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Assessment of packaged water hawkers/vendors and the quality of the water in Kano metropolis, Kano state, Nigeria

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Abstract: This paper examines the quality of package water vendors their socio-demo graphic characteristics, personal hygiene of the water vendors with a view to assess possible contamination and assessment of the quality of package water at consumption point. Samples were taken from different hawking points from the six (6) local government areas of Kano metropolitan namely: Dala, Fagge, Gwale, Kano Municipal, Nassarawa and Tarauni. Result obtained in the study show that water vendors/ Hawkers personal hygiene and package water quality sold in various part of Kano metropolis exhibited variable characteristic interns of their micro biological quality. 50% of package water analyzed contains E. coli and, Aerobic mesophilics bacteria. And almost 70% of swab (Hawker/Vendors hands) analyzed contain either Enterobacter acrogens or Escherichia coli. This means that the package water is not good for human consumption. Recommendations were drawn based on the findings of the work.
Keywords: Packed water, Vendors, Bacteria, Contamination, Nafdac

INTRODUCTION

Package water today is highly makeable because people consider it as safe water for drinking failure to provide sufficient and portable water for Municipal service through municipal water system. This result many people to engage in package water activities ranging from establishment of package water production factories, down to retailers/vendors activities. The integrity of a hygienic environment and conditions where majority of the sachet water markets are produced has also been questioned [1]. Concerns of vertical transmission of disease pathogens by vendors have been raised. Although document evidence is rear, there are claims of past outbreaks of water borne illnesses that resulted from consumption of polluted sachet waters most of which are of unknown origin [2]. The National Agency for food and drugs administration control (NAFDAC) is the sole regulator established and empower to enforce compliance with the drinking qualities guidance; values are recommended by the world Health Organization [3]. Thousands of water vendors (mostly children) are found scattered in different parts of metropolitan Kano where millions of urban dwellers buy and consume from them daily. The personal hygiene of the hawkers is always very questionable because most of their cloth and the containers in which they store the product they hawk are also not hygienic. In a country like Nigeria where even the primary health care facilities are not well equipped to cater for first aid treatment coupled with a very low GDP and per capital income of the people, the personal hygiene of the vendor is a matter of great concern health wise and should always be checked. It was against this background that this work emanated and recommendation drawn.

MATERIAL AND METHODS

Study Area/ Sample Sites

The study area involved are six (6) local government area of Kano state viz: Dala, Fagge, Gwale, Kano Municipal, Nassarawa and Tarauni. While, the sampling sites are 12 selling points 2 each from the six (6) Local Government areas of Kano Metropolitan.

Sample Collection

Samples were collected according to the method of [3] where, a total of 120 structural questionnaires were administered across the study area with 30 each within each local government. Two samples were also collected of both swabs and water at each transept. Both were collected in a clean container and taken to the laboratory in a humid and dark cool environment and stored in the freezer.

Determination of Physical Charactertics

Physical and biological parameters analyzed include pH, odor, test, colour, hardness, aerobic microphysical bacteria count, coli form count, while

swab sample analysis include presence of contaminant (enterobacta acroyenes), absent of contaminant (escheria chiacoli). This entire are determined using appropriate instruments from microbiology laboratory, Bayero University Kano. Critical assessment observation of water vendors include personal hygiene, hands and finger nails, body cleanliness and clothes, nature or condition of environment of the water being sold.

Microbiological Analysis

Standard plate count

Sample preparation and serial dilution

A quantity (10ml) of the sample was diluted with 90 ml of sterile distilled water. This was labeled as 10^{-1} distilled. From the dilution one milliliter was transferred into a test tube containing 9ml of the dilatants and this tube is labeled 10^{-2} dilution. The procedure was repeated until 10^{-5} was reached [3].

Culturing Sample

Form each of the serially diluted tubes, one ml was transferred into appropriately labeled duplicate petridishes. This was followed by pouring aseptically molten nutrient agar. The plates were allowed to solidify and incubated at 37 ^{0}C for 24 hours [3].

