# HIGH PREVALENCE OF *HELICOBACTER PYLORI* INFECTION IN EARLY PREGNANCY AMONG WOMEN IN URBAN SLUMS OF DHAKA, BANGLADESH: A PUBLIC HEALTH CONCERN

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**ABSTRACT**: *Helicobacter pylori* is an extensively prevalent gastrointestinal pathogen that continues to pose a noteworthy public health challenge worldwide, predominantly in low and middle-income countries where overcrowding, poor hygiene, and limited access to healthcare persist common. The current study was undertaken to address this knowledge paucity by evaluating the prevalence of *H. pylori* infection during early pregnancy and reconnoitering its potential health implications among women residing in an urban slum in Dhaka. It was a descriptive, hospital-based cross-sectional study, conducted between August 2017 and April 2018. A total of 45 women, permanent residents of Kamrangir Char in their early trimester (9 to 16 weeks) of pregnancy, were enrolled after securing informed consent from Maternal and Child Health Training Institute (MCHTI), Azimpur. Stool samples were collected from each participant and analyzed for the detection of *H. pylori* antigen using a clinically authorized enzyme-linked immunosorbent assay (ELISA). Laboratory procedures, data entry, and statistical analyses, were carried out at the Nutrition, Immunology, and Toxicology Laboratory of International Centre for diarrheal disease research, Bangladesh icddr,b in accordance with standardized quality-control protocols. The results revealed a high prevalence of *H. pylori* infection, with 75.6% of the participants testing positive. Supplementary stratification of the data by maternal age and gestational age did not demonstrate any statistically significant variation in infection prevalence. The socio-demographic profile of the study population reflected widespread poverty, low levels of formal education, and limited dietary diversity factors that collectively increase susceptibility to chronic infections and nutritional deficiencies during pregnancy. Given the pathogen's potential to impair nutrient absorption and contribute to poor maternal and fetal outcomes, the integration of *H. pylori* screening, targeted nutritional interventions, and health education into routine antenatal care is strongly recommended for high-risk populations in similar settings.

***Key words***: *Helicobacter pylori*, Pregnancy, Prevalence, Slum, Bangladesh, Public health, Maternal health, Infection screening

### INTRODUCTION

*Helicobacter pylori* (*H. pylori*) is a spiral-shaped, microaerophilic, gram-negative bacterium that takes possession of the human gastric mucosa and negative bacterium that takes possession of the human gastric mucosa and often establishes lifelong infections unless treated effectively. It is implicated as a primary causative agent in chronic gastritis, painful ulcers in the stomach and small intestine, more serious condition like mucosa-associated lymphoid tissue (MALT) lymphoma, and gastric adenocarcinoma (Kusters *et al.* 2006, Suerbaum and Michetti 2002, Malfertheiner *et al.* 2007). The WHO has identified *H. pylori* as a top-tier carcinogen (Group I), due to its strong association with gastric malignancies (Malfertheiner *et al.* 2007).

Transmission of *H. pylori* is predominantly fecal-oral or oral-oral, with person-to-person spread facilitated by conditions of poor hygiene, lack of access to clean drinking water, and crowded living environments (Eurogast Study Group 1993). Studies have consistently demonstrated that prevalence is significantly higher in developing countries, including Bangladesh, where children often acquire the infection early in life (Ahmed *et al.* 1997, Mahalanabis *et al.* 1996).

Throughout gestation, quite a lot of physiological adaptations arise for the sustenance of the rising fetus, together with changes to immune function that can upsurge maternal vulnerability to infections (Afsar *et al.* 2020). Together with, prenatal period encourages an augmented prerequisite for crucial micronutrients such as vitamin $B_{12}$, folate, and iron, which are vital for DNA synthesis, red blood cell formation, and fetal neural growth (Kaptan *et al.* 2000, Allen 2008, Siddiqua *et al.* 2019). *H. pylori* infection, through its consequence on gastric mucosa and acid production, impairs the uptake of these nutrients, hypothetically exasperating pre-existing nutritional inadequacies (Kaptan *et al.* 2000, Refsum *et al.* 2001).

