Helicobacter pylori and Associated Factors among Symptomatic and Asymptomatic School-Aged Children Attending Hiwot Fana Specialized University Hospital, Eastern Ethiopia

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Abstract

Background: *Helicobacter pylori* infection is significantly higher in developing nations. It is mainly acquired during childhood and is strongly linked to several stomach conditions ranging from gastritis to gastric cancers. However, there is limited information concerning its occurrence and infection and associated factors among school-age children in Ethiopia. This study aimed to assess the prevalence of *Helicobactor pylori* infection among school-aged children attending the outpatient department of Hiwot Fana Specialized University Hospital, Eastern Ethiopia.

Methods: An institutional-based cross-sectional study was conducted among 1038 school-aged children attending Hiwot Fana Specialized University Hospital outpatient department from 01 January to 30 November 2019. The study population with and without a clinical manifestation of *Helicobactor pylori* was enrolled consecutively until the intended sample size was achieved. Data were collected through an interview using a structured questionnaire. A stool was collected and tested for the *Helicobacter pylori* antigen. Data were analyzed by using the Statistical Package for Social Sciences version 20.0 program. Chi-square and logistic regression models were used to determine the predictor of the outcome variable. A p-value of less than 0.05 was taken as the significant level.

Results: Out of 993 (280 symptomatic and 713 asymptomatic) school-aged children, 173(17.4%) (95 % CI: 15.2-19.7) were positive for *Helicobacter pylori* infection. The prevalence was higher in symptomatic 54(19.3%) compared to asymptomatic 119(16.7%) school age children (p>0.05). Children in the ages group of 10-12 years (AOR: 1.53, 95% CI: 1.09, 2.15), did not attend formal school (AOR: 1.65, 95% CI: 1.12, 2.42), and shared sleeping accommodation with two or more persons (AOR: 1.67, 95% CI: 1.11, 2.50) had higher odds of acquiring *Helicobacter pylori*.

Conclusion: The overall prevalence of *Helicobacter pylori* is high. Age of the child, educational status, and shared sleeping accommodation were identified factors. This calls for improving personal hygiene at the age group of 10-12, avoiding sharing sleeping accommodation and educating the child might reduce the acquisition of *Helicobacter pylori* infection.

Keywords: *H. pylori infection*, school-age children, asymptomatic, symptomatic

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Introduction

Helicobacter pylori (*H. pylori*) infection is the most common human infection worldwide with approximately 50% of the population infected. The infection is usually acquired during childhood, but it is pronounced in adulthood (Salih, 2009), the process that leads to morbidity starts in childhood, as childhood is the critical period for acquiring the infection (Smith *et al*., 202019). *H. pylori* is more common in-developing countries where two-thirds of children are infected (Dore *et al.,* 2012; Hooi *et al.,* 2017). The prevalence of *H. pylori* infection varies from 25% to 90%, depending on the age, geographic location, and socioeconomic status of the population. At least 65.7% of the population of Ethiopia, is infected (Birhaneselassie and Alemneh, 2017).

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The host genetic factors and/or *H. pylori* strains may determine the clinical significance of the infection. Individuals with blood group O and Lewis B antigen are more likely to develop gastritis since these antigens mediate the attachment of *H. pylori* to the gastric mucosa. It was also shown that the frequency of the O blood group and non-secretor phenotype of ABO (A, B, AB) antigens are higher among patients with peptic ulcer (Jaff, 2011; Lopes *et al*., 2013). However, the study reported the absence of an association between *H. pylori* infection and ABO blood groups (Chakrani *et al*., 2018).

The presence of symptoms is a controversial area in the diagnosing and manageming of *H. pylori* infection. The *H. pylori* management guidelines, target the disease manifestations as the potential cause of the symptoms and not necessarily the infection itself (Correa *et al*., 2016; Gold *et al*., 2014). Many *H. pylori* infections are silent and without clinically apparent symptoms. When symptoms do occur, they are primarily the result of gastric or peptic ulcer disease, rather than the actual infection (Correa *et al*., 2016; Dore *et al.,* 2012).

Person-to-person transmission of *H pylori* is most commonly implicated with fecal-oral, oral-oral, or gastric-oral pathways (Dilnessa and Amentie, 2017). As childhood is a period of high risk for the acquisition of *H. pylori*, a good understanding of the mode(s) of transmission in children is required to identify how to break the chain of transmission of the infection (Aitila *et al.,* 2019; Muhsen *et al*., 2015).

