QUALITY OF DIFERRENT WATER SOURCES USED IN POULTRY AND PIGGERY FARMS IN SOUTHEASTERN NIGERIA

Etuk, I.F., Ogbuewu, I.P., Okoli, I.C., Etuk, E.B., Iwuji, T.C. Obikaonu, H. O., Opara, M.N. and Odoemelam, V.U
Department of Animal Science and Technology, Federal University of Technology
P.M.B. 1526 Owerri, Imo State, Nigeria.
Correspondence: ifetuk@yahoo.com

Abstract
Quality of various sources of water used in poultry and piggery farms was assessed in eleven states of southeastern Nigeria. Five hundred and fifty farmers were interviewed comprising three hundred and thirty poultry farmers and two hundred and twenty pig farmers. Most predominant water sources identified were borehole, stream/river, rain water and pipe-borne. About 27% of poultry farmers and 23% of pig farmers interviewed used a combination of pipe-borne, rain and borehole water. Only 3% of poultry farmers and 6% of pig farmers depended solely on water from stream or river. No farmer depended on rain or pipe-borne water only, but about 7% of pig farmers and 4% of poultry farmers relied on the four sources listed here. Overall, 25% of all the farmers interviewed accepted combining rain, pipe-borne and borehole water in their farms, while 5% of the farmers used a combination of the four sources. Laboratory analysis of samples of water collected from these sources showed that total solids were highest in river/stream water (286.50 mg/l), and lowest in rain water (8.64 mg/l). Nitrates concentration was highest in rain water (116.4 mg/l) than in river/stream water, while there was more iron in borehole water (1.28mg/l) than pipe-borne (0.82 mg/l) and river/stream (0.36 mg/l). All water samples tested had pH values between 5.6 and 6.8, but coliform was detected only in river/stream water. These sources could be good sources of drinking water for farm animals, but they are often contaminated due to human activities, thus there is need for proper enlightenment on treatment of water before using in animal farms.

Introduction

Water is of importance to animals as well as humans for a lot of purposes such that non-availability of water can drastically affect their existence in a place. Where water is not available naturally, conscious effort is made by man to get it for himself, his crops and animals. Farmers need enormous quantity of water in poultry and livestock production. Apart from giving it to animals for drinking, water is used for washing of utensils, for most medication, for wallowing and for cleaning of pens among other uses. Drinking water plays important role in animals by helping to regulate body temperature, aiding food digestion and assisting in removal of wastes. According to Scott *et al.* (1982), water is important in maintaining homeostasis by participating in reactions and physiological changes which control pH, osmotic pressure and electrolyte concentrations. In poultry production, it is believed that birds drink as much as twice the amount of feed they consume on a weight basis. In the tropics, mostly in developing tropical countries, more emphasis is placed on quantity of drinking water available for animals in the farm than on quality of such water. However, the quality of water consumed should be of paramount importance as high levels of bacterial contaminants, minerals or other pollutants was reported to affect performance of birds (Blake and Hess, 2010). In an experiment with pigs (McLease *et al*., 1992), total dissolved solute (TDS) was identified as one factor in water causing decreased digestibility and hindering growth performance. Earlier study (Balnave, 1993) indicated that egg shell quality was adversely affected by increase sodium chloride in drinking water. This may result in significant reduction of day-old chicks due to reduced number of settable eggs and lower hatchability. In another experiment with laying hens, Abbas *et al.* (2008) did not observe any significant effect on egg production, egg weight and feed conversion ratio of birds given water from three different sources; but egg shell thickness and mineral contents of plasma showed variability. In Nigeria, as in some other developing economies, poor infrastructural amenities result in little availability of portable water to most states and regions of the federation. In the southeastern part of the country, there are many natural water bodies from where the local population drew most of their drinking water before and shortly after independence. This region also lies within the tropical rainforest zone where rain falls for long periods of the year. Now with the effect of climate change becoming eminent, rainfalls are experienced for longer periods than it was before and more ions may also be washed into drinking water sources. Some dangerous gases and solutes may also come into water sources as a result of gas flaring and due to industrialization activities in the region especially oil drilling and cement manufacturing. In situation of inadequate supply of portable water in the region, residents resort to the use of private boreholes, which are mostly untreated, while others make use of naturally existing water bodies. Some others depend on rain water during rainy seasons to save cost. Farmers also choose water sources depending on availability and cost, to ensure profitability of their business. This work investigated the most commonly used sources of water by farmers in the region as well as the quality of water from these sources.

