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Article

Prevalence of Helicobacter Pylori Infection and Infertility Problems Among Baghdad City Populations: Associations with Food Habits and Environmental Pollution

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Abstract: This study aimed to determine the incidence of *Helicobacter pylori* infection among Baghdad city populations and explore associations with infertility, food habits, environmental factors, and comorbidities like type 2 diabetes mellitus (T2DM). The researcher examined 120 people in Baghdad from June 2020 to March 2022. *H. pylori* antibodies were detected using rapid diagnostic kits. Information on age, gender, food habits, T2DM, smoking status, and living conditions was collected. Semen analysis was done in *H. pylori* positive and negative males with infertility. *H. pylori* seroprevalence was 62.5%. Prevalence increased with age ($p<0.05$) and was higher among females (70%) than males (62.5%), ($p<0.001$). Non-spicy food consumers showed higher prevalence (67%) than spicy food eaters (33%), ($p<0.001$). T2DM patients demonstrated substantially higher prevalence than non-diabetics (81% vs 67%), ($p=0.001$). Rural inhabitants revealed greater prevalence than urban dwellers (66.6% vs 33.3% for males; 70% vs 40% for females), ($p<0.01$). Smokers exhibited higher seropositivity than non-smokers (41% vs 24%), ($p<0.001$). Infertile men showed poorer semen parameters with *H. pylori* infection ($p<0.01$). Good hygiene, healthy diets, and avoiding smoking are vital to curb *H. pylori* infection. Testing for this bacterium should be considered in infertility assessments.

Keywords: prevalence, food habits, type 2 diabetes mellitus, cigarette smoking, *H. pylori*, infertility

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1. Introduction

Helicobacter pylori is a Gram-negative, spiral-shaped bacterium with multiple flagella that colonizes the gastric mucosa of humans [1-5]. It was first isolated by Warren and Marshall in 1983 [6-8]. Approximately half of the global population harbors this organism in their upper gastrointestinal tract (GIT) [9]. Although most infections are asymptomatic, *H. pylori* is a crucial factor in gastritis, peptic ulcers, mucosa-associated lymphoid tissue (MALT) lymphoma, and gastric carcinoma [10-14]. It is regarded as a definite Type 1 carcinogen owing to firm evidence from epidemiological research on its role in gastric cancer development [6, 15, 16]. Successful eradication of *H. pylori* markedly decreases ulcer recurrence risk and probability of malignancy in contaminated patients [6, 9, 17].

H. pylori possesses an array of virulence determinants assisting its colonization and persistence within the hostile acidic gastric environment. These include flagella for motility, adhesins for sticking onto epithelial cells, urease for neutralizing stomach acidity, and certain genes like cagA, vacA, and dupA linked with more severe clinical outcomes [18, 19]. The usual mode of transmission is fecal-oral or oral-oral spread facilitated by overcrowding, poor sanitation and hygiene [6, 20, 21].

After initial acquisition in early childhood, *H. pylori* infection tends to persist lifelong unless treated with targeted antibiotic regimens [6, 22]. Accordingly, infection rates vary widely among nations depending on living standards and are higher in developing than industrialized countries [6, 23]. The prevalence rises with advancing age owing to continued exposure and waning immunity [24].

Since chronic gastritis induced by this bacterium may eventually progress to malignancy, early detection and intervention are warranted, especially in high-risk populations [6]. Recent evidence also indicates associations of *H. pylori* carriage with various extrathyroidal conditions like autoimmune thrombocytopenia, impaired glucose metabolism, thyroid disorders and adverse reproductive outcomes [25-27].

In view of the significant disease burden inflicted by this pervasive pathogen, we aimed to determine its current seroprevalence and correlates in Baghdad City residents. The study objectives included assessing potential effects of sociodemographic attributes like age and gender, lifestyle factors such as food preferences, smoking habit and living environment, T2DM comorbidity and infertility problems among infected males on *H. pylori* positivity rates.

2. Patients and Methods

Study Sample

We enrolled 120 participants from Baghdad City over two years between June 2020 and March 2022. The cohort consisted of 80 males (50 urban and 30 rural inhabitants) and 40 females (25 urban and 15 rural inhabitants), aged 20–60 years.

H. pylori Antibody Detection

Five mL venous blood was collected from each subject into plain vacutainer tubes and allowed to clot. After centrifugation, the separated serum samples were tested for *H. pylori* antibodies employing rapid diagnostic kits (Fastep® *H. pylori* Antibody Screen Test, Houston, USA) as per kit protocols [28].

Data Collection

We gathered information on participant age, gender, spicy food consumption, T2DM status, smoking habit, and residential locality (urban or rural) via questionnaires.

