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Effect of Slaughtering Age on Chemical Composition of Goat Meat

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Abstract: The research consist of chemical analysis 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). Chemical characteristics of goat meat in respect of moisture, protein, fat and ash contents were determined of goat meat processed by butchers under local marketing conditions were investigated during 2008-9. Moisture content of goat meat group A was higher (78.30±0.48%) followed by group B (75.70±0.50%) and group C (73.8±0.061%). Protein, fat, ash content in meat of group A was lowered (15.31±0.68, 1.77±0.24 and 1.20±0.06%, respectively) and increase with advance slaughter age (Group B; 18.43±0.80, 2.71±0.18 and 1.31±0.08% and Group C; 20.30±0.91, 3.07±0.17 and 1.63±0.07. 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 and variation in meat of different age groups animal were found.

Key words: Goat meat, protein, fat, ash content

INTRODUCTION

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).

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.

Few studies on carcass chemical composition 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 analyzed the chemical attributes of goat meat available.

MATERIALS AND METHODS

Collection of meat samples: A total of 30 goat meat samples I-e. (ten from each category) were randomly collected from local meat market of Tando Jam. All the samples were grouped 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. All the samples were brought to Laboratory of department of

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Animal products Technology, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tando Jam, for further analysis.

Moisture content: Moisture content was observed according to the method of Association of Official Analytical Chemistry (AOAC, 2000). The fresh minced meat sample (5 g) was transferred in pre-weighed flat bottom aluminum dish, which was transferred to hot air oven at 101±1°C for 3-4 h. Dried sample was then placed in desiccators having silica gel as desiccant. After 1 h, the dish was weighed. Moisture content was calculated by applying the following formula:

$$\text{Moisture}(\%) = \frac{W2 - W3}{W2 - W1} x100$$

W1 = weight of empty dish
W2 = weight of dish + sample
W3 = weight of dish + dried sample

Total protein content: Protein content was determined according to the method as described by AOAC (2000). The sample (2 g) was digested using Micro-Kjeldhal digester in the presence of catalyst (0.35 g copper sulfate and 7 g sodium sulfate/potassium sulfate) where sulfuric acid (20-30 ml) was used as an oxidizing agent and diluted with distilled water (250 ml). The diluted sample (5 ml) was distilled with 40% NaOH using Micro-Kjeldhal distillation unit where steam was distilled over 2% boric acid (5 ml) containing an indicator bromocresol green for 3 min. The ammonia trapped in boric acid was determined by titrating with 0.1N HCl. The nitrogen percentage was calculated using the following formula:

$$N(\%) = \frac{1.4(V_1 - V_2) \text{ x normality of HCl x } 250}{\text{Weight of sample taken x volume of diluted sample}}$$

V_1 = titrated value
V_2 = blank sample value

While protein percentage was determined by conversion of nitrogen percentage to protein by using conversion factor (6.25) assuming that all the nitrogen in meat was presented as protein i.e. protein percentage = N% x CF.

Total fat content: Total Fat Content (TF) was extracted in Soxhlet Extraction Unit as described by AOAC (2000). Soxhlet Extractor was set with reflux condenser and distillation flask which has been previously dried and weighed. Dried meat sample (2 g) was taken in to fat free extraction thimble and placed in extraction apparatus (soxhlet). Then ether (150 ml) was poured in to extraction flask and condenser was joined and placed on electric heater in order to boil the solvent gently. Extraction was carried out for 6 h. The solution was removed. Fat content was calculated by using the following formula:

$$\text{Fat}(\%) = \frac{W1 - W2}{W3} x100$$

W1 = weight of empty distillation flask
W2 = weight of distillation flask + Fat
W3 = weight of sample taken

Ash percentage: Ash percentage was determined by Gravimetric method as described by AOAC (2000) using muffle furnace. The fresh minced meat sample (5 g) was transferred in pre-weighed crucible and transferred to muffle furnace at (550°C) for 4-5 h. Ashed sample was transferred to desiccator having silica gel as desiccant. After 1 h, the dish was weighed. The ash content was calculated by the following formula:

$$\text{Ash}(\%) = \frac{\text{Wt of ashed sample}}{\text{Wt of sample taken}} x100$$

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

Moisture content: Moisture content of goat meat was examined and consequent results are shown in Fig. 1. Average moisture content in meat of group A goats was observed as 78.30±0.48% (range 76.60-80.02%), which is comparatively higher than the mean moisture contents in meat of group B and group C, goats i.e. 75.70±0.50% (range 73.40-77.00%) and 73.80±0.61% (range 72.20-76.60%), respectively. The overall moisture content in goat meat varied in a range 72.20 and 80.02 (mean 75.99±0.50%) There were statistically (one way AOV) highly significant differences ($p<0.001$) observed in meat of different age groups of goat meat (group A, B and C). Further results of LSD (0.05) comparison of means reveals that the moisture content in meat of different age groups are significantly different ($p<0.001$) from each other.

