International Journal of Sustainable Development Research
2025, Vol. 11, No. 2, pp. 62-73
https://doi.org/10.11648/j.ijsdr.20251102.11

Research Article

Water Sources, Sanitation, and Hygiene Facilities as Risk Factors for Diarrhea among Primary School Pupils in Kube-Atenda Community, Ibadan, Nigeria

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Abstract

This study assessed water sources, sanitation, and hygiene facilities as risk factors for diarrhea among primary school pupils in Kube-Atenda community, Ibadan. The cross-sectional design employed a 3-stage random sampling technique to select Kube-Atenda community, 5 Schools and 184 participants. A pretested questionnaire was used to collect data among pupils, WaSH facilities were observed at 5 schools using observational checklist while the sanitary risk scores of the water collection points were computed. Data were analyzed using descriptive statistics and Chi-square at p=0.05. Respondents' mean age bracket was 11.1 ±1.4 years, 50.5% were males while 56% of the pupils reported cases of diarrhea. Observation revealed that the water sources in all the schools had a form of risk such as inadequate fence or drainage, absence of apron, inadequate cover, floor around the borehole permeable to water. The risk scores revealed that two schools' water sources were at a high risk of contamination. Several (40%) of the schools had basic water supply, 40% had basic sanitation facilities and none had basic hygiene facilities. A significant association existed between type of toilet facility used – single sex toilet, handwashing after using the toilet – and the reported recent episode of diarrhea. Two schools' water sources were at a high risk of contamination, none of the schools had a basic hygiene service while more than half of the pupils reported cases of diarrhea. Intervention to improve sanitary conditions of the water sources and provide basic sanitation and hygiene facilities is essential to reduce the incidence of diarrhea among pupils in Kube-Atenda community.

Keywords

Water Sources, Sanitation, Hygiene, Diarrhea, Primary Schools

1. Introduction

Access to adequate water sanitation and hygiene facilities in schools is a basic right and significant requirement for foundational education for school children. Children spend over six hours of their time daily in school which amounts to over 1100 hours yearly. This shows how very much time students spend interacting within their learning environment. During this interaction, their health habits tell a lot on their learning outcomes. The quality of the school environment has a significant impact

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Received: 31 January 2025; **Accepted:** 18 February 2025; **Published:** 18 March 2025

on the pupils' health, habits, and overall educational performance [1-3]. For instance, poor water quality, unhygienic conditions, high interpersonal contact, and other factors make school environments risky for children and staff, aggravating children's predisposition to environmental health hazards [4]. Moreover, studies have discovered a significant association between WaSH and the number of school days missed particularly among female children who need these facilities for proper menstrual hygiene [5-7].

Besides, the global baseline report has revealed that 570 million children lacked access to safe drinking water, 620 million lacked proper sanitation, and over 850 million globally had no handwashing service at their schools [8]. Sub-Saharan African region has the highest proportion (47%) of schools with no service. This shortage of WaSH facilities continues to persist in low- and middle-income countries around the globe [9]. Analysis of data from rural schools in 12 Sub-Saharan African countries revealed that many school toilets did not meet the criteria for accessibility, quality, or acceptability in Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Niger, Rwanda, Uganda, United Republic of Tanzania, Zambia and Zimbabwe [10, 11]. As evidenced in Nigeria, a WaSH assessment [12] revealed poor levels of water, sanitation, and hygiene facilities in primary schools in Sokoto State. Unfortunately, the inadequacies of such facilities have significantly led to poor wash practices among primary school pupils [13]. Poor sanitation and hygiene culture displayed in schools put students at a great public health risk, making them vulnerable to hygiene-related diseases like diarrhea and the re-occurrence of cholera outbreaks [3].

The consequences of inadequate WaSH can be devastating to public health. They can contribute to the outbreak and chronic presence of preventable infections like pneumonia and diarrhea disease, which are the two biggest killers of children globally. [14, 9]. For example, the burden associated with poor WaSH facilities has been said to be accountable for 88 percent of diarrhea cases worldwide most particularly in developing countries such as Nigeria and other low-to-middle income countries where poor WaSH facilities, knowledge, and practice have been well documented [15, 16]. According to a report, about 151,700 children die yearly from diarrhea diseases in Nigeria [17]. Schools are nurturing grounds where children should learn healthy behaviors with the right skill set to make them change agents in their families and communities. The rate of persistent diarrhea deaths in low- and middle-income countries due to limited access to WaSH facilities is quite alarming [18]. If the situation is not adequately addressed, there would be more cases of diarrhea in children. This could contribute to malnutrition, reduced resistance to infections, missed school days and (if prolonged) impaired physical, cognitive growth and development and, eventually, death. It is essential to understand the relative contribution of these potential risk factors to the burden of diarrhea disease in primary schools to address the issue effectively. This study was therefore conducted to assess water sources, sanitation, and hygiene facilities as risk factors for diarrhea among primary school pupils in Kube-Atenda community, Ibadan.

