



Increasing Challenges of Potable Water Supply and Its Implications on the Population of Buea Municipality, Cameroon

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Authors' contributions

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

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Case Study

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ABSTRACT

The increasing challenges of potable water supply on the population of Buea municipality, Cameroon, if not monitored and effectively managed by government and all the local communities (stake holders) will be very detrimental to the municipality. The water demand of the growing population of Municipality is supplied by CAMWATER (Cameroon Water Utilities Corporation) and the local communities involved in potable water management. This study employed the use of a purposive systematic random sampling technique and focus group discussion among the community dwellers to evaluate the implications of potable water scarcity. A total of 350 questionnaires were administered in the field, interviews were conducted with water supply authorities and various stake holders in the municipality to identify the major problems faced by the inhabitants of Buea as a result of potable water supply challenges. Results revealed that about 27% of the population of Buea faces frequent water shortages, 32% and 41% of the respondents stated that the main causes of water supply challenges are poor management of potable water by the authorities concerned and over exploitation of water sources by the increasing population respectively. Besides the human factors mentioned above, changing climatic conditions worsen

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these challenges. In conclusion, over exploitation of potable water sources by the population and poor management by the authorities concerned stands as a major driver of the challenges of water scarcity in the Buea municipality. As such, we recommend an integrated water management approach as a means of making potable water supply challenges less problematic to the population of Buea.

Keywords: Water supply; challenges; implications; pipe leakage; cam water and water catchments.

1. INTRODUCTION

In the wake of a global pandemic of an unprecedented magnitude within the last few decades, covid-19 has generated enormous awareness with respect to personal hygiene, access to potable water and sanitation. Besides social distancing, wearing of masks and the use of hand sanitizers to evade the deadly effects of the virus, the washing of hand with soap and running water has been the low cost but effective option for most people around the world, especially those in villages of developing countries who wouldn't afford hand sanitizers to fight and contain pathogen and infections. This has therefore, increased the water supply challenges in such places.

Increasing challenges of potable water supply is one of the most important problems to urgently be targeted in the world as a whole. "All peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs" [1].

Water scarcity or lack of safe drinking water is one of the world's leading problems affecting more than 1.1 billion people globally, meaning that one in every six people lacks access to safe drinking water [2]. 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 [3].

The most immediately apparent impact of water scarcity in Africa is on the continent's health. With a complete lack of water, humans can only live up to 3 to 5 days on average. This often forces those living in water deprived regions to turn to unsafe water resources that contribute to the spread of water borne diseases like cholera, diarrhea, dysentery and typhoid fever [2,4].

In the last century, urban water use has greatly outpaced the rate of population growth. This is accounted for by the fact that over 50% of humanity now lives in cities, and it is estimated that by 2025 this will increase to over 67%[5]. About billion people in the world lack access to potable water mainly those living in third world countries [6].

Water scarcity is today a global phenomenon that affects close to 2.8 billion people worldwide, especially in developing countries [7]. The European Union Water Framework Directive (WFD) established by the European Parliament and the Council of 23rd October 2000 states that "water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such" [8]. Furthermore, the objective by the United Nations to address this global water scarcity issue is clearly portrayed in the sustainable development goals, specifically goal 6, which is aimed at ensuring access to water and sanitation to all human beings.

Globally, 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 cm³ [9].

Despite this, 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 (IFRC, 2011). Over the years, reports of more cholera outbreak keep coming and this disease is largely attributed to the absence of clean potable water and poor sanitary conditions [10]. More to that, 9 cholera cases have been confirmed and one death recorded in Buea, the chief town of the South west region of Cameroon this year [11].

