

Study of quality and Water Management of well in sub-urban medium of the DR Congo: Case of the common Bandole and Ndjombo of the urbano-rural city of Basoko

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ABSTRACT: A sample of 68 wells left again in the four districts of the City of Basoko had been the subject of our investigations for the analyses physicochemical and bacteriological. Also an investigation in the 350 households into the behavior of the house holds screw-with screw of water of domestic use was carried out.

The bacteriological analyses raised the presence of the indicator germs of the pollution in analyzed water of the wells, like some pathogenic, whose quantitative average of the colonies is **79,05; 443,39** and **3, 22** units by water 100ml, respectively for the fecal coliformes, streptocoques fecal and *Salmonella* or *Shigella*. This observation shows that all the investigués wells are polluted. The identified germs, in addition to *the Salmonellas* or *Shigella*, are: *C. frendi* (33,8%); *E coli* (26,7%); *Klebsiella spp* (18, 3%); *C intermédiaire* (12,7%) and *Enterobacter* (8,5%).

As for the chemical physico analyses, the pH of water of well takes varies from **4,92** to **7,38**; while their temperature ranges between 25 and 33° C the average values of the proportioned chemical compounds are: **8,635** mg/l for the ions chlorides; **13,225** mg/l for calcium; **8,02** mg/l for magnesium; and that the alkalinity of water of the wells analyzed was **85,6** Mg / L.

It comes out from our investigations that certain households draw and store water in the buckets without lids, (42, 23%); others clean their containers of storage or drawing up that once per week (3,33%). Moreover, it ya of the households which preserve water of domestic use during in the month 3jours (5,78%). 88,22% of the households do not treat water before consumption. In addition, certain households do not have toilets, it is - with - to say défèquent with the free air (10,44%); and that 9,55% of the wells of supply water are located at less than 50 meters of the toilet.

KEYWORDS: Water of well, quality, collection, storage, germs, pollution, cleansing.

1 INTRODUCTION

Water is omnipresent on the ground. Without it, life of the alive beings, of which particularly that of the man and his activities, would be impossible. It constitutes an inexhaustible vital natural resource, in spite of only 1% of the water of the sphere is specific to consumption. During the 50 last years, the human beings modified the ecosystems more quickly and in a way more significant than in that it does not matter another comparable period of the human history. This constant points out the inconsistency of our modes of managements thus degrading the mediums and natural resources, among which water appears in good place in the heavy prize list of the impoverished resources (1).

In 2015, 91% of the world population use a source of improved drinking water, against 76% in 1990. Among the 2,6 billion people having obtained an access to a source of drinking water improved since 1990, 1,9 billion had running water. In the same way on 147 countries of the world which reached the target on drinking water, 77 countries only reached the target on drinking water and the cleansing (2).

In addition, 193 Member States of UNO, with at least 23 international organizations joined together into 2000 in the United States, aimed among the objectives of the millenia for the development, to reduce half the percentage of the population which does not have access of way durable to a supply salubrious drink water and to services of basic cleansing, but also to manage to appreciably improve, from here 2020, the water life minus 100 million inhabitants in precarious living condition (2)

In RD Congo, the constitution of the country affirms in its article 48 that, the right to the access to drinking water and the electric power guaranteed. From this point of view, the Government of the RD Congo through ministries for the wallet and energy, responsabilisé the control of distribution of water (REGIDESO) to make a success of this bet among the large axes of the five building sites of the Republic. Alas, one assists today in our cities, cities and villages with a situation very alarming: deprive, demography galopante, mésusages increasing and intensive, pollution; situation seriously putting in danger the water resources (3).

Also in RD Congo, the quality of the drink water, its mode of management and provisioning, including the hygiene and cleansing of environment constitute a problem of public health and are cause of misfortunes (disease) in several cities of the country, and especially in rural medium. It is estimated that 88% of the cases diseases of the country are due to the sanitary arrangements and environmental too precarious; situation able to be extrapolated in the rural mediums of the country, because of the inexistence almost of the drainage used, but also by the fact that many septic tanks and latrines overflow and pollute the ground and the points of supply water (4).

The urbano-rural city of Basoko is one of the entities the least covered as regards supply drinking water and of cleansing. This dramatic situation becomes complicated day at the following day with the pouring rain, thus causing the floods of the low zones; the they rain ones are not drained and evacuate in an anarchistic way along the water points. Each inhabitant tries to divert surface waters of his concession in his manner, without worrying about the neighbor; situation creating polemic in the districts. Young children by the same phenomenon of flood by water of the rains often lose their life. The wild dumps are a little everywhere in the districts and are used as place of defecation with open sky.

