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Diarrhoea among Children under Five Years Old in Relation to Household Safe Storage Practices in Wukari Local Government Area, Taraba State, Nigeria

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Abstract

Diarrhoea remains a leading cause of morbidity and mortality among under-five children in Nigeria, particularly in rural settings where unsafe water handling and inadequate storage prevail. Diarrhea is defined as the passing of three or more watery or loose stools per day, or more frequent passage than normal for an individual. This cross-sectional study assessed the determinants of diarrhoea in relation to household water practices in Wukari Local Government Area (LGA), Taraba State. The aim was to identify water-related risk factors—source type, treatment method, storage container, and hygiene behaviours—that influence diarrhoeal occurrence among children <5 years. A community-based survey was conducted across randomly selected areas of Wukari LGA. Structured questionnaires captured socio-demographics, water source (protected well, borehole, surface, sachet), treatment (boiling, chlorination, filtration, none), storage (covered narrow-necked jerry can, open bucket, other), and hand-washing practices. A total number of 200 sample were collected for this study among children of five (5) years of age. The result

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shows a prevalence of 34% (n=200) representing 34% (68) respondents of positive and 66% representing 132 respondents of negative. In conclusion, this study demonstrates that despite relatively high access to improved water sources (protected wells/boreholes) in Wukari, the prevalence of diarrhoea among children under five remains elevated (34%) because of pervasive unsafe practices downstream—principally failure to treat water before consumption, storage in uncovered buckets that permit re-contamination, and fetching water with unclean hands. Microbiological evidence confirmed significantly higher faecal coliform counts in open-bucket water, substantiating the causal pathway. Maternal education acted as a buffer, underscoring the role of health literacy. The findings indicate that interventions must shift focus from mere source improvement to promoting point-of-use safety—treatment, covered storage, and hand hygiene—to achieve meaningful reductions in diarrhoeal disease. To this end, it is recommended that; Community-based water safety education, provision of affordable safe-storage vessels, point-of-use water treatment promotion, strengthen maternal health literacy, microbial monitoring, policy advocacy and research follow-up. Implementation and follow-up practices which has to do with giving priorities to areas with highest diarrhoea prevalence (identified in survey) for rapid rollout; monitor via existing Integrated Disease Surveillance & Response (IDSR) system will reduce the prevalent rate of under-five diarrrhoea in Wukari which by extension Taraba State and North East in general.

Keywords: Under-Five Children; Diarrhoeal Disease; Household Water Treatment; Safe Water Storage; Hygiene Practices

INTRODUCTION

Diarrhea is one of the leading causes of morbidity and mortality, especially among children under the age of five years (Imarenezor et al., 2022). Globally, as many as 800,000 children die each year from diarrhea, with most deaths occurring in developing countries (Imarenezor, 2017). Diarrhea is defined as the passing of three or more watery or loose stools per day, or more frequent passage than is normal for an individual. This is contrary to passage of frequent formed stools or the loose pasty stools passed by breast fed babies. It is both preventable and treatable. It is also a leading cause of malnutrition in children under five years old (WHO, 2023). Diarrhea is commonly a sign of an infection in the intestinal tract that is caused by different bacteria, virus and parasitic entities (Imarenezor et al., 2025). These explain that diarrhoea among under-five remains a major public health

concern especially in low and middle-income countries. Diarrhoea disease compromises many children under five lives by limiting their capacity and killing them. In 2016, diarrhoea was ranked the fifth leading cause of deaths among children under five causing about 446 000 deaths (Imarenezor et al., 2018; Troeger et al., 2018). Although, death is the most serious of outcomes, diarrhoea is non-fatal illness and harmful because it also affects children school attendance and performance. It can affect a child's cognitive and physical health during the first 1000 days after conception, a main period of brain development (Imarenezor et al., 2024; Fenta et al., 2019). Although, improving access to safe water, adequate sanitation and proper hygiene are on the frontline of efforts to achieve the anticipated 2030 Sustainable Development Goal 3 and 6. However, unsafe wash is largely attributed to the cause of diarrhoea, a major cause of deaths among children under five. About 297 000 children under five die each year as a result of poor wash (WHO 2023).

