

Prevalence of *Campylobacter* species in ground water in Sokoto, Sokoto state, Nigeria

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Abstract

Aim: The present study was conducted to determine the presence and prevalence of *Campylobacter* species in ground water in Sokoto, Sokoto State.

Materials and Methods: The prevalence of *Campylobacter* species was determined by collecting a total of 74 water samples from wells in Sokoto over a period of four months from May to August 2011 and analyzed using cultural isolation techniques and biochemical characterization.

Results: Totally 39 (52.70%) water samples were *Campylobacter* positive. The species identified were *Campylobacter jejuni* 23 (58.97%), *Campylobacter coli* 11 (28.21%) and *Campylobacter hyointestinalis* 5 (12.82%).

Conclusion: Based on this study, the isolation of *Campylobacter* species from ground water (wells) in this study is of serious public health importance as untreated water has been implicated as the cause of sporadic infections and outbreaks of *Campylobacteriosis* worldwide.

Keywords: *Campylobacter*, prevalence, public health, Sokoto, water, well.

Introduction

Thermophilic *Campylobacters* are among the most common bacteria that cause acute human and animal gastroenteritis worldwide [1-4]. *Campylobacteriosis* is an infectious disease caused by the gram negative bacteria *Campylobacter* [5-7]. Apart from contaminated food and drinking water, direct contact with carrier animals was found to be a possible source of infection for *Campylobacter* [8-12]. Outbreaks of *Campylobacteriosis* are often associated with consumption of unpasteurized milk [4,13] or untreated water [4,13-15]. *Campylobacteriosis* is characterized by diarrhea, abdominal pain, malaise, fever, nausea and vomiting [4,6,16]. Well water is one of the major sources of drinking water in Sokoto metropolis. its usage by humans and animals is due to insufficient supply of pipe-borne water and poor management of water in the metropolis [17]. *Campylobacter* may be found in water sources such as wells that have been contaminated with feces from infected humans or animals. Most Human or animal waste can enter the water through different routes including sewage systems that are not working properly, polluted storm water runoff and agricultural runoff [7]. The rate of *Campylobacter* infections worldwide has been increasing with the number of cases often exceeding those of *Salmonellosis* and *Shigellosis* [5,18].

This increase, as well as the expanding spectrum of diseases caused by the organisms, necessitates a clearer understanding of the epidemiology and control of *Campylobacteriosis*.

The aim of this study was to establish the presence of *Campylobacter* in ground water (wells) and to determine the prevalence and distribution of *Campylobacter* species isolated from ground water.

Materials and Methods

Study Area: Sokoto is the capital of Sokoto State, Nigeria. The State is located to the extreme Northwest of Nigeria between longitudes 4°8'E and 6°54'E and between latitudes 12°N and 13° 58'N [19]. Sokoto metropolis comprises of four local Government area (LGA) namely; Sokoto south, Sokoto north, Wamakko and Dange Shuni local government areas.

Collection of sample: A total of 74 water samples were collected from 15 wells in Sokoto metropolis (the wells that were samples were both government owned wells and private wells), over a period of four months from May to August 2011. The water samples were collected in the morning (between 10.00am and 11.30am) and 1ml of the water sample was added to sterile bijour bottles containing 9mls of Amies transport media (Oxiod, CM0425) and were transported to the laboratory immediately in ice-packed container for analysis.

Isolation and identification of *Campylobacter*: The water samples contained in the pre-enrichment media

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Table-1. Percentage distribution of *Campylobacter* species isolated from wells in Sokoto metropolis

<i>Campylobacter</i> (C) species	Number positive	Percentage (%)
<i>C. coli</i>	11	28.21%
<i>C. hyointestinalis</i>	5	12.82%
<i>C. jejuni</i>	23	58.97%

(Amies) were incubated at 42°C for 48 hours, after which a loopful of the pre-enrichment culture was plated onto modified Charcoal Cefaperazone Deoxycholate Agar (mCCDA) (Oxiod CM0739) and incubated at 42°C for 48 hours in a microaerophilic atmosphere generated by CampyGen system (Oxiod Cn25). All suspected colonies were identified by Gram staining and biochemical test involving oxidase test, catalase test, hippurate hydrolysis and sensitivity to nalidixic acid and cephalothin. Organism was considered to be *Campylobacter* species if they were motile, catalase positive and oxidase positive [20,21].

