

Influence of Slaughtering Age on Chemical Composition of Mengali Sheep Meat at Quetta, Pakistan

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Abstract.- The aim of this study was to investigate chemical composition of meat of Mengali sheep (n=100) without teeth (group A), with 2 teeth (group B), with 4 teeth (group C) and 6 teeth (group D). Chemical characteristics of mutton in respect of moisture, protein, fat, ash and Vitamin A contents were determined. Moisture content for mutton group A was higher (76.20±1.48%), followed by B, C and D sheep viz., 75.12±2.52%, 74.07±1.61% and 73.17±2.32%, respectively. Protein content of group A meat was lower (17.79±1.77%) compared with B (18.31±2.24%), C (20.02±1.98%) and D (20.40±2.14%). The highest fat content was recorded in sheep meat of group D (4.71±0.55%), followed by group C (4.41±0.43%), B (3.91±0.48%) and group A (3.02±0.36%). Ash content in meat of group A sheep averaged 1.21±0.17%, group B 1.334±0.23%, group C 1.353±0.11% and group D 1.32±0.09%. Vitamin A content were found high in meat of group A (683.16±5.33 µg/100g) compared with that of B, C, and D (668.06±7.50, 664.04±5.12 and 653.74±4.89 µg/100 g meat, respectively). The meat of sheep with six teeth had the highest protein and fat contents and the lowest levels of moisture, vitamin A and ash contents. It is concluded that the moisture and Vit. A level decreased with age in the Mengali mutton whereas the protein, fat and ash contents increased with age.

Key words: Mengali sheep, chemical composition of meat, moisture content of meat, Vit A content of meat.

INTRODUCTION

In Pakistan, sheep is the major source of livelihood for millions of farmers especially in arid regions where crop production is limited. It contributes 21.9% of meat produced together with 50.3 thousands tones of carpet type wool per annum. As all over the world, sheep meat is also well-liked in Pakistan, especially in Balochistan and Khyber Pakhtoonkha province. Per capita consumption of meat with 20.5 kg in Pakistan was lower compared with the standards of advanced countries and of the World Health Organization (WHO, 2010). The perception of consumers in the Western world is not in favor of lamb meat; however, the meat consumption pattern of Pakistan is entirely different from developed countries, because of the fact that

majority of Pakistani consumers would prefer mutton over beef. Additionally, it was reported to be a worldwide tendency for rapid increase in demand for mutton (Stankov *et al.*, 2002). Mutton has an immense market potential, for being an ideal choice for consumers who are likely to be health conscious (Carlucci *et al.*, 1998). In recent years, meat marketing has varied depending upon various requirements pertaining to contemporary consumers for easy digestibility and its high nutritive value (Lesiak *et al.*, 1997). Mutton market and consumption pattern of subtropical and tropical countries is different from each other. For many years, sheep meat for longer have a special place in the diet for a variety of reasons such as taste preference, prestige, religion, tradition and availability, in almost all the communities of the country together with its nutritional aspects (Dahnda, 2001).

On the other hand higher intake of meat has been reported deleterious to health and consumption should be limited to meet the dietary requirement of

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the body (WHO, 2010; Sitepoe, 1992). Meat quality is dependent upon changes in its chemical components; *viz.* moisture content, protein, fat, and ash. The chemical properties of meat show a significant variation in respect of animal species, age, sex, feed and the location along with function of these parts in the body (Romans *et al.*, 1994). In addition, the ruminant body weight was significantly correlated with the amount of its chemical components, but the post-pubertal growth generally produces carcass of constant composition in respect of water, fat, protein and ash (Soeparano, 1994).

Few studies have been reported on carcass chemical composition quality of sheep and goat meat (Babiker *et al.*, 1990; Mahgoub and Lodge, 1996; Babji *et al.*, 2000; Arain *et al.*, 2010) and no report is available on the same aspects of sheep meat particularly in Balochistan, Pakistan. Hence, keeping in view the importance of the subject, the present study was designed to identify the chemical properties of Mengali sheep meat available in the mutton market of Quetta.

