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Issue Article

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HYDROCHEMICAL AND SANITARY-MICROBIOLOGICAL INVESTIGATION OF THE SPRING WATERS OF DIMI AND NERGEETI IN IN THE BAGHDATI MUNICIPALITY TO DETERMINE DRINKING WATER SUITABILITY

Abstract: *for the first time, the spring waters of the villages of Dimi and Nergeeti in Baghdati Municipality were analyzed to determine the concentrations of sodium, magnesium, calcium, bicarbonate, sulfate, and chloride ions, as*

well as carbon dioxide, dissolved oxygen, biochemical oxygen demand, permanganate oxidation, dry residue, biogenic element content, and microbiological indicators. Highly sensitive methods were selected for the analysis.Based on the experimental data, it was established that the investigated spring waters are low-mineralized, resulting in a nearly neutral pH. The concentrations of the aforementioned ions in the analyzed waters are within the acceptable limits. The sanitary-microbiological studies were conducted on mesophilic aerobes and facultative anaerobes following MUK 2.1.4 1184-03, total coliform bacteria using MUK 4.2.1018-01, and Escherichia coli according to 18963-73 standards.Based on the analytical results of 11 investigated springs, it was determined that only 4 springs (Upper Dimi, Gotsiridze, Garuchava, and Fulariani) comply with the drinking water standards of Georgia. However, in 7 of the springs (Robakidze, St. George, Ukleba, Dato, and Kaka), excessive levels of mesophilic aerobes and facultative anaerobes were detected. Additionally, in two springs (Nergeeti and Gogelidze), total coliform bacteria were found, rendering these water sources unsuitable for drinking.

***Key words**: spring, pH, highly sensitive method, ion, sanitary, microbiological, bacteria, drinking water, mesophilic, facultative, coliform.*

***Language**: English*

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Introduction

The objective of this study was to investigate the hydrochemical composition and sanitary-microbiological indicators of certain spring waters in the villages of Dimi and Nergeeti, Baghdati Municipality, with a focus on magnesium, calcium, bicarbonate, and chloride ions, considering their biological aspects in relation to human, animal, and plant life processes. The relevance of the issue lies in the fact that, for the first time, the concentrations of spring water ions such as magnesium, calcium, bicarbonate, sulfate, and chloride, as well as carbon dioxide, dissolved oxygen, biochemical oxygen demand (BOD_5), permanganate oxidation, and dry residue, were determined. For this purpose, highly sensitive methods were selected. There are over 2,000 springs in Georgia, which are distinguished by a great variety. Georgia is a country rich in water resources, but despite this, not everyone has access to quality drinking water[1]. The situation is particularly alarming in rural areas, where people consume untreated water for extended periods. Spring water should be clear and beneficial. The consumption of contaminated spring water is dangerous to human health. Naturally, the problem of water pollution also worsens Georgia's economic situation. If we look at the country's economic indicators over the past few years, we can conclude that there is a direct proportional relationship between the increase in water pollution levels and the deterioration of the country's economic situation. The main reason for this is that the economic condition of any country is directly linked to its ecological status. Water is one of the most important and irreplaceable resources on our planet and an invaluable treasure. Water is widely and diversely used. Water is the source of life, and it is the building material used by all organisms. Water brings necessary substances into the organism and removes everything unnecessary. Water is a universal solvent[2]. Chemically pure water does not exist in nature. As water moves through the Earth's crust, it comes into contact with various minerals, dissolves them, and carries them throughout its circulation. Natural water is a solution that contains substances of different types and states[3].

Magnesium and calcium salts determine the permanent and temporary hardness of water. Magnesium and calcium ions are the leading ions in low-mineralized waters. An increase in mineralization leads to a decrease in calcium content, which is caused by the low solubility of $CaCO_3$. However, in chloride waters, the amount of magnesium and calcium increases, as they are highly soluble in water, unlike calcium carbonate and sulfate . In freshwaters, the content of magnesium, calcium, and iron depends on the soil type, the season of the year, and the time of day. One of the main tasks when studying water composition is to determine the ion content. The analysis is based on the specific properties of each ion and investigates their concentration. (Some ions are strong toxins, and due to their presence, water may become unsuitable for drinking. An ion may not be toxic but can worsen the water's physical and organoleptic properties)[3]. The presence of suspended substances in water prevents its use for drinking and household purposes. The chemical composition of water is also significantly influenced by microorganisms that use substances present in the water, primarily organic materials, as food and transform them into mineral substances. Therefore, the sanitary-microbiological study of spring waters is of interest, as fecally contaminated groundwater, which is used by humans for various purposes, can lead to intestinal infections, urinary tract and reproductive organ damage, bacteremia, poisoning, and other diseases [4].

