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# EFFECT OF HEALTH EDUCATION INTERVENTION PROGRAMME ON WATER SANITATION PRACTICES FOR CHOLERA PREVENTION AMONG JUNIOR SECONDARY SCHOOL STUDENTS IN KADUNA STATE, NIGERIA

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**Abstract**

This study examined the effect of health education intervention programme on water sanitation practices for cholera prevention among junior secondary school students in Kaduna State, Nigeria. A quasi-experimental design, involving pre-test and post-test assessments of an experimental group and a control group, was adopted. A sample of one hundred and thirty (130) Junior Secondary School Two (JSS II) students, comprising sixty-five (65) from Government Secondary School, Kakuri (experimental group) and sixty-five (65) from Government Technical College, Malali (control group), was drawn through stratified, purposive, simple random and convenience sampling procedures. The experimental group received a six-week health education intervention on water hygiene, covering safe water sourcing, treatment, storage and handling, while the control group received a placebo intervention on general health topics unrelated to cholera. Data were collected using a ten-item, researcher-developed questionnaire based on a four-point modified Likert scale, with a split-half and Pearson Product-Moment reliability coefficient of 0.87. Data were analysed using means, standard deviations, paired-sample t-test, independent-sample t-test and multiple regression. Findings showed that the intervention significantly improved water hygiene knowledge and practices in the experimental group, with the aggregate mean score rising from 2.15 (pre-test) to 3.12 (post-test) ($t = 8.36$, $df = 129$, $p = 0.001$). A statistically significant difference was also found between the post-test scores of the experimental group (mean = 67.08) and the control group (mean = 51.40) ($t = 8.63$, $df = 128$, $p = 0.001$). School location, age and gender were each found to significantly influence the effectiveness of the intervention. The study concludes that health education is an effective strategy for improving water hygiene practices among junior secondary school students and recommends its integration into the school health curriculum in Kaduna State.

***Keywords:*** *Water Hygiene, Health Education Intervention, Cholera Prevention, Junior Secondary School Students, Kaduna State*

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## INTRODUCTION

Water sanitation refers to the set of practices, precautions and behaviours adopted by individuals to ensure that water used for drinking, cooking and other domestic purposes is obtained from safe sources, adequately treated, hygienically stored and properly handled from the point of collection to the point of consumption (Leckebusch & Abdussalam, 2023). It encompasses behaviours such as sourcing water from protected wells, boreholes or treated taps, boiling or chemically disinfecting water before use, filtering, and storing drinking water in clean, covered containers to prevent recontamination (World Health Organisation [WHO], 2025). As one of the core behavioural pillars of Water, Sanitation and Hygiene (WASH) programmes, water hygiene is universally recognised as a critical determinant of the transmission and control of waterborne diseases, particularly cholera, which spreads predominantly through the faecal-oral route via contaminated water (Ali, Nelson, Lopez, & Sack, 2022).

Globally, unsafe water handling remains a pervasive public health challenge. The World Health Organisation and the United Nations Children's Fund Joint Monitoring Programme has repeatedly reported that billions of people worldwide still lack access to safely managed drinking water services, a gap that sustains the transmission of waterborne pathogens (WHO & United Nations Children's Fund, 2023). Cholera, whose transmission is inextricably linked to poor water hygiene, is estimated to affect between 1.3 and 4.0 million people annually worldwide, resulting in 21,000 to 143,000 deaths, with the greatest burden concentrated in settings where safe water treatment and storage practices are weak (Lessler, Moore, Luquero, Kelly, & Azman, 2022). The WHO (2025) further reports that cholera remains endemic in more than 45 countries, with recurring outbreaks increasingly associated with poor water handling behaviours, climate variability and population displacement.

