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Evaluation of Microbial Quality of Goat Meat at Local Market of Tando Jam

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Abstract: The research consist of the goat meat to investigate the relationship between goat meat in different age groups, group A (≤7 m), group B (8-10 m) and group C (≥11 m). The level of contamination of goat meat processed by butchers under local marketing conditions was investigated during 2008-9. A total of 21 goat meat samples were collected equally from three age groups each containing 7 samples Aerobic plate count, Coliform and yeasts and moulds counts enumerated from meat of group A ($3.8 \times 10^5 \pm 2.3 \times 10^4$, $1.8 \times 10^5 \pm 1.0 \times 10^4$ and $1.5 \times 10^3 \pm 2.2 \times 10^2$ cfug^{-1}, respectively) were not significantly different ($p>0.05$) from goat meat of group B ($3.3 \times 10^5 \pm 4.1 \times 10^4$, $1.7 \times 10^5 \pm 5.9 \times 10^4$, $1.4 \times 10^3 \pm 2.9 \times 10^2$ cfug^{-1}, respectively) and group C ($3.6 \times 10^5 \pm 2.4 \times 10^4$, $1.6 \times 10^5 \pm 1.7 \times 10^4$ and $1.5 \times 10^3 \pm 3.1 \times 10^2$ cfug^{-1}, respectively).The results conclude the meat of goat slaughtered in advanced age may have an extensive advantage to reduce qualitative and quantitative losses of end products; the fact of unhygienic and poor sanitary condition under which the goat meat was handled sold at local meat shops/stalls.

Key words: Goat meat, aerobic plate count, coliform counts, yeasts and molds count

INTRODUCTION

Meat is an important edible postmortem component originating from the live animals that are used as food by human. These animals include domesticated cow, buffalo, sheep, goat, camels and some wild animals i.e. dear, hog and rabbit. In addition poultry have become a major meat producing species, while various game animals and birds provide a substantial amount of meat particularly in localized areas. Fish and other sea foods have also important part of human diet since earliest time. However, cow, buffalo, sheep and goat are the main sources of red meat in Asia. Goat meat is without a doubt one of the staple red meat in human diet. Indeed goat meat is acceptable throughout the world but cultural and social tradition and economic condition often influence consumer preferences.

Goat is the animal of developing countries where more than 95% of goat population are reared indicating their economics importance and adaptation in the different agro-ecological zones of Asia and Africa (Chowdhury and Mutalib, 2003). The goat meat is popular in the Middle East, Africa and South Asia including Pakistan. The perception of consumers in the Western world is not in favor of goat meat; however, in Pakistan the meat consumption pattern is entirely different to those in developed countries, where majority of Pakistani consumers prefer goat meat. There is also a worldwide tendency for rapid increase in demand for goat meat (Stankov *et al*., 2002). Goat meat has an immense market potential, as it can become an ideal choice for health conscious consumers (Johnson *et al*., 1995; Carlucci *et al*., 1998). In recent time market of meat have been adapting to different requirements of contemporary consumers, insisting of lean and easily digestible meat of high quality and good test (Lesiak *et al*., 1997). Goat meat market and geographical pattern of consumption in sub-tropical and tropical developing countries are different. Goat meat for longer occupied a special place in the diet for variety of reason including test preference, prestige, religion, tradition and availability, in almost all the communities of the country with the nutritional aspect (Dahnda, 2001). Pakistan is the second largest goat producing country in South Asia region having 56.7 million goats contributing about 578, 000 tons of mutton (Anonymous, 2008-09). Goat production in Pakistan has expanded considerably over recent decades as a result population densities have also increased.

Limited studies on carcass microbiological quality of goat meat has appeared in literature (Babiker *et al*., 1990; Mahgoub and Lodge, 1996; Babji *et al*., 2000) and no studies have been reported so far on the same aspects of goat meat particularly in Sindh. Therefore keeping in view the importance of the subject, this study is designed to evaluate the selected microbial attributes of goat meat available in local market of Tando Jam.

