ClinicSearch

International Journal of Clinical Epidemiology

J. Omololu-Aso *

Open Access

Research Article

Antibiotic Sensitivity Pattern of Escherichia Coli from Municipal Water Supply, Lagos State Nigeria

J. Omololu-Aso[1], I. Abiona[1], O.O. Omololu[2] and O. Adesunloro[1] E. G. Bello [1]. A. A. Oluyombo[3] and E. R. Oladimeji [3] B. F Ajao [4]

[1] Department of Microbiology, Obafemi Awolowo University Ile-Ife, Osun State, Nigeria.

[2] Department of Obstetrics Gyneacology, University College Hospital, Orita-mefa Ibadan, Oyo State Nigeria

[3]Department of Animal Nutrition Federal University of Agriculture, Abeokuta, Ogun State, Nigeria

[4] Benjamin Carson School of Medicine, Babcock University, Ogun State.

***Correspondence Author:** J. Omololu-Aso, Department of Microbiology, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria.

Received Date: August 04, 2023| Accepted Date: August 11, 2023| Published Date: August 28, 2023

Citation: J. Omololu-Aso, (2023), Antibiotic Sensitivity Pattern of Escherichia Coli from Municipal Water Supply, Lagos State Nigeria, *International Journal of Clinical Epidemiology*, 2(4); **DOI:** 10.31579/2835-9232/035

Abstract

The aim of this study is to isolate, identify and determine Escherichia coli isolates in different water sources obtained at different locations in Shomolu Local Government, Lagos State, Nigeria by using conventional methods to detect the frequency of distribution of E. coli in drinking water samples and to determine the antibiotic susceptibility of the isolates recovered.

A total of 34 water samples which include sachet water, tap water, well water, boreholes were analysed for isolation, identification and antimicrobial susceptibility testing. The samples were taken to the laboratory and transferred into nutrient broth for subsequent culturing and biochemical test. Antibiotic susceptibility was conducted using Kirby and Bauer disc diffusion method and the results were determined using the Clinical and Laboratory Standard Institute (CLSI) 2016 guide.

Escherichia coli were isolated from 4(11.76%) samples. The highest isolation rate was obtained from two (2) well water (5.88%) samples. The Escherichia coli isolates showed zero resistance to amoxicillin, tetracycline, ciprofloxacin, pefloxacin and ofloxacin. A lower susceptibility rate for the isolates were observed in augmentin, ceftriaxone and gentamicin which has 25% respectively. A higher percentage of resistance was observed to cotrimoxazole (50%) and the highest was noted for nitrofurantoin (75%).

Presence of drug-resistance in Escherichia coli strains isolated from this samples posed a great public health risk. It is expedient that indiscriminate use of antibiotics should be prohibited Water from well sources should be subject to effective pre-treatment before use and proper sanitization of the environment where the well is located should be maintained.

Keywords: escherichia coli; infections; antibiotic resistant; antibiotics; water

Introduction

Escherichia coli are motile, Gram-negative rod- ¬shaped bacteria which constitutes healthy flora of the gastrointestinal tracts of humans and other warm-blooded animals within hours or a few days after birth (Jost, Lacroix, Braegger et al., 2012). However, E. coli has a dichotomous existence while majority of E. coli strains exist within the mammalian intestinal tract as harmless commensal, paradoxically several evolutionary lineages have deviated from this harmless lifestyle to become pathogens (Khachatryan et al.,2008). Escherichia coli is a potential indicator to test environmental samples for fecal pollution.

In May 2011, one E. coli strain, O104:H4, was the subject of a bacterial outbreak that began in Germany. Certain strains of E. coli are a major cause of foodborne illness. The outbreak started when several people in Germany were infected with enterohemorrhagic E. coli (EHEC) bacteria, leading to hemolytic-uremic syndrome (HUS), a medical emergency that requires urgent treatment. The outbreak did not only concern Germany, but also 15 other countries, including regions in North America (Outbreaks of E. coli O104:H4 infection. WHO, 2011)?

