

Original Research Article

In-vitro analysis of the microbial-load in raw meat and finished products

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ABSTRACT

Fresh and packaged food safety, especially of meat products has become a major issue because of microbial contamination. 50 % of all food-borne illness cases are associated with meat products. Many methods like thermal processing, drying, freezing, refrigeration, modified atmosphere packaging and adding antimicrobial agents or salts are being used to prevent microbial contamination. In the present study, bacteria were isolated from raw and packaged meat products from various sources. The isolated bacterial samples were identified based on morphological and biochemical characterization as per Bergye's manual of determinative bacteriology. The species identified were *E. coli*, *Staphylococcus sp.*, *Pseudomonas sp.*, *Micrococcus sp.*, *Streptococcus sp.*, *Serratia sp.*, *Salmonella sp.*, *Bacillus sp.*, *Proteus sp.* and *Klebsiella sp.* Bacterial contamination was found more in raw meat sample as compare to finished meat product and obtained results were moreover same for all places. The microbial quality of the raw material, maintenance of cold chain, sanitary condition of the premises, equipment and personnel and general management practices are factors that collectively determine the microbiological quality of the product. There is a need for advanced handling methods to avoid bacterial cross contamination in meat and meat products. Although the contamination level was low in finished products, proper processing and clean packaging is required.

Keywords

Food-borne
pathogen,
bacterial
contamination,
Microbial
load,
meat products

Introduction

Food safety issues are becoming more important in international trade (WHO 1998). Outbreaks of food-borne diseases have led to considerable illness and even death (Albrecht, 1986; Lecos, 1987). It has found that every year there are between 24 million and 81million cases of food-borne illness out of which 50% are associated with meat and poultry (Archer and Kvenberg, 1985; Gravani, 1987; McBean, 1988).

The shelf-life of food decreases by the microbial contamination and it promotes food borne illness. Food borne pathogens like (*Salmonella sp.*, *Listeria monocytogenes*, *Campylobacter sp.*, and verocytotoxin producing *Escherichia coli* O157) originating from the animal during slaughter, contaminate the carcass and distribute via cut or raw meat intended for further processing (Borch and Arinder,

2002) which is a major public health problem. (Bean and Griffin, 1990) reported that in the United States *Salmonella sp.* account for 48% of all beef related outbreaks. A healthy animal may harbor pathogenic bacteria on its hide, hair, and hooves, in its intestinal tract, and around the lymph nodes (Ayres, 1955). Mostly the internal surfaces of the carcasses are sterile but the transfer of bacteria results from dressing and skinning defects which occurs during slaughtering process (Gill and Newton, 1978) and food handlers also are the major source of common pathogens (Dickson and Anderson, 1992).

Traditional methods like thermal processing, drying, freezing, refrigeration, irradiation, modified atmosphere packaging, and adding antimicrobial agents or salts to prevent contamination are not sufficient for fresh meats and ready-to-eat products (Griffiths, 1989). For meat products, microbial contamination occurs at the surface. Although rates of attachment of bacteria to meat have been studied (Unneveher, 2000; Lillard, 1985), there is limited information on how to prevent this attachment. It has been described that Acidified Sodium Chlorite (ASC) is an antimicrobial compound which effectively reduces contamination of poultry and beef products (Rourke, *et al.*, 2003). Use of ASC was approved by the U.S. Food and Drug Administration (FDA) in 1996 as a secondary direct food additive. Processing with ionizing radiation is a most versatile treatment for decontamination of food; it is a safe, efficient, environmentally clean and energy efficient process (Farkas, 1998).

Most food safety officials and scientists view irradiation as an effective Critical Control Point in a Hazard Analysis and Critical Control Points (HACCP) system for meat and poultry processing (Satin, 2002).

In this study we are giving some evidence of microbial contamination in raw and finished meat and meat product from different slaughter houses and some food stalls.