2. Methodology

2.1. Study Area

The study was carried out in Kube-Atenda community in Ibadan. Ibadan, the capital of Oyo State (Nigeria), is the largest city in West Africa and the second largest in Africa covering an area of 240 km^2. There are eleven local governments in Ibadan metropolitan area, consisting of five urban local governments in the city and six semi-urban local governments in the less city [19]. Kube-Atenda community is located along Queen Elizabeth II Road within Agodi vicinity, in Ibadan North Local Government Area. It is sited about Latitudes 70 23' 0''N and 70 24' 15''N, and Longitudes 30 53'30''E and 30 53' 30''E. The community has a population of about 10,000 (based on field estimate). The major income generating activities among the residents of the community were trading, artisanship and civil service. Also, the downward slope of roads leading to the community has made it a converging place for surface water resulting in a flood [20]. There are five public primary schools and one community school within the community. These include Salvation Army Basic School I, Salvation Army Basic School II, St. John Nursery and Primary School, Methodist N5 Nursery and Primary School, and Kube-Atenda Community Nursery and Primary School. (Figure 1).

2.2. Study Design

This study employed a cross-sectional design adopting survey to obtain data. The survey used a pretested semi-structured, interviewer-administered questionnaire, and an observation checklist for data collection.

2.3. Sampling Technique and Data Collection Instruments

A 3-stage sampling method was used to select schools, classes and 184 pupils from five primary schools that were interviewed. Pupils in the selected schools were proportionally allocated and interviewed using the pretested questionnaire. A semi-structured, interviewer-administered questionnaire was developed based on the instrument previously used by WHO/UNICEF Joint Monitoring Programme (JMP). The JMP instrument was reviewed to understand its structure, content, objectives and the overall alignment with the present research objective. Also, areas for improvement were identified and relevant modifications were made. This included adding new items to address issues about water and sanitation-related diseases. The modifications ensured that the questionnaire maintained a logical flow and met the needs of the present research study. The revised questionnaire was

used to elicit information on socio-demographic characteristics, knowledge about water quality, sanitation and hygiene practices from the selected respondents. Their perception of water and sanitation-related diseases and factors influencing the exposure to the diseases were also investigated. Furthermore, the questionnaire was pretested in a primary school in Ibadan North East LGA, a primary school with similar features to the study area. A total of 20 questionnaire copies were administered and analyzed using Cronbach alpha at reliability coefficient of 0.795. An observational checklist was used to assess the functionality status of water supply, sanitation facilities and handwashing sites. The checklist was adapted from UNICEF WaSH in school monitoring package, and Nigerian Sanitation Policy in Schools [21, 22].

2.4. Data Collection Technique

Prior to data collection, the investigator submitted an introduction letter to State Universal Basic Education Board (SUBEB), the authorities in charge of primary schools in Ibadan North LGA. Thereafter, a meeting was conducted with the board's secretary where the purpose, objective and the benefit of the study were discussed. The head teachers of the selected schools were contacted by the secretary while a formal letter was given to the identified head teachers to obtain permission to carry out the study. Also, a sensitization talk was delivered on the theme and objectives of the study at the head teachers' meetings. This was to ensure that the head teachers understood all aspects of the study. Consent forms, after they had been duly completed and signed, were obtained from the head teacher of each school, so also were assent forms from pupils that participated in the study. A total of 184 pupils were interviewed. Two male research assistants were trained on the objectives and importance of the study, sampling techniques, how to obtain informed consent and assent form from the respondents as well as confidentiality throughout the data collection process. They were adequately briefed before proceeding to the field.

2.5. Data Analysis and Management

The data collected were sorted according to the individual schools. The questionnaire copies were numbered serially and the data were cleaned appropriately to detect any form of inconsistency. Data entry and analysis was done using Statistical Package for Social Sciences (SPSS version 20). Descriptive statistics were used to analyze data for socio-demographic characteristics and observational checklist. Data from the interview and observation were presented in frequencies and percentages while statistical associations between sanitation, hygiene and the occurrence of diarrhea were tested using Chi-square at 5% level of significance.

2.6. Ethical Consideration

The study was approved the Oyo State Health Ethical Review Board, Secretariat, Ibadan with registration number NHREC/OYO/10/11/22. Consent was obtained from the headmistress who acted *in loco parentis* for the pupils. Assent was also gotten from each of the pupils that granted the interview. There was no form of coercion; the participants and school authority were ensured of confidentiality of all the information collected.

