


Helicobacter pylori Infection and Predictors Among Dyspeptic Adult Patients in Southwest Ethiopia: Cross-Sectional Study

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Daniel Kahase 
Kassahun Haile

Department of Medical Laboratory
Science, College of Medicine and Health
Science, Wolkite University, Wolkite,
Ethiopia

Background: Globally, *H. pylori* infection affects approximately 4.4 billion people. The burden of the infection varies within and between countries, with a higher prevalence reported from developing countries including Ethiopia. Thus, this study aimed to determine the magnitude and predictors of *H. pylori* infection among dyspeptic patients who visited Wachemo University Nigist Eleni Mohammed Memorial Referral Hospital, Southwest Ethiopia.

Methods: Consecutive willing dyspeptic adult patients (n=405) were enrolled in a cross-sectional study done from September to December 18, 2019. Socio-demographic and behavioral characteristics of the study participants were gathered by a pretested structured questionnaire. Stool samples were examined for *H. pylori* antigens using Wondfo one step *H. pylori* feces test kit. SPSS version 20 was utilized to compute descriptive statistics, binary and multivariate logistic regression. A p-value of <0.05 was considered statistically significant.

Results: Mean age of patients was 30 (\pm 7.4 SD) years, and 56.8% of participants were females. About 51.4% (208/405) of adult dyspeptic patients were infected with *H. pylori*. Being female gender (AOR= 2.56, CI 95% =1.61–4.07, p=0.001), consumption of alcohol (AOR=1.95, CI 95% =1.02–3.73, p= 0.019) and being undernourished (underweight) (AOR= 4.59, CI 95%= 1.28–16.45, p=0.019) were independent predictors of *H. pylori* infection.

Conclusion: In the study area, high (51.4%) magnitude of *H. pylori* infection was observed in dyspeptic patients and significantly associated with female gender, alcohol consumption, and undernourishment.

Keywords: *H. pylori*, dyspepsia, predictors, Southwest Ethiopia

Background

H. pylori infection is a major public health problem worldwide. Globally it affects approximately 4.4 billion people.¹ The overall prevalence of the infection varies within and between countries, with a higher prevalence generally reported from developing countries; a study indicated 50.8% in developing countries as compared to 34.7% in developed countries.² Another study revealed 70.1%, 69.4%, and 66.6% burden of infection in Africa, South America, and Western Asia, respectively.¹ Whereas a large amount of population was affected in different parts of Ethiopia, the percentage varies from 36.8% to 83.3% across the country.^{3–8}

H. pylori infection is acquired in early childhood through fecal-oral or oral-oral transmission and becomes a chronic infection if left untreated.⁹ It possesses

Correspondence: Daniel Kahase
Department of Medical Laboratory
Science, College of Medicine and Health
Science, Wolkite University, P.O. Box: 07,
Wolkite, Ethiopia
Tel +251 912414564
Fax +251 11 322 00 41
Email danielasalfew@gmail.com

different mechanisms to colonize the host and can result in several gastrointestinal diseases, including gastritis, peptic ulcer, duodenal ulcer, and gastric cancer.¹⁰ Studies by Johnson et al and Ersumo et al reported a significant number of gastric cancer cases from Tikur Anbessa hospital, Addis Ababa, Ethiopia where most patients referred from across the country.^{11,12}

Predisposing factors for *H. pylori* infection are related to socio-demographic characteristics, sanitation, the lifestyle of the population, genetic predisposition, and socioeconomic status.^{5,9,13} The diagnosis of *H. pylori* infection is performed by invasive (rapid urease test, culture, endoscopy and endoscopic biopsy for histopathology) and non-invasive (urea breath tests, stool antigen test, and serological tests) methods.¹⁴ Whereas the choice of diagnostic methods generally depends on availability, affordability, differences in test performance, clinical situation, the population prevalence of infection, and factors that may influence the test results, such as the use of anti-secretory treatment and antibiotics.¹⁵

A lot of studies in Ethiopia were conducted using IgG and/or IgM antibody rapid tests^{3,16} which have questionable performance in detecting acute infection and, it can be positive for months to years after eradication making it difficult to discern if it is a current or past infection. This may probably hinder the exact magnitude of the infection in the community, hence the current study was carried out by using a stool antigen test to hasten this problem. Besides, there is a paucity of data in Ethiopia particularly in the Hadiya zone, about the prevalence of *H. pylori* infection and its associated risk factors. Therefore, this study aimed to determine the burden and its associated risk factors of *H. pylori* infection at Hadiya zone, Southwest Ethiopia.

