Scholars Journal of Agriculture and Veterinary Sciences **e-ISSN 2348–1854**
Sch J Agric Vet Sci 2015; 2(2B):131-134 **p-ISSN 2348–8883**

(An International Publisher for Academic and Scientific Resources) DOI: 10.36347/sjavs.2015.v02i02.011

Assessment of Sanitary Conditions and Quality of Water Used for Processing at Ado - Ekiti Municipal Abattoir, Ekiti State, Nigeria

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Abstract: Physicochemical and bacteriological properties of water used in Ado-Ekiti Municipal abattoir in Ekiti State, Southwestern, Nigeria and the general sanitary condition of the abattoir were assessed. Water samples from three sources; Rain, Well and Borehole used for meat processing were analyzed. Also pictures of the activities of butchers and other abattoir personnel were taken to show sanitary condition of the abattoir. Water samples were collected for the determination of pH, Temperature, Total Dissolved Solids (TDS); Total Suspended Solids (TSS); Biochemical Oxygen Demand (BOD); *Coliforms*; *Pseudomonas aeruginosa*; *Faecal streptococcus* and *Clostridium perfringens.* The pH and Temperature for the three sources as well as the TDS and TSS for rainwater and borehole water samples were statistically similar, however values of TSS and TDS obtained for wellwater samples were significantly different($p<0.05$)from other two sources.BOD for rainwater and borehole water samples were significantly different($p<0.05$). *Coliform* values for rainwater were significantly higher than water samples collected from other two sources, also *Faecal streptococcal* values of wellwater and borehole were significantly different from that of rainwater ($p<0.05$), however there is no significant difference($p>0.05$) in the values of *Pseudomonas aeruginosa* and *Clostridium perfringes* for water samples collected from the three sources. Butchers and other abattoir personnel involved in different abattoir operations were not screened to ascertain their health status which is essential for processing of wholesome meat for public consumption. There were no adequate ante mortem and post mortem inspection and animals were slaughtered on bare floor while meat were washed indiscriminately in water from the three sources. The sanitary condition of the abattoir is far from the standard recommended by the Codex Alimentarius Commission on food hygiene and this constitute serious public health hazard to both the abattoir personnel and the public consuming the meat from this abattoir.
Keywords: Abattoir, Water, Physicochemical, Bacteriological, Sanitary,Total Suspended Solids, Total Dissolved Solids, Biochemical Oxygen Demand, Coliforms, Public Health.

INTRODUCTION

The availability of safe drinking water as well as uncontaminated water used for processing is indispensable to preventing diseases and improving the quality of life. Water for consumption and use are derived from various sources which include rainfall, well, borehole, spring, river, stream, sea, ocean, lake while artificial sources includes distilled water, purified or treated water[1].

Water is indispensable in abattoir processing operations, however water so used must be clean, safe and free from microbial contaminations because historically water has played significant role in the transmission of diseases and as such water used in the washing of carcasses could serve as a good source of contamination, therefore water used for cleaning procedures must meet drinking water standards and by definition this water should not contain chemical substances or microorganisms in amounts that could cause health hazards [2].

Adeyemo et al, [3] observed that in Bodija abattoir at Ibadan, Southwestern, Nigeria wells sited within and around the abattoir is primarily used by butchers in dressing carcasses and also serves as source of drinking water for the abattoir workers, also they inundated that the activities within the abattoir were being carried out in a most unhygienic manner because butchers were seen eating and drinking freely and spitting within the slaughter hall. Microbiological and physicochemical analysis of water is a powerful and foremost tool needed to foreclose the presence of microorganisms and dangerous chemicals that might constitute a health hazard[4].

MATERIALS AND METHODS

Study Location

The study location is Ado Ekiti municipal abattoir, Ekiti State which is one of the states in Southwest of Nigeria. It is the largest abattoir in the state as it slaughters over 700 cattle per week. It has sections such as lairage, slaughter slabs and butchering sections. One characteristic of this abattoir is high

traffic of humans and carcasses. Water used for processing is from well and borehole within the abattoir as well as rainwater collected in a reservoir.

Water Sample Collection Method

500mls water samples were aseptically collected as follows:

- 6 samples were collected from the well
- 6 samples were collected from the borehole
- 6 samples were collected from rainwater reservoir
- Samples were transported to the laboratory immediately after collection.
- Samples were processed immediately at the laboratory, that is, between 6- 12hours post collection.

Sanitary Condition Evaluation

On the spot assessment of the abattoir facilities and operations were carried out and photographs were taken as proves. Also abattoir personnel were interviewed on various abattoir operations.

Physicochemical Assessment of Water Samples

pH was determined using a digital pH meter while Milton Roy(USA) Spectronic 20D meter was used to determine the turbidity of the samples.BOD coefficients of the samples were determined using the Winkler's Titration Method as recommended by APHA[5]. Gravimetric method involving filtration and evaporation were used to measure TSS and TDS.

Bacteriological Assessment of Water Samples

Clostrium perfringes and *Pseudomonas aeruginosa* and *Faecal streptococci* counts were done according to the international standard method prescribed by the APHA[5].

About 100mls of the water sample was filtered through a filter that retains bacteria. The filterate was then transferred to Petri dishes containing MacConkey agar and incubated at 37^0C for 48hours [5]. The numbers of coliform colonies formed were counted using a microscope and then the values were expressed as CFU/ml.

Data analysis

Experimental results were analyzed using one-way analysis of variance (ANOVA) to determine the significant difference between the means. Differences were considered at $P<0.05$.

