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Trends in the occurrence of *Helicobacter pylori* infection in Arada Sub-City: A 5-year retrospective study.

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ABSTRACT: *Helicobacter pylori* infection remains a major public health problem in Ethiopia. This retrospective study aims at determining the prevalence of *H. pylori* infection over a period of 5 years, from 2016 to 2020 among dyspeptic patients at nine Health Centers of Arada sub-city, Addis Ababa. Data were collected from the patients record books of the nine Health Centers. At the health centers a stool antigen test is most often used than a serology antibody test, because stool antigen test is more specific and detects only an active infection. Chi-square analysis was employed to identify associations between variables. A P-value of <0.05 was considered significant. In the present study, the overall prevalence of *H. pylori* was 49.2%. The prevalence was higher among patients of age 60 years and above (59%); whereas it was lower in the age category of 15 to 29 years (43%). No association was observed between *H. pylori* infection and the sex (gender) of the studied cases. However, statistically significant increments in *H. pylori* cases were observed over the five year study periods. It can be concluded that the overall prevalence of *H. pylori* was 49.2% and there were no associations between sex (gender) and *H. pylori* infection. The authors would like to recommend the health centers to use stool antigen test and to provide an awareness for the study population.

Keywords/phrases: Arada sub-city, dyspeptic patients, *Helicobacter pylori* infection, prevalence

INTRODUCTION

Helicobacter pylori (*H. pylori*) infection affects more than half (50%) of the world's population (Hunt *et al.*, 2014). *H. pylori* is a microaerophilic gram-negative, spiral, flagellated bacterium with a capability of urease production, which has been implicated in several upper gastrointestinal diseases, such as dyspepsia. *H. pylori* cause gastric cancer (Magraud, 1993; Suerbaum and Michetti, 2002; Ruggiero, 2010; Sachs *et al.*, 2011; Meseret Workineh and Desalegn Andargie, 2016).

The overall prevalence of the infection is higher in developing countries than in industrialized countries. *H. pylori* is transmitted by oral or fecal oral routes (Scott *et al.*, 1998; Hunt *et al.*, 2014). In many reports, it has been estimated that 15% to 20% of people infected with *H. pylori* develops ulcer. Evidences support that *H. pylori* infection associates with gastric cancer, gastric mucosa-associated lymphoid tissue (MALT) lymphoma, and perhaps pancreatic cancer and cardiovascular diseases (Jani and Günter, 2020).

H. pylori infection is prevalent over the world, although its prevalence is higher in developing countries (Bures *et al.*, 2011). The prevalence of *H.*

pylori infection was reported to be 69.4% in South America, 37.1% in North America, 24.4% in Oceania, 54.6% in Asia, 47.0% in Europe and 79.1% in Africa (James *et al.*, 2017; Addisu Melese *et al.*, 2019). The prevalence of *H. pylori* varies due to differences in geographical, ethnicity, and demographic issues of the population studied (Barik, 2009).

In Ethiopia, the prevalence of *H. pylori* is estimated to be 48% among children aged 2–4, and above 95% in adults (Hooi *et al.*, 2017). The overall prevalence of *H. pylori* infection in Ethiopia was 52.2% (Addisu Melese *et al.*, 2019). A lower prevalence (39.95%) and higher prevalence (71%) of *H. pylori* infection was found in Oromia and in Somalia region respectively (Addisu Melese *et al.*, 2019). Usually, studies in Ethiopia were reported from one to four months of the retrospective data (Ahmed Kemal, 2014; Abebe Worku and Wolde Mariam, 2017; Tewodros Kassahun, 2019). This study was designed to assess the prevalence of *H. pylori* infection in dyspeptic patients who were clinically diagnosed in Arada sub-city health centers.

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METHODS

The Study Area

The study was conducted in Arada sub city. Arada is one of the 10 sub-cities of Addis Ababa, the capital city of Ethiopia. It covers an area of 950 hectares (Area of 9.9 sq. km). Its geographical location is $9^{\circ} 2' 6''$ $9.6000''$ N and $38^{\circ} 45' 8.2800''$ E. Arada Sub-city is bordered on the south by Kirkos, on the West by Lideta and Addis Ketema, on the North by Gullele and East by Yeka sub-cities. It is divided into 10 districts, 31 sub-districts, 100 neighborhood and 316

blocks. According to 2017/2018 population projections, the population of Arada sub-city was 272,356; of which 130,730 (48%) were males and 141,625 (52%) were females. The population density per sq.m was 22, 805 (CSA, 2018)

There are ten public health centers in Arada sub-city, one in each district. Except district 9 health center, all health centers have been providing service for more than five years. District 9 health center was started its service in 2019 (Arada sub-city health office).

