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EVIDENCE OF BACTERIAL CONTAMINATION AT DIFFERENT LOCATIONS OF THE CENTRAL ABATTOIR AKINYELE, OYO STATE

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ABSTRACT: *Carcass and products derived from any abattoir are declared safe and fit for human consumption only if the maximum bacterial contamination limit is not exceeded. This study was designed to compare the level of bacterial contamination at different points of Akinyele Central Abattoir, Oyo State. Samples were collected from the drains, floors, walls, soil and water sources for microbiological analysis. The results presented varying degrees of contamination of sampled points due to identifying Salmonella sp., Escherichia coli, Campylobacter sp., Clostridium sp., and Staphylococcus sp., all of public health importance. However, the soil had the highest total bacterial load of 6.158±0.132 ×10^5/cfu/ml, followed by the slaughter floor (5.008±0.176 ×10^5/cfu/ml) and source of water (4.650±0.109 ×10^5/cfu/ml). This study demonstrated that the hygiene and sanitary levels of the abattoir have been compromised. It is hereby recommended that proper hygienic and precautionary measures should be instituted and implemented at this abattoir.*

KEYS: Akinyele, Bacterial contamination, Central abattoir, Hygiene

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INTRODUCTION

All over the world, slaughterhouses have been generally known to cause environmental pollution, either directly or indirectly, through various levels of activities (Adeyemi and Adeyemo, 2007). In Nigeria, adequate abattoir waste management is lacking in all public abattoirs such that large solid wastes and untreated effluents are common sites (Adeyemo 2002), unlike in developed countries where these facilities are adequately provided (Adebowale *et al*., 2010). Many abattoirs or slaughterhouses in Nigeria dispose of their effluents directly into streams and rivers and in the environment without any form of treatment (Alonge, 2002). Reports have also shown that indiscriminate disposal of abattoir effluents may introduce enteric pathogens into surface and groundwater, pathogens isolated from abattoir wastewaters can also survive in the environment. Whenever there is no prior treatment of the effluent, it may impair water bodies, thus, polluting the environment and posing a danger to humans and animals (Ogbonnaya, 2008). When organic matter exceeds the capacity of the micro-organisms in water that break down and recycle the organic matter, it encourages rapid growth or blooms of algae leading to eutrophication (Landhausser *et al*., 2001). Bacteria inhabit soil, water and wastes (Fredrickson *et al*., 2004).

Typically, 40 million bacterial cells are in a gram of soil and a million in a millilitre of fresh water (WHO, 2020). Choi (2013) submitted that microbes can be found everywhere; they are extremely adaptable to inclement conditions.

Bacteria from abattoir waste discharged into water bodies can be absorbed into sediments. When the bottom stream is disturbed, the sediments release the bacteria back into the water columns presenting long-term health hazards (Alonge,2001). Wastewater or effluent generated from the abattoir is characterized by the presence of many pathogenic microorganisms such as Salmonella, Escherichia coli (including serotype 0157:H7), Shigella, and parasite eggs, also, several pathogenic bacteria and fungi species have been isolated from abattoir wastewater and surface water; including *Staphylococcus sp*, *Escherichia coli*, *Streptococcus sp, Salmonella sp,* (Adesemoye *et al*., 2006). These pathogens might threaten public health by migrating into ground or surface water. This study was therefore designed to compare variations in contamination at different locations of the Central abattoir, Akinyele, in Oyo state.

MATERIALS AND METHODS

Study Location and materials

The samples for this study were collected at Akinyele abattoir. Akinyele is one of the local government areas in Oyo state, Nigeria (latitude 7º 56'15'; longitude 3º 90' 61'). The laboratory analysis was conducted at the Microbiology laboratory at the Institute of Agriculture Research and Training Moor Plantation Ibadan. This study ran from 5th April 2019 to 5th June 2019. This covered the periods for sample collection and all laboratory activities.

The materials used in the course of this study include well-labelled sterile swab sticks, well-labelled sterile sample bottles, ice packs, cooler, Petri dishes, autoclave, wire loop, agar, Autoclave, Oven, Fridge, measuring cylinder, Test tube, Methylated spirit, weighing scale and colony counter.

