Addis Ababa University

College of Natural and Computational Sciences

Department of Zoological Sciences

The Prevalence of *Helicobacter pylori* Infection in Arada Sub-City Health Centers from 2016 to 2020

By: Tamrat Birru (ID. GSK 1070/07)

Advisor:- Tegenu Gelana (PhD)

A Thesis Submitted to Department of Zoological Sciences, College of Natural and Computational Sciences, Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master in Biology

June 2021
Addis Ababa, Ethiopia

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DECLARATION

I, Tamirat Birru Haile, declare that the work presented in this dissertation is entirely my original work and that it is has never been submitted elsewhere for any academic award or any other purpose.

Signature: _____

Date:_____

Statement of Certification

This is to certify that TamiratBirru Haile has carried out a thesis on the topic “The Prevalence of *Helicobacter pylori* Infection in Arada Sub-City Health Centers from 2016 to 2020” under my supervision. In my opinion, this thesis is suitable for submission in partial fulfillment of the requirements for the award of the MSC Degree in Biology.

Advisor: TegenuGelana(PhD)

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List of Abbreviation

EGD: Endoscopic Gastroentris Disease

GERD: Gastro Esophageal Reflux Disease

MALT: Mucosa-Associated Lymphoid Tissue

PPIs: Proton Pump Inhibitors

PUD: Peptic Ulcer Diseases

SEER: Surveillance Epidemiology and End Results

SPSS: Statistical package for social study

WGO: World Gastroenterology Organization

Abstract

Background: Helicobacter pylori infection is a major public health problem that affects more than 50% of the world's population. The prevalence of H. pylori differs among various societies and geographical locations. Therefore, it is very important to have timely information on the prevalence of H. pylori in order to prevent the infection. The purpose of this study is to determine the prevalence of H.pylori infection over a period of 5 years among dyspeptic patients at nine Health Centers Arada Sub-City in Addis Ababa City Administration.

Methods: A retrospective analysis of the record dyspeptic patients' records of five consecutive years covering the period July 2016 to June 2020 was conducted. Data was generated from the patients' record books of nine health centers in Arada Sub-City; the health centers used the serology and fecal anti-gene test methods. Chi-square analysis was employed to identify significant predictors. For statistical significance, a P-value of <0.05 was considered.

Results: This study showed high but fluctuating prevalence of H.pylori among the dyspeptic patients diagnosed in the health centers in Arada Sub-City in five consecutive years from 2016 to 2020. The overall prevalence of H.pylori observed in this study was 49% (P-value<0.0001). This study found a slightly different prevalence of H.pylori infection 50% in males and 49% in females. The prevalence of H.pylori was the highest among the participants in the age category of 60 years and above (59%), and the lowest H.pylori positivity was observed in the age category between 15 to 29 years (43%). In general, although there is a slight decrease in the prevalence of H.pylori as the age in the age category increased from between 30 to 44 years to the age category between 45 to 59 years, the prevalence of H.pylori crudely increased as age increased from 15 years to above.

Conclusion: This study showed that the differences between H.pylori positivity of male and female study participants were statistically insignificant. The study found no association between sex and H.pylori infection. In addition to the differences between H.pylori positivity among different age categories, the study participants were statistically significant and the prevalence of H.pylori infection in 5 consecutive years fluctuated from year to year.

Keywords: H. pylori infection, dyspeptic patients, prevalence

1. INTRODUCTION

1.1. Background of the Study

Helicobacter pylori (*H.pylori*) infection is a common bacterial infection that affects more than 50% of the world's inhabitants. *H.pylori* is a microaerophilic gram-negative, spiral, flagellated bacterium with a capability of abundant urease production, which has been implicated in several upper gastrointestinal diseases, such as dyspepsia. *H.pylori* is also found to be associated with the development of gastric cancer (Megraud, 1993; Suerbaum, 2002; Ruggier, 2010; and Sachs, 2011, as cited in Workneh and Andarge, 2016).

The first known reference to microorganisms which have been identified as Helicobacter began before 19th century, with the description of spirochaetes in the gastric mucosa of animals, by Bizzozero in 1893, and Solomon in 1896, in the stomach of cats and dogs. The first observation of spiral-shaped microorganism in the human stomach was made in 1906 by Krienitz. Since that time and until 1980's several observations of these organisms were reported in gastric tissues either from post-mortem individuals or from patients with peptic ulcer and gastric carcinoma (Bizzozero, 1980*).* In the early 1980s, gastroenterologist Barry Marshal and his pathologist colleague, Robert Warren, found spiral-shaped bacteria in about half of the routine biopsies, obtained from patients attending the gastroenterology consultation, and their presence was closely associated with mucosal inflammation (Warren, 1983).

As a result of the accelerating research on both microbiological aspects and the pathogenic role of these newly discovered bacteria, the role of *H.pylori* in duodenal and gastric ulcer disease was established and reported in a consensus statement in 1994. Theories of an etiological link between *H.pylori* and gastric cancer and mucosa-associated lymphoid tissue (MALT) - lymphomas also prompted a number of epidemiological studies (Yamada et al., 1994).

H.pylori cause acute and chronic gastritis, and can cause duodenal and gastric ulcers. There is strong epidemiological evidence to implicate *H.pylori* gastritis in marginal B cell mucosal lymphomas. Although these significant diseases are typically found among adults, there are clear parallels with gastro-duodenal disease in children (David, 2001).

In general, helicobacter is a genus of spiral bacteria that is amazingly capable of surviving the sever acidity of the stomach. The existence of such bacteria has been known since late 1880's, but it was until nearly 100 years later that their significance was realized. Until the 1980's,

stomach ulcers were treated with an assortment of antacids with idea that excess acid had caused the ulcer. In fact most stomach and duodenal ulcers of humans stem from infection with helicobacter. Currently, this ulcerative infection is treated both with antacids and antibiotics specifically directed against helicobacter (Steffen *et al*., 2016).

1.2. Statement of the Problem

The influence of *H. pylori* infection has become easily understood in the field of public health care and the bacterium is now being associated as a major cause of a variety of gastric diseases. As a whole, the overall prevalence of the infection is higher in developing countries than in industrialized countries. Similarly, there are wide variations in the prevalence in more affluent urban and rural populations. The major causes for these variations involve socioeconomic differences among populations all over the world. Largely, *H.pylori* is transmitted by the oral or fecal oral routes. And, the main factors that play a decisive role in determining the overall prevalence of infection include lack of proper sanitation, safe drinking water, and basic hygiene, as well as poor diets and overcrowding, play a role (Scott *et al*., 1998 and Hunt, 2011).

In many reports, it has been estimated that 15% to 20% of people infected with *H.pylori* will develop ulcers. Some evidence also links *H.pylori* infection to gastric cancer, gastric mucosa-associated lymphoid tissue (MALT) lymphoma, and perhaps pancreatic cancer and cardiovascular disease (Jani and Günter, 2011).

There are studies that show the prevalence of *H.pylori* in different countries. *H.pylori* is found in all parts of the world, although the prevalence is higher in developing countries than in industrialized countries (Bures *et al*., 2011). Approximately 50% of the population in industrialized countries is known to be infected with *H.pylori*. This percentage increases to 80% in developing countries (Hunt et al., 2011). Citing James and colleagues, Melese (2019) stated that the global estimate of H.pylori infection was reported at 48.5% while continental reports were 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 (Melese, 2019). As stated earlier the prevalence of *H.pylori* indeed varies based on geographic location, ethnicity, and demographic factors of the population studied (Barik, 2009).

In Ethiopia, the prevalence of *H.pylori* is greater and it is estimated as high as 48% in children aged 2–4 year, 80% at the age of 6 year, and above 95% in adults (Hooi *et al*., 2017). The overall prevalence of *H.pylori* infection still remains high; and according to Meles and colleagues, more

than half (52%) of Ethiopians were infected. And, regional estimates of *H.pylori* infection showed a lower prevalence of 39.95 in Oromia and higher prevalence of 71% in Somalia region (Melese *et al*., 2019).

Most studies in Ethiopia were carried out by taking samples from one or two institutions and did not attempt to carry out a retrospective analysis of data from a relatively longer period of time. For instance; Akmel (2014) conducted a cross sectional to determine the prevalence of *H.pylori* infection among pediatric patients at Beham Specialized Children's Higher Clinic between March 2014 and May 2014 and the prevalence of *H.pylori* infection was 25.8%. Similarly, Worku (2017) carried out a cross sectional study on children at Selam Elementary School between March to June 2017 to determine the prevalence of *H.pylori* and intestinal parasite and their associated risk factor to claim that the prevalence of *H.pylori* infection is 14.6%. Kassahun (2019) also assessed the magnitude of *H.pylori* on peptic ulcer patients of ulcer diseases of two private health facilities in Addis Ababa through an institutional-based cross-sectional study to conclude that the magnitude of *H.pylori* infection was 52%.

As stated above, samples for the researches were selected from one or two institutions only. The data were also collected for one to four months. Moreover, the findings of the studies vary depending on geographic location, ethnicity, and demographic factors such as gender, age, marital status and number of family members of the studied population (Barik, 2009).

Therefore, taking these gaps into consideration and observing that similar studies have not been carried out in the study area previously, this study is designed to assess the prevalence of *H.pylori* infection in patients who were clinically diagnosed for dyspepsia in Arada Sub-City Health Centers in Addis Ababa from 2015/16 to 2019/20.

1.3. Objectives of the Study

1.3.1. The General Objective

The general objective of this research is to determine the prevalence of *H.pylori* infection among dyspeptic patients who were clinically diagnosed for dyspepsia in Arada Sub-City Health Centers in Addis Ababa from 2015/16 to 2019/20.

1.3.2. The Specific Objectives

The specific objectives of this research are:-

- To determine the prevalence of *H.pylori* infection among dyspeptic patients clinically diagnosed for dyspepsia.
- To show the highest prevalence rate of *H.pylori* infection among different age and sex categories.
- To examine the sex-specific trend of *H.pylori* infection among dyspeptic patients clinically diagnosed for dyspepsia.
- To investigate the age-specific trend of *H.pylori* infection among dyspeptic patients clinically diagnosed for dyspepsia.

1.4. Research Questions

The research answers the following major questions:

- What is the degree of prevalence of *H.pylori* infection among clinically diagnosed dyspeptic patients in Arada Sub-City Health Centers in Addis Ababa?
- In which age category is the rate of prevalence of *H.pylori* infection the highest among clinically diagnosed dyspeptic patients in Arada Sub-City Health Centers in Addis Ababa?
- In which sex category is the rate of prevalence of *H.pylori* infection the highest among clinically diagnosed dyspeptic patients in Arada Sub-City Health Centers in Addis Ababa?
- What does the sex-specific trend of *H.pylori* infection look like among dyspeptic patients clinically diagnosed for dyspepsia in Arada Sub-City Health Centers in Addis Ababa?
- What does the age-specific trend of *H.pylori* infection look like among dyspeptic patients clinically diagnosed for dyspepsia in Arada Sub-City Health Centers in Addis Ababa?

1.5. Scope of the Study

The research is concerned with the assessment of the prevalence of *H.pylori* infection among dyspeptic patients who were clinically diagnosed for dyspepsia in Arada Sub-City Health Centers from 2015/16 to 2019/20. The research focused on *H.pylori* infection and on patients who were clinically diagnosed with the infection in health centers in Arada Sub-City in years 2015/16 to 2019/20. It was also limited to studying *H.pylori* infection cases of different sex and age categories clinically diagnosed in years 2015/16 to 2019/20. Data was gathered from patients' register books that completely recorded in gender and age of patients who were

clinically diagnosed for dyspepsia in years 2015/16 to 2019/20 in nine Woreda health centers in Arada Sub-City Addis Ababa.

1.6. Limitations of the Study

In this study, data was collected from patients' register books to study the prevalence of *H.pylori*. However, not all patients with *H. pylori* would visit Woreda health centers as some patients could go to private clinics or hospitals. Others might have not at all gone to health institutions to see a health professional. Moreover, the health centers use two types of tests: serology (blood anti-body test) and stool anti-gene test. And, the difference in test methods could affect the prevalence rate since it is possible that the anti-body 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. Therefore, these limitations could to some extent affect the conclusion as a whole.

1.7. Significance of the Study

This research would be important to understand the degree of prevalence of *H.pylori* infection among dyspeptic patients who were clinically diagnosed for dyspepsia in Arada Sub-City Health Centers. It would enable interested users or officials to have a clue at which age and sex category was the prevalence of the infection the highest and to plan intervention activities in the future. Its findings could also help in strengthening the information available so far and highlight the situation to health administration officials and policy makers if they intended to design effective strategies of combating the infection in the study area. In addition, the research could help those who would like to make further investigations or interested researchers to reexamine the research topic in the study.

