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STUDY THE ACTUAL SITUATION OF DOMESTIC WATER OF 24 MILITARY UNITS IN THE NORTHERN REGION IN 2022

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ABSTRACT

Purpose: *Study on the actual situation of domestic water of 24 military units in the Northern region in 2022.*

Subjects and methods: *A descriptive cross-sectional study with analysis and evaluation of seven basic physical, chemical and microbiological indicators on 113 samples of domestic water collected at 24 military units stationed in the Northern Region from July to October, 2022.*

Results: *The water used for consumption and daily activities in the studied units accounted for 58.4% from drilled wells and dug wells and 35.4% from water supplied by factories, in which 61.1% of the water was untreated before use. The proportion of water sources that did not meet the standards according to QCVN 01:2018/BYT for pH indicator was 29/113 samples (25.7%), and for turbidity was 10/113 samples (8.8%). A comparison of nitrite and ammonia standards between treated and untreated water sources showed approximate equality. The difference in permanganate criteria between treated and untreated water sources and the proportion of samples meeting standards according to QCVN 01-1: 2018/BYT was statistically significant with p < 0.05.*

Keywords: water quality, military units, pH, permanganate.

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1. INTRODUCTIONS

Water is a very important, limited natural resource and an essential need in the life of every community and every person [1], [2]. The quality of water used for daily activities and consumption has a direct impact on human health [3, 6] because if the water does not meet the standards, this can lead to immediate serious consequences (such as the triggering of acute dangerous diseases: diarrhea, cholera, dysentery, typhoid, hepatitis A, etc.) or accumulate over time causing chronic diseases, and even malignant diseases [2, 4, 5]. The quality of domestic water can vary due to natural conditions, habits, lifestyle, and various other factors.

Due to the specific military missions, military units often stationed in remote areas, including forests and mountains. Under these geographical conditions, the water sources used in many units mainly from drilled wells and dug wells, while in some places used surface water from ponds, lakes, rivers, streams, or natural tanks. In recent practice, the water sources used in most units meet sensory requirements, but there were no specific studies to assess water quality according to the current standards.

Starting from the above fact, we conducted this study to investigate certain indicators of water quality in 24 military units stationed in the northern region.

2. SUBJECTS AND METHODS

2.1. Subjects

113 samples of domestic water from 24 military units stationed in the provinces/cities of the northern region were collected from 7-10/2022.

2.2. Methods

- Study design: a descriptive cross-sectional study with analysis.

- Sampling process: according to the guidelines for water sampling TCVN 6663-11:2011. Samples were preserved and transported according to TCVN 6663-3:2008.

- Sampling principle: the military medical units identified the main source of water used by the unit throughout the year for soldiers' daily activities and eating purposes. For units using surface water sources (ponds, lakes, rivers, streams, etc.), the technicians observed the source and take samples directly from it. Water samples were taken from water tanks before use.

For military units using drilled wells or open wells without water storage devices, samples were taken directly from the source. Each unit took at least

two samples of domestic water from two different locations (water source and water at the kitchen tap). Units with distributed locations in different areas adhere to the principle of taking two water samples at two locations: water source and water in the kitchen area.

- Criteria for analyzing and evaluating domestic water: five physico-chemical indicators (pH, turbidity, nitrite, ammonia, permanganate); two microbiological indicators (total coliforms and heat-resistant coliforms). Apply molecular absorption spectrophotometry, culture and titration methods were used to analyze these indicators.

- Evaluation Standards

Indicator	Testing method	QCVN01-1: 2018/BYT
pH	TCVN 6492:2011	6.0-8.5
Turbidity	SMEWW 2130.B:2017	2 NTU
Oxidation degree	TCVN 6186:1996	2 mg/l
Nitrit NO^-_2	TCVN 6178: 1996	0.05 mg/l
Ammonia NH_4^+	TCVN 6179-1: 1996	0.3 mg/l
Coliform	TCVN 6187-2: 1996	< 3 CFU/ 100 ml
Heat-resistant coliform	TCVN 6187-2: 1996	< 1 CFU/ 100 ml

- Data Processing: enter data using Epi Data 3.1 software. Analyzing data will be evaluated by comparing with QCVN 01-1:2018/BYT standards for clean water quality for domestic use. Statistical analysis and processing performed using M.Excel and SPSS.