In the Buea municipality precisely, potable water supply has become an increasing problem as a

result of increasing population, climate change stressors and poor management. There has also been encroachment into water catchments 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. The worse situation is seen in the fact that potable water distribution is uncoordinated, the facilities for water preservation and supply are old, characterized by heavy water loss due to leakages, and are overwhelmed by the increased population of Buea. Some localities only receive water in the late hours of the night when most people are sleeping, while within the day, they lack water supply. As such many water users hardly know when to expect water or when not to, because of the poor management strategies involved. Nonetheless, there is little documented information about the challenges people face in accessing potable water in Cameroon at large and in the Buea municipality in particular. The purpose of this study therefore was to examine the challenges of potable water supply and its implications on the Buea 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. METHODOLOGY

2.1 The Study Area

This study was conducted in the Buea municipality Fig. 1. Briefly, the Buea Municipality is located between latitudes 4° 12' and 4° 31' North of the Equator and longitudes 9° 9' to longitude 9° 12' east of the Greenwich meridian. It has a total surface area of 870 km² [12]. It is the capital of the South West Region of Cameroon, with an estimated population of 300,000 inhabitants as of 2020 [13]. The major springs that are harnessed by the Camerounaise Des Eaux (CDE) and supplied to the population are fed by the radial drainage pattern of Mount Cameroon [14]. The topography of Buea is hilly and characterized by numerous springs and streams [7]. Geologically it has the oceanic volcanic islands with the hot-spot for biodiversity at the eastern slope of Mt Cameroon[7]. And climatically it has two seasons, the dry and rainy season with moderate temperatures of about 20 to 28°C, and with a high rainfall of about 3000 to 5000mm[14]. The vegetation is generally green

almost throughout the year with a tropical forest on the slope of Mt Cameroon, having several water sources currently more or less exploited [14].

2.2 Socio –Economic Characteristics of Buea

The population of Buea is estimated to about 300.000 people of whom 2/3 lives in urban and peri-urban, their main source of income is agriculture and timber [13]. There are more than 259 educational facilities in Buea municipality ranging from nursery schools to universities and the health facilities are few with limited numbers of qualified staffs[16]. Also, about 51% of the settlements are connected to national electricity grid with frequent blackout[16]. About 9% of the settlements do not have any water supply at all. Pipe born water is available in 57% of the villages, but the standard is very low [16].

2.3 Study Design

This was a cross-sectional study design in which primary source of information was derived from field observations, interviews which were conducted with some officials of the CAMWATER and some community water supply schemes in Buea. The study made use of a random sampling method, and focus group discussion with the community members, the council members and CAMWATER officials in Buea to analyze the responses gotten from the field. Three hundred and fifty questionnaires were administered to the community members within the Buea Municipality to identify their views as per the increasing challenges of potable water supply and its implications. Secondary data was gotten from peer reviewed scientific articles, CAMWATER reports and community reports. The questionnaires used for collecting data were divided into sections. Section (A) targeted the evolution of water supply challenges and section (B) was based on the evolution of population increase in Buea (1976-2020). Also, section (C) of the questionnaire indicated the evolution of water consumption per head while section (D) targeted the challenges of potable water supply, and section (E) focused on the implications of increasing population on potable water supply.

2.4 Data Analysis

Field data were coded and entered into an excel spreadsheet version 2016. Analysis was done

using the statistical package for social sciences (SPSS) version 16. The frequencies and percentages of the various challenges people faced related to portable water supply were computed.

3. RESULTS

3.1 Evolution of Water Supply Challenges in Buea

The results reviewed stated that there was little or no notion of water supply challenges in Buea during the 1960s. This was particularly due to the fact that the population was low, and people did not only depend on the national water supply company (SNEC), to get potable water, but could also obtain fresh water from the flowing streams which had not witnessed a high rate of degradation both in quality and quantity. A majority of the respondents (100%) confirmed that the increase in human population has led to the reduction in the water capacity to meet the increasing demands thus leading to the increasing challenges of potable water supply. Water supply challenges have evolved from 2 hours shortages in the 1970s up to between 4 and 7 days of no water supply in the year 2020 Table 1.