Methods

Study Design, Study Area and Study Period

A cross-sectional study was conducted at Wachemo University Nigist Eleni Mohammed Memorial Referral Hospital (WUNEMMRH), Hosanna town, Hadiya Zone, Southern Ethiopia from September to December 18/2019. Hosanna town is located about 232 km far from the capital city of Ethiopia, Addis Ababa. WUNEMMRH is the largest public hospital in the Hadiya Zone and it provides teaching, diagnostic, and referral services for more than 3.2 million people. It gives service in four major departments. Each department has its own inpatient, outpatient, and referral clinics.

Study Population

The study population was dyspeptic adult patients who gave stool samples and interviewed during the study period at the outpatient department.

Sample Size Determination and Sampling Technique

The sample size was computed by using the single population proportion formula, taking 52.2% prevalence of *H. pylori* infection in symptomatic patients from a previous review study done in Ethiopia,¹⁷ and by considering a 95% confidence interval (CI), 5% margin of error and 6% nonresponse rate. Accordingly, the minimum sample size was determined to be 406. However, one participant was not included due to incomplete data and the rest 405 consecutive willing dyspeptic adult patients were enrolled in this study.

Data Collection

At the outpatient department (OPD) data on socio-demographic (gender, age, monthly income, marital status, residence, occupational status educational status), behavioral (smoking, alcohol intake, dietary habit) characteristics of the study participants were collected using a pre-tested structured questionnaire through face-to-face interviews. Body mass index (BMI) data of the study participants were measured during the study period. BMI ≤ 18.5 kg/m² was classified as underweight; BMI = 18.6–24.9 kg/m² as normal weight; and BMI = 25–29.9 kg/m² as overweight.¹⁸

Laboratory Analysis

Approximately 2 grams of stool sample was collected from each study participant using clean, dry, leak-proof, and wide-mouthed containers. *H. pylori* stool antigen was detected by Wondfo one step *H. pylori* feces test kit (Guangzhou Wondfo Biotech, China) which has test sensitivity of 99.1% and specificity of 99.2%. Briefly, stool sample was emulsified and added to the sample well of the test cassette. If the sample contains *H. pylori* antigens, the antigen will bind to the antibody coated on the colloidal gold particles to form antigen-antibody-gold complexes. These complexes pass through the nitrocellulose membrane by capillary action toward the test region and control region. As the complexes reach the test region on which anti-*H. pylori* monoclonal antibodies are immobilized, they bind to the monoclonal antibody and form a colored line. A second red control line will always appear in

the result window to indicate that the test has been correctly performed and the test device functions properly.¹⁹

The intestinal parasite was examined using a bright-field compound microscope under a 10x objective. Both examinations were performed dully according to the standard operating procedure of the hospital and the manufacturer's instruction.

Data Analysis and Interpretation

The completed questionnaire was assured for completeness and integrity by the principal investigators. SPSS version 20 software (SPSS INC, Chicago, IL, USA) was utilized for statistical analysis. Socio-demographic data, behavioral and physical characteristics of study participants were reported by descriptive statistics. Binary logistic regression analysis was performed to examine the presence of an association between *H. pylori* stool antigen positivity and different independent predictors. Subsequently, possible predictors with a P-value of < 0.2 in binary logistic regression were selected for further analysis with multiple logistic regression models. At last, a P-value of < 0.05 was declared as statistically significant.

Results

Socio-Demographic, Behavioral and Dietary Characteristics of the Study Population

A total of four hundred five symptomatic dyspeptic adult patients enrolled with a predominance of females 230 (56.8%). The mean (\pm SD) age of the study population was 30 ± 7.4 years with a range of 18 to 49 years. About 38% of the study participants fell in the age group of 27–34 years. Most of the participants were rural dwellers 236 (56.8%), secondary 121 (29.9%) in their educational status and farmer 109 (26.9%) with regard to occupational status (Table 1).

