EFFECT OF CHEMICAL AND BACTERIOLOGICAL QUALITY OF WATER FOR HUMANS AND LIVESTOCK WITHIN AND AROUND TULLUN GWANKI COMMUNAL GRAZING RESERVE IN SEMI ARID SOKOTO STATE, NIGERIA

†Bello M.R., B.S. Malami, H.M. Tukur., *A. Singh and **S. Muhammad.
Department of Animal Science, Usmanu Danfodiyo University, Sokoto
{Corresponding Author: E-mail bellomrabah@hotmail.co.uk}
††Department of Animal Health and Production, College of Agriculture, Sokoto State Polytechnic Sokoto State, Nigeria
**School of Bio-Sciences Faculty of Science the Nott harm University, Malaysia Campus Jalangroga, Siemens YJH 43500 Siemens Gov, Malaysia.*
***Veterinary Teaching Hospital;; Usmanu Danfodio University Sokoto, Nigeria.*

Abstract
An on farm study was conducted in a communal Grazing Reserve (Tullun Gwanki) between August 2009 and December 2010, to evaluate the seasonal Chemical and Bacterial content of water sources within and around the reserve. Treatments consisted of a factorial combination of 9 water sources and four seasons, laid out in a randomized complete block design (RCBD) with different water sections as replicates. The results indicated that the range of seasonal chemical content of water were within the maximum permit limits for humans and livestock, while 1.4 -1.6mgl^{-1} and 0.02 – 0.1mgl 4.7- 2400 for Cu; HCN and MPN100ml^{-1} respectively exceeded the recommended water quality standards for humans and livestock. The presence of E. coli, Klebsiella spp, Enterobacter spp, Solmonella spp and Enterococcus spp in water indicated pollution from human and livestock feces. It was concluded that the chemical quality of water was fair however, the bacterial quality pose health hazards to both humans and livestock. It is recommended that since the water contamination from runoff is inevitable, and the conventional purification processes are cumbersome and the use of disinfectants requires careful processes. Pastoralists are to be educated to adopt a boiling process of water, since micro-organisms can easily be destroyed by boiling.

Keywords: WaterQuality, Bacteriolocal, Chemical, Tullungwanki, Grazing Researve

Introduction

Livestock need fresh drinking water for normal health and production (Michaud, 1991). However, because of its properties as solvent water may carry many of the essential elements as well as toxic materials (Leonard *et al.*, 1979). The movement of animal wastes into surface and ground waters is often cited as a major factor contributing to the pollution of available water in many regions (Doran and Linn, 1979). Other sources of contamination include human related activities, such as illegal dumping of chemicals, over application of agricultural chemical and improperly constructed or maintained septic systems, wild life and livestock dung and urine (Ipinjolu and Argungu, 1998). However, in rangelands, the quality of water are greatly influenced by factors such as sedimentation, invasion of noxious aquatic weeds, local concentration of ions such as dissolved gases, and the presence of disease causing micro-organisms and their spores (Valentine, 1989). The microbial quality of water sources in Nigerian rangelands, taps and even home filters were reported as poor (Michael *et al.*, 1986). The aim of this study was to evaluate the seasonal chemical and bacterial quality of water within and around the reserve. The fact that the future of livestock industry in Nigeria hinges on the pastoralist's settlement and adoption of modern techniques in Animal Husbandry practices justified the study. The study was conducted in a communal (Tullun Gwanki) grazing reserve, in Silame local government area of Sokoto state in Nigeria. The reserve is situated between latitude 12^0 54' and 13^0 02' North and longitude 4^0 52' and 5^0 00' East. It has the surface land area of 4,312.54 hectares. The climate in the State consists of a long dry season (November - April) and a short rainy season (May - October). The average annual rainfall of the area was 531.66 (SADP, 2005).