Particularly interesting is the study of microorganisms in water that are pathogenic to

humans, animals, and plants. Some of these microorganisms can survive for several months and spread over long distances through the flow of water. The main source of pathogenic microorganisms in water is the fecal matter of animals and humans, from which the water sources become reservoirs for pathogens of diseases such as dysentery, cholera, typhoid fever, Siberian ulcer, and other infectious diseases [5,6].

Experiment.

Thus, for the first time, the spring waters of Dimi and Nergeeti in Baghdati Municipality were analyzed to determine the concentrations of spring water ions—magnesium, calcium, bicarbonate, sulfate, and chloride, as well as carbon dioxide, dissolved oxygen, biochemical oxygen demand (BOD), permanganate oxidation, and dry residue—using chemical methods. The biogenic element content was determined using photometric methods. The results of the analysis are presented in Table #1.

Table N 1. Hydrochemical Study of Spring Waters in the Villages of Dimi and Nergeeti, Baghdati Municipality

N	Regional Names of Spring Waters	*pH*	Mg/L									
			Ca^{2+}	Mg^{2+}	SO_4^{2-}	HCO_3^-	Cl^-	Dissolved Oxygen,	JBM_5	Permanganate Oxidation	CO_2	Dry Residue
1	Upper Dimi	8,12	1,66	2,57	2,88	2,80	1,08	4,69	2,79	0,24	1.16	2.02
2	Gotsiridze	7,72	1,65	1,38	6,72	3,24	0,98	5,06	2,66	0,16	1,04	1,40
3	Garuchava	7,63	1,67	0,58	5,76	3,22	0,77	3,39	2,51	1,04	1,05	1,66
4	Pulariani	7,61	1,44	0,85	6,73	3,50	1,12	3,58	2,56	0,96	1,44	1,62
5	Robakidze	7,34	0,94	0,41	5,75	2,62	0,68	3,14	2,54	1,03	1,28	1,34
6	St.Giorgi	7,56	1,98	0,61	10,56	2,84	0,74	3,32	2,55	1,36	1,17	1,39
7	Nergeeti	7,62	0,85	0,01	8,64	2,51	0,61	2,68	2,06	2,93	1,12	2,07
8	Gogoladze	7,38	4,41	0,75	5,76	5,66	0,86	3,20	2,66	1,42	1,46	2.12
9	Ukleba	7,26	1,05	0,85	3,84	2,92	0,68	3,78	2,73	1,23	0,78	1,35
10	Dato	7,82	1,88	0,37	3,86	3,77	0,94	3,97	2,84	1,14	1,04	1,56
11	Kaka	7,35	5,96	0,69	4,82	7,76	1,06	3,52	2,64	2,22	1,94	1.89

As can be seen from Table N 1, in the studied spring waters of the villages of Zeda Dimi and Nergeeti of Baghdatia Municipality: water, magnesium, calcium, hydrocarbonate, sulfate and chloride ions, carbon dioxide, dissolved oxygen, biochemical oxygen consumption, permanganate oxidation and dry residue content are within the norm. The content of biogenic elements is less than the detection limit and their content is not recorded in the studied spring waters of the villages of Dimi and Nergeeti of Baghdati Municipality.

Microbiological indicators were determined in the waters of the village of Dimi and Nergeeti springs in Baghdati Municipality. The results of the analysis are given in Table #2.

Table 2. Results of the analysis of microbiological indicators of the waters of the village of Dimi and Nergeeti springs in Baghdati Municipality.

№	Regional Names of Spring Waters	Microbiological Indicators			
		Mesophilic aerobes	Facultative anaerobes	Total coliforms	E. coli
		Unit of measurement			
		Colony forming units per ml		300ml	300ml
		37˚C	22˚C		
		Normative			
		20	100	Not allowed	Not allowed
1	Upper Dimi	**12**	**58**	-	-
2	Gotsiridze	**10**	**62**	-	-
3	Garuchava	**8**	**45**	-	-
4	Pulariani	**15**	**85**	-	-
5	Robakidze	**65**	**130**	-	-
6	St.Giorgi	**70**	**172**	-	-
7	Nergeeti	**130**	**242**	**Detected**	-
8	Gogoladze	**143**	**265**	**Detected**	-
9	Ukleba	**45**	**120**	-	-
10	Dato	**32**	**115**	-	-
11	Kaka	**52**	**138**	-	-

According to the analytical results of the 11 studied springs, it became clear that only 4 of the eleven springs (Zeda Dimi, Gotsiridzebi, Garuchava, Fullariani) comply with the norms required by the Georgian drinking water standard. The results obtained show that the investigated springs are not contaminated with domestic wastewater and sewage. No pathogenic microorganisms were found. In the water of the following seven springs (Robakidze, St. George, Ukleba, Dato, Kaka), an excessive number of mesophilic aerobes and facultative anaerobes was observed, as well as in the water of two springs (Nergeeti, Gogelidzebi) total coliform bacteria were observed, which made it clear that the waters of the mentioned springs are unsuitable for drinking.