2. LITERATURE REVIEW

In this section, first, theoretical issues on *H.pylori*, risk factors, epidemiology, related diseases, diagnosis, treatment, and prevention are discussed in theoretical literature review. Then, previously conducted studies on the prevalence of *H.pylori* are revised, and the research gap is implied in the empirical literature review. Finally, the conceptual framework is forwarded.

2.1. Theoretical Literature Review

2.1.1. Helicobacter pylori

Helicobacter Pylori, also known as '*H.pylori*', is a species of helicobacter and it is a bacterium commonly found in stomach. It is a spiral-shaped gram negative bacterium that is found in the gastric mucous layer or adherent to the epithelial lining of the stomach and that can infect the human stomach (Fischbach and Malfertheiner, 2018). *H.pylori* causes more than 90% of intestinal and up to 80% of gastric ulcers (Judyta *et al*., 2016).

Its significance for human disease was first recognized in 1983 (Fischbach and Malfertheiner, 2018). The bacterium lives in the lining of the stomach, and the chemicals it produces causes inflammation of the stomach lining. The infection appears to be life-long unless treated with medications to eradicate the bacterium. It is present in approximately in half of the world's population. Vast majority of people infected with *H.pylori* infection have no symptoms and they will never develop problems (Timothy *et al*., 2016). However, *H.pylori* is capable of causing a number of gastro intestinal disorders, including ulcers and much less commonly, stomach cancer. It is not clear why some people with *H.pylori* get these conditions and others do not (Fischbachand and Malfertheiner, 2018).

In industrialized countries such as the United States, such an infection is unusual during childhood but it becomes more common during adulthood. However, in developing countries, most children are infected with *H.pylori* before age ten (Hooi *et al*., 2017).

2.1.2. The Risk Factors of Helicobacter pylori

H.pylori is probably spread by consuming food or water contaminated with fecal matter. Children living in developing countries may become infected after swimming in contaminated pools, streams, or rivers, by drinking contaminated water, or by eating uncooked vegetables or contaminated food (Zamani *et al*., 2017).

H.pylori causes changes to the stomach and duodenum. The bacteria invade the protective tissue that lines the stomach. This leads to release of certain enzymes and toxins. These enzymes and toxins may directly or indirectly injure the cells of the stomach or duodenum. As a result of these changes, the stomach and duodenum are more vulnerable to damage from digestive juices, such as stomach acid. This causes chronic inflammation in the walls of the stomach (gastritis) or duodenum (duodenitis) (Iannone *et al*., 2018).

Infected persons have a 2- to 6-fold increased risk of developing gastric cancer and mucosal associated – lymphoid - type (MALT) lymphoma compared with their uninfected counterparts. The role of *H.pylori* in non-ulcer dyspepsia remains unclear (Judyta *et al*., 2016)

2.1.3. Epidemiology

Researchers are not certain how *H.pylori* is transmitted or why some patients become symptomatic while others do not. It is most likely acquired in childhood but how this occurs is unknown (Aziz *et al*., 2015). The bacteria are most likely spread from person to person through fecal-oral or oral-oral routes (Bui *et al.* 2016). Possible environmental reservoirs include contaminated water sources (Lauritano *et al*, 2016). Other possibilities of being infected by *H.pylori* are related to transmission by insects like flies and use of medical equipment such as unsterile endoscopes and use of pH probes (Cave, 1997; Grubel *et al*., 1997; Fantry *et al*., 1995). Iatro-genic spread through contaminated endoscopes has also been documented but can be prevented by proper cleaning of equipment (Fantry *et al*., 1995). Anyway, a number of possibilities including sharing food or eating utensils, contact with contaminated water (such as unclean well water), and contact with the stool or vomit of an infected person have all been investigated but the answer is still not known. *H.pylori* has been found in the saliva of some infected people, which means infection could be spread through direct contact with saliva (Bui *et al.* 2016). There is no evidence that pets or farm animals are sources of infection (Zamani *et al*, 2017).

The infection has been shown to occur between family members (e.g. mother and child); however, it is very rare to catch *H.pylori* as an adult. And, most people are infected during childhood (Brown, 2000).

2.1.4. Diseases Caused by Helicobacter pylori

H.pylori infection is associated with other ailments like dyspepsia, gastritis, PUD, gastric adenocarcinoma, and MALT lymphoma. As stated by Venerito and colleagues (2015), up to 20% of *H.pylori* infected individuals can develop one or more of the following after effects: dyspepsia, gastritis, PUD, gastric adenocarcinoma, and MALT lymphoma (Venerito *et al*., 2015).

- **Dyspepsia**

The symptoms of dyspepsia usually include burning and pain in upper part of stomach, blotting and/or early satiety (Lacy *et al*., 2010). EGD must indicate no structural disease that could be related to symptoms; and, patients should have at least one of the symptoms stated previously (Rome Foundation, 2015). Even if ulcers and gastritis can cause such symptoms, up to 70% dyspeptic patients have no evidence of mucosal injury (Loyd and McClellan, 2011). In a prospective cohort study conducted by Sanping and associates, prevention of *H.pylori* was associated with improvement of epigastric pain (Sanping *et al*, 2015). As a result, in patients whose age is under 55 years that do not show alarming features such as, bleeding, anemia, early fullness, unknown loss of weight loss, dysphagia, odynophagia, periodic vomiting, family history of gastrointestinal cancer, previous esophago-gastric cancer, an *H.pylori* eradication treatment called “test and treat” strategy is recommended. However, patients with alarming features should undergo EGD and underlying pathology such as peptic ulcer disease or esophageal or gastric malignancy are not included (Chey and Wong, 2007).

- **Gastritis**

At an early stage of the infection, *H.pylori* gastritis preferentially causes inflammation at the tract from the esophagus to the stomach. Later on, the infection can migrate proximally toward the body and to the opening of the esophagus to the stomach. If it is not treated early, the acute gastritis can change into chronic gastritis. Mostly, *H.pylori* organisms are frequently detected at the holes in the stomach (Dursun *et al*, 2014). However, in some instances the organisms can be identified just in the body of the stomach, especially during proton pump inhibitor use or in the presence of marked atrophy or gastric intestinal metaplasia. When there is chronic inflammation, a loss of gastrin producing G-Cells can be caused and parietal cells are produced resulting in reduced acid production and the development of gastric atrophy or loss of muscle or flesh with intestinal metaplasia (Vaananen, 2003). Therefore, the decrement in gastric acid secretion may

lessen GERD symptoms and that is why it has been suggested that *H.pylori* infection can protect against the development of esophageal tumor. *H.pylori* infected patients associated with atrophic gastritis are usually asymptomatic although they are at increased risk of developing gastric carcinoma (Yanaoka, 2009).

- **Peptic Ulcer Disease**

According to Testerman and Morris, *H.pylori* is shown in 70–85% of patients who have gastric ulcers and 90–95% of patients who have duodenal ulcers (Testerman and Morris, 2014). However, it is necessary to obtain a detailed history to avoid non-steroidal anti-inflammatory drugs as an additional cause of PUD. At the early in infection, *H.pylori* preferentially colonizes the antrum resulting in exaggerated gastrin secretion and decreased somatostatin release, resulting increased acid release contributing to the creation of duodenal ulcers. If it is not treated, the *H.pylori* spreads closer to the body of the stomach where it may cause diffuse gastritis and gastric ulcers (Graham *et al*, 2014).

- **Gastric Adenocarcinoma**

As stated earlier, duodenal ulcers develop in the setting of antral predominant gastritis, minimal atrophy, and increased acid production. On the other hand, gastric ulcers and gastric carcinoma, are associated to widespread gastritis, extensive intestinal metaplasia, and decreased acid production (Correa, 1992).

According to the American Cancer Society (2008), gastric cancer was the fourth most common malignancy worldwide and approximately 72% of new cases occur in developing countries (American Cancer Society, 2008). Again, according to National Cancer Institute (2012), based on Surveillance, Epidemiology, and End Results (SEER) data in years 2005 to 2011, 29% of patients with gastric cancer relatively survive in USA (National Cancer Institute, 2012).

Besides, majority of gastric cancers are adenocarcinomas (Jemal *et al*., 2011). And, the gastric adenocarcinoma can be subdivided into two morphologic types: the first intestinal-type and the second diffuse-type. The later types of gastric adenocarcinomas are specifically less well-differentiated; and are with sheets of cells without gland formation - occasionally with signet ring cells and mucin. According to Sipponen and associates (1983), the commonest contributing factors for the development of intestinal-type gastric adenocarcinomas are *H.pylori* infection, chronic gastritis, atrophy, and intestinal metaplasia (Sipponen *et al*., 1983). Furthermore, *H.pylori* infection can also result in the development of diffuse-type gastric carcinomas although

gastric atrophy and intestinal metaplasia have not been indicated to contribute to its development (Adachi *et al*., 2000).

- **Mucosal Associated Lymphoid Tissue Lymphoma**

The mucosa associated lymphoid tissue in the stomach causes an extra-nodal lymphoma known as Extra-nodal marginal zone B cell lymphoma or low grade B cell lymphoma of MALT. This can develop in other mucosal sites besides the stomach. In up to 92% of patients with MALT lymphoma, the *H.pylori* is present at these sites (Wotherspoon *et al*., 1991). And, *H.pylori* gastritis directly contributes to the pathogenesis of this gastric malignancy and eradication decisive essential for successful treatment of low grade MALT lymphoma (Wotherspoon *et al*., 1991 and Zucca *et al*., 1998). According to a large cohort follow-up study conducted on 420 patients with gastric low grade MALT lymphoma that was carried out by Nakamura and colleagues, about 77% of the study participants responded to *H.pylori* eradication (Nakamura *et al*., 2012).

- **GERD and Barrett's Adenocarcinoma:**

H.pylori affects the acid production in the stomach. As a result it has been hypothesized to impact GERD symptoms and potential the development of esophageal adenocarcinoma. As discussed earlier, at the early stages of the infection *H.pylori* causes increased gastrin secretion while the somatostatin secretion is reduced. This has a net effect of maximizing the gastric acid release. Hence, in patients with a predisposition for GERD the increase in acid production caused by *H.pylori* infection may further exacerbate reflux symptoms. The pathophysiology underlying chronic *H.pylori* gastritis considerably varies from that of acute *H.pylori* gastritis. In the former infection, patients usually suffer from a loss of gastrin producing G cells and acid producing cells which results in decreased acid production. And, this effect can prevent against GERD, Barrett's esophagus and the development of adenocarcinoma in the esophagus. These features suggest a protective role for *H.pylori*, but studies have been limited due to the fact that study participants have been categorized as *H.pylori* infected or *H.pylori* uninfected whether *H.pylori* was localized to the gastric antrum or body has not been continuously examined (Fallone *et al*., 2000; Laine and Sugg, 2002; Nie *et al*., 2012; Weston *et al*., 2012; and, Yaghoobi *et al*., 2010).

2.1.5. Diagnosis of Helicobacter pylori

There are several ways to diagnose *H.pylori*. The most commonly used tests can be divided in to two: Endoscopic testing and Non-endoscopic testing.

- **Endoscopic Testing**

According to Chey and Wong (2007), during EGD, *H.pylori* can be recognized with biopsy by using the rapid urease test (RUT), histology, bacterial culture, or polymerase chain reaction (PCR) (Chey and Wong, 2007). There are many indications for EGD, and these are listed in the 2012 guideline from the American Society for Gastrointestinal Endoscopy. Even if EGD can be used to determine if a patient is infected with *H.pylori*, it should not be carried out only for the purpose of establishing the diagnosis if there are several non-invasive testing techniques available (Chey and Wong, 2007).

- **Rapid Urease Test**

When EGD is to be carried out, the best test methods for detecting *H.pylori* is the RUT conducted on antral biopsy specimens. Among patients who have been taking PPI, antibiotics, or bismuth within 2 weeks before EGD, the spread of *H.pylori* infection can be patchy; hence, biopsies from both the antrum and the gastric body are important for RUT (Chey and Wong, 2007). In a prospective study carried out by Van and associates (2005), biopsies that were obtained from both the antrum and gastric body exhibited the presence of *H.pylori* in 307 (50%) patients out of 620 patients undergoing EGD for gastrointestinal symptom either by RUT or histology (Van *et al*., 2005). As revealed in the study, carrying out RUT on gastric body biopsies in addition to antral biopsies maximized the detection rate of *H.pylori* by 6.3% (Van *et al*., 2005). By and large, for detection of *H.pylori*, RUT has a sensitivity of 90 - 95% and a specificity of 95 - 100% (Midolo and Marshal, 2000; Perena *et al*., 2005).