Studies have found that *H. pylori* directly impacts on the quality of life and the likelihood of developing additional diseases during adulthood. The ideal time to prevent *H. pylori* infection is during childhood (Pacifico *et al*., 2010, Taye *et al*., 2016). There is also a need for each community to determine the prevalence and make attempts to delineate the factors associated with the infection, particularly during childhood. In Ethiopia, studies have been conducted on adults (Dilnessa and Amentie, 2017), and the infection status in school-age children is unknown. This study aimed to explore the prevalence of *H. pylori* infection and associated factors among school-aged children attending the outpatient department of Hiwot Fana Specialized University Hospital, Eastern Ethiopia.

Materials and Methods

Study Design, Area, and Period

A comparative cross-sectional study was conducted among children who attended the outpatient department of Hiwot Fana Specialized University Hospital, Harar, eastern Ethiopia from 01 January to 30 November 2019. It is located in Harar town Regional State. Harar is one of the historical places found 525 km from Addis Ababa. Harar town has of 4 hospitals, 10 health centers, and 20 health posts. More than 100% and 80% of the town's residents have access to health care, and education, respectively (Dessie *et al*., 2014). Hiwot Fana Specialized University Hospital is the teaching hospital for the College of Health and Medical Sciences of Haramaya University. The average school-age children's daily patient was 12 (Hiwot Fana Specialized University Hospital database, unpublished).

Population

Both symptomatic and asymptomatic school-age children were included in the study. Children with severe diseases or immune-compromised status like HIV/ AIDS, those who took treatment for *H. pylori* within the last 14 days and could not provide stool sample for different reasons were excluded from the study.

Sample Size and Sampling Technique

The sample size was determined by using single population proportion formula by taking the prevalence of *H. pylori* (70.1%) among asymptomatic (Avau *et al*., 2015), and 13% among symptomatic school-aged children from a study conducted in Porto Torres, Sardinia, Italy (Dore *et al.,* 2012), 95% confidence interval and a margin of errors of 0.05 and 10% non-response rate. The final size was 1038. Equal number of the study population with and without a clinical manifestation of *H. pylori* was enrolled consecutively until the intended sample size was achieved. This was because of the lack of data that describe the total number of school-age children with confirmed *H. pylori* infection from the Hiwot Fana Specialized University Hospital.

Methods of Data Collection

Data were collected through face-to-face interviews from the parents/ guardians by a senior nurse to gather the following information: Socio-demographic characteristics such as the age of a child, sex, educational status, occupation of family, educational level of fam-

ily, residence, and family size; and environmental factors such as access to indoors or outdoors potable water, access to indoors or outdoors toilet facilities, medical history and medications taken two weeks before the interview. The questionnaire was developed from similar literature (Abebaw *et al*., 2014; Birhaneselassie and Alemneh, 2017; Tadesse *et al.,* 2014). In addition, clinical examination of children was conducted by senior Health officers. Consultation with a senior physician was made for difficult cases.

Blood collection and ABO blood grouping; A 2ml blood sample was obtained from each study participant through venipuncture under aseptic conditions into the ethylenediaminetetraacetic acid vacutainer tube, mixing the blood properly by inverting the tube 6-8 times to avoid the formation of small clots. The ABO blood group was performed using unknown red cells against known anti-A, and anti-B antibodies (Croma test, linear chemicals S.L) on a slide.

Stool collection and antigen testing; approximately, three grams of stool sample was collected in a clean screw-capped plastic container. *H. pylori* antigen was detected using the commercially available SD BIOLINE™ *H. pylori* stool antigen test (Standard Diagnostics, Inc) with 98.4% sensitivity and 100% specificity (Negash, 2018). The test was performed according to the manufacturer's instructions. In brief, a portion of the stool sample (2gm) was transferred to a vial with diluents, gently mixed, and transferred two to three drops (80μL) into the round port of the test cassette. Reading was made after 10 minutes of incubation at room temperature and based on the appearance of colored lines across the central window of the cassette, two lines, “C” (control) and “T” (test) indicate a positive test and only one line in “C” indicates a negative result. If no line appears in the control window the test is considered invalid.

