

Health Impacts of Untreated Water by Populations in the Nkoabang Neighborhood, Nkolafamba Commune (Center Region-Cameroon)

Ronny Serge Song Ott¹; Olive Vivien Noah Ewoti^{2*}; Maximillienne Ascension Nyegue³

^{1,3}Laboratory of Microbiology, Department of microbiology, Faculty of Science, University of Yaoundé 1, P.O.Box 812, Yaoundé, Cameroon

^{1,2}Laboratory of Hydrobiology and Environment, Department of Animal Biology and Physiology, Faculty of Sciences, University of Yaoundé 1, PO Box 812

*Corresponding Author

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Abstract— A health impact study was conducted in the Nkoabang neighborhood of the Nkolafamba commune from January to March 2026 to assess the health risks associated with using drinking water without prior treatment. The approach used combined individual questionnaires, focus groups, and direct observations among 45 individuals. Regarding gender and occupation, the respondents consisted of 58% women and 42% men; and 44% civil servants, 22% traders, 18% informal workers, 11% unemployed, and 5% others, respectively. Regarding water consumption aspects, the population generally uses well water (protected and/or unprotected), boreholes, and rivers for domestic activities; and drinking water from boreholes, wells, and mineral water. Notably, 70% of the population is unaware of the microbiological quality and does not treat the water (minimal chlorination, filtration, boiling). Furthermore, wastewater and solid waste are discharged into the environment without prior treatment by 49% of the population. The waterborne diseases identified in this locality include typhoid, gastroenteritis, diarrhea, and amoebas. Faced with this situation, 87% of the population mainly resorts to self-medication through the use of antibiotics, consisting mostly of Amoxicillin 22%, Ciprofloxacin 20%, Ofloxacin 18%, Cotrimoxazole 11%, certain antiparasitic drugs 11%, and alternative treatments such as medicinal plants.

Keywords— Health risk, drinking water, prior treatment, waterborne diseases, Nkoabang.

I. INTRODUCTION

1.1 Context

Access to safe drinking water is a fundamental determinant of public health. However, in many rural and periurban communities across sub-Saharan Africa, this access remains limited. In Cameroon, nearly 40% of households lack a connection to the safe drinking water supply network, forcing them to use groundwater and surface water resources that are often exposed to fecal and chemical contamination [1]. The Nkoabang neighborhood, a transition zone between the city of Yaounde and its rural periphery, concentrates the effects of this precarious access to water. Furthermore, several studies conducted in periurban areas of Cameroon have highlighted the high vulnerability of water tables to microbiological pollution. Consequently, the direct discharge of wastewater into the environment promotes the spread of pathogenic bacteria such as *Vibrio* and *Pseudomonas* [2].

1.2 Justification

Faced with this permanent exposure, households develop survival strategies that are often inadequate. Self-medication without prior diagnosis is particularly widespread in Cameroonian peri-urban areas. This practice contributes not only to worsening infant morbidity but also to the emergence of antibiotic-multiresistant bacterial strains [3]. The empirical use of broad spectrum,

over the counter antibiotics thus represents an emerging public health problem. Several recent studies [4] have also reported a significant increase in β -lactam-resistant bacteria isolated from water points in the region.

1.3 Objectives

The general objective of this study is to "Evaluate the direct and indirect health impacts related to the use of untreated drinking water in the Nkoabang neighborhood."

More specifically, the goals are to:

- Characterize household water supply sources;
- Identify waste management practices;
- Identify dominant waterborne pathologies;
- Analyze therapeutic practices and the use of medicinal plants.

1.4 Hypothesis

The lack of access to safe drinking water and the sanitation deficit in the Nkoabang neighborhood result in a high prevalence of waterborne diseases. Furthermore, self-medication strategies and the inappropriate use of antibiotics promote increased bacterial resistance among exposed populations.

II. MATERIALS AND METHODS

2.1 Study Area and Population

This study was conducted in the Nkoabang neighborhood, Nkolafamba commune, Center Region, Cameroon, from January to March 2026. The Nkoabang neighborhood is a peri-urban transition zone between the city of Yaounde and its rural periphery, characterized by a cosmopolitan population from different regions of the country with diverse habits and customs. The study population comprised residents of the Nkoabang neighborhood who use groundwater and surface water for domestic and drinking purposes.