In a study by Onanuga et al., 2014 in investigating the prevalence of dirrhaemorrhagenic Escherichia coli (DEC) isolated from children in Gwagwalada, Federal Capital Territory Abuja Nigeria as a means of determining the distribution of DEC associated diarrhea in the North Central part of Nigeria. The highest proportion of DEC (15%) was detected among

the children in age group 4-6 months whilst those in age groups 0-3 months and 22-24 months provided the lowest number of DEC isolates. The EPEC strains were found only among the children 0-9 months whilst ETEC strains were most frequently encountered among the children aged 16-18months.A total of 87.5% of EAEC and 78.9% of STEC strains were significantly found among children older than 3 months in children with diarrhea (Onanuga et al., 2014)

In this study, we investigated antibiotic sensitivity pattern of Escherichia coli from municipal water supply, Lagos State Nigeria.

.

Materials and Method

The samples collection was carried out in Shomolu local government area, Lagos. It is suited in Mushin Lagos, Nigeria. It is geographoical coordinates are 6º 32' 25 North, 3º 22' 18 East.

Sample Population

A total of 34 samples were obtained from diverse sources which include tap water, well water, borehole, sachet water from different locations in Shomolu local government area, Lagos State. The samples were transferred to the laboratory via universal bottle and collected on prepared nutrient broth for subsequent culturing and biochemical test.

Isolation, Identification and Characterisation

Each sample was plated out on MacConkey agar and eosin methylene blue and incubated at 37°C for 24 h for enrichment. Mixed colonies with pink colour on MacConkey agar were later sub-cultured on Eosin Methylene blue and the plates were incubated at 37°C for 24 hr after which discrete colonies with green colour appears. Gram staining, morphological identification, catalase and coagulase tests, sugar fermentation analysis and antimicrobial susceptibility trends of the isolate were conducted.

Results

A total of 34 isolates of Enterobacteriaceae sp. were obtained. Four isolates were found to be E. coli as depicted in the table below.

Sample Code	Source	Growth on MacConkey Agar	Growth on EMB Agar
OLW	Well, Olorunjare Street	Positive	Positive
OJT	Tap, Ojo Street	Positive	Positive
SHW	Well, Shobande Street	Positive	Positive
BAB 1	Borehole, Bailey Street	Positive	Positive
BAB 2	Borehole, Bailey Street	Positive	Negative
ALS	Aliana Sachet Water	Positive	Positive
IBB	Borehole, Ibukunolu Street	Positive	Positive
OBW	Well, Owoduni Balogun Street	Positive	Positive
ANT	Tap, Animashaun Street	Positive	Positive
ODT	Tap, Odunlami Street	Positive	Positive
APB	Borehole, Apata Street	Positive	Negative
SHB	Borehole, Shobande Street	Positive	Positive
OSB	Borehole, Osanyinpejusi Street	Positive	Positive
IBW	Well, Ibukunolu Street	Positive	Positive
BKB	Borehole, Bakare Hannah Street	Positive	Positive
SOW	Well, Sholanke Street	Positive	Positive
OLB1	Borehole, Olaleye Street	Positive	Positive
DIS	Dimas Sachet Water	Positive	Positive

OYB	Borehole, Oyediran Market, Bajulaye	Positive	Positive
PGBW	Puregold Bottled Water	Positive	Positive
MAW	Well, Mafoluke Street	Positive	Positive
MLS	Morelife Sachet Water	Positive	Positive
DUB	Borehole, Durosimi Street	Positive	Positive
DAB	Borehole, Dailey Street	Positive	Positive
CHB	Borehole, Church Street	Positive	Positive
BAT	Tap, Bailey Street	Positive	Positive
ACB	Borehole, Awe Crescent	Positive	Positive
MOB	Borehole, Mosolasi Street	Positive	Positive
OLB2	Borehole, Olaleye Street	Positive	Positive
BRT	Tap, Bariga Street	Positive	Positive
MOT	Tap, Mosolasi Street	Positive	Positive
MDT	Tap, Modupe Street	Positive	Positive
ESB	Borehole, Esangbogun Street	Positive	Positive
MLFW	Morelife Factory Water	Positive	Positive

Biochemical Reaction of Isolates Recovered

This table shows the characteristics of isolates on EMB and MacConkey Agar and this is used for the primary identification of E. coli. It gives a green metallic sheen on EMB. All the isolates were Grams negative but showed pink colonies on MacConkey Agar. Only four out of the samples test positive on EMB.