Data Quality Assurance

The questionnaire first prepared in English was translated into the local languages (Amharic, and Afan Oromo) by bilingual experts and back-translated to English to cross-check for consistency. Before the actual data collection period, it was pre-tested on 5% of the study participants at the outpatient department of Dilchora Hospital, Dire Dawa, Ethiopia. Data collectors were trained before data collection. Supervisors also made daily follow-up. Standard operating procedures were followed strictly and internal quality control materials were included in the test kits. The reagents were stored unopened at 4°C based on manufacturer instructions.

Definition of Terms

Asymptomatic: includes the following or a combination of conditions: never had dyspepsia, any symptoms of dyspepsia, or any anti-acid drug for the last two or more years (Birhaneselassie and Alemneh, 2017).

Symptomatic: include one or more of the following symptoms of peptic ulcer disease and non-ulcer diseases such as upper abdominal discomfort, retrosternal pain, anorexia, nausea, vomiting, bloating, fullness, early satiety, heartburn, epigastric tenderness, hematemesis melena, and weight loss (Dore *et al*., 2012).

School-age children: refer to children whose aged 6 to 12 years (Mount, 2020).

Data Processing and Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0. Continuous variables were summarized using mean (±SD) and categorical variables were summarized in frequencies (percentages). The Chi-square test and logistic regression were used to determine the predictors of *H. pylori* infection. Independent variables with a p-value less than 0.20 in bivariate analysis were further tested via multivariable logistic regression to account for potential confounding. A p-value less than 0.05 was considered statistically significant.

Ethical Consideration

The research protocol was approved by the Institutional Health Research and Ethics Review Committee (IHRERC) of the College of Health and Medical Sciences of Haramaya University. Data collection from each study participant was started after they gave written and signed informed consent. Results were communicated to respective physicians/clinicians for proper management of the study participants. The privacy and confidentiality of the study participants were assured.

Results

Socio-Demographic Characteristics

Of the total 1038, 993 children participated; giving a response rate of 95.7%. Of these, 480(48.3%) were symptomatic and 513(51.7%) were asymptomatic school-aged children. The majority of the children

were females 689(69.4%), and in aged 6-9 years 560(56.4%). The mean age was 10 (SD ±2) years. Three hundred ninety-one (39.4%) of the participants had O blood type. Most of the participants, 882 (88.8%), were from rural areas. Four hundred sixty-five (46.8%) of the participant's families earned a monthly income of more than 2999 Ethiopian Birr (Table 1).

Table 1. Socio-demographic characteristics of symptomatic and asymptomatic school-aged children attending the out-patient department of Hiwot Fana Specialized University Hospital, Eastern Ethiopia, 2019.

Characteristics		Number	Percent
Gender	Male	304	30.6
	Female	689	69.4
Age (years)	6-9	560	56.4
	10-12	433	43.6
ABO blood group	O	391	39.4
	A	230	23.2
	B	168	16.9
	AB	204	20.5
Residency	Urban	111	11.2
	Rural	882	88.8
Ethnicity	Oromo	503	50.7
	Amhara	291	29.3
	Tigray	54	5.4
	Harari	133	13.4
	Others*	12	1.2
Religion	Orthodox	380	38.3
	Muslim	519	52.3
	Protestant	73	7.4
	Others**	21	2.1
Father education level	No formal education	226	22.8
	1-8th grade	436	43.9
	9-12th grade	252	25.4
	above 12th grade	79	8.0
Mother's level of education	No formal education	533	53.7
	1-8th grade	339	34.1
	9-12th grade	74	7.5
	above 12th grade	47	4.7
Child schooling	No formal education	772	77.7
	1-4th grade	124	12.5
	>4th grade	97	9.8
Mother's occupation	Unemployed	350	35.2
	Student	391	39.4
	Housewife	216	21.8
	Trader	36	3.6
Family income (Birr)	< 2000	219	22.1
	2000-2999	309	31.1
	>2999	465	46.8

*Key: *included Gurage, Somali, Sidama, Welayta; **Catholic, traditional beliefs. ABO blood group*

Five hundred ninety-two (59.6%) of the study participants belonged to families who use public toilets. More than half, 577(58.1%) of the children had no hand washing practice after using a toilet. A majority, 594(59.8%) had access to drinking water from public wells (Table 2).