- **Histology**

According to Chey and Wong (2007), although the test is expensive and requires trained personnel, the gastric biopsy histology testing for *H.pylori* has a high sensitivity and specificity, with both exceeding 95% (Chey and Wong, 2007). The accuracy of this test depends on the biopsied site, the number of biopsies obtained, and the size of biopsies submitted. Similarly, RUT, the test performance of this method can be obstructed due to the setting of antibiotic, bismuth, or PPI use (Chey and Wong, 2007). As claimed by Van and associates, to increase the detection rate of *H.pylori* infection the gastric body biopsies can be employed in combination with antral biopsies although it is not clear that whether or not the patients who participated in this study and who had isolated positive gastric body histology with H.pylori were on PPI, antibiotics, or bismuth (Van et al., 2005).

- **Bacterial Culture and PCR**

Both bacterial culture and PCR are not often used in the clinical setting as they are hardly widely available. Although the bacterial culture method is useful for identifying the susceptibility of *H.pylori* to antibiotics, it is not that much effective for identifying the presence or absence of *H.pylori*, and its sensitivity is only 53% while its specificity approaches 100% (Chey and Wong, 2007; Lehours *et al*., 2003). On the other hand, PCR is a DNA amplification technique that uses multiple copies of a target DNA sequence to detect *H.pylori*. And, it can detect *H.pylori* that cannot be identified on histology (Zsicla *et al*., 2006). Its sensitivity is greater than 90% (VanDoorn *et al*., 1998; Sugimoto *et al*., 2009). Besides, it is more advantageous as it can detect mutations associated with antimicrobial resistance. Certainly, this allows clinicians to come up with their eradication own strategy according to the relevant situation (Lawson *et al*., 2005). Nevertheless, as stated earlier, PCR is now mostly limited to research purpose as it is unavailable for daily clinical test operations.

- **Non-Endoscopic Testing**

There are three noninvasive diagnostic tests available for detecting *H.pylori* infection. These are: the antibody testing, the urea breath testing, and the fecal antigen test.

- **Antibody Testing**

This test method is also called serum *H.pylori* IgG testing; and the antibody is generally detectable approximately within 21 days after infection. It also remains positive long after eradication (Ho and Marshal, 2000). This test method has a sensitivity of up to 85% with a specificity of 79% (Loy et al., 1996). Although the antibody testing is cheap and widely available, it has limitations as it cannot distinguish between active and past infection.

- **Urea Breath Test**

Another testing option of noninvasive diagnostic tests is the urea breath test, which requires the patient to swallow urea that is labeled with either non-radioactive (^{13}C) or radioactive carbon (^{14}C); and this is considered as a major drawback. In the presence of *H.pylori* urease produced by the bacteria decomposes the swallowed urea and labeled carbon dioxide which is measured in exhaled air is released (Chey, 2000). The sensitivity and specificity of this testing method is greater than 95%. However, antibiotics and bismuth have to be avoided or removed for at least a month and PPI for 1 or 2 weeks before the testing is carried out. If the test is conducted on these medications, the test results can be associated with an increased false negative rate. Besides, the

availability of the test is determined by the requirement for appropriate testing equipment and the cost of labeled urea limits (Chey and Wong, 2007).

- **Fecal antigen test**

This test detects *H.pylori* antigen in stool through immunologic techniques through the use of a polyclonal antibody directed against *H.pylori* (Chey and Wong, 2007). Fecal antigen identifies active infection; hence, it can be used as an identification test as well as for checking whether the infection is eradicated. If it is to be used for documentation of cure after an *H.pylori* therapy, it has to be performed 8 weeks after the completion of the therapy. As in the case of the urea breath test, patients are required to avoid PPI for at least 2 weeks prior to undergoing fecal antigen test in order to reduce the probability of having a false negative result (Costa *et al*., 2001).

2.1.6. Treatment of Helicobacter pylori

There are many alternative treatments for patients with active *H.pylori* infection. The appropriateness of determining treatments mostly depends on factors such as local susceptibility patterns, whether a patient is undergoing initial treatment, likelihood of patient adherence, and patient factors like the presence or absence of drug allergies. It is important to adhere to a therapy since non-adherence can contribute to failure in treatment as well as antibiotic resistance. Generally, treatments that are easier to administer are most likely preferred. When compared to more frequent dosing treatments, eradication treatments which exterminate the bacteria and require the patient to take drugs two times a day are more likely to be followed. Mostly of the time, both - the three drug treatment and the four drug treatment acceptable as first-line therapies in order to eradicate *H.pylori*. The triple therapy constitutes a PPI, clarithromycin, and amoxicillin or metronidazole and medication is taken twice daily. And, the triple therapy has to be administered for 14 days (Yuan *et al*., 2013; Kim *et al*., 2007).

On the other hand, the quadruple therapy employs a PPI or H receptor antagonist, bismuth, metronidazole, and tetracycline. The medications are to be taken up to four times a day for 10–14 days (Chey and Wong, 2007). Both triple and quadruple therapies that constitute a PPI, clarithromycin and amoxicillin or metronidazole, and a PPI or H receptor antagonist, bismuth, metronidazole, and tetracycline respectively have been recommended as primary options for the treatment of *H.pylori* infection; however, the complexity of taking doses of medication four times a day and taking greater number of medications in quadruple therapy can be challenging

for patients. Moreover, this kind of treatment has the potential to be related with minimized patient adherence.

Eradication rates are different according to the strategy to be used. Although, previous eradication rates with triple therapy and quadruple therapy were as high as 93% and 80%, respectively, Clarithromycin-based triple therapy has been reported to become less effective over time (Kalach *et al*., 2015; Kim *et al*., 2007; and, Romano and Cuomo, 2004). In a meta-analysis conducted by Gong and associates (Gong, 2014) that examined 104 studies on 42,124 patients treated with triple therapy for *H.pylori* infection, the general eradication rate of the treatment was found to be 75% (95% CI 72-77%) by intention-to-treat analysis and 82% (95% CI 8183%) by per-protocol analysis (Gong *et al*., 2014).

Another prospective study by Graham and associates (2014) on 37 patients found that the eradication rate in relation to 14 days of quadruple therapy given two times a day was 92% (95% CI 79-98%) (Graham *et al*., 2014). Although the data implied that quadruple therapy is more efficient than triple therapy, the study sizes greatly differ which requires consideration in interpreting these data.

H.pylori can also be used treated by sequential therapy. This method is different as all medications are taken at the same time. In a sequential therapy, a PPI is first administered with amoxicillin for 5 days, and this is followed by a PPI, clarithromycin, and tinidazole (or metronidazole) for additional 5 days (Chey and Wong, 2007). In a prospective randomized study by Scaccianoce and colleagues (2006) conducted on 213 patients, sequential therapy was proved to be more efficient than either 7 or 10 days of triple therapy with specifity of 94%, 76% and 82% respectively and $p < 0.05$); determination of adherence was done by pill count at follow-up visit. Among the 213 patients who participated in the study, only 6 patients which comprised of 3% of participants withdrew from the study due to side effects; and there was no difference in the incidence in side effect among the treatment forms studied (Scaccianoce *et al*., 2006). In another meta-analysis of 10 randomly controlled trials carried out by Gatta and associates (2009), on 3,006 adults, sequential therapy was reported to be more effective for eradication of *H.pylori* than both 7 day triple therapy with Odd Ratio 3.0, 95% Confidence Interval 2.5-3.6 and 10 day triple therapy with Odd Ratio 2.9, 95% Confidence Interval 2.0-4.4 without a difference in side effects with Odd Ratio 1.2, 95% Confidence Interval 0.8-1.3 (Gatta *et al*., 2009); and

adherence to sequential therapy exceeded 90% (Scaccianoce *et al*., 2006; Zullo *et al*., 2003; Zullo *et al*., 2005; and, Francavilla, 2005).

When the *H.pylori* infection persists, bismuth-based quadruple therapy, levofloxacin-based triple therapy, or sequential therapy are commonly used and acceptable salvage alternatives; and previously used antibiotics have to be avoided in cases of persistent *H.pylori* infection; because, the bacteria can become resistant to prior medications. As they are characterized by expensiveness and lack of availability, culture and antimicrobial sensitivity testing methods are not usually recommended (Chey and Wong, 2007).

2.1.7. Prevention of Helicobacter pylori Infection

The overall improvement in standards of domestic hygiene last century has led to a marked decline in *H.pylori* in the Western world. As no one knows exactly how *H.pylori* spreads, prevention on an individual level is difficult (Chey and Wong, 2007). Researchers are trying to develop a vaccine to prevent and cure *H.pylori* infection. To help prevent the infection, doctors advise people to follow good hygiene practices: "Wash hands with soap and water after using the bathroom and before eating," "Eat food that has been well washed and properly cooked," and "Drink water from a clean, safe source" (Jones *et al*., 2017).

2.2. Empirical Literature Review

Various studies have been conducted worldwide and in the context of Ethiopia regarding the prevalence of *H.pylori* so far. In this section studies carried out by different researchers are revised.

2.2.1. *H.pylori* in the World

H.pylori is one of the most common infections affecting more than 50% of the world population. It is highly prevalent in developing countries (Megraud, 1993). There are studies that show the prevalence of *H.pylori* in different countries. *H.pylori* infection is common in all parts of the world, although the prevalence is higher in developing countries than industrialized countries (Bures *et al*, 2011). Approximately 50% of the population in industrialized countries is proved to have *H.pylori*. This percentage increases to 80% in developing countries (Hunt *et al.* 2011).

According to Graham and colleagues (2009), the prevalence of *H.pylori* and associated diseases has been highly inconsistent worldwide. In industrialized countries there is generally a low prevalence of *H.pylori* infection. On the other hand, the prevalence of *H.pylori* infection is high in less developed Asian countries (Graham *et al*., 2009). The worldwide estimate of *H.pylori* was

reported at 48.5% while reports from different continents were 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 (Melese, 2019).

Although the actual infection rates vary from country to country, *H.pylori* is less common in industrialized countries and the prevalence is approximately 20-30%. In developing countries, the prevalence is higher approaching 90% (WGO, 2011). Similarly, Hooi (2017) claims that the infection is more common in developing countries; and in countries with poor sanitation, 90% of the adult population can be infected (Hooi, 2017).

2.2.2. *H.pylori* in Africa

With regard to Africa, infection with *H.pylori* is relatively common, and it mainly causes at least 90% of intestinal ulcers and 70% of stomach ulcers. Studies conducted in several parts of Africa have reported high prevalence of *H.pylori* infection from 61% to 100%) varying from country to country and between different racial groups within each country (Ndip, 2003). Various studies have reported different rates of prevalence for different countries in Africa; for instance, 89% rate from Addis Ababa, Ethiopia, (Desta *et al*., 2007) 87% in Uganda, (Newton *et al*., 2007) 65% in Tanzania, (Ayana *et al*., 2016) 63.5% in Nigeria, (Abiodun *et al*., 2011) 80.5% in Kenya, (Ogutu *et al*., 1998) and 75.4% in Ghana (Baako and Darko, 1996).

2.2.3. The Overall Prevalence of *H.pylori* in Ethiopia

Ethiopia is one of the developing countries in Africa. According to a journal by the US National Library of Medicine (2019), the prevalence of *H.pylori* infection remains high and the prevalence of *H.pylori* is estimated to be 52%. Recently, Adisu and colleagues (2019) conducted a comprehensive systematic review and meta-analysis through Review Manager (RevMan 5.3) to estimate the pooled prevalence and summarize odds ratios of factors related to *H.pylori* infection. And, they concluded that the prevalence of *H.pylori* infection remains high. Besides, similar to the former study, Adisu and colleagues claimed that more than half of Ethiopians (52%) were infected. And, estimates of *H.pylori* infection from different regions showed a lower prevalence of 39.95% in Oromia and a higher prevalence of 71% in Somalia region (Adisu *et al.* 2019).