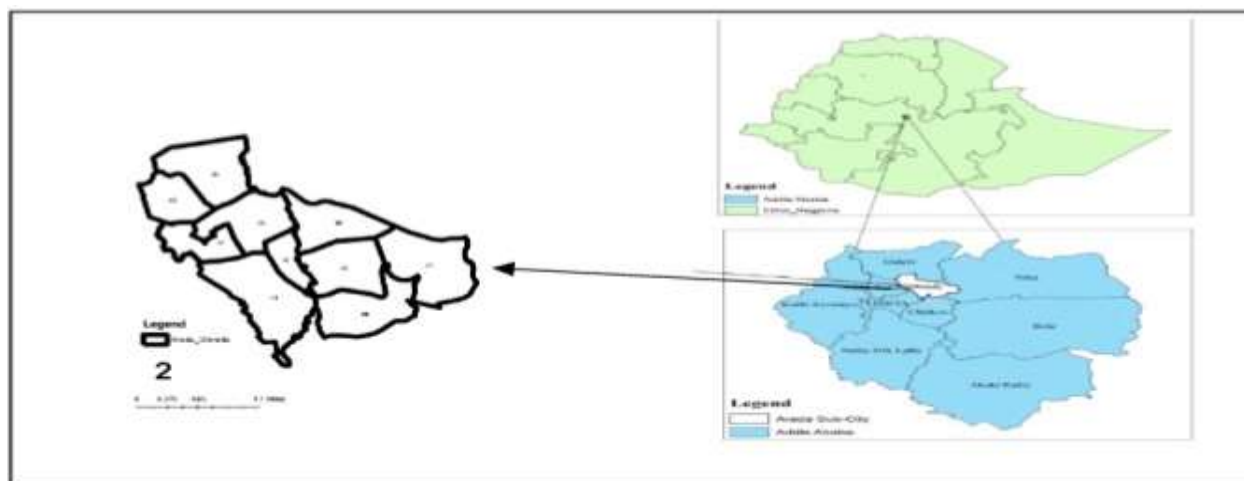


Figure 1: The Map of Ethiopia, Addis Ababa, and Arada Sub-City (Source: Arada Sub-city Land Management Office, 2020)

Study Design and Period

Retrospective study was conducted from 2016 to 2020 in 9 health centers of Arada sub-city (i.e. Kebena, Jan Meda, Arada, Baata, Churchill, Simegn, Afincho Ber, Ras Emiru and Semein). Data were collected from November 2020 to February 2021.

Study Population

The study populations were all dyspeptic patients who had been suspected for *H. pylori* infection and those diagnosed for dyspepsia in Arada sub-city health centers, Addis Ababa from July 2016 to June 2020.

Data Collection Procedures

Retrospective data were collected in this study. All patients who were clinically diagnosed for dyspepsia from 2016 to 2020 in nine health centers of Arada sub-city whose data had been completely registered

were included in the study. A five-year data were taken from patients' registration books. The two major socio-demographic characteristics (age and sex) were the only data found in the data sources (i.e. the patients' registration log book).

Detection of *H. pylori* infection

A stool antigen test that identifies *H. pylori* antigen in the stool, and antibody testing were implemented in the study area. Most of the time, Arada sub-city health centers use stool antigen test and sometimes an antibody test.

Data Analysis

Data analyses were performed using Statistical Package for Social Sciences (SPSS) version 20. Chi-square test was used to evaluate the associations between *H. pylori* with age and sex. A p-value of < 0.05 was statistical significant.

Data Quality Control

To ensure the quality of data, the completeness of the data collected from the patients' registration books in all health centers was first assessed. Then, data collection format sheet was prepared and used for data recording. Before the data was extracted, two willing data collectors working in Departments of Specimen Collection and Laboratory of each of the health centers in Arada sub-city were selected. Then, they were given relevant information about the study and trained on the use of data extraction and use of data collection format. In addition, a sample of the completed data collection forms from each health center was randomly selected and checked for accuracy, completeness, and consistency of data collection. Finally, the collected data was compared with the summarized annual report of dyspeptic patients reported to the city health bureau by the health centers.

Ethical Consideration

This study was approved by the Institutional Review Board of the College of Natural and Computational Sciences of Addis Ababa University. A support letter was obtained from Addis Ababa City Health Bureau to collect relevant data. All patients' data were kept confidential, and used only for the purpose of the study.