Semen Analysis

Semen analysis was conducted in 40 infertile males, including 30 seropositive for H. pylori antibodies and 10 seronegative controls as per World Health Organization (WHO) guidelines (2010). Parameters evaluated encompassed semen volume, sperm count, motility, and morphology [25].

Ethical Approval

The study protocol was approved by the Institutional Ethics Committee. Informed written consent was obtained from all subjects prior to enrolment.

Statistical Analysis

Data were analyzed using SPSS version 15 software. H. pylori seroprevalence was expressed as percentages. Chi-square test was applied to derive p values for assessing correlations of seropositivity with age, gender, food preferences, smoking habit, residential area, T2DM, and infertility. Differences with $p<0.05$ were considered statistically significant.

3. Results

Gender-wise Distribution

Overall seroprevalence in our study cohort was 62.5%. Gender-stratified analysis highlighted 1.86 times higher prevalence among females (70%) relative to males (62.5%), ($p<0.001$, Table 1).

Table 1. Gender-wise distribution of *H. pylori* seropositivity

Gender	No. of samples	Positive		Negative		P Value
		No	%	No	%	
Male	80	50	62.5	30	37.5	($p< 0.001$)
Female	40	28	70	12	30	($p< 0.001$)
Total	120	75	62.5	45	37.5	($p< 0.001$)

Age-wise Distribution

We observed an ascending trend in seroprevalence across successive age groups, implying that colonization risk increased with advancing age (Table 2). The 20-29 years category registered the lowest positivity rate (55.5%), while the eldest 50-60 years group showed maximum prevalence (70.5%), ($p=0.001$).

Table 2. Age-wise *H. pylori* seroprevalence

Age (years)	No of samples	Positive		Negative		P Value
		No	%	No	%	
20-29	18	10	55.5	8	44.5	0.001
30-39	32	20	62.5	12	37.5	0.05
40-49	36	24	66.5	12	33.5	0.05
50-60	44	31	70.5	13	29.5	0.001
Total	120	85	71	45	29	

Detection of *H. pylori* Antibodies

The rapid diagnostic test kit displays results read as either positive or negative for *H. pylori* IgG antibodies. Presence of antibodies indicates current or past exposure to the bacterium. A positive test is indicated by visibility of two bands – the standalone control band plus an additional test band (Figure 1B, Positive). The test band develops only in the presence of specific *H. pylori* antibodies in the test serum. A negative result is denoted by a single control band without the extra test band (Figure 1B, Negative), signaling lack of detectable *H. pylori* IgG antibodies.

To confirm accuracy of the immunochromatographic test cards, ELISA technique was performed in parallel on half of the samples as a gold standard comparator assay.

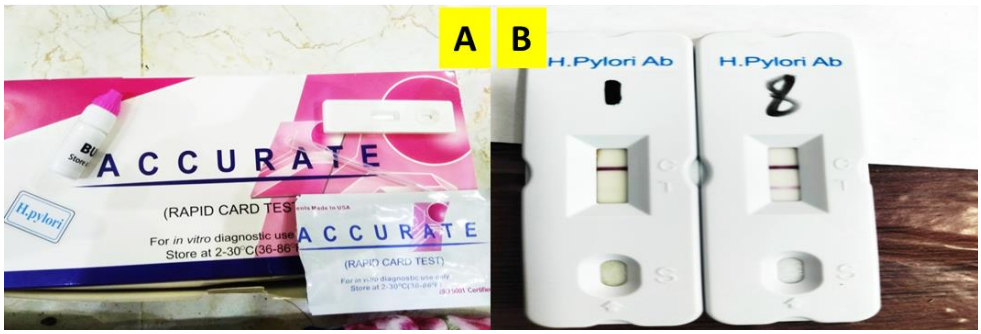

Figure 1. Rapid card test for detection of presence of *H. pylori* infection. Representative image (A). Result outcome (B).

Dietary Habits and Comorbidities

We evaluated the potential effects of dietary spiciness and comorbid type 2 diabetes mellitus (T2DM) on likelihood of testing positive for *H. pylori* antibodies. Individuals reporting regular spicy food intake demonstrated lower seroprevalence (33%) compared to those eating non-spicy food (67%), (Figure 2A). The constituent bioactive phytochemicals may conceivably exert bacteriostatic or microbicidal actions. T2DM represented a significant risk factor predisposing towards *H. pylori* colonization. Diabetic subjects registered 26% higher positivity than non-diabetic controls (81% vs 67%), (Figure 2B). Impaired immunity coupled with microvascular gastric mucosal complications may explain this predilection.

