EVALUATION OF DRINKING WATER QUALITY THROUGH MICROBIAL INDICATOR IN ELBASAN DISTRICT

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Abstract: Clean and safe water is an absolute need for health and productive life. Source waters, susceptible to surface contamination, particularly surface waters and groundwater and spring sources contain micro-organisms such as bacteria, viruses and protozoan parasites which can present a risk to human health if not effectively treated and disinfected. The quality of the water supplies is important in determining the health of individuals and whole communities. The analysis of drinking water for the presence of indicator microorganisms is the key to determining its microbiological quality. Drinking water supplies in Elbasan village are predominantly sourced from surface waters or groundwater influenced by surface water and soil contamination. Present study aims to assess and compare the ground water quality in Elbasan district, during June-August 2018 and with WHO standards. In order to assess the quality of water, the microbial indicators of drinking water quality have been determined in collective wells (20 sampling points/village). Thus, total coliform, intestinal enterococci bacteria and *Escherichia coli* have been analyses in water samples taken in the wells of villages Labinot Fushë, Gjergjan, Papër, Shushicë and Bradashesh. Testing for bacteria is the only reliable way to know if your water is safe. The coliform pollution level continues to be serious problem in studied villages. Water sources were contaminated with fecal wastes and posed a health risk to consumers of that water. Community-led sanitation and hygiene education and better water source protection are urgently needed. The philosophy underlying disinfection of all water supplies is to use the best quality source of water available and to provide multiple barriers to the transmission of any pathogenic organisms to consumers.
Keywords: Drinking water quality, fecal contamination, microbial indicator.

1. INTRODUCTION

Water is one of the indispensable and vital elements of living life. As a result, there is a close relationship between water quality and health. Many diseases (such as *Salmonella typhimurium*, *Escherichia coli*, *Aeromonas hydrophyla*, *Shigella* spp.) can affect people and can cause important health problems with non-hygienic water (Bakirci G. and Çakmak F., 2017). Protection from fecal contamination is one of the most important and difficult challenges facing environmental scientists, regulators, and communities trying to safeguard public water supplies. Water pollution caused by fecal contamination is a serious problem due to the potential for contracting diseases from pathogens (disease causing organisms). Frequently, concentrations of pathogens from fecal contamination are small, and the number of different possible pathogens is large. As a result, it is not practical to test for pathogens in every water sample collected. Instead, the presence of pathogens is determined with indirect evidence by testing for an "indicator" organism such as coliform bacteria.

Total coliform and *Escherichia coli* are used as indicators to measure the degree of pollution and sanitary quality of well water, because testing for all known pathogens is a complicated and expensive process (WHO, 2011). Total coliform counts give a general indication of the sanitary condition of a water supply. Total coliform include bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste. *E. coli* is generally not found growing and reproducing in the environment. The presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination. It is important to note that *E. coli* and waste can get in our water in many different ways. For example, during rainfall and snow melt, *E. coli* may be washed into creeks, rivers, streams, lakes, or groundwater (Roslev and Bukh, 2011). Other ways consist of natural wildlife, failing septic systems, recreational activities and local land use practices (for example, manure used as fertilizers, livestock, concentrated feeding operations). Human and animal sources of fecal pollution represent a serious health risks

because of the high likelihood of the existence of pathogens also in the fecal waste. A pathogen is a microorganism that can cause disease and make someone sick. Cattle, swine, and chickens also carry pathogens that can be transmitted from animals to humans causing disease. Therefore introduction of any animal or human waste in water is of high concern (Roslev and Bukh, 2011). 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 aim of this study is the evaluation of drinking water quality through microbial indicator; total coliform, *E. coli* and intestinal enterococci bacteria, during June-August 2018. The samples are taken in the wells of villages Labinot Fushë, Gjergjan, Papër, Shushicë and Bradashesh, in Elbasan region in Albania. The data analyzes are compare the study with the standards of drinking water quality according World Health Organization (WHO) 2011 and with the result of Osmani *et al*., (2019).

2. MATERIALS AND METHOD

Sampling stations

The study has been conducted in several villages of the city of Elbasan; Labinot Fushë, Gjergjan, Papër, Shushicë and Bradashesh, during June - August 2018. A total of 100 samples (20 for each village) were collected from the private wells, which are building from the people near their home. These villages are over populated the recent years and are known for the development of agriculture, farming and industry. In Labinot Fushë (7.6 km from Elbasan), Gjergjan (11 km from Elbasan) and Papër (15 km from Elbasan) people work in agriculture, Shushicë (9 km from Elbasan) has the biggest chicken farm and Bradashesh (4 km from Elbasan) has the biggest industry in the country. In 2015 in this villages in order to assess the quality of water, the indicator of drinking water quality have been determined; total coliform, *E. coli* and intestinal enterococci bacteria in the wells and pipes (Osmani *et al*., 2019).