3. RESULTS AND DISCUSSIONS

3.1. Current status of water source hygiene in use at Military units

Table 1. Current status of water source hygiene

Variable	Content	Frequency	rate
Water source for consumption and daily activities	Supplied by the factory	40/113	35.4%
	Dug well water/ drilled well/ open well water	66/113	58.4%
	Surface water (stream water)	6/113	5.3%
	Rainwater	1/113	0.9%
Hygiene of water source before use	Water treated before use	44/113	38.9%
	Water not treated before use	69/113	61.1%

According to the National target program on rural clean water and environmental sanitation, the rate of self-exploitation of water for domestic use in Vietnam was 13.5%. This showed that the proportion of units using self-exploited water sources was still relatively high. In this study, 38.9% of water sources treated before use. This rate was higher than in the 2019 study by Nguyen Thi Hoai (27.28%) [9], but much lower than in the study by Bui Huy Tung (100% of drilled well water in households was roughly filtered before being stored in tanks) [10].

3.2. Current status of some water quality indicators in use at military units

- Parameters pH and turbidity:

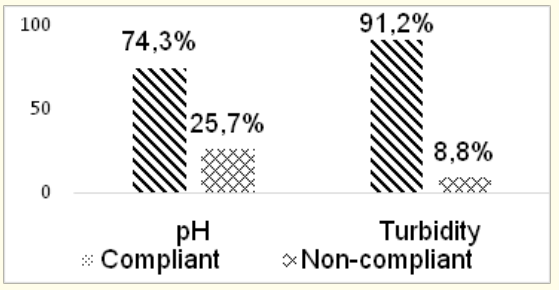

Chart 1. Evaluation results of physical parameters.

The results in chart 1 showed that 74.3% of water samples have pH within the permissible standard range (6.0-8.5). Most water samples did not meet the standard (low pH) were untreated drilled well water, and a small proportion of water has been treated but still did not meet standards according to QCVN. This result was lower than the studies by Vo Thanh Hoa and Nguyen Tri Quang Hung [11], [12]. 91.2% of water samples meet the turbidity standard. 8.8% of water samples did not meet the turbidity standard, mainly from untreated water, with some samples having turbidity levels much higher than the permissible standard. This result was nearly equivalent to the study by Nguyen Tri Quang Hung and Tran Thuy Chi [12], [13].

- Chemical Parameters (Ammonia, Nitrite, Permanganate):

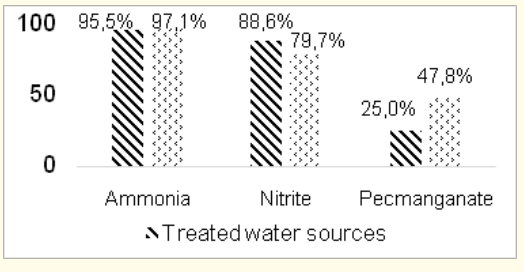

Chart 2. Evaluation results of chemical parameters.

For water sources treated and untreated at the units, we observed a relatively high proportion of samples meeting the standards for Ammonia and Nitrite (95.5%, 97.1%, and 88.6%, 79.7%). However, the percentage of samples meeting the permanganate standard was low, at 25.0% and

47.8%, respectively. This result was lower than the study by Tran Thuy Chi (evaluating the current status of water use and quality of domestic water supply in Dang Xa, Gia Lam, Hanoi, found that 54.55% of samples meet the Permanganate standard) [13]. The low percentage of permanganate meeting the standard in treated water sources may be due to infrequent cleaning and maintenance of water storage tanks (investigation reveals that some units did not regularly clean and wash water storage tanks throughout the year).

- Microbiological parameters (Coliform, Heat-resistant coliform):

For Coliform and heat-resistant Coliform indicators, the percentage of samples meeting the standard was 40.9%, 50.7% for treated water and 61.4%, 69.9% for untreated water, respectively (chart 3). Le Duc Anh studied the current status of water use and groundwater quality in Ho Chi Minh City and did not find the existence of heat-resistant Coliform, but found a high prevalence of Coliform [14]. Nguyen Tri Quang Hung's study found that the water quality at most stations could not be used for drinking water purposes [12]. The appearance of Coliform and heat-resistant Coliform in relatively large quantities in domestic water at the units in this study showed that the water was contaminated with animal and human waste, significantly affecting the health of soldiers. Therefore, it is necessary to carefully examine and monitor the storage process, preservation, and disinfection at the wells and water storage tanks at military units.