Indeed, the inexistence of the control of distribution of water (REGIDESO) and the presence in too small proportion of the arranged sources and modern well (1%) led the population to be satisfied to consume the water of the artisanal wells, which are not very deep and sometimes not to protect. Scrubbings of the clothes as of the crockery made around the wells of supply drink water contribute to the pollution of this water.

Thus, to improve the situation of the quality of the drink water and the behavior of the population vis-a-vis this water of well, three conditions are necessary to make it possible a population to have the drink water in quantity and acceptable quality:

- The perennisation of the source of supply water;
- Maintains in a state of permanent healthiness of the environment and the sources of supply water;
- The compliance with the rules of hygiene relating to the pumping out, transport, the storage and the taking away of the drink water.

The objectives continue with this study are:

- To determine the quality of the water of well consumed in the districts of the urbano-rural city of Basoko;
- To identify the factors of pollution waters of well by the population in the districts of the urbano-rural city of Basoko;
- To appreciate the mode of management of water of well by the population of the districts of urbano the rural – city of Basoko.

2 METHODOLOGY

To achieve these goals, we considered it useful to carry out a descriptive cross-sectional study. The study related to water of well like their mode of management in the households like drink water. Our investigations were carried out in the following way:

- To manage the questionnaires drawn up beforehand with the households;
- To make a direct observation of the wells of supply water; and
- To take water of well for physico analysis chemical and bacteriological at the laboratories of the Congolais office of control (OCC) and microbiology of the Faculty of Science of the University of Kisangani respectively with Kisangani.

The study proceeded in the four districts of urbano the rural –city of Basoko; with knowknowing: district AMBAMBE, district LIBAMBA, district MAMBANDU and district TOYOKANA. According to the files of the State - civil of the known as city, these districts counts 99. 853 inhabitants until April 2016. For this reason all the water wells used as source of drink water were the subject of our study. A sample of 68 wells distributed in four districts Ci tops was listed and analyzed; for the period going from November 2015 to April 2016.

The chemical physico –analysis consisted in on the one hand measuring on the spot: the temperature and pH; in addition to proportion the chemical compounds hereafter: chlorinated ions, alkalinity, ion magnesium and ion calcium.

As for the bacteriological analysis, it was carried out in two stages: the enumeration and identification.

2.1 THE ENUMERATION

The enumeration of the coliformes and streptocoques fecal was made by the method of fermentation out of tube multiples(FTM). The fecal coliformes were counted in the lactosé bubble, by thus using two types of concentrations: double and simple; starting from the dissolution of lactose, peptone and of beef extract in distilled water. While that of streptocoques fecal was carried out starting from the medium of SHERMAN, who consists in preparing two distinct solutions: one containing the powder of the cow's milk concentrated and the other of methylene blue to 1%.

2.2 THE IDENTIFICATION

The identification of the coliformes have been realized by the study of the morphological characteristics on Agar –Lactose in Éosine and the Methylene blue, by differential colouring of Gram according to the method of HUCHER and by study of the biochemical and physiological characteristics using the traditional gallery made up of five mediums: Kligler, citrate of Simon, clark and Lubs, urea, SIM(H₂, Indol, mobility). The research of *the salmonellas* and / or *shigella* was made on medium SS – agar, with 37° C.

3 RESULTATS

The results of our investigations are gathered with three categories:

- Chemical physico analyses;
- Bacteriological analyses;
- Inquire with close to the households into management to the water and cleansing of the wells of supply water.

3.1 CHEMICAL PHYSICO –ANALYSIS

The values of pH of the various analyzed water wells vary from 4,92 to 7,38. While the temperature of analyzed water is between 25° and 33° C. The average values of the proportioned chemical compounds are consigned in the table hereafter:

Table 1: average concentration of the chemical compounds in the water of analyzed wells.

Chemical compounds	Average concentration in mg/l
Chlorides	8,635
Calcium	13,225
Magnesium	8,02
Alkalinity	85,6

It arises from table 1 Ci-high that, no analyzed well presents the value of chemical compound in conformity with the directives of WHO.

3.2 ANALYSE BACTERIOLOGICAL

From the quantitative point of view, the numeration of the indicator germs of fecal pollution of which coliformes fecal, streptocoques fecal; like some pathogenic: *salmonella* and/or *shigella*, in the analyzed well raised an average of colonies

of 79,05; 443,39 and 3,22 units by 100 ml of water respectively. The prévalence of the fecal coliformes identified in the various analyzed water wells are indicated in table 2 following.

