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ScienceDirect
Meat Science 80 (2008) 418–422
MEAT SCIENCE
www.elsevier.com/locate/meatsci

Microbial profiles of frozen trimmings and silver sides prepared at Indian buffalo meat packing plants

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Received 16 April 2006; received in revised form 24 December 2007; accepted 16 January 2008

Abstract

To assess microbiological quality of buffalo meat trimmings (TT = 114) and silver sides (SS = 41), samples were collected from four different Indian meat packing plants. The aim of this study was: (i) to evaluate standard plate count (SPC), psychrotrophic count (PTC), *Enterococcus feacalis* count (EFC), *Staphylococcus aureus* count (SAC) and *Escherichia coli* count (ECC) and the presence of *Salmonella* spp. and *Listeria monocytogenes*; and (ii) also to determine vero toxic *E. coli* (VTEC) by polymerase chain reaction (PCR). TT samples had significantly higher ($P < 0.001$) SPC, PTC, EFC, and SAC than SS, while across the meat types there was no difference ($P > 0.05$) in ECC. *E. coli* was recovered from 32.4% TT and 19.5% SS samples. The prevalence rate of *Salmonella* spp. and *L. monocytogenes* in TT was 1.75% and 0.87%, respectively. But no SS sample was found to be positive for any of these two pathogens. VTEC was found in 2.58% of all the tested samples. This finding suggests that TT contain higher microbes but only small numbers of pathogens of latent zoonotic importance. The present study confirmed the importance of maintaining good process hygiene at meat plants for microbiological status of buffalo meat.

Keywords: Buffalo meat; Trimmings; Silver sides; *Salmonella*; *Listeria*; *Escherichia coli*; *Staphylococcus*; *Enterococcus*; Microbiological quality

1. Introduction

India is the largest buffalo meat producer (1.48 million MT) and exporter (0.343 million tones) in the world (Food and Agricultural Organization, 2004). The exports generated from this meat touched 341.5 million US $ in the recent year (Ranjhan, 2005). Meat meant for export is processed in buffalo meat packing plants, which are certified for Hazard Analysis Critical Control Points (HACCP) and International Organization for Standardization (ISO-9001). The approved dressed carcasses are chilled (0–2 °C), deboned and deglanded, and then different cuts are aerobically packaged, blast frozen and finally exported to the Gulf, Middle East, Far East and South-East Asian countries under frozen conditions. A small portion of meat is also exported chilled condition after vacuum packaging.

In the process of converting live animals into meat, microbial contamination of carcass surfaces is unavoidable. While most of the microflora transferred to the carcasses during the slaughtering process are non-pathogenic, there is a possibility that pathogens such as *Salmonella* spp., *Escherichia coli* O157:H7, *Campylobacter* spp. and *L. monocytogenes* may be present (Borch & Arinder, 2002; Buckle et al., 1989) and it represents one of the

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doi:10.1016/j.meatsci.2008.01.004

most critical quality and safety issues faced by the meat industry. Moreover, during recent years with the increase in global trade and awareness of the consumers of the hygienic quality of the meat, international attention is being focused on ways to improve the microbial quality and safety of foods. However to evaluate the effectiveness of any intervention strategies, it is necessary to know the microbial status of the product before and after implementation of the intervention. The microbial contaminants encountered in fresh buffalo meat from domestic slaughter-houses in India, were of 4.8–5.49 log cfu/g for standard plate counts (SPC), 1.6–3.7 log cfu/g for psychrotrophic counts (PTC) and 2.66–4.8 log cfu/g for *Enterococcus faecalis* counts (EFC), respectively (Agnihotri, 1988; Syed Ziauddin, Rao, & Amla, 1994). The incidences of pathogens like *Salmonella* spp., VTEC, and *L. monocytogenes* were recorded up to 9%, 27% and 5.5%, respectively (Barbuddhe, Malik, Bhilegaonkar, & Kumara, 1998; Hazarika et al., 2005; Rao & Mahendrakar, 2003). But there is no published data on the microbial quality of frozen buffalo meat. So, in view of India's position as one of the largest buffalo meat producers and exporters, a nation-wide survey was carried out to evaluate microbial quality of frozen buffalo meat. Thus, the aim of this study was to (i) determine general microbial profile and prevalence of *Salmonella* spp., *L. monocytogenes*, and *E. coli* in export buffalo meat, and (ii) also to detect VTEC by polymerase chain reaction (PCR) (see Fig. 1).

