EVALUATION OF WATER QUALITY IN THE CITY OF TIRANA

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Abstract

Introduction: Infectious diseases caused by contamination of drinking water by viruses, protozoan, bacterial pathogens and parasites are spread very wide and represent a considerable risk regarding the human health.

The purpose of the study: This study aims to evaluate the microbiological quality of drinking water in Tirana Water distribution network aiming to recognize the quality and to recommend measures for improvement.

Material and Methods: water samples were collected in 31 control points (endpoints) and the method of multiple tubes in 100 ml water was used in order to determine the bacterial loads in the collected samples.

Results: 1922 samples were examined during three months, January, February and March 2012-th. Amongst them 4.4% of samples were contaminated with E. Coli and 0.1% were contaminated with S. Faecal.

Conclusions: the corrosion of the outdated pipeline, negative pressure caused by the water shortages and the uncontrolled interferences in the water supply network by private subjects has smashed water distribution network and impaired the bacteriological quality of the supplied water.

Keywords: drinking water quality, water distribution network, bacterial indicators of pollution.

Introduction

The human body is constituted of water. About 50% of the human body is made of it. Water is essential in the process of digestion, circulation, elimination, and the regulation of body temperature. In fact, the activity of every cell in the body takes place in a watery environment. Water is important as a solvent. Many substances dissolve in water amongst which salt, sugar and alcohol [14, 15]. As a consequence, the quality of water he consumes is of key importance as regards its human welfare. As such the adequate supply of the population with drinking water, in terms of its' quantity and quality, is paramount in order to prevent or limit the spread of many diseases [2, 3, 4] Assessing the risk associated with fluctuations in the microbial quality is difficult and controversial due to the shortcomings of epidemiological data as well as the number of factors that interfere between these factors combined. Of particular, importance is not only the elimination of infectious diseases that can be spread through water, but especially the prevention

of epidemics originating from water, because the size that they can take on these cases are great and perhaps unexpected (10).
The underground network of water, in fact is of high quality in terms of chemical and microbiological purity (13). The ground water generally contains small amounts, or no organic matter, inhibiting the survival of microorganisms. Besides, they are rich with oxygen as well.
Regrettably the surface waters are an environment that contains microorganisms and the oxygen concentration is depended on the quantity and diversity of the microbial species living in them.
Anyway, unfortunately the underground waters are insufficient to meet the growing needs of the population. The need of using the surface waters for human daily use is increasing day by day bringing as consequence the need of cleaning them in order to bring them in the allowed levels the usable water should have.
As a matter of fact, the existence of hydro-borne diseases related to microbiological contamination of drinking water is very coherent. According to WHO, about 30 kinds of infections are recognized to be affected by the water supply, as considering its quantitative and qualitative deficiencies. Actually, it is estimated that over 80% of all diseases in the world are associated with inadequate water (1). In Asia, Africa and Latin America, the lack of adequate amounts of water as well as the dirty water consumption annually is the cause of about 500 million cases of diarrhea infections (1). As far as Europe regards every year are reported around 3 million deaths which are thought to be directly related to the consumption of unsafe water.
Actually, the fight against the infectious diseases originating from water has been an important objective of the public health in Albania during the past 10-years which was realized by applying different technical methods (24). The preservation of water resources from pollution is the first line of defense. Protection of water resources is almost always considered as the best method to ensure safe drinking. Actually, water resources must be preserved from contamination by fecal material of humans and animals, in which are usually found large quantities of bacteria, viruses and parasites, pathogens (10, 23).
Albania is rich in terms of resources. Its hydrographic network includes over 200 major natural sources of groundwater flowing. Generally the aquatic natural qualities of our country are good, not only regarding the groundwater, if considering that 0.5% of ground water is available as freshwater in rivers, lakes and ground waters at depths of 1000 meters [16, 17]. Anyway, the availability of water differs regarding its' temporal and spatial distribution. The recent data related to this question shows that in large parts of towns and villages in our country experience serious deficiencies in the distribution network of drinking water (2).
As a matter of fact, our country has experienced several epidemic outbreaks, caused by the drinking water, such as the cholera epidemic infection of 1994, in which 626 cases were registered (5,6,7) and polio epidemic one of 1996 which had a large impact on the Albanian population (8, 9). In year 2006, Tirana was faced with the outbreak of hepatitis A as well.

The purpose of the study was analyzing the microbiological data of drinking water in water supply distribution network of Tirana, which is a region characterized by a wide variety of natural geological conditions that affect water quality [16, 18]. Tirana city receives water from three different types of water resources, surface water (Bovilla reservoir), flowing underground springs and artesian wells pumped. [19, 20, 21, 22]

The aim of the study was recognizing the quality of water supply in this region and drawing recommendations for the right measures to be undertaken in order that the quality of supply be improved.

Material and Methods

The quality of drinking water supply network in Tirana was monitored during three months, from January to March 2012. Water samples were taken for examination at 31 control points daily (11). The number and location of sampling control points was determined based on the population density and geographical factors. 1922 samples were examined during these three months.

The samples collection and transport was performed in conformity with the standards. Water samples were taken in sterile bottles of 500 ml, where we had thrown tiosulfat sodium, which is usually used for water dechlorination. The transport of the samples was done in refrigerators (2-6^0C) and the examination was performed immediately after the arrival at the laboratory. Water samples were examined for the indicators Escherichia coli and Faecal Streptococci. The bacterial load of analyzed samples is determined using the classical method of multiple tubes in 100 ml of water (12).

