PREVALENCE OF INTESTINAL AND URINARY PARASITIC AND BACTERIAL PATHOGENS AMONG STAFFS OF FOUR RESIDENTIAL HALLS OF A PUBLIC UNIVERSITY IN BANGLADESH

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ABSTRACT

Background: Intestinal parasitic infections and antimicrobial resistance (AMR) are major public health concerns in developing countries, particularly among individuals living or working in densely populated institutional settings. This study aimed to assess the prevalence of intestinal parasites and antibiotic resistance patterns among residential hall staffs at a public university in Bangladesh in order to identify the risk factors for transmission of pathogens to residential students. **Methods:** A total of 100 stool samples were collected from 4 residential hall staffs of a public university and analyzed microscopically for protozoan and helminth infections. Additionally, 10 stool and 13 urine samples from hall staffs, along with 14 revived clinical urinary isolates, were tested for antimicrobial susceptibility using the Kirby-Bauer disc diffusion method. Univariate and multiple quasi-Poisson regression analyses were conducted to examine the association between parasite count and various demographic and behavioral risk factors. **Results:** The overall prevalence of parasitic infections was 100%, with all participants harboring at least one intestinal parasite. Protozoan infections were present in 100% of individuals, while helminths were found in 94%, with *Blastocystis sp.* and *Ascaris lumbricoides* being the most prevalent. The Quasi-Poisson regression analyses revealed that none of the variables were statistically significantly associated with higher parasite counts. Stool isolates showed the highest resistance (60%) to moxifloxacin. Clinical UTI isolates showed alarmingly high resistance (≥85.7%) to all tested fluoroquinolones, with nalidixic acid resistance reaching 92.8%. Complete sensitivity (100%) to ofloxacin (OFX) was observed in *E. coli* isolates from healthy individuals' urine samples, highlighting a stark contrast with the 85.7% resistance seen in clinical isolates. **Conclusion:** The study reveals a critical parasitic disease burden and rising antimicrobial resistance among university staffs, emphasizing the urgent need for integrated public health interventions. These should include hygiene education, deworming programs, routine microbial surveillance, and strict antibiotic stewardship to reduce transmission among students and preserve treatment efficacy.

KEYWORDS: Intestinal parasites, Antimicrobial resistance, Prevalence, Public health, Residential university staffs

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Introduction

Infectious diseases caused by intestinal and urinary pathogens continue to pose significant public health threats globally, particularly in low- and middle-income countries where water, sanitation, and hygiene (WASH) infrastructure remains inadequate (World Health Organization [WHO], 2023). Among these infections, intestinal parasitic infestations and urinary tract infections (UTIs) are widely prevalent and are often underreported due to limited surveillance and diagnostic facilities. These diseases are not only indicators of poor environmental and sanitary conditions but also contributors to malnutrition, anemia, and impaired productivity, especially in vulnerable populations (Jourdan *et al.*, 2018; Hotez *et al.*, 2020).

Intestinal parasitic infections, primarily caused by helminths and protozoans, are transmitted through fecal-oral routes, often via contaminated water or food, or through contact with infected soil. Helminths such as *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms are among the most common soil-transmitted parasites worldwide, while protozoa like *Giardia lamblia* and *Entamoeba histolytica* are frequently associated with waterborne diseases (Bethony *et al.*, 2006). These infections are especially common in settings where individuals live in close quarters and where health education and sanitation facilities are insufficient, such as institutional dormitories and communal housing (Strunz *et al.*, 2014).

Urinary tract infections, on the other hand, are most often caused by Gram-negative bacteria such as *Escherichia coli, Klebsiella pneumoniae,* and *Proteus mirabilis*, with *E. coli* alone accounting for approximately 70–90% of uncomplicated UTIs (Flores-Mireles *et al.*, 2015). UTIs can become chronic or complicated, especially in individuals with poor hygiene, comorbid conditions, or antibiotic misuse. The growing concern around antimicrobial resistance (AMR) further exacerbates the challenge of managing UTIs, as resistant strains of *E. coli* and *Klebsiella* are increasingly reported from community-acquired as well as nosocomial sources (Taneja *et al.*, 2021).

In the context of Bangladesh, where public universities host thousands of students and staff in residential halls with shared restrooms and dining spaces, the potential for disease transmission is considerable. Despite these risk factors, few studies have been conducted to assess the prevalence of intestinal and urinary pathogens among staff members - particularly those who handle food, clean dormitories, or maintain sanitation systems. These individuals are both at risk of acquiring infections and of inadvertently spreading them to others through improper hygiene practices.