Overall, sensible dietary choices and maintaining optimal glycemic control should be promoted to attenuate acquisition risk.

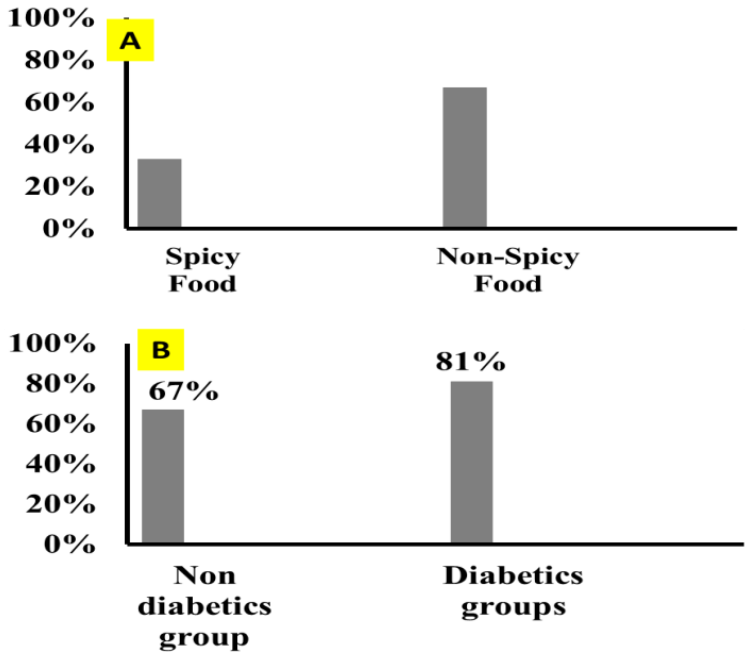

Figure 2. T2DM (A) and living environment (B) as determinants of *H. pylori* colonization risk

Impact of Residential Location

Segregation by habitat demonstrated conspicuously elevated prevalence among rural inhabitants for both genders (Table 3, Table 4). Rural men showed 66.6% positivity relative to 33.3% in urban males (p=0.001). The corresponding rates in women were 70% and 40%, rural versus urban (p=0.001).

Table 3. *H. pylori* seroprevalence in males by living site

Habitation Site	No. of Samples examined	Positive		Negative		P Value
		No.	%	No.	%	
Rural Area	24	16	66.6	8	33.3	0.001
Urban Area	56	19	33.4	37	66.7	0.001
Total	80	35		45		

Table 4. Habitat-wise seroprevalence in females

Habitation Site	No. of Samples examined	Positive		Negative		P value
		No.	%	No.	%	
Rural Area	10	7	70	3	30	0.001
Urban Area	30	12	40	18	60	0.001
Total	40	19		21		

Effect of Smoking

We noted substantially greater seropositivity among smokers relative to non-smokers (41% vs 24%), ($p<0.001$, Table 5). Tobacco usage hence represented a significant risk factor predisposing to *H. pylori* acquisition.

Table 5. *H. pylori* seropositivity and smoking status

Cigarette smoking	No. of Samples examined	Positive		Negative		P Value
		No.	%	No.	%	
Smokers	31	13	41	18	58	0.001
No Smokers	49	12	24	37	75	0.001
Total	80	25		55		

Correlation with Male Infertility

All semen parameters were markedly substandard in *H. pylori* positive compared to negative subjects, suggestive of impaired reproductive capacity (Table 6).

Table 6. Semen profile in relation to *H. pylori* status

Semen characters	Infected	Non-Infected	P Value
Sperm concentration (M/m)	25	33	P<0.001
Sperm motility percent (%)	26	60	P<0.001
Grad A %	10	33	P<0.001
Grad B %	9	20	P<0.001
Grad C %	6	7	P<0.001
Grad D %	74	40	P<0.001
Morphology %	24	65	P<0.001

4. Discussion

Despite its discovery over three decades ago, H. pylori continues to be a ubiquitous infection globally. Developing countries still report substantial carriage rates owing to socioeconomic challenges like overpopulation, inadequate sanitation, low health awareness, and limited healthcare access [10, 24]. Our investigation in Baghdad citizens revealed an overall seroprevalence of 62.5%, analogous to earlier observations from this geographical region (Table 7). The sustained high endemicity in our community indicates persistent transmission via contaminated food or water sources and person-to-person spread through poor personal and domestic hygiene.

