Helicobacter pylori infection and assessment of related factors among Healthy Residents and students in Msallata city

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ABSTRACT

Background

Helicobacter pylori is one of the most common chronic bacterial infections globally, causing a wide range of illnesses including gastritis, peptic ulcers, gastric carcinoma, and mucosa-associated lymphoid tissue (MALT) lymphoma.

Objective

This study aimed to determine the **seroprevalence** of *H. pylori* in asymptomatic, healthy individuals and to explore the potential relationship between *H. pylori* infection and sociodemographic, lifestyle, and environmental factors in the region.

Methods

Venous blood was collected from **85 asymptomatic, healthy students and staff** at the Higher Institute of Medical Technologies, Msallata. The sera were then analyzed using an **enzyme-linked immunosorbent assay (ELISA)**. A questionnaire was used to gather data on sociodemographic and lifestyle variables from the study participants.

Results:

The overall seroprevalence of *H. pylori* was **50.7%**. The highest prevalence was found in the **30-37 year age group**, whereas the lowest prevalence was in the 20-27 year age group (75% negative). Females showed a slightly higher prevalence (**52.6%**) compared to males (**48.9%**). **Married individuals** had a significantly higher prevalence (**64.6%**) than single individuals (**32.4%**). The study also found a relationship between *H. pylori* infection and lifestyle factors such as **coffee and tea consumption**, **source of drinking water**, **family size**, **eating raw vegetables**, **place of residence**, and **monthly income**. Interestingly, the prevalence was higher in the **non-smoker group** than in the smoker group.

Conclusion:

The results indicate a **high prevalence of *H. pylori* infection** in the study population. The findings also support the hypothesis that a relationship exists between certain lifestyle factors and the risk of *H. pylori* infection

Introduction:

Helicobacter pylori is a Gram-negative bacterium that colonizes the human stomach, causing one of the most widespread chronic bacterial infections globally (Hooi et al., 2017). This pathogen is a significant cause of various gastrointestinal diseases, including chronic gastritis, peptic ulcers, and is a major risk factor for gastric cancer and mucosa-associated lymphoid tissue (MALT) lymphoma (Malfertheiner et al.,

2017). The infection is typically acquired during childhood and persists for life if left untreated. e global prevalence of *H. pylori* infection is high, with an estimated seroprevalence exceeding 50% worldwide, though this varies significantly by geographic region, socioeconomic status, and sanitation levels (Hooi et al., 2017; Mégraud et al., 2015). High-income countries have seen a decline in prevalence due to improved living conditions and hygiene, while developing countries continue to have a high burden of infection (Hooi et al., 2017).

Understanding the **seroprevalence of *H. pylori*** among specific populations, such as high institute students, is crucial. This group represents a transitional age, moving from a family-based environment to a more independent one, which may influence exposure to risk factors. Studies have shown that factors such as socioeconomic status, family size, hygiene practices, and consumption of contaminated food or water are linked to the transmission of *H. pylori* (Kayali et al., 2011). Serological testing, which detects specific antibodies against *H. pylori* in the blood, is a non-invasive and effective method for large-scale epidemiological studies to determine exposure rates.

This study aims to investigate the seroprevalence of *H. pylori* among students at a higher institute, identifying the prevalence rates and exploring potential associations with demographic, lifestyle, and environmental factors. The findings will provide valuable data for public health initiatives and contribute to a better understanding of the epidemiology of *H. pylori* in this population.

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H. pylori **Pathogenesis**

H. pylori pathogenesis is a three-stage process involving **gastric colonization**, **immune evasion**, and the **establishment of disease**. The bacterium spreads through

various routes, including fecal-oral and oral-oral transmission, often via contaminated food, water, or medical instruments.

Molecular Mechanisms

- **Colonization:** The process begins with **chemotaxis**, where *H. pylori* uses its **flagella** to move through the thick mucus layer and attach to the gastric epithelium (Gu, 2017). This adhesion is strengthened by **biofilm formation** and specific **outer membrane proteins** like BabA, SabA, AlpA/B, and OipA (Ali & AlHussaini, 2024).
- **Survival:** The bacterium neutralizes the highly acidic stomach environment by producing **urease**, an enzyme that converts urea into ammonia and carbon dioxide (Zeyaullah et al., 2021).

