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DRINKING WATER QUALITY DETERMINATION THROUGH THE WATER POLLUTION INDICATORS, ELBASAN DISTRICT

ABSTRACT

Today's drinking water supply in the Elbasan district continues to be an issue of concern. The population growth nowadays is accompanied by the increase of request for water use. To complete their needs, people have chosen to use groundwater by opening wells. Having their personal well does not guarantee water safety. The aim of this paper is to determine the quality of drinking water through coliform bacteria indicators, in Elbasan district. There are three groups of coliform bacteria, total coliform, intestinal enterococci and *Escherichia coli*. Each of these is an indicator of drinking water quality and each has a different level of risk. In this study are analyzed many water samples taken from villages Labinot fushë, Gjergjan, Papër, Shushicë, and Bradashesh. In some of these villages, the water samples are taken from wells and pipes. The total coliform, *E. coli*, and intestinal enterococci in drinking water of these villages are reflected in this study. The data recorded shows which of the analyzed water sources are within the international standards to be used as drinking water. The coliform pollution levels are higher in the wells water than in the pipes one. The distant areas from the city of Elbasan are more polluted than those nearby.

INTRODUCTION

The situation of water supply infrastructure in Albania is in a critical state, considering the old networks, massive leakage in all parts of the system, illegal connections, unstable supply pattern, uncontrolled rural-to-urban migration, and low maintenance due to lack of funds. The percentage of population hav-

ing access to pipe water supply is uncertain. Figures vary considerably, from 90 percent in urban areas to 50 percent in rural ones. This uncertainty happens because there are no clear criteria what a water-providing infrastructure should look like. Most drinking water systems are old, corroded and provide very little, or, even no water at all to the consumers. Some complex networks have recently been divided into smaller manageable parts and their destiny is unknown. Governmental authorities have not done a complete census of old systems and new ones, mainly due to lack of monitoring resources. Hence, accurate figures are not available and until this happens, approximations are inevitable (World Bank, 2003). Rural coverage with drinking water services is most critical problem, because drinking water infrastructure provides coverage mainly and more comprehensively to urban areas.

Where piped systems are not available, population in rural areas mostly relies on natural springs and domestic wells to satisfy their needs. This implies enormous time and efforts spent in fetching and transporting water as the sources may be far away and because not every family has a well. Transportation is done mainly with animals, in plastic containers that are used for transport and storage as well. People, who have opened wells to satisfy their needs, didn't analyze the water quality. Accurate data on this process are not available, however, two international NGOs have done basic surveys in rural areas where piped systems were absent (PIA, 2001).

Providing safe quality drinking water is an important factor for human health. Safety is increased if multiple barriers are in place, including protection of water resources, proper selection and operation of a series of treatment steps and management of distribution systems (piped or otherwise) to maintain and protect treated water quality. The great majority of evident water-related health problems are the result of microbial (bacteriological, viral, protozoan or other biological) contamination. Cases with infections caused by contact or consumption of contaminated water with pathogenic bacteria such as *Escherichia coli* have been reported from different parts of the world, often causing the epidemic leading to death (Angulo *et al*., 1997). Monitoring for the presence of pathogenic bacteria is a fundamental issue of water quality assessment, where direct or indirect use leads to serious human health problems (Chapman, 1992). According to WHO (2004), about 80% of all diseases and over 1/3 of deaths in developing countries are caused by contaminated drinking water.

The main goals of this study are to determine the quality of drinking waters in through coliform bacteria indicators, in Elbasan district and to compare the study with the standards of drinking water quality (WHO, 2017). Coliform organisms have long been recognized as a suitable microbial indicator of drinking-water quality, largely because they are easy to detect and enumerate in water. Coliform bacteria are present in the environment and feces of

all warm-blooded animals and humans. The presence of *E. coli* in a drinking water sample usually indicates recent fecal contamination. That means there is a greater risk that pathogens are present (Cabral, 2010). If testing detects coliform bacteria in a water sample, water systems search for the source of contamination and restore safe drinking water (WHO, 1997). In order to assess the quality of water, the indicator of drinking water quality have been determined; total coliform (TC), intestinal enterococci bacteria and *E. coli* in the wells and pipes of villages Labinot Fushë, Gjergjan, Papër, Shushicë and Bradashesh.

MATERIALS AND METHOD

Sampling stations

Our study has been conducted in several villages of the city of Elbasan; Labinot Fushë, Gjergjan, Papër, Shushicë and Bradashesh, on 9 July 2015. These villages are over populated the recent years and are known for the development of agriculture, farming and industry. Shushica has the biggest chicken farm and Bradashesh is 4 km from Elbasan city and has the biggest industry in the country. In every village are taken two water samples, in pipes, wells or in natural resources, depending on the water supply in each sampling point. In Papër drinking water supplies were made through individual wells, so the samples are taken in two wells. In Gjergjan are taken in a natural resource and in a well, while in other villages are taken in pipes and wells.