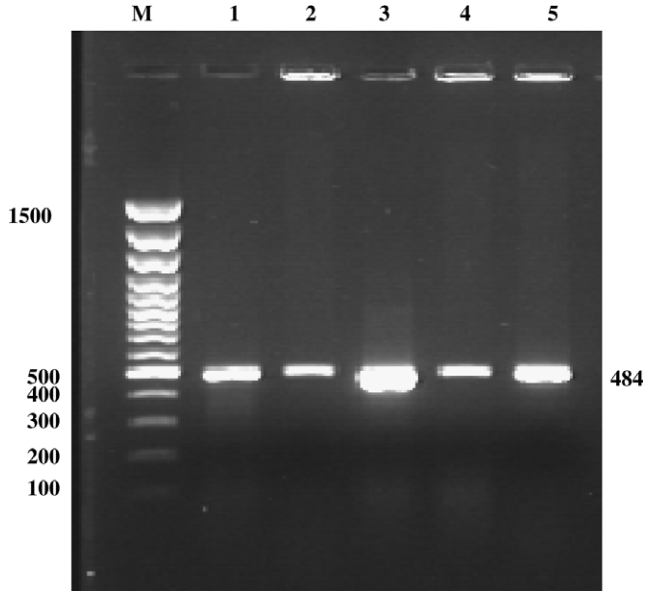

Fig. 1. PCR amplified (slt_2 gene) products positive for verotoxin *E. coli*. Lane M: marker. Lane 1: slt_2 positive (control) VTEC. Lane 2: slt_2 positive VTEC. Lane 3: slt_2 positive VTEC. Lane 4: slt_2 positive VTEC. Lane 5: slt_2 positive VTEC.

2. Materials and methods

2.1. Carcass dressing processes

The carcass dressing processes at four different meat packing plants were examined. All the plants have export facilities in which approximately 800–1000 buffalo are slaughtered during an 8 h working shift. The carcasses are dressed while suspended and moving on a conveyer rail following stunning and bleeding (halal) as per stipulated norms. All four facilities are subject to inspection by qualified veterinarians under the Meat Food Products Order (India) 1973, Amended 1994; and all the four plants have HACCP systems for their carcass dressing processes, with documentation and monitoring procedures as per the International Office of dez-Epizootics (OIE) recommendations.

Carcass skinning was observed during normal working hours on 4–5 consecutive days. On each occasion, notes were made on the persons involved in and actions performed during each operation. In addition, the descriptions of the operations in the HACCP manuals were examined, and individual workers were asked to describe their usual working practices in relation to operations performed. Based on observations and discussions, SS and TT samples were selected for microbial evaluation. SS are one of the valuable cuts from buffalo species but subjected to greater amount of hide contamination during their production and processing. Similarly, TT requires more extensive handling, and is also subjected to more cross contamination due to spilling of faecal matters on to skinned carcasses.

2.2. Sampling

A total of 155 composite meat samples comprised of trimming (TT = 114) and silver sides (SS = 41) were collected with all possible aseptic precautions. Carcasses to be sampled were selected at random from those passing through the holding at 0–3 °C for 48 h following dressing processes and an initial chilling (2 °C) of 24 h with cold air (−5 to 0 °C) during normal processing. A single composite sample was collected from each selected carcass at 3–4 different places on the SS by utilizing previously sterilized stainless steel plates (1.5 mm thick). An oval hole (approx. 12 cm^2) in the center of the plate is positioned so that knife can be used to cut the exposed area of carcass in one movement. The inner edge of the plate was beveled in such a way that the knife will remove the entire surface of the exposed area. For each plant, samples were collected from eight carcasses, with four samples on each of two consecutive days. However, for TT, a total of 28 samples were collected from each plant in which four samples were collected from randomly selected four different lots at each of seven days. Each TT sample was a composite sample with 4–5 randomly selected TT pieces that were produced during meat cutting operations. The samples were placed in pre-sterilized self-sealing polyethylene (PE) bags, labeled