The inferences of these shortfalls during gestation can be far-reaching. Deficits in vitamin $B_{12}$ and folate have been associated to intrauterine growth restriction, herewith unsatisfactory fetal growth; early labor; and neural tube deformities. (Mulayim *et al.* 2008, Felkner *et al.* 2007). As well, elevated maternal homocysteine levels, frequently resulting as of low folate or $B_{12}$ status, are complementary with antagonistic pregnancy outcomes together with preeclampsia and placental abruption (Refsum *et al.* 2001, Koebnick *et al.* 2002).

Even though the universal burden of *H. pylori* is well-established, data on its prevalence among pregnant women in Bangladesh completely from

economically deprived urban areas persist infrequent. Limited studies have focused on general or pediatric populations (Ahmed *et al.* 1997, Mahalanabis *et al.* 1996). Given the overlying load of *H. pylori* infection and maternal malnutrition in these populations, it is decisive to explore infection patterns and their potential health implications. This study therefore aims to address this gap by estimating the prevalence of *H. pylori* infection during early pregnancy among women living in a slum area of Dhaka and inspecting its association with key sociodemographic factors.

## MATERIAL AND METHODS

*Study Model and Participant Demographics:* The study hired a descriptive, cross-sectional approach, carried out in a clinical (hospital-based) setting between August 2017 and April 2018, as fragment of a comprehensive research initiative focused on maternal health and nutritional status during early gestation. A total of 45 pregnant women, aged 18 to 35 years, were employed from antenatal care clinics at the Maternal and Child Health Training Institute (MCHTI), Azimpur, situated in Dhaka. The study protocol was reviewed and approved by the ethical review panel of icddr,b. Participation in the study was utterly voluntary. Prior to enclosure in the study, informed written consent was attained from each participant. All partakers were in initial prenatal period, with a gestational age between 9 and 16 weeks. The study precisely targeted inhabitants of Kamrangir Char, a tightly populated slum area in Dhaka noticeable by insufficient sanitation, overpopulation, and restricted access to basic healthcare facilities.

*Eligibility Criteria:* Apposite participants were apparently healthy, based on clinical evaluation, and had no past records of chronic systemic ailments such as diabetes, hypertension, tuberculosis, or gastrointestinal disorders. Participants who had taken vitamin supplements such as vitamin $B_{12}$ or iron within the month prior to enrollment were excepted from the study to diminish potential confounding effects on the assessment of nutritional status.

Hemoglobin was measured by venous blood at the laboratory of the MCHTI with automatic hematology analyzers as part of clinical screening. Hemoglobin concentration represented a marker of overall nutritional and physiological condition. Trained medical staff also assessed other vital signs such as blood pressure, body temperature, and presence of clinical evidence of infection or acute disease. At recruitment, none of participants had acute medical illness. These strict selection criteria were used in order to select a clinically stable and uniform study population.

A dual-phase approach was employed to determine gestational age. First, a provisional estimate was made based on the last menstrual period (LMP) as

reported by the participant. Given that recall-based methods are subject to error, the LMP estimate was confirmed through transabdominal ultrasonography. The ultrasound scans were performed by certified sonographers at MCHTI and involved metric of the crown-rump length (CRL) or biparietal diameter (BPD), depending on gestational age.

*Data Collection:* After enrollment, socioeconomic, demographic and clinical profiles were gathered using a pretested, systematic questionnaire applied through direct interviews with respondents. Information collected included age, height, weight, parity, education level, household income, dietary diversity, and antenatal care utilization. Body mass index (BMI) was calculated using standard anthropometric methods.

Stool samples were collected in sterile containers and transported under cold chain conditions to the microbiology laboratory at icddr,b. Detection of *Helicobacter pylori* antigen was accomplished using a commercially sourced enzyme-linked immunosorbent assay kit that had been authenticated for clinical diagnostic usage. The assay was performed by measuring optical density (OD) values spectrophotometrically at the specified wavelength. Test results were interpreted using the cut-off values provided by the manufacturer to classify samples as positive or negative. Quantitative OD values were also recorded to allow further analysis of infection intensity.

*Statistical Analysis:* Statistical analyses were conducted using SPSS software. To recap the demographic and clinical characteristics, descriptive statistics such as averages, standard deviations, counts, and percentages were calculated. The prevalence of *H. pylori* infection was scrutinized athwart age categories and gestational age groups.

## RESULTS AND DISCUSSION

After a preliminary screening of 60 supposedly healthy pregnant women with a gestational age between 9 to 16 weeks, 45 individuals encountered all inclusion benchmarks and were registered in the study. Results are displayed in a organized format wrapping clinical evaluation, baseline demographic information, qualitative and quantitative diagnosis of *Helicobacter pylori* infection, and the age- and gestational-age-specific prevalence.

