



# Persistent Challenges of Potable Water Supply, Implications and Mitigation Strategies in Limbe, Cameroon

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## Authors' contributions

*This work was carried out in collaboration among all authors. Authors ENB and AFZ designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ENB and UBN managed the analyses of the study. Authors ENB and UBN managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

Persistent challenges of potable water supply and its implications hinder man's progress in Limbe municipality. The growing population of Limbe Municipality faces increasing challenges of potable water supply with lots of implications. And the Cameroon Water Utilities Corporation (CAMWATER) with the local communities involved in potable water management is unable to meet up with this increasing demand. This has led to the challenges of potable water supply in Limbe municipality which is very frustrating to water consumers. This present study sought to examine the challenges of potable water supply and its implications in Limbe. A combination of research methods (desk review, interviews and reconnaissance field appraisal) have been used in this study. Our findings revealed that increasing population and poor management of potable water supply were the major problems. In the methods utilized, a community based cross-sectional survey was conducted from March to December 2020 using quantitative and qualitative approaches. Wealth Health Organization checklist was used for observation around catchments, then the assessment of water supply challenges was done with a semi quantitative approach. And 200 questionnaires were administered where qualitative data was collected through Focus Group Discussions and in-depth

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interviews. The results obtained from the 7 water catchments assessed indicated that 50% of the water supply challenges were as a result of the increasing population in Limbe municipality. Meanwhile 30% stated that poor management of potable water supply by the authorities concern is another reason of persistent challenges of potable water supply in Limbe. While 20% were of the opinion that the challenges of potable water supply is as a result of anthropogenic activities near water catchments leading to a progressive reduction in water volume. An integrated potable water management team is needed and a periodic monitoring of these catchment in order to reduce this persistent challenges.

*Keywords: Persistent challenges; potable water supply; stakeholders; implications; Limbe, Cameroon.*

## 1. INTRODUCTION

The world's increasing health problems like that of corona virus taking away many lives currently couple with the persistent water supply challenges in Limbe, rapid scientific techniques alongside with sustainable development goals are needed. If this can be done, then the issues of water supply challenges would be overcome. And the use of potable water for drinking, bathing, cooking and for hand sanitizing will no longer be a major problem in the face of rapid urbanization with increasing population growth rate.

Water scarcity or lack of safe drinking water is one of the world's leading problems affecting more than 1.1 billion people globally. This means that one in every six people lacks access to safe drinking water [1]. The Joint Monitoring Program for Water Supply and Sanitation set up by the World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) defines safe drinking water as "water with microbial, chemical and physical characteristics that meets WHO guidelines or national standards on drinking water quality [2].

It is a certainty that without water there would be no life of any kind on earth, and without readily available water in sufficient quantity, and free of disease-causing agents, man's progress is hindered [3]. Globally, 2 billion people use sources of drinking water that are faecally contaminated and not appropriate for consumption [4]. The persistent challenges of drinking water and its implications is a major concern in Cameroon where waterborne diseases happen to be a yearly epidemic [5]. Waterborne diseases are the second and third leading reported weekly epidemiological disease under surveillance in Limbe municipality.

Catchment area is a term used to describe the area immediately upstream from a source or well

When talking of catchment protection of water sources, usually this implies protective measures in a restricted area of one to several hectares surrounding the well or water source [6]. Human activities in the area upstream from a spring or water source may affect the quantity and quality of the water that is obtained. Farming in the direct vicinity of the source may also lead to contamination of the source with silt, nutrients and agro chemicals used in farming. These catchments need to be fenced and should have no form of anthropogenic activities within 100 meters around it [5]. Unfenced drinking water catchments and nearby anthropogenic activities predisposes the water supply to contamination which could lead to (water-borne) illness, endocrine disruption, cancer, liver and kidney problems [4]. Unfortunately, this is the water that is still consumed in certain places justifying Sustainable Development Goal (SDG) 6 that seeks to scale up those using safely managed drinking water.

