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Examination of Physical Properties of Goat Meat

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Abstract: The study was conducted to examine physical properties of goat meat to evaluate the relationship between goat meat in different age groups, group A (≤7 m), group B (8-10 m) and group C (≥11 m). In the first step physicochemical characteristics of goat meat in respect of pH, Water Holding Capacity (WHC), Cooking Loss (CL) and Drip Loss (DL) were determined. A total of 21 goat meat samples were collected equally from three age groups each containing 7 samples. The mean pH value of goat meat of group A, B, and C (6.28, 6.30 and 6.34% respectively) mean WHC (61.77, 63.36 and 63.36% respectively) were not significantly different ($p>0.05$) from each other. WHC of goat meat group B (63.36±028%) and group C (63.36±0.21%) were very similar and significantly ($p<0.05$) higher than meat group A goat (61.77±0.32%). Cooking loss and drip loss in goat meat of group A (38.72±0.60 and 4.93±0.16%, respectively) were higher compared to advanced slaughter age (8-10 m of age: 35.77±0.86 and 4.02±0.10% and ≥11 m of age: 33.40±1.13 and 4.06±0.14%, respectively). The result concludes the meat of goat slaughtered in advanced age may have an extensive advantage to reduce qualitative and quantitative losses of end products and by products with relation to export.

Key words: Goat meat, public health hazards, food borne diseases

INTRODUCTION

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, 2008-9). Goat production in Pakistan has expanded considerably over recent decades as a result population densities have also increased.

Meat is an essential food fit for human consumption obtained after postmortem originating from the live animals after slaughters that are used as food by human. These animals include domesticated cow, buffalo, sheep, goat, camels and some wild animals i.e. dear 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. No doubt, goat meat 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.

It is still difficult to ensure safety of meat supply to the consumers. The public due to unawareness and due to non enforcement of laws, many time buy meat which can not ensure protection to consumers from the effect of potentially danger of inferior quality meat. High sanitation standards, in the slaughter houses, processing plants and handling of meat at various stages of marketing are of great importance to obtain high quality meat; because the meat is an ideal media for the development and multiplication of microorganisms, particularly bacteria. Many changes occur in the handling, processing and packing of meat in relation to microbiological quality because bacteria reduce shelf life of meat and cause public health hazards. Bacteria which are responsible for food borne diseases contaminate the meat directly or indirectly from animal excreta at the slaughter process, and may also transfer from the surfaces, utensils and other equipments. Slaughtering processing and distribution of meat may produce suitable environment for the contamination of carcass by potentially pathogenic bacteria. Therefore hygienic goal of modern harvesting system is to reduce cross contamination; to the practicable level (Brown *et al*., 2000).

Limited studies on carcass physical properties of goat meat have 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 conducted to evaluate the physico attributes of goat meat available in local market of Tando Jam.

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MATERIALS AND METHODS

pH value: Meat sample (10 g) homogenized in distilled water (90 ml) was used to measure the pH value using pH meter (Ockerman, 1985).

Water-holding Capacity (WHC): The method reported by Wardlaw *et al.* (1973) was used to determine the WHC of meat samples. Meat sample (8 g) was mixed with 0.6 M NaCl solution (12 ml) in the test tubes and placed into a water bath (5°C) for 15 min. These were then centrifuged (4°C) at 10,000 rpm for 15 min in a refrigerated centrifuge machine. The supernatant was decanted and measured. WHC was reported as ml of 0.6 M NaCl per 100 g of meat.

Cooking loss: Meat sample (20 g) was placed in polyethylene bag and heated in a water bath at internal temperature of 72°C. Cook-out was drained and the cooked mass was cooled and weighed to determine the weight loss (Kondaiah *et al.*, 1985).

$$\text{Cookingloss}(\%)=\frac{\text{Actualweight}-\text{Cookedmassweight}}{\text{Actualweight}}\text{x}100$$

Drip loss: Drip loss was measured as described by Sen *et al.* (2004). Raw meat samples (50 g) were placed at 4°C for 24 h in a refrigerator under polyethylene sealed covers. After 24 h the sample was wiped and dried with filter paper and weighed. Weight of sample is the drip loss of sample.

$$\text{Driploss}(\%)=\frac{\text{Actualweight}-\text{Weightafterrefrigeration}}{\text{Actualweight}}\text{x}100$$

RESULTS

pH value: The pH value of goat meat was examined and results are presented in Fig. 1. It was observed that pH value slightly varied in different age groups of goat meat. Goat meat of group A (≤7 m) showed pH value in a range between 6.13 and 6.51, while meat of group B (8-10 m) revealed the variation in between 6.12 and 6.42. Where as pH value of meat of group C (≥11 m) appeared in between 6.08 and 6.68. Further, the result revealed that the pH value of goat meat of group C (6.34) is slightly higher followed by group B (6.30) and group A (6.28). Moreover, these differences in the means of pH of goat meat of different age groups are not statistically different (p>0.05).