RESULTS

Age and Sex of the Study Participants

A total of 15,940 dyspeptic patients were screened for *H. pylori* in nine health centers in Arada sub-city for five consecutive years (July 2016 to June 2020). Among 15,940 study participants 6,205 (39%) were male patients while 9,735 (61%) were females (Table1). This implies that more female patients were diagnosed in the health centers than male patients. About 7,467 (47%) patients were between 15 to 29 years. This shows that most of the patients that were diagnosed in the health centers were young and between 15 to 29 years of age.

Prevalence of *H. pylori* Infection among the Study Subjects

About 7,844 (49.2%) of the study participants were found to be *H. pylori* positive. From 6,205 male patients 3,084 (50%) were *H. pylori* positive. And, among 9,735 female patients, 4,760 (49%) were *H. pylori* positive (Table1). Therefore, the prevalence of *H. pylori* infection among the male patients was similar to that of the female patients. The differences between *H. pylori* infection between male and female subjects were not statistically significant ($P=0.320$).

From 1,030 patients in the age group between 0 to 14 years 485 (47%) were *H. pylori* positive (Figure 2). The participants in the age category of 60 years or above were 59%, and the lowest *H. pylori* positivity was observed in the age category between 15 to 29 years (43%). In this case, the differences between *H. pylori* positivity among different age categories of the study participants were statistically significant ($P<0.0011$).

Table 1. The overall prevalence of *H. pylori* among dyspeptic patients in nine health centers in Arada sub-city for five consecutive years from July 2016 to June 2020

Variables		Diagnosed patients		<i>H. pylori</i> positive		<i>H. pylori</i> negative		χ^2	p-value
		N	%	N	%	N	%		
Gender category	Male	6205	39%	3084	50%	3121	50%	0.985266	0.320
	Female	9735	61%	4760	49%	4975	51%		
Age category (in years)	0-14 years	1030	6%	485	47%	545	53%	0.98526576	<0.0011
	15-29 years	7467	47%	3223	43%	4244	57%		
	30-44 years	2291	14%	1264	55%	1027	45%		
	45-59 years	3127	20%	1679	54%	1448	46%		
	≥ 60 years	2025	13%	1193	59%	832	41%		

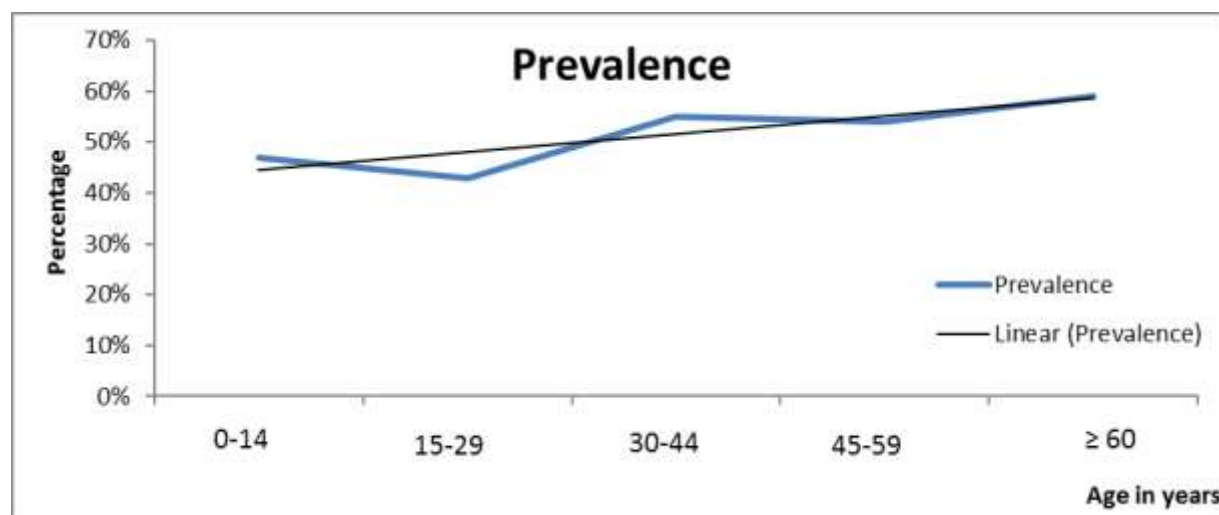


Figure 2. The overall prevalence of *H. pylori* among different age category of dyspeptic patients in nine health centers in Arada sub-city for five consecutive years from July 2016 to June 2020

Trend Analysis of *H. pylori*

The prevalence of *H. pylori* infection among the dyspeptic patients in Arada sub-city health centers was 46.2% in 2016. *H. pylori* prevalence was 47.3% and 51.5% in 2017 and 2018 respectively (Table2). The highest prevalence was in 2018 (51.5%) and the lowest in 2016 (46.2%). However, the prevalence was decreasing slightly in 2020 (49%).

