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Childhood Diarrhoea in Ndop Health District, Cameroon: Findings from a Community-Based Cross-Sectional Study

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Abstract

Background: In Sub-Saharan Africa, including Cameroon, diarrhoea remains a leading cause of mortality among children under five. Its prevalence, risk factors, and management vary by setting, with significant implications for effective interventions. This study aimed to determine the prevalence and associated factors of diarrhoeal diseases among children under five in Ndop Health District, Cameroon. **Methods:** A community-based cross-sectional study was conducted from March to June 2025 among 507 children under five and their mothers/caregivers across nine health areas. Data were collected using structured questionnaires and observation checklists. Descriptive statistics estimated frequencies and percentages. Associations were assessed using Chi-square tests, while bivariate and multivariate logistic regression identified predictors of diarrhoeal disease. Statistical significance was set at $p < 0.05$. **Results:** The mean age of mothers/caregivers was 29.9 ± 8.6 years; most were female (82.6%), Christian (69.2%), and earning below 45,000 CFA (86%). Children were predominantly aged 13 - 36 months (43%), with 71.6% not yet in school. The prevalence of diarrhoea was 65.8%, highest among children aged 6 - 12 months (75.7%), males (67.5%), and rural residents (71.5%). Significant predictors included rural residence ($p < 0.001$), consumption of food from roadside vendors (OR: 1.60, 95% CI: 1.23 - 1.50, $p < 0.001$), unsafe stool disposal (OR: 1.82, 95% CI: 1.60 - 1.70, $p < 0.001$), poor handwashing practices ($p < 0.001$), lack of rotavirus vaccination ($p < 0.001$), poor toilet hygiene ($p < 0.01$), unsafe water storage ($p < 0.02$), and garbage disposal in nearby bushes ($p < 0.002$). **Conclusion:** Diarrhoeal disease remains highly prevalent in Ndop, driven by poor hygiene, unsafe feeding practices, inadequate sanitation, and low rotavirus vaccination coverage. Strengthening hygiene promotion, safe food and water handling, environmental sanitation, and immunization could

significantly reduce this burden.

Keywords

Diarrhoea, Under-Five Children, Prevalence, Risk Factors, Ndop Health District, Cameroon

1. Introduction

Diarrhoeal disease remains one of the leading causes of mortality and morbidity among children under five globally, despite being preventable and treatable [1]. It is estimated that diarrhoea causes approximately 525,000 deaths annually in this age group, with the highest burden occurring in sub-Saharan Africa and South Asia [1] [2]. In these regions, children below three years experience, on average, three episodes of diarrhoea annually, which significantly contributes to malnutrition, impaired growth, and developmental delays [3].

According to a UNICEF [2] report from 2023, diarrhoea was responsible for almost 9% of all deaths in children under five globally, resulting in over 200 children dying from diarrhoea every day, or approximately 444,000 children dying annually.

A report by the Center for Disease Control (CDC) [3] shows that diarrhoea kills more young children than measles, malaria, and HIV or AIDS combined, and it is estimated that each child below 5 years of age in low- and middle-income countries (LMIC) suffers from three episodes of diarrhoea per year. Another report by the United Nations International Children's Emergency Fund (UNICEF) [4] revealed that deaths among children under five years are mostly caused by malaria (5%), diarrhoea (8%), pneumonia (15%), malnourishment (45%), and others (9%).

Furthermore, diarrhoeal illnesses are the main cause of malnutrition, which ranks as the third leading cause of death in children under five, particularly in developing nations [5]. In 2021, diarrhoeal diseases caused an estimated 444,000 deaths among children under five years globally, remaining the third leading cause of mortality in this age group, with an additional 51,000 deaths in children aged 5 - 9 years [6]. According to UNICEF, while global diarrhoeal mortality among children under five has declined substantially over the past three decades, progress remains uneven and the disease still accounts for approximately 8% of all under-five deaths [7].

Modeling studies suggest that if high-impact interventions such as oral rehydration salts, rotavirus vaccination, improved nutrition, sanitation, and hygiene achieved 90% coverage, childhood diarrhoeal deaths could be reduced by 74% by 2030, and potentially by over 90% with concurrent improvements in water and sanitation [8]. Again, the World Health Organization [1] in 2017 reported that more than a quarter (26.9%) of diarrhea deaths occurred among children younger

than five years, and about 90% of diarrhoea deaths occurred in South Asia and sub-Saharan Africa. Children in low- and middle-income countries (LMICs) are the most vulnerable to diarrhoea. Moreover, about 94% of the diarrhoeal disease burden is attributed to the environment and linked with risk factors such as unsafe drinking-water and poor sanitation [3].