MATERIALS AND METHODS

Collection of meat samples

A total of 100 Mengali male sheep meat samples *i.e.*, (25 from each group) were randomly taken from local mutton market of Quetta, Pakistan. All the mutton samples were taken from muscle Longissimus dorsi (150g boneless) and grouped according to the age at slaughter as indicated by permanent incisors teeth, group A (>6 month and without teeth), group B (2 teeth), group C (4 teeth) and group D (6 teeth). All the samples were brought to the Laboratory of Transfer Technology, Center for Advanced Studies in Vaccinology and Biotechnology, University of Balochistan, Quetta for further analysis.

Estimation of chemical components

Moisture content, total protein contents, total fat content and ash content were determining using protocol of Association of Official Analytical Chemistry (AOAC, 2000).

Vitamin A levels were measured ($\mu\text{g}/100 \text{ g}$ meat) according to Lestariana and Madiyan (1988) method.

Statistical analysis

Descriptive statistics for chemical properties sheep meat with regard to different age group were expressed as Mean \pm SE. These quantitative properties were analyzed using ONE-WAY ANOVA, with age group. Mean Separation was performed using Duncan test at a $P<0.05$ significance level. All the statistical evaluations were done using the computer program *i.e.* Student Edition of Statistics (Sxw), version 8.1 (Analytical Software, USA, 2005).

RESULTS AND DISCUSSION

Table I shows the chemical composition of meat of sheep of different age groups. The chemical components are significantly influenced by age factor ($P<0.05$).

Moisture content

The average moisture content of meat of group A sheep was $76.20\pm 1.48\%$ (range 72.50-78.20%) which was higher compared to the moisture content of group B ($75.12\pm 2.52\%$, range 70.90-77.00%), C ($74.07\pm 1.61\%$, range 70.70-76.00%) and D ($73.17\pm 2.32\%$, range 69.80-75.10%). ANOVA shows statistically significant differences ($p<0.05$) between different age groups.

On the average the water content of meat is known to be relatively constant at about 75% (Lawrie, 1995). The decrease in moisture content of sheep meat observed in the present study seems to be related to increasing slaughtering age of sheep (Madruga *et al.*, 1999). However, Stankov *et al.* (2002) stated that the decrease in moisture content in meat resulted from increasing fat content of meat. However, in another study conducted by Beserra *et al.* (2004), the increase in moisture content was attributed with breeding group and with age. In line with the findings of the present study, Arain *et al.* (2010) reported the similar findings of moisture contents of goat meat.

Protein content

The protein content of meat of sheep in group A was $17.79\pm 1.77\%$, which was lower compared to B ($18.31\pm 2.24\%$), C ($20.02\pm 1.98\%$), and D ($20.40\pm 2.14\%$) groups.

Table I. Chemical analysis of sheep meat of different age groups.

Age groups	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Vitamin A ($\mu\text{g}/100\text{g}$ meat)
> 6 months	76.20 \pm 1.48 ^a	17.79 \pm 1.77 ^c	3.02 \pm 0.36 ^d	1.22 \pm 0.17 ^b	683.16 \pm 5.33 ^a
With 2 teeth	75.12 \pm 2.52 ^b	18.31 \pm 2.24 ^b	3.91 \pm 0.48 ^c	1.33 \pm 0.23 ^a	668.06 \pm 7.50 ^b
With 4 teeth	74.07 \pm 1.61 ^c	20.02 \pm 1.98 ^a	4.41 \pm 0.43 ^b	1.35 \pm 0.11 ^a	664.04 \pm 5.12 ^b
With 5 teeth	73.17 \pm 2.32 ^c	20.40 \pm 2.14 ^a	4.71 \pm 0.55 ^a	1.37 \pm 0.09 ^a	653.74 \pm 4.89 ^c
Means	74.64 \pm 2.25	19.13 \pm 2.08	4.02 \pm 0.47	1.32 \pm 0.14	667.25 \pm 5.73

^{abcd} Means in the same column with different superscripts are significantly different ($P < 0.05$).

