



Assessment of microbial loads on cattle processing facilities at the demonstration abattoir in Ibadan metropolis Nigeria

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Abstract

The microbial load on facilities used in the processing of cattle carcass at the Bodija demonstration abattoir was assessed. A total of 108 swab samples were obtained from the abattoir wall, butchers knives, processing tables, floor, cattle carcasses before and after evisceration process and grown on plates to quantify the enterobacteriaceae and total aerobic viable counts (TAVC). Microbial analysis of the water used in cleaning and the discharge effluent was also done. The study revealed high values of both enterobacteriaceae and TAVC on surfaces of the processing facilities and a statistically significant difference ($P < 0.05$) in mean enterobacteriaceae and TAVC before and after processing of the wall, knife, table and floor. There was significant increase in both the enterobacteriaceae (96%) and TAVC (98%) on the carcass after evisceration. The mean TAVC for the water and effluent was 1.16 ± 0.1 and 13.79 ± 0.06 logcfu/ml respectively. This study showed the need to maintain good management practice, good hygienic condition and role of sanitation in our abattoirs.

Keywords: Meat, Enterobacteriaceae, Total Aerobic Viable Counts (Tavc), Carcass, Abattoir Facilities

Introduction

Meat is a good source of animal protein and the expectation of all consumers is to purchase meat that is safe and wholesome. Wholesome meat is produced hygienically, is pathogen free, retains its natural state and nutritive value, has optimum fat and is unconditionally acceptable to the consumers (Govindarajan, 1990). However, meat produced in an unhygienic condition could pose threat to the health of the consumers as well impair the keeping quality of such meat. Contamination of meat can result from contaminated air around which in turn contaminates the meat, the working surfaces and equipment used in the processing. Lues et al. (2007) have implicated microorganisms in bioaerosols to be an important source of food borne pathogens. The quality of water used in meat processing at the abattoir also play a major role in reducing meat contamination, as water is used in washing working surfaces, carcasses, blood off meat and equipment. The state of some abattoirs in Nigeria is such that encourages unsanitary practices as they are usually without modern waste disposal facilities. The abattoirs are often times congested with many people who may not have direct dealings with slaughtering and processing of the carcasses. The processes of slaughtering, evisceration and cutting into quarters are

done on the floor, while the knives used in processing are only washed with water but not sterilized. Efforts being made to maintain some level of cleanliness before and after close of work appear to be insufficient as cleaners often contend with access to potable water and poor drainage ways. There is also the major challenge of handling animal by products; waste products and effluents from processing activities at the abattoir. The problem of unhygienic nature and practices in abattoirs in Nigeria could also to a large extent affect the surrounding ecosystem. It has been implicated with pollution of the soil, surface and ground water (Amisu et al., 2003; Adesemoye et al., 2006). This work therefore compared the level of microbial contamination on working surfaces and equipments used in meat processing before and after work as well as on carcasses after evisceration, in the water used for processing and effluents. The need for proper decontamination treatments for reducing the prevalence of pathogenic bacteria on carcasses is also advocated.

Materials and Methods

Bodija Demonstration Abattoir is a state government owned modular scale enterprise located in Ibadan. Ibadan is a city in Oyo state in southern Nigeria; it is on latitude N $07^{\circ} 25' 977''$ and longitude

E 003° 54' 798'' (Geographical positioning system, etrex, Garmin, Taiwan). Ibadan has a land size of 240 km² and a population of over 3 million people (National Census, 2006).

Sample swabs were randomly collected aseptically in triplicates once a week for a period of 6 weeks from the abattoir walls, butchers knives, processing tables and floor before and after cattle processing as well as from cattle carcass before and after evisceration process. An area of 2cm² was used for swabbing and sterile swab soaked in sterile 0.1% peptone water was used for this purpose. The swab samples were kept in sterile tubes with screw caps on ice in a cooler and taken to the laboratory for further study. In addition, 10 mls each of the water used in processing and the effluent from processing were obtained aseptically in sterile bottles for immediate microbial analysis.

Sterile 10 ml of 0.1% peptone water was added to each tube containing the swab and vortexed for 10 seconds. Serial dilutions were made in sterile 0.1% peptone water. Appropriate dilutions were surface plated on MaConkey agar for enumeration of *enterobacteriaceae* count and on plate count agar for enumeration of total aerobic viable counts. Plates were incubated at 37°C for 18-24 hrs. The number of distinct colonies on each plate were enumerated using a digital colony counter (Model 3325, Leica Quebec Dark Field, Buffalo, NY, USA). Colony Forming Units (CFU) per ml or cm² of sample was calculated, using the dilution factor of each and converted to log₁₀CFU/cm² or ml values. Mean values of *enterobacteriaceae* counts and total aerobic viable counts in log₁₀CFU/cm² or ml of replicates were determined and reported as means ± Standard deviation (SD).