In Cameroon, epidemiological studies conducted at the community level suggest that the prevalence of diarrhoea among children under five ranges from 16% to 23%. For example, Tambe *et al.* [9] conducted a study in the Effoulan Health District of Yaoundé, an urban context, and found that 26.1% of children under five had diarrhoea. However, in a different study conducted in Tiko, a rural area, the prevalence of diarrhoea was found to be 23.8%, with children under the age of 24 months being particularly affected [10]. Similarly, a study conducted in Douala, Cameroon by Mabvouna *et al.* [11] found that the incidence of diarrhoea in children under the age of five was 29.26%.

In Africa, diarrhoeal diseases are a contributing factor in four out of ten deaths in children under five. For example, a study conducted in Uganda found that in 2017, the prevalence of diarrhoea among children under five was 29.1%. This disease also contributed to approximately 140,000 annual deaths and 7.1% of all children under five, ranking Uganda as the 27th most diarrhoeal-prone country in the world [9]. In Ethiopia, diarrhoea is one of the leading causes of death in children under five [12]. In Cameroon, diarrhoeal diseases continue to pose a significant threat to child health. In 2020, they accounted for approximately 6.6% of all deaths nationally, ranking the country around 29th globally in age-adjusted mortality rate (55.9 per 100,000 population) [13]. Etiological investigations reveal a significant role of rotavirus and bacterial pathogens, notably with rotavirus detection rates of 42.8% in the North West and up to 46.5% in the Far North regions of Cameroon, underscoring considerable regional disparities in disease burden [14].

Under-five mortality and morbidity can be decreased with effective diarrhoea management. In order to reduce associated mortality and prevent dehydration caused by diarrhoea, mothers and other caregivers can manage diarrhoea using ORS effectively at home. There is evidence that ORS can lower the particular fatality rate for diarrhoea by up to 93% [15]. However, studies reveal that there is still very poor population coverage for this simple yet effective intervention, especially in the nations most affected by diarrhoeal diseases [16].

In spite of the high morbidity and mortality associated with diarrhoea in children, only one in three who experience an episode receives ORS and less than 5% of them receive zinc [17]. For instance, a study by Adedokum ST, Yaya S. in sub-Saharan Africa found that ORS was used in only 38% of diarrhoea episodes in sub-Saharan Africa, which is notably lower than the 44% average in developing countries [18].

In Cameroon, diarrhoeal diseases contribute substantially to under-five morbidity and mortality, ranking among the top five causes of childhood deaths [19].

Factors associated with childhood diarrhoea include unsafe drinking water, inadequate sanitation and hygiene practices, poor maternal education, incomplete vaccination, and suboptimal health-seeking behaviour [5] [6]. Understanding the local epidemiology and risk factors is critical for designing targeted interventions to reduce the disease burden.

Ndop Health District, located in the North West Region of Cameroon, is predominantly rural and characterized by limited access to safe drinking water and improved sanitation facilities. Despite the known burden of diarrhoeal diseases nationally, there is a paucity of context-specific data on the prevalence and factors associated with diarrhoeal disease among under-five children in this district. Local evidence is essential to understand how environmental, socioeconomic, and behavioral conditions interact within this setting. Given these gaps, this study aimed to determine the prevalence of diarrhoeal disease and to examine factors associated with its occurrence among children under five years in Ndop Health District. Generating district-level evidence will help inform context-appropriate public health strategies, including improvements in water, sanitation, hygiene, and immunization services, and will provide baseline data for future interventions and research in similar rural settings.

2. Materials and Methods

2.1. Study Design

This was a community-based cross-sectional study to assess the determinants of diarrhoeal diseases in children under five years in the Ndop Health District.

2.2. Study Setting and Population

Ndop Health District is one of the 21 health districts of the North West Region of Cameroon. It is bordered to the north by Bangoren Health District, to the south by Tubah Health District, to the east by Kumbo East Health District, and to the west by Fundong and Oku health districts. The district is made up of 15 health areas: one urban health area, two semi-urban areas, and 12 rural health areas. The district is predominantly rural and has a population of 207,781 in 2025 according to the Center for Health Information (CIS). It is located about 60 km on the highway from Bamenda to Kumbo. It is linked to Kumbo by National Road Number 11 (RN-11). Fourteen out of fifteen health areas are accessible by road, and one health area, Mbissa, is accessible by water (Island) across the Bamenjim dam. It covers a total surface area of 1126 km^2. It has limited access to potable water and sanitation infrastructure. Ndop Health District covers the entire Ngoketunjia division, with Ndop, the headquarters, located in Bamunka. Ndop Health District is made up of 13 villages. Ndop is the administrative division of Ngoketunjia with three subdivisions, namely Ndop Central, Babessi, and Balikumbat Subdivisions, corresponding to three council areas: Ndop Central, Babessi, and Balikumbat councils, respectively. The area is lowland, surrounded by hills with streams that

empty into the Bamenjim dam. The Ndop plain makes drainage difficult, and this causes slums around living homes and farmland, which facilitates waterborne diseases. Field data was collected from March to June 2025.

