

Evaluation of Drinking Water Quality for Animals at Lr&D Station Pharpur, Dikhan and in the Surrounding Areas

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Abstract

Water which is the important, but often overlooked, nutrient. Livestock water requirements are affected by many factors, including size, productivity, diet and environmental conditions. Good water quality and cleanliness can increase water intake and improve livestock production. For this purpose this study was designed to evaluate the water in the area of Paharpur. The water was evaluated for the following important components including Total dissolve solids, Ph of water, Nitrates present in water, Nitrites present in water and Total Hardness of water. In this study total of 250 samples were evaluated for the above factors using laboratory techniques. The TDS (Total Dissolved Solids) were found in the permissible range (<1000-2999 ppm). The Ph of water was in the range of 6-8.5 pH, that allowable in livestock. For nitrates of the total samples 250, 53 samples were tested Positive, and for the Nitrites of the total samples, 56 samples were tested positive. For Samples tested for the Total hardness of water The lowest analyzed value of Total Hardness was 60 ppl and the highest value of was 138 ppl. These values are in permissible range will cause no health problems.

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Introduction

Water plays a vital role in life of all living organisms as 90% of living body is constituted of water. Water is universal solvent and mostly the chemicals reactions occurring in body uses water as medium. Ample intake of water by living organism enables it to excrete the waste products of body in the form of defecation, urination, perspiration etc. Water that is advisable and drinkable is clear, clean has no bad odor, palatable to animal when offered free from any type of toxin and contains less mineral content. Signs of poor quality are it contains high levels of soluble salt, algae. Is contaminated with bacteria, turbid in consistency due to presence of clay. The agents causing pollution in water includes, chemical wastes, dead animals remains, droppings of birds and other debris causes problem [1]. TDS is the In-Organic matter present in water [2] having TDS greater than 5000 milligram/iter (mg/l) are not recommended for pregnant and lactation cows. Water with TDS higher than 7000 mg/l is unsuitable for cows. TDS or salinity, refers to the mineral quantities in water. TDS includes common salts such as sodiumchloride, calcium, magnesium, sulphates and bicarbonates. [3] Nitrates/Nitrites are found in reservoir of water stored on ground that has been contaminated by manure or fertilizer. In dugout reservoirs

increase concentrations are rarely found, however in running water their presence is not avoidable due to chemical fertilizers. High Nitrogen concentration in drinking water in form of NO₃ cause methemoglobinemia, whereas other forms of Nitrogen like Nitrite and NO₂ are considered potentially of carcinogenic [4]. The acceptable pH range for livestock is 6.0-8.5 [5]. Water with acidic pH value i.e less than 5.5 may cause decrease in ruminal pH level resulting in acidosis in cattle leading to reduced feed intake and performance.

Objectives

The objectives of this study was to Test the quality of drinking water for animals at LR&D StationPharpur and in Surrounding areas.

Also The present study is designed to create facility of Water quality testing at LR&D Station Pharpur Animal Nutrition Lab.

Material Method

Paharpur Tehsil located in Dera Ismail Khan District, Khyber Pakhtunkhwa, Pakistan

The tehsil is administratively subdivided into 18 union councils with headquarters at Paharpur

Sample collection

For sample collection 10 villages of Tehsil Paharpur were selected including Rakh Belli, Wanda madad, Rang-puradda, Band Kuri, Wanda madat, Wanda norak, Wanda Umari, Wanda Karim Khan, LR&D Station, Hafiz Abad for the collection of samples 2 visits were paid to selected villages/month total of 40 visits were paid and samples were randomly collected from different sources including house hold water reservoirs, wells, standing water in fields and all possible hygiene practices like wearing of gloves, gum boots, apron were adopted to avoid contamination of samples about 25 ml of water sample was collected from each reservoir.

Total number of 250 Samples were collected and were Analyzed for

1. Total Dissolved Solids (TDS).
2. Ph:
3. Nitrate.
4. Nitrites.
5. Hardness of water

After collection of water samples each sample was labeled and stored properly for further processing.

Total Dissolved Solids (TDS)

1 ml sample was dried in pre-weighed crucible and weight of the left over Total solids were calculated

$TDS \text{ mg/l} = \frac{\text{Weight of crucible before drying} - \text{Weight of crucible after drying}}{\text{Volume of sample}} \times 1000$

Volume of sample (Table 1)

PH

Ph of water was checked using Ph meter

Water pH ranging from 6.0 to 8.5 was considered acceptable for most livestock.