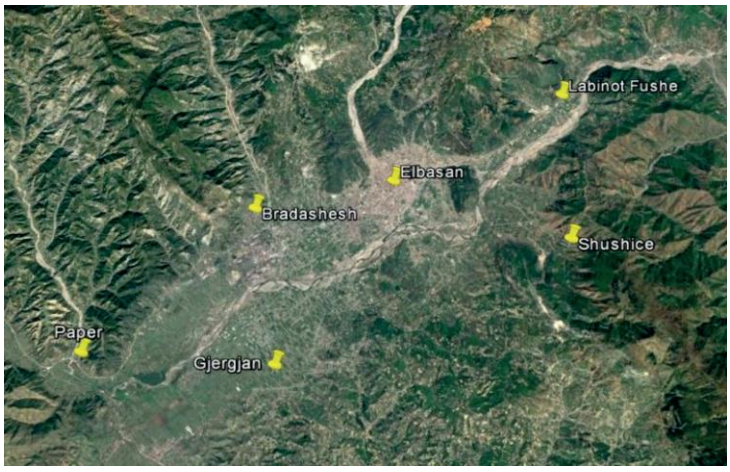

Figure 1: Sample sampling stations

Water Sampling

Water samples for study were taken according to ISO 19458:2006, which provides guidance on planning water sampling regimes, on sampling procedures for microbiological analysis and on transport, handling and storage of samples until analysis begins. It is focuses on sampling for microbiological investigations.

Determination of microbiological indicator

Microbiological analyzes of water samples were determined according to the parameters. For the enumeration of total coliform bacteria and *Escherichia coli* bacteria in water, is used ISO 9308-1:2014. The method is based on membrane filtration, subsequent culture on a chromogenic coliform agar medium, and calculation of the number of target organisms in the sample. The detection and enumeration of intestinal enterococci in water is done with membrane filtration, according to ISO 7899-2: 2000(R2016).

3. RESULTS AND DISCUSSION

A description of the data regarding microbiological indicator for each village is below.

According to the test in Labinot Fushë wells; total coliform, after incubation at 35°C for 18h, varies from 12-228 MPN/100 ml, *E. coli* varies from 1-41 MPN/100 ml and intestinal enterococci, after incubation at 37°C for 48h, varies from 1-59 CFU/100 ml. The microbiological results indicated that the bacteria count at 35°C and 37°C was higher than the required values according WHO (2011) 0 MPN/100 ml for total coliform and 0 CFU/100ml for

intestinal enterococci, and 0 MPN/100 ml also for *E. coli*. Total coliform, *Escherichia coli* and intestinal enterococci were not detected, in 30%, 65% and 60% of water samples, respectively.

Table 1: The microbiological* indicator *in Labinot Fushë wells

Sample	Unit	Total coliform (35°C 18h)	*Escherichia coli*	Unit	Intestinal enterococci (37°C 48h)
W1	MPN/100ml	186	30	CFU/100ml	19
W2	MPN/100ml	1553	4	CFU/100ml	0
W3	MPN/100ml	28	0	CFU/100ml	6
W4	MPN/100ml	365	48	CFU/100ml	37
W5	MPN/100ml	727	0	CFU/100ml	1
W6	MPN/100ml	365	18	CFU/100ml	30
W7	MPN/100ml	15	0	CFU/100ml	0
W8	MPN/100ml	> 2420	12	CFU/100ml	40
W9	MPN/100ml	435	2	CFU/100ml	29
W10	MPN/100ml	102	33	CFU/100ml	48
W11	MPN/100ml	28	7	CFU/100ml	5
W12	MPN/100ml	12	1	CFU/100ml	4
W13	MPN/100ml	17	0	CFU/100ml	7
W14	MPN/100ml	31	0	CFU/100ml	6
W15	MPN/100ml	10	0	CFU/100ml	0
W16	MPN/100ml	> 2420	92	CFU/100ml	75
W17	MPN/100ml	34	0	CFU/100ml	60
W18	MPN/100ml	> 2420	97	CFU/100ml	>500
W19	MPN/100ml	1986	5	CFU/100ml	116
W20	MPN/100ml	165	0	CFU/100ml	200

In Gjergjan wells according to the test; total coliform, after incubation at 35°C for 18h, varies from 12 to over 2420 MPN/100 ml, *E. coli* varies from 1-97 MPN/100 ml and intestinal enterococci, after incubation at 37°C for 48h, varies from 1 to over 500 CFU/100 ml. The microbiological results indicated that the bacteria count at 35°C and 37°C was higher than the required values according WHO (2011) 0 MPN/100 ml for total coliform and 0 CFU/100ml for intestinal enterococci, also for *E. coli,* 0 MPN/100 ml. Total coliform, *Escherichia coli* and intestinal enterococci were not detected, in 0%, 40% and 15% of water samples, respectively.