Materials and Methods

The water sources used by pastoralists within and 2-8km outside the reserve were identified. Treatments consisted of water sampling in a factorial combination of 9 sources of water (Dam, River, Belon pond, Metoin pond, Rumdi well, Belon well, Northern depression, Central depression and Southern depression), and four seasons Early rainy; Late rainy; Early dry and Late dry seasons. Laid out in a randomized complete block design (RCBD) set up. Data was collected

.on chemical, MPN/100mls and bacterial identification as variables. Water samples were collected once in each season. At each sampling, three samples were collected from each section in rainy season and from two sections in dry season (entry, middle, outlet sections and the two wells). Chemical parameters were determined using LED photometer (LF2400) of Windaus Labortechink; EC was determined using conductivity meter, while pH was read using pH meter as described by AOAC (1990). The MPN/100ml index of coli form organisms was determined as described by Anonymous (1993). Bacterial identification was in accordance with Chesbrough (1985). Data was analyzed with ANOVA, (SAS, 1988 software)

Results and Discussions

The range of acidic values (pH 4.7 - 6.9) of water obtained was probably due to contact of the water with acid soils during runoff. The high acidity of water was reported due to increased contact with acid soils (Water-Encyclopedia, 2009). The values fall closely within the range of pH 6.5 - 8.5 reported to be safe for human and livestock (SON, 2007). The range of seasonal chemical content of water 0.03 - 1.1; 0.01 – 1.3; 0.4 – 4.6; 0 – 1.6; 0.01 – 0.2; 7.3 – 123.7 respectively of Mg, Ca, NO_3, Na, Zn, Cl_2 obtained were within the maximum permit limits for man (SON, 2007), and the recommended water quality standards of 0 - 30mgl^{-1}, and Mg and NO_3 90 - 500mgl^{-1} for man and livestock respectively (Schroller, 1977). The values for Cu (1.4 and 1.6mgl^{-1}) were slightly higher compared to the maximum limits, and the recommended water quality standards of 1mgl^{-1} for man (Schroller, 1977; SON, 2007). The range for HCN (0.02 – 0.1mgl^{-1}) in all seasons was higher compared to maximum limits for man with 0.01mgl^{-1} (SON, 2007). Little data for bacterial quality of water in rangelands of North Western Nigeria is available for comparison. The range of 4.7- 2400 MPN100ml^{-1} for bacterial count obtained was in agreement with Ipinjolu and Argungu (1998) who reported 2 - 2400 MPN100ml^{-1} in Zamfara reserve. The lowest mean MPN100ml^{-1} values of 4.7 - 6.7 recorded in the ponds and depressions respectively were probably due to low contamination, as they were reserved for human consumption only. The generally high MPN100ml^{-1} values recorded across the water bodies indicated intense pollution. This agreed with Klyachko (2011) and SON (2007) who reported water of good quality should not contain more than 3 cells of coli-form bacteria per liter. The value for bacterial isolates (19) obtained (Table 1) was higher compared to (11) reported by Ipinjolu and Argungu (1998). The presence of *E. coli*, *Klebsiella spp*, *Enterobacter spp*, *Solmonella spp* and *Enterococcus spp* in the water sampled indicated pollution from human and livestock feces, which might have originated from runoff water (McDowell *et al.* 1984).

Conclusion

The levels of chemical parameters tested obtained a part from Cu and HCN were considered fair, while the bacteriological quality of the water indicated health hazard to both humans and livestock. Since the water contamination from runoff is inevitable, and the conventional purification processes such as sedimentation, absorption, coagulation and flocculation led to partial removal of micro-organisms, while the use of disinfectants requires careful process. It was recommended that the Pastoralists be educated to adopt a boiling process, since micro-organisms can easily be destroyed by boiling.

References

Anonymous, (1993). Microbiological analysis of water Merck Culture Media pp 6, and 11.

AOAC, (Official methods of analytical chemist) (1990):- AOAC fifth edition.

Cheesbrough, M (1985). *Medical laboratory manual for tropical countries Vol.II ELBS Ed.* Published Butterworth and Co pp 58-69, 412.

Doran, J. W and D. M. Linn, (1979). Bacteriological Quality of Runoff Water from Pastureland. *Applied and Environmental Microbiology, May 1979,* P. 985-991.

Ipinjolu, J. K. and L. A. Argungu (1998). The chemical and biological properties of water resources in the Zamfara Reserve. *Prospect of Pastoralism in West Africa: Tropeninstitut, Giessen: 31 – 40.*

Klyachko, Y. A. (2011). Analysis of water quality. Faculty of analytical chemistry in the All Russia Research and Development Institute of a food prosessing industry, Russia http:// www ungl. Org/unldoc/EOLSS/ E 2-13-01-06-TXT aspx. Date accessed 16/03/2011.