In Africa, deficiencies in water sanitation have translated into a disproportionate share of the global cholera burden. Sub-Saharan Africa accounts for over 60% of reported cholera cases and nearly 70% of cholera-related deaths worldwide, a pattern closely tied to reliance on unprotected water sources, minimal household water treatment and inadequate storage practices (Ganesan, Nair, & Subramanian, 2022). Between 2000 and 2025, the WHO Africa region recorded approximately 2.7 million cholera cases and 63,000 deaths, averaging about 113,000 cases annually. During the severe 2025 outbreak, the region recorded close to 300,000 cases and 7,000 deaths across 44 of 47 countries, a regional case-fatality rate of 4.1%, with poor water hygiene infrastructure repeatedly cited as a driving factor (WHO, 2025).

Nigeria bears a substantial proportion of Africa's cholera burden, driven largely by unsafe water sourcing, minimal household water treatment, and open defecation (Nigeria Centre for Disease Control [NCDC], 2026). The country recorded 10,809 suspected cholera cases, including 359 deaths, in 2024, and 10,353 cases with 244 deaths in 2025 (NCDC, 2026). Outbreaks recur most frequently in northern states where open wells, ponds and untreated surface water remain common domestic water sources. During the 2026 outbreak, more than 5,000 suspected cases and over 60 deaths were reported across more than 30 states and the Federal Capital Territory, with unsafe drinking water identified as a leading contributory factor (NCDC, 2026). In Kaduna State specifically, cholera is endemic, with outbreaks frequently linked to the rainy season, inadequate access to safe drinking water and reliance on contaminated sources; during the 2021 nationwide epidemic, Kaduna and Plateau States were among those reporting confirmed outbreaks as part of the 111,062 suspected cases and 3,604 deaths recorded nationally, a case-fatality rate of 3.2% (Elimian et al., 2022).

The prevention of cholera requires a comprehensive, multidisciplinary approach that interrupts the transmission of Vibrio cholerae at multiple points, including access to safe drinking water, improved water treatment, proper refuse disposal, food hygiene, personal hygiene, disease surveillance and, where appropriate, oral cholera vaccination (Dan-Nwafor, Odekunle, & Nwaokoro, 2023). Among these, the WHO consistently identifies sustainable improvement in water hygiene, combined with effective health education and community participation, as the most effective long-term measure for interrupting cholera transmission (WHO, 2025).

Water sanitation functions as a first line of defence against cholera because the causative organism is transmitted principally through ingestion of contaminated water. Practices such as boiling or chemically treating drinking water, sourcing water from protected wells and boreholes, covering stored water, and using clean containers directly interrupt the faecal-oral transmission pathway and reduce the likelihood of infection (Ali et al., 2022). Given the centrality of these behaviours to cholera control, deliberate efforts to improve water hygiene knowledge and practice are essential components of any effective cholera prevention strategy.

Because water hygiene behaviours are learned and reinforced through knowledge, awareness and skill acquisition, health education intervention has been identified as a necessary strategy for promoting sustained behavioural change. Health education intervention is a systematic educational process, delivered through lectures, demonstrations, discussions and practical activities, designed to improve individuals' knowledge, attitude and practice regarding disease prevention (WHO, 2025). School-based health education has repeatedly been shown to improve students' water-related knowledge and behaviours, thereby reducing vulnerability to cholera and other waterborne diseases (WHO, 2025).

A growing body of quasi-experimental evidence supports the effectiveness of health education in improving water hygiene practices. Shapu, Ismail, Lim, Ahmad, and Njodi (2021) reported that a cluster randomised health education intervention significantly improved water sanitation and hygiene practices among adolescent girls in Maiduguri Metropolitan Council, Borno State. Similarly, Freeman et al. (2025) documented measurable improvements in water-related behaviours in school settings following systems-based hygiene interventions, while Taylor, Kahawita, Cairncross, and Ensink (2023) found that combining health education with water hygiene interventions effectively reduced cholera transmission in low- and middle-income countries, although they cautioned that infrastructural limitations could constrain the extent of behaviour change. In contrast, Qasim, Al-Mussawi, Hassan, Muhammad, and Qasem (2018) observed only minimal improvement in water sanitation practices where interventions were of short duration and lacked reinforcement, underscoring the importance of sustained, well-structured programmes. Within Nigeria, Azeez (2023) reported gains in water sanitation knowledge among junior secondary students in peri-urban Lagos after an educational intervention, while Melariri, Yusuf, and Ahmed (2024) similarly found improvements in water sanitation practices among students in Kaduna Metropolis.