In low-income countries, the two most common etiological agents of moderate-to-severe diarrhea are rotavirus and Escherichia coli (Imarenezor et al., 2024). Diarrhea is more common when there is a lack of adequate sanitation and hygiene, safe water supply for drinking, cooking, and cleaning, improper feeding practices, and a poor housing situation (Chopra, et al 2012). Diarrhea continues to be one of the leading causes of child mortality, mostly in children less than 5 years of age living in low and middle-income countries (Mathers, et al 2015).

The aetiology of diarrhoea may be infectious or non-infectious. Non-infectious diarrhea has factors such as food in-tolerances (lactose and gluten), intestinal complications (irritable bowel syndrome, ulcerative colitis, Crohn's disease, and celiac disease), and reactions to drugs (Humphries and Linscott, 2015). Before the late 1960s, less than 20% of enteric infection symptoms could be linked to a specific aetiologic agent by any known diagnostic method (Anyiam and Imarenezor 2024). Diarrhoeal diseases are caused by several viral, bacterial, and protozoan species. Infections by a spectrum of enteric pathogens are the norm in diarrhoeal diseases (Serrano & Millan, 2014). Rotaviruses and diarrhoeagenic E. coli (DEC) are the most reported enteropathogens globally, with the DEC being particularly important in resource low countries (Imarenezor et al., 2024). Evidence based studies from Sudan (Adam et al., 2018), Burkina Faso (Bonkoungou et al., 2013;), Nigeria (Imarenezor et al., 2017), and other endemic regions reveals that a significant amount of diarrhoea episodes in children are caused by enteric viruses. Rotaviruses, Noroviruses, Adenoviruses, Bocaviruses and Caliciviruses have been

implicated in childhood diarrhoea (Aktaş et al., 2019). However, recent reports show rotaviruses as the major cause of fatal cases among children below 5 years old (Gatinu and Giri et al., 2019). Moreover, group A rotavirus, in particular, is the prominent aetiological agent that is responsible for infantile gastroenteritis globally, causing an estimated 20% of diarrhoea-related deaths in children below the age of five. Low-income countries and those which have no running RVA vaccination programmes are particularly affected by the rotavirus group A (RVA) diarrhoea (Gatinu et al., 2016; Zhang et al., 2018; Imarenezor et al., 2017).

Diarrhoeagenic E. coli (DEC) has been grouped into six pathotypes based on their pathogenic processes and clinical features. These subtypes are enteropathogenic E. coli (EPEC), enterohemorrhagic E. coli (EHEC), enterotoxigenic E. coli (ETEC), enteroinvasive E. coli (EIEC), enteroaggregative E. coli (EAEC), and diffusely adherent E. coli (DAEC). DEC pathotypes have also been further categorized based on their virulence mechanisms (Zhang et al., 2016; Thakur et al., 2018). Also, there are important regional variations in the prevalence of the different DEC pathotypes. DEC pathotypes from different locations around the globe are genetically diverse (Imarenezor et al., 2025). In outbreak situations, Vibrio cholerae, Escherichia coli and Clostridium difficile have been reported as the causative agents of diarrhoea (Camacho et al., 2018 & Weill et al., 2019).

The role of viruses as agents of diarrhoea outbreaks among children cannot be overemphasized. Astroviruses in Noroviruses in China (Rogers et al., 2019), and Rotaviruses in India (Erick, 2020) have been implicated in childhood diarrhoea outbreaks.

The parasitic diarrhoeal diseases of public health importance are Amebiasis (Entamoeba histolytica), Cryptosporidiosis (Cryptosporidium spp) and Giardiasis (Giardia lamblia). The two predominant causes that have been reported are Cryptosporidium and Giardia, of which Cryptosporidium is the more medically important across the world (Kotloff et al., 2013; Troeger et al., 2017).