2.2.4. *H.pylori* and Sex

Besides, several studies were carried out on the relationship between sex and *H.pylori* infection. However, the findings on the role sex plays as a risk factor for *H.pylori* infection varies from one study to the other and it is much argued. For instance, in Brazil, two hundred and four individuals, 49 males and 155 females with ages ranging from 18 to 80 years, participated in a study. And, 165 of 204 participants (80%) were *H.pylori* positive, with no significant gender differences (P= 0.49) (Rodrigues, 2005). Sathar and colleagues also conducted similar study in south-eastern and central south Brazil, and from Africa and India, and concluded that there were no gender differences in the risk of acquisition of infection (Sathar *et al*., 1997). Rasheed and colleagues, and Petrovich and colleagues also conducted the same study in some countries in Southern Asia and Eastern Europe, and they found no association between sex and *H.pylori* infection (Rasheed *et al*., 2011 and Petrovic *et al*, 2011). However, Zevit and colleagues, and Rehnberg and colleagues carried out similar studies in Western Europe and Scandinavia respectively; and reported that there is a female predominance and the female are more susceptible to *H.pylori* than the male (Zevit *et al*., 2011 and Rehnberg *et al*., 1998).

2.2.5. *H.pylori* and Age Category

Several studies were conducted to determine the relationship between age category and H.pylori. In developing countries, *H.pylori* infection is markedly more prevalent at younger ages than in industrialized countries (Hunt *et al*., 2011). As stated by Jackson and colleagues, in developing countries in which most of children are infected before the age of 10, and, the prevalence in the adult peaks to more than 80% before the age of 50 years. Whereas, in industrialized nations, serologic evidence of *H.pylori* is rarely found before 10 years of age, but increases to 10% in those between 18 and 30 years of age and to 50% in those older than 60 (Jackson *et al*., 2009) . According to another study by Javed and colleagues, the prevalence of infection with *H.pylori* varied between 7% in a study conducted among asymptomatic children in the Czech Republic, and 24% to 92% in Pakistani population (Javed *et al*., 2010).

Some studies claim that the prevalence rate for *H.pylori* does not vary in age category. For instance, in a rural village of Linqu Country, Shandong Province, China, a study of 98 children found that nearly 70% of those aged 5-6 years were infected with the organism, a rate similar to that reported for adults in that area, suggesting that most infection takes place early in childhood (Thomas *et al*., 2004). Moreover, there are studies that claim the

prevalence of *H.pylori* has become lower in recent years. According to a study conducted in China on children and adults with both a low and a high incidence of gastric cancer in two regions, the prevalence of *H.pylori* was significantly lower in 2006 when compared to the early 1990s, with a decrease in the prevalence between 5% and 28%, depending on the population under study (Shimoyama *et al*., 2009).

As the World Gastroenterology Organization - WGO (2017) claimed, the Prevalence of *H.pylori* in Ethiopia was 48% in age between 2-4, 80% at the age of 6 and 95% in adult's population (WGO, 2017). Hooi and colleagues also agree that in Ethiopia the prevalence of *H.pylori* reaches as high as 48% in children aged 2–4 year, 80% at the age of 6 year; however, their estimation regarding the prevalence of *H.pylori* infection is above 95% in adults (Hooi *et al*., 2017).

In general, there are several studies that showed conflicting findings about the association of age and *H.pylori* infection of patients. Studies conducted in China and Bhutan reported that there is no statistically significant association between age of the patients and *H.pylori* infection (Dorji *et al*., 2013). However, several other studies conducted in other places found a significant relationship between age of the patients and the prevalence of *H.pylori* (Wizla *et a*l., 2001; Malaty *et al*., 2002; and, Granstrom *et al*., 1997).

2.5.6. The Prevalence of *H.pylori* in Different Regions in Ethiopia

Several studies were conducted in specific regions in Ethiopia including Addis Ababa regarding the prevalence of *H.pylori*. The findings of these studies vary due to demographic factors, study participants and methods of test. Some studies are discussed below:

According to Mathewos (2014) who carried out a retrospective study on the prevalence of *H.pylori* among 912 *H.pylori* suspects in Amhara Region in years 2009 to 2011 by using serology test, the prevalence was found to be 65% (Mathewos, 2014). Abebaw (2014) also conducted a cross sectional study in the same region in 2013 on 209 dyspeptic patients through the same test method as the former, and estimated the prevalence of *H.pylori* to be 72.2% (Abebaw, 2014). Again, the same study was conducted in the same region and with similar method of testing in years 2015 – 2016 on 363 study participants with upper gastro-intestinal symptoms and concluded that the prevalence of *H.pylori* was 70.2% (Seid, 2018).

Tesfaye (2017) also carried out a cross sectional study in Oromia on 461 health facility and school children in years 2016-2017 by using serology and stool anti-gene test and found out that

the prevalence of *H.pylori* was 64.2% which is lower than those discussed above (Tesfaye, 2017). Kibru (2014) even estimated a prevalence rate of 52.4% after holding a cross sectional study in Southern Nations and Nationalities Region in 2013 on 401 dyspeptic patients by using stool anti-gene test (Kibru, 2014). Again, Hailu (2016) estimated a prevalence rate lower than this in a similar study in the same region carried out in years 2012-2013 on 349 study participants with upper gastro-intestinal symptoms, this time using only the stool anti-gene test; and the estimation was 50.7% (Hailu, 2016). Furthermore, according to Dilnesa (2017), who conducted similar study on 230 dyspeptic and non-dyspeptic patients in Gumuz in 2015 by employing stool anti-gene test, the prevalence of *H.pylori* was the lowest of all that were discussed in this section, only 48.7% (Dilnesa, 2017).

The results of studies conducted concerning the prevalence of *H.pylori* in Addis Ababa were also different. For instance, according to Asrat (2004), on a cross sectional study carried out in years 2000-2002 on 300 dyspeptic patients through multiple test methods including PCR, rapid urease test, silver stain, stool anti-gene and serology tests, the prevalence of *H.pylori* was estimated to be 91% (Asrat, 2004). Besides, based on Tadesse (2011) who conducted a case control study on 238 dyspeptic and non-dyspeptic patients in 2009 by using stool anti-gene and serology tests, the prevalence of *H.pylori* was 45.8% (Tadesse, 2011). Moreover, a cross sectional study conducted in years 2010-2011 on 212 HIV positive and negative study participants through a serology test estimated the prevalence of *H.pylori* to be 56.6% (Teka, 2016).

As a whole, the prevalence of *H.pylori* infection in studies carried out in specific regions in Ethiopia is different from place to place. Similarly, institution based studies conducted in Ethiopia too, indicate different findings. For example, an institutional-based cross-sectional study was conducted in Gondar by Desie and colleagues (2017) on 354 dyspeptic patients. According to this study, *H.pylori* infection was tested by employing stool antigen test method. In this study, among the total study participants, 201(56.8%) were married, 195(55.1%) were urban residents and 182(51.4%) were females, and the overall prevalence of *H.pylori* infection was 37.6%. In this study, sex and marital status were significantly associated with *H.pylori* infection. Finally they conclude the prevalence of *H.pylori* infection is high showing that the infection is a public health problem in the study area (Desie *et.al* 2017).

Apart from this, a comparative cross-sectional study was also conducted among dyspeptic and non-dyspeptic adults from March 2015 to October 2015 at Assosa General Hospital in Ethiopia. In this study, the presence of stool antigen of *H.pylori* was determined against anti-*H.pylori* antibody conjugated with colloid gold nitrocellulose membrane strip; besides, a structured interview was conducted face-to-face with interviewees to assess risk factors for *H.pylori* infection. Among a total of 230 (115 dyspeptic and 115 non-dyspeptic) study participants, overall 112(48.7%) antigens of *H.pylori* were detected. The prevalence of *H.pylori* was significantly associated with gender in both dyspepsia [AOR=2.33, 95% CI: 1.13-5.86), p=0.023] and non-dyspepsia adults [AOR=1.07, 95% CI: 1.01- 3.83, p=0.035] (Tebelay and Muluwas, 2017). Furthermore, a case control study was conducted between December 2010 to February 2011 on a total of 106 patients at Hawassa Teaching and Referral Hospital, South Ethiopia. Of the total 106 participants, 54 (51%) were male and 52(49%) female with mean age 32 years, range 18-75 years. Of these the seropositivity for *H.pylori* infection was found in 37(70%) of 53 dyspeptic patients (95% CI, 55.7% - 81.7%) and 29 (54%) of 53 non dyspeptic participants (95% CI, 40.4% - 68.4%) p >0.05). The seroprevalence in participants that have family size > 5 was 71.4 % (45/63) and 48.8 % (21/43) for family size < 5 [AOR=2.6 (3.97-7.127) p<0.05] (Alem, 2011).

Research Gap

In general, in most of the researches conducted in Ethiopia, samples for the research were selected from one or two institutions only. The data were also cross sectional i.e. collected for one to four months. Besides, the findings of the studies vary depending on geographic location, economic status and demographic factors such as gender, age, marital status and number of family members of the studied population. Finally, most of the researches were carried on relatively long time ago; and none were conducted on the study area previously.

As a result, it was very important to conduct a research by collecting a time series data (of five years) from different health centers (nine health centers in Arada-Sub-City) to fill the stated research gaps.

2.3. Conceptual Framework

This research is aimed at determining the prevalence of *H.pylori* infection among patients who were clinically diagnosed for dispepsia in nine Health Centers in Arada Sub-City from 2015/16

to 2019/20. Therefore, the researcher has developed the following conceptual framework based on the literature review and Abebe Worku (2017).

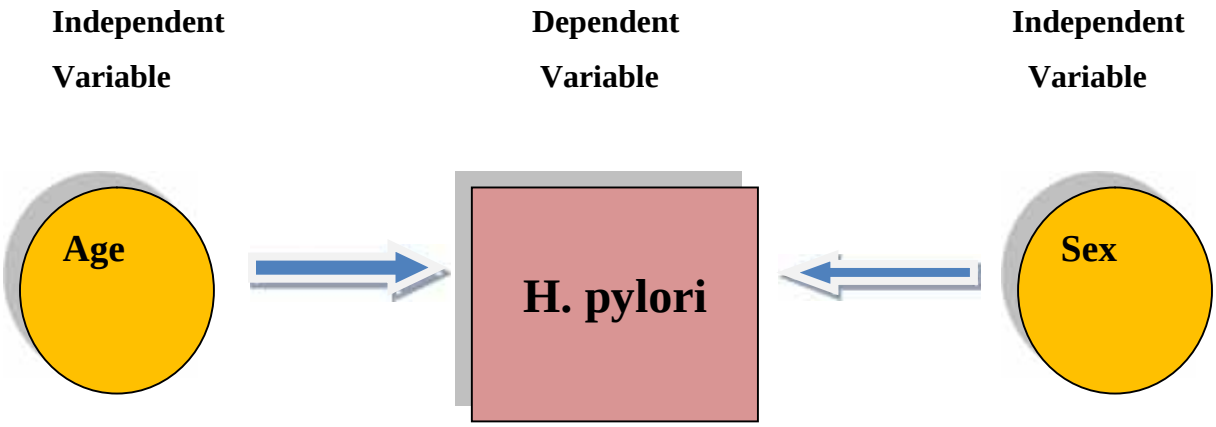


Figure 1: *Conceptual Framework of the Research*

(Adapted from Abebe Worku, 2017)

3. MATERIALS AND METHODS

3.1. 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.). It is roughly situated in the central northern part of Addis Ababa. Its geographical location is 9^0 2'6" 9.6000''N and 38^0 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 woreda's, 31 sub-woredas, 100 sefers and 316 blocks. According to 2017/2018 population projections, the population of Arada Sub-City was 272,356; of which 130,730 (48%) are male and 141,625 (52%) are female. And, the population density per sq.m: 22, 805 (CSA, 2018). There are ten public health centers in Arada Sub-City, one in each woreda. Except Woreda 9 Health Center, all health centers have been providing service for more than five years. The recently built Woreda 9 Health Center started operation in 2019 (Arada Sub-City Health Office).