The study population was mothers/caregivers of children under five years living in households in Ndop health district. Mothers/caregivers of children under the age of 5 years from the selected households were included in the study. A household was considered as people living in the same dwelling and sharing common meals. To be eligible to participate in the study, mothers/caregivers in selected households must have children under 5 years. In households with more than two children under five years, a random child selection within eligible households was done. We excluded eligible mothers/caregivers who had mental cognitive problems or who were very sick and could not respond to the questions.

2.3. Variables

The variables included history of diarrhoea, water treatment, breastfeeding during diarrhoea episodes, purchase of food from roadside vendors, vaccination status, and drinking water sources, which included wells, springs, rainwater, piped water, and streams. Other variables were child's stool disposal. Diarrhoeal occurrence was the outcome variable, which was defined as having diarrhoeal disease in the four weeks prior to the survey. Independent variables included non-water treatment, purchase of food from roadside vendors, non-vaccination with the Rotavirus vaccine, unimproved drinking water sources, water storage containers, stool disposal in open bushes, and poor garbage disposal.

2.4. Data Resources and Measurements

Data collection tool: Data about the child were collected from their mothers/caregivers through questionnaires with the primary caregivers of the children. The survey instrument was developed based on established guidelines and previous research studies [10]-[12].

Data collection: Sociodemographic characteristics of the mother/caregivers and child included sex of child, age, number of siblings, dietary habits, vaccination status, and the occurrence of diarrhea episodes (defined as ≥3 loose stools within 24 hours). Mother's information included age of mother, religion, location of family, mother's education, number of children, marital status, age of mother at first pregnancy, relationship with the child, profession, and level of income. Data about prevalence of diarrhoea included the occurrence of diarrhoea and number of diarrhoea episodes and was categorized as follows: diarrhoea presence and diarrhoea absence. The practices used by mothers included sources of drinking water (pipe borne, well, stream), treatment given to water before drinking, utensils used in storing water, and treatment given to child at home with diarrhoea (ORS, bananas, antibiotics, nothing, etc.). The tool was developed in English, translated into the local language to respondents (where necessary), and pre-tested among 10 mothers/caregivers in a neighboring health area that was not part of the study

sample. Feedback from the pre-test was used to refine and clarify ambiguous or culturally inappropriate items to ensure content validity and reliability. Trained field data collectors (Community Health Workers), fluent in both English and local dialects, administered the questionnaires through face-to-face interviews during household visits. Interviewers received training on the study objectives, ethical considerations, interviewing techniques, and procedures for obtaining informed consent. During data collection, the team visited each selected household and conducted interviews with eligible mothers/caregivers after obtaining their written informed consent. Data were collected using paper-based forms or phones, which were downloaded as Excel and checked daily by field supervisors for completeness and accuracy. Data were downloaded from the phone and merged as an Excel database and exported to SPSS version 26.0. The data have been stored in a password-protected computer and further data cleaning was done using the same software.

The sample size: The sample size was calculated using Cochran's formula [20].

$$\text{Sample Size (n)} = Z^2 \times P(1 - P)/e^2$$

The prevalence of diarrhoea of 29.25% from a study carried out by Mabvouna *et al.* [11] in Douala, Cameroon was used. Therefore, prevalence (P) of 29.25%, with a confidence level of 95% and a maximum error margin (e) of 5%. The standard value of Z at a 95% confidence interval is 1.960.

Therefore, applying the Cochran's formula gives;

$$(1.960)^2 * 0.2925(1 - 0.2925/(0.05)) = 318$$

Assuming a response rate of 80%, the minimum sample size for this study was estimated to be 398 to compensate for non-response. However, a total of 507 mothers/caregivers and their children were recruited from nine health areas for this study.

This study made use of a multistage technique to select health areas, health facilities, communities, households, and mothers/caregivers to participate in the study. In the first stage, health areas were classified into three categories: Urban, Semi Urban, and Rural health areas, which correspond to the classification by the district health service. The one Urban health area and the two Semi Urban health areas were included in the study, and six Rural health areas were randomly selected, giving a total of nine health areas that were considered for the study. The study population was distributed to the various health areas according to the weights of the population size. The second stage was the selection of communities. At the third stage of sampling, households within each of the 36 randomly selected communities were selected using a modified Lot Quality Assurance Sampling (LQAS) approach, maintaining the pre-defined lots-of-four sequence per health area. In each selected community, a rapid household listing was conducted with the assistance of the community health worker and village authorities to identify all households with at least one eligible mother/caregiver (defined as a woman residing in the household with a child in the target age group). Households were assigned unique identification numbers to constitute

the sampling frame.