The analyses were conducted at the Kutaisi Akaki Tsereteli State University, Prof. I. Moseshvili Hydrochemistry Laboratory. (Methods approved in hydrochemical practice were used for the analysis) [1, 2, 7]. Sanitary-microbiological examinations of the test water were conducted at the Kutaisi Akaki Tsereteli State University Microbiology Laboratory and the Microbiologist LLC Testing Laboratory. For microbiological examination, water samples were taken in sterile 1-liter containers. The samples were labeled with the name of the source, date and time, then placed in a special basket in which a low temperature is maintained and then transported to the laboratory. The analysis was performed no later than 6 hours. Mesophilic aerobes and facultative anaerobes, total coliform bacteria, and Escherichia coli were investigated using modern methods [3].

Conclusion: In the studied spring waters of the villages of Zeda Dimi and Nergeeti of Baghdatia municipality: water, magnesium, calcium, hydrocarbonate, sulfate and chloride ions, carbon dioxide, dissolved oxygen, biochemical oxygen consumption, permanganate oxidation, dry residue, and the content of biogenic elements are within the norm. As can be seen from Table 2. - in the first four samples of the analyzed waters (Zeda Dimi, Gotsiridzebi, Garuchava, Fullariani), the main microbiological indicators are within the norm and no microbiological contamination is detected in the examined samples. Their use is suitable for drinking and is advisable from an economic point of view. As for the next seven springs (Robakidze, St. Giorgi, Ukleba, Dato, Kaka), an excessive number of mesophilic aerobes and facultative anaerobes was observed, as well as common coliform bacteria in the water of two springs (Nergeeti, Gogelidzei), which made it clear that the waters of the mentioned springs are harmful for drinking. Tourists should be explained that they should not consume water that does not comply with hygiene standards. Microbiological analysis showed that the consumption of the waters of the springs of Robakidze, St. Giorgi, Ukleba, Dato, Kaka, Nergeeti, and Gogelidzei is unacceptable for domestic and agricultural purposes. Therefore, water pollution is a problem that affects almost all countries in the world, including Georgia. This problem has a decisive impact not only on the ecological and social, but also on the economic situation of the country.

References:

1. Supatashvili, G. (2016). *Quantitative analysis practice.* Tbilisi State University Publishing House. 2016. pp.56-101.
2. Chikovani, M., Gabelashvili, M., Zarkva, M., & Megrelishvili, N. (2020). Hydrochemical and Sanitary Microbiological Research of the Elena Hill Spring Waters in the Nakhunao Community of Martvili Municipality. *RS Global Monographs*, 2020. V 6(58), pp. 27-31.
3. Chikovani, M., Gabelashvili, M., Kupatasvili, N., Gambashidze, A., & Zedashidze, L. (2022). Hydrochemical and sanitary microbiological examination of spring waters of Nakhunao community of Martvili Municipality. *International Scientific Journal Theoretical & Applied Science*, 2022. 112(08), pp. 308-313.
4. Chiqovani, M., Kupatashvili, N., & Jolokhava, M. (2023). Hydrochemical analysis of some fresh waters of Lejokhe, Letane and Mikawa villages of Tsalenjikha municipality. *International Scientific Journal Theoretical Applied Science*, 2023. 127(11), pp. 238-241.
5. Gabelashvili-Bregadze, M. (2019). *General microbiology, virology*. Kutaisi Akaki Tseretelis State University Publishing House. 2019. pp.203 - 20.
6. Chikovani, M., Samkharadze, M., Rusia, M., Endeladze, N., & Papava, N. (2025). *Determination of the Hydrochemical Composition of Water from Some Georgian Springs (In the village of Khidari, Kharagauli Municipality) by different Analysis Methods.* 2025. № 1-3, pp 1-6.
7. Chiqovani, M., Kakhidze, N., Balavadze, L., Giorgadze, N., & Pataridze, M. (2023). Examination of The Cemical, Composition of Spring Waters in Aketi VillaGe of Lanchkhuti Municipalitety RS Global Jurnals. *World Science*. 2023. V 3(81), pp. 1-4.