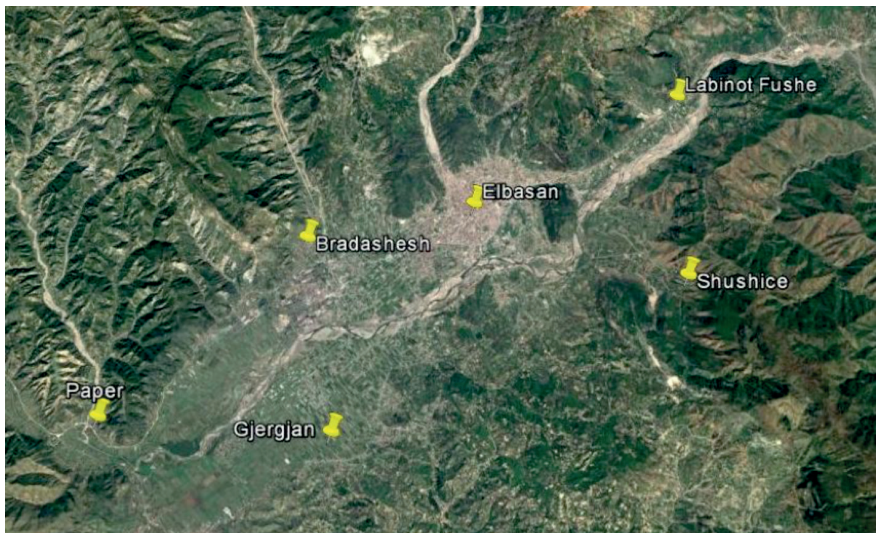

Fig. 1. Sample sampling stations.

Water Sampling

Water samples for study were taken according to WHO (1997). Water samples for bacteriological analysis were obtained via 250 ml sterile bottles, where the date and place of sampling was noted. In natural resources, water samples were taken holding the bottle by the lower part; submerge it to a depth of about 20 cm, with the mouth facing slightly upwards. While in wells and pipes, we have turn on the tap at maximum flow and let the water run for 1-2 minutes. While holding the cap and protective cover face downwards (to prevent entry of dust, which may contaminate the sample), immediately we have hold the bottle under the water jet, and fill.

Determination of microbiological parameters

For the detection and enumeration of *Escherichia coli* and total coliform bacteria in water for human consumption ISO 9308-1 (2002), membrane filtration method was used. The membrane filtration method (ISO 7899-2, 2003) for the detection and enumeration of the intestinal enterococci was used. The tests were conducted in the laboratory of the association "Tjetër Vizion", in Elbasan.

RESULT AND DISCUSSION

The bacteriocological data of the the water samples analyzed are presented in the following table 1. The village most polluted with the total coliform is Gjergjan. In the both type of water source, natural resource and wells, TC are greater than 200.5 CFU/100 ml. In Labinot fushë, pipe is more contaminated with TC (60 CFU/100ml) than well (3 CFU/100ml). In Papër, Shushicë and Bradashesh TC are greater in wells (> 200.5 CFU/100ml) than pipes. About TC in pipes, in Bradashesh is 0 CFU/100 ml, in Labinot Fushë is 63 CFU/100ml and in Shushicë is 25 CFU/100ml.

The wells samples in Bradashesh and the Labinot Fushë are not contaminated with *E. coli* (0 CFU/100ml). Most contaminated are the wells in Gjergjan (>51 CFU/100ml) and Shushicë (43 CFU/100ml). The value of pipes samples in Shushicë and Labinot Fushë, vary 2 and 28 CFU/100ml. Both wells of Papër are contaminated with *E. coli* (3 and 19 CFU/100ml).

No	Villages	Water sourse	Unit	Total coliform	*Escherchia coli*	Intestinal enterococci	Viable bacteria	
							Unit	37?C
1	Labinot Fushë	Well	CFU/100 ml	3	0	1	CFU/ml	4
		Pipe	CFU/100 ml	63	28	15	CFU/ml	57
2	Gjergjan	Natural resource	CFU/100 ml	>200	1	8	CFU/ml	>200
		Well	CFU/100 ml	>200	>51	>200	CFU/ml	>400
3	Papër	Well	CFU/100 ml	>200	3	33	CFU/ml	>300
		Well	CFU/100 ml	70	19	16	CFU/ml	>200
4	Shushicë	Well	CFU/100 ml	>200	43	11	CFU/ml	89
		Pipe	CFU/100 ml	25	2	1	CFU/ml	42
5	Bradashesh	Well	CFU/100 ml	>200	0	45	CFU/ml	>500
		Pipe	CFU/100 ml	0	0	0	CFU/ml	0
6	**Directive***		CFU/100 ml	**0**	**0**	**0**	CFU/ml	**0**

*WHO (1997)

Table 1. The coliform bacteria indicators in drinking water of Elbasan villages.