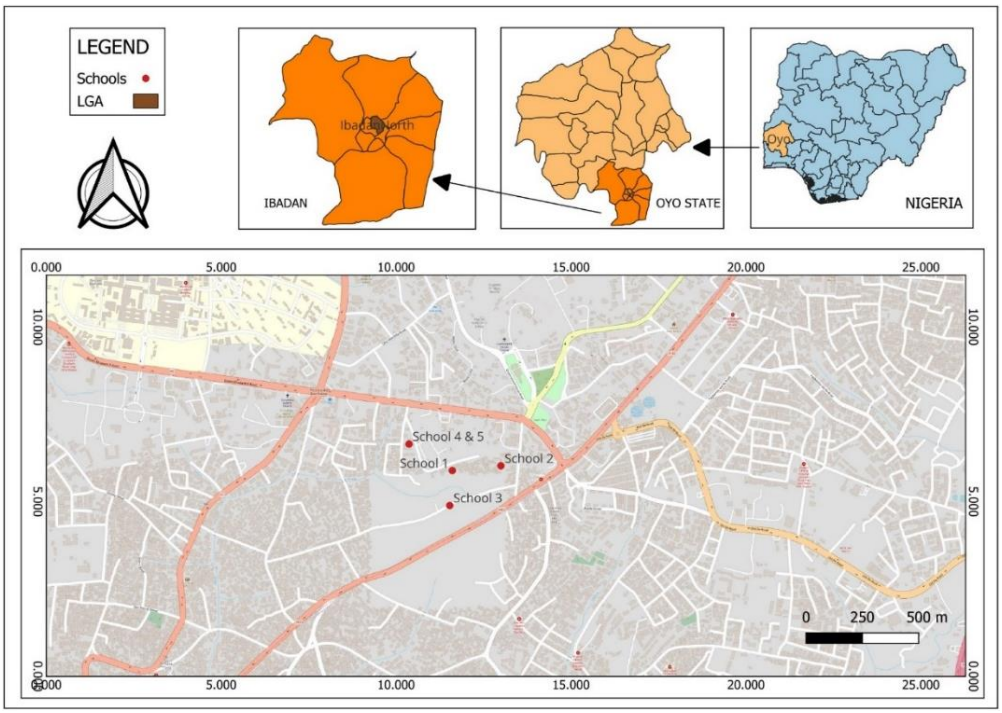


Figure 1. *Map showing the study area.*

3. Results

3.1 Socio-demographic Characteristics

Respondents' mean age bracket was 11.1 ±1.4 years, 50.5% were male while 36.6% were in primary six. Majority (73.9%) of the respondents said their fathers were artisans while 61.4% stated that their mothers were traders. More than half (52.2%) reported that the number of children in their family was less or equal to four, while 64.7% said they were in the 1st to 4th in the sibling order. Fifty percent of the participants said they were living with their (both) parents as presented in Table 1.

Table 1. *Socio-demographic characteristics.*

Characteristics	Frequency	Percentage
Age in years		
8 – 10	74	40.2
11 – 14	110	59.8
Mean ± SD = 11.1 ± 1.4 years		
Sex		
Male	93	50.5
Female	91	49.5
Class		
Primary 4	64	34.6
Primary 5	53	28.8
Primary 6	67	36.6
Father's Occupation		
Trader	40	21.8
Artisan	136	73.9
Civil Servant	8	4.3
Mother's Occupation		
Trader	113	61.4
Artisan	69	37.5
Civil Servant	2	1.1
No of Children		
1 – 4	96	52.2
5 – 8	88	47.8
Position (age ranking) among siblings		
1st – 4th	119	64.7
5th – 8th	65	35.3
Living with whom		
Both parents	92	50
Mother alone	58	31.5
Father alone	13	7.1
Relative	20	10.9
Alone	1	0.5

3.2. Status and Functionality of WaSH Facilities

Table 2. *Status of Water, Sanitation and hygiene facilities.*

Characteristics	Frequency	Percentage
Source of water supply		
Borehole	107	58.2
Well	77	41.8
Water always available		
Yes	119	64.7
No	65	35.3
Available toilet Facility		
Water closet	71	38.6
Pour flush toilet	107	58.2
Pit latrine	6	3.3
Separate toilet for males and females		
Yes	134	72.8
No	50	27.2
Presence of Handwashing facilities	6	3.3
Wash hands after using the toilet		
Yes	108	58.7
No	76	41.3
Available materials for handwashing		
Water only	72	39.1
Water and soap	29	15.8
Water and ash	7	3.8
Hand sanitizer application		
Always	18	9.8
Sometimes	82	44.6
Rarely	69	37.5
Never	15	8.2

[A = School 1; B=School 2; C = School 3; D= School 4 and 5]

Figure 2. *Point of water collection in the selected schools.*

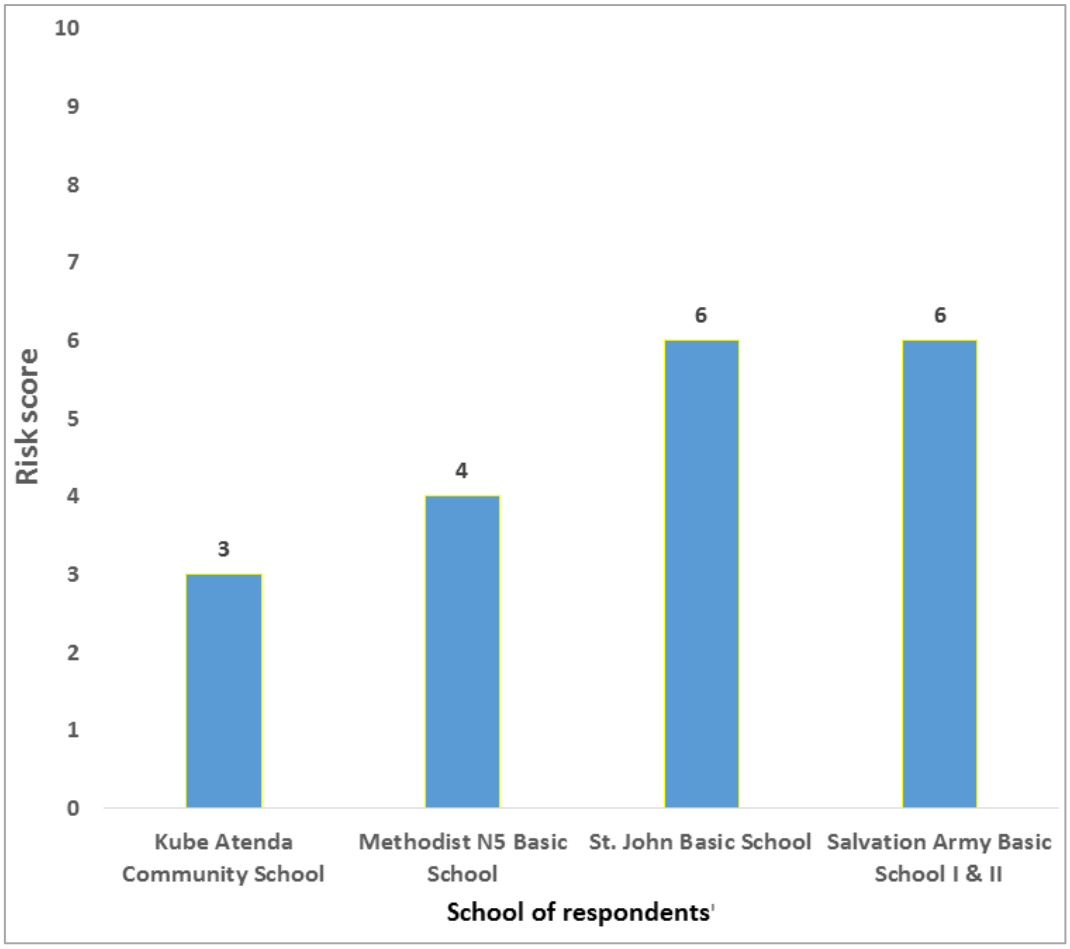
[A = Facility at School 1; B = Facility at School 3; C = Facility at School 5]