2.2 Study Design

A cross-sectional descriptive study was conducted using a mixed-methods approach combining quantitative and qualitative data collection techniques. This approach was chosen to provide a comprehensive understanding of the health impacts associated with untreated water consumption [5].

2.3 Sampling Strategy

A total of 45 individuals were included in the study using a purposive sampling strategy. Participants were selected based on their regular use of groundwater or surface water for domestic and drinking purposes. The sample size was determined considering the exploratory nature of the study and the available resources. The sample included both men and women to ensure gender balance, and represented various socio-professional categories.

2.4 Data Collection

2.4.1 Quantitative Surveys

A cross-sectional survey was conducted in January and February 2026 among the population of the study locality [5]. The questionnaire used included the following modules:

- Respondent's sex and demographic characteristics
- Housing type
- Socio-professional activity
- Average monthly income
- Liquid waste management practices
- Source of drinking water supply and quality

- Primary drinking water source
- Water source for household activities
- Treatments applied before water consumption
- History of waterborne diseases
- Medication practices

The questionnaire was administered through face-to-face interviews with respondents in their homes.

2.4.2 Qualitative Surveys

The methods used for the qualitative surveys essentially included focus groups, informal meetings with stakeholders, and direct observations [5].

Focus Groups: Focus groups were used to characterize the actors and investigate practices related to drinking water supply, precautions taken before water consumption, and treatments applied to drinking water. Group discussions were conducted with community members to explore perceptions, attitudes, and practices regarding water use and health.

Direct Observations: Direct observations allowed for the in situ assessment of liquid waste management and the water treatment methods applied. These observations were documented using a Canon PowerShot SX430 IS camera (Specs: 20MP CCD 1/2.3" sensor, 3" fixed screen, 45x optical zoom).

Informal Meetings: Informal meetings were held with community stakeholders to gain deeper insights into local practices and challenges related to water and sanitation.

2.5 Ethical Considerations

Ethical approval for this study was obtained from the appropriate institutional review board. Prior to data collection, all participants were informed about the purpose of the study, and written informed consent was obtained from each participant. Participation was voluntary, and respondents were assured of the confidentiality of their responses. The ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely witnessed by the authors.

2.6 Data Analysis

2.6.1 Quantitative Data Analysis

The survey data collected from the population were processed using Microsoft Excel 2016. Descriptive statistics were calculated to summarize the data, including frequencies and percentages. The data were organized and presented in tables and figures to illustrate the findings on water supply sources, waste management practices, waterborne diseases, and therapeutic practices.

2.6.2 Qualitative Data Analysis

The link between the microbiological quality of consumed water and the waterborne diseases suffered by local populations was established after a preliminary analysis of the quality of the water used and the questionnaire administered to these populations and healthcare personnel. Focus group discussions were transcribed and analyzed thematically to identify key patterns and themes related to water use practices, disease experiences, and treatment-seeking behaviors.

2.6.3 Assessment of Health Impact

A survey questionnaire directed at populations using the ground and surface waters under consideration was implemented following the recommendations of [5]. This questionnaire accounted for the resurgence of waterborne diseases caused by the microorganisms under study and the frequency of complaints. Ground and surface water contamination is frequent, whether by stormwater runoff, point sources of pollution, or illegal dumping sites. The collected data indicate that these sources contribute to increasing the prevalence of enteric, respiratory, and skin diseases among exposed populations.

2.6.4 Assessment of Socioeconomic Impacts

The objective was to assess the socioeconomic impacts associated with the use of ground and surface water consumed by the local population. This impact assessment also factored in, among other things, the type of activity of the respondents, their level of knowledge regarding water treatment methods, and the primary waterborne diseases they suffer from daily.

III. RESULTS

3.1 Socioeconomic Characteristics of the Studied Population

Of all the individuals interviewed during the survey conducted in the Nkoabang neighborhood, 58% were female, compared to 42% male. Most of them were civil servants (44%), traders (22%), informal workers (18%), unemployed (11%), and others (5%) (Figure 1).

