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Prevalence of *Campylobacter jejuni* in duck faeces around drinking water sources in Makurdi, north-central Nigeria

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Abstract

Faeces from one hundred and ninety-two ducks feeding around ten wells and six ponds in peri urban areas of Makurdi town, North-Central Nigeria were randomly sampled during the dry season period of October, 2004 to March, 2005. In total, one hundred and ninety-two samples were cultured for *Campylobacter jejuni*, followed by biochemical characterization of suspected Campylobacter isolates using standard methods. The overall incidence rate was 63.5%. Incidence rates were very high, 61.7% and 66.7% for faeces obtained from the ducks around wells and ponds respectively. The incidence rate was highest in the month of February, where 80.0% and 83.3% of the faeces samples were positive for wells and ponds, respectively, lowest (40%) in the month of October for wells and March for ponds (50%). *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.

Key words: *Campylobacter jejuni*; Duck faeces; Drinking water sources; Makurdi; Nigeria.

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; Adakayi and Ameh, 2006). 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 characterized 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 diarrhea and enteritis during water scarcity, and the occurrence of domestic birds clustering and feeding around drinking water sources during period presents serious case for concern. The 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 and to highlight the possibility of human infection.

Materials and methods

Study area

The study area is peri-urban area of Makurdi, capital city of Benue State in North Central Nigeria. The city is located in Southern Guinea Savannah, on latitude 7041′ North, longitude 8037′ 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 six ponds, consisting of at least one pond and two wells per ward in five peri urban wards out of the composite eleven for the city were selected by simple random sampling. Faeces from ducks congregating and feeding around these wells and ponds were sampled for six months, from October 2004 to March 2005 to determine the presence of *Campylobacter jejuni*. Faecal samples were obtained from freshly voided faeces of each captured bird using sterile cotton wool. Defecation was initiated by lifting a bird up for about 3 – 4 min 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 were also taken to the laboratory for culture. Samples that could not be cultured immediately were kept in the refrigerator at 4oC until when used. Each site was visited once a week for the six month-period.

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 Test

All collected faecal samples were later inoculated into Butzler's medium as described by Butzler *et al.* (1973). The medium was made up of fluid thioglycollate, 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 without catalyst, gassed by oxoid gas generating kits and then incubated at 420C. They were then observed after 24 hours, 48 hours and 72 hours for evidence of growth of colonies of Campylobacter. Water samples (1 ml per well and pond for each visit) were similarly cultured for identification of the organism.

All suspected *Campylobacter jejuni* isolates were identified to species level by standard microbiological methods described by Barrow and Feltan (1993); these biochemical tests included oxidase and catalase production, and sodium hippurate hydrolysis.

Results

The results of the analyzed faecal samples from ducks obtained around wells and ponds were as shown in Table 1 and Figure I. The majority of the samples 77 (64.2%) from wells originated from normal faeces, whereas the remaining 43 (35.8%) were from diarrhoiec faeces. Among the total 72 faecal samples from ponds, 47 (65.3%) were normal, while 25 (34.7%) were diarrhoeic faeces. A significant difference ($P < 0.05$) was recorded in the isolation rates of *Campylobacter jejuni* between normal (53.2%) and diarrhoiec (76.7%) faeces from ducks feeding around wells (Table 1); however, the difference in the isolation rates between normal (59.6%) and diarrhoiec (80.0%) faeces from ducks around ponds was statistically insignificant ($P > 0.05$). Though the total isolation rate of *Campylobacter jejuni* 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 jejuni* between normal (55.6%) and diarrhoiec (77.9%) faeces of ducks around wells and ponds (Table 1).

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 through out the six 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 II). No significant difference ($P > 0.05$) was recorded in the isolation rates of *Campylobacter jejuni* between normal faeces; nor any significant difference ($P > 0.05$) observed between diarrhoiec faeces from ducks around wells and ponds (Table 2).

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 likely to be positive than water samples taken from wells. Also, water samples obtained from poorly covered wells were more likely to be positive than samples taken from firmly covered wells.