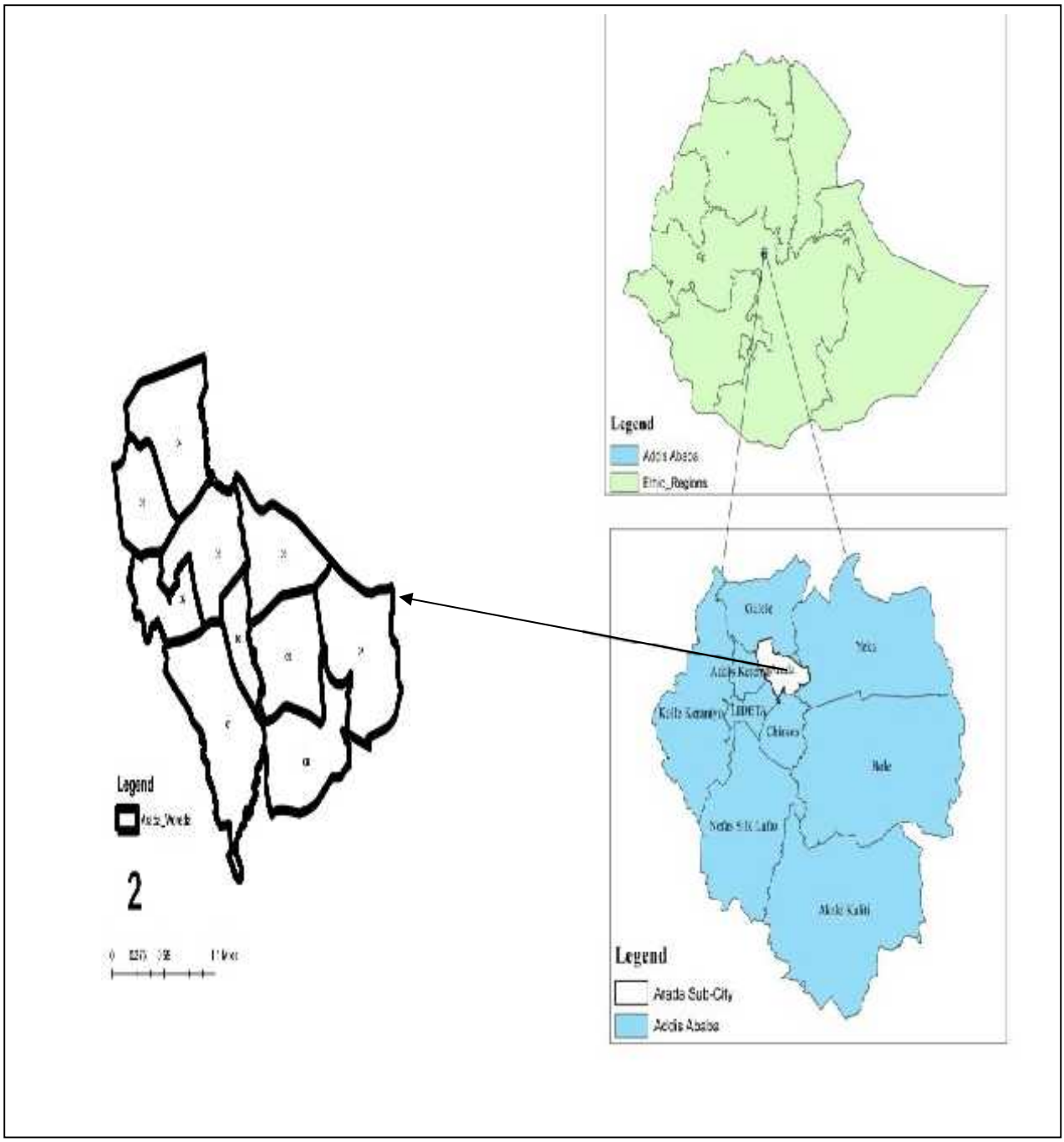


Figure 2: *The Map of Ethiopia, Addis Ababa and Arada Sub-City*

(Source: Arada Sub-City Land Management Office, 2020)

3.2. Study Design and Period

This research was institutions-based retrospective study. It was be conducted based on data from 2015/16 to 2019/20 in nine health centers in Arada Sub-City.

3.3. Study Population

The study population was all dyspeptic patients who had been suspected for *H.pylori* infection and who had been clinically diagnosed for dyspepsia in Arada Sub-City health centers in Addis Ababa from 2015/16 to 2019/20.

3.4. Data Collection Procedure

Time series secondary data was used in this study. As a result, all patients who were clinically diagnosed for dyspepsia from 2015/16 to 2019/20 in nine health centers in Arada Sub-City in Addis Ababa, and whose data had been completely registered were included in the study. Hence, five-year data from July 2016 to June 2020 were taken from the patient record books available in Arada Sub-City Health Centers. For this study data for two major socio-demographic characteristics: age and sex was collected because the objective of the study is to determine the prevalence of *H.pylori* infection among dyspeptic patients with respect to age and sex. Moreover, these two are the only data found registered completely in our data source (i.e. the patients register book).

3.5. Detection of *H.pylori* infection

Data was generated from the Departments of Specimen Collection and Laboratory of nine health centers in Arada Sub-City. These departments mostly carry out fecal antigen testing that identifies *H.pylori* antigen in stool through immunologic techniques and they sometimes conduct antibody testing which is a serological method of detecting the antibodies for *H.pylori* from serum or plasma. The test methods that were used to detect *H. pylori* were SD BIOLINE *H. pylori* Ag Rapid test with 2 pre-coated lines, “T” (Test Line) and “C” (Control Line), EZ-STEP H. pylori Ag ELISA [Principle] the EZ-STEP *H. pylori* stool antigen test that utilizes polyclonal anti- *H. pylori* to capture antibody adsorbed to micro wells, and dBest *H. pylori* test disk that contains a membrane strip, which is pre-coated with H. pylori capture antigen on test band region.

3.6. Variables of the Study

In this study there are three variables. The dependent variable of the study is the prevalence of *H.pylori* infection; and, the independent variables of the study are age and sex.

3.7. Statistical Data Analysis and Presentation

Data was coded, and entry and statistical analysis was performed using SPSS Version 20. Before analysis, the completeness of the collected data was checked, and a frequency distribution of variables was done after that. To test for the presence of association between prevalence of *H.pylori* and the independent variables age and sex, Chi-square test was used. Statistical significance was defined as p-value of < 0.05. The strength of association was interpreted using the chi-squared value (χ^2). Finally, the results were presented in narration, tables and graphs.

3.8. Data Quality Control

To ensure the quality of data, the completeness of the data collected from the patient registration books in all the 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.

3.9. Ethical Consideration

The study was approved by the Institutional Review Board Committee of the College of Natural and Computational Sciences of Addis Ababa University. An official letter was obtained from Addis Ababa City Health Bureau to collect relevant data. Furthermore, a letter of cooperation was also written to access the data in patients register book in the health centers from Arada Sub-City Health Office. And, all patients' data was kept confidential and used for the purpose of the study only.

4. RESULT

4.1. Age and Sex of the Study Participants

A total of 15940 dyspeptic patients were screened for *H.pylori* in nine health centers in Arada Sub-City for five consecutive years from July 2016 to June 2020. Among 15940 study participants 6205 (39%) were male patients while 9735 (61%) were female. The male-to-female ratio of the study participants was 0.64:1. This implies that more female patients were diagnosed in the health centers in Arada Sub-City from July 2016 to June 2020 than male patients. Again, from the study participants, 1030 (6%) are between 0 to 14 years; 7467 (47%) are between 15 to 29 years; 2291 (14%) are between 30 to 44 years; 3127 (20%) are between 45 to 59 years; and 2025 (13%) are 60 years or above. This shows that most of the patients that were diagnosed in health centers in Arada Sub-City from July 2016 to June 2020 were young and between 15 to 29 years old and the least went to patients between 0 to 14 years. (Table 1)

Table 1: Sex and Age of Study Participants

Sex		
	Frequency	**Percent**
Male	6205	39
Female	9735	61
Age Category		
	Frequency	**Percent**
0-14 years	1030	6
15 -29 years	7467	47
30 - 44 years	2291	14
45 - 59 years	3127	20
≥ 60 years	2025	13

In other previous researches that were conducted to assess the prevalence of *H.pylori* too, the number of male and female participants was different. For instance, in a research conducted in Selam Fire Elementary School the percentage of male and female patients who participated in the study were 55.2% and 44.8%. Likewise, in a study carried out on the prevalence of *H.pylori*

in Baham Specialized Hospital was 48.4% and 51.6% (Akmel, 2014 and Worku, 2017). There was also difference in the percentage of participants with regard to their age category and there were different ways of categorizing. Therefore, this difference in sex and age ratio of study participants does not affect the analysis or findings as prevalence is computed separately.

4.2. Prevalence of H.pylori Infection among the Study Participants

Table 2: 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

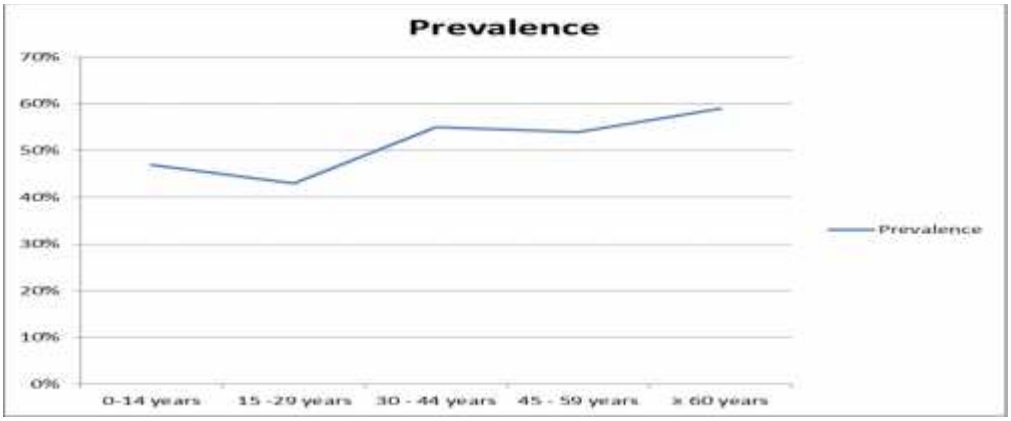
VARIABLES		Diagnosed Patients		H.pylori positive Patients		H.pylori negative Patients		χ^2	p-value
		N	%	N	%	N	%		
Gender	Male	6205	39	3084	50	3121	50	0.985	0.321
	Female	9735	61	4760	49	4975	51		
Age category (in years)	0-14 years	1030	6	485	47	545	53	245.117	<0.0001
	15 -29 years	7467	47	3223	43	4244	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		

Overall, among the total number of 15940 participants of the study 7844 (49%) of the study participants were found to be *H.pylori* positive. From 6205 male patients 3084 (50%) were *H.pylori* positive. And, among 9735 female patients, 4760 (49%) were *H.pylori* positive. Therefore, the prevalence of *H.pylori* infection among the male patients was almost similar to that of the female patients. The differences between *H.pylori* positivity of male and female subjects were statistically insignificant ($\chi^2 = 0.985$, $P = 0.321$). (Table 2)

As shown in Table 2 and Figure 1, from 1030 patients in the age group between 0 to 14 years 485 (47%) were *H.pylori* positive, and from 7467 patients in the age group between 15 to 29 years 3223 (43%) were *H.pylori* positive. Moreover, from 2291 patients in the age category between 30 to 44 years 1264 (55%); from 3127 patients in the age category between 45 to 59

years 1679 (54%), and from 2025 patients in the age category of 60 years or above 1193 (59%) were *H.pylori* positive. The prevalence of *H.pylori* was higher among the participants in the age category of 60 years or above (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 (χ^2= 0.985, P<0.0001).

