International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; SP-8(5): 103-105
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Received: 21-07-2020
Accepted: 25-08-2020

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Physical and microbiological quality of drinking water for livestock under organized and unorganized sectors in the Brahmaputra valley of Assam

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DOI: https://doi.org/10.22271/chemi.2020.v8.i5b.10453

Abstract
A total of sixty (60) samples from organized and unorganized sectors were collected in five different districts of the Brahmaputra Valley of Assam. Six (6) samples were collected each from organized and unorganized farms from one district. The water samples were assessed with the help of water testing kit (JalTara water testing kit-TARA life sustainability Solution Private Limited, New Delhi, India). The physical parameter such as temperature and turbidity was in the range of 16.15-18.88ºC and 0.68-1.41 NTU respectively. These physical parameters were within the permissible limit set by WHO, 2011. The result of microbiological quality of the samples showed that out of 60, only 7 samples indicated the presence of coliform organism in it. It may be concluded that the water samples of both organized and unorganized sectors in terms of physical and microbiological quality were found safe except seven samples which were found to have coliform organisms in it.

Keywords: Drinking water, livestock, Brahmaputra valley, physical quality, microbiological quality

Introduction
Animal husbandry is an integral sub sector of Indian agriculture. Most of the rural populations in India are supported by agriculture and animal husbandry which provides income, employment opportunities and improves the nutritional standard of the farmers.

Water is indispensible to any life forms and is the most important nutrient for livestock and other living organisms as well. In addition to being a nutrient, it is also involved in many essential physiological functions, such as digestion, absorption, enzymatic function, nutrient transportation, thermoregulation, lubrication of joint and organs, elimination of waste. Total body water content of adult cattle ranges between 56-81% of body weight (Murphy, 1992). In addition to managemental practices, it is very much important to assess the quality of feed, fodder and water to ensure a healthy livestock unit.

Water is a good medium for numerous diseases to occur and so it requires proper assessment and adequate treatment whenever necessary. For efficient livestock production a continuous supply of clean, fresh and wholesome potable water is always essential. Though water is essential for life and other functions as well, the same need to be clean, fresh and wholesome, and free of toxic components. Excessive concentrations of heavy metals are detrimental. They destabilize ecosystems because of their bioaccumulation in organisms, and toxic effects on biota and even death in most living beings. All heavy metals, in spite some of them are essential micronutrients, have their toxic effects on living organisms via metabolic interference and mutagenesis. The bioaccumulation of toxic metals can occur in the body and food chain. So, the toxic metals generally exhibit chronic toxicity [Pandey and Madhuri (2014)] [5]. One of the important sources of heavy metals is water through which it finds its way to animal's body. Certain heavy metals even in very low concentration may cause detrimental effect in an animal. Ground water Arsenic (As) and Iron (Fe) contamination in the Brahmaputra river basin were recorded as 0.128 ppm and 5.9 ppm respectively which was above the WHO drinking water guideline values. In the Brahmaputra alluvial plains of Assam, fluoride content has been reported by many researchers in the district of Kamrup, Karbi Anglong, Golaghat, Guwahati.

Kalita (2015) [6] studied the quality of drinking water in Palashbari area of Kamrup rural district in Assam where concentration of fluoride and iron exceeded the WHO (2011) [3] permissible limit.

Many researchers have shown that water has got important impact on animal health and production performances. It was found that the temperature of drinking water of North Eastern India ranged 9.8-26.3, 16.4-25, 18.5-23, 10.1-27, 15-32, 13.1-25, 2.9-17.1 and 20.5-29.5 in Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, respectively (Singh, 2004). The mean turbidity value (NTU) in reservoir, upstream, 0middle stream and downstream of Mahanadi river were 88.5 ± 6.32, 85.0 ± 5.21, 87.9 ± 5.80, 96.1 ± 9.90 respectively (Kar *et al*, 2010). Considering the importance of assessment of quality of drinking water, the present study has been undertaken with the following objectives to identify the sources as well as physical and microbiological quality of drinking water.

Materials and Methods

The study was undertaken to find out physical and microbiological quality of drinking water for livestock under organized (O) and unorganized (UO) sectors [farm (F)] in five different districts of the Brahmaputra Valley of Assam. Five agroclimatic zones were selected from the valley where one district was selected from each zone on the basis of livestock population. Six (6) samples were collected each from organized and unorganized farms from one district. Hence, a total of sixty (60) samples were collected from the selected districts. The water samples were assessed with the help of water testing kits (*JalTara* water testing kit by *TARA life* sustainability Solution Private Limited, New Delhi, India).