*Clinical Evaluation*: During enrollment, the participants underwent a homogenous clinical assessment to establish baseline physiological parameters and certify conformity to the inclusion criteria. The two principal parameters considered at this phase were hemoglobin concentration and gestational age. Consistent with WHO norms, a hemoglobin level underneath 11 g/dL is considered symptomatic of anemia during pregnancy. In present investigation,

the typical hemoglobin concentration among participants was 11.64 ± 0.96 g/dL, with individual values ranging from 9 to 14 g/dL. While some members were found to be insignificantly anemic, they were still considered qualified based on clinical stability and nonappearance of chronic comorbidities.

**Table 1. Determination of Clinical Parameters**

| Clinical Parameters (units) Range min-max | Mean ± Standard deviation (SD) |
|---|---|
| Hemoglobin (g/dL) | 11.64 ± 0.957 |
| Gestational age (weeks) | 12 ± 1.847 |

The gestational age was anticipated primarily as of the participant's prior menstrual period and confirmed by ultrasonography. The dual-step process guaranteed a more precise sorting of participants into explicit gestational age groups. The ultimate established pregnancy age vacillated from 9 to 16 weeks, with an average of 12 ± 1.85 weeks, inserting the study population chiefly within the late first to early second trimester.

This inclusive clinical screening permitted for the selection of a moderately standardized group of early-pregnancy participants, enabling meaningful evaluation of microbiological pathogenicity across gestational subcategories.

*Baseline Information of the Participants:* Comprehensive demographic and biometric statistics were documented during registration to illustrate the study population.
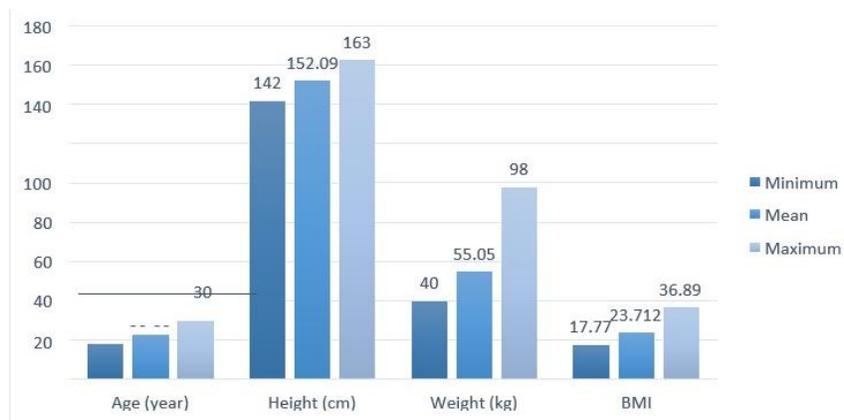


Fig 1. Baseline Demographic Characteristics of Participants

The mean age of the participants was 22.82 ± 3.68 years, presenting the fledgling being 18 years and the eldest 30 years. The typical height was 152.09 ±

5.27 cm, fluctuating from 142 cm to 163 cm. The average weight was 55.05 ± 11.88 kg, with a range of 40 to 98 kg. Grounded on these measurements, the average Body Mass Index (BMI) was calculated as 23.71 kg/m², with individual values spanning from 17.77 to 36.89 kg/m².

These anthropometrical pointers imitate a eclectic variation in nutritional and physiological status amid the participants, consistent with the socioeconomic multiplicity stereotypically originate in urban slum settings. In spite of some individuals falling off the optimum BMI range, no one met the elimination criteria associated with chronic illness or ongoing supplementation. These baseline values were indispensable in contextualizing the infection prevalence data.

*Qualitative Detection of H. pylori Antigen:* A total of 45 stool samples collected from registered participants were scrutinized using ELISA to distinguish the incidence of *H. pylori* antigen. A colorimetric shift (dark yellow signifying positive and light-yellow negative) was established via spectrophotometric analysis. Depending on the qualitative assessment, 34 participants (75.6%) confirmed positive for *H. pylori* infection, while 11 participants (24.4%) were negative for the antigen. These conclusions direct a huge burden of vigorous *H. pylori* infection within the study population through early pregnancy. The outcomes are conceded in Table 2.