The total number of mothers/caregivers to be interviewed was allocated proportionally by area of residence as follows; 396 respondents in rural health areas, 100 respondents in Semi-Urban health areas, and 11 respondents in urban health areas. Within each selected community, the number of households to be surveyed was determined according to the LQAS lot size assigned to that health area. To minimize selection bias, systematic random sampling was applied within each community. The total number of eligible households in the community was divided by the required sample size to determine the sampling interval (4 households). A random starting number between 1 and 4 was selected using a random number table. Households were then selected at fixed intervals (every 4th household) until the required sample size was achieved. The household of the community/village head was used only as a geographic reference point for mapping and orientation and was not automatically included in the sample unless selected through the random procedure. If a selected household did not contain an eligible mother/caregiver, the next household in the predefined sampling sequence was approached. If no eligible respondent was identified after visiting two consecutive households, the team continued following the systematic interval sequence to preserve randomness. In cases of absence, the household was revisited up to two additional times on the same day at different hours before being classified as a non-response. Replacement was done only after confirming non-eligibility or non-response following the revisit protocol. A total of 507 mothers/caregivers were targeted for interview (396 rural, 100 semi-urban, 11 urban). Of these, 507 completed the interview, resulting in an overall response rate of 100%. Non-response was primarily due to absence at the time of visit or refusal to participate.

Data analysis: Data were entered and analyzed using SPSS for Windows version 26.0 statistical software. In order to ensure high-quality data, data collectors followed a restricted approach during the data collection phase and all entries were supervised for completeness and consistency. The dependent variable analyzed was the history of diarrhoeal disease in children, while the independent variables included demographic characteristics and Water, Hygiene, and Sanitation (WASH) variables. Descriptive statistics were used to present frequencies and percentages. We calculated the median and range of quantitative variables such as age. Chi-square tests assessed associations; bivariate logistic regression analyses were conducted to identify factors associated with diarrhoeal diseases. All measures of association were presented as odds ratios. Statistical significance was set at $p < 0.05$ at a confidence interval of 95% (CI).

2.5. Ethical Considerations

Approval to carry out this study was obtained from the Institutional Review Board (IRB) of The University of Bamenda (Ref No 2022/0709H/Uba/IRB). Administrative clearance was obtained from the Regional Delegation of Public Health for the North West Region (Ref No 300/ATT/NWR/RDPH/BRIGAD). Written informed

consent was obtained from all the quarter heads, and mothers/caregivers above 18 years of age signed a consent form before any data collection procedure started. Mothers/caregivers answered questions for children under five years about their health status. For eligible mothers who were less than 18 years old at the time of the survey, informed assent was given, and an assent form was provided for them to sign before participating in the study. The consent and assent forms were read and explained to participants who could not read or write. All data are stored in a computer protected with a password.

3. Results

3.1. Sociodemographic Analysis

A total of 507 mothers/caregivers of children under five years were interviewed. For the children, 43% were aged 13 - 36 months and 22.9% were below 6 months. Slightly more than half (52.3%) were male, and 71.6% were not yet attending school as seen in Table 1. Most mothers/caregivers were female (82.6%) and young (mean age: 29.9 ± 8.6 years). Over half (61.9%) had their first child at or before 20 years of age. A majority (69.2%) were Christians, and almost half (45.2%) had only primary education. Most were unskilled workers (41%) or unemployed (21.5%), and 86% earned below 45,000 CFA per month. Over half (56.8%) were single as seen in Table 2.

Table 1. Sociodemographic characteristics of children under five years and their mothers/caregivers in Ndop Health District, Cameroon, recruited during a community-based survey from March to June 2025 (N = 507).

Characteristic	Frequency	Percentage (%)
Child's age group (months)		
0 - 6	116	22.9
7 - 12	82	16.2
13 - 36	218	43.0
37 - 59	91	17.9
Sex		
Female	238	46.9
Male	265	52.3
Education level		
Not yet attending school	363	71.6
Nursery	70	13.8
Pre-nursery	26	5.1
Primary	44	8.7

Table 2. Sociodemographic characteristics of mothers/caregivers of children under five years in Ndop Health District, Cameroon, recruited during a community-based survey from March to June 2025 (N = 507).

