Original Article

Carriage of Pathogenic Organisms in Gastrointestinal Tract Among Chandigarh Population

Varsha Gupta[1], Anku Goel[2], Meenakshi Singh[3], Dilawar Singh[4], Naveen Krishan[5], Neelam Gulati[6]

[1-4,6]MD, Department of Microbiology, Government Medical, College and Hospital Sector 32, Chandigarh, India, [5]MD, Department of Preventive and Community Medicine, Government Medical College and Hospital, Sector 32, Chandigarh, India.

How to cite this article: Varsha Gupta Anku Goel, Meenakshi Singh et. al. Carriage of Pathogenic Organisms in Gastrointestinal Tract Among Chandigarh Population. Indian Journal of Public Health Research and Development / Vol. 17 No. 2, April-June 2026.

Abstract

Objectives: To understand the epidemiology of various pathogens, it is imperative to understand the carriage of these pathogens in asymptomatic individuals. This helps in understanding the transmission of disease and thus the control measures. This study was carried out to detect the carriage of various pathogenic bacteria, parasites, and Rotaviruses in stool samples of the healthy population of Chandigarh.

Materials and Methods: 500 non-duplicate fecal samples from healthy subjects were collected and processed for isolation of pathogenic bacteria by microbiological culture. Anenzyme-linked immunosorbent Assay was performed for *Clostridium difficile* toxins and Rotavirus antigen detection. Intestinal parasites were detected by wet mount and iodine mount directly, and after the formol-ether concentration technique for parasites. The data were analyzed descriptively using Microsoft Excel, and the results were summarized as percentages to provide a clear understanding of the distribution and trends in the dataset.

Results: Carriage of intestinal pathogens was found to be 44.4% and 55.6% in children and adults, respectively. Carriage of *Shigella* species, *Salmonella* species, and *Vibrio cholerae* was nil in our study, with 2.6% carriage of *Clostridium difficile*. Rotavirus carriage was 3.6% in children. The carriage of parasites was more in adults than in children.

Conclusions: The two main concerns in our study were *C.difficile* carriage and intestinal parasite carriage in adults. Educating the masses regarding hand hygiene is the most important step in this regard. Regarding parasitic infections, a single dose albendazole in school-going children has resulted in lower carriage in children than adults. The same approach, along with education regarding hygienic practices, can be started in the adult population also.

Keywords: Carriage, Stool, Community, Pathogenic, Gastrointestinal tract

Corresponding Author: Neelam Gulati, Associate Professor, Department of Microbiology, Government Medical College, and Hospital Sector 32, Chandigarh, India.

E-mail: drneel222@gmail.com

Submission date: September 27, 2025 **Revision date:** Nov 12, 2025 **Published date: April 14, 2026**

This is an Open Access journal, and articles are distributed under a Creative Commons license- CC BY-NC 4.0 DEED. This license permits the use, distribution, and reproduction of the work in any medium, provided that proper citation is given to the original work and its source. It allows for attribution, non-commercial use, and the creation of derivative work.

Introduction

The human gastrointestinal tract is home to a variety of bacteria, parasites, fungi, and viruses. Infectious causes of acute diarrhea in symptomatic patients, including viruses, bacteria, and parasites, can lead to high morbidity and mortality, particularly in children[1].However, the carriage of pathogens among asymptomatic patients in a community is not known in our region. Asymptomatic patients are those who do not possess signs and symptoms of gastrointestinal illness, but their gut harbors pathogens[2]. This type of surveillance is of utmost importance due to shedding of pathogens in the environment by healthy asymptomatic populations that may potentially lead to dissemination of infection in the community and transmission to the susceptible host. Food handlers working in the food service establishments can also act as carriers of different enteropathogens, possibly causing fecal contamination of foods by their hands, which may be the cause for the transmission of infections to the local community[3]. A carriage rate of as high as 41% has also been reported[4]. There is currently limited epidemiological data to provide an accurate assessment of the burden of enteropathogens in the asymptomatic population of developing countries. This study was carried out with the aim of knowing the prevalence of various pathogenic bacteria, parasites, and Rotavirus in stool samples of the healthy population of Chandigarh. To our knowledge, this is the first study to look for all the major pathogens in a healthy population in our region.