Immune Response and Evasion

- **Host Response:** *H. pylori* infection triggers a chronic inflammatory response in the gastric mucosa, recruiting immune cells and releasing pro-inflammatory cytokines. This leads to an adaptive immune response involving T-helper cells and B cells (Larussa et al., 2015).
- **Evasion:** The bacterium employs sophisticated strategies to evade the host's immune system. These include **antigenic variation** to change its surface proteins, **molecular mimicry** to appear similar to host molecules, and the suppression of host immune cells, allowing it to persist in the stomach for long periods (Larussa et al., 2015).

Disease Progression

Long-term *H. pylori* colonization can lead to significant damage to the gastric mucosa, causing a range of upper gastrointestinal diseases. These include **chronic gastritis**, **peptic ulcer disease**, and even gastric malignancies like **gastric cancer** and **MALT lymphoma** (Zeyaullah et al., 2021). Despite the serious health risks, many infected individuals remain asymptomatic for a prolonged period.

In summary, *H. pylori* is highly adapted to the stomach's harsh environment. It uses a unique combination of motility, adhesion proteins, virulence factors, and immune evasion tactics to persistently colonize the gastric mucosa, causing a continuous inflammatory response in nearly all infected individuals.various age . So the serological testing for H.pylori antibody helps in early detection of "silent" peptic ulcer .

H. pylori Epidemiology and Prevention

H. pylori is a widespread bacterial infection with a global prevalence influenced by socioeconomic conditions (Elazomi et al., 2019; Uerbaum & Pierre, 2002). Prevalence rates are high in developing nations, exceeding 80% in some adult populations, while industrialized countries report lower rates of 20% to 50% (Uerbaum & Pierre, 2002).

Geographic and Regional Variation

- **Global:** Nearly half of the world's population is infected with *H. pylori* (Park et al., 2021). African countries generally have a prevalence over 50%, while in Asia, rates vary significantly, from 43.9% in Korea to as low as 2.5% in Sri Lanka (Alfaray et al., 2021).
- **Libya:** Studies in Libya show considerable regional variation. A study in Msallata found a prevalence of 50.7%, which is comparable to rates in Benghazi (56.5%) and Sabha (57%) but contrasts sharply with higher rates in Tripoli (85.1%) and Kasr Khiar (85%) (Almehdawi & Ali, 2016; Nami et al., 2019; Nami et al., 2020).
- **Australia:** A review of Australian studies showed a decline in prevalence, with population-based studies reporting rates from 38.0% in 1991 to 15.1% in 2002 (Congedi et al., n.d.).

Risk Factors and Vulnerable Populations

Several studies highlight key risk factors for *H. pylori* infection, including age, sex, crowded living conditions, low annual income, and sources of drinking water. Unhygienic habits, such as consuming unwashed vegetables and fruits, also contribute to transmission (Alfaray et al., 2021). A study in Sana'a, Yemen, found that the highest seroprevalence (33.69%) was in students aged 16-21 years and those who drank untreated water (32.61%) (Al-Hussaini et al., 2022). Vulnerable populations, particularly minority groups, have a greater risk of infection and subsequent gastric cancer (Argueta & Moss, 2021).

H. pylori and Gastric Cancer Prevention:

H. pylori is a major cause of gastric cancer. Eradicating the bacterium is a key strategy for preventing this malignancy (Argueta & Moss, 2021). Randomized trials have shown that *H. pylori* eradication can lead to a 50% reduction in the incidence of sporadic gastric cancer. This benefit has been observed in various groups, including first-degree relatives of gastric cancer patients and in population-based screening programs in high-prevalence areas (Argueta & Moss, 2021).

3.0 Methodology:

3.1 Ethical Considerations

This study was conducted with full ethical compliance. Informed consent was obtained from all participants after they were fully informed about the study's purpose and procedures. All demographic and personal data were handled with strict confidentiality and privacy. A written consent form, approved by the Higher Institute for Medical Technologies in Msallata city, was signed by each participant, a copy of which is included in the appendix.

