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Frequency of Helicobacter pylori Infection among Hostelite Students, Peshawar, Pakistan

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ABSTRACT

Background: Helicobacter pylori infection remains a major public health concern, especially in developing countries where overcrowding, poor sanitation, and unsafe drinking water facilitate transmission. Students living in university hostels may be at increased risk because of close living arrangements and shared facilities. However, information regarding the burden of H. pylori infection among hostel-resident university students in Pakistan is still limited. This study aimed to determine the seroprevalence of H. pylori IgG antibodies among undergraduate students residing in hostels at NCS University System, Peshawar, and to identify factors associated with seropositivity. **Methods:** A cross-sectional study was carried out between February and July 2019 among 152 undergraduate students residing in university hostels for at least three months. Participants were selected from three hostels, including two male hostels and one female hostel. Blood samples were collected and screened for H. pylori IgG antibodies using the Immunochromatography Technique (ICT). Data regarding demographic characteristics, lifestyle practices, and gastrointestinal symptoms were obtained through a structured questionnaire. **Results:** Among the 152 participants (mean age: 21.28 ± 2.14 years), 59 students (38.8%) tested positive for H. pylori IgG antibodies. Seropositivity was higher among males (41.0%) compared with females (28.0%), although the difference was not statistically significant (p = 0.23). Tea consumption showed a significant association with seropositivity, with regular tea drinkers demonstrating a higher positivity rate than non-drinkers (41.0% vs. 15.3%; p = 0.047). Although ex-smokers exhibited the highest proportion of positive cases (50.0%), smoking status was not significantly associated with infection (p = 0.38). Most participants reported using unfiltered tube-well water as their primary drinking source. **Conclusion:** A considerable proportion of hostel-resident university students were seropositive for H. pylori, indicating substantial exposure within this population. Tea consumption emerged as the only factor significantly associated with seropositivity. While the cross-sectional nature of the study limits causal interpretation, the findings highlight the importance of improving hygiene practices and ensuring safe drinking water in university hostels.

Keywords: Helicobacter pylori, seroprevalence, IgG antibodies, hostel students, immunochromatography, gastritis, Pakistan.

INTRODUCTION

Helicobacter pylori is a spiral-shaped, Gram-negative, microaerophilic bacterium that colonises the gastric mucosa of humans. Its identification by Marshall and Warren in 1982 significantly altered the understanding of peptic ulcer disease. Before this

discovery, ulcers were largely attributed to stress and excessive gastric acid secretion; however, subsequent evidence established chronic *H. pylori* infection as a principal underlying cause [1]. Owing to its strong association with gastric adenocarcinoma and mucosa-associated lymphoid tissue (MALT) lymphoma, the World Health Organisation categorised *H. pylori* as a Class I carcinogen [2].

Transmission of the organism occurs predominantly through the faecal–oral route, particularly via ingestion of contaminated food or water [3,4]. Additional pathways such as oral–oral spread and exposure to inadequately disinfected endoscopic instruments have also been documented [5,6]. In low-resource settings with poor sanitation, infection is frequently acquired during childhood and may persist for decades in the absence of treatment [7]. Groundwater contamination has been recognised as an important source of infection. According to Stone [8], even chlorinated water systems may contain viable *H. pylori* when disinfection measures are inconsistent or poorly maintained. Similarly, vegetables irrigated with sewage-contaminated water have been implicated in transmission, especially among populations relying on untreated surface water [9].

The burden of *H. pylori* infection remains substantial worldwide, with estimates suggesting that over half of the global population is infected. Prevalence rates are particularly high in low- and middle-income countries, often exceeding 70–80% [10]. Pakistan is considered one of the high-prevalence regions. Previous local studies have demonstrated seropositivity rates of approximately 53.5% among school-aged children between 11 and 15 years [11], while hospital-based investigations from Peshawar reported prevalence figures approaching 60% in adults [12]. Another multicentre Pakistani study found a prevalence of 58.4% among dyspeptic individuals and identified poor socioeconomic conditions and contaminated groundwater as major contributing factors [13]. University hostels may provide favourable conditions for transmission because students commonly share bathrooms, kitchens, and dining facilities where hygiene standards can vary considerably.

