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## Health, Safety and Environment

Journal homepage: <http://sjournals.net/ojs>

### Original article

## Health safety of drinking water in the Dragash zone

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### ARTICLE INFO

#### Article history:

Received 26 May 2013

Accepted 16 June 2013

Available online 28 June 2013

#### Keywords:

Rural regions

Drinking water

Health security

Analysis

Samples

### ABSTRACT

The spread of water-related diseases are very common. Hydric epidemics are fast and explosive, so tendency for healthy drinking water should be constant. In the territory of Dragash live around 33997 inhabitants which are distributed in 35 villages. Characterized by average altitude over 1050 m and is rich in water resources throughout the seasons, but significant decrease during the summer months. In separate villages, there are 65 basins that make the accumulation and distribution of drinking water. None of them is treated before it enters the water distribution nets, except in the town of Dragash, whose basin is managed by the company of "Hidroregjioni Jugor". Evaluation of the quality of drinking water in the rural district of Dragash and security in terms of health for research physicochemical and microbiological parameters. The study was done using prospective epidemiological and analytical method. Water sampling from basins was conducted during 21 days. Samples were analyzed for physic-chemical parameters, and for microbiological analysis was used membrane filter method. Total of 130 samples were taken for analysis. 65 samples were analyzed for the physic-chemical level, and 65 other samples are analyzed in the microbiology field. Physico-chemical analysis indicated that 13

samples were above the maximum tolerated level and 52 within a maximum tolerated levels; increased levels of Iron and Manganese was encountered in 8 samples, while potassium permanganate in one sample. Microbiological analysis has provided 14 samples with bacterial presence or substandard and 51 within the standards. Important presence of pathogenic bacteria was found in rural basins of Bellobrad, Kosavë, Leshtane and Kukuljane. Residents from the territory of Dragash consume safe water in over 85% of cases, in a health plan. The presence of pathogenic bacteria and fecal origin in the village Bellobrad speaks for contamination by wastewater infiltration. Deviation from the standard settings is controllable, and therefore we need urgent measures by the competent authorities in terms of investment in the construction and reconstruction of water accumulator standards that provide drinking water healthy and safe.

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## 1. Introduction

Water is the most important element for our body. Water is everywhere as part of the biological processes that take place in our body at the cellular level and as such is necessary for consumption and hygiene. Water should satisfy human needs not only on the quantity but also the quality of healthcare.

Water supply is an important process residents but also costly. Many diseases transmitted through water. According to WHO (WHO, 2004) waterborne diseases by drinking about 5 million children die annually and ill sixth of the world population (Shittu O.B., et al. 2008). The high volatility of hydro diseases requires significant commitment to the consumption of safe drinking water safe in terms of health. The only safe water is the water that does not contain microorganisms or chemicals above the permitted levels. WHO and other institutions (EU, FAO EPA) to deal with this issue require drinking water to meet certain standards, where its constituent components behave within levels that do not cause damage to the body (WHO, 2004; EU Council. 1998).

Dragash lands located in the south of Kosovo and includes an area of 543 km<sup>2</sup>, where live 33 997 inhabitants, distributed in 35 villages (Census in Kosovo. 20112). This territory lies at an average altitude of 1050 m and is mostly mountainous views, rich with multiple sources of water (Dragash, 2012). All the villages in this area have built water reservoir, which accumulates in drinking water before it enters the distribution networks to family fountains. Someone has even catchments villages in the neighborhood level. Drinking water accumulated from natural sources, leakage of small rivers and catchments.

Drinking water supply in local networks with distributed free fall and only in one case or two pumps water pumps used. Klorinohej drinking water in the town of Dragash only, while all other systems introduced in the distribution network without any pretreatment.

In terms of water collection, storage and distribution process towards household fountains performed without any special supervision and professional. This situation assumes the risk to drinking water and its quality.

The aim of the study is to assess the quality of drinking water in rural area, having Dragash and his safety health aspect, exploring and microbiological parameters fizikokimik it.

