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A STUDY ON MICROBIOLOGICAL ANALYSIS OF RAW MEAT

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ABSTRACT

The present study was conducted to assess the microbial quality of 50 meat samples made up of 25 chicken and 25 mutton that were collected from the retail markets located in and around Hyderabad city in order to ascertain its safety. All the samples were analyzed for microbiological parameters like Total viable count and for the presence of sanitary indicators like *Staphylococcus aureus, Salmonella spp., and Escherichia coli*. Out of all the samples chicken samples (6.12 log of CFU/g) have shown little higher total viable count values when compared to mutton (5.8 log of CFU/g). Chicken samples understudied were positive for *Staphylococcus aureus* (52%) and *Escherichia coli* (76%), whereas mutton samples were positive for *Staphylococcus aureus (64%), Salmonella spp.* (4%) and *E.coli* (64%). All these isolates have been studied morphologicaly and biochemically which proved to be confirmatory. The results of present study indicates the lower standards of operating systems in the slaughtering, processing and sale of meats and also poor personnel hygiene of the operators.

INTRODUCTION

Meat was the first important food that met up the hunger of ancient people living in cave[1] and it has long been known for its nutritive composition which could explain why it is being consumed by many people worldwide. The protein profile of meat consists of aminoacids that have been described as excellent due to the presence of all essential ones required by the body. A large proportion of the worlds population rely on meat as a source of food. Enteric bacteria species can cause infection in humans when undercooked meat products are consumed[2]. It has also been proved that protein and vitamins (especially Vit-A and Vit-B_{12}) in meat could not be substituted for by plant sources, further justifying the nutritive importance of meat. Meat plays a very vital role in keeping the human body strong in order to provide energy, health and vigor[3]. Radical dietary shifts in many developed and developing nations are supplanting traditional patterns of eating with a western diet high in animal meat products and refined carbohydrates and low in whole grains, fruits, and vegetables[4]. As it is rich in nutrients it is not only highly susceptible to spoilage but also frequently implicated in the spread of food borne illness. Contaminated raw meat is one of the main sources of food borne illness[5,6]. Food borne pathogens are leading cause of illness and death in developing countries costing billions of dollars in medical care and medical & social costs[7] and it is well documented that contamination of food with pathogens is a major public health concern worldwide[8]. Microorganisms present in the meat may be harmful for human and may cause spoilage and may be used as indicator organisms. Many researchers have isolated and identified heterogenous types of microflora from fresh meat[9]. In addition to pathogenic bacteria special attention should also be given to the hygienic production and storage of chicken meat. Total count of aerobic mesophilic bacteria, enterobacteria and *e.coli* are considered indicators of microbial quality[10]. During various stages of slaughter and processing, all potential edible tissues are subjected to contamination from a variety of sources within and outside the animal[11] and also from the environment equipment and operators of slaughter house[12] where the routine meat inspection procedures cannot detect the presence of bacteria on meat[13]. Approximately 69% of the gram negative bacteria are known to cause bacterial food borne disease. Several researchers have reported that the meat samples were contaminated with high level of *Klebsiella pneumonia, Enterobacter spp. Pseudomonas aeroginosa, E.coli, Salmonella spp. Serratia marcescens and Proteus vulgaris, Staphylococcus aureus* and *Bacillus spp*[13, 2] and these food borne pathogens are able to

disseminate from contaminated meat to surfaces[14] and can spread infections in the community. If microbial contamination exceeds certain levels, it adversely affects shelf life and renders the meat unfit for human consumption[15]. Meat is considered to be spoiled when it is unfit for human consumption. Meat is subjected to changes by its own enzyme, by microbial action and its fat may be oxidized chemically by microorganisms that are grown on the meat causing visual, textural and organoleptic change when they release metabolites[16]. Consumption of contaminated meat with pathogenic bacteria precedes many food borne illnesses[17, 13] with human health consequences ranging from illness to death[18, 19].

Poultry meat contributes substantially to the human diet[10]. The modernization of chicken farms and globalization of the bird breeding trade also have played a role in infection[20], with several serotypes being isolated from retail poultry products from many years back in various parts of the world[21]. During the slaughter of poultry birds there can be fecal contamination of the carcasses from the gut of these birds which means bacteria present in the spilled gut contents is passed on as contaminants. Of importance is the coliforms especially *Escherichia coli* and *Salmonella*. Colibacillosis and salmonellosis have been described as the leading causes of food borne illnesses worldwide[22], therefore it becomes important that ensuring consumer health concerns the greater involvement of the health sector. *Salmonella* is of an increasing public health concern and *e.coli*, a natural inhabitant of the intestinal tracts of humans and warm blooded animals is used as an indicator bacterium because it acquires antimicrobial resistance faster than other conventional bacteria[23].