Protein content: Protein content in goat meat was analyzed, and results are depicted in Fig. 2. Protein content varied between 13.12-17.50% in goat meat of group A, 15.31-21.87% in group B meat and 17.50-24.06% in group C goat meat. Result further showed that the protein content in group A meat (average 15.31±0.68%) was lower as compared to group B and group C meat (average 18.43±0.80% and 20.30±0.91%, respectively). The overall average protein content in goat meat ranged between 13.12-24.06% (mean,

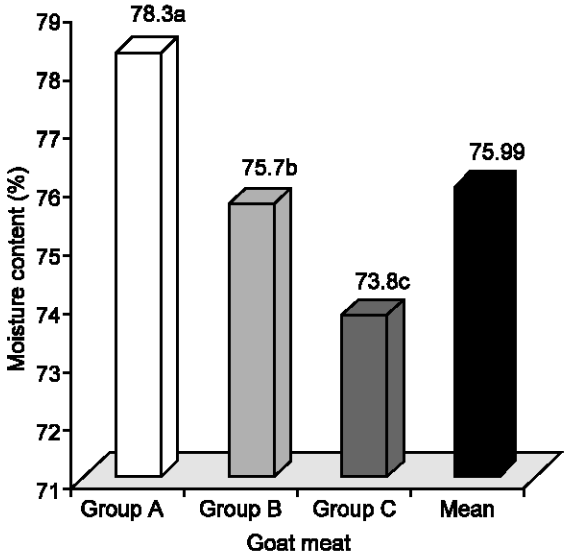

Fig. 1: Moisture content (%age) of goat meat of different age groups

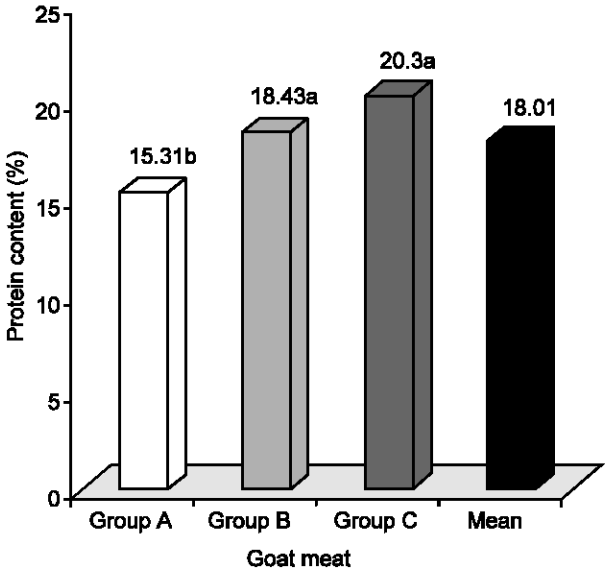

Fig. 2: Protein content (%age) of goat meat of different age groups

18.0±0.64%). It was further observed that protein content was statistically (AOV) different ($p<0.001$) in different age groups of goat meat. However, LSD comparison of means at rejection level of 0.05 revealed that the average protein content in meat of group B and group C goat was not significantly different ($p>0.05$) from each other. While mean of protein content in meat of group A meat was significantly lower ($p<0.05$) from the meat of other groups (B and C) goats.

Fat content: Fat content in goat meat was examined, and results are presented in Fig. 3. A wide variation in fat

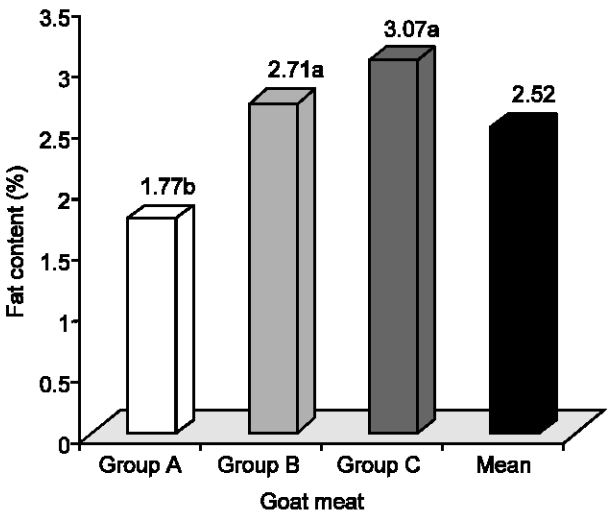

Fig. 3: Fat content (%age) of goat meat of different age groups

content within three groups of goat meat was observed. Fat content in goat meat of group A ranged between 1.0 and 2.5%, in group B between 2.0 and 3.5% and in group C between 2.5 and 3.5%. Furthermore the result showed that the fat content in goat meat of group C was highest (3.07±0.17%) followed by group B (2.71±0.18%) and group A (1.77±0.24%). It was further observed that the fat content was statistically (AOV) different ($p<0.001$) in three groups of goat meat. However, LSD (0.05) comparison of means revealed that the average fat content in goat meat of group A was significantly lower ($p<0.05$) from meat of other groups; while means of group B and group C were not significantly different ($p>0.05$) from each other.

