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Comparative Studies on the Air Microflora in Some Slaughtering Houses of Bangalore City

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ABSTRACT: *The main objective of this study was to enumerate and compare the total airborne bacteria present in bio-aerosols generated in four major slaughtering houses and six Mutton stalls in Bangalore city. Air sampling was done for all slaughter houses and mutton stalls from two spots which includes procurement area and Degutting area by plate's exposure method. Its results revealed that the increased number of pathogenic bacteria in the slaughter houses than the mutton stalls. The slaughter house Russel market has showed maximum number of colony forming units of 112 CFU/plate in degutting area and minimum of 25 CFU/plate for Ulsoor mutton stall in procurement area. Most predominant colonies obtained were identified as to be gram negative E.coli sp., Pseudomonas sp., salmonella sp., campylobacter sp., and gram positive Bacillus sp. and Staphylococcus sp. by based on its morphological and biochemical characteristics. These results suggest that the airborne pathogens are playing major role in the contamination of meat in slaughter houses.*

KEY WORDS: *Airmicroflora, bioload, slaughter houses.*

I. INTRODUCTION

The transfer of contamination through the airborne route is one of the most significant areas of high-care food production [1] and Food safety issues are becoming more important in international trade [2]. Many developing countries have seen substantial growth in non-traditional agricultural exports of specialty food products, such as fruits, vegetables, seafood, and meat [3].Contamination of meat by microorganisms is a major public health and economic problem in the meat industry [4]. Contamination can occur at various points during the slaughter process, cold storage, and processing of meat animals [5]. During slaughter, sources of microbiological contamination on carcass may come from the hide or gastrointestinal tract of the animal or from the slaughter plant environment, including facilities and personnel. Therefore, monitoring carcasses and the slaughter plant environments for specific microorganisms affecting public health is important [4]. Research [6, 7, 8] has shown that microbial contamination of the air in processing facilities is a concern. Organisms can use air as a transport medium to either contaminate product surfaces directly, or to contaminate contact surfaces [7]. Air contamination level in meat plants during processing is due to the airborne microbes which are the potential source of microbiological contamination in meat and meat products [9, 10,11,12,13] . Sirmani [14] found association between air-borne bacteria and contamination during slaughtering. With air being considered a potential source of contamination of product [15], avenues which can allow the air inside the facility to become contaminated must be controlled. The main purpose of this work was to find out the level of air-borne bacteria in various slaughtering houses and processing plants in the Bangalore city.

II. MATERIALS AND METHODS

2.1. Air Sampling

Air samples of bacteria were collected from the two sampling spots at four different slaughter houses (Russel market, Tannery market, K.R market, Johnson market) and six mutton stalls at different locations (Cambridge layout, Domlur, Dairy circle, Neelasandra, Ulsoor, Indiranagar) in Bangalore city. The air sampling were done from procurement area and degutting area at a height of around 1 to 1.5 meter above from the floor. Two plates containing 25 ml of sterilized non selective media Plate Count Agar (PCA) were exposed in the sampling spots for a period of 10 minutes and transferred to lab aseptically. Exposed plates were incubated at 37ºC for 24-48 hours [16]. Sterile conditions were maintained during all microbiological analyses in order to prevent the contamination of samples and isolates obtained from the air samples.

2.2. Morphological Identification

Total bacterial counts were determined for both procurement and degutting area. The grown micro-organisms were characterized morphologically and based on its Colony size, Shape, Margin, Opacity, Elevation, Pigment production and Gram's character. Obtained micro-organisms were streaked and subcultured on to Nutrient agar for further identification.

2.3. Biochemical Identification

Based on the "Bergey's Manual of Determinative Bacteriology" [17] the colonies were characterized biochemically by Indole production test, Methyl red test, Voges-proskauer test, Citrate utilization test, Catalase test, Oxidase test, Urease test, Nitrate reduction test, Starch hydrolysis test, Casein hydrolysis test, Motility test, Gelatin hydrolysis test, Triple sugar iron agar test, Mannitol Fermentation test, Bile Esculin test, Hydrogen sulphide production test, cAMP test and Coagulase test.