Despite this evidence, junior secondary school students in Kaduna State continue to face substantial water hygiene challenges. The researcher observed that several school boreholes are non-functional, wells are frequently left uncovered, and many students lack knowledge of appropriate water treatment methods, relying instead on untreated sources both at home and within the school environment. Existing studies on cholera prevention in the state have tended to focus on general knowledge, attitude and practice surveys or community-level interventions, with comparatively few quasi-experimental studies specifically isolating water sanitation as an outcome among junior secondary school students. This gap limits the availability of context-specific, experimentally derived evidence to guide school-based water hygiene programming in the state.

Given the persistent recurrence of cholera outbreaks in Kaduna State, the observed deficiencies in school water infrastructure and practices, and the scarcity of experimental studies isolating water hygiene among junior secondary school students, this study examined the effect of a health education intervention programme on water hygiene practices for cholera prevention among junior secondary school students in Kaduna State, Nigeria.

## STATEMENT OF THE PROBLEM

Ideally, junior secondary school students should possess sound knowledge and demonstrate consistent safe water hygiene practices, including sourcing water from protected supplies, treating water before consumption, and storing water in clean, covered containers, so as to minimise their risk of cholera infection. Schools are expected to provide functional water infrastructure and reinforce safe water handling behaviours through health education.

However, cholera remains a recurring public health threat in Kaduna State, and the researchers' preliminary observations revealed that several school boreholes are non-functional, wells are commonly left uncovered, and many students consume water from untreated or unprotected sources both at home and in school. Despite periodic government WASH campaigns and oral cholera vaccination drives, these unsafe water hygiene practices persist among junior secondary school students, suggesting that existing awareness efforts have not been sufficiently structured, sustained, or evaluated at the school level. Moreover, while several studies have examined cholera knowledge, attitude and practice among general populations or community members, there remains a paucity of quasi-experimental research specifically evaluating the effect of health education intervention on water hygiene practices among junior secondary school students in Kaduna State. This gap, combined with the persistence of unsafe water hygiene behaviours among students, constitutes the problem addressed by this study.

## PURPOSE OF THE STUDY

The purpose of this study was to examine the effect of a health education intervention programme on water hygiene practices for cholera prevention among junior secondary school students in Kaduna State, Nigeria. Specifically, the study sought to:

1. assess the effect of the health education intervention programme on water sanitation practices among the experimental group of junior secondary school students in Kaduna State;

2. determine the difference in water sanitation practices between the experimental and control groups before and after exposure to the health education intervention programme; and

3. examine the influence of composite demographic variables (school location, age and gender) on the effect of the health education intervention programme on water sanitation practices among junior secondary school students in Kaduna State.

## RESEARCH QUESTIONS

The study answered the following research questions:

1. What is the effect of the health education intervention programme on water sanitation practices among junior secondary school students in Kaduna State?

2. What is the difference in water sanitation practices between the experimental and control groups before and after exposure to the health education intervention programme?

3. Do demographic variables (school location, age and gender) influence the effect of the health education intervention programme on water sanitation practices among junior secondary school students in Kaduna State?

## HYPOTHESES

The following hypotheses were tested at 0.05 level of significance

1. There is no significant effect of the health education intervention programme on water sanitation practices among the experimental group of junior secondary school students in Kaduna State.

2. There is no significant difference in water sanitation practices between the experimental and control groups before and after exposure to the health education intervention programme.