Ash content: The goat meat of different age groups was analyzed for ash content and results are summarized in Fig. 4. Ash content in meat of group A goat averaged 1.20±0.06% (range, 1.0-1.4%), while in group B meat, it was in a range in between 1.0-1.6% (mean 1.31±0.08%) however, ash content in goat meat of group C varied between 1.4 and 1.8% (mean, 1.63±0.07%). One way (ANOVA) revealed significant differences ($p<0.002$) in ash content of different age group of goat meat. However, LSD comparison of means at rejection level of 0.05 revealed that the average ash content in group A and group B meat was not significantly different ($p>0.05$) from each other. While mean of group C meat was significantly ($p<0.05$) higher from other groups (A and B).

DISCUSSION

Moisture content (78.30±0.48) in goat meat with age group of $\leq$7 was remarkably higher than the meat of goat with age group of 8-10 m and with age group of $\geq$ 11 m, i.e. 75.70±0.50 and 73.80±0.61, respectively. It is of

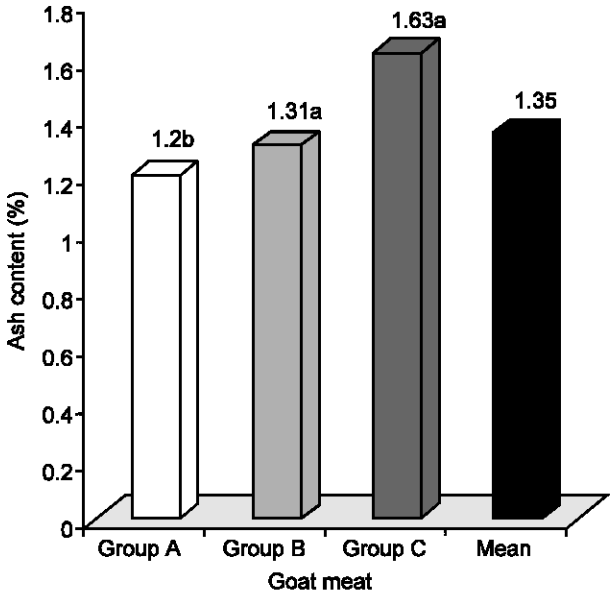

Fig. 4: Ash content (%age) of goat meat of different age groups

interest to point that the decrease in moisture content of goat meat observed in the present study is directly correlates with increase in age of goat. It has been observed that slaughter age had significant effect on decrease in moisture content with advancing slaughter age (Madruga *et al*., 1999 a). While, Stankov *et al*. (2002) reported that the decrease in moisture content in meat has been due to increase in fat content in meat. However in an other study conducted by Beserra *et al*. (2004) the increase in moisture content had been attributed with breeding group and with age.

Meat of goat slaughter at the age of ≥11 revealed remarkably high protein content (20.30±0.91%) compared to meat of goat slaughter at the age of 8-10 m, (18.43±0.80%) and are at the age of ≤7 m, (15.31±0.68%). These results are in agreement with results of Madruga *et al*. (2006) who reported the significant effect of slaughter age on protein content of goat meat. They further reported that meat of goat slaughter at ≥11 m, age was better in chemical composition compared to meat of goat slaughter at the age of ≤7 m and 8-10 m, age. However, there was no significant difference in proximate protein content between Longissimus dorsi and bicep femoris of goat meat. Niedziolka *et al*. (2006) reported the similar trends of protein content of goat meat as observed in present study.

Fat content in young age group ≤7 m of goat meat was considerably low (1.77±0.24%) compared to advance age group 8-10 m (2.71±0.18%) and ≥11 m old age group (3.07±0.17%). There are contradictory results in the literature; fat content is low in younger animal and increased with advancing slaughter age Madruga *et al*. (1999 a). While Akic *et al*. (2001) reported the highest fat content in the meat of old animals as compared to younger animals. This had been confirmed in other study conducted by Stankov *et al*. (2002) they also found the significant differences in slaughtering age (upon reaching sexual maturity). However, Beserra *et al*. (2004) reported the similar results as observe in present study. Ash content (1.20±0.06%) analyzed in group A goat meat was significantly lower followed by in group B goat meat (1.31±0.08%) and in group C goat meat (1.63±0.07%). Considerable research has been conducted in different parts of world on examining the physicochemical changes in goat meat with advancing age. The result of present study is in line with study conducted by Madruga *et al*. (2006) who reported that slaughter age had significant effect on physico-chemical characteristics of meat. Particularly the ash content increased with advancing slaughter age. In another study Pieniak-Lendzion *et al*. (2008) also reported the similar trend of increase in ash content and attributed it with slaughter age.

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