Table 2. Living and health conditions of symptomatic and asymptomatic school-aged children attending Hiwot Fana specialized hospital, Eastern Ethiopia, 2019

Characteristics		Number	Percent
Shared sleeping accommodation	<2 person	817	82.3
	≥2 persons	176	17.7
Toilet type	Public	592	59.6
	Communal	123	12.4
	Private	278	28.0
Hand washing practice after toilet	No	577	58.1
	Yes	416	41.9
Source of water for drinking	Public well	594	59.8
	Private well	159	16.0
	Public tap	79	8.0
	Private tap	161	16.2
Frequency of eating raw vegetables	Daily	381	38.4
	Weekly	400	40.3
	Rarely	212	21.3
Feeding uncooked milk	Yes	256	25.8
	No	737	74.2
Presence of a person with GIT symptom/sign in household	Yes	337	33.9
	No	656	66.1
Types of GIT symptoms	Epigastric pain	222	22.4
	Nausea/ vomiting	68	6.8
	Loss of appetite	85	8.6
	Bad breath	187	18.8
	No	427	43.0
Previous history of the hospital visit	Yes	68	6.8
	No	925	93.2

GIT; gastrointestinal tract

Magnitude of *H. pylori* Infection

The overall prevalence of *H. pylori* infection among school-aged children was 17.4% (95 % CI: 15.2-19.7). The magnitude of infection in symptomatic and asymptomatic school-aged children was 54(19.3%) and 119(16.7%), respectively (P>0.05).

Factors Associated with *H. pylori* Infection

In the bivariate analysis, age, type of blood group, school attendance, shared sleeping accommodation, sources of drinking water, and presence of a person with Gastro Intestinal Tract(GIT) in the household were candidates for multivariate logistic regression analysis (P<0.2).

In multivariate logistic regression analysis, age, educational attainment, and sharing sleeping with two or more people in a single room were factors associated with *H. pylori* infection. School-age children aged 10-12 had 1.53 higher odds of *H. pylori* than their counterparts (AOR=1.53, 95% CI:1.09, 2.15). School-aged children who attended 1-6th grade had 1.65 higher odds of *H. pylori* infection than those who didn't attend formal education (AOR=1.65; 95% CI: 1.12, 2.42). Those school-age children who share sleeping accommodations with two or more persons had 1.67 higher odds of *H. pylori* infection than those who sleep alone or with one person (AOR=1.67;95% CI: 1.11, 2.50) (Table 3).

Table 3. Factors associated with *H. pylori* infections among symptomatic and asymptomatic school-aged children attending the outpatient department of Hiwot Fana Specialized University Hospital, Eastern Ethiopia, 2019.

Characteristics		*H. pylori* infection		COR (95% CI)	AOR (95% CI)
		Yes (%)	No (%)		
Age in year	6-9	84(15.0)	476(85.0)	1	1
	10-12	89(20.6)	344(79.4)	1.47(1.06, 2.04)*	1.53(1.09, 2.15)**
ABO blood group	O	80(20.5)	311(79.5)	0.70(0.44, 1.10)*	0.67(0.42, 1.50)
	A	37(16.1)	193(81.9)	0.94(0.56, 1.57)	0.88(0.51, 1.50)
	B	25(14.9)	143(85.1)	1.03(0.58, 1.82)	0.98(0.55, 1.77)
	AB	31(15.2)	173(84.8)	1	1
School attained	1-6th grade	49(22.2)	172(77.8)	1.49(1.03, 2.16)*	1.65(1.12, 2.42)**
	No formal schooling	124(16.1)	648(83.9)	1	1
Shared sleeping accom-modation	<2 person	132(16.2)	685(83.8)	1	1
	≥2 persons	41(23.3)	135(76.7)	1.58(1.06, 2.34)*	1.67(1.11, 2.50)**
Source of water for drinking	Public well	98(16.5)	496(82.5)	0.96(0.61, 1.56)	0.94(0.58, 1.52)
	Private well	42(26.4)	117(73.6)	0.54(0.31, 0.93)*	1.01(0.30, 1.02)
	Public tap	7(8.9)	72(91.1)	1.98(0.82, 4.79)	1.92(0.79, 4.65)
	Private tap	26(16.1)	135(83.9)	1	1
Presence of a person with GIT in household	Yes	51(15.2)	285(84.8)	1.27(0.89, 1.82)*	1.03(0.64, 1.67)
	No	122(18.6)	535(81.4)	1	1

*GIT; gastrointestinal tract, ABO; blood types; *significant at p<0.2; **significant at p<0.05*

Discussion

In the present study, the overall magnitude of *H. pylori* infection among school-age children was 17.4% which was similar to results reported in Latvia (15.5%) (Daugule *et al*., 2016). This finding, however, was higher than those reported in Yemen (9%) (Santos et al., 2005), and Padova, Italy (13.3%) (Dore *et al.,* 2012). It was lower than the findings from Lagos, Nigeria (72.3%) (Avau *et al*., 2015), Western Ethiopia (48.7%) (Dilnessa and Amentie, 2017), and São Paulo, Brazil (35.6%) (Miranda *et al*., 2010). The variation in the magnitude may be attributed to personal hygiene, quality of life, low economic status, the difference in the study location, sample size as well as the difference in the sensitivity and specificity of testing methods.

