**Prevalence and Load of *Campylobacter spp*. in Raw Chicken Meat from Jammu Province, India**

**ABSTRACT**

 The investigation aimed to know prevalence and microbial load of *Campylobacter* species in raw chicken meat collected from retail markets across five distinct districts of Jammu region. A total of 200 poultry meat samples were obtained using a systematic random sampling methods to ensure representative coverage of the region. Microbiological analyses were conducted using selective culture techniques, followed by confirmatory biochemical testing to detect and quantify *Campylobacter* spp. The investigation revealed a *Campylobacter* prevalence rate of 3.5%, with bacterial counts in positive samples averaging 1.88 log₁₀ colony-forming units per gram (cfu/g). The highest contamination was observed in samples from Jammu district, followed by Udhampur and Rajouri whereas no contamination was detected in samples from Kathua and Samba. Although the overall prevalence was low but poses significant food safety risks due to the organism’s low infectious dose and its potential to cause severe gastrointestinal illness and post-infectious complications. The study emphasizes the critical need for enhanced hygiene practices across the poultry supply chain, consistent microbial monitoring, and consumer education to mitigate the risk of foodborne *Campylobacter* infections.

**Keywords:** *Campylobacter*, chicken meat, microbial load, retail outlets, foodborne pathogens, public health, poultry safety.

**Introduction**

Bacterial foodborne illnesses continue to be a major threat to public health around the world, with some pathogens causing more than their fair share of outbreaks and individual cases. *Campylobacter* species, particularly *C. jejuni* and *C. coli*, are well-acknowledged for their gastroenteritis causing potential. They account for more than 96 million cases of foodborne disease globally, indicating their tremendous burden on public health (Kaakoush et al., 2015, WHO, 2020). These diseases are characterized by acute diseases that do include watery or bloody diarrhoea, fever, abdominal pain, malaise, and vomiting in some cases. Although self-limiting in nature, numerous cases of *C. jejuni* infections do predispose vulnerable populations to severe health complications like reactive arthritis, bacteraemia, and autoimmune neurological disorders including Guillain-Barré Syndrome (Humphrey et al., 2007). Poultry, particularly broiler chickens, serves as the primarily reservoir and vehicle for the transmission of *C. jejuni* to man. The avian gut does colonize with *Campylobacter* species naturally and asymptomatically, often reaching dense proportions of up to 10⁹ colony-forming units per gram (CFU/g). Poultry, and particularly broiler chickens, are the primary reservoirs and vehicles for *Campylobacter* transmission to humans. The colonization of the avian gut occurs naturally and asymptomatically, often reaching very high concentrations (up to 10⁹ CFU/g) (Hermans et al., 2012). *Campylobacter’s* high prevalence in poultry flocks, coupled with the risk for cross-contamination during slaughtering and processing, leads to the widespread contamination of raw poultry meat (Newell et al., 2011). Numerous studies have estimated that a significant proportion of retail chicken meat—up to 70–80% in some regions—is contaminated with *Campylobacter* spp. (EFSA, 2020). This poses a serious risk to food safety, especially when meat is undercooked and when cross-contamination occurs in kitchens and food service establishments. Failure to wash hands properly after dealing with raw chicken, using the same cutting boards used for other foods, or keeping poultry alongside cooked dishes heightens the risk of infection (Kavya et al.,2024). Additionally, the cultural practice of eating raw and partially cooked chicken also poses a health risk to certain populations (Whiley et al., 2013). Despite the implementation of various control measures across the poultry production chain—from biosecurity practices at the farm level to intervention strategies at processing plants—*Campylobacter* continues to be a significant foodborne concern.The emergence of antimicrobial-resistant *Campylobacter* strains is of particular interest due to their complexity in managing severe infections. Both clinical samples and those obtained from poultry have shown resistance to commonly prescribed antibiotics, fluoroquinolones (e.g., ciprofloxacin) and macrolides (e.g., erythromycin) (Tang et al., 2017). This trend can be traced to the rampant, and often unregulated, use of antimicrobials in veterinary medicine for disease prevention and growth promotion. The increase in multldrug-resistant strains of *Campylobacter* not only undermines the available treatment options, but also poses a risk to global health security because of the potential for resistance genes to disseminate among bacteria through horizontal gene transfer (Luangtongkum et al., 2009). Keeping in view these challenges, there is increasing interest in integrated farm-to-fork strategies to control *Campylobacter* contamination and transmission. These include strengthening on-farm biosecurity, improving slaughter and processing hygiene, implementing dubious temperature management policy and/or storage conditions, and increasing the extent of consumer education about appropriate handling and well-done cooking of poultry products (Rosenquist et al., 2006; Epps et al., 2013). Furthermore, surveillance programs and risk prediction models are necessary to track trends of contamination, assess the magnitude or level and time trend of risks. Additionally, surveillance programs and risk assessment models are essential for monitoring trends in contamination, evaluating the effectiveness of intervention strategies, and guiding public health policy (EFSA, 2020).