Figure 3. *Toilet facilities in the selected schools.*

Table 2 presents the status and functionality of WaSH facilities in the selected schools. The two major sources of water mentioned by the respondents were borehole (58.2%) and well (41.8%). Majority (64.7%) reported that the water was available round the year, 85.9% said they usually drank the water while all of them (100% respondents) stated that they had storage container in the school. All the respondents reported that the water containers had cover while 42.9% said they normally cleaned them, water containers, everyday. Slightly more than one-third (38.6%) said they used water closet system, 58.2% reported that they used *pour* flush toilet while 3.3% used pit latrine. Majority (72.8%) had separate toilets for male and female pupils, 96.7% of the pupils cleaned the toilets themselves while 58.7% washed their hands after

using the toilet. Very few (3.3%) respondents said they had one handwash facility, 39.1% washed their hands with water only, while 9.8% used hand sanitizer after washing their hands. Observation revealed the functionality of the WaSH facilities as shown in Table 3. It was found that all the five schools had functioning water collection points (Figure 2). Only Schools 1 and 2 had water supply at the time of visit while all the five schools had water storage containers. Only school 1 used a pit toilet which was not functional. Schools 2, 3, 4 and 5 made use of flush toilet (Figure 3). The toilets in schools 2 and 3 were not functional; schools 1 and 2 had no toilet for teachers, while schools 3, 4 and 5 had separate functioning toilets for male and female pupils. Only one of the five schools (School 1) had a functioning handwashing facility with water. According to the JMP classification for service ladders, less than average (40%) of the schools had basic service for drinking water, 40% had basic sanitation service while none (0%) had basic hygiene service as seen in Figure 5.

The water sources in all the schools had a form of risk such as inadequate fence or drainage, absence of apron, well inadequately covered, floor around the borehole permeable to water, which could probably contaminate the water source. The risk scores computed revealed that Kube-Atenda Community and Methodist N5 primary schools water sources were at an intermediate risk while St. John, and Salvation Army I & II primary schools water sources were at a high risk as seen in Figure 4.



Remark; 0 – 2 (low risk) 3-5 (intermediate risk) 6-8 (high risk) 9 – 10 (very high risk)

Figure 4. *Groundwater risk score.*

Table 3. *Functionality of water, sanitation and hygiene facilities.*

Description	School 1	School 2	School 3	School 4	School 5
Water Supply					
Water Collection Points	+√	+√	+√	+√	+√
Adequate water at the time of visit	+	+	-	-	-

Description	School 1	School 2	School 3	School 4	School 5
Water storage Container	+√	+√	+√	+√	+√
Sanitation Facility					
Toilet in the school premises	+√	+√	+√	+√	+√
Toilet with flush systems	-	+/	+/	+√	+√
Separate toilet for boys and girls	-	-	-	+√	+√
Accessible toilet for boys and girls	+	+	+	+	+
Toilet for male and female teacher	-	+/	+√	+√	+√
Waste bins	+	+	+	+	+
Disinfectants	-	-	-	-	-
Hygiene Facility					
Handwashing facility	+√	-	-	-	-
Water at handwashing site	+	-	-	-	-
Soap at handwashing site	-	-	-	-	-
Sanitizer at handwashing site	-	-	-	-	-

Key: Absent (-)
Present (+)
Present but not functional (+/)
Present and functional (+√)