Coliform counts

This was carried out according to the method of [3]. Water sample (50ml) was transferred in to a bottle containing 50ml of double strength lactose broth. Then 10ml of sample was transferred to each of five tubes containing 10ml of single strength lactose broth with Durham's tube, then 1.0ml of sample into each of five tubes containing 5ml containing 5ml single strength lactose broth. The tubes were incubated for 24 hours in 35 ^{0}C, and for other 24 hour in the absence of gas. Following 24 hours incubation, the tubes were observed for gas production, and the number of gas positive tubes was be compared with the most probable Number table (MPN), to get MPN of coli forms per milliliter of sample.

Detection of Escherichia coli

The swab sticks obtained by swabbing the palms of the hawkers were streaked on cosine methy-line blue agar and incubated for 24 hours at 35 ^{0}C. Following incubation the plates were observed for the presence of bluish black colonies with green metallic sheen which are suspected colonies of E. coli.

Data Analysis and Interpretation

The following are the various data obtained from the field investigation. In view of this, tables were drawn to make comprehension easier using simple percentage software (SPSS).These were carefully carried out.

RESULT AND DISCUSSION

Age Distribution of the Respondent

Table 1 shows the age distribution of the respondent. The analysis below shows that the proportion of the age range (7-10) and (11-14) showing higher street water selling than the age range 19 and above which constitutes about 10.8% as illustrated on the table. The reason for the high increase in the age range (7-10) is due to the fact that they don't attend schools at early age.

Table-1: Age Distribution of the Respondent

Age distribution	Frequency	Percent	Cumulative
7 – 10	39	32.5	32.5
11 – 14	51	42.5	75.0
15 – 18	17	14.2	89.2
19 Above	13	10.8	100.0
Total	120	100	

Source: fieldwork 2016

Gender Distribution

The result on the table 2 below shows that 82.5% of the water vendors are male while the female composition in the water hawking business is lower constituting about 17.5%.

Table-2: Gender Distribution

Sex	Frequency	Percent	Cumulative percent
Male	99	82.5	82.5
Female	21	17.5	100.0
Total	120	100	

Source: fieldwork 2016

Ethnicity Distribution on Water Vendors

The information on ethnicity distribution of water vendors were illustrated below. The table below shows that Hausa has the highest in the street hawking activity with 77.5% followed by Fulani 13.

Table-3: Ethnicity Distribution of the Water Vendors

Ethnicity	Frequency	Percent	Cumulative Percent
Hausa	93	77.5	77.5
Fulani	16	13.3	90.8
Yoruba	6	5.0	95.8
Other	5	4.2	100.0
Total	120	100.0	

Source: fieldwork 2016

Educational Qualification of the Water Vendors

Table 4 shows the educational qualifications of the water vendors indicating 78.3% of the vendors attended Arabic education while, 21.7 western educations.

Table-4: Educational Qualification of water vendors

Educational Qualification	Frequency	Percent	Cumulative Percent
Arabic education	94	78.3	
western education	26	21.7	78.3
Total	120	100	100

Source: fieldwork 2016

Education and Micro-Organism Awareness

Table 5 shows the information on education and its relationship on the awareness of the impact of micro-organism. From the analysis presented on the table below, western education has the higher awareness of the impact of micro-organism on humans than those water vendors who did not attend western education. The high number of unaware vendors on the impact of micro-organism has posed a risk to the consumers of water from the vendors.

Table-5: Education and Micro-Organism Awareness

	Impact awareness of micro-organism		
Education Type	**No**	**Yes**	**Total**
Arabic education	63	31	94
Western education	11	15	26
Total	74	46	120

Source: fieldwork 2016

Relationship between education and washing hands

Table 6 shows the relationship between vendors washing hands before selling water and education shown on the table below. The table below indicates that western educated vendors have higher proportion in terms of washing hands than Arabic education. The reason is that the vendors are not disciplined about personal hygiene from their Arabic teachers.

Table-6: Relationship between Education and Washing Hands

	EDUCATION TYPE		
	Arabic Education	**Western Education**	**Total**
How often do you wash your hands			
Regularly	61	5	66
Not regularly	33	21	54
Total	94	26	120

Source: fieldwork, 2016

Water Container Type and Awareness of Micro-Organism

The information on the water selling containers standard and the awareness on the impact of micro-organism. On the analysis above the table indicates that standard containers are mostly used by those vendors that are aware of the impact of microorganism than those vendors lacking awareness there level of hygiene is incomparable with the standard container users.