3. Composite demographic variables (school location, age and gender) do not significantly influence the effect of the health education intervention programme on water sanitation practices among junior secondary school students in Kaduna State.

## METHODOLOGY

The study employed a quasi-experimental design, incorporating pre-test and post-test assessments for an experimental group (EG) and a control group (CG). This design was considered appropriate because it enabled the researcher to measure real change attributable to the intervention: the pre-test established a behavioural baseline, while the post-test revealed the change following the intervention, thereby controlling for potential confounding variables (Gray, 2023). The experimental group comprised 65 students drawn from Government Secondary School, Kakuri, Kaduna, while the control group comprised 65 students from Government Technical College, Malali, Kaduna. Both groups were confirmed to be equivalent at baseline in terms of demographic characteristics and water hygiene practices. The experimental group received a six-week health education intervention on water sanitation practices, including safe water sourcing, treatment methods (boiling, filtration, chemical purification), and hygienic storage, while the control group received a placebo intervention comprising general health education unrelated to cholera.

The population of the study comprised all 230,110 junior secondary school students in Kaduna State (Kaduna State Universal Basic Education Board [SUBEB], 2025). A sample of 130 JSS II students (65 experimental, 65 control) was drawn using a multi-stage sampling procedure: stratified random sampling was used to select Kaduna Central Senatorial District from the three senatorial districts; purposive sampling was then used to select the two schools and to restrict participation to JSS II students, who were considered more stable participants than newly admitted JSS I students or examination-focused JSS III students; simple random sampling (balloting) was thereafter used to

select the required number of participants from each school; and the selected students were conveniently assigned to the experimental and control conditions based on their school of enrolment.

The instrument for data collection was a section of a larger researcher-developed questionnaire, focusing on water hygiene as a cholera prevention strategy. This section comprised ten (10) items measured on a four-point modified Likert scale (Every Time, Almost Every Time, Almost Never, Never), covering safe water sourcing, treatment, storage and handling behaviours. A mean score of 2.50 and above was adopted as the benchmark for a positive response. Face and content validity were established through review by five experts from the Department of Human Kinetics and Health Education and the Department of Nursing Science, Ahmadu Bello University, Zaria. A pilot study involving 20 students at Government Commercial College, Zaria, produced a reliability coefficient of 0.87 using the split-half method and Pearson Product-Moment Correlation, confirming that the instrument was suitable for the main study.

The intervention was delivered over six weeks through weekly sessions combining lectures, demonstrations of water treatment techniques, and question-and-answer sessions, using a purpose-developed Cholera Prevention Education Training Manual. Data were analysed using means and standard deviations to answer the research questions, paired-sample t-test to test the effect of the intervention on the experimental group, independent-sample t-test to compare the experimental and control groups, and multiple regression analysis to examine the influence of demographic variables. All hypotheses were tested at the 0.05 level of significance.

## RESULTS

**Table 1: Demographic Characteristics of Respondents**

| Variable | Category | Experimental (n) | % | Control (n) | % |
|---|---|---|---|---|---|
| Age (years) | 9–11 | 14 | 21.5 | 8 | 12.3 |
| | 12–14 | 46 | 70.8 | 54 | 83.1 |
| | 15–17 | 5 | 7.7 | 3 | 4.6 |
| Gender | Male | 36 | 55.4 | 30 | 46.2 |
| | Female | 29 | 44.6 | 35 | 53.8 |
| School Location | GSS Kakuri | 65 | 100.0 | – | – |
| | GTC Malali | – | – | 65 | 100.0 |

Source: Field Survey (2025).

Table 1 shows that both groups were comparable at baseline: the majority of respondents in both the experimental (70.8%) and control (83.1%) groups were aged 12–14 years. The experimental group was 55.4% male and 44.6% female, while the control group was 46.2% male and 53.8% female.