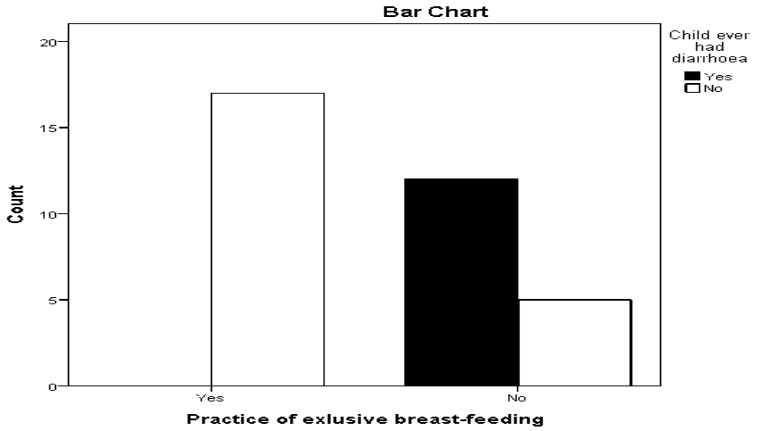
Isolates	**OLW**	**SOW**	**OLB 1**	**DIS**
Lactose Fermentation	+	+	+	+
Sucrose Fermentation	+	+	+	+
Glucose Fermentation	+	+	+	+
Indole	+	+	+	+
Motility	+	+	+	+
Citrate	-	-	-	-
Catalase	+	+	+	+
Methyl Red	+	+	+	+
Voges Proskeur	-	-	-	-
Hydrogen Sulphide	-	-	-	-
Gas Production	+	-	-	+
Identification	***E. coli***	*E. coli*	*E. coli*	*E. coli*

Biochemical characterization of the isolated e. Coli
Positive (+) Negative (+)
Olw-Olorunjare Street Well Sow-Sholanke Street Well Olb1-Olaleye Borehole Dis-Dimas Sachet Water

		Child ever had diarrhea		Total
		Yes	No	
Practice of exclusive breast-feeding	Yes	0	17	17
	No	12	5	17
Total		12	22	34

Practice of exclusive breast-feeding * Child ever had diarrhoea Crosstabulation Count

In this table, it is evident that the practice of exclusive breastfeeding is responsible for higher counts of children with no diarrhea and there are records of children with diarrhea as a result of little or no exposure to exclusive breastfeeding from their primary care giver. This shows that exclusive breast-feeding practices confer immunity on the children which prevent them from water associated diseases and other form of diseases.