The proportion of alcohol consumer at least once a weak and cigarette smoker accounted for 61 (15.1%) and 44 (10.9%) of the study population respectively. An assessment of the food habits of the study participants brought out 213 (52.6%) had a habit of drinking coffee at least once a day and 137 (34%) had a habit of drinking raw milk at least once a week (Table 2).

Physical Characteristics and Intestinal Parasite Status of the Study Population

Microscopic examination of stool revealed that 19.5% (79/405) of the study participants were infected with different

Table 1 Socio-Demographic Characteristics of 405 Study Population

Variables	Frequency (%)
Sex	
Female	230(56.8)
Male	175(43.2)
Age group (years)	
18–25	101(24.9)
27–34	154(38)
35–42	106(26.2)
43–49	44(10.9)
Residence	
Urban	169(41.7)
Rural	236(58.3)
Marital status	
Single	144(35.6)
Married	261(64.4)
Divorced	15(3.7)
Widowed	9(2.2)
Educational status	
Illiterate	114(28.1)
Primary	69(17)
Secondary	121(29.9)
University/College	101(24.9)
Occupational status	
Farmer	109(26.9)
Daily laborer	60(14.8)
Gov't employee	91(22.5)
Student	77(19)
Merchant	61(15.1)
Others	7(1.7)
Income/month category (Birr)	
≤ 1500	195(48.1)
> 1500	210(51.9)

types of medically important intestinal parasites. *G.lamblia* (43%), *A.lumbricoides* (27.8%) and *E. histolytic/dispar* (26.6%) were the dominant parasites respectively. Regarding BMI, the majority (82.5%, 334/405) of the study population fall in the normal followed by overweight (11.9%, 48/405) BMI category (Table 2).

Magnitude of *H. pylori* Infection and Independent Predictors

The overall magnitude of *H. pylori* infection among dyspeptic adult patients was 51.4% (208/405, CI 95%= 46.4–56.3) (Table 2). The proportion of *H. pylori* infection was higher in females (59.1%) than males (41.1%) and the

Table 2 *Helicobacter pylori* Stool Antigen Positivity Among Different Socio-Demographic Characteristics of 405 Study Participants, 2019

Variables		HpSAg Negative N (%)	HpSAg Positive N (%)	COR (95% CI)	P-value
Sex	Female	94(40.9)	136(59.1)	2.1(1.4–3.1) I	<0.001*
	Male	103(58.9)	72(41.1)		
Age group (years)	18–25	55(50.5)	46(45.5)	I 1.36(0.82–2.25) 1.50(0.87–2.59) 1.09(0.54–2.22)	0.229 0.146 0.81
	27–34	72(46.8)	82(53.2)		
	35–42	47(44.3)	59(55.7)		
	43–49	23(52.3)	21(47.7)		
Residence	Urban	86(50.9)	83(49.1)	I 1.17(0.79–1.73)	0.444
	Rural	111(47)	125(53)		
Marital status	Single	80(55.6)	64(44.4)	I 1.54(1.02–2.32)	0.039*
	Married	117(44.8)	144(55.2)		
Educational status	Illiterate	45(39.5)	69(60.5)	I 1.91(1.11–3.29) 2.12(1.04–3.61) 0.94(0.55–1.59) I	0.020* 0.038* 0.813
	Primary	27(39.1)	42(60.9)		
	Secondary	69(47)	52(43)		
	University/College	56(55.4)	45(44.6)		
Occupational status	Farmer	43(38.9)	66(61.1)	I 1.19(0.26–5.61) 0.86(0.18–4.16) 0.77(0.16–3.62) 0.63(0.13–2.98) 0.49(0.1–2.37) I	0.820 0.848 0.737 0.556 0.372
	Daily laborer	28(46.7)	32(53.3)		
	Gov't employee	45(49.5)	46(50.5)		
	Student	42(54.5)	35(45.5)		
	Merchant	37(60.7)	24(39.3)		
	Others	3(43)	4(57)		
	Income/month category (Birr)	≤ 1500	98(50.3)		
>1500		99(47.1)	111(52.9)		

Note: *Statistically significant.

Abbreviations: HpSAg, *H. pylori* stool antigen; N, number; I, reference category; COR, crude odds ratio; CI, confidence interval.

difference was statistically significant ($p < 0.001$). High prevalence of *H. pylori* infection (55.7%) was obtained in the age group of 35–42 years old followed by 27–34 years old (53.2%) participants ($p = 0.146$) (Table 3).