3.2 Study Area, Design, and Population

The study was a cross-sectional investigation conducted at the Higher Institute for Medical Technologies, located in the center of Msallata city. Data and samples were collected from February 2021 to April 2021. The study population consisted of a

convenience sample of 85 healthy, asymptomatic volunteers ranging in age from 20 to 75 years.

3.3 Sample Collection and Preparation

Approximately 3-5 ml of venous blood was collected from each participant. The blood was placed in plain tubes and allowed to clot for 20 minutes. Serum was then separated by centrifugation at 3000 rpm and stored until analysis.

3.4 Serological Assays

Quantitative detection of *H. pylori* IgG antibodies was performed on all serum samples using the Enzyme-Linked Fluorescent Assay (ELFA) technique. The analysis was conducted at the Msallata Health Care Office laboratory using the ELIAS *H. pylori* IgG kit (Biotek ELIAS, Germany).

3.5 Data Collection

A structured questionnaire was administered to each participant to collect relevant demographic and lifestyle information. The questionnaire included questions on personal data (age, gender, marital status, socioeconomic status) and lifestyle factors (smoking habits, coffee and tea consumption, source of drinking water, family size, consumption of raw vegetables, place of residence, and monthly income). The questionnaires were completed voluntarily by the participants.

Statistical analysis

The data were statistically analyzed using SPSS program (SPSS version 18.0). A significant difference between the variables was determined by *P*-value (<0.05) that was considered statistically significant.

4. Results :

4.1 Seroprevalence by Demographic Factors.

Table 1: Seroprevalence by Age:

Age Group	No. Tested	Positive (%)	Negative (%)
20-29 y	20	5 (25%)	15 (75%)
30-39 y	19	11 (57.9%)	8 (42.1%)
40-49 y	23	12 (52.2%)	11 (47.8%)
>50 y	13	4 (30.8%)	9 (69.2%)

Table 2: Seroprevalence by Gender:

Gender	No. Tested	Positive (%)	Negative (%)
Males	47	23 (48.9%)	24 (51.1%)

Gender	No. Tested	Positive (%)	Negative (%)
Females	38	20 (52.6%)	18 (47.4%)

Table 3: Seroprevalence by Marital Status:

Marital Status	No. Tested	Positive (%)	Negative (%)
Single	37	12 (32.4%)	25 (67.6%)
Married	48	31 (64.6%)	17 (35.4%)

4.2 Seroprevalence by Lifestyle and Environmental Factors.

Table 4: Seroprevalence by Smoking:

Smoking Status	No. Tested	Positive (%)	Negative (%)
Smokers	38	20 (52.6%)	18 (47.4%)
Non-smokers	9	9 (100%)	0 (0%)

Table 5: Seroprevalence by Tea & Coffee Consumption:

Tea & Coffee Consumption	No. Tested	Positive (%)	Negative (%)
Yes	46	35 (76.1%)	11 (23.9%)
No	39	16 (41.0%)	23 (59.0%)

Table 6: Seroprevalence by Source of Drinking Water:

Source of Drinking Water	No. Tested	Positive (%)	Negative (%)
Treated	40	17 (42.5%)	23 (57.5%)
Rain	45	26 (57.8%)	19 (42.2%)

Table 7: Seroprevalence by Family Size:

Family Size	No. Tested	Positive (%)	Negative (%)
3-6	39	16 (41.0%)	23 (59.0%)
8-12	46	27 (58.7%)	19 (41.3%)

Table 8: Seroprevalence by Eating Raw Vegetables:

Eating Raw Vegetables	No. Tested	Positive (%)	Negative (%)
Yes	31	8 (25.8%)	23 (74.2%)
No	54	35 (64.8%)	19 (35.2%)

Table 9: Seroprevalence by Place of Life:

Place of Life	No. Tested	Positive (%)	Negative (%)
Modern	32	19 (59.4%)	13 (40.6%)
Rural	53	24 (45.3%)	29 (54.7%)

Table 10: Seroprevalence by Monthly Income:

Monthly Income	No. Tested	Positive (%)	Negative (%)
Moderate	39	24 (61.5%)	15 (38.5%)
Good	46	19 (41.3%)	27 (58.7%)

Discussion of Results :

This study, conducted on 85 healthy individuals, established a **high overall *H. pylori* seroprevalence of 50.7%**. Analysis of demographic, lifestyle, and environmental factors revealed several significant associations, many of which align with established literature, though some unexpected findings warrant further investigation.