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Sample Collection and Laboratory Procedures

The samples were collected by using the labelled sterile swab stick to scrub the floor and wall of the slaughter hall before slaughtering, well-labelled sample bottle was used to collect 3 samples each of drain before and after slaughtering, and three samples of the source of water were collected using well-labelled sample bottles as well, every sample was placed in a cooler containing ice packs. It was taken to the laboratory for analysis.

These samples were taken to the laboratory for microbiological studies within 6 h (of collection). The samples were analysed for microbial quality as FAO (2007) described at the Department of Microbiology, Institute of Agricultural Research and Training (I.A.R.&T.), Apata, Ibadan. The samples were placed on trypticase-soya –agar (TSA) for trophic bacteria. Petri dishes were incubated at 37ºC for 48 - 72 h while the cultures were observed daily under a stereoscopic microscope for the presence of bacterial colonies. The media used were weighed out and prepared according to the manufacturer's specifications with respect to the given instructions and directions. The serial dilution method was used for total microbial counts.

Pure isolates of resulting growth were identified using morphological and biochemical methods described by Lennette et al. (1985) and Jolt et al. (1994). The number of occurrence of each identified bacterium were recorded. The sterility of each batch of test medium was confirmed by incubating one or two un-inoculated tubes or plates along with the inoculated tests. The un-inoculated tubes or plates were always examined to show no evidence of bacterial growth.

All data were subjected to analysis of variance (ANOVA) according to the standard procedure described by Steel and Torrie (1980). Duncan's multiple range test was used to compare means found to be statistically significant ($p < 0.05$), as described by Obi (1990).

RESULTS

Table 1 shows the comparison of *Salmonella sp*. count for the different locations surveyed, the *Salmonella* count of the drains (0.200± 0.025) is not significantly different from those of the walls (0.183±0.027), but both are greater than ($p<0.05$) the *Salmonella* counts in the water (0.112±0.029) and soil (0.000±0.000).

TABLE 1: Comparison of *Salmonella* count at the surveyed locations of Akinyele abattoir.

Locations	*Salmonella* count $\times 10^5$/cfu/ml
Drains	0.200 ± 0.025^{a}
Floor	0.143 ± 0.023^{ab}
Soil	0.000 ± 0.000^{c}
Wall	0.183 ± 0.027^{a}
Water	0.112 ± 0.029^{b}

[a, b,c] mean values that are in the same column with different superscripts are significantly different $P<0.05$

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For the comparison of *E. coli* count at the surveyed locations of Akinyele abattoir, the highest count of 0.900±0.043 was recorded in the floor and water (0.835±0.031), there was no significant difference among the other samples surveyed (Table 2).

TABLE 2: Comparison of *E. coli* count at the surveyed locations of Akinyele abattoir.

Locations	*E. coli* count $\times 10^5$/cfu/ml
Drains	0.483 ± 0.032^{b}
Floor	0.900 ± 0.043^{a}
Soil	0.500 ± 0.081^{b}
Wall	0.450 ± 0.033^{b}
Water	0.835 ± 0.031^{a}

[a b c] mean values that are in the same column with different superscripts are significantly different P<0.05

Campylobacter contamination was observed in all sampled locations except, in the source of water at the abattoir, the highest count **(**0.233±0.072) was recorded in the soil around the abattoir (Table 3),

TABLE 3: Comparison of *Campylobacter* count at the surveyed locations of Akinyele abattoir.

Locations	*Campylobacter* count $\times 10^5$/cfu/ml
Drains	0.117 ± 0.011^{b}
Floor	0.133 ± 0.014^{ab}
Soil	0.233 ± 0.072^{a}
Wall	0.150 ± 0.015^{ab}
Water	0.000 ± 0.000^{c}

[a b c] mean values that are in the same column with different superscripts are significantly different P<0.05

Table 4 shows that the surrounding soil of the abattoir has the highest count of *Clostridium* sp (0.258±0.045), which is the same for the drains (0.233± 0.014) and floor of the abattoir (0.250±0.015), while the count for the wall and water is lower.

TABLE 4: Comparison of *Clostridium* count at the surveyed locations of Akinyele abattoir.