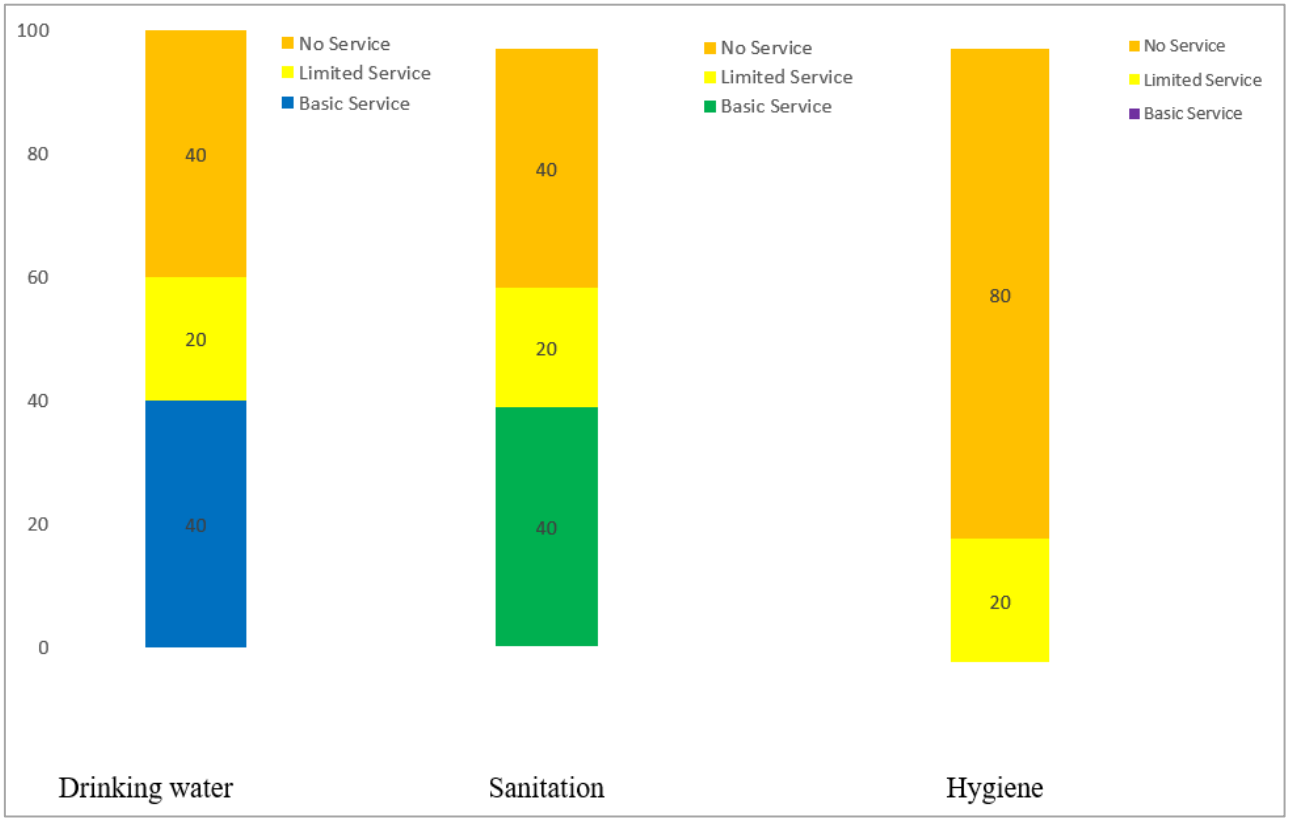


Figure 5. *JMP ladders for primary schools in Kube-Atenda community.*

3.3. Awareness About Water and Sanitation-Related Diseases, Occurrence of Diarrhea and the Outcome Behavior

Majority (84.2%) of the respondents reported having heard about water and sanitation- related diseases, 57.6% reported diarrhea as one of the most common water- and sanitation-related disease while 64.7% mentioned loose/watery stool as a symptom of diarrhea. More than half (56%) reported having experienced episodes of diarrhea in the previous two weeks to data collection, 30.4% stated that they had purchased medication to treat diarrhea while 8.2% were taken to the hospital. Only 14.1% of the respondents reported to have been absent from school due to diarrhea as indicated in Table 4.

Table 4. Perception about water and sanitation-related diseases.

Characteristics	Frequency	Percentage
Heard of water and sanitation related disease		
Yes	155	84.2
No	29	15.8
Diarrhea as the most common water- and sanitation-related disease		
Yes	106	57.6
No	49	26.6
Symptoms of diarrhea		
Loose/watery stool	124	67.4
Itchy skin	23	12.5
Heat rashes	8	4.3
Episodes of diarrhea two weeks prior to data collection		
Yes	103	56.0
No	81	44.0
Frequency of experiencing diarrhea		
Always	35	19.0
Sometimes	68	37.0
Action taken during recent episode of diarrhea		
Taken to the hospital	15	8.2
Purchased medication	56	30.4
No action/went away on its own	32	17.4
Absent from school due to diarrhea		
Yes	26	14.1
No	77	41.9

3.4. Comparison Between Available WaSH Facilities and Recent Episode of Diarrhea

Table 5 presents the association between WaSH practices and recent episode of diarrhea. A significant association existed between WaSH practices and the prevalence of diarrhea. Cleaning of water storage container was significantly associated with the reported recent episode of diarrhea. Significantly, toilet types, availability of single-sex toilet were associated with the recent episode of diarrhea. Similarly, practices of handwashing after toilet use and materials for handwashing

were statistically associated with the recent episode of diarrhea. This denotes that the recent episode of diarrhea among the pupils may have been influenced by available WaSH facilities. Details of this association are shown in Table 5.