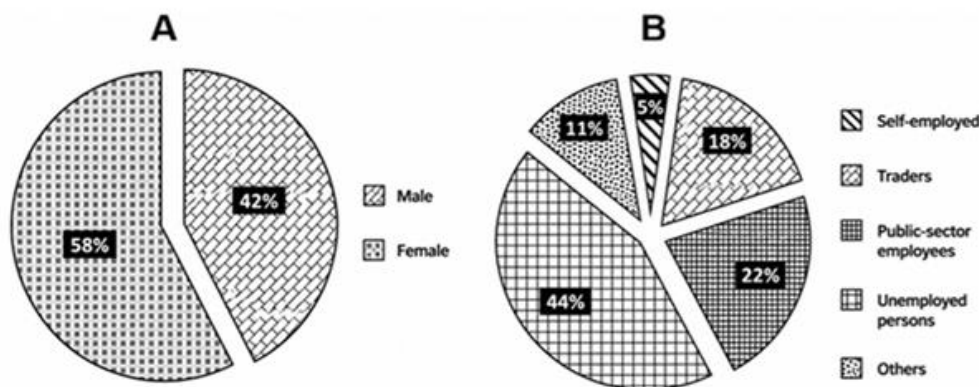


FIGURE 1: Gender distribution and socioeconomic characteristics of the studied population in the Nkoabang neighborhood. (A) Gender distribution showing 58% female and 42% male. (B) Occupational distribution showing civil servants (44%), traders (22%), informal workers (18%), unemployed (11%), and others (5%).

3.2 Water Supply Sources in the Nkoabang Neighborhood

3.2.1 Origin of Water Used by the Studied Population

Water supply for 56% of the population comes from unprotected wells, 24% use borehole water, while 16% fetch water from protected wells. Finally, 4% of individuals draw their water from rivers (Figure 2A).

3.2.2 Drinking Water Source

Overall, the study showed that for the individuals considered, 20% obtain borehole water for drinking, 10% use protected well water, 10% use bottled mineral water, and only 5% use unprotected well water (Figure 2B).

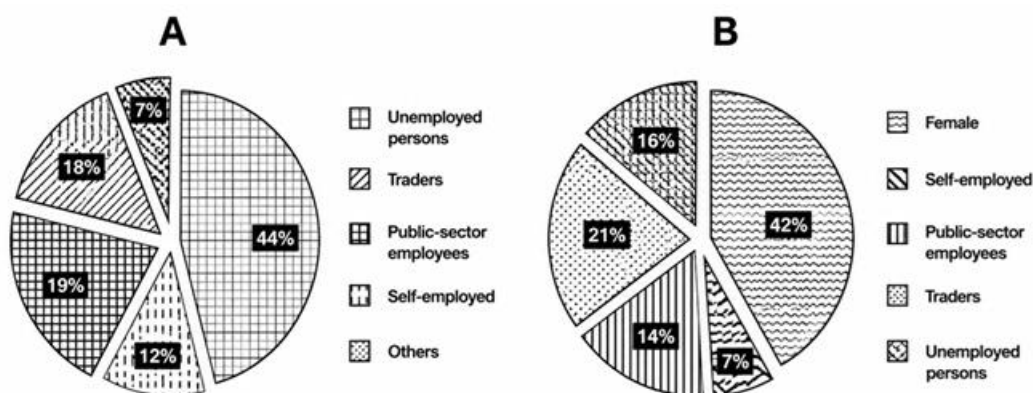


FIGURE 2: (A) Origin of consumption water used by the studied population showing unprotected wells (56%), boreholes (24%), protected wells (16%), and rivers (4%). (B) Origin of drinking water supply showing boreholes (20%), protected wells (10%), bottled mineral water (10%), and unprotected wells (5%). Note: Percentages do not sum to 100% as some respondents reported multiple sources.

3.3 Level of Knowledge Regarding the Quality of Water Consumed by the Studied Population

The majority of interviewed individuals (70%) responded that they do not know the microbiological quality of their drinking water and did not treat the water before consumption. Indeed, almost all respondents lack a true command of drinking water treatment processes, turning haphazardly and irregularly to chlorination (11%), filtration (11%), a combined chlorination-filtration method (4%), or rarely to boiling (4%), which those concerned claim causes a change in the water's taste (Figure 3).