Acute watery diarrhoea often presents with sudden development of an unusual frequent stooling of mostly fluid. Other signs are vomiting, fever, nausea and abdominal pain (Dipasquale et al., 2018). In the gastrointestinal tract, absorption of over 90% of the physiologic net fluid takes place in the proximal small intestine. The pathogenic mechanism that leads to diarrhoea occurs when enteric pathogens attack the proximal small intestine (Imarenezor et al., 2021). Acute watery diarrhoea is often caused by enterotoxin-secreting

bacteria such as enter toxigenic Escherichia coli (ETEC), and Vibrio cholerae, which cause fluid loss without cellular injury (Willey et al., 2013). Viruses such as rotaviruses and caliciviruses that damage the intestinal epithelium also cause fluid loss. Besides, they have more tendencies to cause fever, vomiting and watery stools without blood and mucus (Tagbo et al., 2019). Usually, cases of watery diarrhoea run an acute but brief (1–3 days) self-limiting duration.

Dysentery is bloody diarrhoea, that is, any diarrhoeal episode in which the loose or watery stools contain visible red blood (WHO, 2023). Dysentery is most often caused by Shigella species (bacillary dysentery) or Entamoeba hystolytica (amoebic dysentery). Dysentery starts with the sudden onset of repeated stooling. However, unlike acute watery diarrhoea, stools are often smaller in quantity and are characterized by blood and pus. Thus, it is also referred to as acute bloody diarrhoea. Dysentery usually presents with fever, tenesmus, abdominal pain, and cramps; vomiting occurs less often (Wang et al., 2019). Inflammation of the colon (the part of the large intestine that extends from the cecum to the rectum) due to infection by one of a number of enteric pathogens leads to dysentery. The main cause of dysentery in children is the Shigellae (Tickell et al., 2017).

Persistent diarrhoea is acute as well as prolonged (at least 14 days) rather than brief also referred to as chronic diarrhoea (Centres for Disease Control and Prevention, 2021). The case may begin with the passage of frequent watery or bloody stool but last for a long period thus causing loss of weight. It accounts for less than ten percent of all diarrhoea but is responsible for 30 to 50 percent of death caused by diarrhoea Persistent diarrhoea has different causes which are either infectious or non-infectious. The infectious causes include intestinal parasites (Cryptosporidium, Cyclospora, E. histolytica, Giardia, Microsporidia), bacteria (Aeromonas, Campylobacter, C. difficile, E. coli, Plesiomonas, Salmonella, Shigella), and viruses (norovirus, rotavirus). While the non-infectious causes include altered immune function, disorders of the pancreas, medications (antibiotics), heritable metabolic disorders (enzyme deficiency), intolerance to some food products (gluten, lactose), intestinal disorders, disorders of the thyroid, and reduced blood flow to the intestines (Centre for Disease Control and Prevention, 2021).

Major organisms that are responsible for persistent diarrhoea are enter aggregative E. coli, Shigella, and Cryptosporidium (DuPont, 2016). The pathogenesis of persistent diarrhoea could be multifactorial and fundamentally based on continuous damage to the