Table 5. *Association between WaSH practice and recent episode of diarrhea.*

Practice of WaSH	Recent episode of diarrhea			χ^2 p value	
	Yes (%)	No (%)	Total (%)		
Cleaning of water storage container					
Everyday	36 (45.6)	43 (54.4)	79 (100)		
Alternate days	17 (47.2)	19 (52.8)	36 (100)	12.203	0.002*
Weekly	50 (72.5)	19 (27.5)	69 (100)		
Toilet type					
Water closet	56 (78.9)	15 (21.1)	71 (100)	24.767	<0.001*
Pour flush	45 (42.1)	62 (57.9)	107 (100)		
Pit latrine	2 (33.3)	4 (66.7)	6 (100)		
Availability of Single-sex toilet					
Yes	80 (59.7)	54 (40.3)	134 (100)	7.774	0.032*
No	23 (46.0)	27 (54.0)	50 (100)		
Handwashing after toilet use					
Yes	53 (49.1)	55 (50.9)	108 (100)	5.058	0.025*
No	18 (34.0)	58 (44.3)	76 (41.3)		
Materials for handwashing					
Water only	37 (51.4)	35 (48.6)	72 (100)	12.420	0.006*
Water and soap	11 (37.9)	18 (62.1)	29 (100)		
Water and ash	2 (28.6)	5 (71.4)	7 (100)		

*Statistically Significant

4. Discussion

The study found that a smaller proportion (40%) of the schools had boreholes within their premises, while the other larger proportion had well water. This proportion in slightly higher compared to a similar survey among primary schools in Northwestern Nigeria, where only 10% of the schools had boreholes [12]. Another similar survey in South-South Nigeria had reported 20% of the schools that had boreholes [23]. However, findings from this study fall short when compared to a WaSH assessment in riverine primary schools, which revealed that 73.8% used boreholes as their primary water source [24]. The present study further observed that water sources in two of the selected schools were at a high risk of contamination due to their proximity to septic tanks, dumpsites, latrines, and inadequate drainage systems. Poor sanitary conditions of potable water sources might pose risks to the end-users, particularly through coliform organisms from fecal matter contamination. Presence of *E. coli* in most water sources indicates fecal contamination which is attributed to serious health risks such as urinary tract infections, bacteremia, meningitis, diarrhea, acute renal failure, and hemolytic anemia among the consumers [25].

In this study, the developed JMP service ladder for drinking water in schools revealed that 40% of the school had basic service, 20% had limited service, and 40% had no service. This finding shows a slight improvement compared to a WaSH survey in Yenagoa, where 20% of the schools had basic service, 20% had limited service, and 60% had no service [23]. However, it is lower compared to another WaSH survey in Badagry, where 60% of the schools had basic service, 30% had limited service, and 10% had no service [26]. These results align with the Sub-Saharan Africa rating, where

coverage of basic drinking water service remains below 50%, but significantly differ from the global WaSH in schools' data, where 71% of schools had basic service, 14% had limited service, and 15% had no service [27].

Most of the schools in this study used water closet and pour flush toilets. However, these improved facilities provided limited service. This finding is similar to previous studies which showed a similar trend where all the toilet facilities in the schools consisted of water closet systems but were limited in service [23, 26]. Another study revealed that pit toilets were predominantly used in 76% of the schools in Ibadan, South Western Nigeria [16]. The study found that only 12% of the available toilets were clean. This finding is similar to a previous report where 20% of toilets received regular cleaning [12]. This finding is consistent with that of a study on the sanitation facilities of primary schools in Ilorin which showed that more than 50% of toilet facilities were in very poor condition and required urgent improvement [28]. The lack of hygienic toilet facilities forces some pupils to practice open defecation behind abandoned classroom buildings. Moreover, the study's JMP service ladder for sanitation in schools revealed that less than half (40%) of the schools had basic sanitation, 20% had limited service while 40% had no service. In a similar study in public primary schools in Ghana, 28% of the schools had basic sanitation service, 42% had limited service, and 31% had no service [29]. These findings vary greatly from the global rating but are closely related to Sub-Saharan Africa report, where fewer than half of the schools had basic sanitation [27].

In this study, approximately high proportion of the schools had no handwashing facility, and none of the schools with handwashing sites had soap available. This had made the pupils to rely solely on water for handwashing. A similar study had reported large percentage (80%) of schools with no handwashing facilities, while soap was only available in 22% of the schools with washbasins [16, 12]. The absence of handwashing facilities, particularly in primary schools, has significant health effects on children. The study found that over 50% of the pupils were not always washing their hands after toilet use. Another study also found that 42% of students did not always wash their hands after using the toilet [30]. Several studies had reported similar findings, indicating that poor handwashing practices is prevalent in Nigerian schools [24, 26, 31].

Data from this study on JMP service ladder for hygiene in schools revealed that none of the schools had basic hygiene service; 20% had limited service while 80% had no service. This finding is consistent with a previous WaSH survey, which revealed that none of the sampled schools had basic hygiene service [26] while 80% had no hygiene service [23]. This is also similar with the situation in Sub-Saharan Africa, where fewer than one-third of the schools had basic hygiene service [27]. Fifty-six percent (56%) of the pupils reported cases of diarrhea. The risk factors associated with diarrhea prevalence among the pupils include poor water quality, unhygienic toilets, and inadequate hygiene facilities. This is similar to other WaSH studies that have linked the lack of functional sanitation facilities to diarrhea in schools [30, 32, 33]. Data from this study revealed that cleaning of water storage container, toilet types, availability of single-sex toilet were significantly associated with the reported recent episodes of diarrhea. Moreover, practices of handwashing after toilet use and materials for handwashing were statistically associated with the recent episodes of diarrhea. These findings suggest that the recent episodes of diarrhea among the pupils were influenced by their WaSH practices.