Materials and Methods

This prospective, observational study was carried out at the Department of Microbiology, Government Medical College and Hospital, Chandigarh, and involved 500 healthy individuals from Chandigarh who gave informed consent. This study protocol was approved by Institute of Ethics Committee of Government Medical College and Hospital, Chandigarh on 26th November 2020 (GMCH/IEC/2020/356/120). These participants were divided into two groups: pediatric and adult. The pediatric group included individuals under 14 years old, while those over 14 years of age formed the adult group. Demographic details such as age, sex, and address were recorded on a proforma. A comprehensive laboratory analysis was performed on non-duplicate fecal samples, including bacterial culture, Enzyme-Linked Immunosorbent Assay for *Clostridioidesdifficile* toxins and Rotavirus antigen, and microscopic examination for intestinal parasites using wet mount, iodine mount, and the formol-ether concentration technique. Stool samples were cultured on MacConkey agar, Xylose Lysine Deoxycholate agar, and Thioglycollate Citrate Bile Salt Sucrose agar, with enrichment in Selenite F broth and Alkaline Peptone Water to isolate pathogenic bacteria.

Results

A total of 500 participants were observed, comprising 222 [44.4%] children and 278 [55.6%] adults. Among them, females accounted for 60% (n = 300) and males represented 40% (n = 200). This distribution indicates a higher representation of females in the cohort, with a female-to-male ratio of 1.5:1. Distribution of age and sex is shown in **Table 1.**

Table 1: Age and sex distribution of the stool samples collected from community

	Female		Male		Total
	N	%	N	%	
Children	122	54.9 %	100	45 %	222
Adults	178	64 %	100	35.9 %	278

The study found no carriage of *Shigella* species, *Salmonella* species, or *Vibriocholerae* among the participants. However, *C.difficile* carriage was detected in 2.6% (n = 13) of the study population, with a higher prevalence in adults (3.9%, n = 11) compared to children (0.9%, n = 2). Five carriers among these gave the history of animal handling, with two members from the same family. Rotavirus carriage was 1.6% (n=8) and was seen only in children, making it 3.6% in the children population (**Figure 1, Table 2)**. The carriage of parasites was more in adults than children, as shown in **Figure 2**. A notable proportion (48%, n = 240) of the study participants reported a lack of adherence to handwashing practices before meals.

Table 2: Carriage of various microorganisms in the stool samples collected from community

	Method used	Total		Adult		Children	
		N [500]	%	N [278]	% in Adult	N [222]	% in Children
Bacteria							
Clostridium difficile	ELISA for toxins A & B	13	2.6%	11	3.9%	2/222	0.9%
Shigella spp.	Culture	Nil					
Salmonella spp.	Culture	Nil					
Vibrio cholera	Culture	Nil					
Virus							
Rota virus	ELISA for Antigen	8	1.6%	Nil		8/222	3.6%
Parasites							
Ascaris lumbricoides Egg	Saline & Iodine Mount	9	1.8%	7	2.5%	2/222	0.9%
HookwormEgg	Saline & Iodine Mount	6	1.2%	4	1.4%	2	0.9%
Hymenolepsis nana Egg	Saline & Iodine Mount	5	1.0%	5	1.7%	Nil	
Giardia lamblia Cyst	Saline & Iodine Mount	22	4.4%	14	5.0%	8	3.6%
Blastocystis hominis Cyst	Saline & Iodine Mount	12	2.4%	8	2.8%	4	1.8%

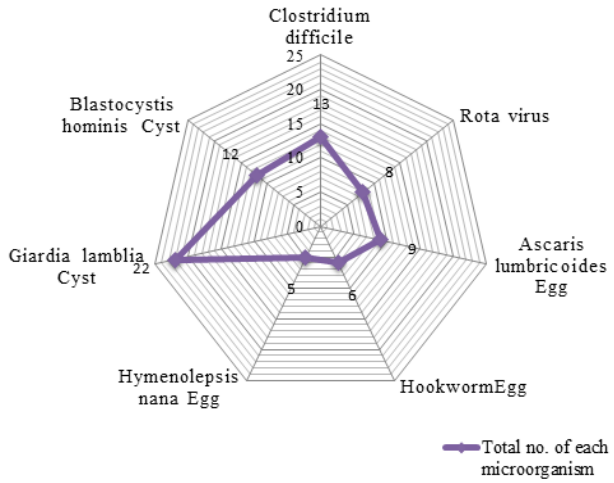

Figure 1: Carriage of various microorganisms in the stool samples collected from the community