**MATERIALS AND METHODS**

A total of 200 raw chicken meat samples were procured from retail outlets distributed across five districts in the study region, ensuring broad geographic representation. Specifically, 65 samples were obtained from Jammu, 40 from Udhampur, 40 from Rajouri, 35 from Kathua, and 20 from Samba. The sampling strategy involved random selection from local markets within each district to minimize bias and reflect real-world consumer exposure. Each meat sample, weighing approximately 10 grams, was placed into sterile, leak-proof containers immediately after collection. To preserve microbial integrity and prevent external contamination, the samples were handled under aseptic conditions and transported in iceboxes to maintain a cold chain. Upon arrival at the laboratory, all samples were properly labeled and stored at a refrigerated temperature of 4°C until microbiological analysis was performed. The enumeration of Campylobacter species was conducted based on standardized procedures outlined by the American Public Health Association (APHA, 1984), with appropriate methodological adaptations to suit the specific needs of this study. For initial preparation, 10 grams of each meat sample were aseptically weighed and mixed with 90 ml of sterile normal saline solution to obtain a 10⁻¹ dilution. This mixture was thoroughly homogenized to ensure even bacterial dispersion. Subsequently, a series of tenfold serial dilutions were prepared up to a maximum dilution of 10⁻⁶.To isolate Campylobacter spp., aliquots of the diluted samples were inoculated onto Modified Charcoal Cefoperazone Deoxycholate Agar (MCCDA), a selective medium suitable for detecting these pathogens. The inoculated plates were incubated at 42°C for 48 hours under microaerophilic conditions, which were established using a candle extinction jar method. To further enhance the low-oxygen environment required for Campylobacter growth, a nutrient agar plate seeded with Escherichia coli was also placed inside the jar. Following incubation, presumptive Campylobacter colonies were identified by their distinct appearance, typically characterized by white to gray, moist colonies with a metallic sheen. Further confirmation of the isolates was achieved through a series of diagnostic tests. These included Gram staining to verify the characteristic spiral or curved rod-shaped, Gram-negative morphology, along with a panel of biochemical assays such as oxidase, catalase, urease activity, Hippurate hydrolysis, and indoxyl acetate hydrolysis. Final bacterial counts were recorded and expressed in logarithmic colony-forming units per gram (log cfu/g) for statistical analysis and interpretation

**RESULT**

In this study, a total of 200 raw chicken meat samples were collected from retail markets located in five districts—Jammu, Udhampur, Rajouri, Kathua, and Samba—and subsequently analyzed for the presence of Campylobacter species. The microbiological examination revealed that Campylobacter spp. was detected in 7 out of the 200 samples, resulting in an overall prevalence rate of 3.5%. When examining the distribution of positive cases by district, the highest detection rate was recorded in samples from Jammu, where 4 out of 65 samples (6.1%) tested positive. This was followed by Udhampur, with 2 out of 40 samples (5.0%) showing contamination. Rajouri reported a lower prevalence, with just 1 out of 40 samples (2.5%) yielding a positive result. Notably, none of the samples collected from Kathua (35 samples) and Samba (20 samples) showed the presence of Campylobacter spp., indicating a zero prevalence in those areas during the study period. These findings suggest regional variation in contamination levels, possibly influenced by differences in meat handling practices, sanitation conditions, or supply chain hygiene across districts. The detailed breakdown of the prevalence rates across all five districts is summarized in Table 1.

**Table1: Area wise occurrence of *Campylobacter* in raw chicken samples (n=200)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Area** | **Positive samples** | **Prevalence (%)** |
| 1. | Jammu(n=65) | 4 | 6.1 |
| 2. | Udhampur (n=40) | 2 | 5.0 |
| 3. | Rajouri (n=40) | 1 | 2.5 |
| 4. | Kathua (n=35) | 0 | 0 |
| 5. | Samba (n=20) | 0 | 0 |
|  | **Total(n=200)** | **7** | **3.5** |

**Mean Campylobacter load in positive samples**

In addition to prevalence, quantitative analysis analysis was conducted to determine the microbial load in the positive samples. The mean *Campylobacter* load was calculated as 1.88 log₁₀ cfu/g across all positive samples. The highest bacterial load was detected in samples from Jammu with an average of 2.00 log₁₀ cfu/g, while the lowest load was found in Rajouri, averaging 1.50 log₁₀ cfu/g. Udhampur samples exhibited an intermediate load of 1.85 log₁₀ cfu/g. No viable colonies were detected in the samples from Kathua and Samba, which corroborates their negative status. These values are detailed in Table 2.