5. Conclusion

The findings of this study highlight the significant relationship between water sources, sanitation, and hygiene facilities and the prevalence of diarrhoea among primary school pupils in the Kube-Atenda community, Ibadan, Nigeria. The study found that water sources in two of the selected schools were at a high risk of contamination. The sanitary facilities in most of the schools were found to be in deplorable and unhygienic state. None of the schools had a basic hygiene service, such as handwashing stations with soap and water, which are essential for preventing the spread of infectious diseases and maintaining a healthy learning environment. Findings in the study provides evidence that pupils in schools lacking clean water and proper sanitation are more vulnerable to waterborne diseases, with poor handwashing practices exacerbating the risk. The results suggest that improving access to safe water, upgrading sanitation infrastructure, and promoting hygiene education are essential steps in mitigating the risk of diarrhoea among schoolchildren in Kube-Atenda. Public health interventions focusing on improving water sources, enhancing sanitation, and teaching proper hygiene practices could play a critical role in reducing diarrhoea morbidity and its associated complications. Moreover, collaborative efforts from government agencies, non-governmental organizations, and the community itself will be necessary to create a sustainable and healthy environment for schoolchildren. Furthermore, Future research should explore the long-term impacts of improved WASH conditions on health outcomes in primary school populations, as well as investigate additional factors influencing diarrhoea disease transmission among school children in rural communities.

Abbreviations

WaSH	Water, Sanitation and Hygiene
N	North
E	East
Km	Kilometer
WHO	World Health Organization
UNICEF	United Nations Children's Fund
JMP	Joint Monitoring Programme
LGA	Local Government Area
SUBEB	State Universal Basic Education Board

Acknowledgments

We acknowledge the assistance of the personnel of the Ibadan North LGA State Universal Basic Education Board (SUBEB) and the selected schools' authority.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Mooijman A., Snel M., Ganguly S. and Shordt K. (2010). Strengthening Water, Sanitation and Hygiene in Schools – A WASH guidance manual with a focus on South Asia. The Hague, The Netherlands, IRC International Water and Sanitation Centre. (TP Series 53). https://www.ircwash.org/sites/default/files/Mooijman-2010-Strengthening.pdf Date accessed 31 January 2025.

[2] Micaiah W. (2014). How much time does Nigerian student spend in school. https://www.slideshare.net/statisense/how-much-time-does-nigerian-student-spend-in-school Date accessed 30 January 2025.

[3] Wada O. Z., Olawade D. B., Oladeji E. O., Amusa A. O., and Oloruntoba E. O. (2022). School water, sanitation, and hygiene inequalities: a bane of sustainable development goal six in Nigeria. Canadian Journal of Public Health. 113(4): 622-635 https://doi.org/10.17269/s41997-022-00633-9

[4] World Health Organization. (2009). Water, sanitation and hygiene standards for schools in low-cost settings. World Health Organization https://iris.who.int/handle/10665/44159 Date accessed 31 January 2025.

[5] Freeman M., Stocks M., Cumming O., Jeandron A., Higgins J., Wolf J. and Curtis, V. (2014). Systematic review: Hygiene and health: systematic review of handwashing practices worldwide and update of health effects. Tropical Medicine & International Health, 19(8), 906-916. https://doi.org/10.1111/tmi.12339

[6] WHO and UNICEF. (2015). Water, Sanitation and Hygiene in Health Care Facilities: Status in Low and Middle Income Countries and Way Forward. Geneva: World Health Organization. Retrieved March 5, 2024, from http://apps.who.int/iris/bitstream/10665/154588/1/9789241508476eng.pdf?ua=1

[7] Akoteyon I. S. and Otusanya O. (2022). Assessment of Wash in Riverine Primary Schools in Ojo Local Government Area of Lagos, Nigeria. Analele Universităţii din Oradea, Seria Geografie, 32(1), 39-54. https://doi.org/10.30892/auog.321104-879

[8] WHO/UNICEF. (2023). Joint Monitoring Program for Water Supply, Sanitation and Hygiene (JMP) – Progress on household drinking water, sanitation and hygiene 2000-2022: Special focus on gender UN-Water. from https://www.unwater.org/publications/who/unicef-joint-monitoring-program-update-report-2023 Accessed on 31 January 2025.

[9] UNICEF. (2020). Evaluation of the UNICEF supported Federal Government of Nigeria Water, Sanitation and Hygiene Programme (2014-2017). https://www.unicef.org/nigeria/media/2986/file/Evaluation%20Report%20on%20WASH%20Programme%202014%20-%202017.pdf Date accessed: 10 May 2024.

[10] WHO. (2020). State of the world's sanitation. World Health Organization https://www.who.int/publications/i/item/9789240014473 Date accessed 12 April 2024.

[11] Morgan C., Bowling M., Bartram J., and Lyn Kayser, G. (2017). Water, sanitation, and hygiene in schools: Status and implications of low coverage in Ethiopia, Kenya, Mozambique, Rwanda, Uganda, and Zambia. International Journal of Hygiene and Environmental Health, 220(6), 950–959. https://doi.org/10.1016/j.ijheh.2017.03.015

[12] Sarkingobir Y., Sharu A. U. and Zayyanu M. M. (2019). Survey of water, sanitation and hygiene (wash) among primary schools in Sokoto State, Nigeria. 1 (3), 01-05.

[13] Ejimogu C. R., Okereke C. C., Amadi C. O. A., and Amadi A. N. (2019). Assessment of Water Sanitation and Hygiene Practices in Public Primary Schools In Owerri Municipal Area Council Imo State, Nigeria. International Journal of Health, Safety and Environments (IJHSE), 5 (5), 444 – 451.