Materials and Methods

A survey was carried out in eleven states of southeastern Nigeria comprising Abia, Akwa Ibom, Anambra, Bayelsa, Cross River, Delta, Ebonyi, Enugu, Edo, Imo and Rivers States. Two hundred and twenty pig farmers and three hundred and thirty poultry farmers were interviewed using questionnaire. Questions were read and interpreted to the

farmers and their responses were translated and documented by agents used for the distribution of the questionnaire forms. The most specific questions were aimed at determining the sources of drinking water used on their farms as well as reasons for using these water sources, in addition to problems and benefits of using these sources. The most prevalent sources were then selected based on numerical strength of respondents who made use of the different sources.

Samples of these water sources were obtained in the month of July when there is adequate of rainfall in the region. These samples were taken to the laboratory of the National Root Crops research Institute, Umudike, Nigeria for analysis. A fresh sample of each water source identified was collected in four-litre containers. These containers were properly washed with detergent and rinsed with the sample water many times before actual collection of samples for analysis. Containers were properly labeled as sample A (rain water), B (pipe-borne water), C (borehole water) and D (river/stream water). Rain water was collected from roof top of a farm building as collected by farmers during long period of rainfall to allow for ideal representative portion to be harvested (the roof was made of Zinc). Pipe-borne water was collected from a public tap in a state capital city; borehole water was collected from a borehole found in one of the farms visited earlier during the survey. Pipe-borne and borehole water were allowed to run for two minutes before samples for analysis were collected. River water was collected from off the shore of one of the rivers identified by a farmer as his source of farm water using sterile containers. Samples were submitted for analysis within two hours of collection, and analysis was done according to AOAC (1984). Data obtained were then compared with standard recommended for drinking water.

Data Analysis

Proportions of respondents were obtained for the most commonly used sources by pigs and poultry farmers. Descriptive statistics were used to analyze the data. Bar graphs were also used in presenting the results.

Results and Discussion

Results of the survey of sources of water used by farmers in the region are presented on Table 1. Most farmers (pig, 23%; poultry, 27%) used a combination of rain, pipe-borne and borehole water, while about 14% of pig farmers and about 12% of poultry farmers used borehole water alone. A combination of pipe-borne water and borehole water was adopted by 8.18% of pig farmer and 8.79% of poultry farmers in the region. Very few poultry farmers (1.82%) used a combination of pipe-borne water and river/stream water; and no pig farmer used such combination. The fact that most farmers (80% of pig farmers and 85% of poultry farmers) used more than one source of water shows that these various sources are not very reliable. For instance, pipe-borne water is provided mostly from governmental agencies and is very erratic in supply; rainfall is often very seasonal and unpredictable; while boreholes are owned by private individual who depend on erratic electricity supply. They may also fail due to malfunctioning of equipment. Despite the fact that most of this region is in the Niger Delta, with many tributaries of River Niger and various other rivers/streams, only 6% of pig farmers and 3% of poultry farmers depended on this source alone for their farms. Their main reason was that it was laborious to use river/stream than borehole water. Low utilization of this source was also attributed to its unclean nature bearing that wastes and rotten materials are washed down or thrown into this source. However, farmers made use of water from this source where there are no alternatives, and some used it mostly for washing utensil, floor of pens and for wallowing since it is cheaper. Rain water was used by only 58% of pig farmers and about 61% of poultry farmers, mostly complemented by other sources. Ajuwon *et al*. (2002) stated that enormous rain water in Nigeria could be harvested at lesser cost for poultry production. The result of this survey is also presented in form a bar chat in figure 1.

Table 1. Distribution of pigs and poultry farmers and their various water sources

Water sources	Frequency of pig farmers	Percentage	Frequency of poultry farmers	Percentage	Total	Percentage
Rain (A)	-	-	-	-	-	-
Pipe-borne (B)	-	-	-	-	-	-
Borehole (C)	30	13.64	39	11.82	69	12.55
River/Stream (D)	14	6.36	10	3.03	24	4.36
A and B	-	-	-	-	-	-
B and C	18	8.18	29	8.79	47	8.55

C and D	13	5.91	23	6.97	36	6.55
A and D	12	5.45	12	3.64	24	4.36
B and D	-	-	6	1.82	6	1.09
A and C	10	4.55	25	7.57	35	6.36
A, B and C	51	23.18	88	26.67	139	25.27
A, B and D	12	5.45	29	8.79	41	77.45
B, C and D	17	7.73	22	6.67	39	7.09
A, C and D	27	12.27	35	10.60	62	11.27
A, B ,C and D	16	7.27	12	3.64	28	5.09
Total	220	100	330	100	550	100

Table 2. Result of laboratory analysis of water used by farmers.