Figure 3*: The overall prevalence of H.pylori among different age category dyspeptic patients in nine health centers in Arada Sub-City for five consecutive years from July 2016 to June 2020*



4.3. Trend Analysis of H.pylori in Five Consecutive Years

4.3.1. Sex-specific trend of prevalence of H.pylori among dyspeptic patients in Arada Sub-City Health Centers from July 2016 to June 2020

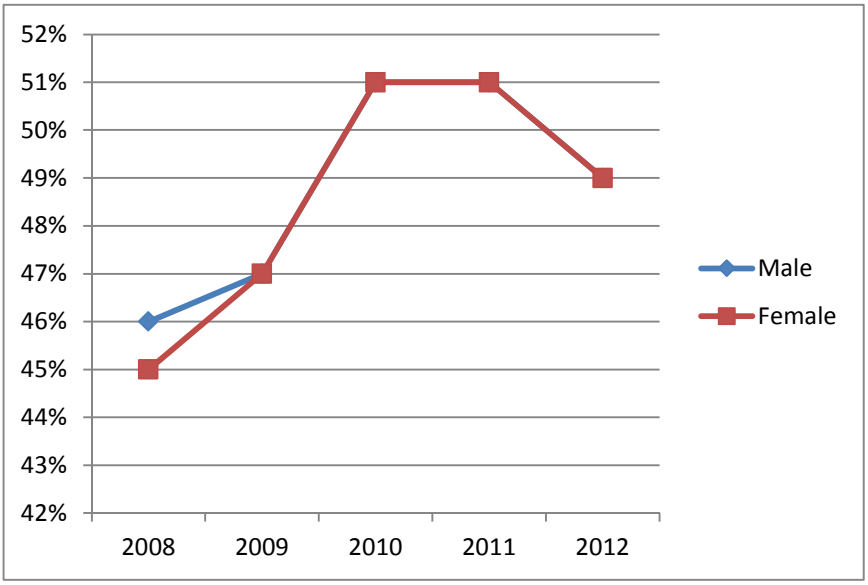
Table 3: Sex-specific trend of total prevalence of *H.pylori* in Arada Sub-City Health Centers from July 2016 to June 2020

Year	Male diagnosed (N)	Male positive (N)	Male Positive (%)	Female diagnosed (N)	Female positive (N)	Female Positive (%)	χ^2	p-value
2016	635	302	48	1064	483	45	0.749	0.387
2017	837	405	48	1359	634	47	0.626	0.429
2018	1011	526	52	1534	784	51	0.206	0.65
2019	1002	519	52	1599	812	51	0.254	0.614
2020	2720	1332	49	4179	2047	49	0.0001	0.992

Regarding the sex-specific prevalence of *H.pylori*, of the 635 male patients diagnosed for *H.pylori* in 2016, 302 (48%) were positive, and of the 1064 female patients examined in the same year, 483 (45%) were found to be positive. This higher prevalence found in males was

higher than one in females in this year was not statistically significant (χ^2=0.749, P=0.387). In 2017, of the 837 male patients diagnosed for *H.pylori*, 405 (48%) were positive, and of the 1359 female patients examined in the same year, 634 (47%) were found to be positive. Again, the higher prevalence found in males than in females in this year was not statistically significant (χ^2=0.626, P=0.429). Similarly, of the 1011 male patients diagnosed for *H.pylori* in 2018, 526 (52%) were positive, and of the 1534 female patients examined in the same year, 784 (51%) were found to be positive. This higher prevalence found in males than in females in this year was not statistically significant (χ^2=0.206, P=0.65). In 2019 also, of the 1002 male patients diagnosed for *H. pylori*, 519 (52%) were positive, and of the 1599 female patients examined in the same year, 812 (51%) were found to be positive. Hera also, the higher prevalence found in males than in females in this year was not statistically significant (χ^2=0.254, P=0.614). Finally, of the 2720 male patients diagnosed for *H. pylori* in 2020, 1332 (49%) were positive, and of the 4179 female patients examined in the same year, 2047 (49%) were found to be positive. Different from the other years, the prevalence found in males and in females in this year was similar and this similarity was not statistically significant (χ^2=0.0001, P=0.992).

Figure 5: Sex-specific trend of total prevalence of *H. pylori* in five years (from July 2016 to June 2020) at Arada Sub-City Health Centers



4.3.2. Age-specific trend of the prevalence of H.pylori among dyspeptic patients in Arada Sub-City Health Centers from July 2016 to June 2020

Table 4: Age-specific trend of total prevalence of *H.pylori* in Arada Sub-City Health Centers from July 2016 to June 2020

Year	0 to 14 Years		15 to 29 Years		30 to 44 Years		45 to 59 Years		60 and above Years		TOTAL		χ^2.	p-value
	Diag.	Prev. (%)	Diag.	Prev. (%)	Diag.	Prev. (%)	Diag.	Prev. (%)	Diag.	Prev. (%)	Diag.	Prev. (%)		
2016	126	38.9	839	38.5	222	59.0	291	55.0	221	55.2	1699	46.2	53.625	<0.0001
2017	166	47.0	1034	42.4	285	56.1	399	49.6	312	52.9	2196	47.3	23.833	<0.0001
2018	239	47.3	1184	42.1	347	58.5	457	59.3	318	70.4	2545	51.5	106.792	<0.0001
2019	158	59.5	1300	44.9	358	52.5	508	51.8	277	72.9	2601	51.2	77.482	<0.0001
2020	341	44.3	3110	44.3	1079	53.9	1472	53.5	897	53.5	6899	49.0	59.633	<0.0001
TOTAL	1030	47.1	7467	43.2	2291	55.2	3127	53.7	2025	58.9	15940	49.0	245.117	<0.0001

With respect to age-specific prevalence of *H.pylori*, in 2016 the highest prevalence (59%) was observed in patients of age 30 to 44 years; and the lowest prevalence (38.5%) was among patients of age 15 to 29 years. For the same year the prevalence of *H.pylori* for patients of age category 0 to 14 years, 45 to 59 years and 60 and above years were 38.9%, 55% and 55.2%; and, the total prevalence for that year was 46.2%. These were statistically significant (χ^2=53.625, P<0.0001). In 2017, the highest prevalence (56.1%) was observed in patients of age 30 to 44 years; and the lowest prevalence (42.4%) was among patients of age 15 to 29 years. This year the second highest prevalence (52.9%) was among patients of age 60 and above years, the third highest prevalence (49.6%) was in patients of age 45 to 59 years and the second lowest prevalence (47%) in age category 0 to 14 years; besides the total prevalence of the year was 47.3%. These were statistically significant (χ^2=28.833, P<0.0001). The next year, in 2018, the highest prevalence (70.4%) was observed in patients of age 60 and above years; and the lowest prevalence (42.1%) was among patients of age 15 to 29 years. For the same year the prevalence of *H.pylori* for patients of age category 45 to 59 years, 30 to 44 years and 0 to 14 years were 59.3%, 58.5% and 47.3%; and, the total prevalence for that year was 51.5%. These were statistically significant (χ^2=106.792, P<0.0001). In 2019, similar to the previous year, the highest prevalence (72.9%) was observed in patients of age 60 and above years; and the lowest prevalence (44.9%) was among patients of age 15 to 29 years. And, the second highest

prevalence (59.5%) was among patients of age 0 to 14 years, the third highest prevalence (52.5%) was in patients of age 30 to 44 years and the second lowest prevalence (51.8%) in age category 45 to 59 years. In addition, the total prevalence of the year was 51.2%. These were statistically significant (χ^2=77.482, P<0.0001). Finally in 2020, the highest prevalence (53.9%) was observed in patients of age 30 t0 44 years; and the lowest prevalence (44.3%) was among patients of age 0 to 14 and 15 to 29 years. This year, the other prevalence observed was 53.5% among patient of age category 45 to 59 and 60 and above years. The total prevalence of the year in 2020 was 49% and these were statistically significant (χ^2=59.632, P<0.0001).

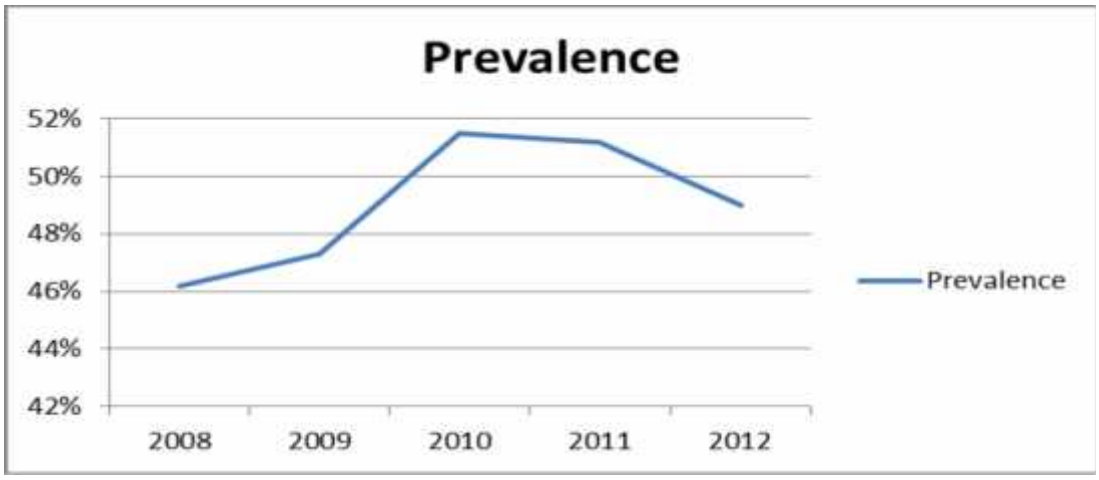
4.3.3. Trend Analysis of the Total Prevalence of *H.pylori* in Arada Sub-City from July 2016 to June 2020

Table 5: Trend of total the total prevalence of *H.pylori* 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
TOTAL	15940	7844	49

As shown in Table 5, the prevalence of *H.pylori* infection among the dyspeptic patients in Arada Sub-City Health Centers was 46.2% in 2016. The *H.pylori* positivity increased to 47.3% and 51.5% in the years 2017 and 2018 respectively. However, it went lower to and 49% in 2019 (51.2%) and 2020 (49%). The highest prevalence was observed in 2018 (51.5%) and the lowest prevalence was observed in 2016 (46.2%). Generally, in this study a high prevalence was found, and the prevalence was fluctuating slightly. (Figure 4)

Figure 4: ***Trend of total prevalence of H.pylori in five years (from July 2016 to June 2020) at Arada Sub-City Health Centers***



4.4. Health Center-Specific Prevalence of *H.pylori* among Dyspeptic Patients in Arada Sub-City from July 2016 to June 2020

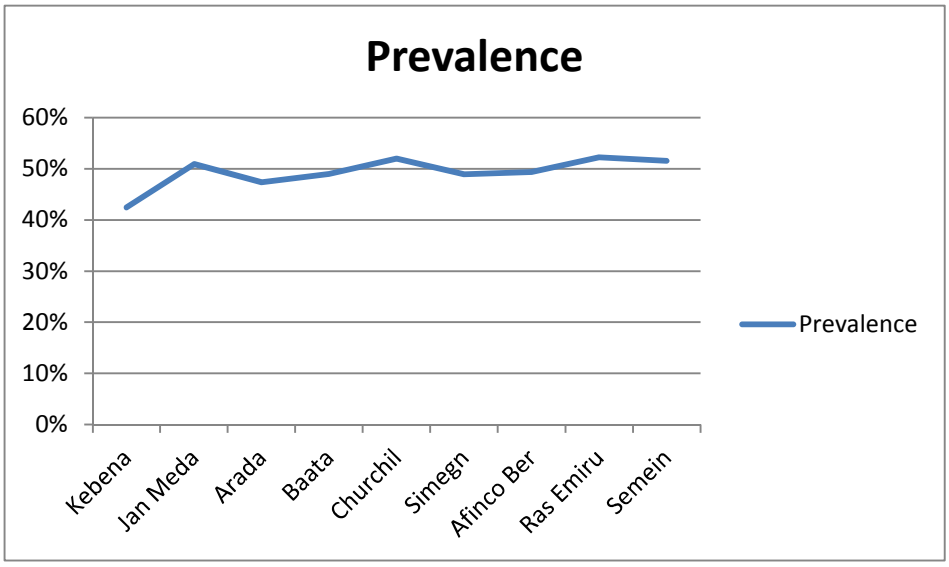
4.4.1. Trend Analysis of Total Prevalence of *H.pylori* in Each Health Center in Arada Sub-City from July 2016 to June 2020

In Arada Sub-City, there are nine health centers. As shown in Table 6, the total prevalence of *H.pylori* in Churchil, Ras Emiru and Semein Health Centers is 52%. The total prevalence of *H.pylori* at Jan Meda is 51% and at Baata, Simegn and Afincho Ber is 49%. In Arada Health Center, the total prevalence of *H.pylori* is 47% but 42% in Kebena Health center. As a whole, the highest total prevalence of *H.pylori* is 52% and the lowest prevalence is 42%. (Figure 6)

Table 6: Health-Center Specific Trend of the Total Prevalence of *H.pylori* in Arada Sub-City from July 2016 to June 2020

Health Centers	Prevalence
Kebena	42%
Jan Meda	51%
Arada	47%
Baata	49%
Churchil	52%
Simegn	49%
Afinco Ber	49%
Ras Emiru	52%
Semein	52%

Figure 6: Sub-City specific total prevalence of *H.pylori* in Arada Sub-City Health Centers



4.4.2. Trend Analysis of Sex-Specific Prevalence of *H.pylori* in Each Health Center in Arada Sub-City from July 2016 to June 2020

As shown in the Table 7 below, the highest prevalence of *H.pylori* in male patients (57%) was observed in Ras Emiru Health Center while the lowest prevalence (43%) was observed in Jan Meda Health Center. And, in female patients, the highest prevalence (57%) was seen in Jan Meda Health Center, whereas the lowest prevalence was in (39%) in Kebena Health Center.

