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Evaluation of Bacterial Composition of the Aerosol of Selected Abattoirs in Akure, South Western Nigeria

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Abstract**—**This study was carried out to reveal the bacterial composition of aerosol in the studied abattoirs. Bacteria isolated were characterized according to microbiological standards. Factors such as temperature and distance were considered as variable in this study. The isolation was carried out at different temperatures such as 27°C, 31°C and 29°C and at various distances of 100meters and 200meters away from the slaughter sites. Result obtained showed that strains of *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Lactobacillus alimentarius* and *Micrococcus* sp. were identified. The total viable counts showed that more microorganisms were present in the morning while the least viable count of 388cfu was recorded in the evening period of this study. This study also showed that more microbial loads were recorded the further the distance is to the slaughter site. Conclusively, the array of bacteria isolated suggests that abattoir sites may be a potential source of pathogenic organisms to commuters if located within residential environment.

Keywords**—**Abattoir, Aerosol, Bacterial Composition, Environment.

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I. Introduction

AN abattoir otherwise known as slaughterhouse is a facility where animals are killed for consumption as food products. It can be defined as livestock producing industries comprising operations relating to animals processing [11]. The major activities involved in the operation of an abattoir according [4] carcass boning and packaging, drying of skin and transport of processed materials.

Odor (air borne waste) is a major problem associated with abattoirs. Operations such as cooking and rendering process (include stale materials and fugitive emissions from cookers), waste effluent treatment plant, waste disposal technique such as burning dead stock animal holding pens (produced by manure and urine), odors from blood, skin handling and skin shed have been potential sources of pollution. Materials burned at an abattoir include coal or gas for boilers and steam production, diseased animals, sludge etc. Also, fuel burning which gives rise to atmospheric emissions is a source of pollution.

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Bio-aerosols are usually defined as aerosols or particulate matter of microbial, plant or animal origin that is often used as synonymously with organic dust. Bio-aerosols or organic dust may consist of pathogenic or non-pathogenic live or dead bacteria, fungi, viruses, high molecular weight allergens, plant fibers, mycotoxins, peptidoglycans, β (1→3)-glucansetc [3].

The interest in bio-aerosol exposure has increased over the decades. This is largely because it is now appropriately recognized that exposure to biological agents in both residential and occupational indoor environment are associated with a wide range of adverse health effects with major public health impact. The diseases associated with bio-aerosol can be grouped into infectious diseases, respiratory diseases and cancer. Other adverse health effects as reported by [2], [7] include dermatitis in latex workers and pre-term birth or late abortion in farm women exposed to mycotoxins with immunetoxic and hormone-like effects. In this study, the bacterial composition of aerosol in and around abattoir sites is however investigated to assess the potential health effect of such facility in the environment.

II. Methodology

A. Collection of Samples

Two major abattoir sites were visited trice for the collection of samples. They include Onyearugbulem slaughter house, Akure and the slaughter house at The Federal University of Technology, Akure Junction. The samples were collected aseptically by exposing agar plates of both general and selected culturing media such as nutrient agar, Eosin Methylene blue agar, and Mannitol salt agar to the abattoir air at the slaughter line and some meters away (100meters and 200meters) from the abattoir sites. These plates were exposed both in the morning (27^0C), afternoon (31^0C) and evening (29^0C) thereafter were transferred into the laboratory and incubated at 37^0C for 24 hours. Meanwhile the plates were coded with identity.

B. Isolation of Microorganisms from Aerosols

The resultant colonies at the end of incubation were counted to know the total viable count and sub cultured to obtain pure cultures. Gram staining was carried out on the subculture to ascertain purity, which were thereafter transferred into double strength medium slants for further studies and identification. Cultural characterization of colonies; color, edge, elevation,

surface and physiological and biochemical characterization tests using conventional methods [6] were employed.

III. Results and Discussion

The total viable count relatively varied with the different locations at the abattoir site (Table I). The abattoir B has the highest CFU at the slaughter line (606 cfu) as compared to Abattoir A (520 cfu). However, a relatively high value was recorded at some meters away from the abattoir site. At B_{L2} (200 meters from the abattoir site) more bacterial count of 685 cfu was recorded. The closer the distance to the abattoir the lesser the total viable count obtained. The effect of temperature on the total viable count was considered in this study. At different temperature range, the total viable count differs (Table I). At low temperature (morning (27^0C) and evening (29^0C)) number of isolated microorganisms is a bit high compared to when the temperature is high. This could be as a result of high rate of degradation which reduces the bacterial load of some specific microorganisms which might not be able to adapt to the sudden change of environmental condition.