2.4. Comparative analysis

Comparison of Colony forming units of total air borne bacteria of different slaughter houses and mutton stalls were studied.

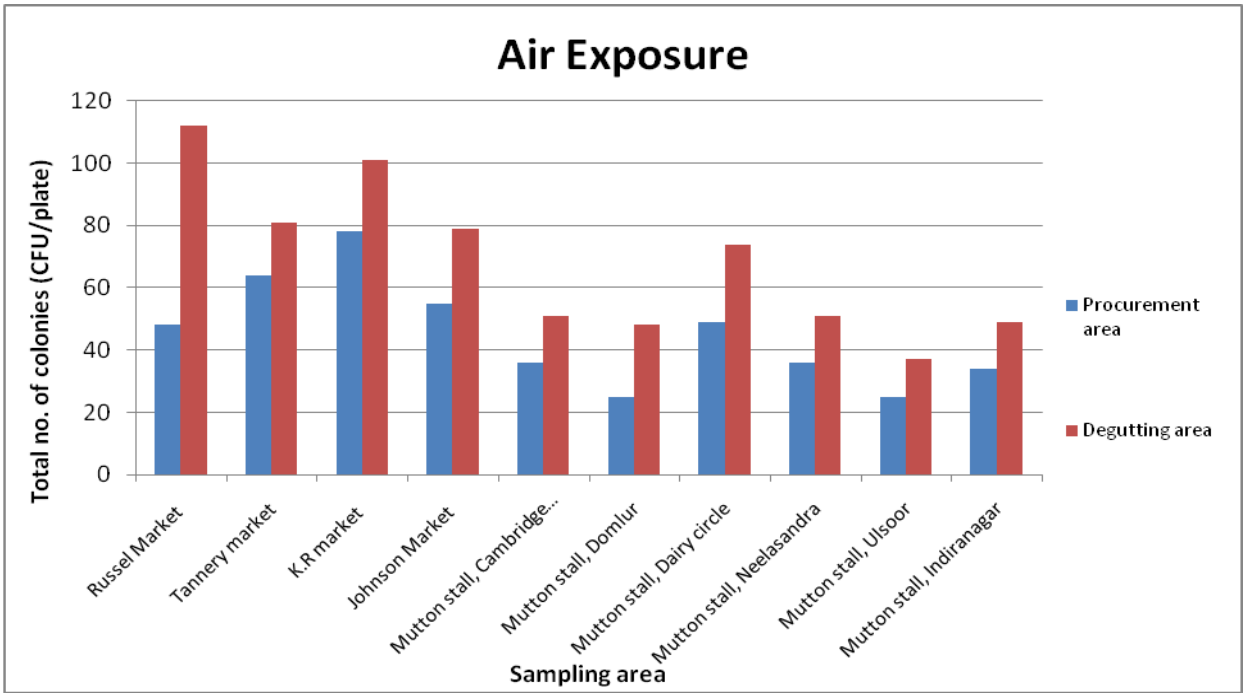
III. RESULTS AND DISCUSSION

Air sampling analysis was done for four slaughter houses and six mutton stalls by plate exposure method for the air borne pathogens which contaminate meat and meat products. The sampling spot Degutting area has showed more Colony forming units (CFU) than Procurement area for all slaughter houses and mutton stalls. Among ten different sampling areas, the degutting area of the slaughter house Russel market has showed maximum of 112 CFU/plate which includes 22 gram negative bacilli and 14 gram positive bacilli (Table 1, Figure 1). Whereas Tannery market has 81 CFU/plate with 10 gram negative bacilli and 21 gram positive bacilli, K.R market 101 CFU/plate with 65 gram negative bacilli and 36 gram positive bacilli and Johnson market has 79 CFU/plate with 15 gram negative bacilli and 18 gram positive bacilli.

