Prevalence and risk factors for thermophilic *Campylobacter* infection in poultry farms in Nsukka area of Enugu State

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Abstract
Thermophilic *Campylobacter* organisms **(**TCOs) are leading cause of bacteria foodborne gastroenteritis worldwide. The organisms colonize the gastrointestinal tract of food animals, especially poultry, which are known reservoirs of the infection for transmission to humans. An epidemiological surveillance into thermophilic *Campylobacter* infection **(**TCI) in poultry was conducted to determine the prevalence and risk factors of the infection in poultry farms in Nsukka area of Enugu State. Questionnaire survey was used to elicit information on the risk factors while isolation of TCOs from fecal samples, to determine the prevalence of the infection, was done following standard microbiological protocol. Rearing of other animals alongside poultry, keeping birds of different ages, thinning, non-treatment of drinking water, extensive husbandry system, and overstocking were the major risk factors facilitating TCI in poultry farms surveyed. Farm and individual prevalence for TCI were 73.3% and 19.4% respectively. Prevalence of 18.1% and 20.2% were recorded for birds sourced from urban and rural areas respectively while prevalent rates of 18.1%, 22.2% and 33.3% were recorded in broilers, layers and cockerels respectively. Only 20.8% and 18.9% prevalence were recorded for male and female birds respectively. There was no significant association (P>0.05) between isolation of TCOs and farm location, breeds or sexes of the birds. The 19.4% overall prevalence is high. Massive improvement in biosecurity practices in poultry farms in the study area is imperative to limit TCI in poultry; and hence, the risk of humans infection via the food chain.

Keywords*: biosecurity, Campylobacter, food animals, poultry, risk factors*

Introduction

Thermophylic *Campylobacter* organisms (TCOs) are Gram negative bacteria belonging to the family *Campylobacteraceae and* genus *Campylobacter* (Modi *et al*., 2015). The organisms *are* small (0.2-0.9 µm wide and 0.5-6.0 µm long), rod shaped (Vandamme *et al.*, 2010). However, coccoid or spherically-shaped forms are usually found in old or stress-exposed cultures, as Viable but Non-culturable Cells (VBNC). Most *Campylobacter* species are flagellated at one or both ends, and hence exhibit rapid darting, spinning or corkscrew motion during microscopy. All *Campylobacter* species are sensitive to oxygen, dehydration, osmotic stress, acidic pH, and high temperatures. The TCOs are fastidious, require temperature range of 42±1 °C and microaerophilic conditions (5% O2, 10% CO2 and 85% N2) for optimal growth.

Although members of the genus *Campylobacter* consists of 32 validly described species and 13 subspecies (Sahin *et al.* 2017), the TCOs, are the most important members of the genus due to their complicity in colonization of food animals, contamination of edible animal products and possession of enormous

pathogenic potentials as the leading cause of bacteria gastroenteritis worldwide (Skarp *et al*., 2016). The TCOs have predilection for the gastrointestinal tracts (GIT) of poultry and this makes poultry main reservoirs of the organism for human infection via consumption of poultry products. Close contact with infected animals may facilitate spread of the infection especially among occupationally exposed individuals - farmers, abattoir workers and poultry processors.

Campylobacter species were first associated with disease in Great Britain in 1906 when McFadyean and Stockman isolated the organism from an aborted sheep fetus. Thereafter, *Campylobacter* organisms have been shown to be the cause of two economically important reproductive disorders in ruminants known as septic abortion and enzootic infectious infertility (Sahin *et al.* 2012, 2017). The disorder is characterized by infertility, early embryonic deaths, and increased cases of late-term abortion (Sahin, *et al.* 2012, 2017). Poultry may be colonized without obvious clinical manifestation but remains reservoir for human infection via consumption of contaminated poultry or the products.

Apart from the animal diseases, TCOs are important zoonotic agents and the leading cause of bacteria foodborne gastroenteritis (Sahin *et al.* 2017). They are responsible for about 98% of all cases of campylobacteriosis in humans (Ugboma *et al.* 2013). Human campylobacteriosis develops approximately 1–5 days post infection and is characterized by gastrointestinal problems such as nausea, vomiting, diarrhoea, dysentery, headache, fever, abdominal cramps and myalgia.