Materials and Methods

Sample collection

Raw meat samples viz. liver, brain, intestine, lungs and mutton were collected from different slaughter houses from Bangalore. Finished products like packaged minced meat, dry mutton kabab, mutton nuggets, mutton cutlet, mutton cubes and mutton sausages were collected from Bangalore.

Raw meat processing

Raw meat samples were collected from different sources as mentioned above, 1 g of each sample was placed in 10 ml of sterile distilled water and then serial dilution was performed. Dilution of 10^{-3} , 10^{-5} and 10^{-7} were used for bacterial isolation. 200 μ l of each diluted water sample was transferred on Petri plate containing Nutrient Agar Media. Sample was evenly distributed on plate by using L-shape sterile glass rod. Plates were kept at 4^o C for 30 min. and then incubated at 37^o C for 24 hrs.

Finished product processing

Different types of finished product samples as mentioned above were collected, 1 g of each sample was placed in 10 ml of sterile distilled water and then serial dilution was performed. Dilution of 10^{-3} , 10^{-5} and 10^{-7} were used for bacterial isolation. 200 μ l of each diluted water sample was transferred on Petri plate containing Nutrient Agar Media. Sample was evenly distributed on plate by using L-shape sterile glass rod. Plates were kept at 4^o C for 3 min. and then incubated at 37^o C for 24 hrs.

Biochemical characterization

Individual colonies with different colony morphology were selected and the number of different types of colonies was documented. Selected colonies were maintained as pure culture on nutrient agar slants. The pure cultures of the bacteria thus isolated were identified by Gram's staining, morphological and biochemical characterization according to Bergey's manual of determinative bacteriology.

Result and Discussion

Bacterial colonies were isolated from all raw and finished meat samples. Maximum of 41 colonies were observed in Raw Mutton sample followed by 31 colonies minced Mutton sample. For the Finished Product samples, number of colonies per plate ranges from 7 to 58 and maximum of 58 colonies were found in Mutton dried Kabab

sample, lowest number of colonies (7 colonies) were found for Mutton nuggets (Figure 1-4). Most of the colonies from all samples were found morphologically similar, these common colonies were then isolated and maintain on nutrient agar. Based on Gram's Staining, phenotypic methods and biochemical characterization as per Bergey's manual, the samples were found to be *E. coli*, *Staphylococcus sps*, *Pseudomonas sp.*, *Micrococcus sp.*, *Streptococcus sp.*, *Serratia sp.*, *Shigella sp.*, and *Salmonella sp.* in raw meat samples *Salmonella sp.*, *E. coli*, *Streptococcus sp.*, *Serratia sp.*, *Campylobacter sp.*, *Proteus sp.* and *Klebsiella sp.* in the finished meat products (Table-1). In the present study it was found that the bio load was more in the finished product (Dry Mutton Kabab) than when compared to the raw meat samples, this could be because of bacterial contamination from air as the samples were kept outside in open area.

Table.1 Distribution of bacterial pathogens in different samples

Bacterial Isolates	Liver	Brain	Intestine	Lungs	Mutton	Minced meat	Mutton kebab	Mutton nuggets	Mutton cutlet	Mutton cubes	Mutton sausages
<i>Klebsiella</i>	-	-	-	-	-	-	++	-	+	+	+
<i>Pseudomonas</i>	-	+	+	++	+	+	-	-	-	-	-
<i>Staphylococcus</i>	++	+	-		+	++	-	-	-	-	-
<i>E. Coli</i>	+	-	+	+	+	+	-	+	-	+	-
<i>Proteus</i>	-	-	-	-	-	-	+	-	+	-	+
<i>Micrococcus Sp</i>	+	+	-	+	+	-	-	-	-	-	-
<i>Shigella Sp</i>	-	+	+	-	-	-	-	-	-	-	-
<i>Serratia Sp</i>	+	-	+	-	-	+	++	+	-	+	+
<i>Streptococcus Sp</i>	-	-	+	+	++	+++	+	+	+	-	++
<i>Salmonella sp</i>	-	+	-	+	+	-	+	+	+	+	-