3.2 Population Evolution for Buea (1976-2010)

Table 2 shows the evolution of the population of Buea from 1976-2020. Buea was characterized by very low population between 1976 to 1998, with no problem of water scarcity. However, from 2010 to 2020, most of the streams and rivers in Buea have been polluted, some have decreased in size, others have disappeared and some like the Mile 18 catchments are getting exhausted as a result of the increasing population. The population of Buea in 2020 stood at 300,000 inhabitants – almost 4 times the population in 1998 (63,853 inhabitants) when there was no water problems in Buea [18].

3.3 Evolution of Water Consumption per Capita for Buea (1976-2020)

The demand for water has outpaced supply and this has resulted to water rationing and scheduling. Results showed that water consumption per capita reduced with increase in human population. This has resulted to a drastic

drop in the annual water consumption per capita of the population from 85.9 m³ in 1976 to about 11.2 m³ in 2010 and about 15.3 m³ in 2020 Table 3.

3.4 Challenges of Potable Water Supply

The increasing challenges of potable water supply in Buea is as a result of poor management by the authorities concerned which has led to frequent water shortages and over exploitation by the increasing population leading to the exhaustion of some water catchments Table 4.

As seen in Table 4, (61%) of the participants in this study stated that there is a frequent water shortage in Buea municipality and 36.6% of the respondents indicated that they do not have access to potable water on grounds that they don't have constructed public taps in their localities most especially in the Molyko neighborhood. In Bomaka, it was also indicated that they at times trek for longer distances in order to fetch potable water. As well as 62.5% were of the opinion that water is poorly managed in Buea by both the government (CAMWATER) and the community concerned in water management as attention is not given to some of the most affected localities like Molyko, Bomaka, Bonduma Gate, Bokwai and Buea Town where the challenges of potable water supply are increasing on a daily basis.

More so, as concern the causes of potable water supply challenges still in Table 4 above, 51.4% of the dominants population expressed that the main caused is poor management by the authorities concerned, while 62.9% of the respondents indicated that over exploitation of potable water by the increasing population was another caused, and 42.6% talked about the exhaustion of catchments caused by the increasing population constructing their houses near water catchments, the aspect of deforestation and the cultivation of plantation farms near catchments in Buea municipality exposing streams to the sun light and as a result water catchments are getting exhausted. Also, 29.4% of respondents indicated that mismanagement of potable water by the Buea population is also another caused whereby the population contributes in destroying pipes carelessly, and in some places broken pipes are expanded by the population instead of fighting toward repairing them.

More so, 54.2 percent stated that the duration of potable supply water lasts in less than a week time and 52.9 indicated that the proximity to the source of potable water is onsite. While 41.7 percent were of the opinion that the proximity to potable water sources is less than 400 meters away but yet the problem of potable water supply in Buea is on a continuous increase. Also, 50.8 percent indicated that the expenditure incurred in acquiring potable water in Buea municipality is expensive as most people in areas of Bomaka, Bokwai, Molyko, Bonduma Gate and Ndongo localities had to trek to distance streams to get

fresh water especially in times of frequent shortages.

3.5 Implications of Portable Water Supply Challenges in the Buea Municipality

These implications were focused mainly on health problems faced by each household. Health data was collected from the Buea Regional Hospital which portrayed the main diseases easily contracted due to portable water challenges as seen in Figs. 2, 3 and 4.