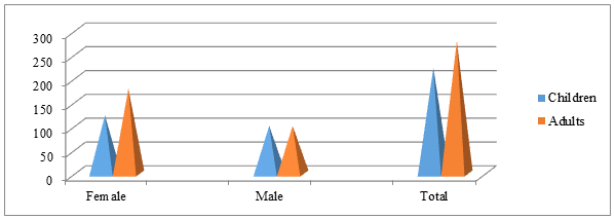

Figure 2: Age and sex distribution of the stool samples collected from the community

Discussion

Clostridium difficile infection (CDI) is an important healthcare-associated infection (HAI) seen mostly in Intensive Care Unit (ICU) settings[5]. *Clostridium difficile* carriage in our community came out to be 2.6% (13), with 3.9% (11) in adults and 0.9% (2) in children. It is important to know the carriage of *C. difficile* in the community as these carriers act as reservoirs for transmission of the microorganism and are also at risk of developing CDI[6]. Baron *et al* have reported that 38.1% of the asymptomatic carriers progressed to symptomatic CDI versus 2% in non-carriers, and this association was found to be statistically significant[6]. Children colonized with *C. difficile* were significantly more likely to develop CDI within 90 days compared to non-colonized children (25% vs 0%, p = 0.002)[7]. *C. difficile* carriage thus poses the carriers at risk of developing symptomatic CDI. Recent hospitalization and livestock proximity have been observed as important risk factors for asymptomatic carriage[8].

Poor hand hygiene after animal contact is a contributing factor, as shown in published literature[9]. In our community, 5 out of 13 people had a history of animal contact, including two members from same family. Hands and the environment easily get contaminated with *C.difficile* from cases and carriers and act as the source of transmission of this microorganism. Gilboa*et al* found that the rooms of *C. difficile* carrier patients were as contaminated as rooms of symptomatic CDI patients, emphasizing the role of carriers also in spreading the infection[10]. In a

study on environmental sampling of microbiology laboratory dealing with *C.difficile* samples, 11.8 of % hands of laboratory workers were contaminated with *C.difficile*[11].Hand hygiene becomes a very important factor in limiting the spread of this microorganism. We also educated the carriers in our study regarding the importance of hand hygiene, especially after animal handling.

Other studies on carriage of *C.difficile* have reported 10% carriage in Iranian children less than 5 years age at day zero of hospitalization[12], 10.4% in US hospitalized patients[8], 7.4% asymptomatic carriers in ICU settings[5] and 2.3% in veterinary healthcare workers in Netherlands[9]. A Chinese study followed 29 children from birth till one year of age for *C.difficile* carriage and found that 20 out of 29 (68.9%) carried *C.difficile* by one year of age[13]. Antibiotic exposure has been known to be the biggest risk factor for CDI. Over the counter antibiotic intake could be a factor in the carriage of *C.difficile* in our community.

Shigella, Salmonella, and *V.cholerae* were not isolated in our study. Subclinical carriage of *Shigella* is known, which can persist for months and also account for the spread of the disease, especially because a low infective dose is required for infection but it is a hardier organism to isolate[14, 15]. Carriage rate for Nontyphoidal Salmonella and *Vibrio cholerae* has been reported as quite low[16, 17].

Rotavirus is known to shed in feces of children without diarrhoea[18]. For the same reason recovery of rotavirus is of little diagnostic value in a diarrhoea patient because it cannot be attributed as the cause in all the cases. A study showed that among 83 children shedding Rotavirus in stool, 40 [48%] did not have diarrhea.[18].In our study, Rotavirus was detected in 1.6% (8/500) of the overall study population and in 3.6% (8/222) of the pediatric subgroup.

Soil-transmitted helminths (STH) is a common public health problem of all age groups. India has achieved one of the largest deworming programs in children by giving single dose albendazole twice yearly to school-going children [19]. Even though single dose albendazole is very effective, children tend to get re-infected from their community. Also, these programs do not target the adult population who could be acting as a source of infection. The prevalence of parasitic carriage in our study was less in children than in adults, which is mostly due to the albendazole given to children at their school under the national programme. The parasites found in our study are *Ascarislumbricoides* 2.5% in adults vs 0.9% in children; hookworm (1.2% vs 0.9%); *H.nana*(1% vs nil); *Giardia lamblia*(5% vs 3.6%), and *Blastocystishominis* (2.4% vs 1.8%). A study from South India has shown a prevalence of 21% for hookworm and <1% for Ascaris in adults[19]. They showed that increasing age and higher vegetation was associated with higher prevalence while high socioeconomic status, higher education and improved sanitation with low prevalence. A few of our individuals gave a history of no hand washing before meals and were advised for do so. An Ethiopian study has shown prevalence of 12.5% for Ascaris and 7.5% for hookworm in a community-based study on adults and adolescents[20]. For adults, education on hygiene and sanitation and albendazole treatment can help to tackle the problem.