RESULTS AND DISCUSSION

Table 1 showed the physicochemical values of water sample from well, rain and borehole. From the table, TSS and TDS value of rainwater and borehole which are statistically ($p>0.05$) similar were significantly different ($p<0.05$) from that of wellwater. Also, BOD value of wellwater and borehole which are statistically ($p>0.05$) similar were significantly different ($p<0.05$) from that of rainwater. The pH and Temperature of water samples from the three sources however were similar ($p>0.05$) statistically. The high values of TSS and TDS obtained for wellwater implies high dissolution of waste materials in this water sample used for processing while the high BOD value implies that there is possibility of excessive dissolved gaseous industrial pollutants in the rainwater thus making it low in oxygen tension. This result corroborates Adeoye *et al* [7] that the quality of water from well in local abattoir generally is poor.

Table 2 showed the bacteriological values of water sample from well, rain and borehole. From the table, coliform values of rainwater and borehole water which are statistically similar were significantly different ($p<0.05$) from that of wellwater. Also, *Pseudomonas aeruginosa* values of wellwater and borehole water which are statistically similar were significantly different ($p<0.05$) from that of rainwater. The *Faecal streptococci* and *Clostridium perfringes* values of water samples from the three sources were however similar statistically. The high coliform value obtained for wellwater implies high dissolution of waste materials in this water sample used for processing while the high *Pseudomonas aeruginosa* values obtained for wellwater and borehole water implies that there is possibility of excessive dissolved gaseous industrial pollutants in the rainwater thus making it low in oxygen tension. This result agrees with the work done by Oduyiga and Oduyiga [6] that groundwater obtained from well and borehole in an abattoir is high in coliform and *Pseudomonas aeruginosa*.

Table 1-Physicochemical values of the three water sources

Physiochemical properties	Well water	Rain water	Borehole water
pH	7.35 ± 1.34^a	7.20 ± 1.41^a	7.00 ± 1.84^a
Temperature (^{o}C)	26.85 ± 0.07^a	27.25 ± 0.35^a	27.05 ± 0.07^a
TSS (mg/l)	1134.50 ± 173.24^a	173.50 ± 3.54^b	122.50 ± 122.33^b
TDS (mg/l)	836.50 ± 115.26^a	46.00 ± 16.97^b	93.00 ± 86.27^b
BOD (mg/l)	59.00 ± 4.24^{ab}	61.50 ± 4.95^a	57.50 ± 3.54^b

Means with different superscript are significantly different($p<0.05$)

Table 2-Bacteriological values of the three water sources

Bacteriological properties	Well water	Rain water	Borehole water
Coliform(10^4CFU/ml)	112.00±28.28[a]	51.00±12.73[b]	48.50±4.95[b]
Pseudomonas aeruginosa (10^4CFU/ml)	38.00±31.11[a]	1.80±1.70[b]	25.00 ±21.21[a]
Faecal streptococci (10^4CFU/ml)	0.70 ±0.14[a]	0.15 ±0.07[b]	0.50 ±0.28[ab]
Clostridium perfringes (10^4CFU/ml)	0.85 ±0.92[a]	0.90±0.14[a]	0.15±0.07[a]

Means with different superscript are significantly different($p<0.05$)

The hygienic quality of water from any source is determined primarily by the kind of microbes and chemicals present in it. It was discovered from this study that TDS, TSS, BOD and bacteriological values for wellwater samples were the highest and the values for the rainwater were the lowest. This implies that the best source of water for processing meat among the three sources is rainwater but when rainwater is not available the second best source is the borehole.

Wellwater should not be used for processing because it is highly contaminated with microbes and also the physical impurities are high. This is due to the fact that drawing buckets are left lying in the mud and on the slaughter slab and re-used at will.

Generally, the condition under which carcasses are being dressed at Ado Ekiti abattoir is far from ideal, however if water from least contaminated source is used then the contamination of processed meat will be minimized.

Fig.1 and Fig.2 shows the unhygienic slaughtering and meat processing activities taking place in the abattoir. Fig.1 shows slaughtering and butchering activities been done indiscriminately on dirty and unkempt abattoir slaughter hall floor. Fig.2 shows a butcher washing meat in wastewater and effluents filled drainage.

Fig.3 shows a butcher carrying out butchering activities on the ground without concern for public health. Meat processed this way will be ladened with soil particles as well as soil microbes which are injurious to human health.

Fig.4 shows carcasses of slaughtered cattle been dragged on the ground out of the abattoir slaughter hall for butchering around the abattoir environment or for transportation to other areas of the city for sales to human in those areas.

Fig- 1: A butcher washing meat in effluent filled drainage in the slaughter hall of the abattoir

Fig-2: Slaughtering and Butchering on unkempt floor of the slaughter hall

Fig.3: A butcher carrying out butchering activities on bare ground.

Fig.4: Carcasses of slaughtered cattle is been dragged on bare ground.

CONCLUSION AND RECOMMENDATION

This work inundates the fact that wellwater used at Ado-Ekiti Municipal abattoir is not hygienic for the processing of meat and this will constitute serious public health risk. The abattoir management authorities should make available the best water source which is the borehole and such borehole should be sited away from waste points and drainages. This will reduce the level of contamination from water used for processing. Also best practices for meat processing should be inculcated by the butchers to reduce or totally eliminate contaminations that occurred as a result of their unhygienic activities. All these will cumulatively improve the hygienic value of meat and meat products from this abattoir.

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