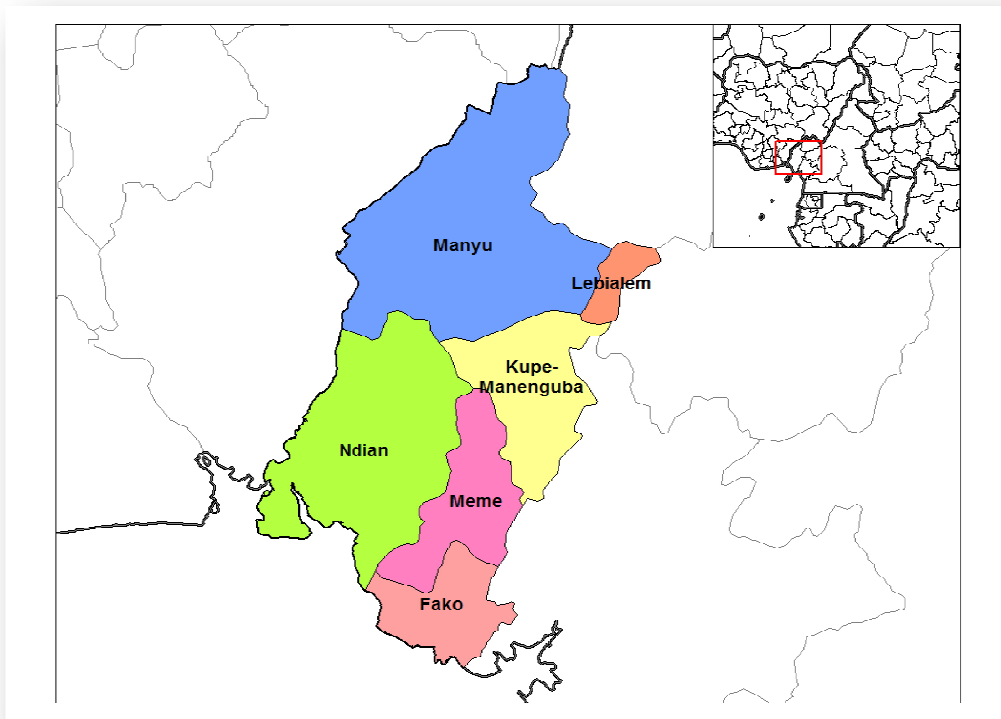


Fig 1. Map of south west region of Cameroon showing division of study area [15] Fichier southwest Cameroon division.png

Table 1. Evolution of water supply challenges in buea municipality (1960-2020)

Year	Supplying Interval
1960	None
1970	2 hours
1975	3 hours
1980	4 hours
1990	6hours
1995	1 day
2000	2 days
2005	3 -4 days
2011 to 2020	4-7 days

Source: adapted from [17]

Table 2. Population evolution for buea (1976-2010)

Year	Population
1976	22,948
1977	23649
1987	26149
1989	63,853
1993	78,632
1998	105,000
2008	141111
2010	176000
2020	300,000

Source: [17]

Table 3. Evolution of water consumption per capita for buea (1976-2020)

Year	Annual water supply (m ³)	Annual population	Consumption/head (m ³)
1976	1970800	22.948	85.9
1977	1970800	23.49	84.0
1989	1970800	63853	29.9
1993	1970800	78632	25.0
1998	1970800	105000	18.0
2008	1970800	141111	13.9
2010	1970800	176000	11.2
2020	2070800	300000	15.3

Source: Calculated from regional service of statistics and camwater, Buea.

Table 4. Challenges of potable water supply

Parameter	Indicator	Frequency	Percentage
Challenges of potable water supply	Frequent water shortages	215	61.0
	No access to potable water	128	36.6
	Poor management	219	62.5
Causes of potable water Supply challenges	Poor management by the authorities	180	51.4
	Mismanagement by the population	103	29.4
	Exhaustion of catchments	149	42.6
Duration of water shortages	Over exploitation by increasing population	220	62.9
	Less than a week	190	54.2
	Few months	120	34.3
Proximity to the source of potable water supply	More than a year	14	4.0
	Onsite	185	52.9
	About 400m	121	34.6
Expenditure incurred Acquiring potable water	Less than 400m	146	41.7
	Affordable	117	33.4
	Expensive	178	50.8
	Very expensive	168	48