MATERIALS AND METHODS

Collection of meat samples: A total of 21 goat meat samples were randomly collected from local meat market of Tando Jam. All the samples were grouped

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according to the age at slaughter as per butcher's information and accredited with A (≤7 m, age), B (8-10 m, age) and C (≥11 m, age) codes. Whereas boneless meat samples for microbiological analysis were collected in sterilized screw caped bottles and brought under refrigeration in ice box. All the samples were brought to Laboratory of department of Animal products Technology, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tando Jam, for further analysis.

Preparation of test samples: Minced meat sample (10 g) was reconstituted aseptically with 90 ml of 0.1% peptone water (Oxoid England) in a laboratory blender (AOAC, 1990).

Enumeration of total viable count (Colony count technique at 30°C): Total viable counts were enumerated according to the method of (IDF, 1991). Pre prepared test sample (1 ml) of 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6} and/or 10^{-7} dilutions was transferred into sterile petri dishes in duplicate through sterile graduate pipette and/or dispensing pipette (1000 µl) with sterile plastic tips and warm (45±1°C) sterile plate count agar medium (15 ml) was mixed with inoculum. The mixture was allowed to solidify and incubated (30°C) for 72±2 h. Parallel to that, control plates were also prepared using similar medium (15 ml) to check the sterility. The dishes containing more than 30 and/or fewer than 300 colonies were selected and counted using colony counter. The result was calculated using following formula:

$$N = \frac{\sum c}{(n_1 + 0.1 \times n_2)\, d}$$

$\sum c$: Sum of colonies counted on all the dishes retained.
n_1 : Number of dishes retained in the first dilution.
n_2 : Number of dishes retained in the second dilution.
d : Dilution factor corresponding to the first dilution.

Enumeration of Coliform counts (Colony count technique at 37°C): Coliform counts were enumerated according to the method of British Standards Institution (BSI, 1993). Pre prepared test sample (1 ml) of 10^{-1}, 10^{-2}, 10^{-3} 10^{-4} and/or 10^{-5} dilution was transferred into sterile petri dishes through dispensing pipette (1000 µl) with sterile plastic tips and warm (45±1°C) sterile violet red bile agar medium (15 ml) was mixed with inoculum. The mixture was allowed to solidify and incubated (37°C) for 24±2 h. Parallel to that control plates were also prepared using similar medium (15 ml) to cheek its sterility. The dishes containing more than 10 and/or fewer than 200 colonies were selected and counted using colony counter. The result was calculated using formula as mentioned in section 3.11.

Enumeration of yeasts and moulds counts (Colony count technique at 25°C): Yeasts and moulds count were enumerated according to the method of IDF (1990). Pre prepared test sample (1 ml) of 10^{-1}, 10^{-2} and/or 10^{-3} dilution was transferred into sterile petri dishes through dispensing pipette (1000 µl) with sterile plastic tips and warm (45±1°C) sterile potato dextrose agar medium (15 ml) was mixed with inoculum. The mixture was allowed to solidify and incubated (25°C) for 5 days. Parallel to that control plates were also prepared using medium (15 ml) to cheek the sterility. The dishes containing more than 10 and/or fewer than 150 colonies were selected and counted using colony counter. The result was calculated using formula as mentioned in section 3.11.

Statistical analysis: Statistical analysis was performed using the computer programme i.e. Student Edition of Statistics (Sxw), version 8.1 (Copy right 2005, Analytical Software, USA).

RESULTS

Aerobic plate count: Goat meat samples of different age groups were analyzed and the results are summarized in Fig. 1. The mean concentration of Aerobic Plate Count (APC) detected from meat of group A, group B and group C goat were $3.8 \times 10^5 \pm 2.3 \times 10^4$, $3.3 \times 10^5 \pm 4.1 \times 10^4$ and $3.6 \times 10^5 \pm 2.4 \times 10^4$ cfug^{-1} (colony forming unit per gram), respectively and ranged between 2.8×10^5 to 4.6×10^5, 1.5×10^5 to 4.8×10^5 and 2.8×10^5 to 4.7×10^5 cfug^{-1} respectively. There are no significant differences ($p>0.05$) in aerobic plate counts detected from goat meat samples among different age groups of goat meat.