Within the context in Cameroon, access to water through taps is a luxury which only a few (32%) inhabitants can afford. With the population growth and the urban sprawling, connecting running water throughout the city requires expanding the water supply network, which is often very challenging for the city councils and the government [7]. These often lead to frequent piped drinking water supply interruptions by the lone water supply body better known by the acronym 'CAMWATER'. The populations salvage their need for drinking water from the natural springs and few bore holes and other alternative water sources in their [6].

The SDG6.1 seeks to scale up the population using safely and basic managed drinking water by 2030. To achieve these, we employed the WSP model, that seeks to do assessment from catchment to point of use where we found paucity of studies in Fako [6]. Our study in Limbe

municipality therefore assessed drinking water catchments through observations, semi quantitative and qualitative approaches.

Cameroon is ranked 49 out of 182 countries in terms of abundant water supply and the second country in Africa in terms of quantity of available water and water resources. She comes next to the Democratic Republic of Congo, with a water resource estimate of 322- billion- meter cube [8].

Despite abundant water resources, in Cameroon, problems linked to lack of potable water are evident in every part of the country. In 2010, more than 600 Cameroonians died from a cholera outbreak [9]. Over the past years, there had been reports of cholera outbreak which had highly been attributed to the absence of clean potable water and poor sanitary conditions (Nkemngu, 2011). Recently, nine cholera cases have been confirmed and one death recorded in Buea, the chief town of the South west region of Cameroon this year (Buea Health District, 2020).

In the Buea municipality, potable water supply is a serious problem as a result of increasing population, climate change stressors and poor management [10]. There has also been encroachment into water catchments of this municipality especially in areas like Mile 18, Mile 16, Koke and at Soppo where the rate of population increase is highly witnessed with a lot of uncontrolled construction of houses; some near water catchments, leading to frequent water shortages every year (Buh, *et al*, 2021). This same scenario is happening in Limbe town and needs to be address immediately in order to overcome potable water supply challenges.

Persistent challenges of potable water supply in the Limbe municipality could be likened to the situation of the Buea municipality where inadequate supply of potable water is as a result of increasing population, and poor management (Folifac F, 2003). Increasing population resulting from anthropogenic activities have equally been seen in catchment areas of Mile 4 Limbe, Mile 1 and 2, New Town and Batoke water catchments in Limbe with a lot of uncontrolled construction of houses (Folifac F, 2003). Potable water distribution is uncoordinated causing some localities in Limbe to always go on a wanton search for drinking water as many water users hardly know when to expect water. More to that, there is little documented information about the challenges people face in accessing potable

water in Cameroon at large and in the Limbe municipality in particular. The purpose of this study therefore was to examine the persistent challenges of potable water supply and its implications on the Limbe municipality, with the hope of generating information which will be useful in deriving solutions to water crisis by government and stakeholders involved in water management.