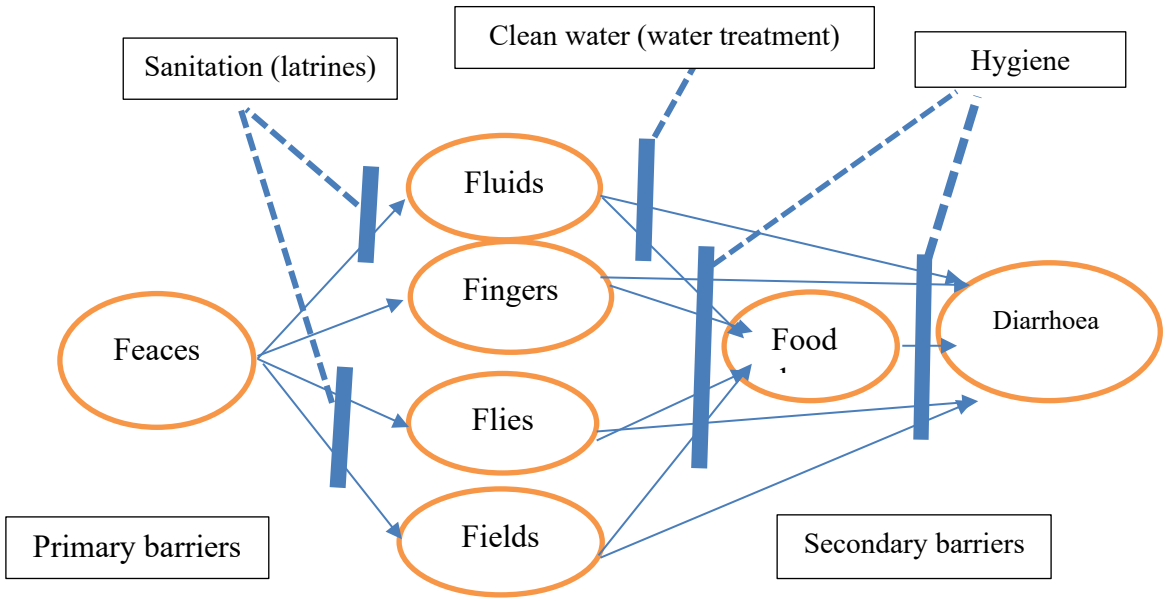
mucosal linings of the intestines due to several infections with different pathogens (Weill et al., 2019). Malnutrition also increases the likelihood of death in children with persistent diarrhoea. Evidence based studies have established a strong relationship between chronic diarrhea and HIV-positive patients in developing countries (Imarenezor et al., 2024).

Diarrheal disease affects human life both in developed and developing countries. Acute diarrhea is one of the main problems affecting children under- five in the world, reducing their wellbeing, and this leads to a considerable demand for health care services. Despite the fact that it affects both developed and developing countries, it is evident that there is a strong relationship between diarrhea, poverty and unhygienic environmental conditions (Imarenezor, et al., 2023). Diarrhea can be caused by numerous pathogens and transmitted through multiple vehicles. Some of the most common pathogenic causes of severe and fatal diarrhea in young children globally are rotavirus and shigella. Rotavirus takes the lives of over 3,600 children under five years and accounts for approximately 40% of all deaths caused by diarrhea (CIDRZ, 2013). Risk factors for diarrhea among children include age, sex, geographic location, drinking from unprotected water supply and household economic status. While poor sanitation, limited access to potable water, inappropriate breast-feeding practices contribute to the burden of the disease, there continues to be the need to further document the socio-demographic correlates of diarrhea in order to inform policy and programmatic interventions that have potential to stem the prevalence of the disease (Imarenezor et al, 2023). Many studies including cohort and case control studies on diarrhea and associated factors have been done in developed and undeveloped (developing countries) and most of them were based on small hospital and community-based studies. Furthermore, the prevalence and correlates of diarrhea may vary with season, geographical area and between countries (Imarenezor et al, 2023). Persons living in developing countries with poor access to safe water, sanitation, or hygiene infrastructure have increased risk of exposure to viral, bacterial and parasitic pathogens that can cause diarrheal diseases (Imarenezor et al., 2022).

Lack of adequate safe drinking water, absence of basic sanitation and poor hygienic practices are associated with high morbidity and mortality of excreta borne diseases. Water has a great chance of contamination by pathogens if the water source not protected and with the lack of the above-mentioned factors this leads to contamination at house hold level. Diseases caused by contaminated water consumption and poor hygiene practices are

the leading causes of death among children worldwide especially in developing countries (Imarenezor et al., 2021).