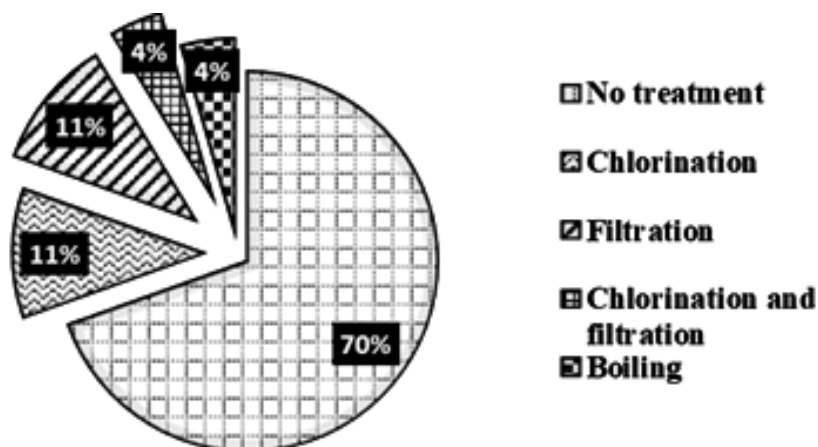


FIGURE 3: Selected methods of drinking water treatment practiced irregularly by the considered populations in the Nkoabang neighborhood. The majority (70%) do not treat water, followed by chlorination (11%), filtration (11%), chlorination-filtration (4%), and boiling (4%).

3.4 Solid and Liquid Waste Management

3.4.1 Discharge Locations for Wastewater and Solid Waste by the Population

In general, it was found that wastewater discharge by the population occurs directly into the environment without any prior treatment. Specifically, 22% of respondents discharged their wastewater directly into gutters, 10% into the yard, 8% into septic tanks, and 5% onto roads. Regarding solid waste, the target population dumps solid waste into the environment without any prior treatment (sorting, recycling, composting, etc.). Records show that 20% of respondents burn their solid waste directly in makeshift septic pits, 10% discard their waste in trash bags, 10% hand over their waste to collection agents, and 5% dump their solid waste in fields. The complete set of data recorded regarding liquid and solid waste disposal locations is shown in Figure 4A. Figure 4B presents a photograph of this waste obtained from direct observations at the homes of several surveyed individuals.

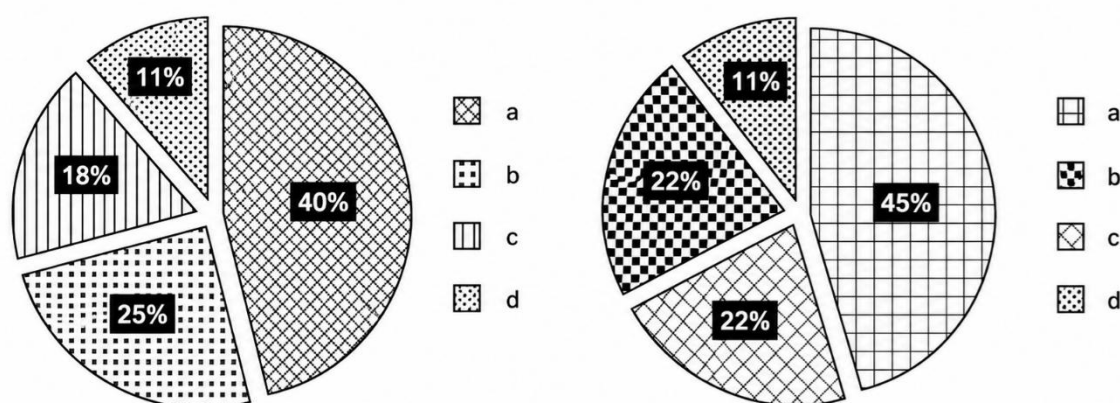


FIGURE 4: (A) Discharge locations of wastewater and solid waste by local populations. Wastewater is discharged into gutters (22%), yards (10%), septic tanks (8%), and roads (5%). Solid waste is burned (20%), disposed in trash bags (10%), collected by agents (10%), or dumped in fields (5%). (B) Photograph of waste obtained from direct observations among some surveyed individuals, showing improper waste disposal practices in the neighborhood.



FIGURE 4: (B) Photograph of waste obtained from direct observations among some surveyed individuals, showing improper waste disposal practices in the neighborhood.