Helicobacter pylori infection was more prevalent in symptomatic (19.3%) than asymptomatic (16.7%) school-age children, with a non-statistically significant difference between the two groups. This was in line with findings from Asosa in Western Ethiopia (58.2% vs. 39.1%) (Dilnessa and Amentie, 2017). The possible reasons for these variations could be a clinical manifestation scoring systems, lack of a clear-cut definition of symptoms between individuals with and without GIT symptoms, sample size, methodological differences, including study power, randomization, and various confounding factors such as social, economic, and demographic factors.

Helicobacter pylori are thought to be acquired mostly during childhood and nothing is known regarding the age of onset, rate, or mechanism of infection (Muhsen *et al.,* 2015). In the present study, a higher magnitude of *H. pylori* was recorded in ages between 10 and 12 years with significant association. The current finding is consistent with research findings from Ethiopia and Kuwait which showed the prevalence increases with age (Aitila *et al*., 2019; Waleed *et al*., 2010).During the newborn period, the source of infection would be confined to caretakers, family members, and nursery staff. As age increases, contact with various infection source might increase during playing in contamination schools and villages. However, further investigation

needs in this area to support or contradict the explanation with strong evidence. Prevention of infection at a younger age, such as in childhood, may help to lower the rate of *H. pylori* infection (Koletzko *et al*., 2011) which might lead to duodenal and gastric ulcers at a later age.

In this study, the odds of acquiring *H. pylori* infection among children who attended primary school (1-6th grade) were higher than those who did not attend formal school. This implies that after starting school, they may expose to a poor environment which increases the risk of infection and transmission from person to person (Aitila *et al*., 2019).

As to the relation between the ABO blood group and *H. pylori* infection, contrasting evidence exists in which some studies revealed the presence of an association (Chakrani *et, al.,* 2018). However, the current study found a high frequency of *H. pylori* infection among blood type O participants (20.5%) without a statistically significant difference. This is similar to other studies reports (Aryana *et al*., 2013; Tadesse *et al.,* 2014). However, this finding contradicted studies conducted in Ethiopia (Aryana *et al.,* 2013; Tadesse *et al*., 2014) and Cameroon (Kouitcheu *et al*., 2018).

In this study, the odds of getting *H. pylori* infection was higher in children who sleep with more than one person. The finding was similar to the result reported in Brazil (Dattoli et al., 2010), and the Czech Republic (Bures et al., 2006). However, this study finding contradicted a finding from Southern Nigeria (Ofonime *et al.,* 2012) that reported the absence of association. Overcrowding in developing countries, which leads to closer contact between children, mothers, and/or siblings could be a contributor to the high *H. pylori* infection rates (Hooi *et al*., 2017).

This study analyzed stool samples for the presence of *H. pylori* antigen from many of school-age children. However, the study did not perform bacteriological culture on the participants and family members. The study also used a cross-sectional design which cannot assess the temporal relation between factors and the outcome.

Conclusion and Recommendation

The magnitude of *H. pylori* infection is relatively high among school-age children. Increased age, attending formal education, and sharing sleeping accommodations with more than one person increase the likelihood of acquiring *H. pylori* infection. Improving personal hygiene in the age group of 10-12, avoiding sleeping with more than one person in a single room, and educating families may help to reduce the risk of acquiring *H. pylori* during childhood. Further studies based on culture isolation are recommended to clarify the necessity of early screening, long-term surveillance, and eradication of *H. pylori* infection in school-aged children.

