 (37.2)	*0.64*	1.00
	≤ secondary	237	97 (41.1)		1.18 (0.85-2.24)
Father education level	> secondary	454	159 (35.2)	*0.94*	1.00
	≤ secondary	259	108 (41.6)		1.25 (0.91-1.85)

Table 3. *H. pylori* seropositivity in children in relation to environmental, individual hygienic status and children life style.

Variables		**N**	***H. pylori* infection in children**		
			HP(+) n (%)	***p***	**OR (95% CI)**
Water Sources	Spring	201	100(49.8)	0.015	1.00
	Home well	683	273 (39.9)		0.65 (0.41-0.94)
	Other	68	34 (50.0)		1.05 (0.62-1.82)
Latrine use	Yes	596	225 (37.6)	*<0.001*	1.00
	No	356	174 (48.9)		1.57 (1.32-2.51)
Food taking by hand	No	705	296 (41.9)	*0.449*	1.00
	Yes	247	111 (44.9)		1.12 (0.83-1.50)
Increment use in field	No	521	212 (40.7)	*0.160*	1.00
	Yes	431	195 (45.2)		1.21 (0.93-1.62)
Regular hand washing before meal	Yes	153	59 (38.6)	*0.240*	1.00
	No	799	348 (43.5)		1.24 (0.86-1.77)
Regular hand washing after defecation	Yes	137	48 (35.0)	*0.050*	1.00
	No	815	359 (44.1)		1.46 (1.00-2.14)
Regular receiving chewing food in childhood	No	593	229 (38.7)	*< 0.001*	1.00
	Yes	359	178 (49.6)		1.56 (1.23-2.00)
Breastfeeding duration (month)	< 12	407	161 (39.6)	*0.071*	1.00
	>12	501	228 (45.6)		1.28 (0.92-1.71)

Table 4. Children *H. pylori* seropositivity in relation to promiscuity, status of *H. pylori* infection and gastro-duodenal (GD) disease, history of allergy in parents and antibiotic use in children.

Variables		*H. pylori* infection in children			
		N	HP (+) n (%)	*p*	OR (95% CI)
Initiation of collective life (year)	≤ 3	327	106 (32.4)	*0.591*	1.00
	> 3	408	137 (33.6)		1.14 (0.81-1.62)
Regular sharing bed	With 1	647	287 (44.36)	*0.144*	1.00
	With ≥2	305	129 (39.34)		0.89 (0.67-1.92)
H. pylori infection in father	(-)	388	155 (39.9)		1.00
	(+)	313	145 (39.9)	*0.090*	1.29 (0.93-1.81)
H. pylori infection in mother	(-)	356	137 (38.5)		1.00
	(+)	272	136 (50.0)	*0.004*	1.59 (1.23-2.23)
H. pylori infection in parents	Both (-)	113	44 (38.9)		1.00
	Either (+)	459	207 (45.1)	*0.220*	1.29 (0.82-1.93)
	Both (+)	63	37 (58.73)	*0.012*	2.21 (1.21-4.23)
H. pylori infection in sibling *	1 sibling (+)	427	252 (59.0)	*<0.001*	1.00
	2 siblings (+)	190	155 (81.1)		3.84 (1.62-6.29)
GD disease in father	No	335	142 (42.4)		1.00
	Yes	105	38 (36.2)	*0.260*	0.92 (0.631-1.33)
GD disease in mother	No	423	178 (42.1)		1.00
	Yes	127	51 (40.2)	*0.700*	0.82 (0.57-1.17)
Allergy history in father	No	529	234 (44.2)	*0.266*	1.00
	Yes	97	37 (38.1)		0.86 (0.67-1.46)
Allergy history in mother	No	626	268 (42.8)	*0.642*	1.00
	Yes	88	35 (39.8)		0.91 (0.82-1.34)
Antibiotic use within 12 months in children	No	677	289 (42.7)		1.00
	Yes	273	117 (42.9)	0.960	0.91 (0.83-1.31)

* 335 children belonging to households without *H. pylori* positive offspring

No relationship between the rate of *H. pylori* seropositivity in children and variables related to promiscuity, *H. pylori* infection in fathers, gastroduodenal disease, allergic history in parents and history antibiotic use within 12 months in children was observed. However, children whose mother or sibling were infected by *H. pylori* were further higher *H. pylori* seropositive than others ($p< 0.005$ and $p< 0.001$, respectively). Results of final model analyzing association between *H. pylori* seropositivity in children and variables that were statistically significant in univariate analysis were presented in Table 5.