Water holding capacity: The effect of age on water holding capacity of goat meat was analyzed and the results are presented in Fig. 2. It was found that the meat of young goat has low water holding capacity than old age groups. The water holding capacity varied between 60.50-63.0% (average 61.77±0.32%) in group A goat meat; while in between 62.50-64.50% (average 63.36±0.28%) in group B goat meat and in between 62.50-64.0% (average 63.36±0.21%) in group C goat meat. Furthermore, the results of statistical analysis illustrates that the differences in water holding capacity between three groups of goat meat were highly significant (p<0.001).

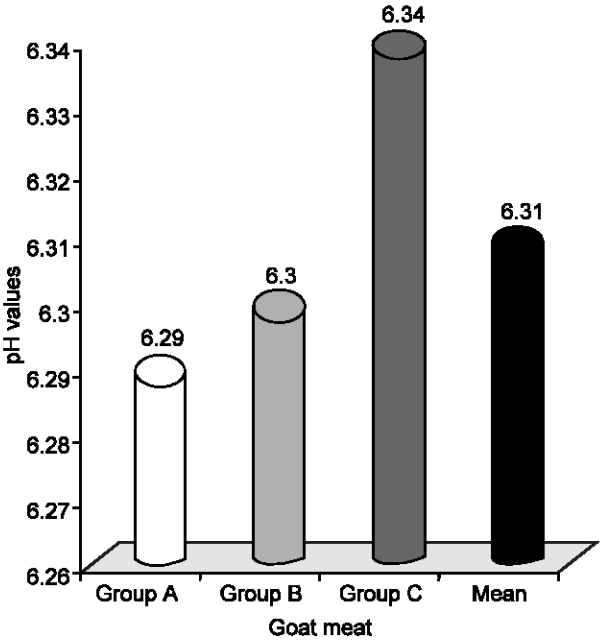

Fig. 1: pH value of goat meat of different age groups

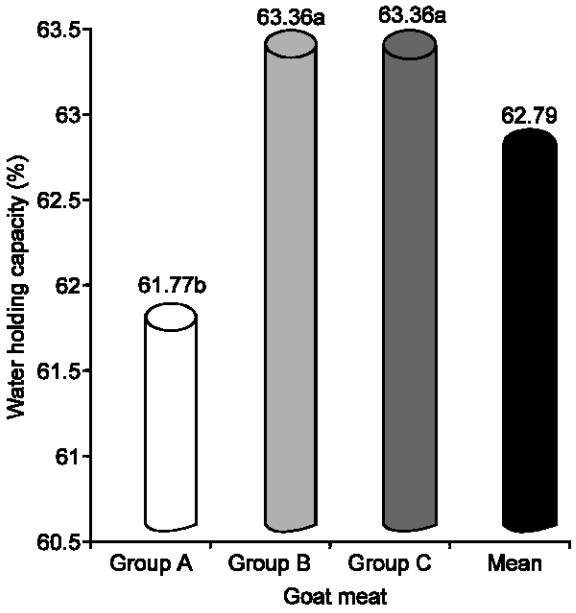

Fig. 2: Water holding capacity of goat meat of different age groups

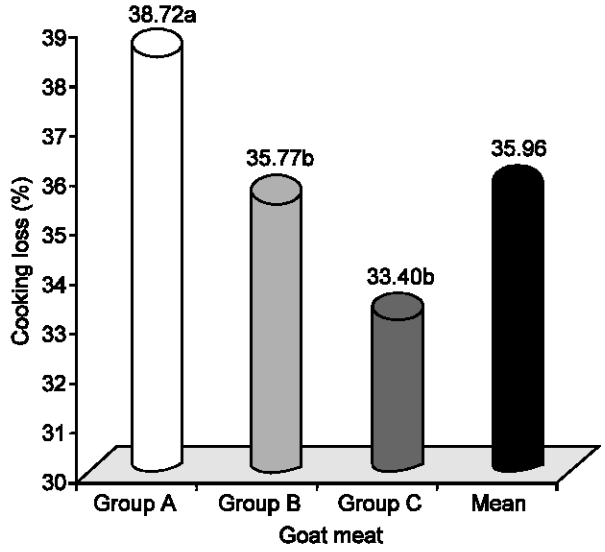

Fig. 3: Cooking loss (%age) of goat meat of different age groups

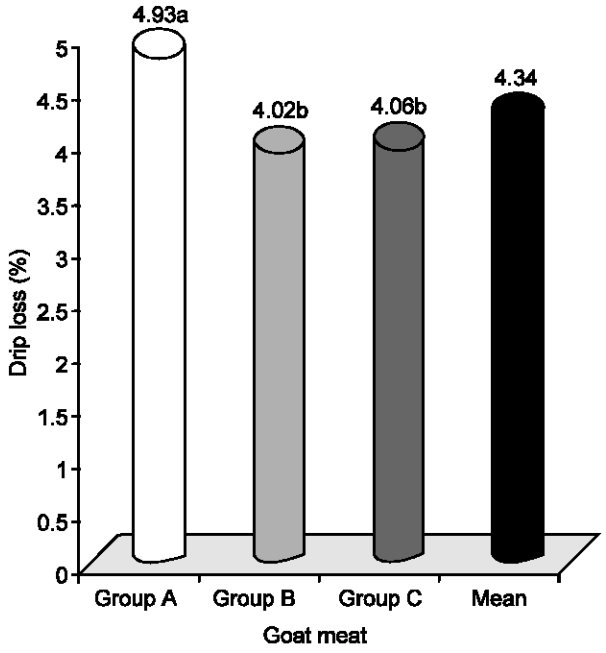

Fig. 4: Drip loss (%age) of goat meat of different age groups

However, when means ware compared (LSD 0.05), the result showed no significant difference ($p>0.05$) in water holding capacity in group B and group C; While meat of group A was significantly different ($p<0.05$) in water holding capacity from other groups.

Cooking loss: The effect of age on cooking loss of goat meat of different age groups was evaluated and results are shown in Fig. 3. It was observed that the cooking loss in meat of young age goat (≤7 m) group A was higher (38.72±0.60%; range 36.45-41.15%) compared to group B (8-10 m) and group C (≥11 m) i.e. 35.77±0.86% (range 32.60-38.25%) and 33.40±1.13% (range 29.65-37.85%) respectively. Statistical analysis (ANOVA) showed significant differences ($p<0.002$) in cooking loss in meat of different age group. Both groups (B and C), of which cooking loss in meat was significantly different ($p<0.05$) from the meat of group A, (≥7 m) goat.

Drip loss: The goat meat of three different age groups was analyzed for drip loss and results are summarized in Fig. 4. The drip loss in goat meat of group A averaged 4.93±0.16% (range 4.48-5.69%), which is remarkably higher than the drip loss in meat of group B 4.02±0.1% (range 3.58-4.42%) and in group C, goats 4.06±0.14% (range 3.58-4.60%). Statistical analysis (AOV) indicates highly significant differences ($p<0.001$) in drip loss in meat of different age groups.

However, the means of drip loss in meat of group B and group C goat were statistically (LSD 0.05) non significant ($p>0.05$); while drip loss in meat of both groups (B and C) goats was significantly ($p<0.05$) lower compared to drip loss in meat of group A goats.

DISCUSSION