**Table 2: *Campylobacter* (log10 cfu/g) of chicken samples** **(n=7).**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Area** |  **(log10 cfu/g)** |
| 1 | Jammu (n=4) | 2.00 |
| 2 | Udhampur (n=2) | 1.85 |
| 3 | Rajouri (n=1) | 1.50 |
| 4 | Kathua (n=0) | ND |
| 5 | Samba (n=0) | ND |
|  | **Total (n=7)** | **1.88** |

**Discussion**

*Campylobacter* species, particularly *C. jejuni* and *C. coli*, are among the most frequently reported bacterial pathogens responsible for foodborne gastrointestinal illnesses worldwide. Poultry meat, due to its widespread consumption and the natural colonization of poultry intestines by *Campylobacter*, represents a key vehicle for human infection (Silva et al., 2011; EFSA, 2021). The detection of *Campylobacter* in 7 out of 200 chicken meat samples, yielding a prevalence rate of 3.5%, aligns with certain earlier studies that reported similarly low prevalence in poultry meat under improved processing and handling conditions (e.g., Fernandez et al., 2000). This relatively low detection rate may reflect the effect of local hygiene practices and storage protocols, although suboptimal handling at the retail level remains a concern.

 The prevalence observed in this study is substantially lower than the figures reported in several countries of the world. In contrast to the findings of this study, significantly higher prevalence rates have been documented 100% in Tanzania (Ghosse et al.,2025),90% in Greece (Kostoglou et al. ,2023) and 93% in USA (Sahin et al., 2024). Studies from Egypt and Thailand, for example, have reported *Campylobacter* prevalence rates of 26.4% and 24.8%, respectively (Thomrongsuwannakij et al., 2017; Hafez et al., 2018). The variation in prevalence rate in *Campylobacter* species in different regions/countries may be driven by a complex interplay of factors including environmental temperature, slaughterhouse hygiene, infrastructure quality, differences in food safety enforcement, and cultural practices surrounding meat preparation and consumption (Habib et al., 2008; Kaakoush et al., 2015). Seasonal variation also plays a role, with higher prevalence often noted during warmer months when ambient conditions Favor bacterial growth and survival (Sahin et al., 2015). Despite the relatively low prevalence in the current study, the public health implications should not be underestimated while formulating any policy to mitigating the problem of spreading the food borne *Camylobacter* infection. *Campylobacter* is notable for its low infectious dose, with fewer than 800 CFU capable of causing illness in humans (Black et al., 1988). Clinical symptoms range from self-limiting diarrhoea and abdominal pain to severe systemic outcomes such as bacteraemia, Guillain-Barré syndrome (GBS), and reactive arthritis in a minority of cases (Allos, 2001; Nachamkin et al., 2008). This makes even minimal contamination in food products a matter of serious concern. Given these risks, the findings of this study underscore the need for continued vigilance, even in low-prevalence settings. Strengthening food safety through regular microbiological surveillance, enforcement of standardized sanitation protocols, and comprehensive monitoring of antimicrobial use in animal husbandry is essential. Integration of hazard analysis and critical control point (HACCP) systems, routine inspection of processing facilities, and public awareness campaigns focused on safe food handling practices can collectively reduce the burden of campylobacteriosis (WHO, 2020; EFSA, 2021).

**CONCLUSION**

In summary, foodborne illnesses linked to pathogens such as Salmonella, Staphylococcus aureus, Escherichia coli, and Campylobacter remain a pressing concern for global public health, particularly due to the consumption of contaminated meat products. This investigation involved the microbiological examination of 200 meat samples, aiming to detect the presence of these harmful microorganisms. Notably, Campylobacter species were identified in 7 samples, with an average microbial load of 1.88 log₁₀ cfu/g. Although the overall prevalence of Campylobacter was relatively low, its detection highlights the persistent threat such pathogens pose within the food supply chain. The presence of even low levels of these bacteria can have serious health implications, especially given the potential for cross-contamination and the low infectious dose required to cause illness. These findings emphasize the critical need to improve sanitary practices throughout poultry processing environments. Implementation of routine microbial surveillance, stricter adherence to food safety standards, and improved handling protocols are essential strategies to reduce contamination risks. Moreover, the study reinforces the importance of a comprehensive hygiene framework that spans the entire meat production continuum—from slaughterhouses to retail distribution. This should include routine facility inspections, stringent oversight of sanitation procedures, regular health assessments of food handlers, and consistent enforcement of regulatory policies. By adopting such measures, it becomes possible to significantly reduce the likelihood of pathogen transmission and safeguard public health more effectively.

**Data Availability statement:** Data will be provided on request.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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