Table-7: Water container type and awareness of Micro- Organism

Impact awareness of micro-organism			
	No	**Yes**	**Total**
Selling container type			
Standard	49	16	65
Not Standard	25	30	55
Total	74	46	120

Source: fieldwork, 2016

AEROBIC PLATE COUNT OF THE PACKAGE WATER SAMPLE

In table 8, the result shows that sample 167 in every one w\mile of water it contain 1.20 x 103 (CFU/ml) of aerobic microphilis plate count. This means, that water is not good for human consumption. According to NAFDAC, WHO regulations portable water for indicators of faucal contamination and aerobic microphilis plate a count of drinking water must be zero [4]. However, the same kind of result indicated in sample 94, 66, 172 and 57. When indicated numbers of aerobic microphilis bacteria are present in same package water within Kano metropolis.

While some, package water samples analyzed are free from bacteria's those samples are sample 46, 158, 6, 31, and 25 indicating the Water is safe for human consumption.

Aerobic microphilis bacteria are indicator organism that grow and live at the temperature between 20 ^{0}C to 40 ^{0}C in the present of oxygen, and express in colony forming unit. It means growing of bacteria cell that form colony.

Present of those bacterial above setting number has capable of causing urinary tract infection, bacteremia, meningitis, diarrhea, acute renal failure and hemolytic anemia [5].

Table-8: Aerobic Plate Count of the Package Water Sample at Vending Sites

S/no	**Sample**	**Aerobic Plate Count (CPU /Ml)**
1	167	1.20 xlO^3
2	94	5.10 x 10^1
3	60	4.20 xlO^1
4	172	3.10 xlO^1
5	100	NSG
6	46	NSG
7	158	NSG
8	6	NSG
9	57	1.30 x 10^5
10	31	NSG
11	25	NSG

Source: Laboratory analysis (BUK 2016) *N S G: No Significant growth*

COLI FORM COUNT OF PACKAGE WATER SAMPLE AT VENDING SITES

Table 9 shows the coli form count of water samples at the vendors point/ site, numbers of gas tubes positive as well as most probable number (MPN/M1). The result shows that sample 169 has coli form count of 7 (MPN/ml) in every 1ml of water with 1, 1, 2 number of positive tunes (The tunes that produces gas). According to this standard, portable water for human consumption must contamination, and, coli form, count per 100ml of drinking water must be zero [4].

Coli forms were detected in sample 57, 94, 60 and 172. While coli form can, live in human gastro intestinal tract and cause many infection. This shows that this package water is not safe for human consumption.

While some package water samples analyzed in table 7: shows less coli form count or absence of coli form this samples are: sample 100, 46, 158, 6, 31 and 25.

Table-9: Coli Form Count of the Package Water Sample at Vending Sites

Sample	Gas No: of positive tubes	MPN/ML
167	1,1,2	7
94	1,2,0	5
60	0,2,1	3
172	1,2,0	5
100	0,1,0	1
46	0,1,0	1
158	0,0,0	1
6	0,2,0	2
57	1,4,0	13
31	0,0,0	1
25	0,0,0	1

Source: Laboratory analysis (BUK 2016)
MPN: Must Probable Number
N S G: No Significant growth

SWAB STICK SAMPLE

Table 10 presented the swab result. The essence of Swabs collection from the hands of water vendors/ retailers is to investigate whether their hands are contaminated which contaminate the package water while, drinking the contaminant will be ingested into human body.

From the result analyzed most of their hand are contaminated because it contain Escherichia coli, Enterobacter etc. where in some sample has much number of colonies, this shows that the water vendors are the contributors to the water contaminations. In any water / food the present of such organism E. coli the water is not safe for the drinking. If the E. coli and Enterobactor is presence in any human body /or hands he is not fit to handle the water and the water is not good in any way for human consumption. Table 10 also shows the result in details of one day incubated result and 48 hours result. From the result package water Hawker/vendors are the contributors of disease transmission to human body through drinking faecal contaminated package water.