Table 2: Prévalence of the fecal coliformes in water of well analyzed

Species coliformes	Frequency	%
<i>Citrobacter freundii</i>	48	33,8
<i>Escherichia coli</i>	38	26,7
<i>Klebsiella spp</i>	26	18,3
<i>Citrobacter intermédiaire</i>	18	12,7
<i>Enterobacter</i>	12	8,5
Total	142	100

It is released from table 2 that, *Citrobacter freundii* and *Escherichia coli* account for 60,5% of the fecal coliformes found in the analyzed water wells.

3.3 RESULTS OF THE INVESTIGATION ON THE LEVEL OF THE HOUSEHOLDS

It comes out from our investigations that, on 350 consulted households, 74% of the interviewed people were of female sex, against 26% of male sex; and that the people whose age varies between 21 with 3âns were represented, with 44,89% of the cases. 11,56% of the questioned people were not at the school. The majority of the households counted 6 to 10 people by household.

With regard to the management of water in the households, some of them draw and store water in the buckets, i.e. 42,23% of the cases; and that 11, 11% of the containers did not have lids. 18,22% of the households are used for of the unsuitable ustensils to consume water. 19,78% of the households store together the water of drink and water to other uses. 3,33% of the households clean their containers of drawing up or storage once per week. Certain households stoked their water with use domesticates 3jours or more, that is to say 5, 78% of the cases. The majority of the households does not treat water before consumption, that is to say 88,22% of the cases; against 11,78% of those which treat it and use only chlorination as process of treatment of water before consumption. 26,45% of the households are located at more than 500 meters of the wells of supply water.

As for the cleansing, 10,44% of the households do not have toilets, it is with - to say défèquent with the free air; 96,44% of the households have open sky dustbins their pieces. The majority of the surveyed households do not program days of healthiness, that is to say 50,44% of the cases. 64, 43% of the wells are victims of the multiple streamings. 9,55% of the water wells are located at less than 50 meters of the toilet.

4 DISCUSSION OF THE RESULTS

Considering in Basoko the problem of the water pollution is related to its mode of management, the insufficiency of the cleansing and the influence of the climate, the discussion of our study turns all around the parameters related to this state of affair.

4.1 PHYSICOCHEMICAL QUALITY OF WATER OF STUDIED WELLS

It comes out from our investigations that the various water wells of Basoko reveal of an acid nature, that is to say 77,78% of the cases. In the same way, the values of pH of these various water wells vary from 4,92 to 7,38.

In referent to the standards of WHO (pH ranging between 6,5 and 9) for drinking water, 61,11% of the water samples analyzed are not in conformity with human consumption.

For this reason, the result of our investigations corroborates that of COULIBALY (5) in Bamako / Mali and is close to that of KAZADI (6) in the area of Kisangani in RD Congo, which noted that the water pH of consumption in these areas varies from 4,59 to 7,02 and 5,4 with 6,9 respectively.

We think that the acidity of water of well of urbano- the rural city of Basoko can be explained by the fact why the bordering population of countered often makes the crockery and detergent all around the water points; and that worn

water infiltrates, causing thus the aforementioned acidity. Other share, the situation would be explained by the streaming of water of the rains which cart all kinds of polluting substances in this water and make them thus too acid.

In our series, the temperature of analyzed water varies from 25 with 33°. Indeed, the majority (94,44%) of analyzed water does not answer the criteria of WHO, in the which normal temperature of the water of consumption should not exceed 25°. This result that we found is almost the same one as that of ASSOUMA and OUSSOU (7) with Kpamasse and AKODOGBO (8) in Oporto-Novu which found a temperature about 27° C with 30° C. We dare to believe that these high degrees of water temperature of found wells with Basoko would be justified by the low depth of the underground water tablecloth in the territory of Basoko. As should it be noted as a water temperature of more than 25° C constitutes a good culture medium for the micro-organisms surrounding, especially in tropical medium (9).

Proportionings of the chemical compounds of water of well of Basoko reveal that no well presents the value in conformity with the directives of WHO, it is with - to say to it quasi totality of the wells have a weak concentration of chemical elements, especially out of residual chlorine (6,897mg / L), whose average value is largely lower than the normal (250mg/l); what would constitute one of the causes of contamination of water of well by the pathogenic micro-organisms with Basoko.

4.2 BACTERIOLOGICAL QUALITY OF WATER OF WELL ANALYZED

The bacteriological analysis of water of well analyzed reveals that the near total of the wells was polluted.