Based on the data show in table 1 the most contaminated with intestinal enterococci is Gjergjan well (>200 CFU/100ml) and then come Paper (33 and 46 CFU/100ml), Bradashesh (45 CFU/100ml) and Labinot fushë (15 CFU/100ml) wells. The least contaminated are Shushicë wells (1 and 11 CFU/100ml), the well in Labinot Fushë and the pipe in Shushicë with 1 CFU/100ml.

Only the data on Bradashesh pipe correspond to the WHO (1997) directive (0 CFU/100ml), as a result the water is not contaminated with intestinal enterococci.

The viable bacteria at 37˚C is greater in Bradashesh well (> 500 CFU/ml), Gjergjan sample (>200 and >400 CFU/ml) and Papër sample (>200 and >300 CFU/ml). In Shushicë, it varies 42 CFU/ml in pipe and 89 CFU/ml in well. In Labinot Fushë, it varies 4 CFU/ml in well and 57 CFU/ml in pipe. The viable bacteria are higher in wells, in Labinot Fushë and Shushicë pipes. Only in Bradashesh pipe is 0 CFU/ml.

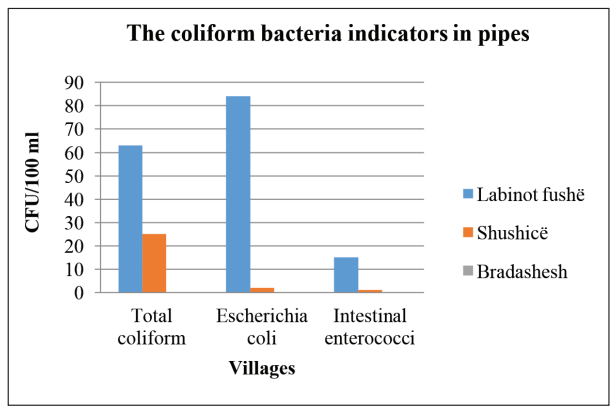

Fig. 2. The coliform bacteria indicators in pipes.

The data show that the high percentage of coliform bacteria in the pipes is due to the amortization of distribution pipes, water supply 2 or 3 hours/day and their non-regular disinfection. Only the water in Bradashesh pipe is not contaminated and it is recommended for drinking water.

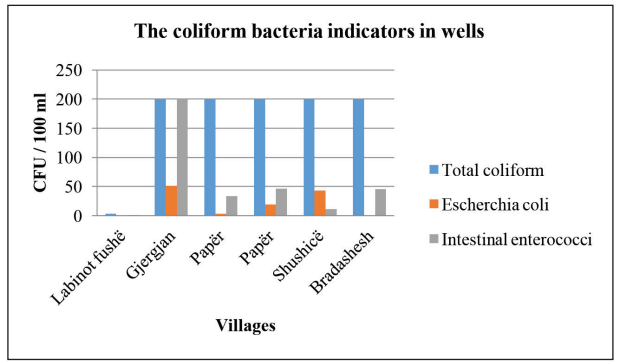

Fig. 3. The coliform bacteria indicators in wells.

All the wells are contaminated with coliform bacteria. Their values are higher than the recommended values for drinking water because they are contaminated with coliform bacteria.

This pollution has come from over-utilization of livestock compost, fertilizers, pesticides etc., to increase the soil fertility. Inappropriate way of irrigation and rainfall have affected the penetration of coliforms in the soil depths and underground water.

Also, the cause of wells and pipes pollution is the absence of sanitary sewer.

The natural resources in Gjergjan is contaminated because it has not been isolated, to be preserved by the passage and feed of living organisms on it.

By comparing the data of our study with the study of Mali *et. al.*, (2011), in Paper drinking water pollution continues to be an issue of concern even though four years have passed. Due to amortization of the water pipes and the lack of water supply wells, people in Paper have decided to use wells as water resources. The quality of drinking water supply in the villages of Elbasan continues to be an issue of concern. This is because people are not informed for the importance of water quality and the risks associated with its consumption.

CONCLUSIONS

Presently, rural water supply systems remain in desperate need of improvement, even though many of them are well beyond cost-effective repairs and interventions that are more painstaking should be considered. Should be paid attention to the investments in the development of the village's water

supply with pipes (24 hours/day), investments in the sanitary sewer and their disinfection should be done regularly. The wells must fulfill the hygienic-sanitary norms. Also, disproportionate use of livestock, fertilizers, pesticides etc., should be avoided. People need to be informed about the importance of ideal water supply and the impacts of water polluted have on their health.

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