3.5 Potential Contamination Sources of Drinking Water in the Nkoabang Neighborhood

The various potential contamination sources of drinking water identified during this study showed that this water can be contaminated through infiltration and/or runoff of leachate from household waste and open dumps at rates of 33% and 18%, respectively. Furthermore, this contamination can occur via stormwater runoff from gutters (27%) and pit percolation (22%) (Figure 5).

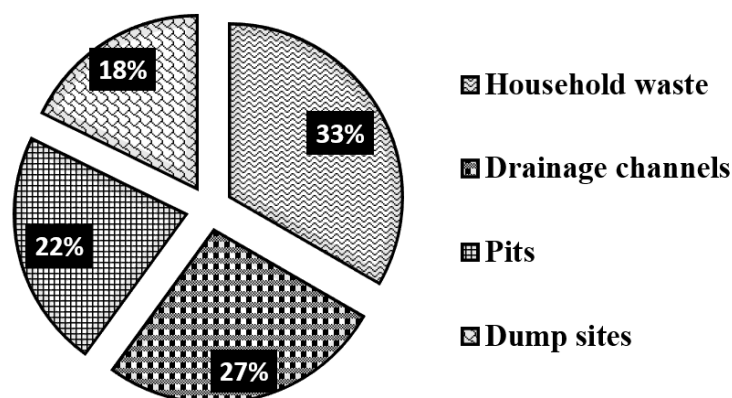


FIGURE 5: Possible contaminants of water in the locality. Contamination occurs through infiltration of leachate from household waste (33%), open dumps (18%), stormwater runoff from gutters (27%), and pit percolation (22%).

3.6 Health Risks Related to the Use of Untreated Water in the Nkoabang Neighborhood

The direct health impact related to the use of water of unknown microbiological quality by local populations is perceived through recurring waterborne diseases. The diseases recorded, which the population directly links to the use of consumed water in the Nkoabang neighborhood, include typhoid, gastroenteritis, diarrhea, and amoebas, among others. The occurrence rates of these diseases are distributed as follows: gastroenteritis (33%), typhoid fever (22%), skin and eye infections (20%), amebiasis (18%), and schistosomiasis (7%) (Figure 6).

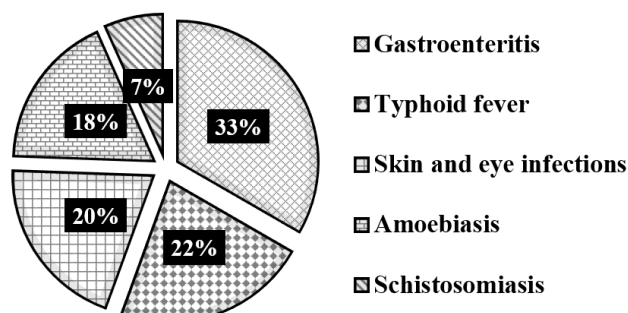


FIGURE 6: Diseases generally encountered among the interviewed populations, which they link to the use of water consumed in the Nkoabang neighborhood. Gastroenteritis (33%), typhoid fever (22%), skin and eye infections (20%), amoebiasis (18%), and schistosomiasis (7%).

3.7 Medicine Procurement Methods and Treatment Procedures for the Target Waterborne Diseases

Across the entire surveyed population, it appears that 87% of respondents do not consult a doctor and procure medicines without a prescription, while only 13% consult a doctor and obtain their medication via prescription. The drugs used to treat their illnesses consisted primarily of antibiotics such as Amoxicillin (22%), Ciprofloxacin (20%), Chloramphenicol (18%), Ofloxacin (18%), and Cotrimoxazole (11%), compared to 11% for certain antiparasitic drugs, and alternative methods such as medicinal plants (Figure 7).