## 2. Materials and methods

Research on water quality is made by prospective epidemiological and analytical method. Is performed within months from May to June '12. The sampling plan was designed to expand the analysis of drinking water in all residences, respectively from two samples for each watershed. Sampling was conducted for 21 days, taking an average of 3.1 samples per day. Three teams are engaged in sampling. Samples were transferred within 4 to 6 hours, depending on the terrain, to laboratories for microbiological and physicochemical analysis. To facilitate research, the region of Dragash have divided into five areas; Opoja, Brezne, Dragas, Brod and Restelicë. In this way

including villages that lie mainly in these areas and have closer communication. Sampling was carried out according to the WHO manual on plastic bottles prepared in advance.

### 2.1. Physicochemical analysis

Physicochemical analysis included the determination of temperature, wind, taste, turbidity, color, pH, kaliumpermanganat, chlorine free (DPD1/DPD4), chloride, ammonia (ammonium ion), nitrates, nitrites, iron, manganese, conductance, dissolved oxygen and aluminum. For analysis of samples are used HANNA Instruments devices, NOVA 60 photometer and methods entitlement to KMnO<sub>4</sub>

### 2.2. Microbiological analysis

Microbiological analysis of samples was carried out by a membrane filter method and in two stages, and we compared our findings with the WHO and EU standards.

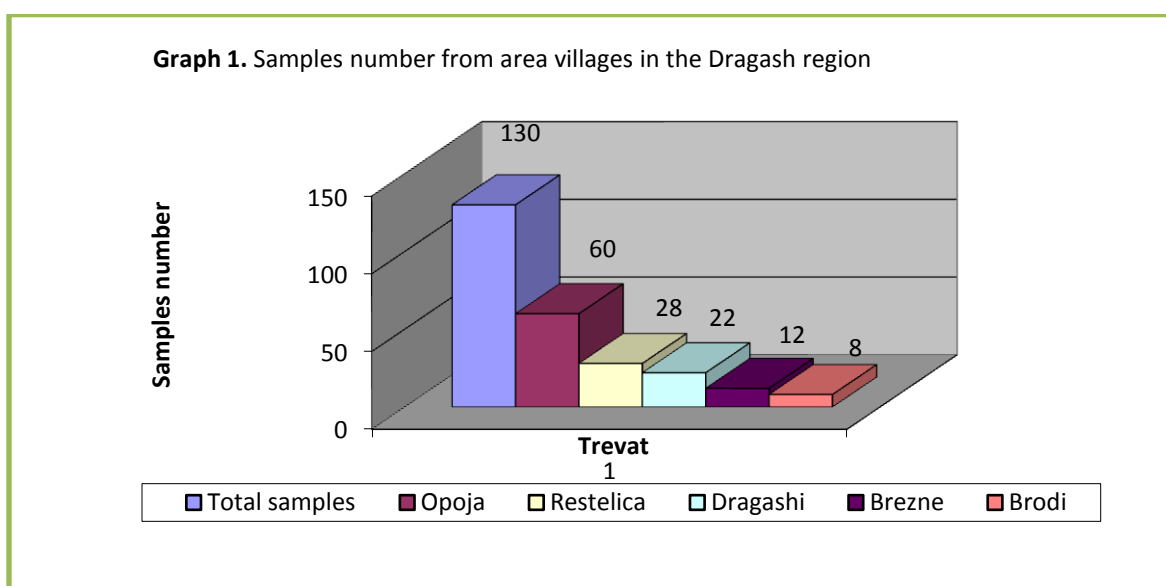
## 3. Results

130 samples were taken in 65 water tanks in all villages trevës Dragash. In each tank was taken from two water samples, one for microbiological analysis and the other for physicochemical analysis (Table 1):

**Table 1**  
Microbiological analysis and the other for physicochemical analysis.

Nr.	Area	Physicochemic samples		Microbiology samples		Total samples	
		N	%	N	%		%
1	Opoja	30	23.07	30	23.07	60	46.15
2	Brezne	6	4.61	6	4.61	12	9.23
3	Dragash	11	8.46	11	8.46	22	16.92
4	Brod	4	3.08	4	3.08	8	6.15
5	Restelica	14	10.78	14	10.78	28	21.55
Total		65	50.00	65	50.00	130	100.00