Table 1: Bacteria isolated through the air exposure from Procurement and Degutting area

Sampling area	Procurement area (CFU/plate)	Degutting area (CFU/plate)
Russel Market Slaughter house	48	112
Tannery market Slaughter house	64	81
K.R market Slaughter house	78	101
Johnson Market Slaughter house	55	79
Mutton stall, Cambridge layout	36	51
Mutton stall, Domlur	25	48
Mutton stall, Dairy circle	49	74
Mutton stall, Neelasandra	36	51
Mutton stall, Ulsoor	25	37
Mutton stall, Indiranagar	34	49

Figure 1: CFU of bacteria isolated through the air exposure from Procurement and Degutting area



Among the mutton stalls in the Bangalore city, the degutting area of the Dairy circle mutton stall has 74 CFU/plate with 11 gram negative bacilli and 25 gram positive bacilli, followed by Cambridge layout and Neelasandra mutton stall has showed 51 CFU/plate, followed by Indiranagar 49 CFU/plate and Domlur mutton stall 48 CFU/plate. Ulsoor mutton stall has showed with minimum of 37 CFU/plate which includes 3 gram negative bacilli and 14 gram positive bacilli. The majority of the Gram negative airborne bacteria isolated in slaughtering were from Degutting area. On the basis of "Bergey's manual of determinative bacteriology" and biochemical results of the plate exposed micro-organisms were identified to be as Bacillus sp-1., Staphylococcus sp, Micrococcus sp., Pseudomonas sp., Salmonella sp., E. coli, Streptococcus sp., Serratia sp., Shigella sp., Bacillus sp-2., Campylobacter sp., Proteus sp. and Klebsiella sp. Among the identified micro-organisms, Gram negative E.coli sp. and Pseudomonas sp. were more predominant in the K.R market and Russel market slaughter houses followed by salmonella sp., campylobacter sp. in Johnson market and Ulsoor mutton stall. Among Gram positive bacterial species Bacillus sp-1 and Staphylococcus sp were more predominant in K.R market slaughter house and Dairy circle mutton stall followed by Bacillus sp-2 and Micrococcus sp. in Tannery market slaughter house and Indiranagar mutton stall. A strong relation between the carcass and air contamination was observed in this study. The skin and internal organs of slaughtered animals has been the important source of air borne bacteria in slaughter houses [18, 19]. The realization claim that bio-aerosols transport bacteria contributes to the further contamination of meat and meat products. The vigorous physical activities of slaughter and carcass dressing like carcass splitting and washing can be actually the sources of aerosols due to carcass-saw water cooling and the water stream meat washing, which actively spread potentially contaminated aerosols into the air [20, 21, and 22]. This validates the importance of controlling airborne contamination [23]. The determination of the levels and types of airborne bacterial contaminants in a slaughter houses has also offers an alternative and effective method for carcass contamination control in slaughter houses. The effectiveness of a plant's sanitation program can be evaluated by collecting air samples after cleaning and sanitizing and comparing the bacterial counts to those obtained during slaughtering. Cross contamination of the meat from the carcass and from the environment are most effectively controlled by appropriate changes in the slaughter processes through the implementation of good manufacturing practices (GMP).

IV. CONCLUSION

Food borne illness is becoming a major issue especially related to meat and this study supports it. According to present results of CFU analyses it has been concluded that the presence of airborne bacteria in slaughter houses sampling had showed highest number colonies compared to Mutton stalls in Bangalore city. In the four major slaughter houses, the much crowded Russel market slaughter house has been more contaminated with airborne pathogens (CFUs) than to other slaughter houses. Our study concludes that the air and crowded

population is the major cause of contamination in the meat and meat products, confirming with the assumption of Knudtson and Hartman [24] that airborne bacteria can cause contamination to the slaughter houses. The prime control measures of bacterial contamination could be following HACCP based principles by analyzing hazard critical points, practicing good personal hygiene, cleaning of the lairage pens and slaughter houses as said by Swanenburg [25] and washing truck trailers [26].

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