Parameters (mg/l)	Rain water	Pipe-borne water	Borehole water	River water	WHO
Total solids	8.64	12.6	16.1	286.5	250
Hardness	-	-	38.16	15.92	50
p^H	5.6	6.3	6.1	6.8	6.0-8.0
Nitrates		-	-	31.66	45
Sulphates	4.94	24.6	36.26	128.54	200
Phosphates	3.66	16.48	22.6	114.48	200
Calcium	0.86	6.67	42.22	16.56	50
Zinc	0.06	0.76	2.04	1.86	5
Iron	0.12	0.82	1.28	0.36	0.3
Copper	ND	0.12	0.01	0.03	0.6
Arsenic	ND	ND	ND	0.04	0.05
Lead	ND	ND	0.02	0.08	0.05

Manganese	ND	ND	0.01	0.01	0.05
BOD	0.80	1.10	1.20	2.4	3
Coliform	Nil	Nil	Nil	6	Nil
Helminthes	Nil	Nil	Nil	Nil	Nil

WHO: World Health Organization

Table 2 shows the result of laboratory analysis of the different water sources collected in the study area. Total solids were lower in rain water, pipe-borne water and borehole water, but higher in river water. These levels may not cause serious health hazard to pigs and poultry. The pH range of water samples from these sources was between 5.6 and 6.8 which indicated all the samples were slightly acidic. Morris (2002) found out that some well water in southern part of Northern Carolina similarly had pH lower than 6. Blake and Hess (2001) stated that lower pH range can have negative effect on performance and could be corrosive to equipment too, while high pH can clog watering systems. Nitrates level was higher in rain water than river water, but nitrates were not detected in pipe-borne and borehole water. Nitrates may not be very harmful to animals, but when they are converted to nitrites, they tend to reduce oxygen-carrying capacity of blood by reacting with the haemoglobin (Pfost *et al.* 2001). Carter and Sneed (1996) specified that nitrates levels above 20 mg/l may affect performance of animals. Sulphates were more in river water (128.54 mg/l) although still below the WHO permissible limit of 250 mg/l. United States Environmental Protection Agency (2003) advised that sulphate levels in drinking water be reduced to 250 mg/l since higher content affects taste of water. High concentration of calcium in borehole water may be the reason for hardness level observed. This may make water unpalatable to animals and can also form scales on plumbing pipes thereby blocking flow to and in farms. Reports by Vodela *et al.* (1997) indicated that increase in levels of drinking water contaminants (arsenic, cadmium, lead, benzene, trichloroethene) at low levels of vitamins and minerals diet resulted in the suppression of natural immunity, humoral and cell-mediated immune responses. Biological factors were also considered in this quality analysis. The absence of helminthes in all the water sources investigated suggests that water from these sources may be good for drinking. However, the fact that coliform was detected in river water at higher levels may hinder the usefulness of this source unless it is treated before use. Chemical shock treatments can be used to suppress formation of biofilms and slime layers followed by use of organic acids for controlling harmful bacteria (Quiroz, 2008).

Conclusion

The current importance and higher growth rate of livestock production in this region in particular and worldwide in general, call for proper planning of water resource development and management. Large scale farming requires more water, and livestock farmers will probably find it difficult to maintain high quality water supply in future due to global warming which may decrease precipitation, thereby leading to higher concentration of contaminants in water sources. Increase industrialization may lead to more use of water resources from natural sources and could also result in high pollution rate of open surface water sources. In Nigeria, it is noticed that the cost of acquiring water for farming and domestic uses are increasing. This should call for urgent intervention in this sector, especially now that the Federal Government is turning attention to power supply. Conscious effort should be made to control all wastage, improve sanitation and increase participation in generating portable water in order to ensure adequate supply of drinking water to livestock farms in the region.

