



Waste management and practices in a slaughterhouse in Abeokuta Nigeria: Case study, implications and alternative methods

OO Adebowale

Department of Veterinary Public Health and Reproduction, Federal University of Agriculture, Abeokuta, Nigeria

Correspondence: Tel.: +2349085608043; E-mail: oluwawemimo1@yahoo.com

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Abstract

The waste management operations at a main slaughterhouse (SH) in Ogun State was assessed. Waste generated included condemned organs, carcasses, ruminal contents, hair, hoofs, horns, faeces, blood and carcass trimmings which are poorly utilized. Solid wastes were observed as open dumps within SH facilities, while waste water was discharged in a nearby river, which also served butchers as main water source for meat washing. The unhygienic disposal of solid and liquid waste are potential threats to food safety, environment (air, surface and groundwater) and public health and some operable waste utilization strategies were described.

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Introduction

The livestock industry in Nigeria has grown over the years, thus making the country leading livestock producer in Africa (Maina, 2017). In an attempt to continuously increase livestock production, animal protein and human per capita consumption, a key pivot in the achievement of SDG 2 goal, there are related environmental and health issues associated with livestock waste generation. Slaughterhouse (SH) waste constitutes solid wastes, which include inedible animal tissues such as condemned meat/organ, undigested ingesta, ligaments, tendons bones, horns, hairs and aborted fetuses, (Franke-Whittle & Insam, 2013). While, the liquid waste is usually composed of

dissolved solids, blood, gut and contents (Chukwu *et al.*, 2008). SH waste, if not adequately re-utilized contributes to the transmission of foodborne diseases (Adeyemi & Adeyemo, 2006) and contaminates ground and surface waters with various pathogenic and non-pathogenic organisms (Elemile *et al.*, 2019). The effects worsen where abattoirs are located close to residential areas. An assessment of a Lagos state SH revealed that prevalence of flies, cockroaches, mosquitos and rats were considerably higher around residences at close proximity the slaughterhouse with associated polluting and adverse health effects (Olawuni *et al.*, 2015). In addition,

zoonotic and antimicrobial resistant pathogens have been demonstrated by past studies, which included *Salmonella* spp (Iroha *et al.*, 2016), *E. coli* O157 (Adebowale *et al.*, 2016), *Campylobacter* spp. (Sasakia *et al.*, 2014), *Cryptosporidium parvum* and *Giardia lamblia* (O'Handley & Olson, 2006). Apart from microbes reported, the presence constitutes a public nuisance and degenerates the aesthetic value of the environment (Ogbonna *et al.*, 2002).

Materials and Methods

The SH is located in Abeokuta, which is the capital city of Ogun state. Ogun borders Lagos State to the south, Oyo and Osun states to the north, Ondo to the east and the Republic of Benin to the west.

Results and Discussion

The SH consisted of facilities such as a lairage, administrative block, veterinary officer post, slaughter slabs and meat market. Hygiene amenities e.g., cooling room, hand washing, changing rooms and toilets and animal waste management were lacking. Post-mortem (PM) meat inspection was performed by qualified veterinarians and para-veterinarians and routine protocol included visual inspection, palpation and incision of visceral organs. Floor dressing and mixed operations (clean and dirty) were common practices observed.

SH generated wastes were separated into solid and liquid waste. The solid waste included condemned meat/organs, horns, hoofs, bones, hair, aborted fetuses, faeces, undigested ingesta and fats and oils. Solid wastes were seen as open dumps within the SH. Conversely, the liquid waste comprised blood, water usually directly from the slaughtering and cleaning processes, suspended ruminal contents and urine. The liquid waste drained into a nearby river, which also serves as main water source for meat washing. Plate I show the open dumps situated around the SH. In Nigeria, disposal of waste directly into streams and rivers is typical practice (Adeyemo, 2002; Adebowale *et al.*, 2012; Elemile *et al.*, 2019) (Plate I).