To overcome the difficulties in providing safe water, household water treatment has been advocated as a means to improve access to potable water and decrease the global burden of diarrhoea disease (Imarenezor et al., 2020). However, in Nigeria previous studies on the effectiveness of water quality interventions in reducing diarrhoea failed to consider the relative importance of household water treatment. For this reason, little is known in Nigeria, leading to low uptake and use, especially among rural population who are more at risk of water borne disease. It is difficult to identify the population that benefit most from the potential effect of the intervention. It is against this backdrop in literature that, the current study examined the effect of household of water treatment on under-five diarrhoea in Nigeria.



F-diagram of fecal-oral disease transmission and the barriers

Source: WHO (2023).

METHODOLOGY

The Study Area

This study was carried out in the Department of Microbiology, Federal University Wukari, Taraba State, Nigeria. Wukari metropolis is a large town which is the Headquarter of Wukari Local Government Area of Taraba State. Geographically, Wukari lies between

latitude 7°55'42" North and longitude 9°47'59" East. It has an area of 4,308 km2. Wukari is home to Federal University Wukari, Kwararafa University and National open university. The major languages spoken are Jukun, Kutep, Tiv, Hausa and Fulani (Imarenezor et al., 2018).

Study Population

The study populations used in this research work are children and their caregiver/mother residents in Wukari local government area who are civil servants, students, employed and unemployed. Any consented households with children below five years in the Wukari District were included in the study.

INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria any consented households with children below five years in Wukari District were included in the study.

Exclusion criteria Households were excluded in the study if:

1. They had children above 5 years of age,

2. They had children under 5 years of age who were critically ill,

3. The caregivers refused to consent.

Sample Size Determination

The sample size for the survey was determined using the statistical formula for population sample size estimation.

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

Where:

n = desired minimal sample population

z = standard normal deviate which is 1.68 at 95% confidence level.

p =estimated diarrhoea disease among under five children and household treatment and safe storage factor {19%) (WHO/UNICEF, 2011).

d = degree of accuracy (0.05)

N= Total diarrhoea disease among under five children and household treatment and safe storage factor

Therefore, using a confidence of 95% that corresponds to the standard normal deviate of 1.96, the proportion in the target population is estimated at 19%, total number ward across wukari was 200 household will be obtain and the degree of accuracy required is 0.05. This was applied as

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

Follows

n = 1000

z =1.68

e = 0.05

p= 0.5

Sample size = 220

Approximately = 200 samples

Sampling Method

Random sampling method was used to select cases of diarrhea among children and household water treatment and safe storage factor in Wukari local government area. This is a sampling technique where by all those involved have equal chances of being selected for analysis.

Instrument of Data Collection and Data Collection Approach

Data collection was done using a questionnaire. Two hundred questionnaires were distributed with prior instructions on how to fill it under strict supervision.

Data Entry and Analysis

In the quantitative study, each participant was interviewed by a trained research assistant in a private area where they felt comfortable in answering questions. The researcher used three (3) research assistants trained on ethical consideration involving human subjects. These were public health students who were able to communicate fluently in Jukun, Kuteb, Hausa and English. The questions included personal details, such as, age, education, occupation status, marital status, and numbers of household members as well as information on Diarrhoea among children and household water treatment and safe storage factors such as, source of drinking water, treatment of water, sanitation and hygiene practices and breastfeeding and vaccination. The average time taken to complete each questionnaire was 5-10 minutes depending on the caregivers' response to the questions. The research assistants ensured completeness of tools by cross checking the completed questionnaires. Data collected were entered and sorted by Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics (of frequency, percentage) was used to summarize prevalence, mortality and management outcome for the different socio-demographic variables and test of association was carried out using Pearson Chi-square and Correlation tests. Statistical level of significance was held at $p < 0.05$ for test of association.