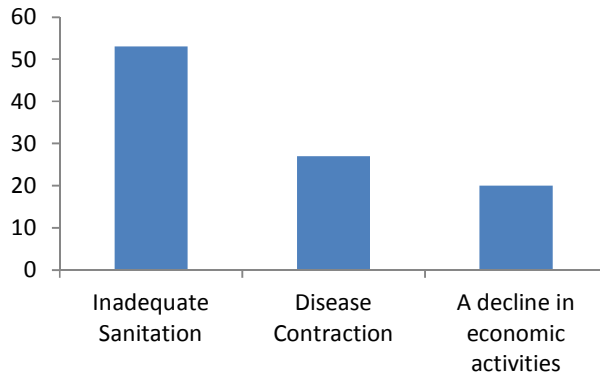


Fig. 2. Percentage of problems faced by the households

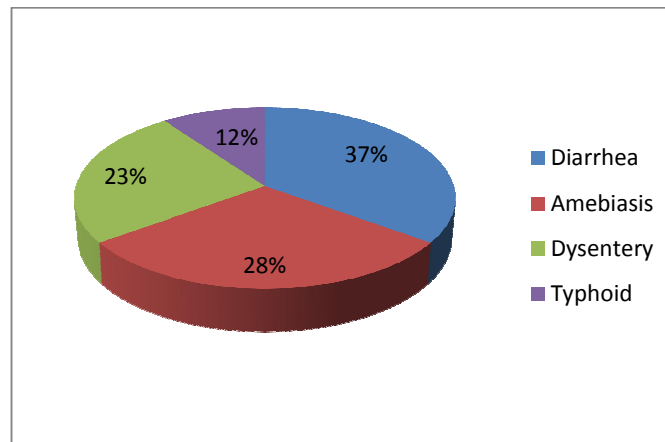


Fig. 3. Diseases contracted as a result of potable water supply challenges

As observed above, each of the problem was evaluated on a percentage of its own, a majority (53%) of the respondents indicated that they faced the problem of inadequate sanitation as a result of the increasing challenges of potable water supply. And 27% of the respondents stated that they easily contract a lot of diseases like diarrhea, dysentery and typhoid fever. While 20% faces a decline in economic activities due to the challenges of potable water supply in Buea municipality. This was a clear fact in that, once the level of sanitation is poor in a particular area then many people are liable to contracting a lot of diseases mostly from drinking and using unsafe water sources and hence water which is not properly treated[19]. When people contract these diseases they become unhealthy and are not actively carrying out their daily activities and this tends to negatively affect economic activities in the municipality.

37% expressed that they easily contract diseases like diarrhea which frequently causes many to be sick and spend more in buying drugs instead of investing in a other personal developmental activities. Also, 28% of respondents stated that they contracted ameobiasis while 51% and 40% contract diseases like dysentery and typhoid fever respectively in Buea municipality as a result of potable water supply challenges.

3.6 Number of Patients Affected by these Diseases in Regional Hospital of Buea as a Result of Potable Water Supply Challenges

The numbers of patients who easily contract these diseases yearly were equally indicated in the Regional hospital of Buea, stating that the exact number cannot easily be obtained patients

buy their medications privately from pharmacies and others use traditional herbs.

From Fig. 4, it was indicated that more than 600 patients are recorded yearly in Regional hospital of Buea as a result of issues directly related to potable water supply in Buea municipality [20]. This statistic shows that the numbers of persons who are affected yearly are currently on an increase due to increasing depletion of resources. Also, it was indicated that 370 persons are affected yearly with diarrhea [20]. This number shows that most people contract this disease as they fetch water from unsafe sources like Wells in Bomaka during periods of frequent shortage. More so, 180 persons suffer from amoebiasis yearly and 95 persons suffer from dysentery while 85 are affected yearly by typhoid fever [20]. The field data shows that diarrhea, dysentery and typhoid are the most frequent diseases affecting the population of Buea municipality as a result of the scarcity of potable water which cannot meet the demand of the increasing population. As a result, these diseases mostly affect children and the young adult class which often result to the increasing death rate [20] caused by the increasing challenges of potable water in the Buea municipality.