Moreover, the frequent use of over-the-counter antibiotics and lack of microbial monitoring in these populations may contribute to the emergence of multidrug-resistant organisms (Ahmed *et al.*, 2019). The public health burden is not limited to morbidity alone; these infections can significantly impact workforce productivity, increase healthcare costs, and perpetuate cycles of poverty and disease.

Previous studies conducted in institutional and community settings have demonstrated the importance of identifying associated risk factors such as water source, personal hygiene, sanitation habits, and occupational exposure (Kibret & Abera, 2012; Mengistie *et al.*, 2015). However, limited research has focused on support staff in public educational institutions in Bangladesh, despite their heightened vulnerability and potential to act as vectors.

Given this background, the present study seeks to determine the prevalence of intestinal and urinary parasitic and bacterial pathogens among the staff of residential halls at a public university in Bangladesh. It also aims to assess relevant demographic and behavioral risk factors. In addition, the study utilizes selective and differential plating methods to presumptively identify bacterial genera based on colony morphology and lactose fermentation. This combined epidemiological and microbiological approach provides a comprehensive understanding of pathogen distribution, risk associations, and potential public health implications for infection prevention and control strategies.

Methods

Study Area and Period

The current study was conducted among the staff members of four residential halls at a public university in Dhaka, Bangladesh. The study period extended from February 2022 to February 2023. Residential hall staff included canteen workers, cleaners, office attendants, and security personnel who are in close contact with students and shared facilities.

Survey and Data Collection

A structured questionnaire was administered to 100 staff members to gather demographic information, occupational exposure, personal hygiene practices, and dietary habits. Verbal consent was obtained from each participant before sample collection. The data were anonymized to maintain confidentiality.

Sample Collection

Fresh stool samples were collected from 100 participants using clean, wide-mouthed, labeled, and leak-proof containers. Samples were processed within a few hours of collection to ensure diagnostic integrity. All the 100 stool samples underwent parasitological analysis. In addition, a subset of 10 stool samples were selected for microbiological analysis. Furthermore, thirteen urine samples were obtained from healthy individuals who were asymptomatic for urinary tract infection (UTI). In parallel, fourteen previously preserved clinical isolates from patients with laboratory-confirmed UTIs were retrieved from glycerol stocks and subjected to microbiological analysis to compare the AMR pattern with the healthy isolates.

Parasitological Analysis

Formal ether concentration technique was used to enhance the parasite detection sensitivity. Approximately 1 gram of stool was emulsified in 7 mL of 10% formalin and strained. The filtrate was mixed with 3 mL of diethyl ether, centrifuged at 3000 rpm for 1 minute, and examined under a light microscope. Samples were initially screened for the detection of protozoan trophozoites and cysts, and helminth eggs and larvae.

Microbiological Analysis

Isolation and Identification of microorganisms

Microbiological testing of the stool and urine samples specifically targeted *Escherichia coli (E. coli)* as the indicator organism. This selection was based on its well-established clinical relevance as a major etiological agent of both intestinal and extra-intestinal infections, including diarrheal disease and UTIs. Stool and urine samples were streaked onto MacConkey and Eosin Methylene Blue (EMB) agar plates for the selective and differential isolation of *E. coli*. The plates were incubated at 37°C for 24 hours. Pink colonies on MacConkey agar and metallic green sheen in EMB agar indicated presumptive *E. coli* colonies which were selected for further analysis.

Antibiotic Susceptibility Testing

Antimicrobial susceptibility of the bacterial isolates was assessed against four quinolone drugs using the standard Kirby-Bauer disk diffusion method on Mueller-Hinton agar. The antibiotics tested included - Nalidixic acid, Ciprofloxacin, Ofloxacin, Moxifloxacin. Zones of inhibition were measured in mm and interpreted as sensitive, intermediate, or resistant according to the CLSI (Clinical and Laboratory Standards Institute) guidelines.

Results

Parasitological Analysis

A total of 100 stool samples of residential hall staff members were examined for intestinal parasitic infections. The overall prevalence of parasitic infection was 100%, with each participant harboring at least one protozoan or helminthic parasite. Protozoan infections were detected in 100% of individuals, while helminth infections were observed in 94% of the total participants.

Identification of Parasites

The identification of parasites was based on the morphological features of cysts and eggs observed under the light microscope. A total of seven different intestinal parasites were identified, comprising both protozoan and helminth species (Figure 1).