Table-10: SWAB STICK SAMPLE

S/n	Swab Stick Sample	Result (1st reading) within 24 hours	Result (2nd reading) within 48 hours
1	2	NG	
2	1-70	One Pinkish Colour	Enterobacter Aerogenes
3	46	NG	
4	174	One Pinkish Colony (small)	Enterobacter
5	28	One Pinkish Colony (small)	Enterobacter
6	80-90	10 Colonies (big *and* shiny)	E. coli
7	131	NG	
8	61	2 small Colonies (pinkish)	Enterobacter, E. coli
9	91	NG	
10	94	One colony (Small greenish and shiny)	E. coli
11	118	NG	
12	108	NG	E. coli
13	138	One colony (small greenish and shiny)	E. coli
14	151	NG	E. coli
15	100	one colony (small and pinkish)	Enterobacter
16	121	NG	
17	144	NG	
18	172	NG (with fungal like growth)	
19	165	One Colony (Small)	
20	116	NG	
21	50	2 Colonies (pinkish)	Enterobacter, E. coli
22	20	NG	
23	60	30 Colonies (very tiny and pinkish)	Enterobacter
24	167	NG	

25	34	19 colonies (pinkish and shiny)	Enterobacter
26	70-80	1 big colony(pinkish and shiny)	E. coli
27	9	NG	
28	31	1 colony (small and greenish)	E. coli
29	132	NG	
30	21	NG	
31	57	NG	
32	25	NG	
33	6	3 colonies (small, green shiny)	
34	158	NG	
35	150	NG	
36	80-90(AI-Ansar)	32 colonies (small, greenish and shiny)	E. coli

Source: Laboratory analysis (BUK 2016)
NSG- No significant Growth

Physical parameter

The result showed that for physical parameters (Table 11) pure water had pH which ranged from 6.5 - 8.5, which is odourless and colourless, while the test of package water is tasteless. More important in this study for physical parameter were found within NAFDAC approve standard.

Table-11: Physical parameter of the Water Sample Analysis at the Vending Site.

Parameters	Reading
pH	6.5-8.5
Colour	Colourless
Taste	Tasteless
Odour	Odourless

Source: Laboratory analysis (BUK 2016)

DISCUSSION

Result obtained in the study show that water vendors/ Hawkers personal hygiene and package water quality sold in various part of Kano metropolis exhibited variable characteristic interns of their micro biological quality. 50% of package water analyzed contains E. coli and, Aerobic mesophilics bacteria. And almost 70% of swab (Hawker/Vendors hands) analyzed contain either Enterobacter acrogens or Escherichia coli. This means that the package water is not good for human consumption. Accordingly, water meant for human consumption must be free of microbial indicator count and must be zero [4]. Present of those bacteria in package water or vendors hand is capable of causing urinary tract infection, bacteria anemia, meningitis, diarrhea, acute renal failure and hemolytic anemia [6].

Result shows that water vendors/retail person hygiene is totally poor, their hands are contaminated which contribute to contaminate the package water while drinking, that contaminated water will be ingested into human body. If the E. coli and Enterobacter are present in any human body or hands that person is not fit to handle the water and the water is not good for human consumption.

Lastly, from the result package water & Hawker/ Vendors are the contributors of diseases transmission to human body through drinking faecal contaminated packaged water in Kano metropolis.

CONCLUSION

This study covered six local government areas in Kano metropolis of Northern part of Nigeria. The results show that the health implication of these Hawker/ Vendors and their package water, on immediate or on long - term basis might not be good to the society.

The case is worsened by the isolation of bacteria one of which is of faecal origin and as such, the so called pure water after all may be contaminated or poorly processed water.

There is the need for the public to be properly informed on the presence of packaged drinking water of doubtful qualities in the markets. The consuming public also must be informed of the consequences of consuming contaminated package water and the vendors' personal hygiene practices.

RECOMMENDATION

Based on the outcome of this research work we would like to give the following recommendation:-

- The producers of packaged water should endeavors to disinfect their product with solar radiation which is sample to construct and easy to maintain.
- Environmental managers/officers in the states and local government employment owe it a duty to the public to educate the Vendors.

- Stringent NAFDAC regulation and enforcement will be put in place so as to comply with the standard.
- Producers of package water should drill their borehole 30 m away from fit latrine, gutter and landfill site and other doubtful environmental sources.
- Similar research should be conducted or carried out on normal, time interval.

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