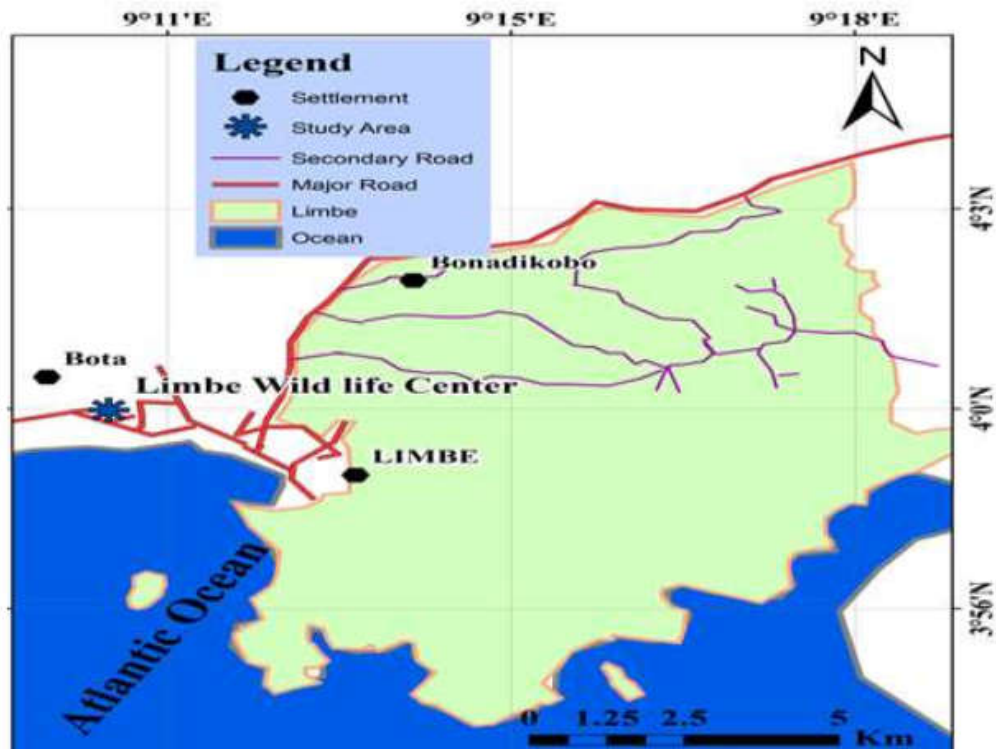
## 2. MATERIALS AND METHODS

### 2.1 Study Setting and Procedure

The study was carried out in Limbe a town in Fako Division, South West Region of Cameroon. Located in an active dynamic coastal zone situated between longitude 90° and 130° east and latitude 40° and 90° north of the equator with a surface area of about 674km<sup>2</sup> (Limbe Town Planning Office, 2000). And an elevation of 150m at the foot of Mount Cameroon. Limbe is bounded to the West by Limbe II settlement up to Debuncha and the Atlantic Ocean to the South West. To the North, it is bounded by Moliwe, East by Tiko Sub-Division and to the South East by confines of Limbe III Municipality and it is also located within the coastal lowlands of Cameroon with an estimated population of 118210 (Limbe council, 2020). Limbe is made up of 3 sub division namely; Limbe 1, Limbe 2, and Limbe 3. The main settlements here include; Mbende, Limbe Camp, Unity Quarter, Animal Farm, Church Street, Motowoh, Limbe 2 and 3. From the 3 sub divisions in Limbe, we randomly selected seven catchments as follows; CAMWATER catchment in Wotutu Mile 4, and Mile 2, Communities water catchments like the Makoka catchment in New Town, Towe catchment at Mile 2, Moliwe in Mile 4, Limbola toward SONARA, and Batoke catchments all found in Limbe. Climatically it has two seasons, the dry and rainy season with moderate temperatures of about 20 to 28<sup>0</sup>c, and with a high rainfall of about 3000 to 5000mm [11]. The vegetation is generally green almost throughout the year having the Limbe Botanic Garden, with a tropical forest on the slope of Mount Cameroon, having several water sources currently more or less exploited [11].

### 2.2 Socio – Economic Characteristics of Limbe

Field data collected from Limbe Municipal Council in April 6, 2021 shows that the population of Limbe is estimated to about 118210



**Fig. 1. Map of Limbe city showing the settlement and study area adapted from Melle Ekane Maurice [12]**

inhabitants, and Limbe has one of Cameroon's largest companies known as Cameroon Development Corporation (CDC). The head office is at Bota, Limbe, the only oil refinery company SONARA is also found in Limbe with a non-operational natural seaport. Limbe has a number of tourist attractions such as Limbe wildlife center, the Limbe Botanic Garden and private beaches. There are several small inns and hotels, including the LK Hotel, Musango Beach Hotel, Atlantic Beach Hotel, Guest House, Savoy Palms and First International Inn as was observed from the field. The respondents equally indicated that there are only few educational and health facilities with limited numbers of qualified staffs. Also, about 51% of the settlements are connected to national electricity grid with frequent blackout and pipe born water is available in 57% of the villages, but the standard is very low [13].

### 2.3 Study Design

This study design involves both quantitative and qualitative (Focus Group Discussions and In-Depth Interviews) approaches were employed.