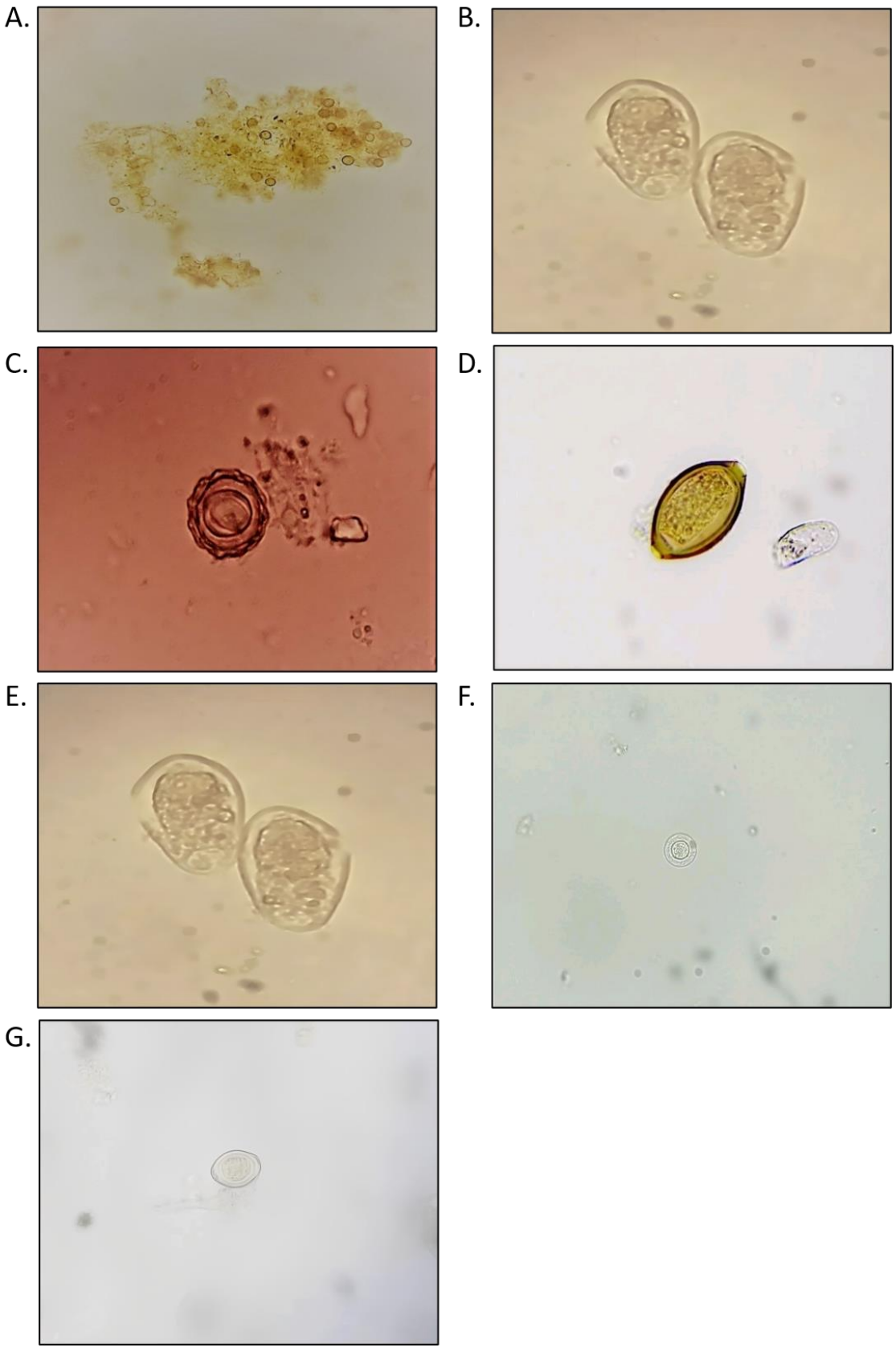

Figure 1. Parasitic stages present in the stool samples: (A*) Blastocystis spp* cyst (40X), (B) *Cystoisospora spp* oocyst (40X), (C) *Ascaris lumbricoides* cyst (40X), (D) *Trichuris trichiura* cyst (40X), (E) *Enterobius vermicularis* (40X), (F) *Hymenolepis spp* egg (40X), (G) *Diphyllobothrium latum* egg (40X)

Prevalence of Specific Intestinal Parasites

Among the protozoan parasites, *Blastocystis spp* was found in 100% of the infected individuals, followed by *Cystoisospora spp* with a prevalence of 91%. Among helminths, *Ascaris lumbricoides* had the highest occurrence (92%), followed by *Hymenolepis spp* (41%), *Diphyllobothrium latum* (29%), *Trichuris trichiura* (6%), *Enterobius vermicularis* (3%) (Figure 2).