Legend; - : No of colonies, +: Low number of colonies, ++: Moderate number of colonies, +++: High number of colonies

Figure.1 Biolaod of different raw meat samples collected from Shivajinagar area

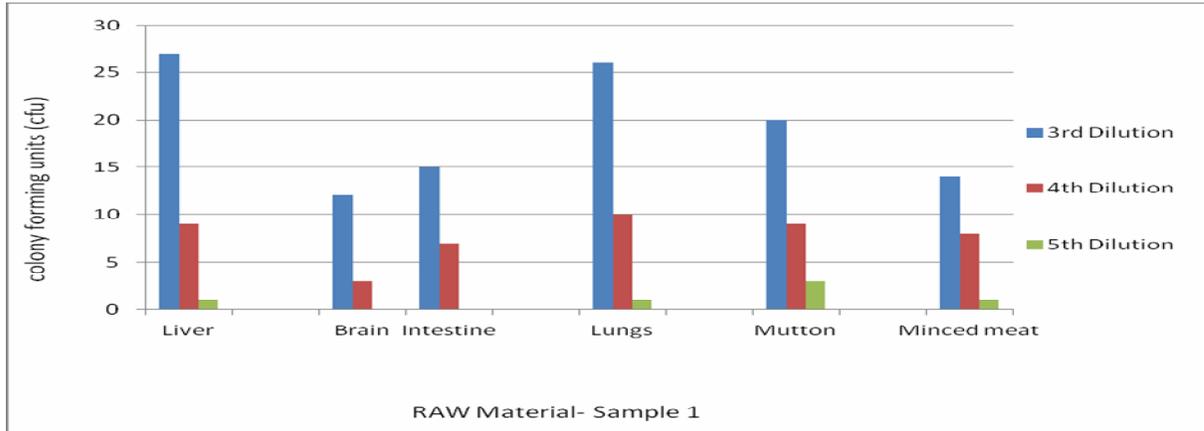


Figure.2 Biolaod of different raw meat samples collected from Frazer town area

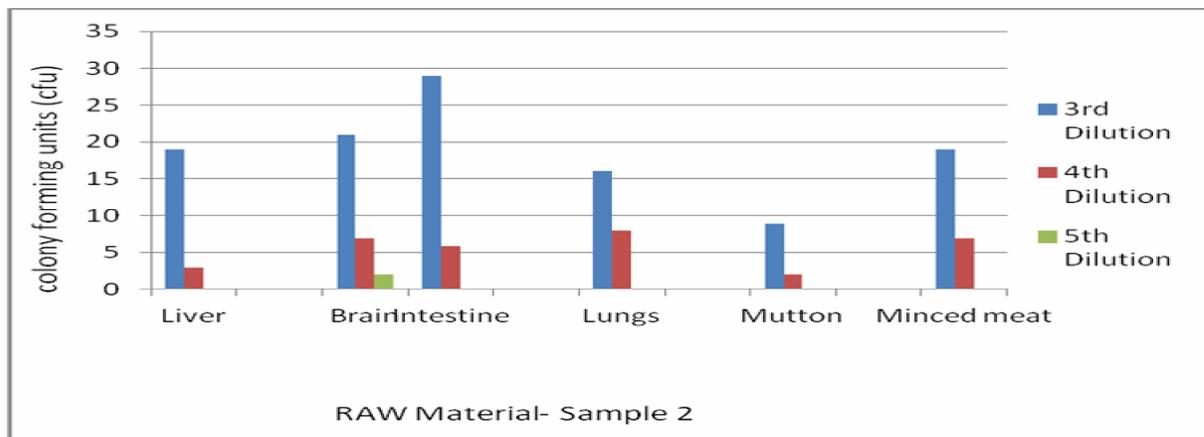


Figure.3 Biolaod of Different raw meat samples collected from market area

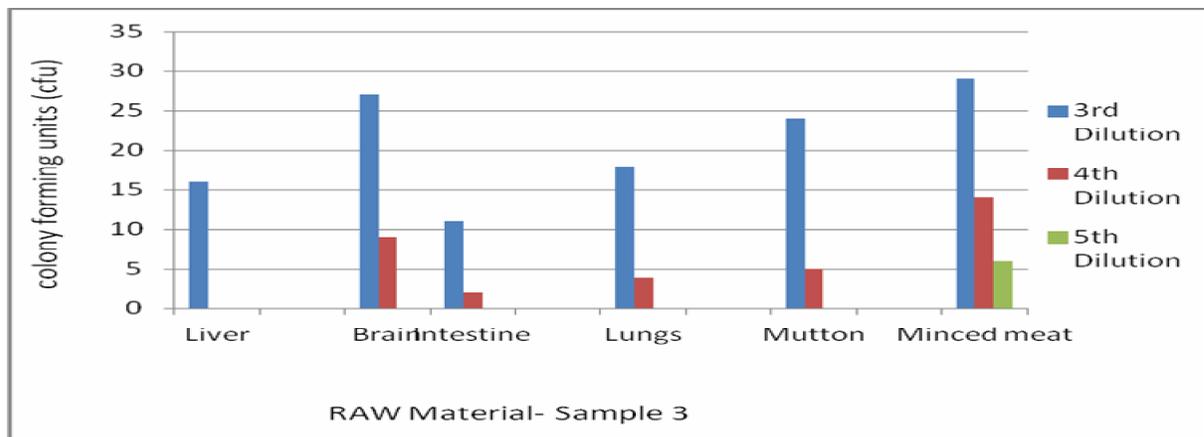
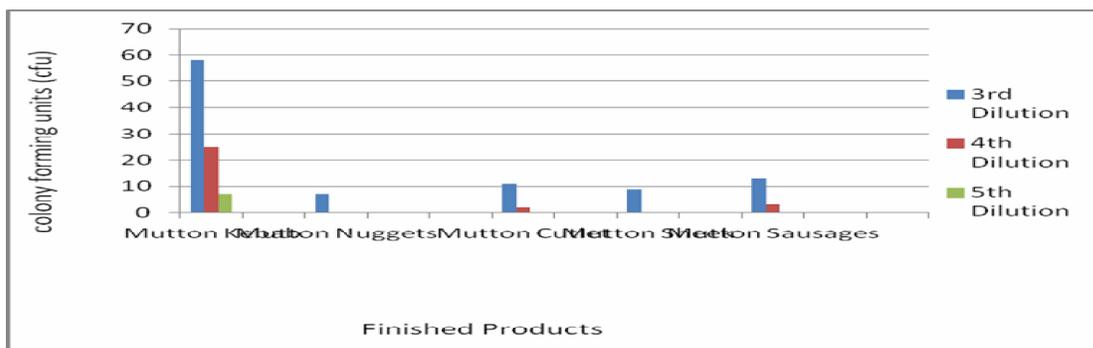


Figure.4 Bioload of different finished products



The conclusion is presence of the *Campylobacter sp.* in finished product shows the lack of sanitary condition of premises, equipment and personnel surfaces and general management practices. Since microbial contamination of these foods occurs primarily at the surface, due to post-processing handling, attempts have to make to improve safety and to delay spoilage by use of antibacterial sprays or dips. However, direct surface application of antibacterial substances onto foods have limited benefits because the active substances are neutralized on contact or diffuse rapidly from the surface into the food mass. On the other hand, incorporation of bactericidal or bacteriostatic agents into meat formulations may result in partial inactivation of the active substances by product constituents and is therefore expected to have only limited effect on the surface microflora. Our finding suggests or rather insists to adopt advance techniques and good handling practices to avoid bacterial contamination in food products.

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