Table 2: The microbiological* indicator *in Gjergjan wells

Sample	Unit	Total coliform (35°C 18h)	*Escherichia coli*	Unit	Intestinal enterococci (37°C 48h)
W1	MPN/100ml	186	30	CFU/100ml	19
W2	MPN/100ml	1553	4	CFU/100ml	0
W3	MPN/100ml	28	0	CFU/100ml	6
W4	MPN/100ml	365	48	CFU/100ml	37
W5	MPN/100ml	727	0	CFU/100ml	1
W6	MPN/100ml	365	18	CFU/100ml	30
W7	MPN/100ml	15	0	CFU/100ml	0
W8	MPN/100ml	> 2420	12	CFU/100ml	40
W9	MPN/100ml	435	2	CFU/100ml	29
W10	MPN/100ml	102	33	CFU/100ml	48
W11	MPN/100ml	28	7	CFU/100ml	5
W12	MPN/100ml	12	1	CFU/100ml	4
W13	MPN/100ml	17	0	CFU/100ml	7
W14	MPN/100ml	31	0	CFU/100ml	6
W15	MPN/100ml	10	0	CFU/100ml	0
W16	MPN/100ml	> 2420	92	CFU/100ml	75

W17	MPN/100ml	34	0	CFU/100ml	60
W18	MPN/100ml	> 2420	97	CFU/100ml	>500
W19	MPN/100ml	1986	5	CFU/100ml	116
W20	MPN/100ml	165	0	CFU/100ml	200

According to the test in Shushicë wells; total coliform, after incubation at 35°C for 18h, varies from 1-1200 MPN/100 ml, *E. coli* varies from 2-46 MPN/100 ml and intestinal enterococci, after incubation at 37°C for 48h, varies from 1 - 165 CFU/100 ml. The microbiological results indicated that the bacteria count at 35°C and 37°C was higher than the required values according WHO (2011) 0 MPN/100 ml for total coliform and 0 CFU/100ml for intestinal enterococci, also for *E. coli*, 0 MPN/100 ml. Total coliform, *Escherichia coli* and intestinal enterococci were not detected, in 0%, 35% and 25% of water samples, respectively.

Table 3: The microbiological* indicator *in Shushicë wells

Sample	Unit	Total coliform (35°C 18h)	*Escherichia coli*	Unit	Intestinal enterococci (37°C 48h)
W1	MPN/100ml	1	0	CFU/100ml	0
W2	MPN/100ml	3	0	CFU/100ml	0
W3	MPN/100ml	22	6	CFU/100ml	3
W4	MPN/100ml	12	2	CFU/100ml	2
W5	MPN/100ml	11	4	CFU/100ml	4
W6	MPN/100ml	9	2	CFU/100ml	7
W7	MPN/100ml	0	0	CFU/100ml	0
W8	MPN/100ml	5	0	CFU/100ml	0
W9	MPN/100ml	17	0	CFU/100ml	0
W10	MPN/100ml	14	0	CFU/100ml	3
W11	MPN/100ml	5	3	CFU/100ml	1
W12	MPN/100ml	93	38	CFU/100ml	19
W13	MPN/100ml	1	0	CFU/100ml	4
W14	MPN/100ml	410	46	CFU/100ml	165
W15	MPN/100ml	613	5	CFU/100ml	29
W16	MPN/100ml	40	12	CFU/100ml	16
W17	MPN/100ml	19	12	CFU/100ml	7
W18	MPN/100ml	18	3	CFU/100ml	8
W19	MPN/100ml	1200	15	CFU/100ml	6
W20	MPN/100ml	387	5	CFU/100ml	2

In Papër wells according to the test; total coliform, after incubation at 35°C for 18h, varies from <1 to over 2420 MPN/100 ml, *E. coli* varies from 1-97 MPN/100 ml and intestinal enterococci, after incubation at 37°C for 48h, varies from 1 to over 500 CFU/100 ml. The microbiological results indicated that the bacteria count at 35°C and 37°C was higher than the required values according WHO (2011) 0 MPN/100 ml for total coliform and 0 CFU/100ml for intestinal enterococci, and also for *E. coli*, 0 MPN/100 ml. Total coliform, *Escherichia coli* and intestinal enterococci were not detected, in 0%, 50% and 20% of water samples, respectively.