Statistical Analysis

The microbiological data were expressed in Log₁₀ cfu/cm² and log cfu/ml. The means and standard deviations were determined using Graph pad Prism. Student't' Test for paired samples was used to determine the levels of statistical significance at 95% confidence interval. Microsoft Excel 2003 was used for the Student't' test computation.

Results

The enterobacteriaceae counts and total aerobic viable counts (TAVC) before and after processing were presented in table 1. All counts were higher in facilities after processing than before processing (Figure 1). The enterobacteriaceae count and TAVC on the wall increased significantly by 99% and 100% after processing; while that on the butchers knife increased significantly by 100% each. There was an increase of 84% and 95% in enterobacteriaceae count and TAVC respectively on the processing table; while on the floor,

the enterobacteriaceae count and TAVC increased by 90% and 93% respectively. The enterobacteriaceae count and TAVC increased significantly by 96% and 98% respectively after the process of evisceration. The enterobacteriaceae count in the water was less than one log while the TAVC was 1.16 ± 0.10 log cfu/ml. The enterobacteriaceae count and TAVC in the effluent were 13.11 ± 0.04 and 13.79 ± 0.06 log cfu/ml respectively.

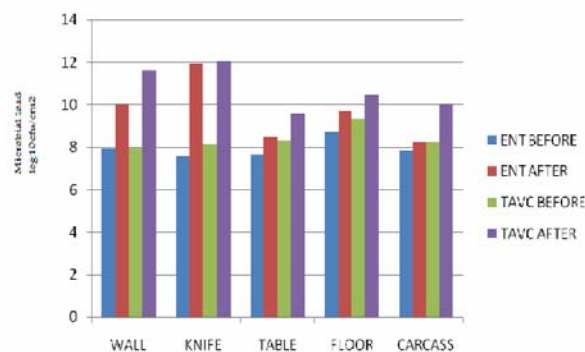


Fig. 1: Enterobacteriaceae and total aerobic viable counts before and after processing

Discussion

The primary focus of meat inspection is to ensure that meats produced are safe, wholesome and fit for human consumption. This study reported enterobacteriaceae count and TAVC from the abattoir wall before and after processing as 7.92 ± 0.02 ; 10.0 ± 0.17 and 7.96 ± 0.01 ; 11.63 ± 0.06 logcfu/cm² respectively. The TAVC of 7.96 ± 0.01 obtained from the abattoir wall before processing in this study is similar to, though higher than the TAVC of 6.22 ± 0.11 logcfu/cm² also obtained from the abattoir wall, reported by Sudhakar et al, 2009 at an abattoir in Mumbai, India. The high TAVC obtained from the abattoir wall in this study is an indication of the ineffective and inadequate cleaning of walls at the abattoir before commencement of work or at the close of work. The significant 100% increase in the TAVC obtained from the abattoir wall after processing is suggestive of lack of good management practice (GMP) at the abattoir. The enterobacteriaceae count and TAVC obtained from the butcher's knife before and after carcass processing were 7.57 ± 0.03 and 11.93 ± 0.06 ; 8.15 ± 0.02 and 12.05 ± 0.04 logcfu/cm² respectively. The TAVC of 8.15 ± 0.02 logcfu/cm² obtained from butcher's knife in this study is higher than but similar to values obtained by Bello and Son 2009 and Sudhakar et al 2009, who reported TAVC of 6.7 ± 5.3 logcfu/cm² in Russia and 5.52 ± 0.03 logcfu/cm² in India respectively. The high microbial load on the knife is an indication of inadequate cleaning and poor or absence of

Table1: Comparison of microbial contamination in cattle carcass processing

Sample	Enterobacteriaceae		Total aerobic viable count	
	Before Processing Mean \pm SD (logcfu/cm ²)	After processing Mean \pm SD (logcfu/cm ²)	Before Processing Mean \pm SD (logcfu/cm ²)	After processing Mean \pm SD (logcfu/cm ²)
Wall	7.92 \pm 0.02	10.0 \pm 0.17*	7.96 \pm 0.01	11.63 \pm 0.06*
Knife	7.57 \pm 0.03	11.93 \pm 0.06*	8.15 \pm 0.02	12.05 \pm 0.04*
Table	7.67 \pm 0.03	8.46 \pm 0.09*	8.33 \pm 0.01	9.60 \pm 0.01*
Floor	8.69 \pm 0.05	9.70 \pm 0.06*	9.32 \pm 0.04	10.47 \pm 0.19*
Carcass (evisceration)	7.83 \pm 0.03	9.27 \pm 0.02*	8.24 \pm 0.01	9.99 \pm 0.01*