**Table 2. Qualitative and Quantitative Detection of *H. pylori* Antigen**

| Qualitative Determination | | |
|---|---|---|
| **Qualitative measurement** | **Frequency** | **Percentage**% |
| *H. pylori-* Positive | 34 | 75.6 |
| *H. pylori-*Negative | 11 | 24.4 |
| Total | 45 | 100 |

| Quantitative Detection | | | | |
|---|---|---|---|---|
| **Quantitative parameters** | **Mean ± Standard deviation** | **Median** | **Range Minimum** | **Minimum** |
| *Helicobacter pylori* (ng/mL) | 229.18 ± 1023.226 | 11.05 | 0 | 6805 |

The present study determines a severe prevalence of *Helicobacter pylori* infection 75.6% among expecting women in their first and early second trimesters inhabiting in the Kamrangir Char slum of Dhaka, Bangladesh. These findings are in line with information from other low- and middle-income countries (LMICs), mostly in areas where sanitation is neglected, healthcare access is restricted, and population density is excessive. Analogous infection rates have been conveyed in equivalent populations in India and Egypt, underpinning the

conception that *H. pylori* is exceedingly endemic in socioeconomically underprivileged settings (Bassily *et al.* 1999, Mahalanabis *et al.* 1996).

*Quantitative Detection of H. pylori Antigen:* Resulting the primary qualitative assessment, stool samples from all participants were subjected to quantitative assessment using an ELISA-based spectrophotometric method. The current investigation projected to distinguish the antigen load of *Helicobacter pylori* through gauging the optical density (OD) of individual sample. Based on the manufacturer's protocol, a cut-off value of 3 ng/mL was established to distinguish between positive and negative cases. The concentration of *H. pylori* antigen in the stool samples varied noticeably athwart the study population, reflecting different levels of infection severity. The antigen concentrations ranged from 0 ng/mL (indicating no detectable infection) to a maximum of 6805 ng/mL, with a mean value of 229.18 ± 1023.23 ng/mL and a median of 11.05 ng/mL. The large standard deviation recommends substantial variability in bacterial load among the infected participants.

These findings highlight a spectrum of infection intensities, from unnoticeable to extremely high antigen levels, which may correspond to variations in clinical presentation, immune response, and nutritional status amongst individuals.

*Virulence:* Quantitative cataloguing of *H. pylori* antigen levels among participants exposed a wide range of infection severity. Nearly 15% of participants had null detectable antigen (0 ng/mL), while 8.8% exhibited marginal levels (<3 ng/mL), signifying negligeable or early exposure. The majority of infected individuals fell within the mild category (5–15 ng/mL), accounting for 37.77%, followed by 20% in the moderate group (15–100 ng/mL). Severe infections, demarcated by antigen concentrations between 100–500 ng/mL, were detected in 11.11% of participants, and the residual 6.6% demonstrated very severe antigen levels extending from 550 to 7000 ng/mL, indicative of considerable bacterial load and potentially active disease.

Conspicuously, the quantitative analysis of antigen load in this study discovered a broad spectrum of infection severity, ranging from undetectable to extremely high concentrations. This variability may represent differences in immune response, bacterial virulence, nutritional status, or the duration of infection. The major proportion of women fell within the mild to moderate infection categories, although a significant marginal exhibited severe and very severe levels of antigen, which may warrant clinical attention. The potential correlation between higher bacterial concentration and worsened nutritional or pregnancy outcomes merits further investigation.

*Age-Specific Prevalence of Helicobacter pylori Infection*: When graded by age, the highest prevalence of infection was distinguished in the youngest group

(18–20 years), where 85.7% tested positive. In the 21–24-year age group, 66.7% were infected, while the 25–30-year group exhibited a prevalence of 76.9%.
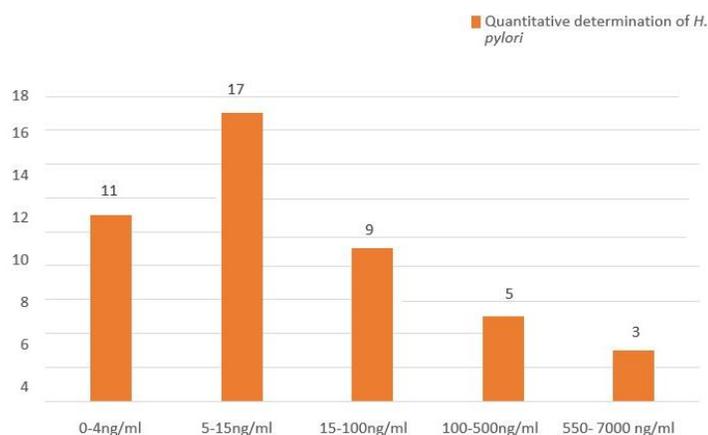


Fig. 2. Severity of *H. pylori* Antigen among participants.