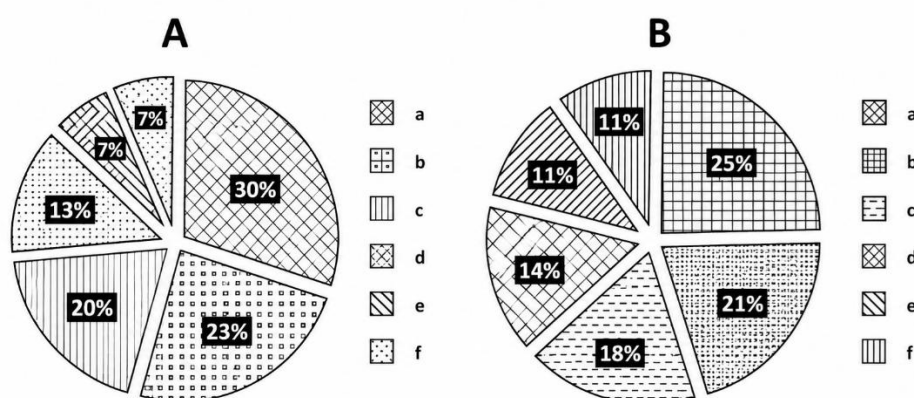


FIGURE 7: Medication procurement channels and treatment procedures among local populations. (A) Healthcare-seeking behavior showing 87% self-medicate without prescription and 13% consult a doctor. (B) Types of medications used showing Amoxicillin (22%), Ciprofloxacin (20%), Chloramphenicol (18%), Ofloxacin (18%), Cotrimoxazole (11%), antiparasitic drugs (11%), and medicinal plants.

IV. DISCUSSION

This study assessed the health impacts associated with the use of untreated drinking water in the Nkoabang neighborhood of the Nkolafamba commune, Cameroon. The findings reveal significant challenges related to water quality, sanitation, waste management, and healthcare practices that collectively contribute to a high burden of waterborne diseases and inappropriate antibiotic use.

4.1 Socioeconomic Characteristics and Water Access

Among the respondents, civil servants represented 44%. This proportion of administrative workers could be explained by the fact that the study area is a peri-urban zone of Cameroon's capital (Central Africa), dominated by significant public services with a diversified economy. The predominance of civil servants may reflect the proximity to Yaoundé and the employment opportunities in the capital city, while the presence of traders (22%) and informal workers (18%) indicates a diverse economic base typical of peri-urban settlements.

4.2 Water Sources and Treatment Practices

The study found that 56% of the population relies on unprotected wells for their water supply, with only 20% using borehole water for drinking. This reliance on unprotected water sources is concerning, as these sources are highly vulnerable to contamination from surface runoff, improper waste disposal, and pit latrines. The finding that 70% of the population does not treat their water before consumption and is unaware of its microbiological quality represents a critical public health risk. This lack of awareness and treatment is consistent with findings from other peri-urban areas in Cameroon [2,5].

Among the small minority who do treat water, practices are irregular and inadequate, with only 11% using chlorination, 11% using filtration, and 4% boiling water. The reluctance to boil water, due to perceived taste changes, is a common barrier to effective water treatment in resource-limited settings. These findings highlight the urgent need for health education and behavior change communication to promote household water treatment as a key intervention for preventing waterborne diseases.

4.3 Waste Management and Environmental Contamination

It was reported that the populations of the Nkoabang neighborhood discharge domestic liquid and solid waste into the environment without prior treatment. These results match those of [2] in the locality of Ombessa, which showed that in the periurban neighborhoods of Yaoundé, direct discharge practices and the deficit of formalized collection are the primary drivers of environmental degradation. Yet, these wastes are capable of polluting the air, soil, subsoil, and subsequently receiving waters due to high levels of organic matter and microorganisms of fecal origin [6].

The study identified that 22% of respondents discharge wastewater directly into gutters, 10% into the yard, and 5% onto roads. Similarly, 20% burn solid waste in makeshift pits, 10% discard it in trash bags, and 5% dump it in fields. These practices create multiple pathways for contamination of water sources.

Furthermore, [5] confirmed, in a similar study conducted in Nkolafamba, that dump leaching and household wastewater infiltration constitute the main routes of water table contamination by fecal coliforms. [7] demonstrated that leachate from open dumps and poorly sealed septic tanks migrates vertically through the sandy soils of the periurban zone, carrying organic loads and fecal germs down to shallow water tables. [8] highlighted that sandy soils and the lack of impermeable lining on waste disposal sites, along with the use of gutters as outlets, accelerate the percolation of contaminated runoff water, making groundwater particularly vulnerable.