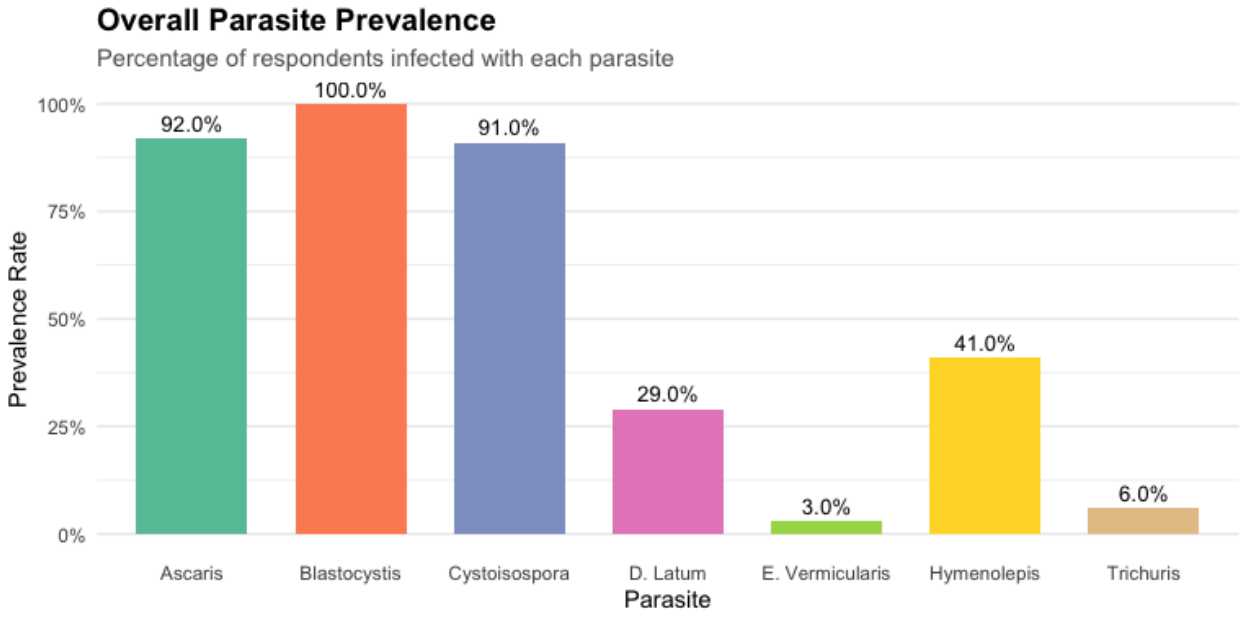

Figure 2. Prevalence of specific intestinal parasites among residential hall staffs (n=100)

Statistical Analyses of Associated Risk Factors

Statistical analysis was performed to find out the association between parasitic infections and various demographic and behavioral risk factors. We applied quasi-Poisson regression instead of standard Poisson regression to account for underdispersion observed in the parasite count data, where the variance was lower than the mean. This approach adjusts the standard errors, providing more reliable inference under such conditions. Table 1 shows that in both univariate and multivariate analyses, no variable showed a statistically significant association with parasite count. However, hall type (Male or Female) displayed non-significant trends that may merit further exploration in future studies.

Table 1. Results from the Quasi-Poission Regression Models

		Univariate Quasi-Poisson Regression			Multiple Quasi-Poisson Regression		
Characteristic	**N**	**IRR**	**95% CI**	**p-value**	**IRR**	**95% CI**	**p-value**
Age	100	1.00	1.00, 1.01	0.23	1.00	1.00, 1.01	0.21
Sex	100			0.48			
Female		—	—		—	—	
Male		1.05	0.91, 1.22		0.96	0.80, 1.16	0.69
Education	100			0.40			
Illiterate		—	—		—	—	
Primary		0.87	0.71, 1.07		0.88	0.71, 1.10	0.27
Secondary+		0.90	0.76, 1.09		0.92	0.74, 1.14	0.44
Hall Type	100			0.086			
Female		—	—		—	—	
Male		1.10	0.99, 1.24		1.10	0.94, 1.29	0.23
Toilet	100			0.11			
Personal		—	—		—	—	
Shared		0.87	0.74, 1.03		0.91	0.75, 1.11	0.34
Marital Status	100			0.87			
Married		—	—		—	—	
Unmarried		0.97	0.62, 1.43		0.92	0.55, 1.48	0.74
Smoker	100			0.25			
No		—	—		—	—	
Yes		1.07	0.95, 1.20		1.04	0.90, 1.20	0.62
Income (BDT)	100			0.60			
6,000-10,000		—	—		—	—	
11,000+		0.96	0.82, 1.12		0.92	0.76, 1.13	0.44
House Type	100			0.71			
Building		—	—		—	—	
Tin-shed		1.03	0.89, 1.18		1.04	0.89, 1.21	0.65
Nail Biting Habit	100			0.58			
No		—	—		—	—	
Yes		1.04	0.91, 1.18		1.01	0.88, 1.17	0.85
Eating Outside Habit	100			0.24			
No		—	—		—	—	
Yes		0.85	0.65, 1.12		0.82	0.62, 1.10	0.18
Abbreviations: CI = Confidence Interval, IRR = Incidence Rate Ratio							