Although mortality rate associated with campylobacteriosis is low and infections may resolve without treatment; the organisms cause severe debilitating illnesses and fatal complications in human such as Guillain-Barré syndrome, reactive arthritis and irritable bowel syndrome, hemolytic uraemic syndrome and meningitis (Nwankwo *et al*. 2017). In both man and animal, campylobacter infection may be transmitted through the feco-oral route and by close contact with infected animals (Ngulukum *et al.*, 2015). Majority of human infections are acquired through handling and consumption of contaminated and undercooked poultry products (Nwankwo *et al*, 2017).

Because of the zoonotic and economic importance of *Campylobacters* species, the study was undertaken to determine the prevalence and risk factors for thermophilic *Campylobacter* infection in poultry farms in Nsukka area of Enugu State. This will highlight the current status of *Campylobacter* infection in poultry in the study area, since there is no surveillance programme or database information relating to C*ampylobacter* infections in food animals in Nigeria.

RESULTS

Prevalence of Thermophilic *Campylobacter in* poultry

Thermophilic *Campylobacter* were isolated from 22 of the 30 farmed surveyed and from 62 out of the 320 fecal samples cultured. These translate to flock and individual prevalence of 73.3% and 19.4% respectively. Prevalence of 18.1% and 20.2% were recorded for birds sourced from urban and rural areas respectively while prevalent rates of 18.1%, 22.2% and 33.3% were recorded in broilers, layers and cockerels respectively. Only 20.8% and 18.9% prevalence were recorded for male and female birds respectively. There was no significant association (P>0.05) between isolation of thermophylic *Campylobacter* and farm location, breeds or sexes of the birds (Table 1).

Table 1: Prevalence of thermophylic *Campylobacter* infection in poultry in Enugu State according to farm locations, type of poultry and sex

Variables	Number Sampled	Number Positive	Prevalence	P-value
Farm locations				
Urban areas	127	23	18.1	0.642
Rural areas	193	39	20.2	
Total	320	62	19.4	
Types of poultry				
Broiler	227	41	18.1	0.579
Layer	90	20	22.2	
Cockerel	3	1	33.3	
Total	320	62	19.4	
Sex				
Male	77	16	20.8	0.48
Female	243	46	18.9	
Total	**320**	**62**	**19.4**	

Risk factors for thermophylic *Campylobacter* infection in poultry in farms

Risk factors indentified for thermophylic *Campylobacter* infection in farms survey and the percentage of farms involved are: Non-treatment of drinking water (66.7%), rearing of other animals alongside poultry (80%), non-quarantine of exposed or incoming birds (70%), rearing of birds of different ages (76.7), thinning – partial depopulation of the flock (70%), and feeding other animals reared with untreated poultry droppings (63.3%) and extensive (free range) husbandry management system (10%).

Discussion

The overall prevalence of 19.4% recorded in this study is lower than 36% prevalence previously reported in the same study area (Akwuobu *et al*. 2010). This shows that the infection is on the decline. The decline may be attributed to the husbandry management system as most farms (93.3%) have now adopted intensive husbandry system of poultry production in the study area. Intensive husbandry management system has the advantage of low or no pathogen infectivity as against the extensive or free range (organic) system that predispose to pathogens and diseases, especially in the tropics. Under intensive management system, the animals are shielded from climatic and certain epidemiological factors that facilitate acquisition and spread of infection in animal farms (Jatfa *et al*. 2019).

Additionally, this could be due to prophylactic administration of antibiotic, widely practiced in poultry farms nationwide. This practice may have contributed in reduction of *Campylobacter* colonization

of the animals in the farms surveyed. Given that TCI do not usually result in clinical manifestation of disease in animals and hence antibiotic treatment not be warranted, admiration of antimicrobial agents for therapeutic or chemoprophylactic treatment of other invasive infections may help depopulate non-targeted organisms such as *Campylobacter* species. The resultant effect therefore is reduction in colonization of poultry with TCOs but risk of the zoonotic transmission still subsists.

The higher prevalence of *Campylobacter* infection in layers (22.2%) than broilers (18.1%) as revealed in the study may be attributed to coprophagy and pecking of vents which are common in layers. In addition, layers are usually kept for longer period in the farm than other birds. The extended period of stay in the farm exposes them to Campylobacter infection much more than the broilers usually reared for 8 -10 weeks. Furthermore, stress associated with egg production, which laying birds usually undergo, tends to lower their immunity and predisposes them to infectious agents like Campylobacter.

Conclusion: However, the 19.4% overall prevalence is high from public health point of view. Thermophylic *Campylobacter* colonization of one in every four poultry reared in the study area portents great public health risk; as the chances of contamination of poultry meat during processing may be high.

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