Validity and Reliability of data

Prior to the pre-testing the research instruments, professional opinion and expertise from the assigned university supervisors and from the public health specialist from Wukari were sought for purposes of face and content validity of the instruments. Validity of qualitative data was also ensured through triangulation of the results from quantitative with the information from the Pretesting of the study tools ensured that the required information was collected. Data collection plan ensured that mobilization and data collection for both quantitative and qualitative interviews were conducted concurrently to ensure that participants for the survey, this ensured that the study captured diverse opinions to enrich the study findings.

Data Management and Analysis

The quantitative data was entered into MS Excel spreadsheet package. It was coded, cleaned and exported to Statistical Package for Social Sciences (IBM SPSS) version 21 where univariate and bivariate analyses were conducted. Descriptive statistics were

computed for the independent variables of age, sex, socio-economic status, environmental related factors, breast feeding, and health seeking behavior and vaccination status. Bivariate and multivariate analyses were also conducted. For the qualitative survey, the notes were transcribed and the information coded and organized into relevant sub-themes and analyzed thematically by organizing the information collected. The coding framework was developed based on the study guide and from reading the interview scripts

Ethical Considerations

A Letter of Introduction and Ethical clearance was obtained from the Research Ethics Committee of the National Open University of Nigeria (NOUN) before the research was conducted. Informed consent was obtained from parents prior to their participation in the survey and participants were informed about their right to withdraw from the survey whenever they are uncomfortable to continue. This research maintained the ethics of research in line with the confidentiality and safety of respondents.

RESULTS

All data were collected from household in Wukari local government area of Taraba State. The total sample used and presented in this research work is two hundred 200 household. Data are presented on background of the participants and the clinical details of diarrhoea among children and household water treatment and safe storage factor.

Social-Demographic Characteristics of the Study Population

Table 1: Show Distribution of study population by ward in Wukari Local Government Area of Taraba State

Respondents	Frequency	Percentage
Avyi	**20**	**(10%)**
Akwana	**20**	**(10%)**
Bantage	**20**	**(10%)**
Chonku	**20**	**(10%)**
Hospital	**20**	**(10%)**
Jibu	**20**	**(10%)**
Kente	**20**	**(10%)**
Puji	**20**	**(10%)**
Rafin kado	**20**	**(10%)**

Respondents	Frequency	Percentage
Tsokundi	20	(10%)
Total	200	100

Table **2:** Show the Reported prevalence of under-five diarrhoea in the household

Characteristics	Frequency	Percentage (%)
Did the child experience Diarrhoea in the past 2 weeks [N=200]		
Yes	68	(34%)
No	132	(66%)
Total	200	100

Table 3: Show Household water sources and water treatment practices for drinking

Water source	Frequency	Percentage (%)
Deep well	102	(51%)
Shallow well	98	(49%)
Total	200	100

Table 4: shows household water treatment practices in Wukari Local Government Area of Taraba State

Household	Frequency	Percentage (%)
Do you do anything to make water safer to drink? [N=200}		
Yes	132	(66%)
No	68	(34%)
Why don't you treat your drinking water? [N=200]		
I do not know any method of treatment	37	(18.5%)
Costs	33	(16.5%)
Bad taste and smell of treated water	49	(24.5%)
Belief that water is safe from the source	28	(14%)
Used to drink untreated, nothing happens to us	36	(18%)
Others	17	(8.5%)
Total	200	100

Table 5: Show Household water treatment and safe storage Options (HWTS) in Wukari Local government Taraba State

Household	Frequency	Percentage (%)
What do you normally do to make water safe to drink [N=200]	**87**	**(43.5%)**
Boiling methods	**15**	**(7.5%)**
Use of chlorine method	**47**	**(23.5%)**
Allow it stand and settle method	**51**	**(25.5%)**
Strain with cloth method		
Which container do you normally store water for drinking[N=200]	**59**	**(29.5%)**
Store in Bucket with a lid	**38**	**(19%)**
Store in Bucket without a lid	**71**	**(35.5%)**
Store in Jerry cans without lid	**18**	**(9%)**
Use of Soil pot without lid	**14**	**(7%)**
Others		
How do you draw water for drinking from containers (N=200)	**116**	**(58%)**
Use a cup	**67**	**(33.5%)**
Use small pan	**17**	**(8.5%)**
Others	**200**	**100**