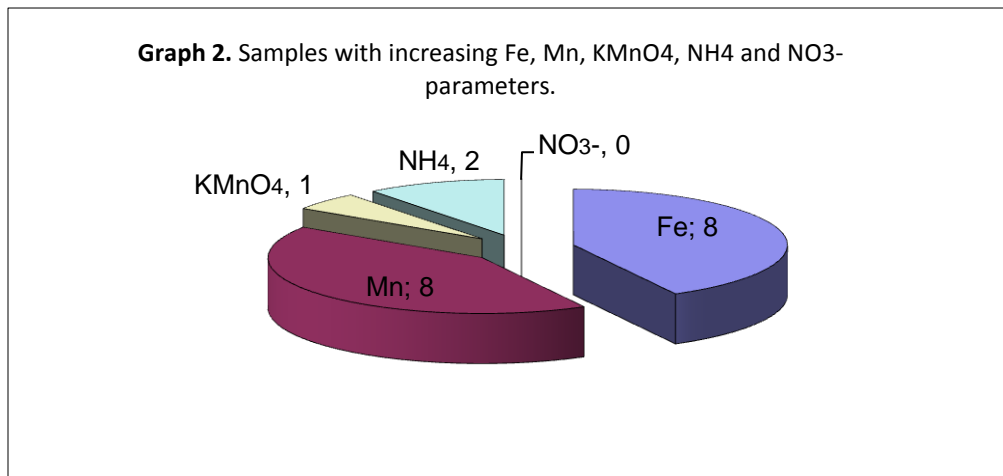
Most of the samples taken in the area of Opoja (46.15%) where the majority lies the village of Dragash, then the area of Restelica (21:55%) and the town of the Dragash (16.92%) (Graph 1):



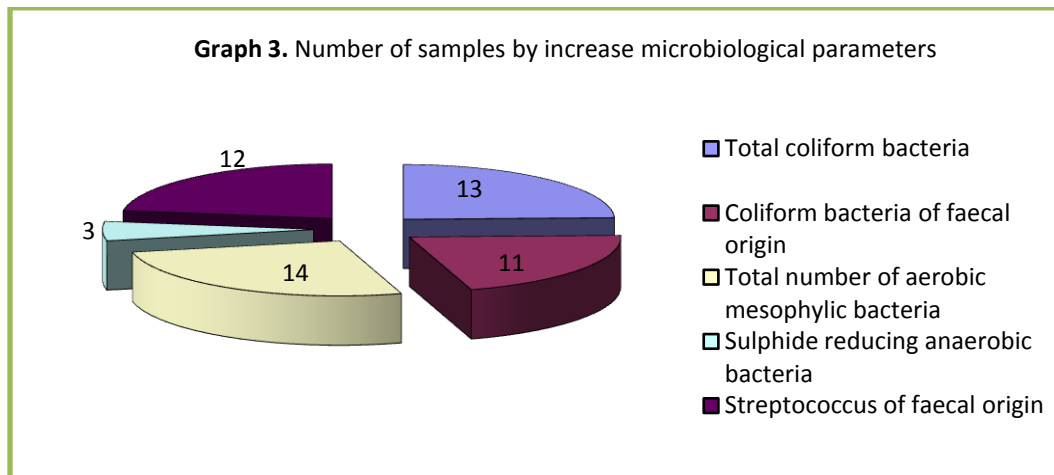
From a total of 130 samples, 65 (50%) were obtained for physicochemical analysis. All physical parameters of water resulting researched within acceptable parameters; bring average temperature is 8-12°C levels, average turbidity at 0.16, smell, taste and color acceptable.

Chemical parameters in 52 of the samples (80%) resulted in maximum acceptable values allowed by local standards. Meanwhile, from 13 samples (20%) outside of acceptable values, nine (9) samples were encountered in the region of Opoja (village Bellobrad/24-35) and by a village Orçushë/22, Restelicë/21, Krushevë/40 and Zlipotok / 47. (Table 2):