Protozoa are also an important cause of diarrhea, but detection of Giardia cannot be associated with diarrhoea in all times[21].Giardia carriage in children has been reported by various studies, ranging from 1.3% to 37%[22, 23, 24]with 3.6% in our study. Adult population showed carriage of 5% for Giardia, while a study from Tanzania reported 53%[25]. An interesting observation was made in a study on Israeli children that faltering growth was observed after *Giardia lamblia* infection, rather than predisposing it, but this observation needs further studies[21]. *Blastocystishominis* carriage was also reported in the same study to be 61% which was 2.4% in our study, which is much higher than ours. These variations could be geographically determined. A study from Zambia done on the pediatric population with children 5-18 years, showed a carriage rate of 37.9% for Balstocystis sp., 30.9% for *Giardiaintestinalis*, 13.3% for *Entamoebadispar,* and 4.3% for Cryptosporidium spp. No *E.histolytica* was detected in their study. Molecular methods were used for detection in this study, which are more sensitive, and hence the higher detection rates[26].

Conclusion

In conclusion, pathogenic bacterial carriage for most bacteria was nil in our study, which, in all

probability, is due to the safe water supply in our city, but *C.difficile* carriage is a concern for which educating the masses is important regarding hand hygiene, especially in animal handlers. Regarding parasitic infections, a single dose of albendazole in school-going children has resulted in lower carriage in children than adults. The same approach, along with education regarding hygienic practices, can be started in the adult population also.

Funding: Department of Science and Technology, Chandigarh, India

Conflicts of interest: The authors have declared no conflicts of interest.

References

1. Ethelberg S, Mølbak K, Josefsen M.H. Bacteria: Salmonella Non-Typhi, Encyclopedia of food safety; 2014 (1):501-514.
2. LAMPS LW. Infectious Disorders of the GI Tract. Surgical Pathology of the GI Tract, Liver, Biliary Tract, and Pancreas. 2009:51–79.
3. Takalkar AA, Madhekar N., Kumavat A., and Bhayya S. Prevalence of intestinal parasitic infections amongst food handlers in hotels and restaurants in Solapur city. Indian Journal of Public Health, 54, (1); 47, 2010.
4. Horwood PF, Soli KW, Maure T, Naito YI, Morita A, Natsuhara K. A high burden of asymptomatic gastrointestinal infections in traditional communities in Papua New Guinea. Am J Trop Med Hyg. 2017; 97(6): 1872–1875.
5. Worley J, Delaney ML, Cummins CK, DuBois A, Klompas M, Bry L. Genomic Determination of Relative Risks for Clostridioides difficile Infection from Asymptomatic Carriage in Intensive Care Unit Patients. Clin Infect Dis. 2021,5;73(7):e1727-e1736.
6. Baron SW, Ostrowsky BE, Nori P, Drory DY, Levi MH, Szymczak WA, *et al*. Screening of Clostridioides difficile carriers in an urban academic medical center: Understanding implications of disease. Infect Control HospEpidemiol. 2020;41(2):149-153.
7. Reasoner SA, Zhang LS, Bernard R, Edwards KM, Nicholson MR. Prevalence and sequelae of asymptomatic Clostridioides difficile colonization in children with inflammatory bowel disease. J PediatrGastroenterolNutr. 2025;80(3):446-449.
8. Muñoz-Price LS, Hanson R, Singh S, Nattinger AB, Penlesky A, Buchan BW, *et al*. Association Between Environmental Factors and Toxigenic Clostridioides difficile Carriage at Hospital Admission. JAMA Netw Open. 2020, 3;3(1):e1919132.
9. Meijs AP, Gijsbers EF, Hengeveld PD, Kuijper EJ, Dierikx CM, de Greeff SC, *et al*. Faecal carriage of Clostridioides difficile is low among veterinary healthcare workers in the Netherlands. Epidemiol Infect. 2022, 28;150:e63.
10. Gilboa M, Houri-Levi E, Cohen C, Tal I, Rubin C, Feld-Simon O, *et al*. Environmental shedding of toxigenic Clostridioides difficile by asymptomatic carriers: A prospective observational study. ClinMicrobiol Infect. 2020;26(8):1052-1057.
11. Reigadas E, Vázquez-Cuesta S, Onori R, Villar-Gómara L, Alcalá L, Marín M, *et al*. Clostridioides difficile contamination in a clinical microbiology laboratory? ClinMicrobiol Infect. 2020;26(3):340-344.
12. Sayyadi M, Kouhsari E, Kalvandi G, Kazemian H, Ghafouri Z, Sadeghifard N. Characteristics of Clostridioides difficile colonization in Ilamian children. Ann Ig. 2021;33(3):209-219.
13. Cui QQ, Yang J, Sun SJ, Li ZR, Qiang CX, Niu YN, *et al*. Carriage of Clostridioides difficile in healthy infants in the community of Handan, China: A 1-year follow-up study. Anaerobe. 2021;67:102295.
14. Allen H, Mitchell HD, Simms I, Baker KS, Foster K, Hughes G, *et al*. Evidence for re-infection and persistent carriage of Shigella species in adult males reporting domestically acquired infection in England. ClinMicrobiol Infect. 2021;27(1):126.e7-126.e13.
15. Bliss J, Bouhenia M, Hale P, Couturier BA, Iyer AS, Rumunu J, *et al*. High Prevalence of Shigella or Enteroinvasive Escherichia coli Carriage among Residents of an Internally Displaced Persons Camp in South Sudan. Am J Trop Med Hyg. 2018;98(2):595-597.
16. Mbuyi-Kalonji L, Barbé B, Nkoji G, Madinga J, Roucher C, Linsuke S, *et al*. (2020) Non-typhoidal Salmonella intestinal carriage in a *Schistosomamansoni* endemic community in a rural area of the Democratic Republic of Congo. PLoSNegl Trop Dis 14(2): e0007875.
17. Llanes R, Somarriba L, Hernández G, Bardaji Y, Aguila A, Mazumder RN. Low detection of *Vibriocholerae* carriage in healthcare workers returning to 12 Latin American countries from Haiti. Epidemiol Infect. 2015;143(5):1016-9.
18. Champsaur H, Questiaux E, Prevot J, Henry-Amar M, Goldszmidt D, Bourjouane M, *et al*. Rotavirus carriage, asymptomatic infection, and disease in the first two years of life. I. Virus shedding. J Infect Dis. 1984;149(5):667-74.
19. Ajjampur SSR, Kaliappan SP, Halliday KE, Palanisamy G, Farzana J, Manuel M, *et al*. Epidemiology of soil