Coliform count: Coliform counts in goat meat of different age groups (group A, group B and group C), were examined and results are presented in Fig. 2. The coliform count varied from 1.5×10^5 to 2.3×10^5 cfug^{-1} (average, $1.8 \times 10^5 \pm 1.0 \times 10^4$ cfug^{-1}) in group A goat meat, while 1.6×10^5 to 2.1×10^5 cfug^{-1} (average, $1.7 \times 10^5 \pm 5.9 \times 10^4$ cfug^{-1}) in group B goat meat and 1.4×10^5 to 2.7×10^5 cfug^{-1} (average, $1.6 \times 10^5 \pm 1.7 \times 10^4$ cfug^{-1}) in group C goat meat. The overall mean of coliform count in goat meat computed in range between 1.4×10^5 and 2.7×10^5 cfug^{-1} (mean, $1.7 \times 10^5 \pm 6.9 \times 10^3$ cfug^{-1}). Further more the result shows that there is no significant ($p>0.05$) variation in the means of Coliform count found in the meat of different age groups of goat meat.

Yeasts and molds count: Three different age groups of goat meat were analyzed for yeasts and molds count, and results are presented in Fig. 3. The average yeasts and molds count varied between 1.0×10^3 to 2.6×10^3 cfug^{-1} (average $1.5 \times 10^3 \pm 2.2 \times 10^2$ cfug^{-1}) in group A goat