Table 6: Show Social economic characteristics of households of under-five children in Wukari Taraba State

Characteristic	Frequency	Percentage (%)
What type of toilet do household members normally use? [N=200]		
Flush/Pour flush to septic tank	**33**	**(16.5%)**
Flush/Pour flush to pit latrine	**52**	**(26%)**
Pit latrine with slab	**63**	**(31.5%)**
No facility/bush	**41**	**(20.5%)**
Others	**11**	**(5.5%)**
Do you use soap for hand washing following house activities[N=200]		
Yes	**177**	**(88.5%)**
No	**23**	**(11.5%)**
Total	**200**	**100**

Table 7: Show social distribution of study population by their demographic characteristics of under-five children in Wukari Taraba State

CHARACTERISTICS	FREQUENCY	PERCENTAGE %
SEX [N=200]		
male	94	(47%)
Female	106	(53%)
AGE DISTRIBUTION [N=200]		
0-1year	87	(43.5%)
2- years	46	(23%)
3-years	30	(15%)
4-years	24	(12%)
5-years	13	(6.5%)
NUTRITION STATUS [N=200]	141	(70.5%)
Malnourished	21	(10. 5%)
Well nourished	179	(89.5%)
BREAST-FEEDING (EVER/CURRENTLY [N=200]		
Yes	122	(61%)
No	78	(39%)
	200	100

Table 8: Show Relationships of the distribution of respondents by their demographic characteristics in Wukari Taraba State

Characteristic	Frequency	Percentage (%)
Relationship of a child respondent [N=200]		
Mother	67	(33.5%)
Father	47	(23.5%)
Aunty	42	(21%)
Uncle	33	(16.5%)
Others	11	(5.5%)
Age group [N=200]		
>18-25 years	47	(23.5%)
<25-30years	71	(35.5%)
<30-35years	49	(24.5%)
<35-40years and above	33	(16.5%)
Marital status[N=200]		
Married	118	(59%)
Single	39	(19.5%)
Divorced	27	(13.5%)
Widowed	16	(8%)
Level of education [N=200]	24	(12%)
Degree	48	(24%)
Diploma	46	(23%)
Secondary school	59	(29.5%)
Primary school	23	(11.5%)
Non school	200	100

DISCUSSION

This research project works earns to determine diarrhoea among under-five children and household water treatment and safe storage factors in wukari local government area of Taraba State by determine the prevalence of reported diarrhoea among under five children in Wukari Local government area of Taraba State. To ascertain the above, this research work was carried out on 200 household of Wukari local government area and data are sourced through the use of questionnaire. Among them were child that experience Diarrhoea in the past 2 weeks 68((34%) respondents yes and 132 (66%) no respectively. Household water sources and water treatment practices for drinking distribution of household and sources of drinking water. The response show that 102(51%) of the household depend on water from deep wells and 98(49%) from shallow well. In a research work carried out by (WHO, 2023) prevalence of diarrhea among children under 5 years in Wukari, Taraba State was 20.8% (95% CI: 6.8 - 25.6). These findings suggest that one in every five children living in Wukari, Taraba State at risk of dying from diarrhoea disease. This finding is in line with prevalence of diarrhea in children under 5 years which is 19% (WHO, 2023). However, this result was lower than 33% of prevalence of diarrhea among children under 5 years in Puje, Ward Wukari Taraba State (Imarenezor et al., 2018). Furthermore, the finding was also lower than 43.3% of prevalence of diarrhea among children under five years (Imarenezor, 2021). This implied that maintaining the cleanliness and hygiene of these latrines was a challenge for the study population. Furthermore, close to 80% of the study children were not able to use the latrines on their own and 15% of the households either buried or threw the children feacal matter in the open surrounding. Burial of children's feaces in the soil has been associated with diarrhea in children. The feaces provides breeding sites for insects that carry diarrhea pathogens from the waste to water and food (Godana & Mengiste, 2013). Poor hand washing practices among caregivers were observed in this study. It is important that caregivers wash their hands before handling a child's meal or after using the toilets. In this study, appropriate hand washing using soap was low (14%) among the caregivers the poor practices of washing hands with soap after visiting the toilet or handling food was attributed to ignorance among caregivers, and poor socio-economic status. Similar findings were reported in Wukari Taraba State where children who did not wash their hands had higher incidence of diarrhea (Imarenezor, 2021). The prevalence of reported under five diarrhoea was found to