The results of protein contents of the present study were in agreement with the results of Madruga *et al.* (2006). They further remarked that meat of the animal more than one year age had higher protein content of younger age. Recently, Niedziolka *et al.* (2006) and Arain *et al.* (2010) have reported the similar trends of protein content of sheep meat and goat meat with the results of the present study.

Fat content

The fat content in sheep meat of group D was the highest (4.71% \pm 0.55%) followed by group C (4.41 \pm 0.43%), B (3.91 \pm 0.48%) and group A (3.02 \pm 0.36%), with an overall mean of 4.02 \pm 0.47% (Table I). All groups were statistically different from each other ($P < 0.05$).

The results of fat contents obtained in the present study were in line with those reported by Purbowati *et al.* (2006), who obtained the meat fat contents of 3.96(%) and 5.06(%) for yearling sheep and ones bigger than yearling sheep. Fat content of the present study was higher in comparison with the one reported by Purbowati and Suryanto (2000) with fat content ranging between 2.08 to 3.00%. Soeparno (1995) reported that meat fat content of 3-7% is optimal for the deliciousness of the product for the consumer. In the present study the fat content is on the lower side (3-4.5%) in all groups. This is consistent with several other reports showing that the older animals had higher fat content than the younger animals (Purbowati and Suryanto, 2000; Beserra *et al.*, 2004; Arain *et al.*, 2010). Lambuth *et al.* (1970) emphasized that the levels of fat for each type of muscle could be different from one another. Loin and rib fat proportion could be higher when made comparison with the fat proportion of the

thighs and shoulders, because the thigh muscles and shoulders are involved in locomotory activity.

Ash content

The meat of group A sheep had ash content of 1.21 \pm 0.17% (range, 1.0-1.4%), for group B it was 1.334 \pm 0.23% (range, 1.0-1.6%), for group C it was 1.353 \pm 0.11% (range, 1.3-1.8%) and group D 1.32 \pm 0.09 (range, 1.2-1.7%) (Table I). Statistically significantly different values were found in the four groups. The ash content for groups B, C and D was however, not significantly ($P > 0.05$) different from each other, though significantly different from group A ($P < 0.05$).

The average ash content in the present study was 1.32 \pm 0.14 % of all groups. Lowest ash content was revealed in group A ($P < 0.05$) and this slight variation in ash content of sheep meat in different groups is probably due to difference in age, while no significant difference was observed in all other groups. Arain *et al.* (2010) reported non significant difference in ash content in different age groups of goat meat, while Berg and Butterfield (1976) observed that ash content of cattle meat increased with age. The present result are in line with those of the study conducted by Madruga *et al.* (2006) who reported that slaughtering age had a significant effect on physico-chemical characteristics of meat, particularly, the ash content increased with the increasing slaughter age.

Vitamin A content

The highest vitamin A content in group A was 683.16 \pm 5.33 ($\mu\text{g}/100\text{g}$), followed by 668.06 \pm 7.50 in group B, 664.04 \pm 5.12 in group C and 653.74 \pm 4.89 $\mu\text{g}/100\text{g}$ meat in group D. No

significant difference ($P>0.05$) in vitamin A content was found between groups B and C, both of which were statistically different from group D ($P<0.05$). In addition, group A was statistically superior to the remaining three groups.

The results of concentration of vitamin A of the present study are in agreement with those of Purbowati *et al.* (2006), who reported 682.06 μ g Vit. A / 100g meat of yearling sheep and 663.32 μ g/100g in the meat of sheep older than one year.

CONCLUSIONS

Chemical composition of meat from the results of this study can be concluded (moisture content, ash, fat, protein and vitamin A) varies with advancement in the age of animals. The moisture and Vit A content of the treatment groups decreased with the increasing age. However, the Protein, fats and ash content of the Mengali sheep meat increased. Younger animals (2 and 4 teeth) would be preferred by the consumer due to fit composition of meat. Sexual dimorphism is overt for chemical composition of meat in sheep. Moisture, fat and protein contents are highly variable while ash contents showed lesser variation with age.

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