We randomly selected 7 drinking water catchments sources in Limbe municipality. We observed the catchment areas and then held focus groups discussions (FGDs) and In-depth Interviews with the stakeholders involved in the management of potable water.

### 2.4 Data Collection

A check list was used for data collection with the following challenges that were observed on each drinking water catchment; location of drinking water catchment, activities taking place near water catchments, the use of septic tanks. Presence of stagnant water around catchments, trees planted around water catchments. We then used these results to assess the challenges of potable water supply in Limbe using an adapted semi quantitative approach and possible control measures (mitigation). We used a FGD and an IDI guides for qualitative data. We conducted three FGDs with each lasting 65 minutes. Group 1 was conducted in mile 4 community Hall Limbe among stakeholders involved in potable water management and group 2 at Mile 1 Regional Hospital of Limbe with medical doctors, and

members of Limbe council involved in the treatment and supply of potable water. And Group 3 was at Down Beach Limbe Hall with Cameroon Water Utilities Corporation (CAMWATER) involved in potable water supply management. During the FGD with stakeholders involved in potable water management, they were probed on awareness of the diseases contracted as a result of potable water supply challenges, its implications and mitigation.

### 2.5 Data Analysis

The data obtained using checklist from observations around catchments was entered, cleaned and prepared for tabulation using an in-depth semi quantitative approach. Data were categorized in two groups; quantitative for the assessment of the challenges of potable water supply and qualitative to have a detailed explanation of the results of the latter. We assessed the drinking water catchments in Limbe to see if they met up with the sustainable development goals, and fitting the results in an adapted semi quantitative approach to propose mitigation strategies.

## 3. RESULTS

### 3.1 Number of Sample Questionnaires Distributed and Estimation of the Total Response Rate

Of the 200 questionnaires distributed in these localities of Limbe municipality, a total response rate of 100% was recorded (Table 1).

**Table 1. Number of questionnaires distributed and estimation of the total response rate**

Locality	Questionnaires Distributed	Response rate (%)
Mile 4	50	25
Mile 1 and 2	50	25
New Town Limbe	50	25
Batoke	50	25
Total	200	100

### 3.2 Evolution of Water Supply Challenges and Population Increased in Limbe Municipality (1960-2020)

Statistic gotten from the field showed that Limbe municipality had no water supply challenges from 1960 to 1970s. And the population rate was still

very small as compare to 2010 and 2020 that the rate of population increase is growing rapidly from 15,919 inhabitants in 1960 to 118,210 in 2020 (Limbe council). Also, with increasing demand for potable water, showing that people can stay from 5 to 8 days in some areas in Limbe without the supply of potable water, Table 2.

**Table 2. Evolution of water supply challenges and population increased in Limbe municipality (1960-2020)**

Year	Supplying interval	Rates of population increase
1960	None	15,919
1970	None	26,988
1980	2 hours	44,561
1990	5 hours	46,203
2000	1 day	11,6047
2010	3-5days	114,982
2020	5-8 days	118,210

Source: (Limbe Council, 2020)

### 3.3 Challenges of Potable Water Supply in Limbe Municipality

50% of the population stated that there is poor management of potable water supply by government authorities in Limbe municipality while the lowest respond rate of 20% indicated that there is mismanagement of potable water by the local population, Fig. 2.