Table 7. Reported prevalence across different world regions

Author	Year	Number of patients	Test used by laboratory	Prevalence	Country
Lim SH et al. [29]	2013	19272	IgG Serology for H. pylori	54.4%	Korea
Bravo LE et al. [30]	2003	8652	Biopsy for histopathology	69.1%	Colombia
Hu D et al. [24]	2013	3995	IgG Serology for H. pylori	44.9%	China
Nakajim S etal. [31]	2010	1246	Biopsy for histopathology	52.7%	Japan
Gill HH et al. [32]	1993	526	Biopsy for histopathology and urease test of biopsy	65%	India
Shiota S et al. [33]	2013	381	IgG Serology for H. pylori	71.1%	Bhutan
Garg B et al. [34]	2012	300	Biopsy for histopathology	43%	India
Krashias G et al. [35]	2013	103	PCR* for H. pylori in tissue sample	39.8%	Cyprus
Bakri M. [36]	2012	70	Culture and PCR* for H. pylori in tissue sample	85.7%	Saudi Arabia

Several host attributes and environmental influences may modulate susceptibility to this pathogen. Accordingly, we evaluated their relative contributions in explaining the burden within our population.

In concordance with earlier evidence [37], female gender constituted a significant risk factor for *H. pylori* acquisition. Possible reasons may encompass enhanced sensitivity to hygiene lapses during food handling and preparation due to cultural norms, closer exposure to young children who amplify transmission, and hormonal or genetic elements regulating immune responses [37].

Our data also confirmed previous observations that infection risk increases steadily with advancing age, likely from prolonged exposure opportunities over time [24, 38]. Childhood and adolescence are thus critical windows for imbibing hygienic habits within families that may attenuate future colonization potential.

Diet represents a key adjustable determinant of *H. pylori* positivity, considering the oral-oral route that sustains spread of this organism [39]. We noted preference for spicy cuisine to be accompanied by significantly lower likelihood of infection. Constituent bioactive ingredients may conceivably exert bacteriostatic or microbicidal actions within the stomach. While contradictory observations have been documented regarding this relationship [40], further explorations are necessitated given the profound role nutrition plays in health.

Comorbidities like T2DM appear to enhance vulnerability to infectious agents through mechanisms still being elucidated [27, 41]. Analogously, T2DM diagnosis doubled the probability of testing seropositive in our cohort, as seen earlier [42]. Persistent low-grade inflammation induced by this bacterium may contribute to insulin resistance and impaired glucose handling. Screening T2DM patients for evidence of colonization and appropriate antibiotic elimination if detected merits consideration.

Geographical variations in contamination rates often reflect disparities in socioeconomic privileges and standards of living [24, 43]. Corroborating these concepts, inhabitants of rural zones revealed 1.5 to 2-fold higher positivity than urban citizens in our investigation. Agricultural occupations may increase exposure risks along with challenges accessing clean water and maintaining personal hygiene faced by rural communities. Targeted interventions promoting hand washing, sanitary food handling and cooking practices could effectively reduce transfer rates and disease burden [35, 44, 45].

Tobacco usage similarly inclined subjects towards H. pylori acquisition by potentially modifying gastric mucosal defenses and immune competence [6, 46, 47]. Counseling smokers regarding heightened vulnerability may provide additional motivation and justification for quitting this harmful habit.

An average 20% of couples globally currently grapple with fertility issues, half of which can be traced to male partners [25]. Mechanistic links between reproductive health and microbial infections are being increasingly acknowledged [48]. Our analysis revealed pervasive semen defects in colonized men, hinting at inflammation-mediated damage to sperm genetic integrity and function [25]. Screening for asymptomatic carriage should hence be incorporated into routine infertility workups. Antimicrobial eradication and anti-inflammatory nutraceuticals could assist recovery of gonadal function.

Our study had some limitations being a questionnaire-based survey confined to one city with a modest sample size. Wide variations in dietary composition, diabetes control status, smoking intensities and rural living conditions between subjects could not be accounted for. The rapid antibody detection kits used also do not reliably distinguish current from past episodes of infection. Nonetheless, it provides vital preliminary data regarding distribution of this stealth pathogen within our population and its clinical and lifestyle correlates to guide future efforts.

5. Conclusion

In conclusion, our findings underscore the need for improving community hygiene and sanitation infrastructure in developing regions still tackling infectious disorders like *H. pylori*. Promoting healthier diets, regular handwashing, and cessation of smoking could considerably reduce circulation of this hardy organism. Screening for active colonization should be considered during diagnostic workups for associated comorbidities like T2DM, gastritis, and infertility to enable timely therapeutic interventions. Public education is equally pivotal so that populations remain vigilant and seek early medical assistance when symptomatic. Larger parallel multicentric studies can help consolidate evidence regarding epidemiological patterns and region-specific risk attributes.

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