Being married, being illiterate (COR=1.91, CI 95%=1.11–3.29, $p=0.020$) and primary (COR=2.12, CI 95%=1.04–3.61, $p=0.038$) in educational status were observed as predictors of *H. pylori* infection in bivariate analysis. However, in multivariate analysis, primary level and secondary level education of the participants showed a borderline association ($p=0.070$ versus $p=0.050$) (Table 4).

A significantly high infection rate was also observed in undernourished study participants (82.6%) as compared to overweighed participants (AOR=4.59, CI 95% =1.28–16.45, $p= 0.019$). In addition, drinking alcohol had a positive relation to *H. pylori* infection (AOR= 1.95, CI 95% = 1.02–3.73, $p= 0.019$) (Table 4). However, other studied independent factors such as age group, monthly income, residence, occupational status, smoking cigarette, dietary habit, and intestinal parasite status had shown no

statistically significant association with *H. pylori* infection (Table 3).

Discussion

A significant burden of *H. pylori* infection is reported in most of the world with large amounts of variation existed among regions even within the same country.¹ The current study demonstrated an overall magnitude of *H. pylori* stool antigen positivity in adults (≥ 18 years old) with dyspepsia as 51.4%. This magnitude was comparable with the work of Melese et al, 52.2%¹⁷ and Kibru et al, 52.4%.⁵ In the contrary, lower burden of *H. pylori* infection was reported from Dessie 30.4%,¹⁹ Addis Ababa 36.8%,⁸ Gonder, Ethiopia 37.6%⁶ and China 42%.²⁰ Those differences could reflect variation in life-style, geographic area and socio-economic status of the study participants.

However, a high magnitude of *H. pylori* was documented in studies done in Gonder, Ethiopia (65.7%),¹⁶ and Hawassa, South Ethiopia (83.3%).³ In addition, reports

Table 3 *Helicobacter pylori* Stool Antigen Positivity Against Behavioral, Dietary Habit, Physical Characteristics and Intestinal Parasite Status of 405 Study Participants, 2019

Variables		Frequency (%)	HpSAg Positive N (%)	COR (95% CI)	P-value
Smoking cigarette	No	361(89.1)	188(52.1)	I	0.77(0.41–1.44)
	Yes	44(10.9)	20(45.5)		
Drinking alcohol	No	344(84.9)	170(49.4)	I	0.64(0.37–1.71)
	Yes	61(15.1)	37(60.7)		
Consumption of raw fruit and/or vegetable	No	158(39)	79(50)	I	1.09(0.73–1.63)
	Yes	247(61)	129(52.2)		
Consumption of milk	No	266(66)	132(49.6)	I	1.23(0.81–1.86)
	Yes	137(34)	75(54.7)		
Drinking coffee	No	192(47.4)	94(49)	I	1.2(0.81–1.77)
	Yes	213(52.6)	114(53.5)		
Drinking tea	No	203(50.1)	109(52.4)	I	0.83(0.56–1.22)
	Yes	202(49.9)	99(47.6)		
BMI category	Undernourished	23(5.7)	19(82.6)	I	4.75(1.41–16.05)
	Normal	334(82.5)	165(49.4)		
	Overweight	48(11.9)	24(50)		
Intestinal parasite	No	326(80.5)	164(50.3)	I	1.24(0.76–2.04)
	Yes	79(19.5)	44(55.7)		

Note: *Statistically significant.

Abbreviations: HpSAg, *H. pylori* stool antigen; N, number; I, reference category; COR, crude odds ratio; CI, confidence interval.

from Pakistan (57%),²¹ Cameron (64.39%)¹³ and Kenya (71%)²² indicated high *H. pylori* infection rate. Possibly the source of the difference could be due to variation in the study design, laboratory diagnosis technique (antibody detection test from blood) and personal hygiene of the study population.