Characteristics	Frequency	Percentage	Mean ± SD
Age categories(years)			
≤20	55	10.8	29.9 ± 8.6
21 - 35	328	64.7	
≥36	124	24.5	
Age category at first childbirth (years)			
≤20	314	61.9	20.7 ± 4.4
21 - 35	183	36.1	
≥36	9	1.8	
Gender of the guardian			
Female	419	82.6	
Male	88	17.4	
Religion			
Christian	351	69.2	
Muslim	142	28.0	
None	13	2.6	
Mother's education			
High school	40	7.7	
Primary	229	45.2	
Secondary	214	42.2	
University	24	4.7	
Level of income per month			
45,000 to 60,000 CFA	52	10.3	
61,000 to 100,000 CFA	6	1.2	
Greater than 100,000CFA	6	1.2	
Less than 45,000 CFA	436	86.0	
Number of children under the care group			
1 - 3	279	55.1	3.7 **± 2.3**
4 - 5	126	24.9	
≥6	94	18.5	
Marital status			
Married	291	57.4	
Single	288	56.8	
Divorced	3	0.6	

3.2. Descriptive Analysis

In this study, 334 out of 507 children (65.8%) had diarrhoea in the past one month. The prevalence was highest among children aged 6 - 12 months (75.7%), followed by 13 - 59 months (67.3%), and lowest in <6 months (56.1%). Males (67.5%) had slightly higher rates than females (64%). Children living in rural areas had a significantly higher prevalence (71.5%) compared to urban (43%) and semi-urban (27.3%) areas ($p < 0.001$), as seen in Table 3. The findings also reveal that more than half of mothers reported treating water at home (56.2%), while a significant proportion (43.3%) still consumed untreated water. Over half (54.8%) continued breastfeeding during diarrhoeal episodes, while almost half (45.2%) did not. Risky behaviors were prevalent, including frequent purchase of food from roadside vendors (65.5%), inadequate handwashing with soap (only 41.6% practiced it), and poor toilet hygiene, with just 20.5% cleaning toilets very often and 37.4% not cleaning them at all. Although 62.5% of children were vaccinated against rotavirus, over a third were not. Feeding during diarrhoea was mostly reduced (57%). Unsafe water sources, like wells (29.1%) and streams (13.8%), were used, and over half of households used unimproved toilets (58.1%) and disposed of children's stool in open spaces (61.7%). Waste disposal was mainly in nearby bushes (66.5%). Storage of water in utensils with lids was practiced by 92.3%, as seen in Tables 4-6.

Table 3. Prevalence of diarrhoea in the past one month among children under five years in Ndop Health District, Cameroon, by age group, sex, and place of residence, March-June 2025 (N = 507).

Characteristics	Frequency	Prevalence (%)
AGE		
<6	83	56.1
6 to 12	84	75.7
13 - 59	167	67.3
Sex		
Male	179	67.5
Female	155	64
Residence		
Rural	283	71.5
Semi Urban	8	27.3
Urban	43	43
Total Prevalence	334	65.8

Table 4. Mothers' practices in the prevention and management of diarrhoeal diseases among children under five years in the Ndop Health District, Cameroon, March-June 2025 (N = 507).

Practices	Frequency (n)	percentage (%)
Water treatment at home		
Not treated	222	43.3
Treated	285	56.2

Continued

Breastfeeding during diarrhoeal episode		
Don't breastfeed	229	45.2
Breastfeed	278	54.8
Purchase of food		
From roadside vendors	332	65.5
Not from roadside vendors	185	36.5
Handwashing with water and soap		
Practiced	211	41.6
Not practiced	296	58.2
Vaccination against rotavirus		
Vaccinated	317	62.5
Not vaccinated	190	37.4
Frequency of cleaning the toilet		
Very often	104	20.5
Less often	213	42
Not at all	190	37.4
Environmental factors: Drinking water source		
Well	149	29.1
Pipe borne	167	33
Mineral	121	23.9
Stream	70	13.8
Nature of toilet facility		
Improved	212	41.8
Not improved	295	58.1
Disposal of child's stool		
In toilet	194	38.3
In open space	313	61.7
Garbage disposal		
Garden	34	6.7
Nearby bushes	337	66.5
Ponds	51	10.1
Public dumps	85	16.8
Number of children in the household		
1 to 2	178	35.1
3 to 4	170	33.5
5 and above	157	31
Water storage at home		
Utensils with lids	468	92.3
Without lids	39	7.7

Table 5. Association between the occurrence of diarrhoea and the age, sex, and place of residence of children under five years in the Ndop Health District, Cameroon, March–June 2025 (N = 507).

Factor	Occurrence of diarrhoea during the past 1 month		χ^2	p-value
	Yes (%)	No (%)		
Age of child (months)			11.31	0.004
<6	83 (56.1)	65 (43.9)		
6 - 12	84 (75.7)	27 (24.3)		
13 - 59	167 (67.3)	81 (32.7)		
Sex			1.44	0.23
Male	179 (67.5)	86 (32.5)		
Female	155 (64.0)	87 (36.0)		
Residence			29.01	<0.001
Rural	283 (71.5)	113 (65.3)		
Semi-urban	8 (27.3)	3 (27.3)		
Urban	43 (43)	57 (57)		

Table 6. Predictors of diarrhoea occurrence among children under five years in Ndop Health District, Cameroon, March–June 2025 (N = 507).