The pathogenicity of *H. pylori* is linked to both direct epithelial injury and chronic immune-mediated inflammation. Several virulence factors contribute to disease development, including *VacA*, a vacuolating cytotoxin capable of damaging epithelial cells, and *CagA*, a high-molecular-weight protein present in nearly 60% of strains that is strongly associated with severe gastric disease [14,15]. In addition, the organism possesses a distinctive lipopolysaccharide structure that assists in evading host immune responses. Rather than eliminating the infection, the host inflammatory response often promotes ongoing mucosal damage through persistent neutrophilic infiltration, cytokine release, and activation of lymphocytes [16].

A number of behavioural and environmental factors have also been explored in relation to *H. pylori* infection. Cigarette smoking has been suggested to increase susceptibility by impairing gastric mucosal defence mechanisms and reducing mucus production [17]. Consumption of caffeinated beverages may further influence bacterial colonisation by altering gastric acidity [18]. A systematic review involving South Asian populations reported that both smoking and regular intake of hot beverages were associated with increased *H. pylori* seropositivity, although the strength of association differed across studies [19]. Evidence regarding gender differences remains inconsistent. Some population-based studies have described higher prevalence among females [20], whereas hospital-based Pakistani studies more often report male predominance,

Because hostel-dwelling students represent a plausible high-risk group, and because there are very few published data on *H. pylori* in this population in Pakistan, we designed the present study to determine the frequency of *H. pylori* IgG seropositivity at NCS University System, Peshawar, and to identify the demographic and lifestyle factors that were associated with a positive result.

METHODOLOGY

2.1 Study Setting and Population

The work was done between February and July 2019 in three student hostels at the NCS University System, Peshawar, two accommodating male students and one for female students. To be included, a student had to be currently resident and to have been living in the hostel for at least three consecutive months; the three-month cut-off was chosen because it was felt to be long enough to produce meaningful exposure to the shared environment.

2.2 Study Design and Sampling

We used a cross-sectional design, which is appropriate for estimating prevalence at a single point in time. The required sample size was worked out with the SurveyMonkey online calculator (95% confidence, 5% margin of error, estimated population 250), giving a minimum of 152. Students were recruited by convenience sampling until we reached that target. The practical advantage of this approach in a hostel setting is obvious, but we are aware that it may limit how far the findings can be generalised.

2.3 Data Collection and Laboratory Analysis

Each participant completed a structured questionnaire covering age, sex, smoking history, dietary habits, including how often they drank tea and whether they ate raw fruit or vegetables, their drinking water source, and any symptoms referable to the upper gastrointestinal tract such as dyspepsia or heartburn. Written and verbal consent were obtained before any data or samples were collected.

Blood samples were collected from all participants through venipuncture using standard aseptic procedures. The samples were transferred into heparinised and gel-separator tubes and then transported to the NCS laboratory for analysis. Detection of *H. pylori*-specific IgG antibodies was carried out using ICT rapid diagnostic strips, which are also routinely employed in the Khyber Teaching Hospital (MTI), Peshawar reference laboratory. Test results were interpreted in accordance with the manufacturer's guidelines. Since IgG serology reflects previous or ongoing exposure to *H. pylori* rather than definite active infection, individuals with positive results were classified as seropositive cases instead of confirmed active infections.

2.4 Statistical Analysis and Ethical Considerations

The collected data were entered and analysed using IBM SPSS Statistics version 25. Continuous variables were summarised as mean \pm standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages. Associations between *H. pylori* seropositivity and different categorical variables were evaluated using Pearson's chi-square test. Fisher's exact test was applied in situations where expected cell counts were less than five. Statistical significance was considered at a p-value of less than 0.05.

Ethical approval for the study was obtained from the institutional review committee before data collection. Permission to conduct the study within the hostels was granted by the hostel administration and wardens. Participant confidentiality and privacy were strictly maintained throughout the study process.

RESULTS

3.1 Overall Seroprevalence and Gender Distribution

A total of 152 hostel-resident students participated in the study, and all completed the required procedures. Among them, 127 (83.6%) were male and 25 (16.4%) were female. The overall mean age of the participants was 21.28 ± 2.14 years. Based on ICT screening, 59 students (38.8%) tested positive for *H. pylori* IgG antibodies, while 93 (61.2%) showed negative results (Table 1).