[*None: 0 ng/mL (15%), Borderline: <3 ng/mL (8.8%), Mild: 5–15 ng/mL (37.77%), Moderate: 15–100 ng/mL (20%), Severe: 100–500 ng/mL (11.11%), Very Severe: 550–7000 ng/mL (6.6%).*]

These findings advocate that *H. pylori* contamination is extensive across all reproductive age groups, with a remarkably higher load amongst younger women, potentially reflecting early-life procurement and chronic determination of the bacterium in socioeconomically underprivileged environments.

The consistent prevalence of infection across different age groups and gestational periods should be one of the most substantial perceptions from this study. This outline advocates chronic colonization possibly attained in early childhood, which has been well documented in endemic regions (Ahmed *et al.* 1997). The persistence of the infection into reproductive years, mostly in malnourished women, advances concerns about its potential influence on both maternal and fetal health during gestation.

*Prevalence of H. pylori antigen by Gestational Age Group*: To scrutinize the distribution of *H. pylori* infection across different stages of early pregnancy, participants were grouped into three gestational categories: 9 to <12 weeks (late first trimester), 12 to <14 weeks (early second trimester), and 14 to 16 weeks (late second trimester). In the first group (9–<12 weeks), 69.2% of participants tested positive for *H. pylori* antigen. Among those in the early second trimester (12–<14 weeks), the prevalence increased to 76.9%, while in the late second trimester group (14–16 weeks), the prevalence was slightly higher at 78.9%. Although these figures demonstrate only modest variations in infection rates

between gestational stages, the overall burden of infection remained consistently high across all groups. This pattern suggests that *H. pylori* colonization likely



| | Sub-group-1 (18-20 years) | Sub-group-2 (20-24 years) | Sub-group-3 (25-30 years) |
|---|---|---|---|
| ▪ Total percentage of the sub-group | 31.11% | 40% | 28.88% |
| ▪ % of H. pylori negative antigen | 4.44% | 13.33% | 6.66% |
| ▪ % of H. pylori positive antigen | 26.66% | 26.66% | 22.22% |

Prevalence

▪ Total percentage of the sub-group  ▪% of H. pylori negative antigen  ▪% of H. pylori positive antigen
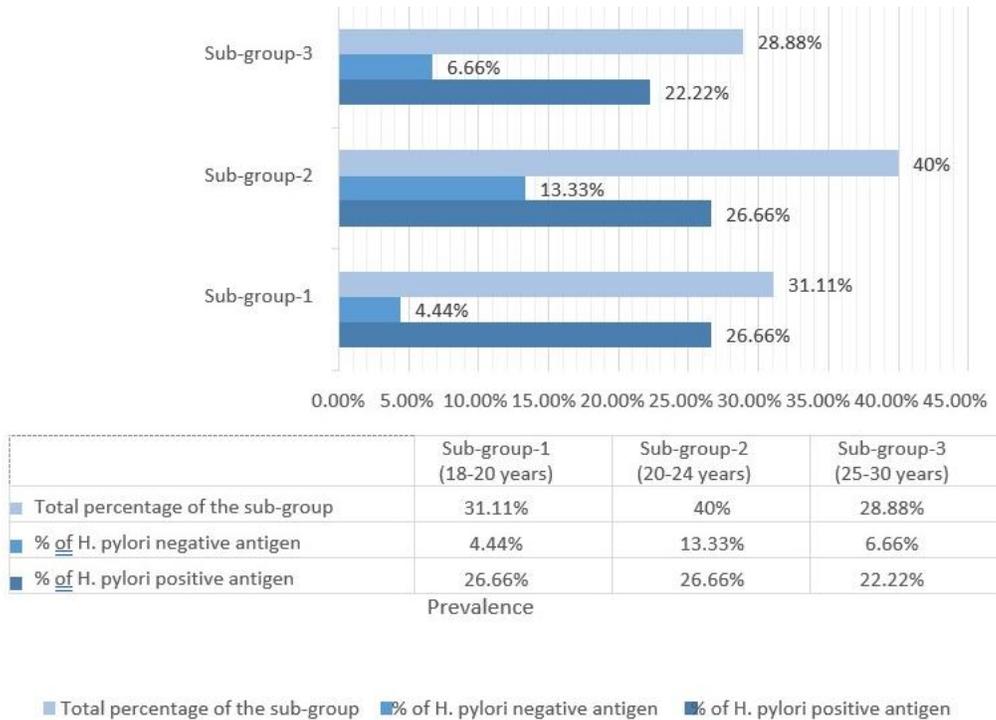
Fig. 3. Prevalence of *H. pylori* antigen by Age Group