Factor	Presence of diarrhoea		OR	95% CI	p-value
	Yes [n (%)]	No [n (%)]			
Age of child (months)					
<6	83 (56.1)	65 (43.9)	0.04	1.44 - 1.78	0.78
6 - 12	84 (75.7)	27 (24.3)	2.14	1.16 - 3.94	0.015
13 - 59	167 (67.3)	81 (32.7)	Ref		
Sex of the child					
Male	179 (67.5)	86 (32.5)	1.17	0.85 - 1.61	0.33
Female	155 (64.0)	87 (36.0)	Ref		
Residence					
Rural	283 (71.5)	113 (65.3)	3.28	2.03 - 5.29	<0.001
Semi-urban	8 (27.3)	3 (27.3)	0.69	0.12 - 0.28	0.21
Urban	43 (43)	57 (57)	Ref		
BF during diarrhoea episodes					
Not properly breastfeed	65 (12.8)	164 (32.3)	0.93	0.68 - 1.27	0.64
Properly Breastfeed	101 (19.9)	177 (34.9)	Ref		
Purchase of Roadside food					
Road side vendors	126 (28.9)	206 (40.6)	1.60	1.23 - 2.08	<0.001
No roadside vendors	99 (19.5)	86 (17.0)	Ref		

Continued

Handwashing soap/water					
Not Practiced	79 (15.6)	132 (26,0)	2.41	0.1.75 - 3.32	<0.001
practiced	156 (30.8)	140 (27.6)	Ref		
Vaccination against Rotavirus					
Vaccinated	201 (39.6)	116 (22.9)	Ref		
Not vaccinated	105 (20.7)	85 (16.8)	2.76	1.98 - 3.85	<0.001
Child feeding practices during diarrhoea					
About the same amount	56 (11.0)	87 (17.2)	1.22	1.01 - 1.23	0.65
Less than usual	101 (19.9)	188 (37.1)	3.21		
More than usual	15 (3.0)	60 (11.8)	Ref		
Frequency of cleaning the toilet					
Very often	88 (17.4)	125 (24.6)	0.93	1.04 - 1.52	<0.01
Less often	38 (7.5)	66 (13.0))	0.81	0.01 - 0.88	0.02
Not at all	111 (22.0)	79 (15.6)	Ref		
Water storage at home					
Utensils with lids	301 (59.4)	185 (36.5)	Ref		
Without lids	19 (3.7)	20 (3.1)	0.61	1.26 - 1.77	<0.02
Disposal of child's stool					
In toilet	121 (28.9)	73 (14.4)	Ref		
In open space	107 (21.1)	206 (40.6)	1.82	1.34 - 2.48	<0.001
Garbage disposal					
Garden	118 (23.3)	219 (43.2)	0.21	0.63 - 0.77	0.96
Nearby bushes	20 (3.9)	14 (2.8)	0.66	0.85 - 1.23	<0.002
Ponds	40 (7.9)	11 (2.2)	0.87	1.10 - 1.61	0.31
Public dumps	10 (1.9)	75 (14.8)	Ref		

3.3. Chi-Square Analysis

There was a statistically significant association between diarrhoea in the past one month and child's age ($\chi^2 = 11.31$, $p = 0.004$) as well as place of residence ($\chi^2 = 29.01$, $p < 0.001$). No significant association was observed between diarrhoea and **sex** ($\chi^2 = 1.44$, $p = 0.23$). The prevalence of diarrhoea was 56.1% among children aged < 6 months and 75.7% among those aged 6 - 12 months. Additionally, 71.5% of children residing in rural areas experienced diarrhoea in the preceding month compared to 43.0% of children in urban areas.

3.4. Bivariate Analysis

Children residing in rural areas had significantly higher odds of diarrhoea compared to those in urban areas (COR = 3.28; 95% CI: 2.03 - 5.29; $p < 0.001$). Con-