Table 5. Results of final model of logistic regression analysis.

Variables	OR (95% CI)
Blood group O	0.39 (0.18-0.83)
Latrine presence in family	0.49 (0.28-0.87)
Receiving chewing food	1.81 (1.08-3.03)
H. pylori infection in mother	1.96 (1.24-3.11)
H. pylori infection in 2 siblings	3.12 (1.34-5.46)

** The variables in the final model were included using a backward selection algorithm among variables that were statistically significant in univariate analysis (blood group, latrine use, regular receiving chewing food in childhood, regular taking food by hand, regular hand washing before meal, regular hand washing after defecation, H. pylori infection in mother, H. pylori infection in sibling) and adjusted for sex, age and ethnicity.*

In the final model of multivariate analysis, low risk for *H. pylori* infection in children was independently associated with 'blood group O' and 'presence of latrine in the family'. In contrast, regular feeding children with chewing food in childhood, *H. pylori* infection in mother and in *H. pylori* infection siblings in particular was independently associated with higher risk for *H. pylori* infection in children.

Discussion

Up to date, most of the population based *H. pylori* prevalence studies are exclusively done on adults or children and were used small sample size [17-22]. In those small studies it was difficult to interpret the result considering close host-bacterium-environment interaction. In this cross-sectional community-based study, data from 2,049 of all generations living together in the same home of 489 households were collected. Our results showed a *H. pylori* seroprevalence of 42.6% (42.8% in children from 6 months to 18 years *versus* 42.5% in adults), with a slight increase in *H. pylori* seroprevalence under 3 years of age, without significant difference between Kinh majority and Thai minority ethnics. Our study allowed identifying blood group O and presence of latrine in the family as protective factors, but *H. pylori* infection in mothers, in siblings and regular receiving chewing food in childhood as risk factors for infection in *H. pylori* children.

The overall seroprevalence of *H. pylori* infection of 42.6% with 42.8% in children under 18 in this study was comparable to 45.2% (892/1,968) with 40.0% (476/1,186) in children reported by Le *et al* (2012) in a community-based study carried out in a population of Kinh and 4 other minority ethnics in central highland (Tayngyuen) [23]. This rate was slightly higher than 38.5% (301/781) with 26.7% (109/408) in children under 18 observed in our previous study in 2007 carried out in a population of Kinh and 3 other minority ethnics in a mountainous area of northern border (Lao Cai province) [22]. However, the rate of *H. pylori* seroprevalence in the present study was lower than those reported in other community-based studies in Vietnam [17-21]. In a community-based study in Kinh majority ethnic in Hanoi (2003), Hoang *et al* reported a rate of *H. pylori* seroprevalence of 58.2% (310/533) with 47.3% (112/327) in children [17]. In another community-based study in Kinh of a rural area from Nghe An (2007), we observed an overall rate of *H. pylori* seroprevalence of 61.5% (525/854) with 55.5% (213/384) in children [21].