**Table 2: Aggregate Mean Scores of Responses on Water Sanitation Before and After the Health Education Intervention Programme (Experimental Group)**

| Test | N | Mean | SD | Mean Difference |
|---|---|---|---|---|
| Pre-test | 65 | 2.15 | 0.64 | |
| Post-test | 65 | 3.12 | 0.69 | 0.97 |

Decision Mean = 2.50

Table 2 shows that the experimental group's aggregate mean score on water hygiene rose from 2.15 at pre-test, which was below the decision mean of 2.50 and indicated poor baseline water hygiene practice, to 3.12 at post-test, which exceeded the decision benchmark. This indicates a marked improvement in students' knowledge and practice of safe water sourcing, treatment and storage following the intervention.

**Table 3: Aggregate Mean Scores of Responses on Water Sanitation Between the Experimental and Control Groups After the Health Education Intervention Programme**

| Group | N | Mean | SD | Mean Difference |
|---|---|---|---|---|
| Control (post-test) | 65 | 2.31 | 0.65 | |
| Experimental (post-test) | 65 | 3.12 | 0.69 | 0.81 |

Decision Mean = 2.50

Table 3 reveals that the experimental group recorded a substantially higher post-test mean score (3.12) than the control group (2.31), yielding a mean difference of 0.81 in favour of the experimental group. Both groups were, however, statistically comparable at pre-test (aggregate mean difference of −0.02), confirming that the observed post-intervention gap was attributable to the intervention.

**Table 4: Paired-Sample t-test on the Effect of the Health Education Intervention Programme on Water Sanitation Practices (Experimental Group)**

| Group | Test | N | Mean | SD | t-cal | Df | p-value |
|---|---|---|---|---|---|---|---|
| Experimental | Pre-test | 65 | 46.02 | 5.98 | 8.36 | 64 | 0.001 |
| | Post-test | 65 | 67.08 | 7.41 | | | |

t-critical (two-tailed, $\alpha = 0.05$) = 3.51

Table 4 shows a computed t-value of 8.36 (df = 64, p = 0.001), which is less than the 0.05 level of significance. This indicates that the increase in the experimental group's water hygiene score, from a pre-test mean of 46.02 to a post-test mean of 67.08, was statistically significant. Hypothesis one was therefore rejected, confirming that the health education intervention had a significant effect on students' water hygiene practices.

**Table 5: Independent Samples t-test on the Difference in Water Sanitation Practices Between the Experimental and Control Groups**

| Group | Test | N | Mean | SD | t-cal | df | p-value | Decision |
|---|---|---|---|---|---|---|---|---|
| Experimental | Pre-test | 65 | 46.02 | 5.98 | | | | |
| | Post-test | 65 | 67.08 | 7.41 | 8.63 | 128 | 0.001 | Reject $H_0$ |
| Control | Pre-test | 65 | 46.84 | 6.12 | | | | |
| | Post-test | 65 | 51.40 | 6.84 | | | | |

Table 5 reveals that although the experimental (46.02) and control (46.84) groups were closely matched at pre-test, the experimental group's post-test mean (67.08) far exceeded that of the control group (51.40). The independent-samples t-test produced t = 8.63 (df = 128, p = 0.001), confirming a statistically significant difference between the two groups after the intervention. Hypothesis two was therefore rejected.

**Table 6: Regression Coefficients Showing the Influence of Demographic Variables on Water Sanitation Practices Following the Health Education Intervention**

| Demographic Variable | B | SE | Beta | T | p-value |
|---|---|---|---|---|---|
| School Location | 0.471 | 0.076 | 0.401 | 6.161 | 0.001 |
| Age | 0.541 | 0.200 | 0.491 | 2.711 | 0.009 |
| Gender | 0.672 | 0.149 | 0.410 | 4.521 | 0.001 |