The presence of some of the isolated microorganisms in the abattoir is hazardous to human. The tests carried out showed biodiversity of both Gram positive and Gram negative pathogenic and non-pathogenic bacteria in the abattoir sampled (Table II). The species of bacteria were identified as *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Lactobacillus alimentarius* and *Micrococcus* sp. *Lactobacillus* sp. are known to cause spoilage in meat. Lactic acid bacteria can grow and spoil the meat when the oxygen tension in the package is low [8]. *Lactobacillus alimentarius* is reported to be a potential airborne meat spoilage microorganism and should be considered a processing critical control point [9], [5]. *Escherichia coli* is a bacterium responsible for outbreak of diarrhea. It is common in gastro intestine of warm blooded animals. Their presence is attributed to poor hygiene. This bacterium is known to cause food poison when taken in and result into gastro intestinal disease [12]. *Staphylococcus aureus* can cause a wide variety of diseases in human and other animals through toxin production. Staphylococcal toxins are a common cause of food poisoning, as they can be produced by bacteria growing in improperly stored food items [1]. *Bacillus subtilis* is also known to cause disease in severely immunocompromised patients. It causes food poisoning and chronic skin infection [10]. In conclusion, the potential health effects of bio-aerosol from abattoir can be overwhelming; hence, the establishment of abattoir in residential environment can be a potential threat to humanity.

TABLE I
Bacterial Count (CFU) of Sampled Abattoir Sites at Different Period of the Day

Sample	Total Viable Count(cfu)		
	Morning (27^0C)	Afternoon (31^0C)	Evening (29^0C)
A_{SL}	520	450	388
A_{L1}	600	560	520
A_{L2}	633	592	542
B_{SL}	606	557	475
B_{L1}	674	565	545
B_{L2}	685	624	566

Legends
ASL- abattoir at the junction of federal university of technology, Akureslaughter line
AL1- abattoir at the junction of federal university of technology, Akure100meters from slaughter line
AL2- abattoir at the junction of federal university of technology, Akure200meters away from slaughter line
BSL- abattoir at Onyearugbulemmarkrt, Akureslaughter line
BL2- abattoir at the Onyearugbulemmarket, Akure100 meters away from abattoir site
BL2- abattoir at the Onyearugbulemmarket, Akure200 meters away from abattoir site

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TABLE II
FREQUENCY OF OCCURRENCE OF BACTERIA ISOLATES AT DIFFERENT PERIODS AND LOCATIONS

Sample Locations	Isolates				
	S. aureus	*L. ailmentarius*	*B. subtilis*	*E. coli*	*Micrococcus* sp
A_{MSL}	+	+	-	+	+
A_{ML1}	+	-	+	+	+
A_{ML2}	+	+	+	+	-
A_{NSL}	+	+	+	+	-
A_{NL1}	+	+	+	-	+
A_{NL2}	+	+	+	-	-
A_{ESL}	+	-	+	+	-
A_{EL1}	+	+	+	+	+
A_{EL2}	+	+	+	+	-
B_{MSL}	+	-	+	+	-
B_{ML1}	+	-	+	+	+
B_{ML2}	+	+	+	+	-
B_{NSL}	+	+	+	+	-
B_{NL1}	+	+	+	+	-
B_{NL2}	+	-	+	+	+
B_{ESL}	+	-	+	+	+
B_{EL1}	+	+	+	+	-
B_{EL2}	+	+	+	+	-

AMSL-morning samples from abattoir at the junction of Federal University of Technology, Akure slaughter line, **AM L1-** morning samples from abattoir at the junction of Federal University of Technology, Akure 100m away from abattoir site abattoir site,**AML2-** morning samples from abattoir at the junction of Federal University of Technology, Akure 200 m away from abattoir site, **ANSL** - afternoon samples from abattoir at the junction of Federal University of Technology, Akure slaughter line,**ANL1-**afternoonsamples from abattoir at the junction of Federal University of Technology, Akure 100 M Away From Abattoir Site, **ANL2-**afternoonsamples from abattoir at the junction of Federal University of Technology, Akure 200 m away from abattoir site, **AESL**- evening samples from abattoir at the junction of Federal University of Technology, Akure,**AEL1-**evening samples from abattoir at the junction of Federal University of Technology, Akure 100 m away from abattoir site,**AEL2-**evening samples from abattoir at the junction of Federal University of Technology, Akure 200 m away from abattoir site, **Bmsl-**morning sample from abattoir at Onyearugbulem market, Akure slaughter line**, BML1-** morning sample from abattoir at Onyearugbulem market, Akure100 meters away from abattoir site**,BML2-**morning sample from abattoir at Onyearugbulem market, Akure 200 meters away from abattoir site, **BNSL**- afternoon sample from abattoir at Onyearugbulem market, Akure slaughter line**,BNL1**- afternoon sample fromabattoir at Onyearugbulem market, Akure100 meters away from abattoir site,**BNL2-** afternoon sample from abattoir at Onyearugbulem market, Akure 200 meters away from abattoir site, **BESL-** evening sample from abattoir at Onyearugbulem market, Akure slaughter line**,BEL1-** evening sample from abattoir at Onyearugbulem market, Akure 100 meters away from abattoir site**, BEL2-**evening sample from abattoir at Onyearugbulem market, Akure 200 meters away from abattoir site. + - present, --- = absent

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