Differences in prevalence of *H. pylori* infection among racial and ethnic groups have been so much described in the literature [9-11]. However, it is not clear yet to what extent such differences can be ascribed to socioeconomic factors and other possible risk factors. This community based-study, enrolling 2,049 members of all generations living together in the same home of 489 households of Thai and Kinh cohabiting for decades on the same ground, did not find any difference in *H. pylori* seropositive rates between 44.4% in Kinh children (220/496) and 44.0% in Khmer ones (187/456). Kinh and Thai are naturally different in genetics and they may be influenced by different flows of migration and then bacterial sources as reported recently by Breurec *et al* [14]. In addition, several traditional habits and numerous practices in lifestyle are inevitably different between Kinh and Thai. However, the fact that the two ethnics are subjects of similar *H. pylori* seropositive rates in our study suggests major role of similar socioeconomic conditions as well as events and suffering that they shared during long centuries of natural circonstances in close mutuality and cohabitation. This fact may be partly influenced by not only cultural but also biological crosses appeared between the two ethnics in the long history of cohabitation. In reality, inside many households, administratively fathers or mothers are Kinh or Thai for actual generation, but biologically they inherited a repeatedly mixed ethnicity in the past during long history of living together. Even at present, as far as we know during the field work, cross marriage between Kinh and Thai is not rare. Nevertheless, the same and the different rates of *H. pylori*infection in different ethnics observed in our population-based studies are always puzzled and perplexed facts. In our previous community-based study in 2007, enrolling 784 members of 245 households of Kinh majority and 4 other minority ethnics (Day, Hmong, Tay, Dao) living in a mountainous area in northern border, no significant difference in *H. pylori* seropositive rates between 41.0% (16/39) in Kinh and 38.1% (52/135) in Giay cohabiting in an agglomeration. Interestingly, these rates were far higher than 20.3% (15/74) in Dao and 16.7% (6/36) in Tay as well as 16.1% (20/124) in Hmong, who lived in remote areas, completely separately from the group of Kinh and Day ($p< 0.001$) [22]. The thing is totally adverse in another community-based study recently carried out in central highland, enrolling 1,968 members of 498 households, including 782 adults and 1,186 children under 15 years old (381 Kinh, 342 K'ho, 212 Ede and 246 Raglai children). This study did not show any significant difference in *H. pylori* seropositive rates between King majority children (35.3%) and K'ho minority ones (36.0%) living together on the same mountainous ground nearby Dalat town. Surprisingly, *H. pylori* seropositive rates in children of two minority ethnics (47.6% in Ede and 47.2% in Raglai) living far away in very remote mountainous areas were far higher than that in Kinh and K'ho ($p< 0.01$) [23]. Because no major differences in *H. pylori* seropositive rateswere found to be correlated with studied variables related to socioeconomic status, habits and lifestyle of study populations, and data on bacterial nature as well as on human genetics of the study populations were not explored yet, it is impossible to propose any explanative hypothesis for the fluctuation in *H. pylori* seropositive rates in our studies in Vietnam.

Potential exposure variables in relation to environmental and individual hygiene as well as exclusive habits and life-style have been always sought by investigators in epidemiological studies on *H. pylori* infection [5,11,30-33], in developing countries in particular [3,18-23]. Their target was to identify risk factors that are potentially intervenable or preventable so as to feasibly interrupt transmission pathways of this ubiquitous infection. However, researchers worldwide had hardly identified or ascertained any consistent risk factor among numerous attributive variables. As mouth-to-mouth or feces-to-mouth transmission has been ascribed to the most important or unique way for *H. pylori* to get to the host, so much attention had been done by researchers worldwide to seek out the pejorative role played by different putative variables in relation to food manipulation and feeding, vegetables, water and toilet practices. Running water, raw vegetables, chop stick use, chewing feeding had been some where reported prejudicial as risk factors for *H. pylori* infection [3,29,30,32,33], they were, however, not at all consistent in other studies of the kind. In the present study, 'using water from home well" and 'regular washing hand after defecation', though significantly associated to lower *H. pylori* seropositivity in univariate analysis, were not likely to be risk factors for the infection in multivariate analysis, the same as observed in our previous studies [18-23]. In contrast, 'owing latrine in the family' appeared as protective factor and 'receiving chewing food in childhood' as risk factors for *H. pylori* infection in this population in the final model using multivariate logistic regression analysis. This is the first time these variables manifested its role on *H. pylori* infection, although that had been desperately sought out in our previous studies in Vietnam [18-23]. In our opinion, more confirmative studies seem warranted and reasonable to confirm the role these variables veritably play in *H. pylori* infection for children, because it would be extremely important for this fact in health education to this population.

Intrafamilial clustering of *H. pylori* infection with predominant role of mothers and siblings as sources of *H. pylori* transmission to children has been largely reported worldwide [34-41]. The fact had been confirmed in Vietnam by our previous studies [30-35] and reconfirmed by this study. Our data showed that *H. pylori* seropositive rate in children whose mothers were infected by *H. pylori* was 50%, significantly higher than 38.5% in those whose mothers were *H. pylori* seronegative (*p=0.004*). *H. pylori* infection in one sibling and in 2 siblings in the family rendered other siblings more likely to be infected (252/427 or 59% and 155/190 or 81.1%, respectively, in comparison to 407/952 or 42.8/% in all children subpopulation). The fact that *H. pylori* infection in siblings influenced more on the infection of other children than the infection in the mother might be explained by longer and closer contact between siblings than with mother, because in Vietnam, like in most developing countries, after the first year of age, children spent more time to play and to sleep together with siblings than with mother and with father.

