Campylobacter jejuni in Duck Faeces around Drinking Water Sources in Makurdi, North-Central Nigeria: Public Health Implication

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SUMMARY

Faeces from 192 ducks feeding around 10 wells and 6 ponds in peri-urban areas of Makurdi town, North-Central Nigeria were randomly sampled during the dry season period of October, 2006 to March, 2007. The samples were cultured for *Campylobacter jejuni*, followed by characterisation of positive samples. The overall prevalence was 63.5%. Prevalence rates were very high, 61.7% and 66.7% for faeces obtained from the ducks around wells and ponds respectively. The prevalence rate was highest in the month of February, where 80.0% and 83.3% of the faecal samples were positive for wells and ponds, respectively; prevalence rates were lowest (40.0%) in the month of October for wells and 50% for ponds in March. *Campylobacter jejuni* infection in ducks was highly associated (P = 0.36) with diarrhoea as *Campylobacter* was isolated from 76.7% of cases with diarrhoea. Water samples from 66.7% of the wells and 83.3% of the ponds were also *Campylobacter*-positive. The presence of this pathogen in duck faeces and sources of drinking water pose a very serious public health problem. There is therefore a need to intensify public health education and protect the wells and ponds against contamination and pollution.

Keywords: *Campylobacter jejuni*, campylobacteriosis, characterization, isolates, contaminated water, faecal droppings.

INTRODUCTION

Acute shortage of potable drinking water usually occurs during the dry season period (October to March) in the city of Makurdi in North-Central Nigeria due to poor water management and insufficient supply of pipe-borne water. During this time, the quest for sourcing drinking water from local wells and ponds increases drastically. Some of these wells are, however, not properly constructed, covered or cased, and the ponds are not fenced (Ofukwu *et al*., 1989). This has led to contamination by sewage from animals and humans. Such animals include free range ducks which usually congregate and feed around these water sources (Grant *et al*., 1980; Mohammed, 1986). Unfortunately, the faecal droppings from these birds could contain *Campylobacter jejuni* that can contaminate the water (Butzler and Skirror, 1979). Even though infection with *Campylobacter* might not cause a devastating disease in these birds, consumption of the contaminated water by humans could lead to serious cases of human campylobacteriosis (Butzler *et al*., 1973; Blaser *et al*., 1980; Garcia *et al*., 1983)

Campylobacteriosis in humans is characterised by fever, headache, dizziness, delirium, malaise, rigors, and vomiting.

This may be followed by rapidly occurring watery, foul-smelling and often bile or blood-stained diarrhoea. Moreover, enteritis and peri-umbilical abdominal pain are common occurrence (Butzler and Skirror, 1979). Even though human campylobacteriosis has not been reported in Makurdi or any part of Benue State, the often reported cases of profuse diarrhoea and enteritis during water scarcity, and the occurrence of domestic birds clustering and feeding around drinking water sources during this period present serious case for concern. The present study was therefore initiated with the aim of determining the prevalence of *Campylobacter jejuni* in faeces of ducks that feed around wells and ponds in Makurdi area to highlight the possibility of human infection.

MATERIALS AND METHODS

Study area

The study area was peri-urban area of Makurdi, capital city of Benue State in North-Central Nigeria. The city is located in Southern Guinea Savannah, on latitude 7°41′ North, longitude 8°37′ East and on an altitude of 97 meters above sea level. It has an annual rainfall of 130 mm, and a population of about 0.5 million people. Half of the population, who are mainly farmers, live in the peri-urban wards and are usually faced with perennial water scarcity.

Sample Collection

Ten wells and 6 ponds, consisting of at least 1 pond and two wells per ward in 5 peri-urban wards out of the composite 11 for the city were selected by simple random sampling. Faeces from ducks congregating and feeding around these wells and ponds were sampled for 6 months, from October 2006 to March 2007 to determine the presence of *Campylobacter jejuni*. The well and pond sites were visited every 2 weeks, and for each visit, 10 and 6 of the ducks feeding around the wells and ponds respectively were sampled. The faecal samples were obtained from freshly voided faeces of each captured and marked bird using sterile cotton wool. Defecation was initiated by lifting a bird up for about 3 – 4 minutes and subsequently dropping it. Cotton wool swabs of the faeces were obtained and kept in test tubes containing Stuart transport media with char-coal, and then taken to the laboratory for culture. Five ml of water samples from each well and pond per visit were also taken to the laboratory for culture. Samples that could not be cultured immediately were kept in the refrigerator at 4°C until when used.

