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# *CAMPYLOBACTER*-REVIEW ON ITS SIGNIFICANCE AS A FOODBORNE PATHOGEN

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***Abstract***

*Food borne pathogens significantly cause illness in human which vary from mild symptoms to life threatening disease depending on the nature of microbial pathogens. Bacteria are almost responsible for 75% of food borne diseases in human. The food products especially of animal origin or their by products serve as the major source of transmission of food borne pathogens. All types of meat mainly beef, lamb and chicken and their by products can be contaminated with food borne pathogens like Campylobacter, Salmonella, Staphylococcus, E. coli and Listeria. These bacterial pathogens are equipped with several virulence factors and toxins which lead to illness in human. The severity of the disease mainly depends on the virulence of ingested pathogen. Campylobacter has been reported as the most frequent causative agent regarding foodborne illness. This article is aimed to review all aspects of Campylobacter as a foodborne pathogen.*

***Keywords:*** *Campylobacter, Campylobacteriosis, Foodborne pathogen, Zoonotic agent, Food Contamination*

## INTRODUCTION

Although the food storage and its consumption has been greatly modified in recent decades and strict hygienic measures are followed to prevent any sort of contamination, still food borne pathogens pose a great health risk worldwide especially in developing countries (1). Almost, 600 million people each year suffer with food borne sickness around the globe and almost 2 million deaths are estimated only in developing countries because of this illness (2). This overwhelming sickness and deaths have great impact on health system and economy (3). The major foods borne out breaks are caused by different pathogens including bacteria, viruses and parasites (4). The food can be contaminated by these pathogens during slaughtering, harvesting, cooking and storage. In most of the cases the origin of these pathogens is from animals and can be transmitted to human when processed for food consumption (5). The other sources of food contamination are handlers, contaminated water, working place/utensils and in some case the air and dust (6).

The developed countries have significantly minimized the risk of outbreaks caused by food borne pathogens by implementing strict hygienic practices, modified the food safety and security laws and proper certification of the food handlers and restaurants (7-

11). However, such practices have not been adopted in developing countries and the food quality in terms of free from pathogens is not that promising (12-17). Strict implementation of food safety laws and public awareness are the only solutions to minimize the risk of food contamination with microbial pathogens.

This review article summarizes the importance, prevalence, disease outbreak and pathogenesis of *Campylobacter*.

## *CAMPYLOBACTER*

Infection caused by *Campylobacter* is known as campylobacteriosis (18). This is known as the most common cause of diarrhea caused by any bacteria (19). *Campylobacter* are classified as Gram-negative and are curved or rod shaped bacteria (20). These are equipped with either single or double polar flagella and in some species they lack the flagellum. *Campylobacter* are micro-aerobic and needs special conditions to grow and don't produce spores (20). Campylobacteriosis, the disease caused by *Campylobacter* has been reported worldwide and has increased significantly during recent decades (21). Only in USA 20 out of 100,000 people suffer with this disease, however significant number of cases go unreported otherwise this number could be much higher (22). Summer season is reported more suitable for this disease when compared to winter (23).

Food can be contaminated by *Campylobacter* in many ways. Mostly the infected animals like cows, turkeys and chickens which do not show any signs and symptoms but serves as carriers and source of pathogen spread (24). *Campylobacter* can reside in several organs of these animals and when this contaminated meat is consumed may lead to infection in human (25). Around 400 million cases of campylobacteriosis have been reported each year worldwide and still there are lot other cases which are not documented especially from developing countries (26). Out of these reported cases 15% have to be hospitalized and 5% of those hospitalized lead to death (27). The consumption of contaminated meat, milk, egg and other by products is considered as main source of infection of *Campylobacter* and other foodborne pathogens (28-34). One can acquire infection by direct contact, contaminated equipment or water (31, 33). The major route of transmission to human is consumption of contaminated food. The animal origin food can be contaminated during slaughtering, dressing or equipment contamination. The other source of infection in modern era is consumption of contaminated ready to eat food products. These food products are mostly contaminated by the infected food handlers or cross contamination during preparation, packaging and storage (35).

The mechanism of disease caused by *Campylobacter* has been investigated worldwide and several mechanism of its pathogenesis has been reported (20, 22). The bacterial flagellum which make it motile and helps to adhere the intestinal mucosa and later invasion into the epithelial cell play a vital role in onset of disease (20).

*Among reported 26 species of Campylobacter, Campylobacter jejuni* (*C. jejuni)* is major specie which leads to gastroenteritis in human and is followed by *Campylobacter coli (C. coli) (20)*. It has been reported that very low dose (360 CFU) of *C. jejuni can lead to* campylobacteriosis and 800 CFU was required to cause diarrhoea in volunteers (36).

Several other studies have reported that onset of disease is dependent on *C. jejuni* strain involved, like strain 81-176 may lead to campylobacteriosis with significantly lower dose when compared with CG8421 strain (36-38).