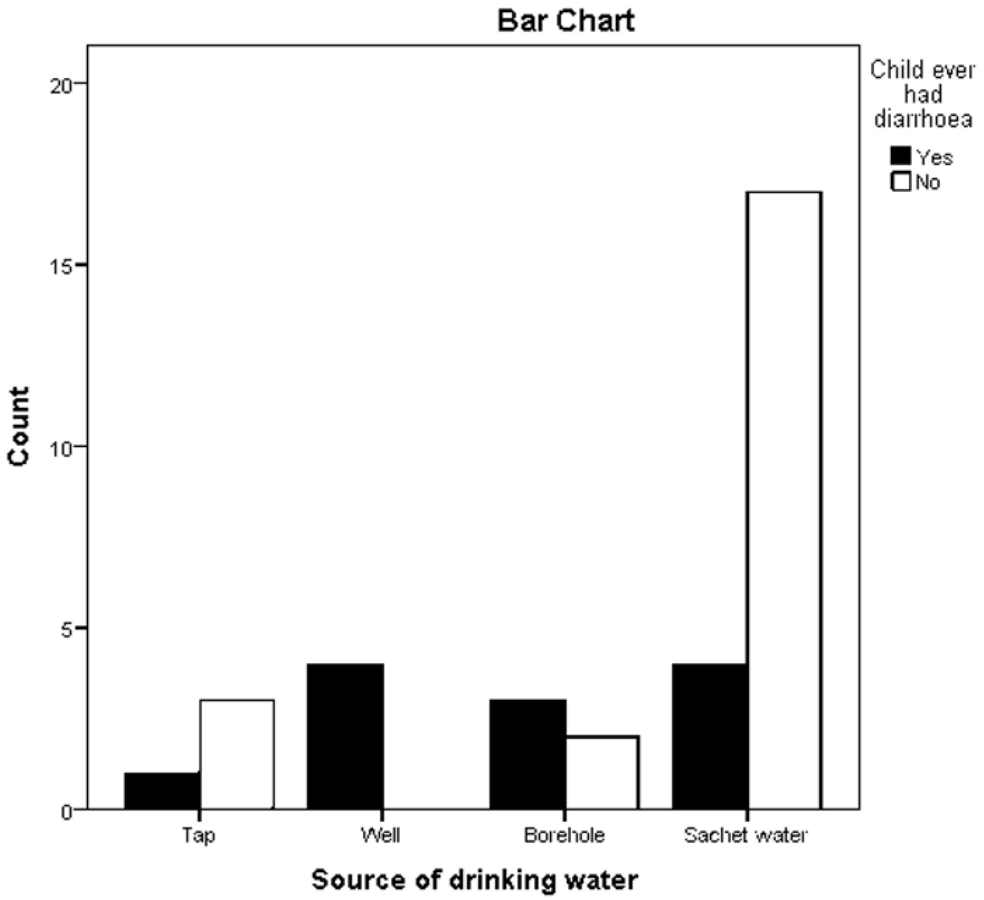


The Relationship Between Exclusive Breastfeeding and Occurrence of Diarrhoea

Source of drinking water	Child ever had diarrhea		Total
	Yes	No	
Tap	1	3	4
Well	4	0	4
Borehole	3	2	5
Sachet water	4	17	21
Total	12	22	34

Source of drinking water * Child ever had diarrhoea Crosstabulation
Count

In this table, the highest counts of diarrhea cases are associated with well water which is followed by sachet water and borehole. Little cases of diarrhea are assosciated with tap water. This indicated that effective water treatment is germane especially on well water sources.



The Relationship Between Source of Drinking Water and Occurrence of Diarrhea

SAMPLE CODE	CPX	TET	PFX	AUG	CRO	NIT	GEN	COT	OFL	AMX
OLW	S	S	S	S	S	R	R	S	S	S
SOW	S	S	S	R	R	R	S	R	S	S
OLB 1	S	S	S	R	R	R	S	S	S	S
DIS	S	S	S	R	R	R	S	R	S	S

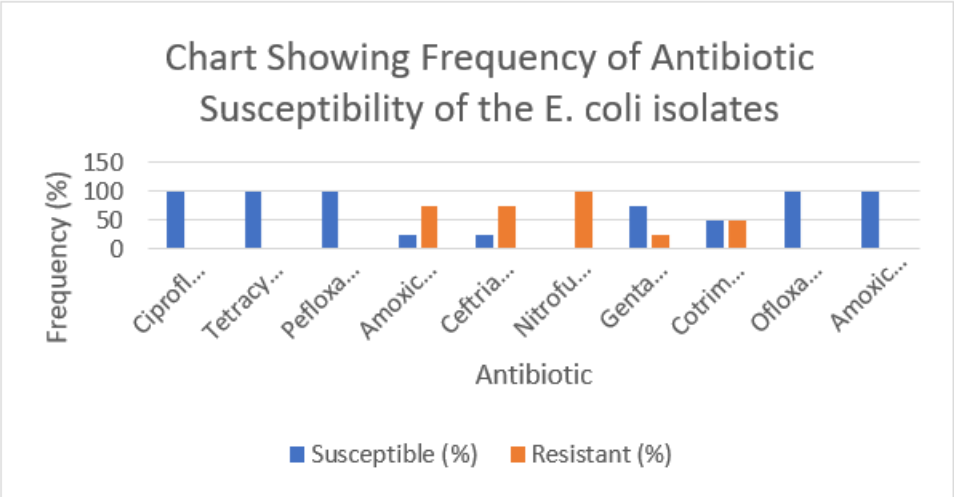
Antibiotic Susceptibility Profile of *Escherichia Coli*

KEY

R– Resistant
CPX – Ciprofloxacin
OFL – Ofloxacin
NIT –Nitrofuratonin
TET – Tetracycline
PFX – Pefloxacin
S – Susceptible
AUG – Augmentin
CRO - Ceftriaxone
AMX - Amoxicillin
GEN – Gentamicin
COT - Cotrimoxazole