Identification of bacteria

Of the 13 urine samples collected from healthy individuals asymptomatic for urinary tract infection (UTI), bacterial growth was observed in 8 samples, while the remaining 5 showed no detectable growth. In all 8 culture-positive samples, the bacterial load was below 10^5 CFU/mL, suggesting colonization rather than active infection. From each of the 8 culture-positive samples, one representative colony exhibiting a characteristic metallic green sheen on eosin methylene blue (EMB) agar was randomly selected. EMB agar was chosen for its ability to provide more specific and visually distinctive identification of *Escherichia coli* (*E. coli*). As a result, eight *E. coli* isolates were obtained from urine samples of healthy individuals.

Additionally, ten *E. coli* isolates were similarly obtained from stool samples, based on colony morphology on EMB agar. The fourteen previously stored UTI isolates, revived from glycerol stock, were also presumptively identified as *E. coli* based on their characteristic colony appearance on MacConkey and EMB agar.

Antibiotic resistance profile of Stool isolates of Healthy individuals

Stool isolates demonstrated a resistance rate of 10% for nalidixic acid, with 1 isolate resistant, 8 sensitive, and 1 intermediate. Ciprofloxacin (CIP) showed 50% resistance (5 resistant and 5 intermediate). For ofloxacin (OFX), 1 isolate (10%) was resistant, 8 were sensitive, and 1 intermediate. Moxifloxacin (MFX) exhibited a resistance rate of 60%, with 6 resistant and 4 sensitive isolates (Figure 3).

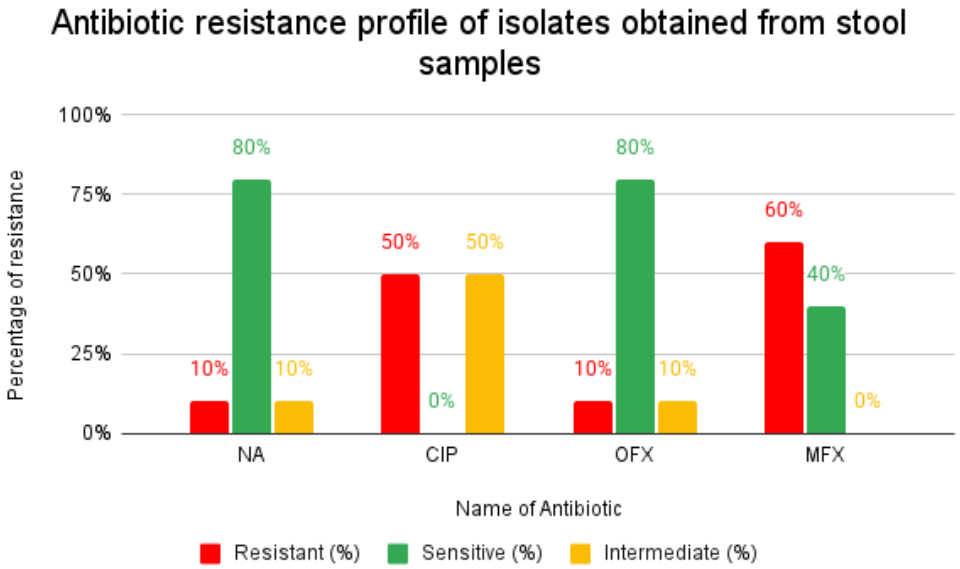

Figure 3. Antibiotic resistance profile of bacterial isolates obtained from stool samples of healthy individuals. (NA= Nalidixic Acid; CIP= Ciprofloxacin; OFX= Ofloxacin; MFX= Moxifloxacin)

Antibiotic resistance profile of Urine isolates of healthy individuals

Among the 8 urine isolates from healthy individuals, no resistance was observed against NA; 5 isolates were sensitive and 3 showed intermediate susceptibility. In contrast, 62.5% of isolates (5/8) were resistant to CIP, with 1 sensitive and 2 intermediate isolates. Complete sensitivity (100%) was noted against OFX. Against MFX, 37.5% of isolates (3/8) were resistant and 62.5% (5/8) were sensitive. In healthy urine isolates, resistance to CIP was highest (62.5%), while NA and OFX showed no resistance. Healthy urine samples have more sensitivity (Figure 4).