A total of 120 and 72 faecal samples were obtained from the birds around the wells and ponds respectively. Moreover, 120 and 72 well and pond water samples, respectively, were also collected.

Culture and Biochemical Tests

Collected faecal samples were later inoculated into Butzler's medium as described by Butzler *et al*. (1973). The medium was made up of thioglycollate broth, 15% defibrinated sheep blood and oxoid supplement SR 85, (obtained from Oxoid Ltd., Banking Stoke, Hampshire England). The inoculated plates were placed in an anaerobic jar containing anaerobic gas-generating envelope without a catalyst, and then incubated at 42°C. These were then observed after 24 hours, 48 hours and 72 hours for evidence of growth of colonies of *Campylobacter* species. Water samples (1 ml per well and pond for each visit) were similarly cultured for identification of the organism.

Biochemical tests for characterization of *Campylobacter* isolates as described by Barrow and Felthan (1993) was used.

Catalase, oxidase and hippurate hydrolysis tests were conducted on each sample that showed growth of colonies and were gram-negative curved rods. Samples that were catalase-positive, oxidase-negative and hydrolyzed hippurate were regarded as *Campylobacter jejuni*.

RESULTS

The results of the analyzed faecal samples from ducks obtained around wells and ponds were as shown in Table 1 and Figure 1. Majority of the samples 77 (64.2%) from around wells were normal faeces, whereas the remaining 43 (35.8%) were diarrhoeic faeces. Of the 72 faecal samples from ponds, 47 (65.3%) were normal, while 25 (34.7%) were diarrhoeic. A significant difference ($P < 0.05$) was recorded in the isolation rates of *Campylobacter* between normal (53.2%) and diarrhoeic (76.7%) faeces from ducks feeding around wells (Table 1); however, the difference in the isolation rates between normal (59.6%) and diarrhoeic (80.0%) faeces from ducks around ponds was statistically insignificant ($P > 0.05$). Though the total isolation rate of *Campylobacter* from faeces of ducks feeding around ponds (66.7%) was higher than the isolation rate from ducks around wells (61.7%) (Table 1), there was no significant difference ($P > 0.05$) between the two. The study recorded a significant difference ($P < 0.05$) in the isolation rates of *Campylobacter* between normal (55.6%) and diarrhoeic (77.9%) faeces of ducks around wells and ponds (Table 1).

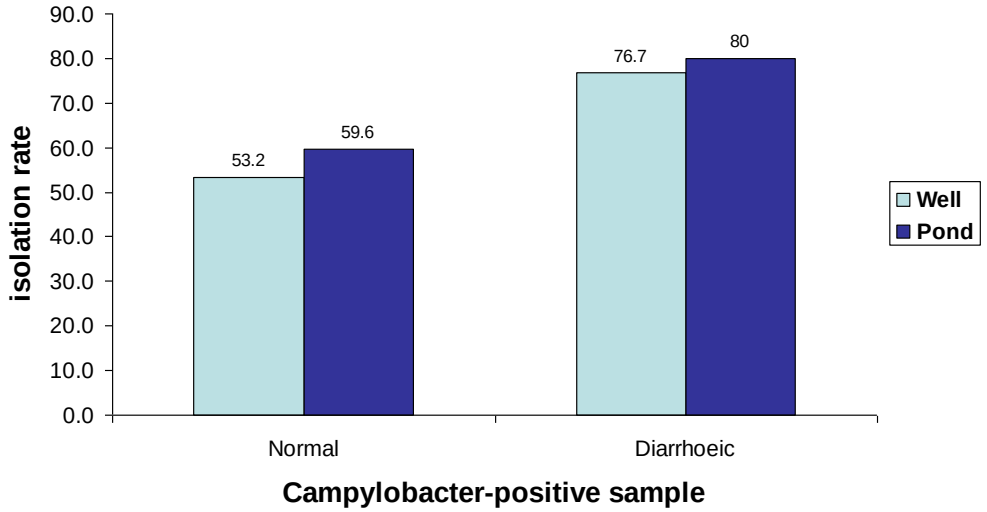

Figure 1: Isolation rates of *Campylobacter jejuni* from normal and diarrhoeic faeces of ducks around wells and ponds in Makurdi, North-Central Nigeria (October 2006 – March 2007).