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Competing Interests

The authors declare that there is no conflict of interest

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List of Abbreviation

ABO: A, B, AB, and O blood group; AOR: Adjusted Odd Ratio; CI: Confidence Interval COR; Crude Odd Ratio; HFSUH: Hiwot Fana Specialized University Hospital; IHRERC: Institutional Health Research and Ethics Review Committee; SPSS: Statistical Package for Social Science; GIT: gastrointestinal tract; WHO: World Health Organization

Authors' Contribution

DM was the principal investigator for the study; YD, MT, DD, MD, and DB contributed to the design of the study; DB, MD, and YD supervised data collection; DM, MD, and DD performed the statistical analyses; MT and DB interpreted the result; all authors contributed to the write-up and approved the final manuscript.

References

Abebaw,W.,Kibret,M.,and Abera, B. 2014. Prevalence and risk factors of H. pylori from dyspeptic patients in northwest Ethiopia: a hospital-based cross-sectional study, *Asian Pacific Journal of Cancer Prevention*, 15: 4459-63.

Aitila,P.,Mutyaba,M.,Okeny, S., Ndawula, Kasule M., Kasule, R., Ssedyabane, F., Okongo, B., et al. 2019. Prevalence and risk factors of *Helicobacter pylori* infection among children Aged 1 to 15 years at Holy Innocents Children's Hospital, Mbarara, South Western Uganda, *Journal of Tropical Medicine*, 2019: 9303072.

Aryana,K.,Keramati,M.,Zakavi,S., Sadeghian, M., and Akbari, H. 2013. Association of *Helicobacter pylori* infection with the Lewis and ABO blood groups in dyspeptic patients, *Journal of the Nigeria Medical Association,* 54: 196-9.

Avau, B.,Rotondo,A.,Thijs, T.,Andrews,C.,Janssen P., Tack, J., and Depoortere, I. 2015. Targeting extra-oral bitter taste receptors modulates gastrointestinal motility with effects on satiation, Scientific Reports, 5: 15985.

Birhaneselassie,M.,and Alemneh,A.2017.The relation ship between dyspepsia and *Helicobacter pylori* infection in Southern Ethiopia,*Global Advanced Research Journal of Medicine and Medical Sciences*, 6: 86-90.

Blaser, M.,Nomura, A.,Lee, J., Stemmerman, Grant N., and Perez-Perez G. 2007. Early-life family structure and microbially induced cancer risk, *PLOS Medicine*, 4: e7.

Bures,J.,Kopacova,M.,Koupil,I.,Vorisek,V.,etal 2006. Epidemiology of *Helicobacter pylori* infection in the Czech Republic, Helicobacter, 11: 56-65.

Chakrani, Z., Robinson, K., and Taye, B. 2018. Association between ABO blood groups and *Helicobacter pylori* infection: A Meta-Analysis, Scientific Reports, 8: 17604.

Correa, S., Machado, N., Carvalho, M., and Rodrigues, M. 2016. *Helicobacter pylori* infection is high in pediatric non-ulcer dyspepsia but not associated with specific gastrointestinal symptoms, Acta Paediatrica, 105: e228-31.

Dattoli, V.,Veiga, R., Da., Cunha, S., Pontes-De Carvalho, L., Barreto, M., and Alcantara-Neves, N. 2010. Seroprevalence and potential risk factors for *Helicobacter pylori* infection in Brazilian children, Helicobacter, 15: 273-8.

Daugule, I., Karklina, D., Rudzite, D., Remberga, S., and Rumba-Rozenfelde, I. 2016. Prevalence of *Helicobacter pylori* infection among preschool children in Latvia: no significant decrease in prevalence during ten years, Scandinavian *Journal of Public Health*, 44: 418-22.

Dessie, Y., Berhane, Y., and Worku, A. 2014. High parental monitoring prevents adolescents from engaging in risky sexual practices in Harar, Ethiopia, Glob Health Action, 7: 25724.

Dilnessa, T., and Amentie, M. 2017. Prevalence of *Helicobacter pylori* and risk factors among dyspepsia and non-dyspepsia adults at Assosa General Hospital,West Ethiopia:A comparative study,*Ethiopian.Journal.of Health.Development* , 31: 4-12.

Dore,M.,Fanciulli,G.,Tomasi,P.,Realdi,G., Delitala G, Graham.D,etal.2012.Gastrointestinal symptom and *Helicobacter pylori* infection in school-age children residing in Porto Torres, Sardinia, Italy, Helicobacter, 17: 369-73.

Gold,B.,Gilger,M.,and Czinn, S. 2014. New diagnostic strategies for detection of *Helicobacter pylori* infection in pediatric patients, *Gastroenterology & hepatology*, 10: 1-19.