SHs in the country are typically characterised by inadequate waste management facilities, poorly designed and obsolete amenities, unhygienic operations, marshy surroundings due to poor drainages, insufficient government funding and policies and environmental pollution particularly of air and water (Adebowale *et al.*, 2012). The waste disposal methods identified in this SH were unhygienic, aesthetically unacceptable and a source of food safety threats. Plate III shows blocked

drainage at the SHs. A range of pollutants excreted with animal waste such as nutrients, nitrates, pathogens, natural and synthetic hormones, veterinary antimicrobials and heavy metals can find their way into the environment and pose direct or indirect human health hazards. Airborne pollutants and noxious gases produced from decomposed animal waste pile-ups increase greenhouse effects, pulmonary diseases, cardiovascular problems and early deaths (Ogbonna *et al.*, 2002). Similarly, the impact of the discharge of untreated SH waste on surface and ground water in Nigeria have been well documented (Kwadzah & Iorhemen, 2015; Adebowale *et al.*, 2016). The substandard methods of waste disposal impact food quality assurance. For instance, the SH is inadequately provided with potable water supply, subsequently resulting in the use of nearby stream for meat processes, which also serves as drains for wastewater effluents (Plate IV). Animals are sources of zoonoses and the use of contaminated streams could aid the propagation of diseases outbreaks among the public. Also, meat produced from unhygienic SHs are prone to quick deterioration due to a high level of bacterial contamination (Nwanta *et al.*, 2008).

The future of livestock-environment interface is shaped by resolving the balance between the demands of animal food products and the environmental impact (FAO, 2006). Various acceptable hygienic methods of SH waste disposal in order of hierarchy are discussed. The biogas technology is a multifunctional machinery for manure management and promotes the recovery and reuse of energy by adapting manure management practices to collect gas. It reduces greenhouse gas emissions, is a sustainable resource and utilised in the generation of electricity for SHs and farms, household heating and cooking and biofuel cars.

Moreover, to ensure biosafety and bio-security against animal diseases and the spread of infection, incineration is the best method. It is a waste solution for all agricultural waste and useful as an alternative heat source. It requires minimum land, can be operated in any weather, produces stable odour free residue and reduces greenhouse effects. However, this method requires substantial capital and operating costs as well as trained personnel (Kanja & Kumar, 2017).

Composting works under controlled conditions in which air, temperature and moisture content are regulated for bacterial growth and conversion of organic materials into resourceful one (Chapman,



Plate I. Open dumps of animal solid wastes, at a major slaughterhouse in Ogun State, Nigeria



Plate III: Blocked drainages within the slaughterhouse facility



Plate II: Liquid waste discharge into a river near the slaughterhouse in Ogun State, Nigeria



Plate IV: Pumping of water from the same river for meat washing

2005; NDSU, 2014). Composting process is a hygienic way of recycling nutrients of the organic by-products of agricultural, urban and industrial activities. From the environmental point of view composting enhances soil fertility, restoration of degraded solids and sequestration of carbon dioxide; hygiene perspective, organic matter is disinfected by the high temperatures processes (Shilev *et al.*, 2007), Rendering is a method of waste utilisation and recovery of fats from animal materials by heating without any loss of nutrients. It is acceptable to consign dead animals to another user who intends to process them for other purposes, including animal feed and biofuels. The temperature and process of rendering kill or inactivate disease-causing agents and has been viewed as a stage at which the disease transmission cycle can be disrupted (Sharma, 2003). This burial method is inexpensive where there is the availability of land. The method can be used for dead animals, condemned meat and meat products. Burial should be used only if all other options prove to be impractical. They must be located no closer than 120 meters from any well or spring that is used as a water

supply; 90 meters from any other surface water. The disadvantages associated with this method of disposal include risk of disease transmission, pollution and reduction in land value.

In conclusion, resolving waste issues in SHs in Nigeria should be collaborative to meet the specific needs of planning and implementation of chosen alternative strategies. Also, modernizations in slaughterhouse structures and installations, waste treatment, potable water supply and best practices to are required.

Conflicts of Interest

The authors declare no conflicts of interest.

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