Table 7: Sex-Specific Trend of the Prevalence of *H.pylori* in Health Centers in Arada Sub-City from July 2016 to June 2020

Health	Total Diagnosed	H. pylori positive		Male			Female		
		N	%	Diagnosed	Positive		Diagnosed	Positive	
					N	%		N	%
Kebena	1768	750	42%	615	303	49%	1153	447	39%
Jan Meda	2499	1273	51%	1120	483	43%	1379	790	57%
Arada	1787	846	47%	886	414	47%	901	432	48%
Baata	1904	932	49%	687	352	51%	1217	580	48%
Churchil	1202	625	52%	491	260	53%	711	365	51%
Simegn	1429	699	49%	483	241	50%	946	458	48%
Afinco Ber	2307	1139	49%	880	448	51%	1427	691	48%
Ras Emiru	1516	792	52%	538	304	57%	978	488	50%
Semein	1528	788	52%	505	279	55%	1023	509	50%
TOTAL	**15940**	**7844**	**49%**	**6205**	**3084**	**50%**	**9735**	**4760**	**49%**

The table also indicates that the highest difference in the prevalence of *H.pylori* in male and female patients (14%) was observed in Jan Meda Health Center where the prevalence in male patients was 43% and in female patients 57%. The second highest prevalence ((10%) was seen in Kebena Health Center with the prevalence in male patients 49% and 39% and in female patients. The least difference in prevalence (1%) was in Arada Health Center with 47% in male patients and 48% in female patients. The second least difference in prevalence was 2% and was observed in Churchil Health Center 53% in male patients and 51% in female patients, and in Simegn Health Center where the prevalence in male patients was 50% and in female patients 48%. In Baata and Afincho Ber Health Centers the difference in the prevalence of male and female patients was 3%; 51% in males and 48% in females for both Health Centers. Other differences in prevalence of *H.pylori* in male and female patients were 5% in Semien Health Center and 7% in Ras Emiru Health Center: for the first, 55% in male and 50% in female patients, and 57% in male and 50% in female patients for the second.

4.4.3. Trend Analysis of Age-Specific Prevalence of *H.pylori* in Each Health Center in Arada Sub-City from July 2016 to June 2020

This study considered five age categories: 0 to 14 years, 15 to 29 years, 30 to 44 years, 45 to 59 years and 60 and above years.

Table 8: Age-Specific Trend of the Prevalence of *H.pylori* in Health Centers inArada Sub-City from July 2016 to June 2020

Health Center	Total Diag.	H. pylori Positive		0-14 years			15 -29 years			30 - 44 years			45 - 59 years			=or>60 years		
		N	%	Diag.	+ve		Diag.	+ve		Diag.	+ve		Diag.	+ve		Diag.	+ve	
					n	%		n	%		n	%		N	%		N	%
Keben	1768	750	*42%*	102	45	*44%*	629	183	*29%*	304	154	*51%*	435	219	*50%*	298	149	*50%*
Jan M	2499	1273	*51%*	263	94	*36%*	1239	520	*42%*	335	183	*55%*	335	243	*73%*	327	233	*71%*
Arada	1787	846	*47%*	140	54	*39%*	810	343	*42%*	263	141	*54%*	375	189	*50%*	199	119	*60%*
Baata	1904	932	*49%*	73	37	*51%*	1023	456	*45%*	260	129	*50%*	366	189	*52%*	182	121	*66%*
Churc	1202	625	*52%*	61	40	*66%*	639	293	*46%*	163	90	*55%*	234	127	*54%*	105	75	*71%*
Simeg	1429	699	*49%*	63	37	*59%*	642	272	*42%*	220	151	*69%*	309	130	*42%*	195	109	*56%*
Afinco	2307	1139	*49%*	137	73	*53%*	1046	480	*46%*	356	187	*53%*	497	264	*53%*	271	135	*50%*
Ras E	1516	792	*52%*	68	45	*66%*	551	252	*46%*	253	138	*55%*	356	198	*56%*	288	159	*55%*
Semen	1528	788	*52%*	123	60	*49%*	888	424	*48%*	137	91	*66%*	220	120	*55%*	160	93	*58%*
TOTAL	**15940**	**7844**	***49%***	**1030**	**485**	***47%***	**7467**	**3223**	***43%***	**2291**	**1264**	***55%***	**3127**	**1679**	***54%***	**2025**	**1193**	***59%***

In the first age category, 0 to 14 years, the highest prevalence (66%) was observed in Churchill and Ras Emiru Health Centers while the lowest (36%) was in Jan Meda Health Center. The second highest prevalence was 7% less than the highest in Simegn Health Center and the third highest (53%) was seen in Afincho Ber Health Center. On the other hand, the second lowest prevalence (39%) was in Arada Health Center and the third lowest (44%) was in Kebena Health Center. And in Baata and Arada Health Centers, the prevalence in the age category was 51% and 49% respectively. 47% was the overall prevalence of this age category.

Among patients of age 15 to 29 years, the lowest prevalence (29%) was recorded in Kebena Health Center where the highest (48%) was in Semein Health Center. For this age category, while a prevalence of 46% was observed in Churchill, Afincho Ber and Ras Emiru Health Centers, 42% was seen in Jan Meda, Arada and Simegn Health Centers. In Baata Health Center, the prevalence was 45%; and 43% was not only the overall prevalence of *H.pylori* among patients of age 15 to 29 years but also the lowest prevalence of all age categories.

In the next age category, 30 to 44 years, the highest prevalence (69%) was seen in Simegn Health Center and the lowest (50%) was in Baata Health Center. The second highest prevalence was 3% less than the highest in Semein Health Center; and, the next highest prevalence (55%) in Jan Meda, Churchill and Ras Emiru Health Centers. On the other hand, the second, third and fourth lowest prevalence (51%, 53% and 54%) were in Kebena, Afincho Ber and Arada Health Centers respectively. In this age category, the overall prevalence *H.pylori* was 55%.

In patients of age 45 to 59 years, the highest prevalence (73%) was observed in Jan Meda but the lowest (42%) in Simegn Health Center. The second highest prevalence, 17% less than the highest, was observed in Ras Emiru Health Center. The following three highest prevalences (55%, 54%, 53% and 52%) were recorded in Semein, Churchill, Afincho Ber and Baata health Centers. And, the prevalence in Kebena and Arada Health Centers was 50%. 54% was the overall prevalence of this age category.

In the last age category, 60 and above years, while the lowest prevalence (50%) was recoded in Kebena and Afincho Ber Health Centers, the highest (71%) was in Jan Meda and Churchill Health Centers. The second highest which was 5% less than the highest and the third highest which was 6% less than the highest were observed in Baata and Arada Health Centers respectively. And, in Semein, Simegn and Ras Emiru Health Centers, the prevalence seen were 58%, 56% and 55%. Finally, the overall prevalence in this age category was 59% and was the highest prevalence of all age categories.

5. DISCUSSION

This study was conducted to determine the prevalence of *H.pylori* infection among dyspeptic patients clinically diagnosed for dyspepsia in nine health centers in Arada Sub-City for five consecutive years, 2015/16 to 2019/20, and to show the highest prevalence rate of *H.pylori* infection among different age and sex categories. Therefore, the study questions - regarding the degree of prevalence of *H.pylori* infection, in which age category the rate of prevalence of *H.pylori* infection is the highest, and in which sex the rate of prevalence of *H.pylori* infection is the highest, should be answered.

The overall prevalence of *H.pylori* observed in this study was 49%. Generally, the prevalence of *H.pylori* has been inconsistent worldwide although the prevalence is mostly lower in industrialized countries than in developing countries (Megraud, 1993; Bures *et al*, 2011; Hunt *et al.* 2011; Graham *et al*., 2009; Melese, 2019; and, Hooi, 2017). In Ethiopia, the prevalence of *H.pylori* was reported to be 52%; and the highest and lowest regional estimates were 71% in Somalia region and 39.95% in Oromia (US National Library of Medicine, 2019 and Adisu *et al.* 2019); which were taken as bench marks of this study for the recentness of the studies and the heterogeneity of data sources. And, the 49% overall prevalence observed in this study is between the highest (71%) and the lowest (39.95%) reported in Somalia and Oromia respectively. Besides, this prevalence (49%) is only 3% less than the overall prevalence of 52% reported in Ethiopia (Adisu *et al.* 2019).

Moreover, the prevalence found in this study (49%) is higher than the 37.6% prevalence stated in an institutional-based cross-sectional study conducted in Gondar (Desie *et.al* 2017); and, the 45.8% prevalence estimated in a case control study in 2009 Addis Ababa (Tadesse, 2011). Nevertheless, the prevalence rate of this study is nearly the same as the prevalence rate of 48.7% in two studies held in 2015 in Gumuz and in Assosa General Hospital (Dilnesa, 2017; and, Tebelay and Muluwas, 2017).

On the contrary, the prevalence of *H.pylori* observed in this study was slightly lower than 52.4% and 50.7% prevalence rates estimated in two studies conducted in in Southern Nations, Nationalities and Peoples' Region in years 2012-2013 (Kibru, 2014 and Hailu, 2016). The prevalence of this study is also lower than 64.2% prevalence reported in Oromia in years 2016-2017; 65% in Amhara in years 2009 to 2011; and, 70.2% in years 2015- 2016 and 72.2%, in the same region in

2013 (Tesfaye, 2017; Mathewos, 2014; Seid, 2018; and Abebaw, 2014). Again, the prevalence rate in this study is farther lower than the 91% prevalence reported in a cross sectional study conducted in years 2000-2002 in Addis Ababa (Asrat, 2004).

The difference in the prevalence might be because of various contributing factors including social and economic status, geographical factors, standard of living, and ethnicity of the population. Or, it could be as a result of variations in demographic factors of population, the level of environmental sanitation, and difference in economic conditions. Besides, the other reasons for the higher prevalence of *H.pylori* infection found in this study could be because of the test methods the health centers used: the stool antigen test and the blood antibody test.

This study found a slightly different prevalence of *H.pylori* infection with regard to sex; 50% in males and 49% in females. The differences between *H.pylori* positivity of male and female study participants were statistically insignificant (χ^2= 0.985, P= 0.321). The analysis of the sex-specific prevalence of *H.pylori* in years 2016 to 2019 showed that the difference in prevalence found in males than in females in these years were not statistically significant (χ^2=0.749, P=0.387; χ^2=0.626, P=0.429; χ^2=0.206, P=0.65; and χ^2=0.254, P=0.614). Different from the other years, the prevalence found in males and in females in 2020 was similar and this similarity was not statistically significant (χ^2=0.0001, P=0.992). This implies that the study found no association between sex and *H.pylori* infection.

Although, the findings of several studies regarding the relationship between sex and *H.pylori* infection varies, 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 (Rodrigues, 2005; Sathar *et al*., 1997; Rasheed *et al*., 2011; Petrovic *et al*, 2011; Zevit *et al*., 2011 and Rehnberg *et al*., 1998). However, the finding of this study disagrees with the findings of a comparative cross-sectional study at Assosa General Hospital which stated that the prevalence of *H.pylori* was significantly associated with gender (Tebelay and Muluwas, 2017). This may be due to common risk of acquiring the infection in both sexes or differences in data sources.

In this study, the prevalence of *H.pylori* was 47% in the age category between 0 to 14 years, 43% in the age category between 15 to 29 years, 55% in the age category between 30 to 44 years, 54%

in the age category between 45 to 59 years, and 59% in the age category of 60 years or above. The differences between *H.pylori* positivity among different age categories of the study participants was statistically significant (χ^2= 0.985, P<0.001). This agrees with studies conducted elsewhere and found a significant association between age of the patients and the prevalence of *H.pylori* infection (Wizla *et a*l., 2001; Malaty *et al*., 2002; and, Granstrom *et al*., 1997); yet, it disagrees with a study in China and Bhutan that reported no statistically significant association between age of the patients and *H.pylori* infection (Dorji *et al*., 2013).