Retail shop meat contain higher microbial load because of the large amount of exposed surface area, more readily available water, nutrient and greater oxygen penetration[24]. In local retail meat shops where meat will be there in open air without appropriate temperature control, will be purchased by most of the consumers which may lead to food borne illness[25]. According to the International meat secretariat news letter (November 30, 2005) it is reported that as the standard of living improves, meat consumption also increases. These increases in meat demand is said to be due to increased urbanization, higher disposable income, and the human desire from a greater variety in their diets. Therefore the safety of meat has been in the fore front society concerns in recent years and evidence exists that challenges of meat safety will continue in the future[26]. Consequently it is very important to implement proper hygiene and safety procedures not only during slaughter but also when handling and processing meat[27].

The present study was conducted with a view to investigate microbial load of several chicken and mutton meat samples collected from various retail meat shops located in and around Hyderabad city.

MATERIALS AND METHODS

Meat sample collection: Samples of raw meat were collected aseptically from the retail markets located in and around Hyderabad city. Approximately 250 grams of chicken (25samples) and mutton (25 samples) were bought from the shop by the researcher just like any other customer. Meat samples were put in sterile polyethylene bags, properly labeled and placed under ice in a cool box before transportation to the laboratory of Department of Veterinary Public Health, College of Veterinary Science, Rajendranagar, Hyderabad. In the laboratory meat samples were processed within 6hrs after collection to avoid contamination and multiplication of bacteria.

Meat sample preparation: 10grams of the solid sample was weighed and aseptically taken into a sterile jar containing 90ml of sterile normal saline. It was homogenized with sterile blender at 3000 rpm for 5-10mins. A 1ml aliquot of homogenate was transferred to a test tube containing 9ml of sterile distilled water to make 10^{-2} dilution and shaken well with vertex mixer. Serial dilution upto 10^{-5} were prepared for the microbiological analysis.

Microbiological analysis: The microbiological quality of raw meat was assessed on the basis of Total viable bacterial count (TVBC), Total *Staphylococcus aureus* count (TSAC), Total *Salmonella Shigella* Count (TSSC) using plate count agar (HiMEDIA, India), Mannitol Salt Agar (HiMEDIA, India), XLD agar (HiMEDIA, India) respectively. The diluted meat samples were spread onto these plates and incubated at 37^0c for 24 hrs. The different isolates were confirmed by microscopic, cultural and standard biochemical tests (Motility test, catalase test, coagulase test, oxidase test, urease test, citrate utilization, indole test, gelatin hydrolysis, MRVP test, Triple Sugar Iron test) according to Bergey's manual of Determinative bacteriology, 9^{th} edition [28] for further analysis.

RESULTS AND DISCUSSION

The present study was conducted to isolate and identify several bacterial pathogens in raw meat samples that were bought and randomly collected from some retail shops in and around Hyderabad city. In the present study the mean value for Total viable count (TVC) of chicken was 6.12 log of CFU/g and for mutton it was 5.8 log of CFU/g as shown in table which indicates higher Total viable count in chicken compared to mutton. In our study the mean Total viable count in chicken meat was higher than the count reported by Bogere and

Baluka[29] in meat from the abattoir and Cohen et. al.[30] reported higher Total viable count than the present study from the chicken meat collected from various supermarkets (5.9). Adeyanju and Ishola[31] also reported higher Total viable count in chicken meat samples that were collected from retail outlets in Nigeria region. Lower than the understudied count was reported by Datta et. al.,[32] from the meat samples of Dhaka region (8.65) and Hoque et. al.,[33]. The mean Total viable count in mutton was 5.8log of CFU/g, higher than the count reported by Bradeeba and Sivakumar[27], who had investigated the microbial contamination of meat sold in and around Tamilnadu. Lower counts than the present count was reported by Fredrick et. al.,[34]. Total viable count is indicative of the populations of spoilage microorganisms and act as an index of hygienic quality. In this study out of 50 samples only 36% (9) of chicken and 48% (12) of mutton showed acceptable levels of total viable counts as per ICMSF (1974). This finding confirms the existence of microbial hazards. Mutton contamination by various organisms have been reported in other countries by different authors. In Chennai city, India, Selvan et. al.,[35] found that the mean total viable count was significantly greater in mutton products than all other products .