The indicator kinds of fecal pollution found are: coliformes fecal (*Citrobacter freundii* 33,8%; *Escherichia coli* 26,7%; *Klebsiella spp* 18,3%; *Citrobacter intermédiaire* 12,7% and *entérobacter* 8,5%), streptocoques fecal; like some pathogenic, of which *salmonella spp* and/or *shigella spp*. Among the identified fecal coliformes, *Citrobacter freundii* and *Escherichia coli* account for 60,5% of the cases. Indeed, our results are the same ones as those found by MAKOUTODE and his/her collaborators (10) in Benin, in which the most frequent germs were *Citrobacter freundii* (34,2%) and *Escherichia coli* (30,8%). The difference of the proportions would be said to the sample size.

Within sight of the bacteriological results, we think that several factors could explain the water pollution of well with Basoko.

- insalubrity in the surroundings of the wells of supply water (detergent, crockery);
- behaviors of the community (defecation to the free air);
- streaming;
- the small proportion of residual chlorine in the water wells.

4.3 MANAGEMENT OF THE WATER OF THE WELLS IN THE HOUSEHOLDS AND CLEANSING

In our series, the investigation reveals that certain households with Basoko draw and store water in the buckets (42,23%), of which 11,11% of these containers do not have lids. Others are used for of the unsuitable ustensils to consume water, i.e. 18,22% of the cases, but also store together the drink water and that with another use (19,78%). 3,33% of the households clean their containers of drawing up or storage once per week; others store water with use domesticates at least 3jours (5,78%). The majority of the households does not treat water before consumption (88,22%); and that 26,45% of the households are located at more than 500 meters of the wells of supply water. On the other hand, certain surveyed households do not have toilets and défèquent with the free air (10,44%). The majority of the wells are victims of the multiple floods ou/et streamings (63,43%) and others are located at less than 50 meters of the toilet (9,55%). There is not programming of the days of healthiness in half of the households (50,44%).

Taking into consideration these result, our study confirms the report of EMPEROR - BISSONET and its collaborateurs(11) in the village of Boassa to Burkina-faso, on which the drinking water collected by the population instead of provisioning is often contaminated during transport (38%), storage and handling in residence (62%). The factors accused for this purpose were the ignorance of the rules of hygiene and the use of the unsuited containers, opened and without protection.

As for what concerns us, we dare to believe that in Basoko, water of domestic use is contaminated at the point of provisioning that in residence. The factors which induce this pollution would be the precarious hygienic conditions of the population: cleanliness of container of drawing up, storage and the ustensils used to consume water in residence, use of the little children at ends of the taking away of drink water, nonthe cleansing of the domestic environment and points of supply water, the rate/rhythm of renewal of stored water; but also multiple streamings towards the wells of water, and even floods.

5 CONCLUSION

Taking into consideration result of our investigation on the study of the quality and the management of water of well consumed by the population of Basoko, it arises three major facts:

1° From the quality point of view of water

The physicochemical analyses reveal that 61,11% of water of investigués wells present an acid character nonin conformity with human consumption; more than 90% of water samples have a temperature higher than 25° C and 100% of the wells of supply water with use domesticate have a low residual chlorine rate. But the bacteriological analyses show that all the wells are polluted (100%), it is with - to say that present a high health risk of the consumers.

2° From the management point of view of water:

The habitats of the town of Basoko are confronted with several constraints likely to return the unsuitable drink water to consumption: provisioning of water in not protected wells, the use of the non covered containers to draw and drink water, use of the little children at ends of taking away of drink water, nonthe differentiation of the places of storage it water of drink and water to another use and not cleaning of the containers before each filling, the conservation of the drink water more than two days, an accessibility difficult with the water and nonthe treatment of water before consumption.

3° From the cleansing point of view of the medium:

Certain wells are polluted following the floods. There are not days of healthiness in the households (50,44%). Several people use the same toilet by household, which causes the filling early the latter, even its collapse, with potential risk of fecal contamination. Therefore, of all the facts Ci-tops, there are real problems in the urbano-rural city of Basoko related to the quality of the water of consumption and cleansing. It is of a duty obliged of the persons in charge for our companies to preserve the health of the man by making regular quality controls of the wells of provisioning of water and setting up drainage systems on the one hand, and other share the population must carry out the modification of certain behaviors it is with - to say to make the study of the existing behaviors, to identify the barriers to the aforementioned modification and to define the objectives of change. A partnership between the various actors concerned, the use of means of adequate medical organizers and the participative methods contribute to the adoption of this new behavior.

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