sumption of food from roadside vendors was associated with increased odds of diarrhoea (COR = 1.60; 95% CI: 1.23 - 2.08; p < 0.001). Children from households that did not practice regular handwashing with soap had higher odds of diarrhoea (COR = 2.41; 95% CI: 1.75 - 3.32; p < 0.001). Non-vaccination against rotavirus was strongly associated with diarrhoea (COR = 2.76; 95% CI: 1.98 - 3.85; p < 0.001). Infrequent toilet cleaning was associated with increased odds of diarrhoea (COR = 1.69; 95% CI: 1.15 - 2.49; p = 0.008). Unsafe water storage without lids increased the odds of diarrhoea (COR = 1.54; 95% CI: 1.08 - 2.21; p = 0.018). Disposal of children's stool in open spaces was significantly associated with diarrhoea (COR = 1.82; 95% CI: 1.34 - 2.48; p < 0.001). Garbage disposal in nearby bushes was also associated with increased odds (COR = 1.71; 95% CI: 1.22 - 2.40; p = 0.002). Breastfeeding during diarrhoeal episodes was not significantly associated with diarrhoea occurrence (COR = 0.93; 95% CI: 0.68 - 1.27; p = 0.64).

3.5. Multivariate Analysis

After adjustment for potential confounders, Rural residence remained independently associated with diarrhoea (AOR = 2.54; 95% CI: 1.49 - 4.33; p = 0.001). Non-vaccination against rotavirus remained a strong independent predictor (AOR = 2.21; 95% CI: 1.52 - 3.22; p < 0.001). Non-practice of handwashing with soap remained significant (AOR = 1.98; 95% CI: 1.36 - 2.89; p < 0.001). Open disposal of children's stool remained independently associated with diarrhoea (AOR = 1.57; 95% CI: 1.11 - 2.23; p = 0.011). Consumption of roadside vendor food showed attenuated but still significant association (AOR = 1.42; 95% CI: 1.05 - 1.94; p = 0.023). Garbage disposal in nearby bushes remained marginally significant (AOR = 1.46; 95% CI: 1.01 - 2.12; p = 0.044). However, unsafe water storage without lids (AOR = 1.29; 95% CI: 0.88 - 1.89; p = 0.19) and infrequent toilet cleaning (AOR = 1.33; 95% CI: 0.89 - 1.99; p = 0.16) were no longer statistically significant after adjustment. Breastfeeding during diarrhoeal episodes remained non-significant (AOR = 0.95; 95% CI: 0.69 - 1.31; p = 0.75).

4. Discussion

This study found a high prevalence (65.8%) of diarrhoea among under-five children in Ndop Health District, which is considerably higher than the national prevalence of 21% reported in the 2018 Cameroon Demographic and Health Survey [19]. The prevalence observed in this study is also higher than findings reported by Tambe in Effoulan (26.1%) and Mabvouna *et al.* in Douala (29.25%) [9] [10]. The higher burden observed in Ndop may reflect contextual differences, including rural residence, sanitation coverage, and access to safe drinking water. However, given the cross-sectional nature of the study, these findings indicate differences in prevalence rather than causal relationships. Although the highest proportion of diarrhoea cases was observed among children aged 6 - 12 months, consistent with the complementary feeding period when exposure to contaminated foods and water may increase, age was not statistically significantly associated with diarrhoea

in the regression analysis. This contrasts with findings from Walker *et al.* and Checkley *et al.* [21] [22], who reported higher susceptibility among younger children due to weaning, increased mobility, and greater environmental exposure. In our study, while descriptive patterns suggested variation by age group, the lack of statistical significance indicates that age was not independently associated with diarrhoeal occurrence in this population. Similarly, no statistically significant association was observed between sex and diarrhoea, despite a slightly higher prevalence among males. This aligns with studies suggesting that diarrhoea affects both sexes relatively equally, even when small differences in prevalence are observed.

Findings from other studies in sub-Saharan Africa, including Mengistie *et al.* and Alemayehu *et al.* [23] [24], have reported associations between diarrhoeal disease and unsafe water, inadequate sanitation, low maternal education, and incomplete immunization. In this present study, several of these factors were also significantly associated with diarrhoea. Maternal education is widely recognized as being linked to health knowledge and practices, including hygiene behavior, recognition of danger signs, and timely care-seeking [25]. In our study, nearly half of mothers had only primary-level education, which may influence household hygiene and child-care practices.

Socioeconomic characteristics further contextualize these findings. A substantial proportion of mothers/caregivers were engaged in unskilled work (41%), and most reported low monthly income (87.6% earning less than 45,000 CFA francs). Lower socioeconomic status may be associated with reduced access to safe water, sanitation infrastructure, adequate nutrition, and healthcare services. While income and occupation were not interpreted causally, these characteristics may help explain patterns observed in diarrhoeal prevalence. Water, sanitation, and hygiene (WASH) conditions in the study area indicate multiple areas of concern. Although 56.2% of mothers reported treating drinking water at home, 43.3% consumed untreated water. A considerable proportion relied on wells (29.1%) and streams (13.8%) as water sources. More than half of households used unimproved toilets (58.1%), and 61.7% disposed of children's stool in open spaces. Waste disposal in nearby bushes was common (66.5%). These environmental conditions were significantly associated with diarrhoea in the regression analysis, supporting findings from similar low-resource settings. Despite high reported safe water storage practices (92.3% using containers with lids), other gaps in sanitation and waste management remain evident.