Gender-wise analysis showed that seropositivity was more frequent among male students, with 52 out of 127 males (41.0%) testing positive. In comparison, 7 of the 25 female students (28.0%) were seropositive. Although the proportion appeared higher in males, the association between gender and *H. pylori* seropositivity was not statistically significant according to the chi-square test ($p = 0.23$). The relatively smaller number of female participants should be considered when interpreting this comparison, as it may have reduced the statistical power of the analysis.

Table 1. Overall *H. pylori* IgG Seroprevalence by Gender

Characteristic	Total n	<i>H. pylori</i> +ve n (%)	<i>H. pylori</i> -ve n (%)	p-value
Overall	152	59 (38.8)	93 (61.2)	—
Male	127	52 (41.0)	75 (59.0)	0.23
Female	25	7 (28.0)	18 (72.0)	—
Mean age, yrs (SD)	21.28 (± 2.14)	—	—	—

ICT = Immunochromatography Technique. Values expressed as n (%) unless otherwise stated. *Chi-square test (male vs. female). SD = standard deviation.

3.2 Lifestyle and Dietary Risk Factors

The detailed distribution of *H. pylori* seropositivity according to different risk factors is presented in Table 2. Out of all the variables analysed, only tea consumption showed a statistically significant association with seropositivity. Among students who reported drinking tea regularly, 57 out of 139 (41.0%) tested positive for *H. pylori* IgG antibodies. In contrast, only 2 of the 13 students who did not drink tea were seropositive (15.3%), and this difference reached statistical significance ($p = 0.047$).

Smoking status showed some variation in positivity rates, although the association was not statistically significant overall ($p = 0.38$). Ex-smokers had the highest proportion of seropositive cases, with 11 out of 22 students (50.0%) testing positive. Among non-smokers, 38 of 102 (37.2%) were positive, while current smokers showed a positivity rate of 35.7% (10/28). The pattern was somewhat uneven, and the relatively small numbers in some smoking groups may have influenced the comparison.

Nearly all participants reported using unfiltered tube-well water as their main drinking source. Of the 150 students relying on this water supply, 59 (39.3%) were found to be seropositive for *H. pylori*.

The two students who used packaged mineral water were both seronegative. Because almost everyone used the same water source, there was not enough variation to test this statistically in a meaningful way.

Seropositivity rates for raw vegetable consumption, dyspepsia, heartburn, and fruit intake showed only minor numerical differences between subgroups, and none reached significance ($p = 0.91, 0.79, 0.83, \text{ and } 0.38$ respectively).

Table 2. *H. pylori* IgG Seropositivity by Behavioural and Environmental Risk Factors

Risk Factor	Category	n	Positive n (%)	Negative n (%)	p-value
Tea Consumption	Regular drinker	139	57 (41.0)	82 (59.0)	0.047
	Non-drinker	13	2 (15.3)	11 (84.6)	
Smoking Status	Non-smoker	102	38 (37.2)	64 (62.7)	0.38
	Ex-smoker	22	11 (50.0)	11 (50.0)	
	Current smoker	28	10 (35.7)	18 (64.2)	
Water Source	Tube-well (unfiltered)	150	59 (39.3)	91 (60.6)	0.54 [†]
	Mineral (packaged)	2	0 (0.0)	2 (100.0)	
Raw Vegetables	Consumed	97	38 (39.2)	59 (60.8)	0.91
	Not consumed	55	21 (38.2)	34 (61.8)	
Dyspepsia	Present	42	17 (40.5)	25 (59.5)	0.79
	Absent	110	42 (38.2)	68 (61.8)	
Heartburn	Present	50	20 (40.0)	30 (60.0)	0.83
	Absent	102	39 (38.2)	63 (61.8)	
Fruit Consumption	Regular	138	55 (39.9)	83 (60.1)	0.38
	Irregular/none	14	4 (28.6)	10 (71.4)	

Values expressed as n (%). ICT = Immunochromatography Technique. p-values from Pearson's chi-square unless marked [†] (Fisher's exact test). [†]Near-complete absence of variation precluded standard chi-square testing.

DISCUSSION

An overall *H. pylori* IgG seropositivity rate of 38.8% was found in this group of hostel students. This sits within the range seen in other Pakistani and regional studies. It is lower than the 60% reported from Lady Reading Hospital, Peshawar [12], but that is not unexpected — hospital-based studies enrol symptomatic patients who are already seeking care, and are therefore more likely to be infected, whereas our participants were young adults who were broadly well. The importance of matching study populations when comparing figures across settings is a recurring theme in *H. pylori* epidemiology.