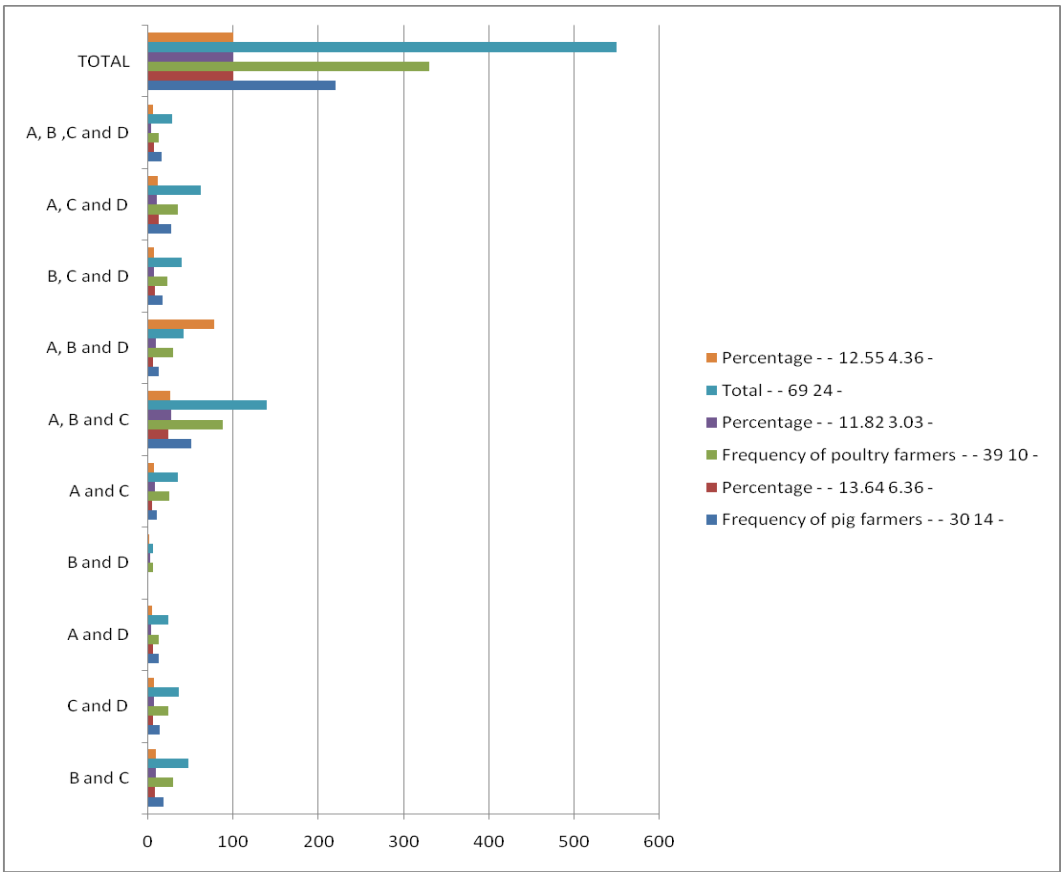

Figure 1. Graphical representation of poultry and pigs farmers and their sources of water

References

Abbas, T E.E., Elzubier, E.A. and Arabbi, O. H. (2008). Drinking water quality and its effects on productive performance of layers during winter season. Intl. J. Poult. Sci., 7(5): 437- 440.

Ajuwon, K.M., Matanmi, O. and Daniyan, O.C. (2002). Effect of water sources and ascorbic acid supplementation on egg quality and production parameters of laying hens. Livestock Research for Rural Dev., 14 (6) 2002. http/www.cipav.org.org.co/1rrd/1rrd14/6/ajuw146 .htm

AOAC (Association of Analytical Chemists) 1984. Official Methods of Analysis. 14th edition, Arlington.

Balnave, D. (1993). Influence of saline drinking water on egg shell quality and formation. World's Poultry Science Journal, 49:109 - 119.

Blake, J.P. and Hess, J.B. (2001). Evaluating water quality for poultry. Alabama Cooperative Extension system, ANR-1201.

Carter, T.A. and Sneed, R.E. (1996). Water quality and waste management- Drinking water quality for poultry. North Carolina Cooperative Extension service.

Mclease, J.M., Tremblay, M.L., Patience, J.F. and Christison, G.I. (1992). Water intake patterns in weaning pigs: effect of water quality, antibiotics and probiotics. Anim.Prod., 54:135.

Morris, R. (2002). Water quality affects poultry production- Agronomic services news release. www.ncagr.com/agronomic

Pfost, D.L., Fulhage, C.D and Casteel, S. (2001). Water quality for livestock drinking. EQ 381 pp.8.

Scott, M. L., Nesheim, M. C. and Young, R. J. (1982). Nutrition in the chicken. 3rd edn. Humphrey Press Inc., Geneva.

Quiroz, M. (2008). Water quality and broiler performance. North Carolina Cooperative Extension service. College of Agriculture and life sciences.

Vodela, J.K., Renden, J.A., Lenz, S.D., Mcelhenny, W.H. and Kemppainen, B.W. (1997). Drinking water contaminants (arsenic, cadmium, lead, benzene and trichloroethylene).1. Interaction of contaminants with nutritional status on general performance and immune function in broiler chickens. Poult. Sci., 76:1474 - 1492.

United States Environmental Protection Agency (2003). Drinking water Advisory: Consumer acceptability advice and health effects analysis on sulfate. www.epa.gov/safewater.ccl/pdf/sulfate.pdf