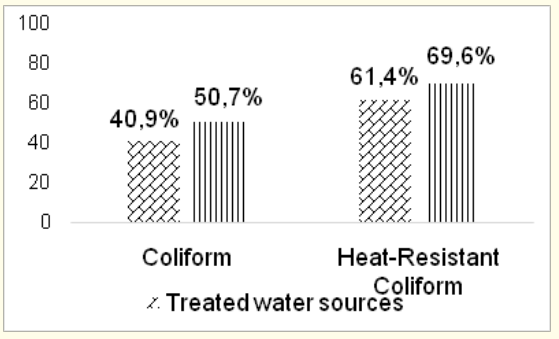

Chart 3. Evaluation Results of microbiological parameters.

Table 2. Relationship between domestic water quality and water source characteristics

Indicator	Water source			
	Supplied by the factory (n = 40)		Drilled well/open well/dug well water	
	Compliant	Non-compliant	Compliant	Non-compliant
pH	37 (92.5%)	3 (7.5%)	40 (60.6%)	26 (39.4%)
Turbidity	40 (100%)	0	56 (84.8%)	10 (15.2%)
Ammonia	40 (100%)	0	62 (93.9%)	4 (6.1%)
Nitrit	26 (65.0%)	14 (35.0%)	61 (92.4%)	5 (7.6%)
Permanganate	31 (77.5%)	9 (22.5%)	12 (18.2%)	5 (81.8%)
Coliform	33 (82.5%)	7 (17.5%)	20 (30.3%)	46 (69.7%)
Heat-resistant Coliform	39 (97.5%)	1 (2.5%)	35 (53.0%)	31 (47.0%)

Of the 40 water samples provided by the factory, we encountered 35.0% of samples with Nitrite indicators that did not meet the permitted standard, 22.5% of samples with Permanganate indicators that did not meet the allowed standard, 1/40 samples (2.5%) appeared thermostable Coliform in tap water samples. Among the water samples from open wells/dug wells/drilled wells, the indicators that did not meet the criteria were high (samples that did not meet the criteria of Permanganate: 81.8%, Coliform: 69.7%).

Table 3. Comparison of water quality indicator rates at the source and in storage tanks

Indicator		Sampling location				OR	p
		At the source (n = 69)		In storage tanks (n = 44)			
Ammonia	Compliant	67	97.1%	42	95.5%	1.5	0.644
	Non-compliant	2	2.9%	2	4.5%		
Nitrite	Compliant	55	79.7%	39	88.6%	0.5	0.216
	Non-compliant	14	20.3%	5	11.4%		
Permanganate	Compliant	33	47.8%	11	25.0%	2.7	0.015
	Non-compliant	36	52.2%	33	75.0%		

Coliform	Compliant	35	50.7%	18	40.9%	1.4	0.308
	Non-compliant	34	49.3%	26	59.1%		
Heat-resistant Coliform	Compliant	48	69.6%	27	61.4%	1.4	0.368
	Non-compliant	21	30.4%	17	38.6%		

The difference between sampling locations (at the source and in storage tanks) regarding the percentage of samples meeting QCVN 01-1:2018/BYT standards for Permanganate was statistically significant with $p < 0.05$. The difference between sampling locations with the proportion of samples meeting QCVN 01-1:2018/BYT standards for Ammonia, Nitrite, Coliform, heat-resistant Coliform was not statistically significant ($p > 0.05$).

4. CONCLUSIONS

Study on the 113 water samples for consumption and daily activities collected in 24 military units stationed in the northern region from July to October 2022 concluded:

- 58.4% of the water samples used from drill well, and 35.4% of water samples were supplied by the factory. Samples with pH indicator that did not meet the standard accounted for 25.7%. The water sample had turbidity higher than the permitted standard, accounted for 8.8%.

- The treated and untreated water samples have high compliance rates for ammonia and nitrite (95.5%, 97.1%, 88.6% and 79.7%, respectively). Permanganate indicators meeting standards were low (25.0%, 47.8%, respectively).

- There was a relationship between the water samples meeting the permanganate standard and the sampling location (at the source and in the tanks), with a significant difference at $p < 0.05$.

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