Sex-specific trends of *H. pylori* prevalence

Among 1,011 male patients diagnosed for *H. pylori* in 2018, 526 (52%) were positive, and of the 1,534 female patients examined in the same year, 784 (51%) were found to be positive (Table3). But, the difference was not statistically significant ($P=0.649715813$). In 2019, a total of 1002 male patients diagnosed for *H. pylori*, 519 (52%) were positive, and of the 1,599 female patients examined in the same year, 812 (51%) were found to be positive. But, the difference between male and female was not statistically significant.

Health centers specific prevalence of *H. pylori* in Arada sub-city

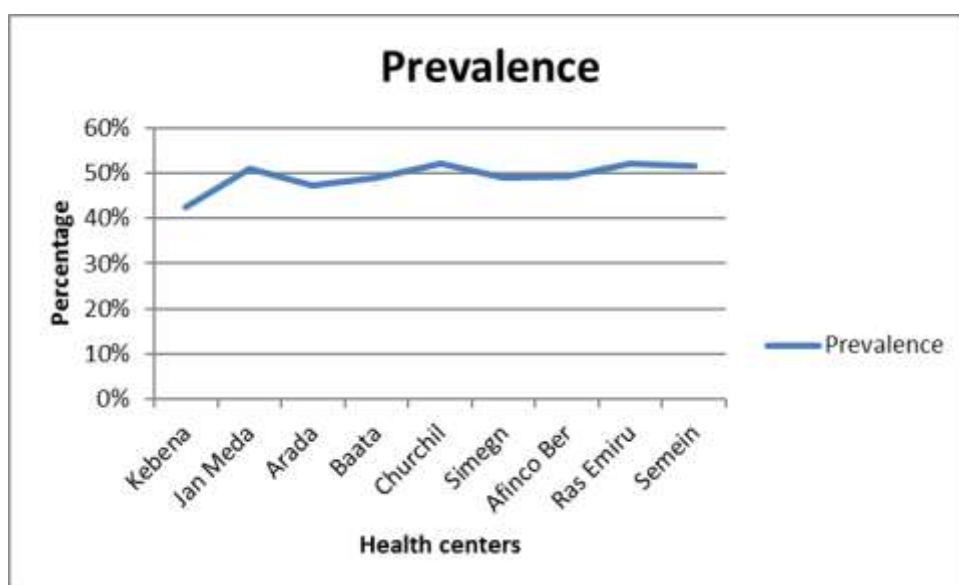
In Arada sub-city, there are nine health centers. The overall prevalence of *H. pylori* in Churchill, Ras Emiru and Semein Health Centers was 52%. The overall prevalence of *H. pylori* at Jan Meda was 51% and at Baata, Simegn and Afincho Ber was 49%. In Arada sub-city health center, the overall prevalence of *H. pylori* was 47% but 42% in Kebena Health center. As a whole, the highest and lowest overall prevalence of *H. pylori* was 52% and 42% respectively (Figure 3).

Table 2. Trends of *H. pylori* infection in Arada sub-city health centers from July 2016 to June 2020

Year	Total Diagnosed	Positive (N)	Positive (%)
2016	1699	785	46.2%
2017	2196	1039	47.3%
2018	2545	1310	51.5%
2019	2601	1331	51.2%
2020	6899	3379	49%

Table 3. Sex-specific trends of *H. pylori* prevalence over the last five years

Year	Male diagnosed (N)	Male positive (N/%)	Female diagnosed (N)	Female positive (N/%)	χ^2	p-value
2016	635	302 (48%)	1064	483 (45%)	0.7494(37004)	0.3866(54539)
2017	837	405 (48%)	1359	634 (47%)	0.6256(05844)	0.4289(71716)
2018	1011	526 (52%)	1534	784 (51%)	0.2062(58602)	0.6497(15813)
2019	1002	519 (52%)	1599	812 (51%)	0.2538(18458)	0.6143(99126)
2020	2720	1332 (49%)	4179	2047 (49%)	0.0001(01738)	0.9919(52251)

Figure 3: Health centers specific prevalence of *H. pylori* in Arada sub-city

DISCUSSION

The overall prevalence of *H. pylori* observed in this study was 49.2%. In general, the prevalence of *H. pylori* was lower in industrialized countries than in developing countries (Magraud, 1993; Graham *et al.*, 2009; Bures *et al.*, 2011; Hunt *et al.*, 2014; Hooi, 2017; Addisu Melese *et al.*, 2019). In Ethiopia, the prevalence of *H. pylori* was reported to be 52.2% in which the highest and the lowest regional estimates were 71% in Somalia and 39.95% in Oromia region (Addisu Melese *et al.*, 2019). The overall prevalence

(49.2%) in this study is between the highest (71%) and the lowest (39.95%) reported in Somalia and Oromia region, respectively. Besides, his prevalence (49.2%) it is close to the national prevalence (52.2%) of Ethiopia (Addisu Melese *et al.*, 2019).