It's important to understand what the ICT IgG test is actually telling us. This test does not pick up active *H. pylori* infection at the time of sampling. Instead, it detects IgG antibodies, which show that a person has been exposed to the bacterium at some point in the past or may still be infected. The problem is that these antibodies can stay in the body for a long time, even after the

infection has cleared. So, what we are really measuring here is exposure over time, not current infection. Because of this, our results can't be directly compared with studies that used more specific tests like the urea breath test or stool antigen test, which are better for identifying active infection.

When we looked at gender differences, we found that males had a higher seropositivity rate (41.0%) compared to females (28.0%). This pattern is similar to what has been reported in some other studies from Pakistan. However, in our case, the difference was not statistically significant ($p = 0.23$). One thing to keep in mind is that the number of female participants was quite small (only 25), so it's hard to make strong conclusions about gender differences from this dataset. The higher rate in males may be more related to lifestyle and behaviour rather than any biological difference. For example, female students may generally follow better hygiene practices and are less likely to smoke, which could lower their risk.

Tea consumption was the only factor that showed a statistically significant association with *H. pylori* seropositivity ($p = 0.047$). Students who drank tea regularly had a noticeably higher positivity rate compared to those who did not. One possible explanation is related to caffeine, which may increase gastric acid secretion and potentially create conditions that support bacterial survival [18]. Another simple explanation is behaviour—tea is often prepared and shared in groups in hostel settings, and sometimes cups are reused or shared, which could increase the chance of oral–oral transmission. Most likely, it's a mix of both biological and social factors.

For smoking, we saw an interesting pattern where ex-smokers had the highest seropositivity (50.0%), followed by non-smokers and current smokers. Although this looks meaningful, it was not statistically significant overall. One possible reason is that smoking can damage the stomach's protective lining by reducing mucus and affecting prostaglandins [17], and some of these effects may continue even after someone stops smoking. Still, since this is a cross-sectional study, we can't really say whether smoking led to infection or if other factors are involved.

Almost all students (150 out of 152) were drinking unfiltered tube-well water, so it wasn't really possible to compare different water sources. Interestingly, the two students who used packaged water tested negative, which is in line with other studies suggesting contaminated groundwater can be a major source of infection [8,9]. When almost everyone shares the same water source, it can also make other comparisons less clear because the exposure is basically the same for the whole group.

We also didn't find any strong link between symptoms like dyspepsia or heartburn and seropositivity. This is not too surprising because many people with *H. pylori* don't actually show clear symptoms, especially young adults. Also, these symptoms are quite general and can be caused by many other things besides *H. pylori*. The seropositivity rate in symptomatic students was lower than what Khan et al. reported [21], but their study used more sensitive PCR-based methods, which are better at detecting active infection.

Limitations

There are a few limitations that should be kept in mind. First, the IgG test cannot distinguish between past and current infection, so we can't confirm active cases. Second, the sample was based on convenience sampling, so it may not perfectly represent all hostel students. Third, the number of female participants was quite small, which makes gender comparisons less reliable. Fourth, since this was a cross-sectional study, we cannot establish cause and effect. Lastly, the study was done at a single university, so the findings may not apply to other settings in Pakistan.

CONCLUSION

In summary, around 4 out of 10 hostel students were positive for *H. pylori* IgG, suggesting a fairly high level of exposure in this population. Among all the factors we studied, only tea consumption showed a significant association with seropositivity. Other factors like gender, smoking, and water source showed trends but were not statistically significant, possibly due to sample size and limited variation.

Overall, these findings suggest that hostel environments may support transmission of *H. pylori*, mainly through shared living conditions and common water sources. Improving hygiene practices, ensuring safer drinking water, and reducing risky shared habits like cup sharing could help reduce exposure. Future studies with larger, more balanced samples and better diagnostic tools would give a clearer picture of the true active infection burden.

DECLARATIONS

Ethical approval: Ethical approval of this study was obtained from NCS University system Peshawar, Pakistan (REF:023IRB/2019) before start of this study.

Availability of data and materials: The data used and/or analysed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions

RAK and FK contributed to study conception, design and data collection. SM performed statistical analysis. RAK supervised all study. All authors contributed to interpretation of results and manuscript drafting. All authors reviewed and approved the final manuscript.

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