According to Table 2, NH<sub>4</sub> and NO<sub>3</sub><sup>-</sup> range a permissible level and NO<sub>2</sub><sup>-</sup> is zero, therefore, we can say that there is a potential source of fecal pollution in the vicinity of water reservoirs. From Table 2, were derived the graph 2, note that the Fe + in 8 samples is easy on or above the maximum permitted dose, as well as Mn + [E.U.S. (98)]. Manganese also except 8 samples were found on the maximum dose, allowed in 13 other samples is at the limit of 0.05 mg / l. KMnO<sub>4</sub> resulted only in an adult sample, while the other is a sample of the upper limit (graph 2):



For microbiological analysis were taken of 65 samples. Of these, 51 samples or 78.5% resulted in the boundaries of acceptable standards; while 14 samples or 21.5%, were identified microbial findings (graph 3):



**Table 2**

Chemical samples without of MAL\*.

Parameters & Units	WHO st.'93	EU St. ('98)	RKS Stan.	Samples without acceptable levels, marked with numbers												
				1/21	2/22	3/24	4/25	5/27	6/28	7/29	8/30	9/31	10 /34	11 /35	12 /40	13/47
Iron (Fe <sup>+</sup> ) mg/l	0.3*	0.2	0.3	0.20	0.14	0.05	0.12	0.10	0.07	0.06	0.10	0.16	0.10	0.20	0.20	0.02
Manganese (Mn <sup>+</sup> ) mg/l	0.5, 0.4 (C)	0.05	0.05	0.03	0.05	0.06	0.04	0.07	0.09	0.08	0.10	0.08	0.11	0.05	0.03	0.14
Kaliumper manganat (KMnO <sub>4</sub> )	n/a	n/a	12	3.79	6.0	6.95	12.6	10.1	5.37	6.0	6.6	3.16	9.79	4.42	3.79	2.21
Ammonia (NH <sub>4</sub> ) mg/l	0.5 (D)	0.5	0.1	0.04	0.05	0.1	0.08	0.07	0.06	0.09	0.1	0.01	0.05	0.06	0.04	0.05
Nitrates (NO <sub>3</sub> <sup>-</sup> ) mg/l	50	50	10	0.5	0.1	0.8	0.9	0.2	0.5	0.3	0.6	0.5	0.3	0.4	0.5	0.5
Nitrites (NO <sub>2</sub> <sup>-</sup> ) mg/l	0.005-0.01	0.5	0.005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MAL\*- Maximal Acceptable Level; \*Desirable, C= The concentration of substances in value or below the health-based guidance may affect the taste, odor or appearance of water, leading to customer complaints; P= Interim guidance value, identified as harmful, but the information available to health effects is limited.

**Table 3**

Results of microbiological samples with microbial findings and their comparison.

Parameters	WHO st.'93	DWD 98/83/	Local Stand.	Samples without standards identified by numbers														
				14	24	26	27	28	29	30	33	34	37	38	52	53	54	
Total coliform in 100ml	0	0	10 or 5	10	50	50	20	10	150	50	10	50	0	20	50	50	50	
Coliform bacteria of faecal origine 100 ml	0	0	0	0	10	10	10	10	10	10	10	10	0	0	10	10	10	
Total number of aerobic mesophylic bacteria in 1 ml in 37 <sup>0</sup> C	100	0	100	30	100	100	100	10	150	100	100	10	200	200	100	10	100	
Sulphide reducing anaerobic bacteria in 100 ml	1	0	1	0	0	0	0	0	0	2	0	0	5	5	0	0	0	
Streptococcus of faecal origine in 100 ml	0	0	0	10	30	30	25	5	15	4	15	50	0	0	20	50	20	

From Graph 3 and Table 3 shows that from 14 positive samples in terms of bacterial, 13 (20.00%) of them have resulted in two or more types of bacteria. For example in 13 samples or 20% of their total coliform bacteria, in 11 samples or 16.90% Coliform bacteria of fecal origin, in 14% samples or number 21,50 % the total number of aerobic mesophylic bacteria, the sulfide reducing anaerobic bacteria in three samples or 4.60% and 18,50% or 12 samples Streptococcus of fecal origin.