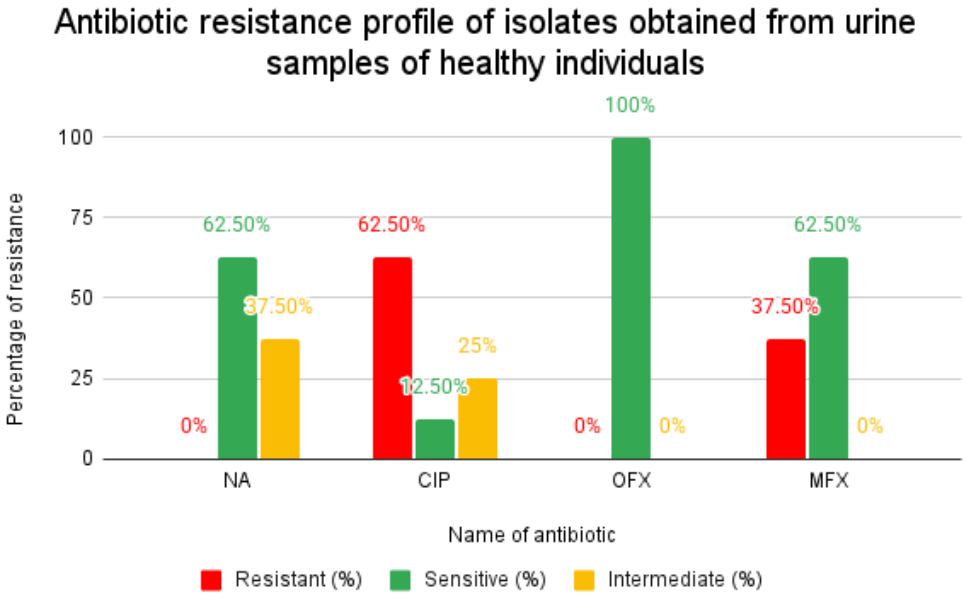

Figure 4. Antibiotic resistance profile of bacterial isolates obtained from urine samples of healthy individuals. (NA= Nalidixic Acid; CIP= Ciprofloxacin; OFX= Ofloxacin; MFX= Moxifloxacin)

Antibiotic resistance profile of Clinical UTI Patient Isolates

Clinical UTI isolates (n=14) exhibited a high percentage of resistance to all four fluoroquinolone drugs (Figure 5). For NA, 92.8% (13/14) of isolates were resistant. Similarly, CIP, OFX, and MFX each showed resistance rates of 85.7% (12/14), with only 2 isolates being sensitive to each antibiotic. No intermediate susceptibility was observed among clinical isolates.

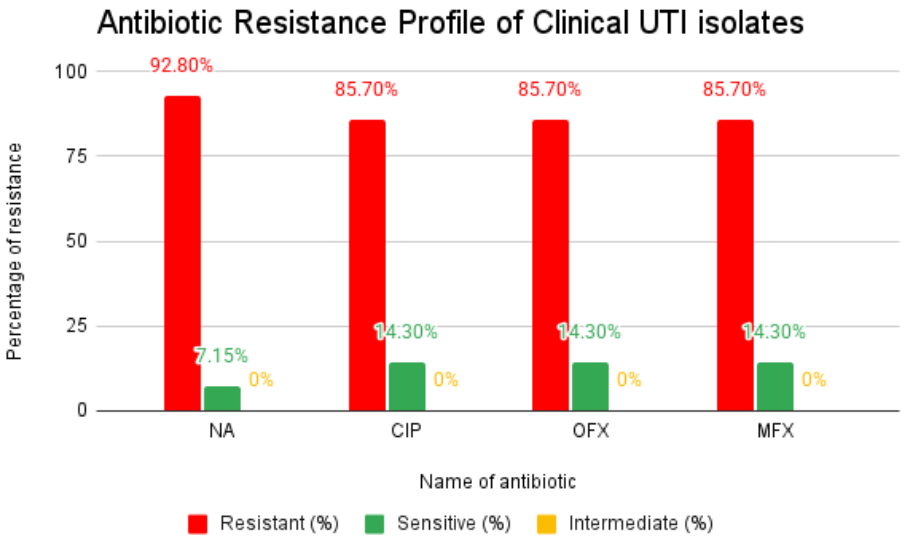

Figure 5. Antibiotic resistance profile of Clinical UTI isolates (NA= Nalidixic Acid; CIP= Ciprofloxacin; OFX= Ofloxacin; MFX= Moxifloxacin)