Table 6 shows that school location ($\beta = 0.401$, t = 6.161, p = 0.001), age ($\beta = 0.491$, t = 2.711, p = 0.009), and gender ($\beta = 0.410$, t = 4.521, p = 0.001) each made a statistically significant contribution to the effectiveness of the intervention on water hygiene practices. Descriptively, students in the experimental school (Government Secondary School, Kakuri) recorded a considerably higher mean score (3.12) than their counterparts in the control school (2.31); older students (15–17 years) recorded slightly higher gains than younger students (9–11 years); and female students in the experimental group (mean = 3.18) recorded marginally higher scores than male students (mean = 3.08). Hypothesis

three was therefore rejected, confirming that composite demographic variables significantly influenced the effectiveness of the intervention on water sanitation practices.

## DISCUSSION OF FINDINGS

The finding that the health education intervention programme significantly improved water sanitation practices among the experimental group ($t = 8.36$, $p = 0.001$) affirms that demonstration-based instruction on safe water sourcing, treatment and storage can meaningfully change students' behaviour within a relatively short period. This finding aligns with Shapu, Ismail, Lim, Ahmad and Njodi (2021), who reported significant improvements in water sanitation and hygiene practices among adolescent girls in Maiduguri following a comparable school-based intervention, and with Freeman et al. (2025), who documented measurable gains in water-related behaviours in school settings using systems-based hygiene education. It also corroborates Melariri, Yusuf, and Ahmed (2024), who found improved water sanitation practices among students in Kaduna Metropolis after health education, and Azeez (2023), who reported similar gains among junior secondary students in peri-urban Lagos. However, the finding contrasts with Qasim, Al-Mussawi, Hassan, Muhammad, and Qasem (2018), who observed only minimal improvement in water sanitation practices following short-duration interventions with limited reinforcement, suggesting that the sustained, six-week structure of the present intervention was instrumental to its success.

The significant difference observed between the experimental and control groups after the intervention ($t = 8.63$, $p = 0.000$) further validates the effectiveness of health education relative to routine, unrelated instruction. This is consistent with Taylor, Kahawita, Cairncross, and Ensink (2023), who found that combining health education with water hygiene interventions substantially reduced cholera transmission risk in low- and middle-income settings, although the same authors cautioned that infrastructural limitations, such as non-functional boreholes, may still constrain the practical application of newly acquired knowledge. This caveat is particularly relevant given the researcher's observation of non-functional boreholes and uncovered wells within the study schools, suggesting that sustained gains in practice may ultimately depend on complementary improvements in school water infrastructure.

The finding that school location, age and gender significantly influenced the effectiveness of the intervention supports the view that demographic characteristics moderate how effectively health education translates into behaviour change. Students in the experimental school demonstrated markedly greater improvement than those in the control school, reflecting the direct benefit of exposure to the intervention rather than mere maturation or routine schooling. The slightly larger gains recorded among older students (15–17 years) may reflect greater cognitive maturity and readiness to internalise health messages, while the marginally higher scores recorded by female students align with earlier reports that girls tend to be more responsive to hygiene-focused health education, possibly due to greater involvement in household water-related tasks (Shapu et al., 2021).

## CONCLUSION

Based on the findings, it is concluded that health education intervention significantly improves water sanitation knowledge and practices among junior secondary school students in Kaduna State, and that the effectiveness of such intervention is significantly shaped by students' school location, age and gender.

## RECOMMENDATIONS

Based on the findings of the study, the study recommended the following:

1. Schools in Kaduna State should integrate sustained health education on water sanitation and hygiene, such as safe sourcing, treatment and storage, into the school health curriculum rather than relying on periodic, one-off campaigns.

2. Teachers and school health clubs should incorporate practical demonstrations of water treatment methods (boiling, filtration, chemical purification) to reinforce classroom instruction on water hygiene.

3. Health education programmes on water sanitation and hygiene should be tailored to demographic differences, with additional reinforcement for younger students and male students who recorded comparatively smaller gains.

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