### 3.4 Causes of Potable Water Supply Challenges in Limbe Municipality

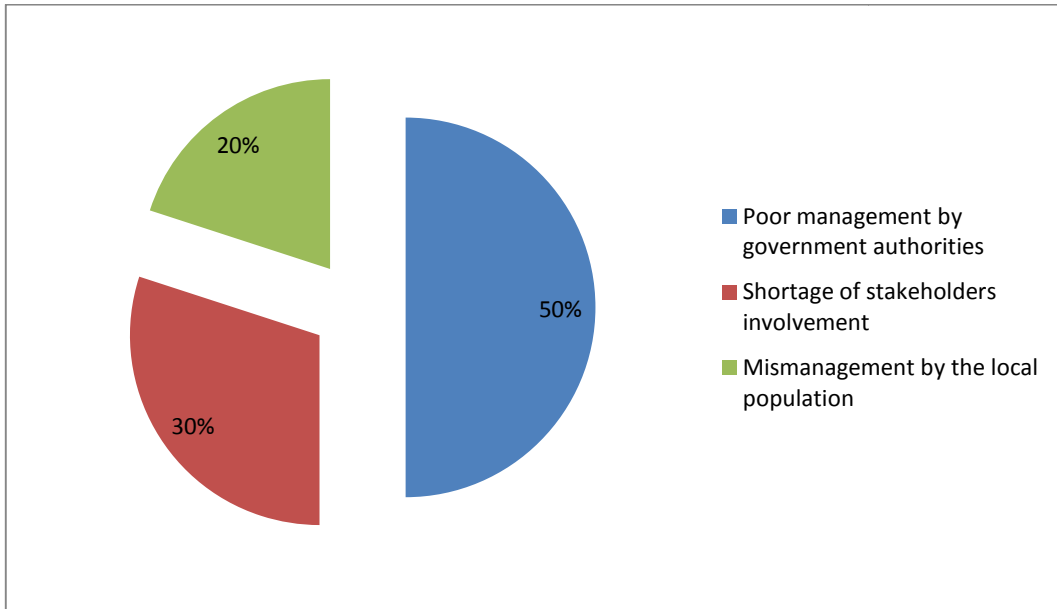
Also, data collected from the field indicated that persistent challenges of potable water supply in Limbe is as a result of the following causes, 50% of the respondents stated that the major caused is over exploitation of potable water by the increasing population. while 20% of the least respondents were of the opinion that anthropogenic activities by constructing houses, farming and felling down trees near water catchments is another caused of potable water supply challenges in Limbe municipality, Fig. 3.

### 3.5 Implications of Potable Water Supply Challenges Gotten from Mile 1, Regional Hospital of Limbe Municipality

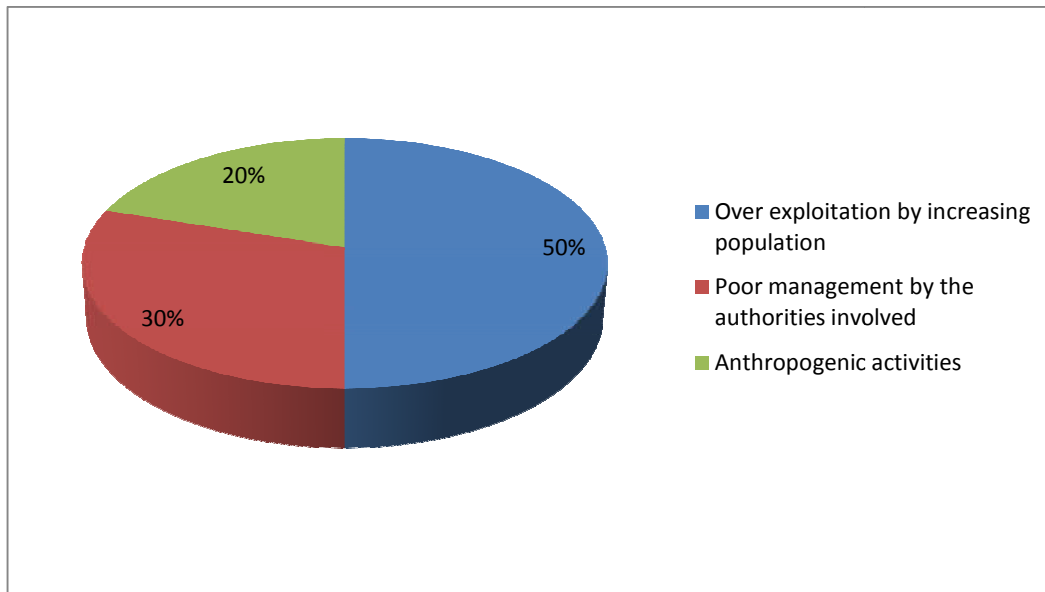
Persistent challenges of potable water supply and its causes have resulted to the following implications; 50% of the patients and doctors in

the Mile 1, Regional hospital of Limbe, indicated that they contract lot of diseases like dysentery, diarrhea and typhoid fever as a result of the absent of potable water causing most of the inhabitants to depend on the use of untreated water. And 32% of the respondents in Mile 1 Regional hospital of Limbe equally stated that high death rate in the municipality is as a result of the use of untreated water where most of the