Nitrate & Nitrite

For calculation of nitrate and nitrite in laboratory with following chemicals test was performed.

Table 1: Guideline for use of saline water for dairy cattle.

TDS level mg/l or ppm	Guide line for use
<1000	Safe and pose no health problems
1000-1999	Generally safe
2000-2999	Safe but may cause mild diarrhea in animlas
3000-4999	Animal performance adversely affected
5000-6999	Water should be avoided for pregnant and lactating animals
>7700	Should not be fed to animals health problems and poor production

Source National research council 1974

Nitrate

Chemicals: Brusin, Sulphuric acid few drops

Positive sample: cherry Red colour is positive sample.

Nitrite

For calculation of nitrite in solution the laboratory test is used

Solution A. Naphthylamine, Acetic acid, Distilled water

Solution B. sulphanilic acid, Acetic acid, Distilled water

Positive sample: Colour changes to pink then sample is positive if colour remain unchanged then sample is negative [6].

The recommended level of Nitrates and nitrites in water of livestock are 100 mg/l nitrate/l & 10 mg/l nitrate (CCME-2005)

Hardness of water

Purpose to determine the concentration of Calcium(Ca²⁺) and Magnesium(Mg²⁺) in water sample. The hardness of water was tested by Titration with Erichrome Black T .EBT reacts with ions in water and forms wine red colour the added EDTA changes the colour of solution to blue. The end point of titration is indicated with sharp colour change from winered to blue

Reagents: Buffer solution Ph10, Erichrome Black T, EDTA 0.1 molarity solution (Table 2).

Statistical analysis

Data collected was arranged in Micro Soft Office Excel in 10 groups, 25 samples in each group and descriptive statistics were applied on the data. Means values of each group and standard deviation was calculated.

Results and Discussion

Ph

The present study was carried out at LR&D Station Nutrition laboratory D.I.Khan. Total of 250 samples of water were collected from different reservoirs and were analyzed the finding of study reveals that the mean values \pm SD of pH of water for 10 groups each group with 25 samples of the area of Tehsil Paharpur are (7.12 \pm 0.59, 6.69 \pm 0.703, 6.82 \pm 0.62, 6.97 \pm 0.58, 6.9 \pm 0.611, 6.94 \pm 0.533, 7.23 \pm 0.54. 7.22 \pm 0.51 7.13, \pm 0.67, 6.71 \pm 1.53) Table 01. The lowest pH value observed in 250 samples was 6 while the highest pH value observed was 8.5. These values are in permissible range according to the prescribed standard Water pH ranging from 6.0 to 8.5 was considered acceptable for most

Table 2: Titration reading with EDTA 0.1 M indicates hardness of water.

Concentration (PPL)	Hardness Rating
<61	Soft
61-120	Moderately hard
121-150	Hard
>180	Very Hard

Hard water formula= $A-B \times .1 \times 100 \times 1000$

Volume of sample

A-B=Volume of sample used

livestock. [7] The accepted level for livestock drinking water is 6-8 pH [8]. The pH effects by changing different properties drinking of water including taste, chlorination efficiency, corrosive potential and also many other properties also [7]. Minor alkalinity by herbivores in drinking water is tolerable than acidity. (Table 3) The pH less than 5.5 causes acidosis of ruminal pH, it causes less water and feed intake, poor food conservation ratio, diarrhea problems etc [9].

TDS

The mean values ± SD for TDS of the 10 groups, each group with 25 samples are (1642.92 ±462.21, 1815.75 ±521 1730.32 ±476.43 1669.8 ±571.12 1855.67 ±465.58 1623.96 ±508.12 1770.32 ±511.88 1977.12 ±416.7 1700.72 ±529.93 1707.08 ±399.78) Table 01. These values are in permissible range according to the prescribed standard and will cause no health problems. [10] The lowest analyzed value of TDS was 600 ppm and the highest value of TDS was 2500 ppm, found that water with TDN Less than 3,000 (ppm or mg/L) Usually satisfactory for most livestock, [3] states that 1,000 - 2,999 ppm [slightly saline] Should not affect health or performance, but may cause temporary mild diarrhea. The TDS and salinity is the amount of total dissolved salts in water/ it primarily measures the amount of dissolved salts in the water it can include carbonates, magnesium and potassium, Hersom, et al. Water <1000 ppm TDS is fresh and impacts no serious problems and with TDS 1000 ppm to 2999 ppm Is satisfactory

for use of adult ruminants may cause some time temporary and mild diarrhea but will not affect the performance or health, [12].