The epidemiological data is inconclusive as the developing countries of Asia, Africa and Middle East have not adopted the standard reporting protocols (21). However, based on available data it has been observed that the cases of campylobacteriosis have been increased during recent decades (23). Based on available reports, the data suggests the huge variation of cases among different countries and cities of the same country (23). One of the proposed reasons for such variation is the diagnostic method as *Campylobacter* is not that easy to grow so many countries are not equipped with those modern sophisticated tools and techniques to perform the proper diagnosis. The other reason regarding variation in reported cases among different countries was the immune level of population (3). The people with strong immunity can tolerate the infection without showing any sign and symptoms of the disease (13). Importantly, children of developing countries are the most affected population and the occurrence of *campylobacteriosis* decreases significantly with increase in age (38). The possible reasoning is that exposure in early age may lead to protection from reoccurrence of disease. However, these asymptomatic adult carriers might lead to infect the children by direct or indirect contact (38).

The outbreaks of *Campylobacter* have been reported frequently worldwide and the most common cause reported was consumption of contaminated poultry meat and water. Out of 143 outbreaks, 114 were those caused by consumption of poultry meat (21). Similarly, more than 70% of cases of campylobacteriosis in Switzerland were associated with consumption of chicken (25). Similarly in Pakistan meat from different sources was found to be contaminated with Campylobacter (39-41) and several other studies have also documented that domesticated animals are also one of the key reservoirs of Campylobacter (42-44). The meat consumed from these animals lead to development of disease (44). Moreover, direct contact with these domesticated animals has great potential to infect the ones who come in contact. One study from Denmark reported that 17% of the campylobacteriosis cases were those who were in direct contact with cattle and in Switzerland this figure reached to 19.3% (43). However, there is great variation regarding the prevalence of *Campylobacter* in cattle. It varies from 23 to 90% (44). The most isolated species of *Campylobacter* from cattle are *jejuni*, *coli, larai* and *lanienenae*. Pigs and wild animals have also been reported as potential reservoirs of *Campylobacter* and can cause disease when their meat is consumed or by direct or indirect contact (45, 46).

Water has also been documented as the source to transmit *Campylobacter* (47). Importantly, both animals and human can be infected after consumption of contaminated water (48). Several studies performed around the globe have reported prevalence of *Campylobacter* in drinking water (49). Furthermore, researchers reported that the people and animals who consumed that contaminated water were found positive for *Campylobacter* (50). So far the water as potential source of *Campylobacter* transmission is underestimated and extensive research is required to explore it in detail.

Developing countries are the most affected ones in term of *Campylobacter* infection in general and especially the food borne (3, 39). The data reported from these countries is nowhere near to real situation as most of the cases go undiagnosed and even several diagnosed cases are not documented and reported properly (3). However the limited studies conducted in these under developed countries have reported that *C. jejuni* is on top of the list as a causative agent of diarrhea (18). The one study conducted at different cities of Bangladesh (Mirzapur), Pakistan (Karachi), India (Kolkata) and African countries found that *C. jejuni* was one of the most common agents in diarrheal cases (18).

In developing countries the most common technique used to detect *Campylobacter* is use of selective media to grow it (18). This technique has several draw backs and the most important one is that growth conditions vary for different Campylobacter spp. (18). Thus adopting optimum growth conditions for specific specie will hinder the growth of others. The other modern molecular techniques are employed in developed countries however most of the developing nations cannot provide such facility to all population. The alternate techniques such as enzyme immune assay and PCR based diagnosis have demonstrated promising results but its long journey ahead before adopted by the under developed countries (50). Such poor diagnostic facilities have lead to irrational use of antibiotics and this resulted in increase of Campylobacter strains which are resistant to antibiotics (51). Macrolide and fluoroquinolones resistant strains have been increased significantly during the recent decade (51). To cope with such situation European countries banned the use of fluoroquinolones in poultry, however the use of same drug in poultry feed in developing countries is not regulated and unfortunately it is used commonly (52-54).

The control of *Campylobacter* exposure and spread in developing countries is the most difficult task as the contamination of food items and water is very common (2). Furthermore, the unawareness of public has made it almost impossible. To control the spread, it's of utmost important that strict hygienic measure should be implemented at all levels. The breading and rearing of poultry and animals should be monitored regularly and the birds and animals should be screened for infections before slaughtering (55). The vendors and food handlers should also be screened for infections and certification process may be implemented for those involved in food industry. To provide immunization against *Campylobacter* several attempts have been made to develop a vaccine but so far no concrete success has been achieved (56).

## CONCLUSION

In conclusion, the epidemiology and burden of *Campylobacter* is not fully documented, especially in developing countries. The modern molecular techniques should be adopted for the accurate and efficient diagnosis of infection. To minimize the spread, strict hygienic measures must be adopted and the use of antibiotics should be rational.

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