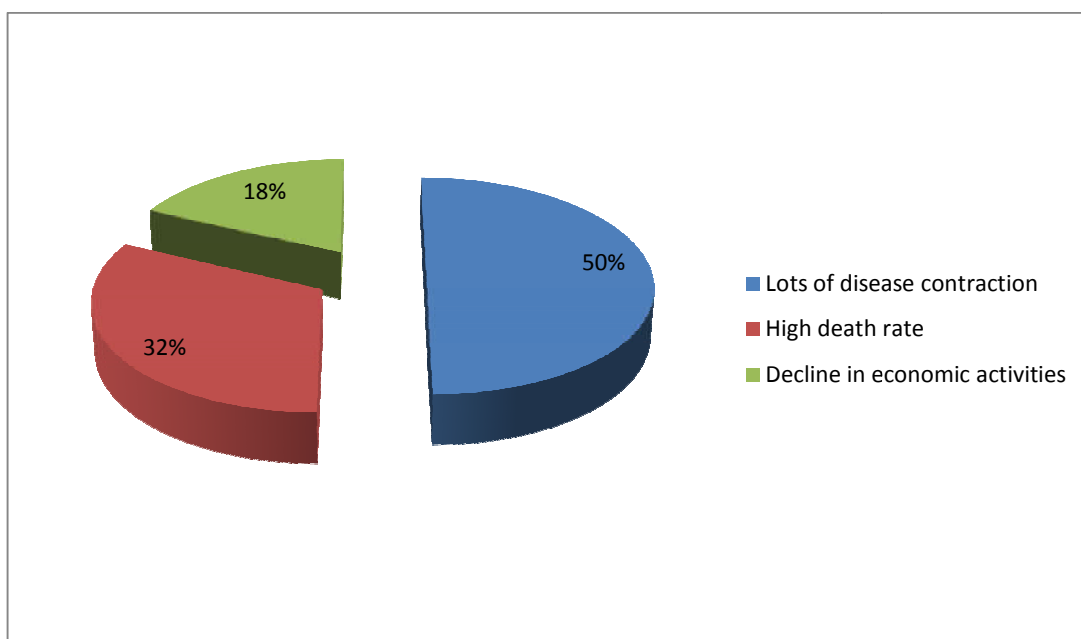
local population dies once they contract this diseases from untreated water sources. 18% of the least respondents in Mile 1 Regional hospital of Limbe were of the opinion that there is a decline in economic activities of Limbe municipality since some of the active population contract lot of diseases from untreated water sources and die in their early ages, Fig. 4.



**Fig. 2. Challenges of potable water supply in Limbe municipality**



**Fig. 3. Causes of potable water supply challenges in Limbe municipality**



**Fig. 4. Implications of potable water supply challenges gotten from Mile 1, Regional hospital of Limbe municipality**

#### 4. DISCUSSIONS

##### 4.1 Assessment of the Challenges of Potable Water Supply in Limbe Municipality

After analyzing the result obtained from the study areas with the aim of obtaining reliable data for the potable water supply challenges in Limbe municipality, this study revealed that there is poor management of potable water supply by government authorities. Only few stakeholders are involved in potable water supply management and there is mismanagement of potable water by the local population by cutting down trees, polluting natural streams and constructing near water catchments exposing them. This is true with the facts that Limbe has abundant water resources like streams and rivers, and Cameroon as a whole is blessed with abundant water resources but despite all these, water still remained a scarce resource because of inadequate management practices [8].