[14] Liu L., Johnson H. L., Cousens S., Perin J., Scott S., Lawn J. E., Rudan I., Campbell H., Cibulskis R., Li M., Mathers C. and Black R. E. (2012). Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. The Lancet, 379(9832), 2151–2161. https://doi.org/10.1016/s0140-6736(12)60560-1

[15] WHO, (2015). Nigeria: Demographic and Economic Estimates, GLAAS, un-Water Global Analysis and Assessment of Sanitation and Drinking Water; https://www.who.int/publications/i/item/WHO-FWC-WSH-17.01 Date accessed 11 April, 2024.

[16] Egbinola C. N. and Amanambu A. C. (2015). Water supply, sanitation and hygiene education in secondary schools in Ibadan, Nigeria. Bulletin of Geography. Socio-Economic Series, 29(29), 31–46. https://doi.org/10.1515/bog-2015-0023

[17] Jiwok J. C., Adebowale A. S., Wilson I., Kancherla V. and Umeokonkwo C. D. (2021). Patterns of diarrhoeal disease among under-five children in Plateau State, Nigeria, 2013–2017. BMC Public Health (21), 2086. https://doi.org/10.1186/s12889-021-12110-y

[18] Prüss-Ustün A., Bartram J., Clasen T., Colford J. M., Cumming O., Curtis V., Bonjour S., Dangour A. D., De France J., Fewtrell L., Freeman M. C., Gordon B., Hunter P. R., Johnston R. B., Mathers C., Mäusezahl D., Medlicott K., Neira M., Stocks M. and Wolf J. (2014). Burden of disease from inadequate water, sanitation and hygiene in low- and middle-income settings: a retrospective analysis of data from 145 countries. Tropical Medicine & International Health, 19(8), 894–905. https://doi.org/10.1111/tmi.12329

[19] Tomori M. A. (2017). Ibadan Metropolitan Area and the challenges to sustainable development. https://macosconsultancy.com/Ibadan%20metropolitan.html Date accessed 17 April 2024.

[20] Onyemesim J. S., Sridhar M. K. C. and Coker A. O. (2017). Causes and Prevention of Flooding and Erosion in Urban Centres: A Study of Kube-Atenda Community, Ibadan North Local Government Area, Oyo State, Nigeria. International Journal of Scientific & Engineering Research, 8(3) ISSN 2229-5518.

[21] UNICEF. 2011. WASH in Schools Monitoring Package. https://www.unicef.org/wash/schools/files/wash_in_schools_monitoringpackage_.pdf as accessed on 23/04/2024.

[22] Federal Ministry of Education. (2006). Implementation Guidelines on National School Health Programme.

[23] Odafivwotu O. (2019) 'Status of Water, Sanitation and Hygiene Facilities in Public Secondary Schools in Yenegoa, Nigeria. World Journal of Social Sciences and Humanities, 5(3), 176 – 183 https://doi.org/10.12691/wjssh-5-3-7

[24] Akoteyon I. (2022). Assessment of Wash in Riverine Primary Schools in Ojo Local Government Area of Lagos, Nigeria. https://doi.org/10.30892/avog.321104-879 license: CC BY-NC-ND.

[25] World Health Organization. (2022). Guidelines for drinking-water quality: fourth edition incorporating the first and second addenda. Geneva: Licence: CC BY-NC-SA 3.0 IGO. https://www.who.int/publications/i/item/9789240045064 Date accessed 10 May 2024.

[26] Wada O. Z., Oloruntoba E. O., Adejumo M. and Aluko O. O. (2019). Adequacy and Functionality of water, sanitation and hygiene facilities in secondary schools within Badagry coastal community, Lagos Nigeria. International Conference of Environmental Health Science.

[27] WHO/UNICEF. (2022) Progress on Drinking water, sanitation and hygiene in schools: 2000 – 2021 dataupdate. https://www.who.int/publications/m/item/progress-on-drinkingwater--sanitation-and-hygiene-in-schools--2000-2021-data-update Date accessed 19 May 2024.

[28] Aremu A. (2012). Assessment of Sanitation Facilities in Primary Schools Within Ilorin, Nigeria. Journal of Applied Sciences in Environmental Sanitation.29. 29-33.

[29] Tiswin T. N., Luguterah A. and Aladago A. D. (2019) Assessing the Types, Condition and Functionality of Water, Sanitation and Hygiene Facilities in Public Primary Schools in the Zabzugu District of Ghana, UDS International Journal of Development, 6 (1): 92-101.

[30] Wami M. (2023) "Water, Sanitation and Handwashing Assessment and Determination of Critical risk factors for Diarrhoea among pre-schoolers and Students" Loughborough University http://doi.org/10.26174/thesis.Iboro.22202590.v1

[31] Wada O. Z. and Oloruntoba E. O. (2021). Safe Reopening of Schools during COVID-19: An Evaluation of Handwash Facilities and Students' Hand Hygiene Knowledge and Practices. European Journal of Environment and Public Health, 5(2), em0072. https://doi.org/10.21601/ejeph/9704

[32] Gebrehiwot T., Geberemariyam B., Gebretsadik T. and Gebresilassie A. (2020). Prevalence of diarrhoeal diseases among schools with and without water, sanitation and hygiene programs in rural communities of north-eastern Ethiopia: a comparative cross-sectional study. Rural and Remote Health. 20(4): 4907 https://doi.org/10.22605/rrh4907

[33] Cha Y. E., Fu Y. Z. and Yao W. (2021). 'Knowledge, practice of personal hygiene,school sanitation, and risk factors of contracting diarrhoea among rural students from five western provinces in China', International Journal of Environmental Research and Public Health, 18(18). 9505. https://doi.org/10.3390/ijerph18189505