In the table 3 we compare our results with WHO standards and Drinking Water Directive 98/83 of the European Union for closed source, what has been the object of our research (table 3):

By comparing the data presented in table 2 and 3, we see that six water samples (24,27,28,29,30 and 34) result in irregularities physicchemic and microbiology at the same time. All these samples were from the village Bellobrad (Opoja), where water accumulates in a reservoir and then distributed in 11 other reservoirs for each neighborhood. From the same village reservoirs are samples 26 and 33. Samples 52, 53 and 54 are from the village reservoirs Kosavë (Opoja). For a sample with standard parameters are set out in villages Brrut (Opoja), Leshtanë (Dragash) and Kukuljane (Restelicë). Three microbiological samples (52,53,54) of 4 results obtained in the village Kosavë (Opoja) resulted only in off-standard microbiological parameters.

#### **4. Discussion**

Periodic inspection and testing of drinking water supplied to the community is a permanent imperative and should be an obligatory supervisory agency in the country. It should assess the risks from microbial and chemical contamination potential.

Physico-Chemical indicators and microbiological quality of drinking water provide a good basis for commitment towards the community supply of drinking water and public health protection.

Our research findings indicate good quality of drinking water as a natural resource that exists in the region of Dragash. In the quantitative, appears to be sufficiently available to residents, their hygiene and other activities of daily living. In terms of the quality and safety of health aspect also satisfactory and meets local standards of the WHO (WHO, 2004) and the EU (EU DWD 1998).

Physical parameters of water in the region of Dragash explored such as temperature, smell, taste, color and turbidity brought within acceptable local standards but also compared with those of the WHO (WHO, 2004) and the EU (EU DWD 1998).

Chemical parameters indicators of human and animal pollution (Ammonia, Nitrates, Nitrites) also brought within standards tendency towards the upper limits, respectively, in the upper limits of the permissible dose, and levels comparable with WHO and EU standards.

In total, 80% of the samples analyzed in chemical terms are delivering results within the standards, providing safety and quality of drinking water for community use. 20% of the samples are recorded values exceeded the maximum allowed as follows: Iron, Manganese and Kaliumpermanganati. Since Mn in 13 samples brought to the high limit of DFM (12:05), while in 8 samples is above this limit, consider that it comes from the composition of the soil, while overcoming kaliumpermanganatit values associated with bacterial contamination of water.

Other parameters such as pH, Conductivity, Oxygen and Aluminium are within acceptable standards.

Microbiological research has given negative results in 78.5% of samples, which means that this measure, using community drinking water in rural areas of Dragash quality is acceptable and safe. 21.5% of the samples resulted in substandard or bacterial presence drinking water making it useless and dangerous to the health of residents.

#### **5. Conclusion**

Physicochemic and microbiological quality of drinking water in rural areas of Dragash is largely good and acceptable.

Only 20% of the samples resulted in exceeding the maximum permissible value of chemical parameters and 21.5% resulted in bacterial contamination.

Such a situation of water makes it chemically within acceptable standards and physically fresh and pleasant and microbially safe. This increases safety for community health consumers of this water for their absolute majority (about 80-85%), while the other requires the intervention of the competent authorities to remedy the situation.

Surveillance of drinking water quality in rural areas of Dragash not properly done or periodically.

All these waters are nonchlorination.

Preventing the introduction of sewage into the water body in the village captures Bellobrad priority should be competent municipal bodies, in order to prevent bacterial contamination of drinking water.

The perimeter security fencing at all pools will also prevent contamination of Kosava village and two other villages, as it would increase the overall safety of drinking water.

Some accumulation basins require rapid action towards building or rebuilding their standards in order to increase the safety of drinking water quality.

Chlorinating of all reservoirs is an immediate need.

During the summer months come to reduce the amount of water must therefore invest in the accumulation of this vital resource for Dragash 34 thousand inhabitants, creating sufficient reserves for all.

Dragash, as the institution responsible for the drinking water supply for the citizens, must have an agreement with the National Institute of Public Health for supervision, at least periodically, the quality of drinking water in its territory.

### Acknowledgements

I want to thank the fieldwork teams; Dr. Razije Lipoveci, Elvira, Nexhmia, Badema, Muhamed and Bediha, for correct and professional sampling, as well as laboratory Microbiology and Chemistry at the NIPH in Prizren. Thank you. No one of us had any material interest or benefit, except contribution to public health of residents of Dragash.

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