Demographic Factors and Prevalence Trends:

Consistent with previous studies suggesting that *H. pylori* is acquired early and persists chronically (Malfertheiner et al., 2017), the seroprevalence **increased with age**, peaking in the **30-39 years (57.9%) and 40-49 years (52.2%) groups**, and showing the lowest rate in the 20-29 years group (25%). The marginal decline observed in the oldest group (>50 years) may reflect a smaller sample size or a cohort effect of improved public health over time. Gender showed a **negligible difference** (females 52.6% vs. males 48.9%), supporting the general consensus that gender is not a major determinant of infection risk (Hooi et al., 2017).

A particularly strong association was found with **marital status**, where the prevalence among **married individuals (64.6%) was double** that of single individuals (32.4%). This finding strongly supports the hypothesis of **person-to-person transmission** within close family units, a primary route of infection (Alfaray et al., 2021). The prevalence was also higher in individuals with a **larger family size (58.7% for 8-12 members)** compared to smaller families (41.0% for 3-6 members), reinforcing that **household crowding** and close domestic contact are major risk factors (Hooi et al., 2017).

Environmental and Lifestyle Factors:

Findings related to environmental factors strongly supported existing literature on transmission routes. The seroprevalence was **higher in individuals drinking rainwater (57.8%)** compared to treated water (42.5%), which aligns with the well-established link between *H. pylori* transmission and **contaminated water sources** (Alfaray et al., 2021). Furthermore, the link between socioeconomic status and infection was confirmed, as those with a **moderate monthly income (61.5%)** had a significantly higher prevalence than those with a good income (41.3%). This result is consistent with global trends linking **lower socioeconomic status** to reduced access to clean water, proper sanitation, and generally less hygienic living conditions (Hooi et al., 2017).

Two notable and **unconventional findings** emerged. Firstly, individuals who **did not eat raw vegetables** had a higher prevalence (64.8%) than those who did (25.8%), which **contradicts** the expected transmission through contaminated produce. Secondly, the prevalence was unexpectedly **higher in a "modern" place of life (59.4%)** compared to a "rural" one (45.3%), which is contrary to the typical global association of *H. pylori* with poorer, rural sanitation. These two anomalies may be attributed to confounding variables unique to the study region, such as specific local hygiene practices, or a statistical artifact requiring further clarification with larger, precisely defined cohorts. Finally, the data on **tea and coffee consumption** showed a higher prevalence (76.1%) but is unlikely to be causal, suggesting consumption is a **confounding factor** linked to other risk factors (e.g., social habits or age). The data regarding **smoking** high rate (100%) infection rate in the non-smokers group due to small sample size or honesty of participants), making any conclusion on this factor impossible.

Limitations and Future Directions

While this study offers a preliminary overview of *H. pylori* prevalence and associated factors in Msallata, it is important to acknowledge its limitations. The study's cross-sectional design and relatively small sample size restrict the generalizability of our findings to the broader Msallata population and prevent the establishment of a causal relationship between the observed factors and *H. pylori* infection. As a pilot study, its primary contribution is to provide foundational data. Future, large-scale, and multicenter epidemiological studies are underway to further explore the epidemiology of *H. pylori* in the Msallata population, aiming to support public health initiatives for the prevention and eradication of this common bacterial infection.

Conclusion:-

In summary, this research successfully identifies **marital status, family size, lower income, and reliance on untreated water sources** as major risk factors for *H. pylori* infection in this population. Future investigations should focus on large-scale, prospective studies that employ more granular definitions of "place of life" and conduct rigorous checks on data fidelity, particularly in subgroup analyses, to clarify the unexpected trends observed. This will enable the design of targeted public health

interventions that prioritize improved sanitation, water treatment, and family-based screening to reduce the high burden of *H.pylori* infections in different group of population.

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