Comparative Analysis of Healthy Urine and Clinical UTI isolates

Clinical UTI isolates showed very high resistance (>85%) to all tested antibiotics. In contrast, healthy isolates exhibited much lower resistance, especially to OFX and NA. All healthy urine isolates (100%) were sensitive to Ofloxacin. Clinical isolates, however, showed 85.7% resistance to the same drug, indicating strong antibiotic pressure and resistance development in clinical settings. Intermediate responses were recorded only among healthy isolates, particularly for NA and CIP (suggesting evolving resistance), but were absent in clinical UTI isolates, which had high-level resistance. Nalidixic acid resistance was 0% in healthy isolates but 92.8% in clinical UTI isolates, making it a potential marker of pathogenic vs. colonizing strains (Figure 6).

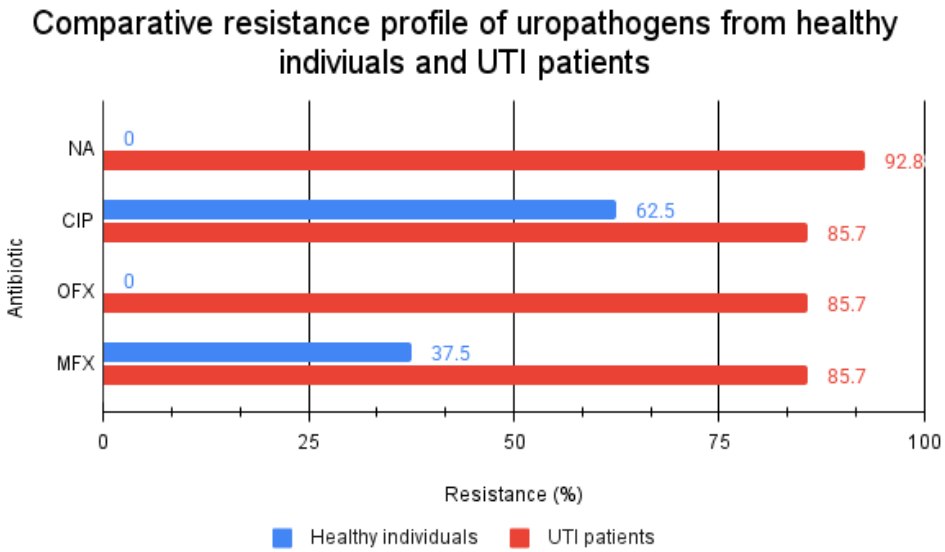

Figure 6. Comparison of antibiotic resistance in isolates from healthy individuals' urine samples and clinical UTI isolates. (NA= Nalidixic Acid; CIP= Ciprofloxacin; OFX= Ofloxacin; MFX= Moxifloxacin)

Discussion

The present study revealed an alarmingly high prevalence of intestinal parasitic infections among residential hall staff, with 100% of participants infected. This underscores the endemic nature of parasitic diseases in certain institutional settings in Bangladesh and aligns with previous reports indicating high parasitic burdens in low-resource environments with inadequate sanitation (Haque, 2007; Brooker *et al.*, 2006). Protozoan infections, particularly *Blastocystis* sp., were ubiquitous, while *Ascaris lumbricoides* dominated the helminth profile, infecting 92% of participants. This is consistent with global findings where *Blastocystis* is among the most prevalent intestinal protozoa (Stensvold & Clark, 2020) and *Ascaris* continues to be a leading soil-transmitted helminth (WHO, 2020).

The risk factor analysis showed behavioral factors had no significant impact on infection rates, contrasting prior studies. In Bangladesh, irregular handwashing and eating street food increases the risk of enteric pathogen transmission (Barua *et al.* 2024; Hoque *et al.* 1995; Nizame *et al.* 2015), while nail biting and smoking may elevate risks by facilitating pathogen entry and microbiome disruption (Reddy *et al.* 2015; Lee *et al.* 2018). These practices, often overlooked, can facilitate the oral transmission of infectious agents, especially in communal living or working spaces. The explanation could be the healthy immune system of the studied population which may have suppressed the negative impact of such behaviors.