The speciation of isolates were based on biochemical characterization involving hippurate hydrolysis (Sigma, Munich), susceptibility or resistance to nalidixic acid and cephalothin determined by standard diffusion techniques with 30µg discs (Oxiod) incubated in microaerophilic conditions at 37°C for 48 hours. Isolates that hydrolyses hippurate were identified as *C. jejuni* (*C. jejuni* is the only *Campylobacter* specie that hydrolyses hippurate). Isolates that were susceptible to nalidixic acid but resistant to cephalothin were identified as *C. coli*, and the isolates that were resistant to both nalidixic acid and cephalothin were identified as *C. hyointestinalis*.

Results

Out of the 74 water samples collected and analyzed, 39 (52.70%) were positive for *Campylobacter* species. The *Campylobacter* species isolated from the water samples were *C. jejuni* (58.97%), *C. coli* (28.21%) and *C. hyointestinalis* (12.82%). The most common *Campylobacter* species in this study was *C. jejuni* while *C. hyointestinalis* had the lowest isolation rate (Table-1).

Discussion

The presence of *Campylobacter* species in ground water has been established in this study. The result of this study indicates that the overall prevalence of *Campylobacter* from ground water in this study was 52.70%. The prevalence rate in this study was higher than the rate reported by Akwuobu and Ofukwu [22] who observed a rate of 5.8% in well water samples in Makurdi, Benue State, Nigeria. The difference in the prevalence in this study compared to the other study may be due to the fact that the study area has the second largest livestock population in the country, having 3 million cattle, 3.85 million sheep, 4 million goats, 800,000 camels and various species of poultry including chickens guinea fowls, ducks and turkeys [23] and so more livestock congregate around wells to drink water and also to feed on grasses around the wells

during which they defecate into the water [24]. It has been established that the natural habitat of *Campylobacter* spp. is the intestinal tract of warm-blooded animals [25,26], and almost all the livestock in the study area are reported to carry the organism [27-30]. The most frequently isolated *Campylobacter* species from wells in Sokoto metropolis was *C. jejuni*. This observation is in agreement with the reports that *C. jejuni* is the most common thermophilic *Campylobacter* species in water [24]. The isolation rate of *C. coli* was 28.21%, these observation is in line with the report of Popowski *et al.* [24] on the basis that the isolation rate of *C. coli* in rivers is always lower than that of *C. jejuni*. The low isolation rate of *C. hyointestinalis* may be associated with the incubation temperature of 42°C which optimized the growth of thermophilic *Campylobacter* (*C. jejuni* and *C. coli*). However the use of CampyGen gas generating sachets may have further suppressed the growth of non-thermophilic *Campylobacter* like *C. hyointestinalis*, as it does not create a hydrogen enriched atmosphere which is required by the non-thermophilic *Campylobacter* [31]. The prevalence of *Campylobacter* species in wells in the study area is high; the potential of human infection through drinking water from these sources is also very high.

Conclusion and recommendation

This study has shown that *Campylobacter* organisms are present in wells in Sokoto, Sokoto State. The identification of these organisms in wells is of serious public health importance as untreated drinking water has been implicated as the cause of sporadic infections and outbreaks of *Campylobacteriosis* worldwide [32].

Based on the findings from this study and the public health implications of *Campylobacter* infection, the following recommendations are suggested:

- * Government and individuals should intensify public health education on proper casing and covering of wells to avoid contamination by sewages and by fecal droppings of animals that gather around wells to drink water.
- * Public enlightenment on the hazards involved in drinking untreated water from wells and
- * The conventional treatment of domestic water supplies which can be accomplished by the addition of chlorine which is highly effective against certain Gram-negative bacteria like *Campylobacter* and enteric bacteria such as the coliform group.

Authors' contribution

All authors contributed equally. All authors read and

approved the final manuscript.

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Competing interests

Authors declare that they have no competing interest.

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