Mcdowell, L. G., J. H., Conrad, G. L. Ellis and J. K., Loosli (1984):- Minerals for grazing Ruminant in Tropical Regions. The U. S. Agency for international Development 86 pages.

Michaud, J.P. (1991): A citizen's guide to understanding and monitoring lakes and streams. Publ. 94-149. Washington State

Dept. of Ecology, Publications Office. Olympia. WA, USA (360) 407-7472. Moore, ML. 1989.

Michael, J. P. E. C. S. Chan, N. R. Krieg, M. F. Felczar (1986). *Microbiology* 5th edition. Mcgraw Hill Company 592 – 607.

Leonard, A.M, J.K Loosli, F.Hintz and R.G worner [1979] *Animal Nutrition, Seventh edi; 602 pp.*

P.T.F, Petroleum Special Trust Fund, (1998). Food Supply Programme: Progress and problems of grazing reserve development. Implementation conference Kaduna, 6 pp.

SADP, (2005). Rainfall distribution and rainy days in Sokoto state from 1994 – 2004 (MM).

SAS, (1988). Statistical Analysis System (SAS/STAT) *User's Guide Release 6.03 ed.* Statistical Analysis Systems Institute Inc. Cavy Nc. PP.549 – 640.

SON, Standard Organisation of Nigeria (2007). Nigerian Standard for drinking Water Quality. Nigeria_standard_for_drinking_water_quality **Vallentine**, J.(1989): *Range Management and improvement. 3rd edition. Academic press Inc. California 524 p.*

Table 1: Coli-form and other bacteria isolated from different water bodies within and 2 -8km outside the reserve

S/N	Types of Coli-form bacteria	Dam	River	BP	MP	ND	RW	BW	Total
1	*Staphylococcus epidermicles*	3	1	0	0	0	1	0	5
2	*Escherichia coli*	1	2	0	1	2	2	1	8
3	*Klebsiella aeroginosa*	2	0	0	0	0	1	0	3
4	*Enterobacter aerogines*	1	1	1	0	1	1	0	5
5	*Bacillus fruendii*	1	0	0	0	0	0	0	1
6	*Lactobacillus acidophilus*	4	1	0	0	0	0	0	5
7	*Enterococcus Spp*	1	0	0	0	0	0	0	1
8	*Citrobacter fruendii*	1	1	1	0	0	0	0	3
9	*Solmonella Spp*	1	0	0	0	0	0	0	1
10	*Pseudomonas aeruginosa*	0	3	2	0	0	1	0	6
11	*Micrococcus Spp*	0	1	1	2	0	0	1	5
12	*Citrobacter Spp*	0	1	0	0	0	0	1	2
13	*Shigella Spp*	0	2	0	0	0	0	1	3
14	*Yersinia enterocolitica*	0	0	0	0	0	1	0	1
15	*Streptococcus faecalis*	0	1	0	0	0	1	0	2
16	*Proteus vulgaris*	0	0	0	0	0	1	0	1
17	*Lactobacillus spp*	0	1	0	0	0	0	0	1
18	*Bacillus subtilis*	0	1	0	0	0	0	0	1
19	*Staphylococcus aureus*	0	1	0	0	0	0	0	1
	Total	11	15	4	3	3	8	5	22

BP = Belon pond, MP = Metoin pond, ND = Northern depression, RW = Rundi well, BW = Belon well.

Table 2: Mean Seasonal Bacterial Count (MPM/100mls) from different water bodies within and around the reserve

	Sources						
Seas	Dam	River	BPond	MPond	NDep	RW	BW
ERS	697.8^{de}	996.8^{cde}	6.7^{e}	5.7^{e}	4.7^{e}	1966^{abc}	1753.3^{abc}
LRS	1202.1^{bcd}	1015.3^{cde}	9.0^{e}	8.5^{e}	5.7^{e}	1966^{abc}	1966^{acb}
EDS	2183.3^{ab}	1533.3^{a-d}	-	-	-	2400^{a}	2400^{a}
LDS	-	1966^{abc}	-	-	-	2400^{a}	2400^{a}

Means within columns with the same latters are not significantly different using DMRT at 5% level
BP = Belon pond, MP = Metoin pond, ND = Northern depression, RW = Rundi well, BW = Belon well.