Hooi, J., Lai, W., Ng, W.Suen, M., Underwood, F., Tanyingoh, D., et al. 2017.Global Prevalence of *Helicobacter pylori* Infection: Systematic Review and Meta-Analysis, *Gastroenterology*, 153: 420-29.

Jaff,M.2011.Relation between ABO.blood groups.and *.Helicobacterpylor i*infectionin symptomatic patients,Clinical and Experimental Gastroenter ology, 4: 221-6.

Koletzko,S.,Jones,N.,Goodman,K.,Gold,B., Rowland, M., Cadranel, S, et al. 2011. Evidence-based guidelines from ESPGHAN and NASPGHAN for.*Helicobacter pylori* infection in children, *Journal of Pediatric Gastroenterology*, 53: 230-43.

Kouitcheu, M., Noundjeu, N., and Leundji, H. 2018. Potential risk factors and prevalence of *Helicobacter pylori* infection among adult patients with dyspepsia symptoms in Cameroon, *BMC Infectious Diseases*, 18: 278.

Lopes,M.,Alves,S.,Barreira,R.,Ferreira,P.,Figueiredo, J., Osorio, N., et al. 2013. *Helicobacter pylori*

infection and ABO and Lewis blood groups, Laboratory Medicine, 40: 35–39.

Miranda, A., Machado, R., Silva, E., and Kawakami, E. 2010. Seroprevalence of *Helicobacter pylori* infection among children of low socioeconomic level in Sao Paulo, *Sao Paulo Medical Journal*, 128: 187-91.

Mount, S. 2020. School-age children development. https://www.mountsinai.org/health-library/special-topic/school-age-children-development.

Muhsen,K.,Goren,S.,and Cohen,D.2015.*Helicobacter pylori* Infection in Early Childhood and Growth at School Age, Helicobacter, 20: 410-7.

Negash,M.,Kassu, A., Amare, B., Yismaw, G., Moges, B. 2018. Evaluation of SD BIOLINE *H. pylori* Ag rapid test against double ELISA with SD *H. pylori* Ag ELISA and EZ-STEP *H. pylori* Ag ELISA tests. *BMC Clin Pathol*. 18:4. doi 10.1186/s12907-018-0071-6.

Ofonime, M, Enobong, E., and Emmanuel, E. 2012. Seroepidemiology of *Helicobacter pylori* infection among children seen in a tertiary hospital in Uyo, southern Nigeria, *Pan Africa Medical Journal*, 12: 1-9.

Pacifico, L., Anania, C., Osborn, J. F., Ferraro, F. & Chiesa,C. 2010. Consequences of *Helicobacter pylori* infection in children. *World J Gastroenterol*, 16, 5181-94.

Salih, B. 2009. *Helicobacter pylori* infection in developing countries: the burden for how long?, Saudi Journal of Gastroenterology, 15: 201-7.

Santos, I., Boccio, J., Santos, A., Valle, N., Halal, C., Bachilli, M., and Lopes, R. 2005. Prevalence of *Helicobacter pylori* infection and associated factors among adults in Southern Brazil: a population-based cross-sectional study*, BMC Public Health, 5: 118.*

Smith, S., Fowora, M., and Pellicano, R. 2019. Infections with *Helicobacter pylori* and challenges encountered in Africa, World *Journal of Gastroenterology*, 25: 3183-95.

Tadesse, E., Daka, D., Yemane, D., and Shimelis, T. 2014. Seroprevalence of *Helicobacter pylori* infection and its related risk factors in symptomatic patients in southern Ethiopia, *BMC Research Notes*, 7: 834.

Taye, B., Enquselassie, F., Tsegaye, A., Amberbir, A., Medhin, G., Fogarty, A., Robinson, K. & Davey, G. 2016. Effect of *Helicobacter pylori* infection on growth trajectories in young Ethiopian children: a longitudinal study. International Journal of Infectious Diseases, 50, 57-66.

Waleed, M., Saddiue, Alzamiiqbal., Alateeqi, Nebee.,l and Al-Nakib, Basil., 2010. Prevalence of *H. pylori* infection among new adult outpatients with dyspepsia in Kuwait, *Journal of BMC Gastroenterology*, 10: 14-100.

Zabala, T., Lucero, Y., Lagomarcino, A., Orellana Manzano, A., George, S., Torres, J., and O'ryan, M. 2017. Prevalence and dynamics of *Helicobacter pylori* infection during childhood, *Helicobacter*, 22.