4. DISCUSSION

4.1 Assessment of the Challenges of Potable Water Supply in Buea Municipality

After analyzing the result obtained from the 350 questionnaires equally distributed from all the study areas with the aim of obtaining reliable data for the potable water supply challenges in Buea municipality, this study revealed that there is frequent water shortage even though the duration of water shortages last for less than a week. Besides, the respondents reported that the proximity to the source of potable water is less than 400 meters in some localities like in Bomaka, Molyko and Ndongo areas of Buea and the population sometimes go long distances in search of potable water from unknown sources which are not treated or taken care of like streams and wells. However, it was also indicated that the proximity of potable water is onsite especially in some areas in Molyko, Bonduma Gate, and Sandpit and in Bakweri Town. Even though there are few taps in these areas, the population still suffers from frequent

water shortages due to poor management of potable water in the Buea municipality.

Still on the challenges, the expenditure incurred in acquiring potable water is expensive with 50.8% of the respondents stating that half of the increasing populations of the Buea municipality are facing lots of challenges in acquiring potable water in their various localities. To that effect, people are bound to contract many diseases because of the challenges involved in supplying potable water.

As for the causes of potable water supply challenges, the study participants stated that the main caused is poor management by the authorities concerned. This is true because Buea has abundant water resources like streams and rivers, and Cameroon as a whole is blessed with abundant water resources. Despite all these, water still remains a scarce resource because of inadequate management practices [9]. Also, CAMWATER Buea, indicated that the volume or storage capacity of their water catchment is 7200m³ which is very small to satisfy the the water needs of the increasing population of Buea municipality. Most of the community water catchments are poorly manage with some fast degrading like the community catchments of Mile 18 as was indicated by the Buea municipal council and the population as a whole.

4.2 Implications of Potable Water Supply Challenges

The result of the analysis in Fig. 2 shows that in the Buea municipality, inadequate sanitation is the major health problems faced in most of the localities as a result of the potable water supply challenges or the scarcity of potable water in Buea municipality.

According to [21], more than 5 million people die each year from diseases caused by unsafe drinking water sources, lack of sanitation and hygiene. This same situation is true in Buea municipality as indicated above. More to that, the respondents stated that people contract lots of diseases and easily become sick, and as such a decline in economic activities becomes the order of the day because once the active sector of the population easily contract these diseases then a decline in the economic activities is bound to occur.

Furthermore, the percentage of diseases easily contracted as a result of potable water supply

challenges were also indicated in Fig. 3 above, where the respondents expressed that diarrhea is one of the main diseases easily contracted in most of the localities in Buea municipality. Diarrhea is a disease caused by the ingestion of untreated contaminated water which easily causes stomach upset [22]. To this effect, potable water needs regular monitoring and treatment in order to reduce the increasing rate of diarrhea and other water borne diseases affecting the population. According to Regional Hospital of Buea, more than 30% of the affected population of Buea easily contract and suffers from diarrhea disease every year. Also, diarrhea is a 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 [21]. More to that, a study conducted by [23], identified that the diseases attributed to the consumption of untreated water sources include diarrhea diseases. To this effect, the Buea municipality needs to discourage its population from drinking or using untreated water sources and both the government and local communities involved in managing and supplying potable water should be encouraged to step up their rate of management, storage, treatment and supply of potable water in Buea municipality in order to reduce the increasing rate of this diarrhea disease from contaminating potable water sources in the municipality.

Besides, another diseases easily contracted by the Buea population are dysentery and typhoid fever as was also indicated by the respondents. Dysentery is caused by bacteria found in contaminated water or food, same as typhoid fever. As such the treatment of water before drinking is encouraged to eliminate these diseases.