Antibiotic with disc potency	Resistance	Intermediate	Susceptible	Total
Ciprofloxacin (5µg)	0	0	100	100
Tetracycline (30µg)	0	0	100	100
Pefloxacin (30µg)	0	0	100	100
Augmentin (30µg)	25	0	75	100
Ceftriaxone (10µg)	25	0	75	100
Nitraofuratonin (30µg)	100	0	0	100
Gentamicin (10µg)	25	0	75	100
Cotrimoxazole(25µg)	50	0	50	100
Ofloxacin(5µg)	0	0	100	100
Amoxicillin(25µg)	0	0	100	100

Frequency (%) of antibiotic Susceptibility of the *E. coli*



Frequency of antibiotic susceptibility of the E. coli isolates.

Table 5 depicts the susceptibility of the 4 isolates of Escherichia coli. In table 6, the frequency of the antibiotic susceptibility of the isolates is presented.100% of the E. coli isolates were susceptible to amoxicillin, tetracycline, ciprofloxacin, pefloxacin and ofloxacin.

A higher percentage of resistance was found to augmentin, ceftriaxone and gentamicin with 25% and cotrimoxazole (50%) respectively. The highest percentage of resistance was observed to nitrofurantoin (75%). No intermediate was observed.

Discussion

The current study showed that the prevalence of E. coli was higher in well water compared to other water sources. 100% of the E. coli isolates were susceptible to amoxicillin, tetracycline, ciprofloxacin, pefloxacin and ofloxacin. However, increasing resistance were noted for augmentin, ceftriaxone and gentamicin with 25% and cotrimoxazole (50%). The highest percentage of resistance was noted for nitrofurantoin (75%).

The introduction of antibiotics is one of the most important medical interventions with regard to reducing human morbidity and mortality. However, the intensive use of antibiotics (which was estimated in 2002 to be 100,000–200,000 tonnes per annum (Andersson and Hughes, 2010), worldwide has dramatically increased the frequency of resistance among human and animal pathogens and threatens a loss of therapeutic options. Resistance dramatically reduces the possibility of treating infections effectively and increases the risk of complications and of a fatal outcome. Furthermore, an enhancement of risk for acquisition of resistant organisms by animal hosts, because of selective use of antibiotics in human hosts in the same environment has been described by Lipsitch and Samore (2002).

Conclusion

Water is an elixir of life and its importance cannot be estimated. Any water that will be considered for human consumption and daily activities irrespective of its source must be subjected to effective water treatment in order to nip water related diseases into bud. Adherence to the standard use of antibiotic guildlines must be embraced to circumvent the adverse effect of antimicrobial resistance which is claiming human lives like a hunting wolf.

Recommendation

Good hygienic practices must be encouraged. Well water should be properly treated before use, use of a common fetcher should be embraced in various households and the well should be located far away from the sewage carnal. Proper and efficient waste disposal system should be provided. Primary care-giver should be sensitized on the numerous benefits associated with exclusive breastfeeding. Adequate and qualitative therapeutic management system should be established in various healthcares to circumvent drug abuse and antibiotic resistance.

References

1. Adebola Onanuga, Oluwatoyin Igbeneghu, Adebayo Lamikanra, (2014). A study of the prevalence of diarrhoeagenic Escherichia coli in children from Gwagwalada, Federal Capital Territory, Nigeria. The Pan African Medical Journal,17-146.
2. JOST, T., Lacriox, C., Braegger, C.P, et al., (2012). New insights in Guts Microbiota Establishment in Healthy Breast Fed Neonates,PLos omne, 7(8).
3. Khachatryan, A.R, T.E Besser, and D.R Call, (2008). The SSuT antimicrobial resistance element form calf-adapted Escherichia coli is widely distributed in Washington State cattle. Applied and Environmental Microbiology 74:391-395.Outbreaks of E. coli O104:H4 infection: update 29". WHO? 7 July 2011. Archived from the original on 8 August 2011.
4. Lipsitch, M., and Samore, M.H, (2002) Anti-microbial use and anti-microbial resistance: A A population perspective. Emerging Infectious Diseases; 8:347-354.