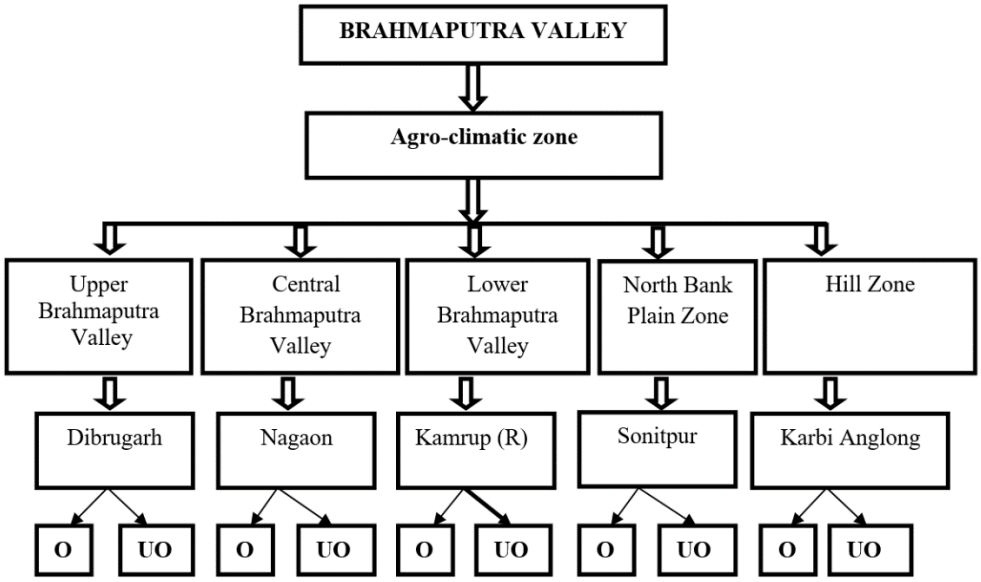

Fig 1: Diagrammatic representation of collection of samples from different districts of the Brahmaputra Valley of Assam

Color

Color of the samples was examined through visual inspection at the point of collection.

Temperature and Turbidity

Temperature of the samples was measured with the help of thermometer. Turbidity of the samples was measured with the help of digital turbidity meter.

Microbiological Qualities

Microbiological qualities of the samples with reference to coliform organism were determined with the help of TARA Aquacheck vial provided by JalTARA (water testing kit by TARA life sustainability Solution Private Limited, New Delhi, India) water testing kit.

Collection of water samples

The water samples of the selected districts were collected in sterile sample container directly from the point of sources. The samples had been collected hygienically wearing sterilized hand gloves to minimize any sorts of contamination. The containers with the samples inside were transported following standard protocols.

Preservation of Samples

Standard preservation protocols were followed while preserving the water samples.

Statistical Analysis

The data were analyzed by statistical techniques like descriptive statistics, analysis of variance and Duncan multiple range post-hoc test using SAS enterprise guide 4.3 version.

Results and Discussion

Identification of source

In the present study, the water samples were collected from the sources that were given to the livestock, namely well, tube well, bore well, pond and river.

Colour

In the present study all the water samples of organized and unorganized sectors in Dibrugarh, Kamrup (R), Karbi Anglong, Nagaon and Sonitpur districts were found to be colourless.

Temperature

The average temperature (^{o}C) obtained in the study were 16.90±0.06 and 16.83±0.08 in Dibrugarh, 17.73±0.03 and 17.73±0.06 in Kamrup (R), 18.08±0.03 and 18.28±0.10 in Karbi Anglong, 18.88±0.11 and 18.80±0.04 in Nagaon and 16.18±0.03 and 16.15±0.02 in Sonitpur in Organized and unorganized sectors respectively (Table 1). No significant ($p>0.05$) differences between the organized and unorganized sectors were recorded in the study.

Turbidity

The average turbidity obtained in the study were 1.09 ± 0.03 and 1.12 ± 0.02 in Dibrugarh, 1.41±0.13 and 1.35±0.09 in Kamrup (R), 0.83±0.04 and 0.81±0.03 in Karbi Anglong, 1.20±0.01 and 1.18±0.00 in Nagaon and 0.71±0.04 and 0.68±0.04 in Sonitpur in Organized and unorganized sectors respectively (Table 1). Moreover, no significant (p>0.05) differences between the organized and unorganized sectors were recorded in the study.

Table 1: Average (MEAN± SE) Temperature (°C) and Turbidity (NTU) of water samples of organized AND unorganized sectors in different districts

Sector / Districts	Organized		Unorganized		p-value	
	Temperature	Turbidity	Temperature	Turbidity	Temperature	Turbidity
Dibrugarh	16.90±0.06	1.09 ± 0.03	16.83±0.08	1.12 ± 0.02	0.541	0.421
Kamrup (R)	17.73±0.03	1.41±0.13	17.73±0.06	1.35±0.09	1.000	0.692
Karbi Anglong	18.08±0.03	0.83±0.04	18.28±0.10	0.81±0.03	0.088	0.756
Nagaon	18.88±0.11	1.20±0.01	18.80±0.04	1.18±0.00	0.520	0.389
Sonitpur	16.18±0.03	0.71±0.04	16.15±0.02	0.68±0.04	0.401	0.605

Microbiological Quality

Out of a total of 60 samples in the selected districts, 4 samples were positive for coliform organism in organized sectors and 3 in unorganized sectors (Table 2). Rest of the 53 samples didn't show presence of coliform organism.

Table 2: Microbiological quality (coliform organism) of water sample in organized and unorganized sectors in different districts

Sector / District	Total sample	Organized		Unorganized	
		Positive	Negative	Positive	Negative
Dibrugarh	6	1	5	-	6
Kamrup (R)	6	-	6	1	5
Karbi Anglong	6	2	4	-	6
Nagaon	6	-	6	1	6
Sonitpur	6	1	5	1	5

Conclusion

From the result of the present study it may be concluded that the water offered to the livestock of organized and unorganized farms of the selected districts was below/within the permissible limit of WHO (2011) [3]. However, seven samples out of the total sixty were found positive for Coliform organisms. Further study may be required with a large number of samples to correlate the findings of present study.

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