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Article Review

Epidemiology of Campylobacter

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ABSTRACT

Food-borne *Campylobacter* enteritis in humans is mostly caused by *Campylobacter* in developing countries. Contaminated meat is recognized a major human causes of *Campylobacteriosis.* Meat contamination can happen at various stages of production, including transportation, distribution, processing, and marketing. They are common in pets like cats and dogs as well as food animals. In order to reduce risks to public health, it is necessary to regularly monitor resistance. Additionally, more attention should be given to stopping the spread of these pathogens between various habitats.

INTRODUCTION

Campylobacter is a gram-negative bacterium. It is thought that *C. jejuni, C. coli and C. lari* are the most significant from both a microbiological and public health perspective that can cause infection and gastroenteritis **(Ryan and Ray, 2004).** Most animals with warm blood have broad populations of *campylobacter* species. They are common in pets and food animals like chickens, cattle and sheep **(World Health Organization, 2011)**. They are thought to be the second major etiology of pediatric diarrhoea **(Rao et al. 2001).** In Egypt, estimated rate of infected kids is 12.3% **(El-Tras et al. 2015).**

17.33% of human stool isolates of *C. jejuni,* it could be the consequence of eating raw or undercooked chicken meat and eggs contaminated with this bacteria **(Ghoneim et al. 2021)** in Egypt. The liver is regarded as a tropism organ for *C. jejuni* (**Boukraa et al. 1991**) and 14% were isolated by **Khalifa et al. (2013). Youseef et al. (2017) and Hafez et al. (2018)** reported a lower rates (4% and 6.6%), although **Barakat et al. (2015) and El Fadaly et al. (2016)** observed higher rates (37.5% and 52.8%).

Because of high isolation of *C. jejuni* from chicken and samples of human **feces (Ghoneim et al. 2021),** the potential danger of transmission *C. jejuni* as a foodborne infection is high.

Pathogenicity:

Campylobacter colonization of market-age poultry' intestines may cause substantial spoilage in factories for processing **(Luangtongkum et al. 2006).**

The initial and most important phases of *Campylobacter* pathogenesis are intestinal col-

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onization and adhesion. The intestinal mucus's (mucins and glycoproteins) chemotaxis process comes before colonization **(Hamer et al. 2010).** Numerous proteins adhesins, such as *Cap*A, which are found on the surface of the bacteria, mediate bacterial adherence to the intestinal epithelial surface of the host. **(Konkel et al., 1997).** The destruction of the cells is due to secretion of cytotoxines as Cytolethal Distending Toxin **(Bang et al. 2001).** Desoxy-ribonuclease activity in this toxin dictates the cell cycle halt and nucleus disruption that results in cell death. *Campylobacter* adhesin to fibronectin F (*cad*F) is highly virulence gene, which may cause human infection and chicken colonization **(Elsayed et al., 2019**).

Numerous strains originated from poultry may be harmful to humans, as indicated by the comparatively high occurrence rate of the *cad*F gene in isolates from chickens **(Kalantar et al. 2017).** High frequency of virulence genes, particularly in human stool samples and chickens, suggests that stringent food safety, public health, and control measures are needed. The availability of bacterial virulence data could increase understanding of them from a clinical and commercial significant pathogen strains (**Ghoneim et al. 2021).**

Transmission to Human:

In addition to the possibility of transmitting the infection, spreading the infection by drinking unpasteurized milk, polluted water and ingesting improper cooked of meat of animal origin, as well as by coming into touch with farm animals and pets **(DuPont, 2007).** The use of poor-quality drinking water constitutes a concern to public health since the surroundings (ground and freshwater) contributes to the spread of *campylobacteriosis*, both directly to humans and an indirect means through farm animals, particularly poultry farms **(Zhang et al. 2018).**

Chickens are the main source of infection (50–80%) especially in farms that lack the means of isolation between poultry houses **(Figure1) (Clark and Bueschkens 1988).** It is believed that *C. jejuni* naturally exists in chickens because the bacteria thrive in an optimal physiological habitat found in their intestines **(Hailu et al. 2021).** Chicks typically become colonized by 15-21 days, but after colonization, they typically exhibit no symptoms (**Awad et al. 2015).** Human health may be at risk if processed chickens contaminated with the digestive tract content of *Campylobacter* **(Newell et al. 2011).**

Human activity on poultry farms is another factor contributing to the spread of *Campylobacter*. Inadequate application of stringent biosecurity measures may result in contaminated farmworkers. According to **Hertogs et al. (2021)** this procedure was linked to a higher risk of *Campylobacter* entry into the broiler house.