Before *H. pylori* era, several epidemiological studies had found that nonsecretors of ABO blood group antigens and individuals of blood group O were overrepresented among patients with peptic ulcer [42]. This fact encouraged so many researchers to investigate the relationship between ABO blood groups and their secretor status with peptic ulcer. Many authors had reported an association between blood group O and *H. pylori* infection [43-45], while others failed to find such an association [46-48]. For the first time in Vietnam, we explored the relationship between ABO blood groups and *H. pylori* infection in the present study. Our results showed that individuals with blood group O were significantly less prone to *H. pylori* infection than others [OR (95% CI): 0.63 (0.41-0.92)]. This finding was partly compatible with results reported by Kanbay et al (2005) who found that individuals with blood groups A or O were more prone to *H. pylori* infection and those with blood group AB was less prone to this infection [43]. In addition, Jaff *et al* recently studied in Iraq (2011) and found that *H. pylori* seropositive rate was significantly higher in individuals with blood group O (*p=0.01*) and significantly lower in those with blood group B (*p=0.007*) when compared with that in general population, and also when compared with that in seronegative individuals with *p=0.0397* and *p=0.0495*, respectively [44]. More recently in Japan, Inoue *et al* (2014) found that among the group of people taking yogurt or beverage containing lactic acid bacteria more than 5 times a week, individuals with blood group B less prone to *H. pylori* infection than those taking that stuff less than 3 times a week; and no difference in *H. pylori* infection between those with blood group O and those with other than O group (i.e. A, B and AB groups). Among individuals without taking that stuff, the tendency of being less prone to *H. pylori* infection disappeared and individuals with blood group O were more prone to *H. pylori* infection than those with other than group O [OR (95% CI): 2.59 (1.12-6.22)] [49]. Results observed by Inoue *et al* strongly suggested that differences in intake of dairy products affected the relationship between *H. pylori* infection and the ABO blood group system. In a general meaning, that implied the important role of different daily intake that could change the interaction between the bacteria and host reaction. This topic seems very attractive and worthy to invest more investigation.

In this cross-sectional community based-study, we recruited a large population (2,049 individuals) who were all members of all generations living together in the same household. This method of sampling facilitated the data analysis and interpretation, provided a more comprehensive understanding about the interaction or interrelation between studied variables and *H. pylori* infection. Therefore, it rendered more feasible and more reliable for risk factors to be identified among studied socio-demographic and potential exposure variables. Different weaknesses in this study are issued from the limitation of structured questionnaire reluctantly adopted facing to shortage in human and financial conditions. The first limitation resides in recall bias inevitably committed by respondents during interview. One more limitation is ambiguity and difficulty to calculate exact income per capita per month considering diversity in homemade and self-serving products, very popular in this population living in remote and mountainous areas of Dien Bien. Another point of limitation issued from lack of knowledge of participants in recognizing history of gastroduodenal disorders and loss of health booklet or medical prescription in many cases, sources of inaccuracy in deciding whether someone had suffered from digestive disease in relation to *H. pylori* infection.

As evidences from scientific data become only useful when results from academic studies are served as pivotal points for transforming community health through health care strategy of local health authorities by constructing appropriate models of health care management as developed for the first time by Wagner et al (1998) and generally conceptualized by WHO (2002) [50] and successfully implemented by Ciccone et al (2010) [51]. Vietnam has been well known since 1970s for the highly effective and sustainable community (village) health system [52] that enables us to transfer evidences from scientific studies to improve national population health in general and better care inhabitants in study sites in particular. In fact, results from our study not only served as baseline for building national strategy of public health policy, but also had been handovered to local health authority who informed the health care-givers team working in the field to transfer scientific evidences into daily practice to improve the quality of care and to back up the health education activities.

Conclusion

This first community-based study of epidemiology of *H. pylori* infection in a population of Kinh and Thai settled together in mountainous and remote areas in Dien Bien showed low and indifferent rates of seropositivity of *H. pylori* infection in both ethnics. Moreover, results of our study strongly suggest that environmental, personal hygiene and some life style practices should be improved to lower the prevalence of *H. pylori* infection in this population.

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Conflicts of Interests

No competing interests exist in this study.

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