Behavioral practices were also important. Frequent purchase of food from roadside vendors (65.5%), inadequate handwashing with soap (only 41.6% reported regular practice), and poor toilet hygiene were common. These practices were significantly associated with diarrhoea in both bivariate and multivariable analyses, suggesting that household and community hygiene behaviors are closely linked with diarrhoeal occurrence in this setting. Feeding practices during diarrhoeal episodes were suboptimal; although 54.8% continued breastfeeding, 45.2% did not,

and 57% reported reducing feeding, contrary to WHO recommendations.

Rotavirus vaccination was significantly associated with lower odds of diarrhoea. While this finding is consistent with established evidence demonstrating the effectiveness of rotavirus vaccination in reducing severe diarrhoeal disease [26], the cross-sectional design of this study allows only the identification of associations rather than causal inference. Nevertheless, over one-third of children were not vaccinated against rotavirus, which may contribute to the overall burden observed. Rural residence was independently associated with higher odds of diarrhoea. This association may reflect disparities in access to improved water sources, sanitation infrastructure, and hygiene services between rural and urban settings. However, causality cannot be established due to the study design.

5. Strengths and Limitations of the Study

This study has several notable strengths. First, the use of a community-based sampling approach enhanced the representativeness of the findings and allowed inclusion of both rural and urban households within the health district. Also, the study incorporated multivariable logistic regression analysis to adjust for potential confounders, strengthening the validity of the observed associations. In addition, the comprehensive assessment of sociodemographic, environmental, behavioral, and immunization-related factors provided a holistic understanding of the context in which childhood diarrhoea occurs in this setting.

The limitations of this study included the fact that this study was carried out only in one health district, and the findings may not be representative of all the children in the country. There is a possibility that there could have been a recall bias in the reporting of management practices, given that this aspect was carried out using a questionnaire. Selection bias may have occurred at the household level. Although households were selected using a structured sampling approach, the selection of the index child within households with more than one eligible under-five child may not have been fully randomized. If caregivers preferentially reported on a child who was recently ill or more memorable, this could have led to an overestimation of diarrhoeal prevalence and potentially inflated associations with household-level exposures. the measurement of diarrhoea and related practices relied on caregiver self-report over a one-month recall period, which introduces the possibility of recall bias and misclassification. Caregivers may have underreported mild episodes or overreported more severe episodes. Similarly, socially desirable responses regarding handwashing, water treatment, or vaccination status could have resulted in non-differential misclassification. Such misclassification would likely bias associations toward the null, potentially underestimating the strength of true relationships. The cross-sectional study design used in this study does not permit us to establish a causal association between the dependent and independent variables.

6. Conclusions

Diarrhoeal disease remains a challenge among children under five years in Ndop

Health District, with a prevalence of 65.8% and the highest burden among infants aged 6 - 12 months and those in rural settings. Associated factors include: poor hygiene, unsafe feeding practices, inadequate sanitation, and low rotavirus vaccination coverage. Strengthening hygiene promotion, safe food and water handling, environmental sanitation, and immunization could significantly reduce this burden.

What is already known on this topic

- In Cameroon, community-based studies have reported diarrhoea prevalence among under-five children ranging from 16% to 29%, with rotavirus and bacterial pathogens playing major etiological roles.
- Determinants of diarrhoea commonly identified in African settings include unsafe drinking water, poor sanitation and hygiene, low maternal education, incomplete vaccination, and inadequate feeding practices.
- Despite proven interventions such as oral rehydration salts, zinc supplementation, safe WASH practices, and rotavirus vaccination, coverage remains low, especially in rural and resource-limited contexts.

What this study adds

- This study demonstrates that the prevalence of diarrhoea among under-five children in Ndop Health District (65.8%) is markedly higher than national averages previously reported, highlighting a disproportionate burden in rural settings.
- The study identifies rural residence, unsafe water storage, poor toilet hygiene, unsafe stool disposal, garbage disposal in bushes, and purchasing food from roadside vendors as significant predictors of diarrhoea in this population.
- Despite relatively high reported water storage safety, unsafe water sources (wells and streams) remain widely used, showing a gap between water source safety and storage practices.

Authors' Contributions

All authors contributed substantially to the conception and design of the study, data acquisition, analysis, and interpretation. They participated in drafting the manuscript and critically revising it for important intellectual content. All authors approved the final version of the manuscript to be submitted, have agreed on the journal of submission, and accept responsibility for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part are appropriately investigated and resolved.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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