The data were presented in tables and graphs. The existence of linkages between the pollution and chlorine levels was analyzed using the SPSS package 17.

Results

The table 1 shows the number of the water samples examined for their contamination with F. Streptococci during the three months meanwhile the table 2 shows the water samples analyzed for their contamination with Escherichia Coli. The figure one on the other hand, shows the percentages of the samples which revealed contaminated with these bacteria for every month in relation with the total of the analyzed samples.

As it is shown in the over mentioned figures in January the level of water contamination with Escherichia coli was 6.0%, in February was 5.5% and in March was 1.6%. In total 95.6% of the analyzed samples revealed as clean water and only 4.4% of them as contaminated with E. Coli.

The percentages of contaminated samples of the drinking water with F. Streptococci were respectively: 0.2% in January, 0.2% in February and 0.0% in March. In total 99.9% of of the analyzed samples revealed as clean water and only 0.1% of them as contaminated with F. Streptococci.

From the obtained results it is apparent that E. coli is more present and affects drinking water more easily as compared with F. Streptococci. Moreover January reveals with the highest percentage of water contamination.

Table 1: The contamination of drinking water with S.Faecal

S.Faecal		No contamination	contamination	Total
Month	January	650	1	651
	February	650	1	651
	March	620	0	620
Total		1920	2	1922

Table 2 The contamination of drinking water with E.Coli

E.Coli		No contamination	contamination	Total
Months	January	612	39	651
	February	615	36	651
	March	610	10	620
Total		1837	85	1922

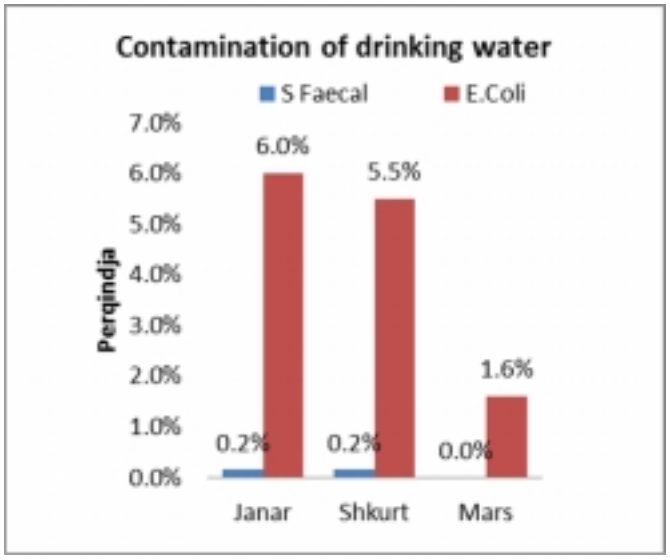

Figure 1. Rates of drinking water contamination in total

The table 3 shows the result revealed about the existence of linkages between the pollution and chlorine levels was analyzed using the SPSS package 17. According to the table we see a strong correlation between pollution levels and the level of chlorine in the control points ($P < 0.001$).

Table 3: The link between pollution levels and the level of chlorine

Year	number of samples	P
2012	1922	< 0.01

Discussions

In the above tables and graphs are presented the results of bacteriological examinations conducted during January, February, March 2012 received in 1922 checkpoints, where it is noted that the drinking water of the city of Tirana is contaminated with E.Coli with 13.1% (in total for the three month) and 0.4% is contaminated with S.Faecal. Similar results are shown in Yamaguchi MU study where the pollution level is 5% (25). According to another study conducted by Kohnen W., 12% of water samples are contaminated network (26). High levels of pollution are shown by Kassenga (27) and Zamberlan da Silva (28) where the level of pollution in the water system is 49.2% and 36.4% respectively.

Conclusion

The quality of drinking water in Tirana supply network is generally good, although there is a risk of contamination by various factors such as the: amortized pipeline corrosion, improper interventions in the water supply, the negative pressure formed over the network outages and water intersections with the network of water used.

Bacteriological quality of water in some checkpoints is not always within the standards allowed for human consumption and of risk for the spread of diseases originating from water by the use of these waters, in some cases.

This is caused by several factors such as:
- Factors associated with the distribution network itself: Network hubs lying about 800 km of pipes, is the weakest point of the system to supply drinking water for. It is not appropriate proportions in many sectors. Internal water supply network in the greater is outdated, therefore damages and losses are numerous. Amortization of lines, putting them under vacuum due to lack of water, creates favorable grounds for contamination of drinking water. Also another phenomenon that implies the quality of drinking water is the use of water tanks by many citizens as sewage and wastewater is quite damaged.
- Factors associated with unplanned urbanization: The city of Tirana has a population of over 800,000 inhabitants. This huge demographic growth is accompanied by uncontrolled urbanization, with unexplored interference in the distribution network, damaging sanitation and drinking water. Network interventions lead to the collapse of water pressure, and non-coping

with water flow to meet customer needs. To think that all these factors bearing the risk of contamination of drinking water, the spread of diseases due to hydro origin.

Recommendations

- Establish and respect for generations of sanitary protection in all sources used to supply the capital city with drinking water.
- Establishment of modern technology in all warehouses chlorination of water, the water supply network, and keeping under control the content of chlorine in the distribution network.
- Reconstruction of water supply network and sewage channels.
- Continuous monitoring of drinking water standards conformity.
- Implementation of supply for each resident during the day with sufficient quantity and of adequate quality drinking water.
- Care and informed population to feel secure about the quality of the water distribution network.
- Public health is closely linked to quality and product safety water. Consumers, everywhere, deserve safe water!

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