The potential contamination sources identified in this study—leachate infiltration from household waste (33%), stormwater runoff from gutters (27%), pit percolation (22%), and open dump runoff (18%)—are consistent with these previous findings. These contamination pathways underscore the need for integrated approaches to water and sanitation management that address both source water protection and safe disposal of waste.

4.4 Waterborne Diseases

The resurgence of ground and surface water contamination should drive populations to adopt various water treatment methods before consumption [9]. A small fraction of the population possesses a culture of short-term health risks associated with the consumption of water with poor microbiological quality; they feel they are already accustomed to this poor bacteriological water quality and note that it is children who suffer the most from waterborne diseases (gastroenteritis, typhoid, diarrhea, amebiasis, schistosomiasis, among others), likely due to their immature immune systems.

[10], in a similar study conducted in Nkolafamba, reported that this chronic exposure to contaminated water results in a high prevalence of digestive and parasitic pathologies in children under 5 years old, confirming the direct link between bacteriological water quality and disease burden in periurban areas without water piping. This chronic exposure correlates with a high prevalence of diarrhea and parasitic infections in children under five [11].

The diseases reported in this study—gastroenteritis (33%), typhoid fever (22%), skin and eye infections (20%), amebiasis (18%), and schistosomiasis (7%)—are consistent with waterborne disease patterns documented in other peri-urban areas of Cameroon. The high prevalence of gastroenteritis and typhoid fever is particularly concerning, as these diseases are directly linked to fecal contamination of water sources. The presence of skin and eye infections suggests that inadequate water quantity for hygiene may also be a contributing factor, in addition to water quality issues.

4.5 Self-Medication and Antibiotic Use

The empirical use of antibiotics without bacteriological diagnosis promotes the selection of multiresistant strains. This phenomenon is documented by [12], who report a significant increase in bacteria resistant to β -lactams and fluoroquinolones in the ground and rainwater of the region. Barriers to primary healthcare access and the financial burden of medical consultations explain why households resort to inappropriate and dangerous health practices.

In this study, 87% of respondents reported not consulting a doctor and procuring medicines without a prescription. The antibiotics most commonly used—Amoxicillin (22%), Ciprofloxacin (20%), Chloramphenicol (18%), Ofloxacin (18%), and Cotrimoxazole (11%)—are broad-spectrum antibiotics that are widely available over the counter in Cameroon. This pattern of antibiotic use is alarming, as it contributes to the selection of multidrug-resistant bacteria and undermines the effectiveness of these essential medicines.

The practice of self-medication with antibiotics without proper diagnosis is particularly concerning given the waterborne nature of the diseases being treated. Typhoid fever, for example, requires specific antibiotic treatment based on susceptibility testing, and inappropriate antibiotic use can lead to treatment failure and chronic carriage. Similarly, amebiasis requires specific antiparasitic treatment rather than antibiotics.

In parallel, a significant class of the population resorts to traditional pharmacopeia, where the use of local medicinal plants has shown that they contain numerous chemically and biologically active properties exerting various pharmacological actions: antioxidant, anti-inflammatory, analgesic, antiviral, antibacterial, and antifungal activities [13]. The use of medicinal plants (11%) represents an alternative treatment approach that may have cultural significance but requires further study to evaluate efficacy and safety.

4.6 Implications for Public Health Policy

The findings of this study have several important implications for public health policy and practice in Cameroon:

- 1) **Strengthening water quality monitoring:** Regular monitoring of groundwater and surface water sources in peri-urban areas is essential to identify contamination and guide interventions.
- 2) **Promoting household water treatment:** Health education programs should promote simple, effective, and acceptable water treatment methods, including chlorination, filtration, and solar disinfection.
- 3) **Improving waste management:** Investment in formal waste collection and disposal systems is needed to prevent environmental contamination of water sources.
- 4) **Enhancing healthcare access:** Improving access to primary healthcare services can reduce the reliance on self-medication and inappropriate antibiotic use.
- 5) **Regulating antibiotic sales:** Enforcement of regulations on antibiotic dispensing can help curb the misuse of antibiotics and reduce antimicrobial resistance.
- 6) **Integrating traditional medicine:** Further research is needed on medicinal plants used for treating waterborne diseases to evaluate their efficacy and safety, and to explore potential integration with conventional medicine.