Table 4: The microbiological* indicator *in Papër wells

Sample	Unit	Total coliform (35°C 18h)	*Escherichia coli*	Unit	Intestinal enterococci (37°C 48h)
W1	MPN/100ml	44	3	CFU/100ml	6
W2	MPN/100ml	84	21	CFU/100ml	36
W3	MPN/100ml	42	1	CFU/100ml	6
W4	MPN/100ml	5	0	CFU/100ml	1
W5	MPN/100ml	46	4	CFU/100ml	0
W6	MPN/100ml	<1	0	CFU/100ml	0
W7	MPN/100ml	>2420	97	CFU/100ml	>500
W8	MPN/100ml	24	0	CFU/100ml	3

W9	MPN/100ml	8	0	CFU/100ml	1
W10	MPN/100ml	345	47	CFU/100ml	63
W11	MPN/100ml	<1	0	CFU/100ml	0
W12	MPN/100ml	2,0	0	CFU/100ml	1
W13	MPN/100ml	<1	0	CFU/100ml	0
W14	MPN/100ml	>2420	9	CFU/100ml	40
W15	MPN/100ml	66	11	CFU/100ml	3
W16	MPN/100ml	727	45	CFU/100ml	145
W17	MPN/100ml	248	3	CFU/100ml	67
W18	MPN/100ml	166	0	CFU/100ml	2
W19	MPN/100ml	79	0	CFU/100ml	9
W20	MPN/100ml	111	0	CFU/100ml	14

According to the test in Bradashesh wells, total coliform, at 35°C for 18h, varies from <1 to over 2420 MPN/100 ml, *E. coli* varies from 1-49 MPN/100 ml and intestinal enterococci, at 35°C for 48h, varies from 1to over 500 CFU/100 ml. The microbiological results indicated that the bacteria count at 35°C and 37°C was higher than the required values according WHO (2011) 0 MPN/100 ml for total coliform and *E. coli*, and 0 CFU/100ml for intestinal enterococci, and also for *E. coli*, 0 MPN/100 ml. Total coliform, *Escherichia coli* and intestinal enterococci were not detected, respectively in 0%, 55% and 25% of water samples.

Table 5: The microbiological* indicator *in Bradashesh wells

Sample	**Unit**	**Total coliform (35°C 18h)**	***Escherichia coli***	**Unit**	**Intestinal enterococci (37°C 48h)**
W1	MPN/100ml	<1	0	CFU/100ml	0
W2	MPN/100ml	10	0	CFU/100ml	0
W3	MPN/100ml	166	0	CFU/100ml	1
W4	MPN/100ml	2420	17	CFU/100ml	61
W5	MPN/100ml	517	49	CFU/100ml	16
W6	MPN/100ml	770	0	CFU/100ml	4
W7	MPN/100ml	>2420	25	CFU/100ml	270
W8	MPN/100ml	2420	0	CFU/100ml	>500
W9	MPN/100ml	411	0	CFU/100ml	9
W10	MPN/100ml	162	1	CFU/100ml	10
W11	MPN/100ml	5	0	CFU/100ml	4
W12	MPN/100ml	<1	0	CFU/100ml	0
W13	MPN/100ml	770	26	CFU/100ml	8
W14	MPN/100ml	517	2	CFU/100ml	3
W15	MPN/100ml	1	0	CFU/100ml	3
W16	MPN/100ml	2	0	CFU/100ml	0
W17	MPN/100ml	291	0	CFU/100ml	0
W18	MPN/100ml	225	10	CFU/100ml	13
W19	MPN/100ml	4	3	CFU/100ml	2
W20	MPN/100ml	1733	14	CFU/100ml	51

The higher percentage of total coliform are found in Gjergjan, Papër, Shushicë and Bradashesh samples (100% contaminated) and 70% in Labinot Fushë samples; *Escherichia coli* is in Shushicë (65%) > Gjergjan (60 %) > Papër (50%)> Bradashesh (45%) > Labinot Fushë (35%) samples; intestinal enterococci is in Gjergjan (85%) > Papër (80 %) > Shushicë and Bradashesh (75% both) > Labinot Fushë samples (40 %).

Analysis for fecal indicator organisms provides a sensitive, although not the most rapid, indication of pollution of drinking-water supplies. Because the growth medium and the conditions of incubation, as well as the nature and age of the water sample, can influence the species isolated and the count, microbiological examinations may have variable accuracy. Although not very harmful, the presence of fecal contamination in the water indicates natural pathways or direct contamination of the water with feces (WHO, 2011).

By comparing the result with Osmani *et al*., (2019) it seems that the well water in these villages continues to be an issue problem. This pollution comes from over-utilization of livestock compost, fertilizers, pesticides etc., to increase the soil fertility. Inappropriate ways of irrigation and rainfall have affected the penetration of coliforms in the soil depths and underground water. Also, the cause of wells contaminated with microbiological is the absence of sanitary sewer.

4. CONCLUSION

Well water in these villages of Elbasan area continues to be an issue problem. Consequently, routine analysis and controls of this well water should be continuously monitored and the factors causing this contamination should be determined and necessary precautions should be taken. In addition, all hygiene controls must also be thoroughly performed in terms of public health. 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. Also, disproportionate use of livestock, fertilizers, pesticides etc., should be avoided.

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