Moreover, the prevalence of the present study (49.2%) is higher than 37.6% prevalence reported from Gondar (Desie Kasew *et al.*, 2017) and 45.8% prevalence from 2009 Addis Ababa (Gizachew Taddesse *et al.*, 2011), but nearly the similar to 48.7% in Assosa General Hospital (Tebelay Dilnessa and Muluwas Amentie, 2017).

On the contrary, the prevalence of *H. pylori* was slightly lower than 52.4% and 50.7% in Southern Nations, Nationalities and Peoples Region from 2012-2013 (Dargaze Kibru *et al.*, 2014; Getnet Hailu *et al.*, 2016). The prevalence of this study is also lower than 64.2% reported in Oromia from 2016-2017; 65% in Amhara from 2009 to 2011; and 70.2% from 2015-2016 and 72.2% in the same region in 2013 (Beniam Mathewos *et al.*, 2013; Wubejig Abebaw *et al.*, 2014; Mihret Tesfaye, 2017 and Abdurahman Seid *et al.*, 2018). The prevalence rate of the present study was lower than 91% reported in Addis Ababa from 2000-2002 (Daniel Asrat *et al.*, 2004).

The difference in the prevalence of *H. pylori* might occur due to diverse contributing factors such as socioeconomic status, geographical or living conditions, demographic factors, and environmental sanitation of each population (Natuzzi, 2013). Besides, the higher prevalence of *H. pylori* infection in this study may be due to the test methods that the health centers used (the antigen test and the antibody test).

With regard to sex and *H. pylori* positivity; 50% were males and 49% were females, which were not statistically significant ($\chi^2 = 0.985$, $P = 0.32$). This implies that there were no associations between sex and *H. pylori* infection.

This result agrees with studies conducted in Brazil, Africa, India, Southern Asia and Eastern Europe, which stated that there were no significant gender differences in the risk of acquisition of *H. pylori* infection (Rehnberg *et al.*, 1998; Rodrigues, 2005; Rasheed *et al.*, 2011; Petrović *et al.*, 2011; Zevit *et al.*, 2014; Sathar *et al.*, 2016). However, the finding of this study disagrees with the findings of a comparative cross-sectional study at Assosa which stated that the prevalence of *H. pylori* was significantly associated with gender (Tebelay Dilnessa and Muluwas Amentie, 2017).

In the present study, there were associations between patients' age category and *H. pylori* infection, which was in agreement with previous studies (Granstrom *et al.*, 1997; Wizla *et al.*, 2001; Malaty *et al.*, 2002). But, it disagrees with studies in China and Bhutan that reported no significant association between age of the patients and *H. pylori* infection (Dorji *et al.*, 2013). The prevalence of *H. pylori* was increasing as age increases from 15 years and above. This was supported by a study conducted in Brazil, which showed that the prevalence of *H. pylori* was associated with increasing age (Ina *et al.*, 2005).

The prevalence of *H. pylori* was 46.2%, 47.3%, 51.5%, 51.2% and 49% from 2016, 2017, 2018, 2019 and 2020, respectively. In this study, a fluctuation in the prevalence of *H. pylori* was observed (Table 2). However, a study in China was significantly lower than the previous year's report (Shimoyama *et al.*, 2009). This study has its own limitation first the data was collected from patients register books and not all patients with *H. pylori* would visit district health centers as some patients could go to private clinics or hospitals. Others might have not at all visited health institutions to see a health professional. Moreover, the health centers use two types of tests: serology (blood antibody test) and stool antigen test. And, the difference in test methods could affect the prevalence rate since it is possible that antibody could remain in the blood for longer time after the infection had been successfully treated and the result obtained from the serology test might be misleading.

CONCLUSIONS

The overall prevalence of *H. pylori* was 49.2%. In the present study, there were no associations between sex and *H. pylori* infection. The study implies the prevalence of *H. pylori* infection varied from 2016 to 2020 years. The authors would like to recommend the health centers to use stool antigen test because it is more specific and it detects only an active infection.

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