Campylobacter species are known to be present in intestinal tract of chickens throughout processing, notably in the caecum and colon. Similarly, coming into contact with faeces on eggs causes contamination of the egg and allows the bacteria to enter the egg, which starts the illness once the egg is consumed (**Vinueza-Burgos et al. 2017).**

It is acknowledged that poultry is a major source of *Campylobacter species* **(Ahmed et al. 2015).** Extensive researches in different poultry farms demonstrated that they are a primary cause of *Campylobacter* infections in contact people **(Mostafa et al. 2018).** The genetic similarity between man and poultry *Campylobacter* isolates was highlighted by phylogenetic tree analysis. **(Ghoneim et al. 2017).**

In Egypt, processed chickens are a major contributor to foodborne campylobacteriosis in humans. From retail fresh or frozen chicken, *C. jejuni* and *C. coli* were isolated (**Abd El-**

Tawab et al. 2015). There is a significant likelihood of zoonotic dangers because *Campylobacter* strains recovered from Slaughtered chicken had genetic characteristics that were identical to those of handlers' personnel and users (**El Fadaly et al. 2016).**

At the surveyed locations, the bacteria were clearly isolated from patients who had diarrhoea as a result of consuming water from these plants **(Barakat et al. 2015).** Stool samples from residents of the communities near Giza, and ground water samples also included isolates of *C. jejuni.* **(Elfadaly et al. 2018)**

Genetically, farmed animals and poultry account for the great majority (97%) of *Campylobacter* infections that affect humans, with environmental sources only account for three percent of cases **(Khalifa et al. 2013).** High percentages of this microbe have been isolated from milk and its products of Egyptian sheep and cattle **(El-Zamkan and Abdel Hameed 2016).**

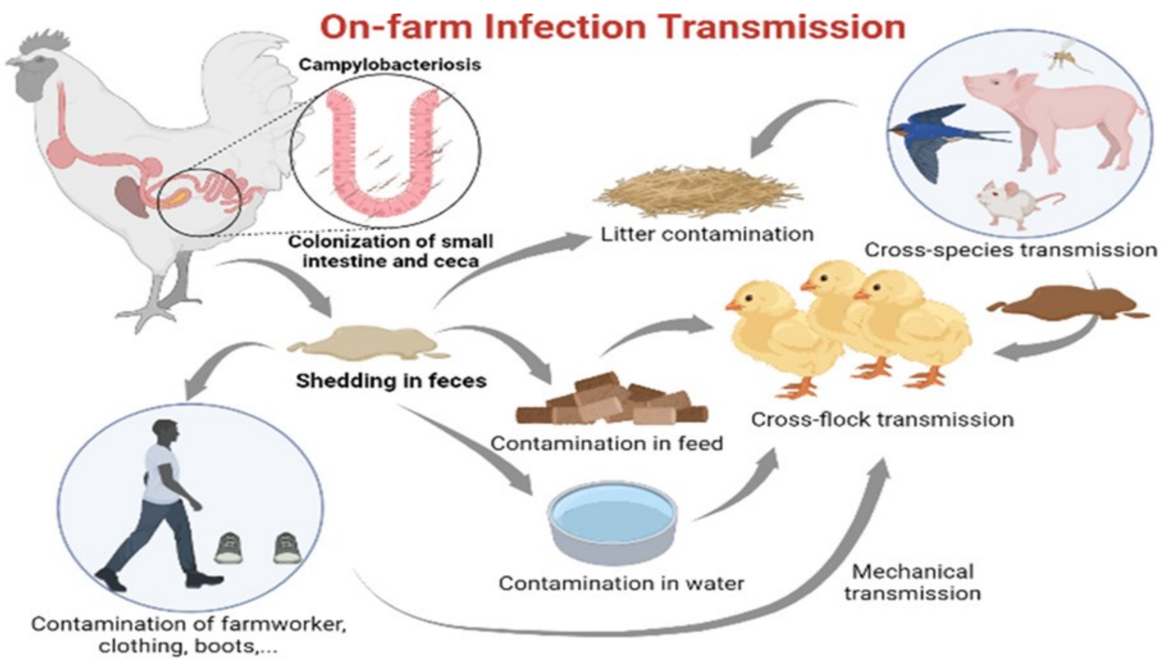

Figure (1)