Table 1: Prevalence of *Campylobacter jejuni* in faecal samples from ducks feeding around wells and ponds in Makurdi, North-Central Nigeria (October 2006 to March 2007)

	Total no. faecal samples	Consistency of faeces No. (%)		*Campylobacter*-positive samples No. (%)*		
		Normal	Diarrhoeic	Normal	Diarrhoeic	Total
Well	120	77 (64.2)	43 (35.8)	41 (53.2)	33 (76.7)	74 (61.7)
Pond	72	47 (65.3)	25 (34.7)	28 (59.6)	20 (80.0)	48 (66.7)
Total	**192**	**124 (64.6)**	**68 (35.4)**	**69 (55.6)**	**53 (77.9)**	**122 (63.5)**

*The percentage of samples positive for *Campylobacter* for normal and diarrhoeic faeces was calculated as a fraction of the normal and diarrhoeic faeces respectively.

The prevalence of *Campylobacter jejuni* in ducks around wells was lowest (40.0%) in October, and increased to the highest in February (80.0%) and decreased slightly (70.0%) in March, even though, the prevalence was high throughout the 6-month period; while the monthly prevalence in ducks around ponds ranged from 50.0% in March to 83.3% in February (Table 2 and Figure 2). No significant difference ($P > 0.05$) was recorded in the isolation rates of *Campylobacter* between normal or diarrhoeic faeces from ducks around wells and ponds (Table 2). The study established that *Campylobacter* infection rates of ducks feeding around wells and ponds are the same.

Seven (5.8%) out of 120 well samples and 13 (18.1%) out of 72 pond samples were *Campylobacter*-positive. Water samples from the ponds were more positive ($P < 0.05$) than that taken from wells. Also water samples obtained from poorly covered wells were more positive ($P < 0.05$) than samples taken from firmly covered wells. Water samples from 3 (25.0%) poorly covered wells situated close to ponds, and 4 (33.3%) wells and 4 (66.7%) ponds with a high population of congregating ducks, had higher prevalence of contamination compared to the 5 (41.7%) properly covered wells and 2 (33.3%) ponds with lower number of congregating ducks.

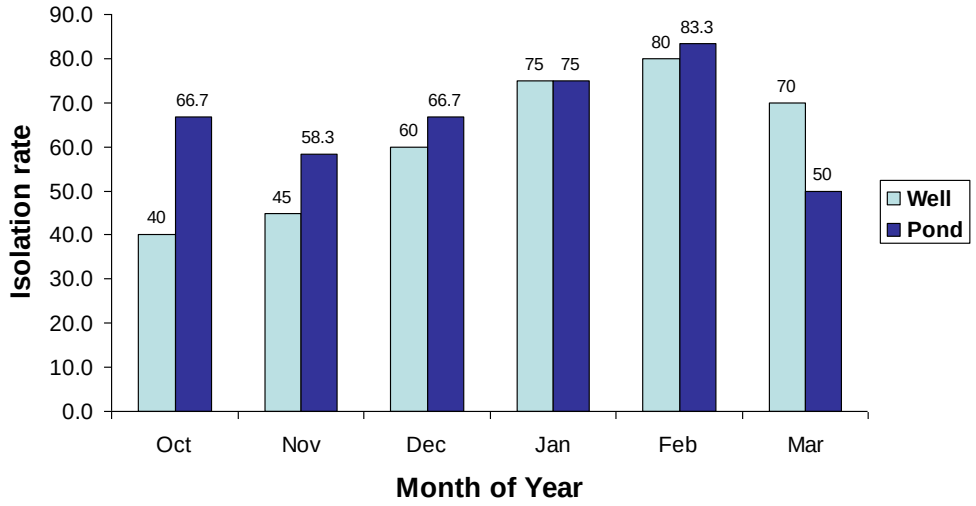

Figure 2: Monthly isolation rates of *Campylobacter jejuni* from faeces of ducks around wells and ponds in Makurdi, North-Central Nigeria (October 2006 – March 2007).