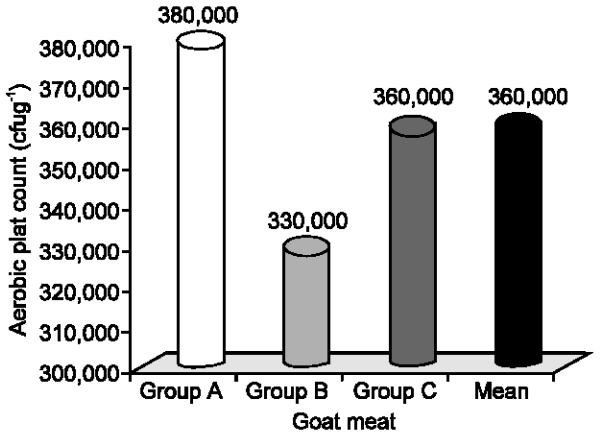

Fig. 1: Aerobic plate count (cfug^{-1}) of different age groups of goat meat

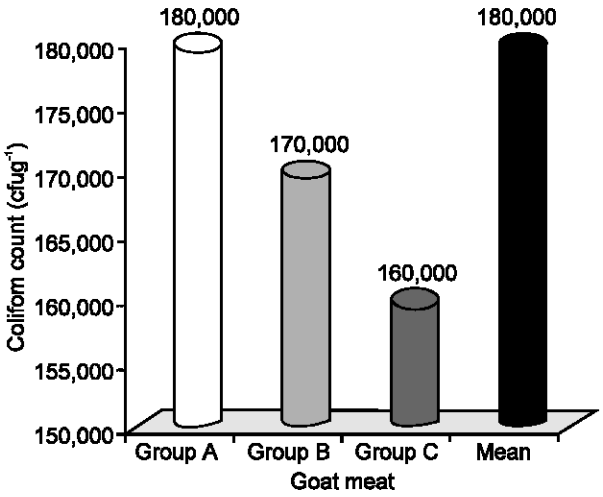

Fig. 2: Coliform count (cfug^{-1}) of different age groups of goat meat

meat, while ranged between 4.0 x 10^2 to 2.5 x 10^3 cfug^{-1}, (mean 1.4 x 10^3±2.9 x 10^2 cfug^{-1}) in group B goat meat and in between 7.0 x 10^2 to 3.0 x 10^3 cfug^{-1}, (averaged 1.5 x 10^3±3.1 x 10^2 cfug^{-1}) in group C goat meat. The overall yeasts and molds count in goat meat ranged between 4.0 x 10^3 to 3.0 x 10^3 cfug^{-1} (mean 1.5 x 10^3±1.5 x 10^2 cfug^{-1}). Furthermore statistical analysis showed no significant differences ($p>0.05$) in yeasts and molds counts in the means of meat from different age groups of goat meat.

DISCUSSION

There were no significant differences in aerobic plate count in goat meat samples in three groups ($p>0.05$). The higher aerobic plate count enumerated from goat meat 3.6 x 10^5±1.7 x 10^4 cfug^{-1}, suggested that an unusual amount of contamination and/or growth of

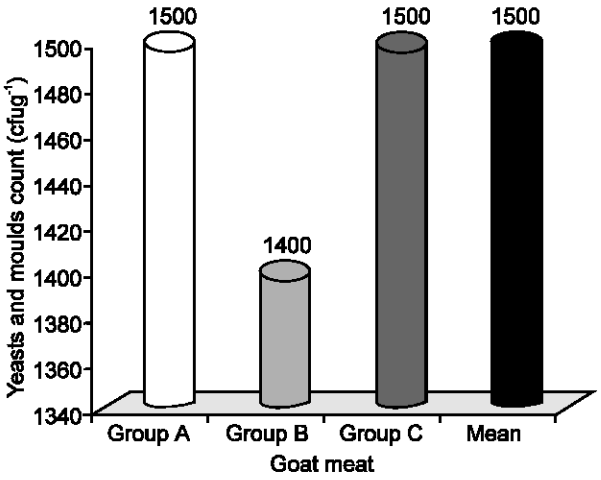

Fig. 3: Yeasts and molds (cfug^{-1}) of different age groups of goat meat

natural floral occurred during marketing; The finding of Vanderline *et al.* (1998) were similar to those of the present study. Higher numbers of bacteria could be transmitted from the fleece of goat to the carcass surfaces during hide removal (Bell *et al.*, 1993). The area of highest contamination was those sites where cuts were made through the skin (Bell and Hathaway, 1996). Over all study revealed that the level of contamination in the traditional meat shops was significantly higher compared to the reported from developed countries. The finding of present study reflected the hygienic status of meat production in the developing world (Bhandare *et al.*, 2007). According to Pace (1975) and Solberg *et al.* (1986) that bacterial count exceeding 10^5/g^{-1} in delicatessen food products are indicative of dangerous contamination.

Coliform count was observed from goat meat revealed no significant relation ($p>0.5$) with an increasing slaughter age. However, the concentration of Coliform count enumerated from goat meat (1.7 x 10^5±6.9 x10^3 cfug^{-1}) is very higher which is assumed to be an indicator of fecal contamination. It is likely that the observed incidence of fecal bacteria is due to problem associated with removal of the fleece and its coming into contact with the surface of carcass (Ozlem-Erdogrul, 2005). Chaubey *et al.* (2004) enumerated the Coliform the majority of the meat samples and being suggested that raw meat and meat products should be handled under strict hygienic condition and stored in cool places to avoid contamination and safeguard the health of consumers. According to Pace (1975) and Solberg *et al.* (1986) that Coliform count higher than 10^2/g in delicatessen food products are indicative of dangerous contamination.

The count of yeasts and molds observed in goat meat averaged 1.5 x 10^3±1.5 x10^2 cfug^{-1}. There were no

significant differences within different age groups of goat meat in term of yeasts and molds count ($p>0.05$). The value displayed a similarity to the illustrative values of (Ozlem-Erdogrul, 2005).

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