4.7 Limitations of the Study

This study has several limitations that should be considered when interpreting the findings:

- 1) **Small sample size:** The study included only 45 respondents, which limits the generalizability of the findings to the broader population of Nkoabang or other areas.
- 2) **Purposive sampling:** The use of purposive sampling may have introduced selection bias, as participants were not randomly selected.
- 3) **Self-reported data:** Reliance on self-reported information may be subject to recall bias and social desirability bias, particularly regarding sensitive topics such as waste disposal and medication use.
- 4) **Lack of water quality testing:** The study did not include microbiological or chemical analysis of water samples, relying instead on reported perceptions of water quality.
- 5) **Lack of clinical confirmation:** Diseases were self-reported and not confirmed through clinical examination or laboratory testing, which may affect the accuracy of disease prevalence estimates.

- 6) **Seasonal limitations:** The study was conducted during a specific period (January to March), and water quality and disease patterns may vary seasonally.
- 7) **Single location:** The study was conducted in only one neighborhood, limiting the generalizability of findings to other areas.

Despite these limitations, the study provides valuable insights into the health risks associated with untreated water consumption in peri-urban Cameroon and highlights the urgent need for interventions to improve water quality, sanitation, and healthcare practices.

V. CONCLUSION

The objective of this study was to evaluate the health risks associated with using ground and surface water intended for human consumption by populations in the locality of Nkoabang, Cameroon (Nkolafamba Commune). The survey of local populations identified the primary pollution factors, notably poor management of household waste, excreta, and wastewater, among others. Consequently, due to lapses in hygiene standards, these waters are contaminated with germs, presenting a major risk of gastroenteritis, typhoid, skin and eye diseases, amebiasis, and schistosomiasis for consumers.

The study found that 70% of the population does not treat water before consumption and is unaware of its microbiological quality. Furthermore, improper waste disposal practices create multiple pathways for contamination of water sources. The high prevalence of waterborne diseases and the widespread practice of self-medication with antibiotics without prescription represent significant public health concerns that require urgent attention.

Adhering to hygiene standards and promoting water treatment before usage by populations must be encouraged to prevent the occurrence of epidemics. Strengthening healthcare access, regulating antibiotic sales, and implementing integrated water and sanitation management approaches are essential for addressing the health impacts of untreated water in the Nkoabang neighborhood and similar settings.

VI. RECOMMENDATIONS

Based on the study findings, the following recommendations are proposed:

- 1) **Health education:** Implement community-based health education programs to raise awareness about the risks of untreated water and promote simple, affordable household water treatment methods (chlorination, filtration, boiling, solar disinfection).
- 2) **Water quality monitoring:** Establish regular monitoring of groundwater and surface water sources in peri-urban areas to identify contamination and guide interventions.
- 3) **Sanitation infrastructure:** Invest in formal waste collection and disposal systems, including improved sanitation facilities and wastewater treatment.
- 4) **Healthcare access:** Strengthen primary healthcare services to reduce reliance on self-medication and ensure appropriate diagnosis and treatment of waterborne diseases.
- 5) **Antibiotic regulation:** Enforce regulations on antibiotic dispensing to curb misuse and reduce antimicrobial resistance.
- 6) **Medicinal plant research:** Conduct further research on medicinal plants used for treating waterborne diseases to evaluate their efficacy, safety, and potential integration with conventional medicine.
- 7) **Multisectoral approach:** Promote integrated approaches to water, sanitation, and hygiene (WASH) that address both source water protection and safe disposal of waste.
- 8) **Community participation:** Engage community members in the design and implementation of interventions to ensure ownership and sustainability.

VII. FUTURE RESEARCH

Future studies should:

- 1) Conduct microbiological and chemical analysis of water sources to confirm contamination and identify specific pathogens.
- 2) Include clinical diagnosis and laboratory confirmation of waterborne diseases.

- 3) Employ larger, randomly selected samples to improve generalizability.
- 4) Assess seasonal variations in water quality and disease patterns.
- 5) Evaluate the effectiveness of different household water treatment methods in reducing disease burden.
- 6) Investigate the antimicrobial resistance patterns of bacteria isolated from water sources and clinical samples.
- 7) Explore the socio-economic and cultural factors influencing water treatment practices and healthcare-seeking behaviors.

VIII. CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely witnessed by the authors.

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