DISCUSSION

The study showed that 61.7% and 66.7% of ducks feeding around wells and ponds, respectively, were infected with *Campylobacter*. These results are similar to those obtained by Grant *et al*. (1980), Prescott and Bruin-Mosch (1981) and Adekeye (1986) who reported infection prevalence above 60.0%. We also found that a significantly ($P < 0.05$) higher percentage of the diarrhoeic faecal samples (77.9%) from around wells and ponds were *Campylobacter*-positive compared to that of the normal faeces (55.6%) from wells and ponds. These findings are in agreement

with those obtained for duck faeces around wells in Zaria, Nigeria by Adekeye (1986).

Table 2: Monthly prevalence of *Campylobacter jejuni* in faecal samples from ducks feeding around wells and ponds in Makurdi, North-Central Nigeria (October 2006 to March 2007)

Month of the year / Wells	Total no. faecal samples	Consistency of faeces No. (%)		*Campylobacter*-positive samples No. (%)*		
		Normal	Diarrhoeic	Normal	Diarrhoeic	Total
October	20	13 (65.0)	7 (35.0)	4 (30.8)	4 (57.1)	8 (40.0)
November	20	12 (60.0)	8 (40.0)	4 (33.3)	5 (62.5)	9 (45.0)
December	20	14 (70.0)	6 (30.0)	7 (50.0)	5 (83.3)	12 (60.0)
January	20	14 (70.0)	6 (30.0)	10 (71.4)	5 (83.3)	15 (75.0)
February	20	12 (60.0)	8 (40.0)	8 (66.7)	8 (100.0)	16 (80.0)
March	20	12 (60.0)	8 (40.0)	8 (66.7)	6 (75.))	14 (70.0)
Sub-total	**120**	**77 (64.2)**	**43 (35.8)**	**41 (53.2)**	**33 (76.7)**	**74 (61.7)**
Ponds						
October	12	8 (66.7)	4 (33.3)	6 (75.0)	2 (50.0)	8 (66.7)
November	12	7 (58.3)	5 (41.7)	3 (42.9)	4 (80.0)	7 (58.3)
December	12	8 (66.7)	4 (33.3)	5 (62.5)	3 (75.0)	8 (66.7)
January	12	5 (41.7)	7 (58.3)	3 (60.0)	6 (85.7)	9 (75.0)
February	12	8 (66.7)	4 (33.3)	6 (75.0)	4 (100.0)	10 (83.3)
March	12	11 (91.7)	1 (8.3)	5 (45.5)	1 (100.0)	6 (50.0)
Sub-total	**72**	**47 (65.3)**	**25 (35.4)**	**28 (59.6)**	**20 (80.0)**	**48 (66.7)**
Grand total	**192**	**124 (64.6)**	**68 (35.4)**	**69 (55.6)**	**53 (77.9)**	**122 (63.5)**

*The percentage of samples positive for *Campylobacter* for normal and diarrhoeic faeces was calculated as a fraction of the normal and diarrhoeic faeces respectively.

The high association ($P < 0.05$) between the diarrhoeic faeces and the infection in this study has also been reported by Butzler and Skirror (1979), Prescott and Bruin-Mosch (1981), Olusanya *et al*. (1983) and Mohammed (1986). Our results also show that even though a large proportion of the normal duck faecal samples were *Campylobacter*-positive, they showed no sign of the disease as evidenced in diarrhoea. This also corroborates findings by Prescott and Bruin-Mosch (1981) who reported presence of *Campylobacter jejuni* in apparently healthy non-diarrhoeic animals. The finding also agrees with the report of World Organisation for Animal Health (2005) that in birds, disease is rare, if it occurs at all, despite high level of colonization with *Campylobacter*.

The contamination of wells and ponds is probably due to high load of infected faeces being discharged into the water by the large population of birds at each point in time (Adekeye, 1986). Contamination of these water sources and subsequent consumption of water by humans most likely leads to human cases of campylobacteriosis with its attendant consequences (Olusanya *et al*., 1983; Prescott and Mun rose, 1987).

Prevalence of *Campylobacter jejuni* in duck faeces and poorly covered wells and ponds is high in Makurdi, Nigeria. The potential of human infection through drinking water from these sources during dry season is high. It is therefore recommended that government should provide potable water for the population. It should also intensify public health education on proper casing and covering of wells to avoid contamination by sewages and faecal wastes. Duck owners should also be educated on proper housing and

general management of their birds to avoid their congregation around water sources.

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