Asterisks (*) = statistically significant at P<0.05; SD = standard deviation

sterilization. The 100% increase in the microbial load on the butcher's knife before and after processing could be due to poor hygienic condition of the abattoir, lack of sterilization points, continuous use of a single knife despite contact with dirty or contaminated surfaces and lack of separation between clean and dirty processes. The enterobacteriaceae count (7.67 \pm 0.03 logcfu/cm²) and TAVC (8.33 \pm 0.01 logcfu/cm²) obtained from the processing table in this study were higher than the value reported by Fasanmi et al, 2010 (5.54 logcfu/cm²) from meat sellers tables from various markets in Ibadan, Nigeria. The high microbial load obtained from the butchers table is an indication of the ineffectiveness of the method used in cleaning the tables, which are usually washed with water only. More so, the 84% and 95% increases in enterobacteriaceae count and TAVC respectively further stresses the compromise in hygiene level at the abattoir. The abattoir floor had enterobacteriaceae count of 8.69 \pm 0.05 logcfu/cm² and TAVC of 9.32 \pm 0.04 logcfu/cm², these values are higher but similar to TAVC reported by Narsimha and Ramesh, 1992 (6.4 logcfu/cm²), Tarwate et al, 1993 (6.70 \pm 0.15 logcfu/cm²) and Sudhakar et al, 2009 (7.19 \pm 0.18 logcfu/cm²). The high TAVC obtained from the floor prior commencement of carcass processing underscores poor cleaning and disinfection of the abattoir floor. In addition, the over 90% increases in both enterobacteriaceae and TAVC could be due to several processing activities done on the abattoir floor, appreciable large presence of people at the abattoir and lack of proper separation between clean and dirty processes. High average values of 7.83 \pm 0.03 and 8.24 \pm 0.01logcfu/cm² were reported as the enterobacteriaceae count and TAVC respectively from the beef carcass before the process of evisceration in this study; these values were higher but similar to those reported by Haque et al. (2008), who reported total coliform count of 4.85 logcfu/gm and TAVC of 6.03 logcfu/gm in goat meat from the slaughter yard. Ruban and Nadeem, 2011 also reported TAVC of 3.87 \pm 0.10 and 5.25 \pm 0.07 logcfu/gm in poultry meats from sophisticated processing plants and non-sophisticated processing in India. However, Sumner et al, 2003

reported lower TAVC in beef carcasses from abattoir (1.72 logcfu/cm²) and very small plants (1.81 logcfu/cm²) in South Australia. The high TAVC on beef carcass in this study may be due to the low level of sophistication at the abattoir and because carcasses are dressed on the floor. Butcher's low level of hygiene and poor abattoir sanitation could also be responsible for the high TAVC on the carcass. The enterobacteriaceae count and TAVC on the beef carcass after evisceration were 9.27 \pm 0.02 and 9.99 \pm 0.01 logcfu/cm² respectively, higher but similar to values reported by Sudhakar et al. (2007), who reported TAVC of 6.06 \pm 0.53 and 6.48 \pm 0.27 logcfu/cm² after evisceration in modern Indian abattoir and traditional meat shops. The present study revealed 96% and 98% increases in enterobacteriaceae and TAVC, which further indicates evisceration as a dirty process during carcass dressing. More so, it is an indication of the level of compromise in good management practices.

The result of the study revealed the importance of supply of potable water at the abattoir (1.16 \pm 0.1 logcfu/ml). Potable water is an essential requirement in the quality assurance of meat produced at the abattoir. Adeyemo et al. (2002), in a similar work on water at a main abattoir in Ibadan reported mean coliform and total bacterial counts of 4.3 logcfu/ml and 5.18 logcfu/ml respectively. Tarwate et al, 1993 and Sudhakar et al. (2009) reported TAVC of 2.07 \pm 0.06 and 3.90 \pm 0.07 logcfu/ml respectively in water used at the abattoir. The low TAVC in water at the abattoir in this study is an indication of a clean source of water supply to the demonstration abattoir. However, this did not translate to overall low TAVC on processing facility surfaces and carcasses at this abattoir. The enterobacteriaceae count and TAVC in the effluent from this study were 13.11 \pm 0.04 and 13.79 \pm 0.06 logcfu/ml, values significantly higher the TAVC reported by Adesemoye et al. (2006) in Agege (7.52 logcfu/ml)and Ojo (7.43 logcfu/ml) abattoirs both in Lagos, Nigeria. The high enterobacteriaceae count and TAVC in the effluent supports the high values obtained from the processing facility surfaces and beef carcass.

In conclusion, the high microbial load on the processing facility surfaces and beef carcasses in this study underscores the poor level of personnel hygiene and poor sanitation at the abattoir. It is also suggestive of the possible role of the environment in carcass contamination, Geornaras et al., 1995; Eisel et al., 1997; Forsythe, 2000; Leus et al., 2007). It is recommended that the water source to the abattoir be maintained and that education on the role of good management practices, personal and environmental hygiene with sanitation be given to the butchers and the management team at the demonstration abattoir.

Acknowledgement

The authors acknowledge the DVM IV (2007/2008) session of the University of Ibadan for assistance with sample collection.

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