In this study, a high proportion of female participants (59.1%, 136/230) were infected and being female was a predictor for *H. pylori* infection ($P < 0.001$). This was supported by studies done in Assosa, Ethiopia⁷ and Iran.²³ However, the exact mechanism of why being female significantly associated with *H. pylori* infection remains unclear. Unlike our result, one meta-analysis study indicated that male sex was associated with a greater prevalence of *H. pylori* infection, both in children and adults.²⁴ But several studies reported that there is no sex preferences during *H. pylori* infection.^{5,6,8,17,19} This all might show the absence of consensus on the concept that males or females more likely to be infected.

Based on our findings, age had not significant influence ($p > 0.05$) on *H. pylori* infection which is comparable to previous reports from Ethiopia.^{3,8} Other studies showed a significant association between age and *H. pylori*

infection.^{3,5,16} These differences might be influenced by the participants' age range, in our case, it was 18–49 years. The role of educational status differentially put patients with a low educational level at higher risk of infection was also shown by others^{5,8} though this could not be revealed in the current and similar previous studies.^{3,19}

Interestingly, our result depicted alcohol consumers were significantly at risk of acquiring *H. pylori* infection which is in line with the report of Seid et al, and Melese et al,^{17,19} This might be explained by the result of a study that found alcohol concentrations of greater than 10% increases the mucosa's permeability by damaging the mucosal barrier.²⁵ In contrast, some authors revealed alcohol consumption as a protective factor against active *H. pylori* infection^{5,26} and others report no relation in between.^{6,7} The reason for the contradiction of these results could be due to the fact that *H. pylori* colonization may be affected by multiple factors and type, amount, and duration of alcohol consumption.

Studies revealed that overweight and obese patients had significantly a higher rate of *H. pylori* infection compared to BMI-healthy individuals.^{20,21} However, in our observation undernourishment (low BMI) was another

Table 4 Multivariate Analysis of Selected Possible Predictors Associated with Stool Antigen Positivity of *H. pylori*

Variables		AOR (95% CI)	p-value
Sex	Female	2.56(1.61–4.07)	< 0.001*
	Male	I	
Age groups (years)	18–25	I	0.237
	27–34	0.58(0.23–1.44)	
	35–42	0.67(0.23–1.92)	
	43–49	0.51(0.16–1.66)	
Marital status	Single	I	0.804
	Married	1.08(0.59–1.95)	
Educational status	Illiterate	1.67(0.93–3.05)	0.083
	Primary	1.92(1.00–3.67)	
	Secondary	0.93(0.52–1.67)	
	University/College	I	
Drinking alcohol	No	I	0.043*
	Yes	1.95(1.02–3.73)	
BMI category	Undernourished	4.59(1.28–16.45)	0.019*
	Normal	0.94(0.49–1.78)	
	Overweight	I	

Note: *Statistically significant.

Abbreviations: I, reference category; AOR, adjusted odds ratio; CI, confidence interval.

factor that significantly predicted *H. pylori* infection, given 82.6% of the underweight were infected which is in agreement with the work of Kibru et al.⁵ This association could be due to the fact that *H. pylori* affect iron and vitamin B12 absorption and hormones implicated in the regulation of appetite and growth negatively.^{27,28}

This study has some limitations. First, it was limited to adult patients with dyspepsia which may not infer to the prevalence of *H. pylori* infection of the general population. Second, alcohol consumption data with regard to type, amount, and duration was not gathered. Third, the study was limited to a single institution and a certain population but the information reported could be a significant contribution to the existing knowledge on the burden of *H. pylori* infection and predictors.

Conclusion

Our study showed that the prevalence of *H. pylori* among our study population was high (51.4%). Among the studied associated factors, it was significantly greater in females (59.1%), alcohol consumers (60.7%), and malnourished patients (82.6%). Therefore, interventions against *H. pylori* infection prevention in the study area need to be scaled up to diminish the burden.

Abbreviations

AOR, adjusted odds ratio; BMI, body mass index; COR, crude odds ratio; WUNEMMRH, Wachemo University Nigist Eleni Mohammed Memorial Hospital.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The study was reviewed and approved by the Ethical Committee of the Department of Medical Laboratory Sciences of Jima University. It was sought while we were students at Jima University. Participation was voluntary and each study subject involved in the study gave written informed consent. The study was carried out in accordance with the Declaration of Helsinki.

Consent for Publication

Not applicable.

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Author Contributions

Daniel Kahase conceived, designed the study and drafted the manuscript. All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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