Epidemiology

Survey on *Campylobacter* infection: In 2005 infectious diarrhea were identified in 53.6%. *C. jejuni* with other pathogenic microbes were recorded **(Sanders et al. 2005).** A comparable investigation on 72 persons suffering with traveler's diarrhoea in the Multinational Force in Sinai, Egypt, was carried out in 2011. The percentage of *C. jejuni* isolation was 10% **(Riddle et al. 2011).**

Later on, In Egypt 6.6% of human stool from gastroenteritis patients had *Campylobacter spp.*, which was found using PCR and traditional methods **(Abd El-Baky et al. 2014).** The findings indicated the variability in the population's *Campylobacter* spp. and C. *jejuni* capsular polysaccharide, high incidence of type-6 secretion system in *C. jejuni* isolates was noted **(Sainato et al. 2018).**

C. jejuni is responsible for 77.3% of food-borne diseases (**Doyle and Erickson, 2006**). It is thought that *campylobacter* species constitute the second main cause of diarrhoea in children **(Rao et al. 2001).** In Egypt, the estimated percentage of this diarrhoea in children is 12.3% for *C. jejuni* **(El-Tras et al. 2015).**

C. jejuni and *C. coli* are both implicated in food-borne disease; the most frequently is *C.*

jejuni. **(Fernández et al. 1999).** Acheson and Allos (2001) reported that *C. jejuni* infections are frequently linked to gastroenteritis and that about 30% of patients with highly debilitating irritable bowel syndrome, with an estimated 5 fatalities per 100,000 instances of the disease. 40% of Guillain-Barré syndrome belongs to this microbe (**Nachamkin et al. 1998). *Campylobacter*** can frequently be isolated from asymptomatic people; workers who have frequent contact with chickens are susceptible to contracting this pathogen independent of any digestive disorders they may have **(Zaghloul et al. 2012).**

Genetic studies revealed that 3 clustered of *C. jejuni* related to sequences of human origin, two of them belong to poultry. This demonstrates the significance of these two *C. jejuni* isolates for zoonotic research as well as the ongoing pathogen cycle that affects both humans and chickens. Knowledge the epidemiology of *C. jejuni* needs more knowledge **(Ghoneim et al. 2021**).

Treatment and Strategies of control

Due to its potential to undermine the efficacious management of *campylobacteriosis*, multidrug resistance in *Campylobacter* isolates is becoming an increasingly concerning issue. *Campylobacter* species that were examined showed resistance to three or more antibiotic classes. They are therefore classified as MDR; high resistance were found in the strains from water samples and chicken cloaca swabs **(Ghoneim et al. 2020);** it has been noted that the percentage of MDR strains is higher in isolates from animals and meat than from humans **(Said et al. 2010**). Crucially, because resistance genes may spread between hosts, developing MDR *Campylobacter* represents a serious risk to both humans and the chicken business.

It was established that the *C. jejuni* and *C. coli* strains were resistant to fluoroquinolones **(Said et al. 2010).** Human strains were found to be resistant to 62.5% of erythromycin and 75% of streptomycin, and tetracycline (Hassanain, 2011). But the best sensitive antibiotics for these strains were gentamicin, amikacin, and chloramphenicol (**Abd El-Baky et al. 2014).**

Applying sensitive antimicrobial agents, boosting avian host defense by immunization, and lowering environmental issues contact with *Campylobacter*, clean and sterilize the slaughterhouses and make sure not to share slaughtered chicken **(Meunier et al. 2016).**

There are attempts to prepare a vaccine that prevents *Campylobacter* infection in laying hens **(Wafaa et al. 2016).** Controlling C. *jejuni* proliferation has been studied using a variety of methods, such as food additives as (prebiotics, probiotics) and immune-based like vaccinations. Living bacteria known as probiotics have demonstrated encouraging outcomes in the prevention and management of *C. jejuni* infection in Egyptian poultry farms **(Hakeem and Lu 2021).**

In general, clean slaughter procedures minimize the chance that faeces may contaminate carcasses. To reduce contamination, abattoir staff and producers of raw meat must get training in hygienic food safety. The sole efficient way to get rid of *Campylobacter* from contaminated food is to use a bactericidal treatment, like cooking, pasteurizing or radiation.

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