be 32.7% higher than what was reported by Puje ward Wukari, Taraba 12% in the year 2010.

To determine the proportion of households that uses any HWTS options, household water treatment practices, 132(66%) households reported treating water with any method (boiling, strain on cloth, use of chlorine and allow it stand and settle), 68(34%) their drinking water and the common reasons given for not treating were belief that the water is safe from the source and 37(18.5%) household do not know any method of water treatment, Household water treatment and safe storage Options (HWTS), response of household water treatment and storage options. Respondent that used boiling and strain with cloth method were frequently practiced as methods for water treatment, 87(43.5%) and 51(25.5%) respectively, (7.5%) reported using chlorine Also 71(35.5%) reported to store their drinking water in bucket with lid, 59(29.5%) in bucket without lid the minority of respondents reported using small pans, soil pot and others as drinking water storage containers.

To determine the relationship between diarrhoea and demographic and economic characteristic, characteristic of household relationship in under-five children 67(33.5%) were mothers, 118(59%) married and 59(29.5%) were primary school respectively

CONCLUSION

This study demonstrates that despite relatively high access to improved water sources (protected wells/boreholes) in Wukari, the prevalence of diarrhoea among children under five remains elevated (34%) because of pervasive unsafe practices downstream—principally failure to treat water before consumption, storage in uncovered buckets that permit re-contamination, and fetching water with unclean hands. Microbiological evidence confirmed significantly higher faecal coliform counts in open-bucket water, substantiating the causal pathway. Maternal education acted as a buffer, underscoring the role of health literacy. The findings indicate that interventions must shift focus from mere source improvement to promoting point-of-use safety—treatment, covered storage, and hand hygiene—to achieve meaningful reductions in diarrhoeal disease. To this end, it is recommended that; Community-based water safety education, provision of affordable safe-storage vessels, point-of-use water treatment promotion, strengthen maternal health literacy, microbial monitoring, policy advocacy and research follow-up. Implementation

and follow-up practices which has to do with giving priorities to areas with highest diarrhoea prevalence (identified in survey) for rapid rollout; monitor via existing Integrated Disease Surveillance & Response (IDSR) system will reduce the prevalent rate of under-five diarrrhoea in Wukari which by extension Taraba State and North East in general.

Based on the findings in this study, the following recommendations have been made;

1. Health education should be provided on the importance of treating water by boiling and storing them in covered containers.

2. Advocacy should be done on other effective methods of water treatment approved by WHO to replace less effective local methods currently practiced

3. The advocacy on hand hygiene with detergent (soap) to children care takers should be emphasized as it protects the children against diarrhoea.

4. Since the people prefer strain their water in cloth because it is not related to objectionable odour it is the high time to promote filtration by ceramic filters.

5. Household water treatment promotion: The Government should invest more heavily in scaling-up programs and policies needed to communicate the importance of treating drinking water for family's currently lacking reasonable-quality water supply in order to prevent waterborne illness and associated diarrhea and other related diseases.

6. Health promotion unit of all Health facilities in Wukari Local Government Area of Taraba State Service through community nurses and the community-based health planning and services, should advocate and intensify education programs with appropriate training and follow-up on household water treatment.

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Conflicts of interest

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