##### 4.2 An Assessment of the Causes of Potable Water Supply Challenges in Limbe Municipality

According to World Health Organization in 2006, the basic and essential requirement - to ensure

the safety of drinking-water is the implementation of a "framework for safe drinking-water" based on the Guidelines of (WHO). This framework provides a preventive, risk-based approach to managing water quality. It would be composed of health-based targets established by a competent health authority using the Guidelines as a starting point, adequate and properly managed systems (adequate infrastructure, proper monitoring and effective planning and management) and a system of independent surveillance. Such a framework would normally be enshrined in national standards, regulations, or guidelines, in conjunction with relevant policies and programs to better manage and guaranteed the safety of drinking water. But such a framework has not been implemented in Limbe municipality and attention has not been given to the increasing population of Limbe leading to overexploitation of potable water sources. And the worst-case scenario is the anthropogenic activities whereby the primitive urban dwellers construct their houses even near water sources, felling down trees, exposing natural streams and rivers and polluting water catchments. In order to overcome these persistent challenges of potable water supply in Limbe municipality, the WHO, framework for safe drinking water alongside with an integrated water management approach need to be implemented.

#### **4.3 An Assessment of the Implications of Potable Water Supply Challenges Gotten from Mile 1, Regional Hospital of Limbe Municipality**

The results of the implications of potable water supply challenges in Mile 1, Regional hospital of Limbe indicated that a lot of diseases like diarrhea, dysentery and typhoid fever are contracted as a result of the use of untreated water sources. This is true in that diarrhea is the major killer disease, in 1998 it was estimated to have killed 2.2 million people in the developing countries, and most of whom were children under 5 years of age (WHO, 2000). That is diarrhea is mostly gotten from drinking and using untreated water sources which were ought to have been treated before using. Also it is recently indicated with confirmed one case that there is the outbreak of cholera in Buea municipality stating that any person age 5 years or more with acute watery diarrhea should be taken to the hospital (Buea health district, 17<sup>th</sup> September 2020). More so, other diseases easily contracted by the limbe population are dysentery and typhoid fever as was equally indicated in Mile 1 Regional hospital of Limbe. Dysentery is caused by bacteria and amoebae found in contaminated water or food substance same too as typhoid fever. And once affected with these diseases, will show signs within a gestation period of four days and the signs are high fever and traces of blood in the faecal matter. And as such the treatment of water before drinking is encourage to eliminate these diseases, according to (WHO, 2010), about 12 million people are affected by typhoid fever caused by salmonella typhi bacteria, contracted by consuming contaminated food and water sources. The persistent challenges of potable water supply in Limbe is therefore leading to a high death rate and a decline in its economic activities in localities of Mile 4, Mile 1 and 2, New town and Batoke where these challenges is highly witnessed and urgent new strategies are needed to be implemented to overcome these challenges.

#### **5. CONCLUSION**

Persistent challenges of potable water supply in Limbe municipality which is as a result of poor management by the authorities involved in potable water supply, overexploitation of potable water by the increasing population, anthropogenic activities near natural streams and catchments have resulted to the following implications; a lot of diseases are being

contracted by the local population, high death rate is recorded and there is a decline in economic activities. Also, some African countries like Eritrea, Papua New Guinea and Uganda are equally facing severe situations as lack of basic water and sanitation remains the order of the day. There is a good option for meeting potable water supply challenges in Limbe municipality and in some of these Africans countries facing the same problem as mentioned above. The following mitigation strategies will be of good help if only taken into consideration. There is the need for the implementation of the World Health Organization framework for safe drinking water alongside with an integrated water management approach. The bodies involved in water management need to initiate a platform for multi-stakeholder dialogue, networking and social learning essentially for building trust on how to better manage potable water supply in the municipality. There is need for synergy between the Limbe Council and the government to seek ways of improving on the treatment of water sources and increase the storage capacity and supply rate of potable water to the increasing population of Limbe municipality. Dumping of waste and other polluting activities into nearby streams should be banned so that this water can regain its purity and serve the population in times of shortage. Catchment restoration could also be done through re-afforestation schemes and prohibit anthropogenic activities near natural streams and catchments.

#### **DISCLAIMER**

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

#### **CONSENT**

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.



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