In addition to the parasitological findings, this study also reports notable microbiological findings, especially fluoroquinolone antibiotic resistance of bacterial isolates obtained from stool and urine samples of healthy individuals, as well as their comparison to clinical UTI isolates. In bacterial isolates obtained from stool samples of healthy individuals, the overall resistance rate was relatively low for NA and OFX (10% each), suggesting limited exposure to these antibiotics or absence of selective pressure in the gut microbiota of asymptomatic individuals. However, resistance to CIP and MFX was noticeably higher, at 50% and 60% respectively. This trend may be indicative of subclinical antibiotic exposure or environmental acquisition of resistant strains, even in healthy populations. Similar patterns of elevated resistance in commensal flora from healthy individuals have been previously reported (van den Bogaard & Stobberingh, 2000; Taneja *et al., 2010).*

Striking difference has been noticed between the antibiotic resistance profile of the uro-pathogens of healthy individuals and clinical settings. No resistance to NA was observed in urine isolates from healthy individuals, contrasting sharply with the 92.8% resistance rate seen in clinical UTI isolates. These findings are in line with earlier studies indicating that fluoroquinolone resistance is more prevalent in hospital-derived pathogens than in community-acquired strains (Kahlmeter, 2003). Resistance rates exceeded 85% for all tested antibiotics, raising significant clinical concern. This stark contrast suggests that individuals in clinical settings are likely exposed to stronger selection pressures, including frequent antibiotic exposure, leading to elevated resistance (Ventola, 2015). National surveillance reports from Bangladesh also corroborates with the fact by stating that hospital-derived *Escherichia coli* and *Klebsiella* species have shown increasing fluoroquinolone resistance over the past decade, largely driven by inappropriate prescribing, over-the-counter antibiotic sales, and lack of infection control in healthcare settings (IEDCR 2021). Notably, the absence of intermediate susceptibility among the clinical isolates in our study suggests strong selection pressure within clinical environments, often linked to repeated or improper antibiotic use. The emergence of such high resistance in clinical samples has profound implications for empirical treatment strategies and infection control policies (Laxminarayan *et al.*, 2013).

The dual burden of parasitic infections and antimicrobial resistance among non-hospitalized staff is particularly troubling because it highlights community-level transmission and environmental contamination risks. If left unaddressed, this could lead to wider outbreaks and ineffective treatments in the future. To mitigate this threat, integrated strategies including deworming programs, hygiene education, safe food practices, and antibiotic stewardship are essential. Regular health screenings in residential institutions, improved sanitation infrastructure, and stronger policy enforcement against over-the-counter antibiotic sales could contribute significantly to reversing current trends.

Overall, the findings from this study emphasize the urgent need for multidisciplinary interventions addressing both infectious diseases and antimicrobial resistance in densely populated institutional settings. Future research should explore longitudinal trends, molecular characterization of resistant strains, and the effectiveness of targeted public health interventions in similar environments.

Conclusion

This study revealed a critically high burden of intestinal parasitic infections and a disturbing prevalence of antimicrobial resistance among residential hall staff at a public university. The detection of at least one parasite in every participant, with *Blastocystis sp.* and *Ascaris lumbricoides* as the most dominant species, underscores the need for immediate and sustained public health interventions.

Moreover, the emergence of antimicrobial resistance among both healthy and clinical bacterial isolates, particularly against fluoroquinolones, signals an urgent threat to effective infection management. The stark contrast between the resistance levels in healthy individuals and clinical UTI patients demonstrates how antibiotic misuse and overexposure in clinical environments can drive the evolution of drug-resistant strains.

Taken together, these findings emphasize the necessity of integrated control strategies that address both parasitic infections and antimicrobial resistance. This includes improving hygiene infrastructure, implementing regular screening and deworming programs, promoting rational antibiotic use, and conducting community-level health education. Without such measures, these public health threats will continue to compromise individual well-being and place greater strain on healthcare systems.

Author Contribution

Sultana F: Methodology; Investigation; Data analysis, Writing - Original Draft; Review & Editing

Barua P: Conceptualization; Methodology; Data analysis, validation, and result interpretation; Writing - Original Draft, Supervision, Project administration, Funding acquisition
Mishu ID: Conceptualization; Methodology; Data analysis, validation, and result interpretation; Writing - Original Draft, Supervision, Resources
Biswas MR: Methodology; Data analysis; validation and result interpretation; Review & Editing; Supervision
Musa S: Methodology; validation and result interpretation; Review & Editing; Supervision; Project administration, Funding acquisition

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Ethical Approval

Ethical approval for the current study was obtained from the Ethical review committee of the Faculty of Biological Sciences, University of Dhaka (Ref. No. 202/Biol.Scs.).

Declaration

The authors declare no conflict of interest. The study represents original research work carried out by the team and the contents of the paper are neither published nor submitted for publication to any other journal

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