precedes pregnancy and persists throughout the first and early second trimesters, reinforcing the need for early antenatal screening, particularly in high-risk populations.The relevance of infection timing is considered to be significant. Early pregnancy is characterized by organogenesis, a phase when the fetus is extremely prone to teratogenic and nutritional insults. If maternal nutrient absorption is negotiated during this period due to *H. pylori*-induced gastritis, the consequences could be enduring, potentially distressing fetal growth, to some extant health, even into postnatal life. Quite a lot of studies have allied maternal *H. pylori* infection with augmented rates of anemia, preeclampsia, and miscarriage, yet causality remains to be conclusively established (Refsum *et al.* 2001, Koebnick *et al.* 2002).

The pathophysiological approaches by which *H. pylori* may distress pregnancy outcomes are gradually documented. The bacterium persuades chronic gastritis and weakens gastric acid manufacture, which are pivotal for the effective absorption of micronutrients such as vitamin $B_{12}$, folate, and iron

(Kaptan *et al.* 2000, Allen 2008). These nutrients are disparagingly significant throughout pregnancy projected for sustaining maternal hemoglobin levels,
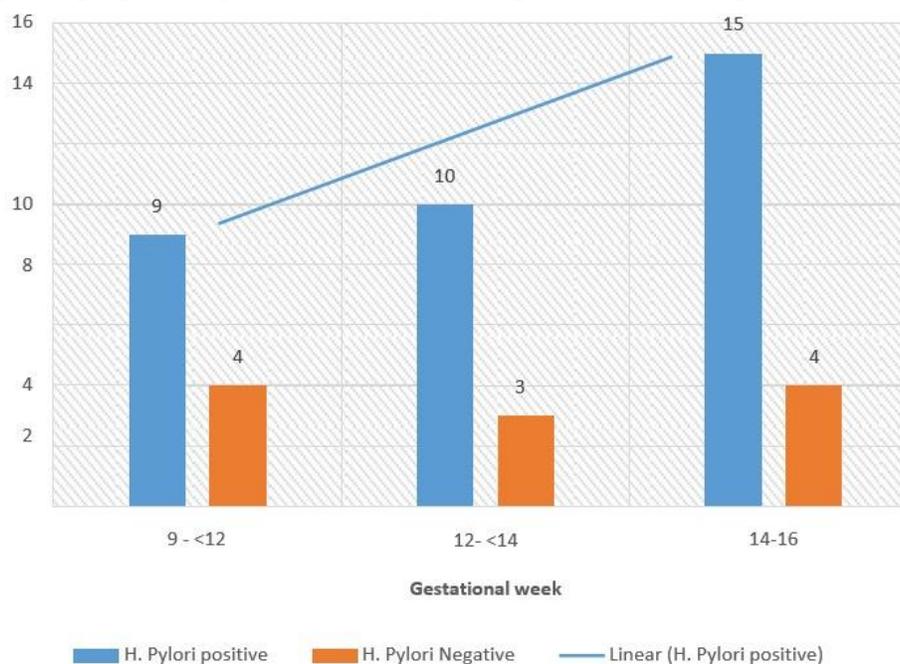


Fig. 4. Prevalence of *H. pylori* antigen by Gestational Age Group.

supporting fetal neural growth, and falling the risk of intrauterine development restriction (IUGR), preterm delivery, and reduced birth weight (Mulayim *et al.* 2008, Felkner *et al.* 2007).