transmitted helminths and risk analysis of hookworm infections in the community: Results from the DeWorm3 Trial in southern India. PLoSNegl Trop Dis. 2021, 30;15(4):e0009338.

20. Goshu A, Alemu G, Ayehu A. Prevalence and Intensity of Soil-Transmitted Helminths and Associated Factors among Adolescents and Adults in BibugnWoreda, Northwest Ethiopia: A Community-Based Cross-Sectional Study. J Trop Med. 2021, 23;2021:7043881.
21. Fraser D, Bilenko N, Deckelbaum RJ, Dagan R, El-On J, Naggan L. Giardia lamblia carriage in Israeli Bedouin infants: risk factors and consequences. Clin Infect Dis. 2000;30(3):419-24.
22. Efunshile MA, Ngwu BA, Kurtzhals JA, Sahar S, König B, Stensvold CR. Molecular Detection of the Carriage Rate of Four Intestinal Protozoa with Real-Time Polymerase Chain Reaction: Possible Overdiagnosis of Entamoebahistolytica in Nigeria. Am J Trop Med Hyg. 2015;93(2):257-62.
23. Davies AP, Campbell B, Evans MR, Bone A, Roche A, Chalmers RM. Asymptomatic carriage of protozoan parasites in children in day care centers in the United Kingdom. Pediatr Infect Dis J. 2009;28(9):838-40.
24. Grimmond TR, Radford AJ, Brownridge T, Farshid A, Harris C, Turton P, *et al*. Giardia carriage in aboriginal and non-aboriginal children attending urban day-care centres in South Australia. AustPaediatr J. 1988;24(5):304-5.
25. Forsell J, Granlund M, Samuelsson L, Koskiniemi S, Edebro H, Evengård B. High occurrence of Blastocystis sp. subtypes 1-3 and Giardia intestinalis assemblage B among patients in Zanzibar, Tanzania. Parasit Vectors. 2016; 29;9(1):370.
26. Mutengo M, Kaduková M, Mulunda NR, Chabala FW, Dashti A, Hayashida K, *et al*. Asymptomatic carriage of intestinal protists is common in children in Lusaka Province, Zambia. PLoSNegl Trop Dis. 2024;18(12):e0012717.