Locations	*Clostridium* count $\times 10^5$/cfu/ml
Drains	0.233 ± 0.014^{a}
Floor	0.250 ± 0.015^{a}
Soil	0.258 ± 0.045^{a}
Wall	0.050 ± 0.015^{b}
Water	0.000 ± 0.000^{b}

[a b c] mean values that are in the same column with different superscripts are significantly different P<0.05

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TABLE 5: Comparison of *Staphylococcus aureus* count at the surveyed locations of Akinyele abattoir.

Locations	*Staphylococcus aureus* $\times 10^5$/cfu/ml
Drains	0.617 ± 0.042^{c}
Floor	1.425 ± 0.054^{a}
Soil	0.942 ± 0.045^{b}
Wall	0.967 ± 0.058^{b}
Water	0.750 ± 0.073^{bc}

$^{a\ b\ c}$ mean values that are in the same column with different superscripts are significantly different $P<0.05$

The highest total bacterial count of 6.158±0.132 was recorded in the surrounding soil of the abattoir, there was no difference between the total bacterial count of the floor (5.008±0.176) and water (4.650±0.109). The lowest count was observed in the drains and walls (2.458±0.098).

TABLE 6: Comparison of the total bacterial count at the surveyed locations of the Akinyele abattoir.

Locations	Total bacterial count $\times 10^5$/cfu/ml
Drains	2.608 ± 0.068^{c}
Floor	5.008 ± 0.176^{b}
Soil	6.158 ± 0.132^{a}
Wall	2.458 ± 0.098^{c}
Water	4.650 ± 0.109^{b}

$^{a\ b\ c}$ mean values that are in the same column with different superscripts are significantly different $P<0.05$

DISCUSSION

All the locations sampled (water, drains, soil, floor, wall) at the Central abattoir contained bacteria (*Salmonella sp., E. coli, Campylobacter sp., Clostridium sp., Staphylococcus sp.*) that are of public health importance and can at the same time cause different levels of contamination of meat and meat products, thereby constituting a threat to food safety (Biswas et al., 2011).

When abattoir facilities are not in conformity with standard conventional requirements or when such facilities are available but non-functional, standard operating procedures and good hygiene practices are compromised in the abattoirs, which may pose a danger to public health (Stevenson, 2001). It was observed that the source of water was heavily contaminated due to the high *E. coli* count. This is probably a result of faecal contamination (Malhotra et al., 2015) due to indiscriminate disposal of abattoir waste and effluents on soil surfaces and water bodies. Hence, the surface run-offs find their way back to the water source with the accompanying debris.

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The mean total bacterial count was high for samples from the studied abattoir; going by international standards, any water contaminated to this level is neither good for domestic use nor should it be discharged directly into the environment without treatment.

Just as in previous stages of the meat chain, cross-contamination from equipment, personnel or the working environment is likely to occur during the production of meat products if appropriate control measures are not effectively put in place (Wong et al., 2002).

The faecal shedding of *Salmonella* and pathogenic *E. coli* constitutes an important factor in cattle contamination. In fact, pathogens excreted in the faeces may contaminate the environment through which other cattle can acquire contamination and carry the bacteria in their digestive tract and/or on their hides (Rhoades et al., 2009). The contamination of live cattle destined for slaughter may occur at the farm level, during the transportation of cattle to the slaughterhouse or during the lairage period in the abattoir (Niyonzima et al., 2015).

The total bacterial population obtained from the contaminated abattoir soil was also high. The organisms, such as those isolated from the abattoir sites and wastewater samples reported in this study, are a normal part of the gut flora found in livestock animals' intestines, tripes and offals. In contrast, others are found in water or soil or are parasites on various animals and plants, as is commonly found at abattoir sites. Moreover, they are often the causes of gastroenteritis outbreaks, urinary tract infections and neonatal meningitis (Wallace et al., 2011). Therefore, the present study's results underscore the poor hygiene practices at Akinyele Central abattoir sites.

CONCLUSION

This study has shown that the hygiene level of the surveyed abattoir is very poor, manifested by varying degrees of contamination with different types of bacteria that are of public health importance identified.

The source of water used at the slaughterhouse is the most contaminated of the sampled locations.

Based on the result of this study, it is hereby recommended that proper hygienic measures and precautions should be taken to prevent or minimise bacterial pathogens at the different locations of Akinyele Central abattoir.

The supervision of every stage of meat inspection and hygiene should be ensured. Also, proper waste and effluent disposal must be cultured to prevent environmental contamination.

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