Nitrates and Nitrite

Out of total 250 samples 53 samples of (21.2%) were positive for Nitrate in water while 197 (78.8%) samples were found negative & 56 samples (22.4%) were positive for Nitrite in water while 194 samples (77.6%) were found negative Nitrates (NO₃) are less commonly found in drinking water and they are less toxic while nitrite (NO₂) is much toxic and may cause carcinogenic effects nitrogen fertilizer and livestock operations elevate their levels. Nitrates when absorbed in bloodstream ultimately affect oxygen transport ability of red blood cells (RBCs), so it causes death and suffocation and lack of oxygen transport [10,13,14] (Table 4).

Total hardness in water

The resultant mean ± SD values for 10 groups each group with 25 samples are (82.43 ±17.44, 106.46 ±19.34, 99.13 ±19.87, 102.48 ±23.03, 97.76 ±24.67, 100.64 ±25.71, 94.94 ±22.91, 94.43 ±21.62, 98.016 ±22.62, 96.704 ±26.39) Table 01. The lowest analyzed value of Total Hardness was 60 ppl and the highest value of was 138 ppm. Water containing 290 ppm impose no effects milk production, weight gain of animal or water consumption [15]. The main cause of Hard water is the high concentrations of calcium and magnesium, but iron magnese strontium and aluminum also contribute to hardness of water [16]. It states

Table 3 Percentage to total samples.

	TDS	Ph	TH	Nitrates	Nitrites
Group 1	*1642.92	*7.12	*82.43	n ⁶⁺ , **24%	n ⁶⁺ , **24%
	±462.21	±0.59	±17.44	n ¹⁹⁻ , 76%	n ¹⁹⁻ , 76%
Group 2	1815.75	6.69	106.46	4+, 16%	8+, 32%
	±521	±0.703	±19.34	21-, 84%	17-, 68%
Group 3	1730.32	6.82	99.13	5+, 20%	2+, 8%
	±476.43	±0.62	±19.87	20-, 80	23-, 92%
Group 4	1669.8	6.97	102.48	4+, 16%	7+, 28%
	±571.12	±0.58	±23.03	21-, 84%	18-, 72%
Group 5	1855.67	6.9	97.76	1+, 4%	5+, 20%
	±465.58	±0.611	±24.67	24-, 96%	20-, 80%
Group 6	1623.96	6.94	100.64	6+, 24%	7+, 28%
	±508.12	±0.533	±25.71	19-, 76%	18-, 72%
Group 7	1770.32	7.23	94.94	4+, 16%	4+, 16%
	±511.88	±0.54	±22.91	21-, 84%	21-, 84%
Group 8	1977.12	7.22	94.43	6+, 24%	6+, 24%
	±416.7	±0.51	±21.62	19-, 76%	19-, 76%
Group 9	1700.72	7.13	98.016	8+, 31%	6+, 24%
	±529.93	±0.67	±22.62	18-, 72%	19-, 76%
Group 10	1707.08	6.71	96.704	7+, 28%	5+, 20
	±399.78	±1.53	±26.39	18-, 72%	20-, 80%

*Means ±SD, n⁺= Number of Positive/Negative samples of Nitrate/Nitrite in group with 25 samples each, ** Percentage to total samples (25) in group

Table 4: Total of 250 samples checked for Nitrate & Nitrite in laboratory the results obtained are as such.

Nitrate		Nitrite	
Positive Samples	Negative Samples	Positive Samples	Negative Samples
53	197	56	194

that water hardness in the range of 116 ppm to 190 ppm has no influence on the performance of animals.

Conclusion

It is concluded from the above study that the water available for

drinking at the Paharpur station and surrounding areas is safe to be utilized for of livestock purposes and will have no negative impact on general health and over all body performance of the animal.

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