In plain terms, this investigation establishes a evidently high prevalence of *Helicobacter pylori* infection (75.6%) among pregnant women in their first and early second trimesters residing in Kamrangir Char, an disadvantaged urban settlement in Dhaka. These findings highlight a wide-ranging public health concern, expressly given the potential of *H. pylori* to impair nutrient absorption and unfavorably influence maternal and embryonic health outcomes.

Our findings are broadly consistent with current data from other Bangladeshi urban slum populations. Siddiqua et al. (2019) testified an incidence of around 65% fecal *H. pylori* antigen positivity among pregnant women in early pregnancy, with momentous co-occurrence of vitamin B12 deficit (23%) and anemia (~26%). The resemblance between these findings and the present investigation accentuates the persistence of *H. pylori* as a highly endemic infection in poor communities in Bangladesh, where inadequate sanitation, overcrowding, and limited healthcare access perpetuate its spread.

Prominently, our advanced prevalence may imitate provincial variances in sanitation infrastructure, dietary practices, or sample size variations, however, it nevertheless strengthens the pressing need to integrate infection screening into antenatal services.

Beyond prevalence evaluations, emerging indication is firming up the linkage between *H. pylori* infection and hostile pregnancy outcomes. A recent study in Turkey verified that *H. pylori* exposure in women with nausea and vomiting of pregnancy meaningfully augmented the jeopardy of preterm labor and electrolyte imbalances (e.g., lower serum potassium levels), highlighting the infection's systemic effects even in the nonattendance of gastrointestinal ulcerative symptoms (Masaadeh *et al* 2023). While our cross-sectional design did not assess pregnancy outcomes longitudinally, the high bacterial burden detected in several participants recommends a conceivable hazard for such difficulties, necessitating follow-up research in Bangladeshi cohorts.

Comparative data from other low- and middle-income countries also highlight the maternal burden of *H. pylori*. An Egyptian case-control study reported that approximately 44% of women with hyperemesis gravidarum tested positive for *H. pylori*, and infection was strongly associated with anemia, rural residence, and recurrent vomiting (Al-Omda *e al* 2020). These associations parallel our finding that some participants presented with borderline or mild anemia despite clinical stability, suggesting that *H. pylori* infection may exacerbate pregnancy-related nutritional stress. Although our participants were not specifically selected for hyperemesis, the high prevalence observed indicates that *H. pylori* may be a hidden contributor to poor maternal nutrition in similar slum populations.

Taken together, these findings position *H. pylori* infection not only as a gastrointestinal pathogen but also as a maternal health risk factor in Bangladesh. The persistence of high prevalence despite decades of awareness suggests that public health interventions must move beyond clinical treatment and include improved sanitation, safe water access, and targeted nutritional support for pregnant women. Given the challenges of antibiotic use in pregnancy, interim measures could involve antenatal micronutrient supplementation and postpartum eradication therapy, as recommended in other contexts. Future studies in Bangladesh should adopt longitudinal designs to examine the direct relationship between maternal *H. pylori* status and outcomes such as anemia progression, preterm birth, and neonatal growth.

This study confronted a limitation in terms of its timeline, with data collection restricted to a defined and relatively brief period. A few important wet laboratory analyses were being carried out at the University of California, Davis, but the improvement stood substantially overdue during the COVID-19

pandemic (2020–2021), when laboratory access was delimited. Therefore, the investigational segment was only finalized in late 2022, and publication was further adjourned as the grander dataset was systematized into a series of fixated manuscripts. Although this gap between data collection and dissemination is noteworthy, the results remain robust and continue to provide timely insights into the high burden of *H. pylori* infection in early pregnancy within resource-limited urban settings. Concisely, this study suggested crucial baseline statistics on the incidence of *H. pylori* infection in early pregnancy in a neglected urban setting in Dhaka. The considerable rate of infection among gravid women in Kamrangir Char calls for incorporation of *H. pylori* screening into routine prenatal care services. Also, public health efforts must emphasis on matarializing sanitary practices, endorsing hygiene, and addressing nutritional insufficiencies. Although, this study offers valued baseline data, it is inadequate by its cross-sectional design, modest sample size, and lack of follow-up on pregnancy outcomes. Future longitudinal studies integrating dietary assessments, hematological profiles, and neonatal health indicators are compulsory to fix in what way maternal infection affects pregnancy outcomes and child development, which offer a profound perception into the clinical significance of *H. pylori* infection in gestation.

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