Table 1: Prevalence of *Campylobacter jejuni* in faecal samples from ducks feeding around wells and ponds in Makurdi, North Central Nigeria: October 2004 – March 2005 (No. (%))

Source	Total No. of faecal samples	Consistency of faeces		*Campylobacter*- positive samples		
		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 were calculated as a fraction of the normal and diarrhoeic faeces respectively

Table 2: Monthly prevalence of *Campylobacter jejuni* in faecal samples from ducks feeding around wells and ponds in Makurdi, North Central Nigeria: October 2004 – March 2005 (No. (%))

Source and time sampling	Total No. of faecal samples	Consistency of faeces		*Campylobacter*- positive samples		
		Normal	Diarrhoeic	Normal	Diarrhoeic	Total
Wells						
October	20	13(65.0)	7(35.0)	4(30.8)	4(57.1)	8 (40)
November	20	12(60.0)	8(40.0)	4(33.3)	5(62.5)	9 (45)
December	20	14(70.0)	6(30.0)	7(50.0)	5(83.3)	12 (60)
January	20	14(70.0)	6(30.0)	10(71.4)	5(83.3)	15 (75)
February	20	12(60.0)	8(40.0)	8(66.7)	8(100.0)	16 (80)
March	20	12(6.0)	8(40.0)	8(66.7)	6(75.0)	14 (70)
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)	6(50.0)
Sub-total	*72*	*47(65.3)*	*25(34.7)*	*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 were calculated as a fraction of the normal and diarrhoeic faeces respectively

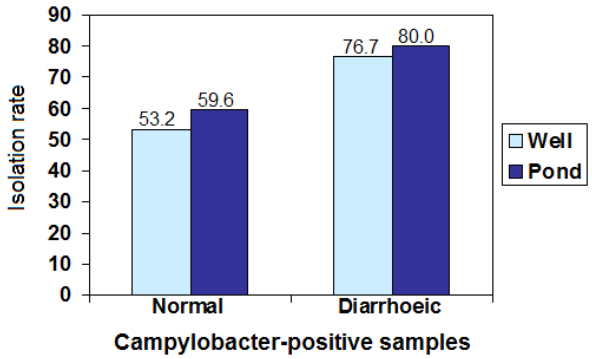

Figure 1: Isolation rates of *Campylobacter jejuni* from normal and diarrhoeic faeces of ducks around wells and ponds in Makurdi, North Central Nigeria

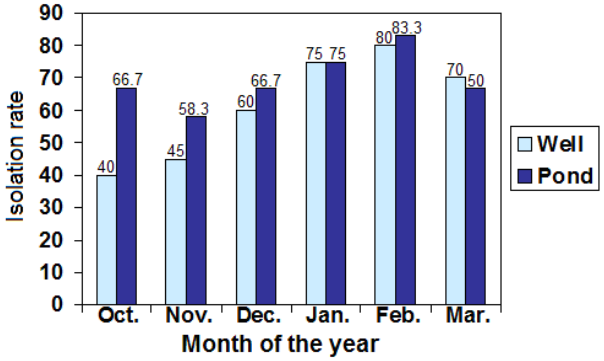

Figure 2: Monthly isolation rates of *Campylobacter jejuni* from faeces of ducks around wells and ponds in Makurdi, North Central Nigeria

Discussion

The study showed that 61.7% and 66.7% of ducks feeding around wells and ponds, respectively, were infected with Campylobacter. This result is similar to that obtained by Grant *et al.* (1980), Prescott *et al.* (1981), and Adekeye (1986) who all reported infection prevalences above 60%. We also found that a significantly ($P<0.05$) higher percentage of the diarrhoeic faecal samples (77.9%) from around wells and pond 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).

The high association ($P<0.05$) between the diarrhoeic faeces and the infection in this study has also been reported earlier, e.g. by Butzler and Skirror (1979), Prescott and Bruin-Mosch (1981), Olusanya *et al.* (1983) and Mohammed (1986). Our result also shows 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) of presence of *Campylobacter jejuni* in apparently healthy non-diarrhoeic animals. The finding also supports the report of World Organisation for Animal Health (2005) that in birds, disease is rare, if it occurs at all, despite high level of colonisation with *Campylobacter jejuni*. The study also established that campylobacter infection rates of ducks feeding around wells and ponds are the same.

It was observed that water samples from 3 (25%) poorly covered wells situated close to ponds, as well as 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. The contamination of wells and ponds is probably a result of the high load of infected faeces being discharged into the water by the large population of bird at each point in time (Adekeye, 1986; Adakayi and Ameh, 2000). 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).

Conclusion

Prevalence of *Campylobacter jejuni* in duck faeces and poorly covered wells and ponds is high in Makurdi, Nigeria. The potential of human infection by drinking water from these sources is also high.

It is therefore recommended that the government should 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 drinking water sources.

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