The counts of *Staphylococcus aureus* were high especially in mutton (64%) compared to chicken (52%). But less prevalence than the present study was reported by Hassan ali et al., [18], 2.4% , Syne et. al.,[36] 1.7% in chicken meat, Westindies. Higher prevalence than the present study was reported by Anowar et. al.[37] 90.63% and Datta et. al.,[32] 73.68%. The prevalence of *Staphylococcus aureus* in mutton was 64% which was higher than the reports of Bradeeba and Sivakumar[27], (10%) in mutton collected from Tamilnadu. The reason for the high prevalence of *Staphylococcus aureus* could have been due to poor personal hygiene of the workers and opening technique of the abdomen using bare hand and infrequent washing. Such a high level of contamination with staphylococcal food poisoning outbreaks is inadequate control of cold temperature with the initial contamination often being traced to poor personal hygiene by food handler[38]. *Staphylococcus spp.* can be part of normal flora of skin of humans and animals which can be transmitted from person to product through unhygienic practices[39]. *Staphylococcus spp.* Cause infections such as arthritis, black pox, boil, bronchitis, bumble foot, carbuncle, cystitis, endocarditis, meningitis, osteomyelitis, pneumonia and scalded skin [40].

This study had revealed the presence of *Salmonella* in 1%of mutton samples, but no chicken sample had showed the presence of *Salmonella*. The prevalence of *Salmonella* was recorded as 7.41% in chicken meat[41] and 5.7% in a study of chicken carcasses in Accra[42]. High

prevalence (33.33%) of *Salmonella* was reported from the study of Adeyanju and Ishola[31] which was higher than the present study and higher than the reports 11.1% and 2% of Ukut et. al.,[43], and Adesiji et. al., [44] respectively. In the present study presence of *Salmonella* had been detected in 1% of mutton samples which was less than the reports of Hassani ali et. al.,[18], who had reported contamination of *Salmonella* in 7% of the mutton samples and Bradeeba and Sivakumar[27] reported 32% *Salmonella* positive mutton samples. *Salmonella* in more than 25g of poultry meat is considered unsafe for human consumption. *Salmonella* are important causes of gastroenteritis. Symptoms of *Salmonella* infection in healthy human beings include fever, diarrhea, abdominal pain and sometimes vomiting.

Escherichia coli is recommended to be totally absent from poultry meat before such can be fit for human consumption. Form the work understudied higher levels of *E.coli* was reported from chicken meat samples (76%) than from mutton meat (64%) samples. Prevalence in chicken meat samples i.e 76% (19) obtained from the work was very high in comparison to 0.4%, 5.6%, 11.1% and 16% from Syene et. al.,[36], Tavakoli & Riazipur,[45], Adesiji et. al.,[44] and Ukut et. al.,[43] respectively. The prevalence levels obtained in mutton from present study was 64%, which was very high when compared to the reports by Bradeeba and Sivakumar[27] who had reported it as 24% in mutton samples. High rates of *E.coli* obtained is an indicative that poultry meats obtained from sourced areas were unfit for human consumption in accordance with criterion of recommended limits by foreign food agencies. Poultry meat obtained from these markets should therefore be properly cooked to denature toxin produced by the organism as well as the organism such that consumption will not pose health-risks to human population. *E.coli* causes illness ranging from gastrointestinal tract-related complications such as diarrhea, dysentery, urinary tract infection, pneumonia and even meningitis[46], although majority of the *e.coli* strains are non pathogenic and exists in the intestinal tract of humans and animals.

Table showing microbiological quality of different meat samples

Type of sample	**TVC**	***Staphylococcus* positive samples**		***Salmonella* & *Shigella* positive samples**		***E.coli* positive samples**	
	log of CFU/gm	**No. of positive samples**	**Percentage of positive samples**	**No. of positive samples**	**Percentage of positive samples**	**No. of positive samples**	**Percentage of positive samples**
Chicken (25)	6.12	13	52	0	0	19	76
Mutton (25)	5.8	16	64	1	4	16	64

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