pH value of 6.28±0.05 was observed in ≤7 m age group, while it was 6.30±0.04 in 8-10 m age group compared to ≥11 m age group (6.34±0.07). The results in the present study were not significantly different in respect of pH value between three age groups of goat meat. These results are supported by Laskar and Nath (1998). However, Karakaya *et al.* (2006) found significant ($p<0.05$) differences between meat species in respect of pH value in pre and post rigor stages. Pearson and Young (1989) investigated that rigor stage of meat species had significant effect on pH value, this is because of glycolysis, under which the glycogen is largely degenerated and mainly responsible for the formation of lactic acid. Laskar and Nath (1998) reported no significant differences in pH value of either between sexes or between muscle cuts at 24 and 72 h after slaughter.

Water holding capacity of (61.77±0.32%) in group A goat meat was lower compared to goat meat in group B (63.36±0.28%) and in group C goat meat (63.36±0.21%). In a study conducted by Laskar and Nath (1998) found that ultimate pH of meat showed a significant positive correlation with water holding capacity. The relationship between pH and water holding capacity has been well established Warriss *et al.* (1999). In another study Karakaya *et al.* (2006) reported that mutton and goat meat had higher EbC and water holding capacity value in both pre and post rigor stages. The rigor stage of meat species affect significantly, ($p<0.05$) of pH, EbC water holding capacity.

The maximum cooking loss (38.72±0.60%) was observed in ≤7 m age group of goat meat, while gradually decreased with increase in age of goat i.e. (35.77±0.86% and 33.40±1.13% in 8-10 m and ≤11 m age group of goat meat respectively. Karakaya *et al.* (2006) reported the significant differences ($p<0.05$) in cooking loss between the species of pre rigor stage. These results are consistent with those of Aaslyng *et al.* (2003), who showed the significant effect of pH and water holding capacity on cooking loss. In an other study the increase in cooking loss had been attributed with decline in pH value Lawrie (1991).

Drip loss (4.93±0.16%) in goat meat of ≤7 m age group was higher compared to 8-10 m age group (4.02±0.10%) and ≤11 m age group (4.06±0.14%). Significant increase in drip loss towards the time and different muscles had been observed Nagaraj *et al.* (2005). There were different opinions regarding the reason behind the increase in drip loss, namely protein degeneration (Penny, 1977), sarcomere shortening (Honekel *et al.*, 1986) and myosin degeneration (Offer, 1991) resulting in shrinkage of myosin, drawing the thick and thin filaments more closely together.

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