The prevalence rate increases from the age category between 15 to 29 years to the age category between 30 to 44 years from 43% to 55%, then it decreases to 54% in in the age category between 45 to 59 years and it further increases to 59% in the age category of 60 years or above. The slight decrease in the prevalence of *H.pylori* from the age group between 30 to 44 years to the age group between 45 to 59 years may be due to the number of the difference in the study participants in the two age categories which is 2291 in the age category between 30 to 44 years and 3127 in the age category between 45 to 59 years. In general, although there is a slight decrease in the prevalence of *H.pylori* as the age category increases from between 30 to 44 years to the age category between 45 to 59 years, the prevalence of *H.pylori* crudely increases as age increases from 15years to above. This could be related to long time acquisition of *H. pylori* as age increases. And, this was supported by a study conducted in Brazil and stated that in crude analyses the prevalence was associated with increasing age (Ina *et al*., 2005).

Finally, in this study the researcher found varied prevalence of *H.pylori* infection in 5 consecutive years. The prevalence fluctuates from year to year. The prevalence of *H.pylori* was 46.2%, 47.3%, 51.5%, 51.2% and 49% from 2016 to 2020 respectively. The decrement in the prevalence in the last two years might be a result of improvement in sanitation, more access to water, better life style and quality of life, behavioral changes or successful prevention and awareness creation efforts. As a whole, in this study a high prevalence was found; and the prevalence fluctuated slightly. This is against a study conducted in China that stated the prevalence of *H.pylori* was significantly lower in recent years when compared to previous years (Shimoyama *et al*., 2009).

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

This study showed high but fluctuating prevalence of *H.pylori* among the dyspeptic patients diagnosed in health centers in Arada Sub-City in five consecutive years from 2016 to 2020. The overall prevalence of *H.pylori* observed in this study was 49%. Moreover, this study found a slightly different prevalence of *H.pylori* infection: 50% in males and 49% in females. The differences between *H.pylori* positivity of male and female subjects were statistically insignificant. Hence, the study found no association between sex and *H.pylori* infection.

The prevalence of *H.pylori* was higher among the participants in the age category of 60 years or above (59%), and the lowest *H.pylori* positivity was observed in the age category between 15 to 29 years (43%). In general, although there is a slight decrease in the prevalence of *H.pylori* as the age category increases from between 30 to 44 years to the age category between 45 to 59 years, the prevalence of *H.pylori* crudely increases as age increases from 15 years to above. And, the study implied varied prevalence of *H.pylori* infection in 5 consecutive years from 2015/16 to 2019/20. The prevalence fluctuated from year to year, too.

6.2. Recommendation

Owing to this study, the researcher recommends that:

- The Addis Ababa City Administration should implement economic development programs to increase income, to minimize overcrowded living conditions, and to improve the living standard of the society.
- The Sub-City Health Office should work with relevant authorities to create awareness on *H.pylori* infection and it ought to strive to facilitate accessibility of personal hygiene care in the community as health education in the area is mandatory.
- Community campaigns should be held in schools, markets, streets and religious institutions to make the community be aware of prevention mechanisms of *H.pylori* infection such as personal hygiene and sanitation.
- Health centers have to upgrade and standardize their test methods, and they have to improve record keeping and management system in their labs.

- Further investigations should also be held to detect the possible sources of *H.pylori* infection and to study the prevalence of *H.pylori* infection with respect to other variables like family size, education level, income, and type of dwelling.

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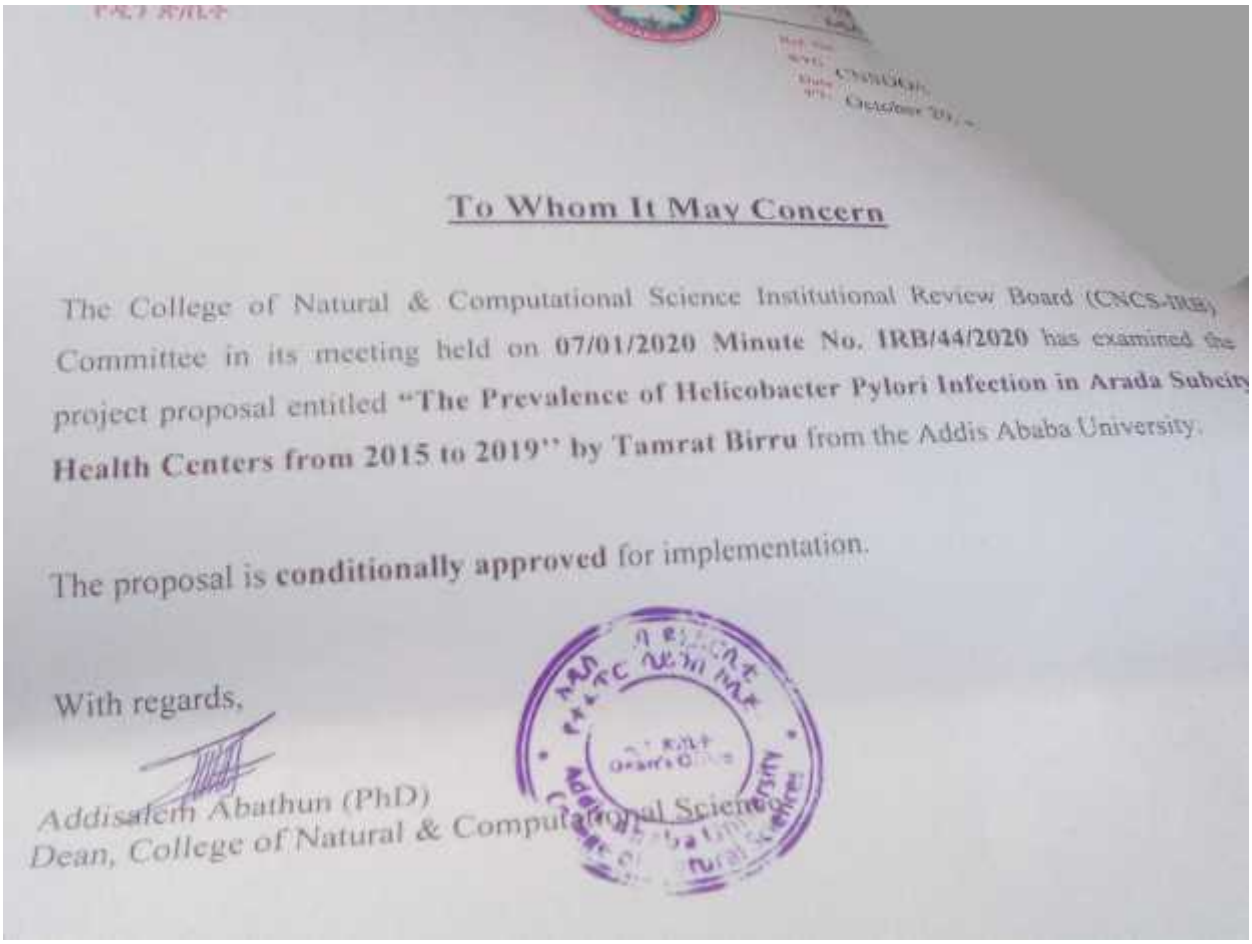
APPENDICES

Appendix 1

A letter of approval of the project proposal from the Office of the Dean of AAU, College of Natural and Computational Science



To Whom It May Concern

The College of Natural & Computational Science Institutional Review Board (CNCS-IRB) Committee in its meeting held on **07/01/2020 Minute No. IRB/44/2020** has examined the project proposal entitled **"The Prevalence of Helicobacter Pylori Infection in Arada Subcity Health Centers from 2015 to 2019" by Tamrat Birru** from the Addis Ababa University.

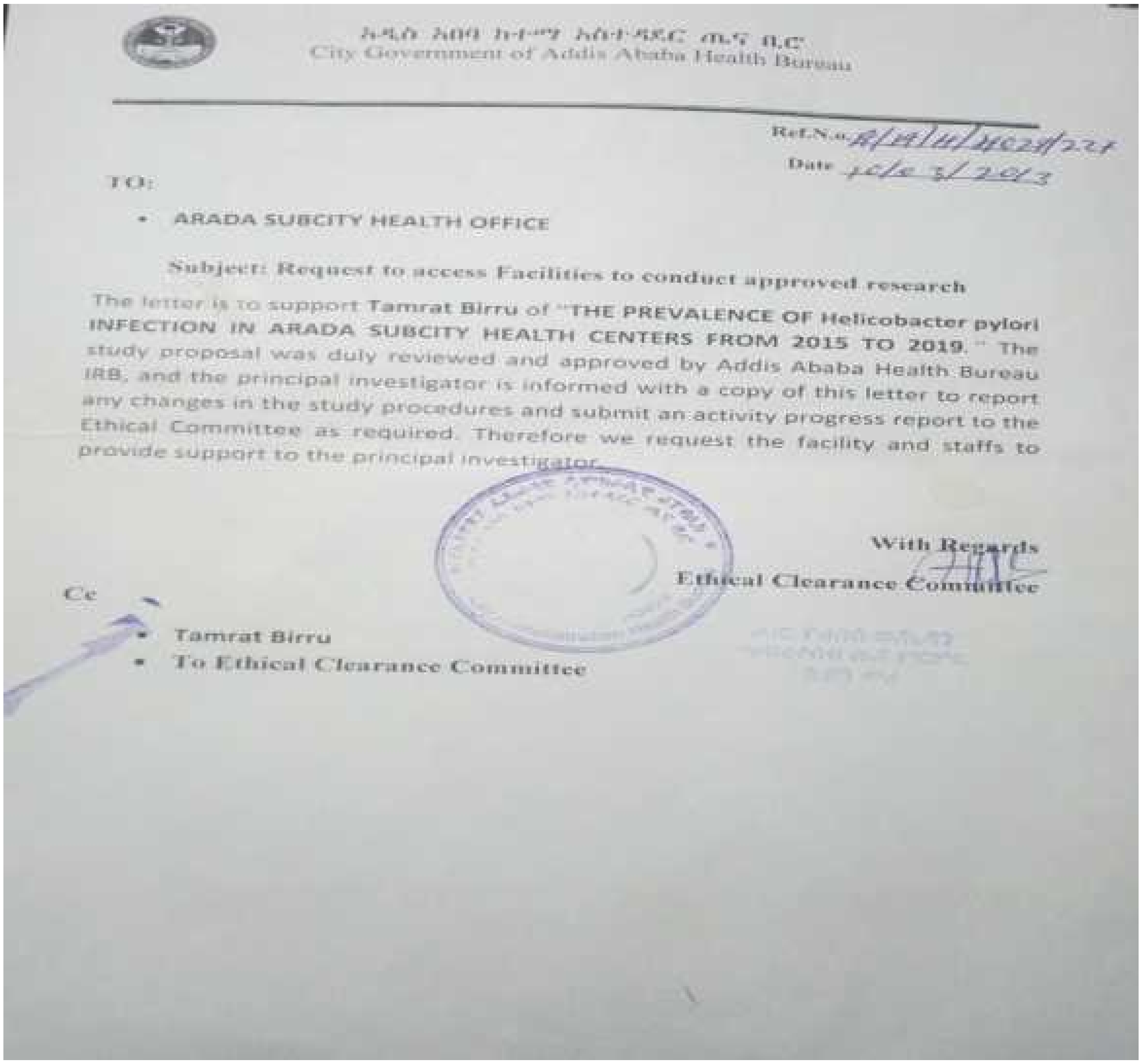
The proposal is **conditionally approved** for implementation.

With regards,

Addisalem Abathun (PhD)
Dean, College of Natural & Computational Science

Appendix 2

A letter of request to access facilities to conduct approved research from City Government of Addis Ababa Health Bureau



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City Government of Addis Ababa Health Bureau

Ref.No. [illegible]
Date [illegible]

TO:

- ARADA SUBCITY HEALTH OFFICE

Subject: Request to access Facilities to conduct approved research

The letter is to support **Tamrat Birru** of "**THE PREVALENCE OF Helicobacter pylori INFECTION IN ARADA SUBCITY HEALTH CENTERS FROM 2015 TO 2019**." The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required. Therefore we request the facility and staffs to provide support to the principal investigator.

With Regards

Ethical Clearance Committee

Cc

- Tamrat Birru
- To Ethical Clearance Committee

Appendix 3

A letter of request for cooperation from Arada Sub-City Administration Health Office

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Arada Sub-City Administration
Health Office

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ጥራቱን የጠበቀ ፍጥነት ለአገልግሎት ለሁሉም!

Appendix 4

Plagiarism Report

Document Information

Analyzed document	Recent tamirat.doc (D110047508)
Submitted	7/2/2021 11:21:00 AM
Submitted by	
Submitter email	leulgelana@gmail.com
Similarity	5%
Analysis address	tegenu.gelana.aauni@analysis.urkund.com