4.3 Assessment of the Number of People Affected by these Diseases in Regional Hospital of Buea as a Result of Potable Water Supply Challenges

The results of the analysis in Fig. 4 stated that 370 persons are affected every year in Regional hospital of Buea with diarrhea disease as a result of water scarcity and the use of unsafe drinking water in Buea. More persons are also recorded in Regional hospital of Buea affected with amebiasis diseases, more than 85 patients are equally recorded yearly in Regional hospital of Buea as those being affected with dysentery and typhoid fever respectively as was indicated by the staff of the Buea regional hospital. Stating that more than 600 persons are affected every year with these diseases as a result of increasing challenges of potable water in this municipality. It was equally indicated that the exact number of affected cases cannot be recorded because some patients privately treat themselves. According to World Health Organization, more than 1.1 billion people globally lack safe drinking water and are liable to contract these diseases. This same situation is true in Buea municipality in that, water scarcity and lack of safe drinking water is one of the major problems that affect people in the Bomaka, Molyko, Bonduma Gate, and Ndongo localities, all in Buea municipality. Safe drinking water is often a difficult thing to find in Buea as some of their catchments are being polluted during periods of heavy rainfall and some of them become dry during the dry seasons leading to frequent water shortages and this main problem was noticed in most of the exposed water catchments like the Mile 18, mile 16, and the Koke water catchments found in Buea municipality.

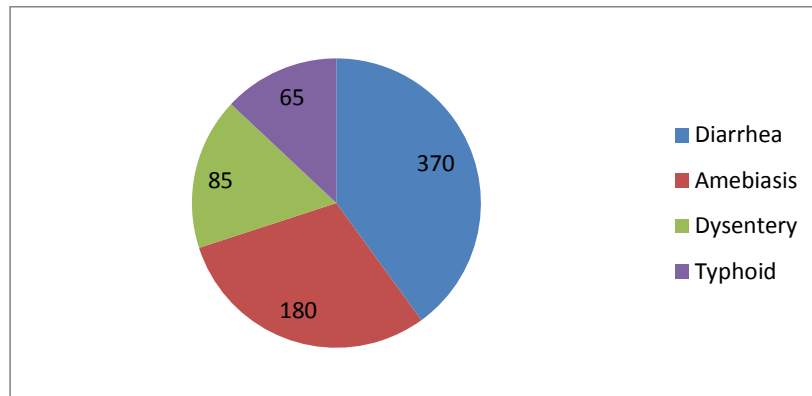


Fig. 4. Number of patients affected yearly in Regional hospital of Buea

Other scientific papers like that of Lotsmart Fonjong published in February 2017, titled "Water Crisis and Options for Effective Water Provision in Urban and Peri-urban Areas in Cameroon" is in line with the results of potable water supply challenges in Buea municipality as it equally indicates that many urban and peri-urban areas in Cameroon faces the problem of water scarcity.

5. CONCLUSION

Over exploitation of potable water sources by the increasing population and poor management by the authorities concerned stands as a major driver of the challenges of water scarcity in Buea municipality. This has eventually given rise to health implications as a result of inadequate sanitation which has led to disease contraction like diarrhea and typhoid fever and is causing a decline in economic activities in the Buea municipality. Once the active youths are affected with these diseases, they cannot work or carry out their businesses effectively and contribute to the economic development of the town, and the end result would be a decrease in economic activities as a result of the increasing challenges of potable water supply. The need for efficient, equitable and sustainable water allocation policies in the face of growing human numbers and demand in the Buea Municipality is imminent. Solutions to the increasing challenges of potable water sources revolve around the need to introduce flexible and highly coordinated strategies which will bring all the stakeholders at the forefront in order to overcome these challenges. It is hoped that to solve the water challenges, there is need in increasing community and cam water storage capacities, renewing water pipes, adopting a water distribution timetable, and the need for catchments rehabilitation can reduce this increasing challenges. Banning the dumping of waste into streams and near catchments, encouraging community water treatment, restoring polluted streams, and encouraging effective hygiene by washing of hands with soap or using hand sanitizer needs to be practiced to prevent disease contraction and subsequent health challenges. These measures discussed can reduce the increasing challenges of potable water supply and its implications in the municipality if only these measures are all taken into consideration. As such this study suggests an integrated water management approach as a means of making potable water supply

challenges less problematic to the population of Buea.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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