Influence of Breed, Age and Sex of Indigenous Cattle on Sensory Parameters of raw and cooked Beef Meat at Peshawar

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Abstract

The aim of the present study was to investigate the influence of breed, age and sex of indigenous cattle for beef quality parameters of raw & cooked beef. A total of 288 beef samples were collected from 36 cattle. Two breeds of cattle (Dajal and Dhanni) were selected having three age groups (i.e. group 1(12 to 24 months), group 2 (24 to 48 months) & group 3 > 48 months. Each age group includes animals of both sexes. Beef samples were collected from animals, which were pre indentified in the stockyard of slaughter house, one day before their slaughter. Raw samples were checked for, color, marbling and texture. Two hundred and eighty eight cooked beef samples were evaluated for tenderness, juiciness, flavor, taste, aroma, cooked color and overall liking. Data was analysed using Mann-Whitney test for breed and sex, where as Kruskal Wallis test for age and Spearmen's correlation was used among various parameters in SPSS version 20. The age and breed had a significant effect (P<0.05) on sensory parameters. Sex did not show significant effect (P>0.05) on sensory parameters. Dajal was 16% more tender than Dhanni. Result indicates that Dajal cattle were 17% more flavored as compare to Dhanni. Among three age groups of cattle, age group one was 25% more tender than age group two, similarly age group two was 21% more tender than age group three. Between two breeds of cattle female found 3% tender than male. Also female found 6% more flavor than male. Beef tenderness is positively correlated with beef juiciness and overall liking and the relationship was significant. It was concluded that Dajal was found better than Dhanni in respect of sensory parameters. Among three age groups, age group one was more tender, juicer while age group two have higher flavor, taste and aroma. Female found better in sensory parameters but no significant influence was seen in both breeds. Dajal cattle of two-three years may be placed in fattening program for better quality meat availability to the public and for export.

Keywords: *Dajal, Dhanni, Beef tenderness, flavor, cattle age*

Introduction

Historically livestock play a vital role in Khyber Pakhtunkhwa, Pakistan; Most of small holders keep livestock to access the food (milk, meat, manure) and a source of cash income for their daily requirement. In Pakistan, Livestock considerably contribute to the Gross Domestic Product. In last few years' livestock population consistently increased. Livestock contribute 56.6 percent to agriculture and 11.9 percent to GDP of Pakistan. Livestock worth increased 2.8 percent previous year. Currently 41 million cattle, 37 million buffalo are present in country, similarly sheep population is 29 million and goat 69 million, whereas camel contributes 1 million and poultry birds constitutes 862 million (Econ. Survey, Pak, 2015). In Pakistan, nine different well documented breeds of cattle are present. Some of these breeds are milch type (*Sahiwal, Red Sindhi* and *Achai*), other are draught purposes (*Bhagnari, Dajal, Dhanni* and *Tharparkar*), and some breeds have good potential for meat. Meat consumption depends on cultural values/norms, some people like to eat certain species and some dislike certain species. Religious obligation, Muslims are allowed for meat of following animals' i.e. cattle,

buffalos, goat, sheep, camel, poultry and marine animals, when slaughter according to Islamic way. In Pakistan public meat consumption pattern varies depending on weather conditions, however with the advancement of information technology, the public liking is also tremendously improved. Most of the earlier research was focused on dairy production, Weight gain, Meat composition and Nutrition in Pakistan. But latest trend is changed due to overall changes happened in global market. Pakistan shares in term of Halal meat production and their respective export. People demand high quality meat (i.e. Palatability, Tenderness, Juiciness, Flavor and overall acceptability). Ultimately, access of any food product is determined by the person's choice, which is mostly fined by the perception of quality (Dransfield, 2001). Normally, on daily basis 500-600 animals slaughtered in abattoir at Peshawar. Presently no specific animals are reared for beef purpose in Pakistan. Many Scientists are conducting research to develop beef breed. For this purposes beef production center is established in Baluchistan province (Sibi). In Khyber Pakhtunkhwa there is no well developed meat sector, however old, culled and unproductive cattle are brought from other provinces and

rural areas of adjacent city. These animals are sold and slaughter by the individual farmer need basis.

In Khyber Pakhtunkhwa, meat consumption trend suggest that Public like beef. However their liking trend is more towards quality. So in current study local indigenous cattle are selected to find out whether the breed, age and sex effect the raw and sensory properties (i.e. tenderness, juiciness & flavor etc) of cooked beef. For this purpose, current research was carried on different age groups of cattle, In order to reach the demand and preference of consumer's choice for good quality beef. The objectives of this study to determine the influence of breed, sex and age on the sensory characteristics of raw and cooked beef and determine inter-relationship among sensory parameters of beef.

Materials and Methods

Area Study

The research was performed in Peshawar, Khyber Pakhtunkhwa Pakistan. Around 500-600 cattle are slaughtered on daily basis in two shifts. A huge livestock market is located nearby from where the most of the animals are brought and slaughtered by Butchers.

Breed Selection

Based on previous research (Rahman *et al*., 2012), the following breeds were selected.

Dajal

The breed found in *Dajal* areas of Punjab province; district Dera Ghazi Khan, Bahkar, Bahawalpur, Multan etc. *Dajal* cattle are white color or light gray in color. The male cattle are blackish gray on hump. Normal weight of male cattle is 480 and female weight comprises 380 Kg. *Dajal* cattle are similar to *Bhagnari* breed but are less in size and the color is lighter than *Bhagnari* cattle. *Dajal* cattle are used for meat, however lower milk producer, male are good for draught purposes (Shah, 1994).

Dhanni

Dhanni breed found in Attock, Chakwal, Rawalpindi, Jhelum, Mianwali and Sargodha District of Punjab province. The *Dhanni* cattle are dual purpose breed. Available in different body color including black with white spot (Kala Burga), and white coat with black spot (Chitta Burga). *Dhanni* cattle have small head and ears. Forehead is broad and thin between horns. Short dewlap, straight back and hard hump. Muzzle is black and eye hairs are black. *Dhanni* breeds are used for multipurpose (milch, meat and draught). Average weight of *Dhanni* male constitute 400 kilograms

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whereas female 300 kilograms on average. The tail is long; switch hairs are white up to fetlock. The udder is medium size (Shah, 1994).

Animal Age Groups

Different age groups animal were slaughtered in slaughter house. During present study the animals were divided into three age groups i.e. Age group 1 ranged below 24 months, Age group 2 ranged from 24 up to 48 months, Age group 3 ranged Above 48 months.

Age determination

Animal age was confirmed from the owner and by dentition examination. Before slaughtering, Animals of selected breed, sex and age group was preidentified (Table 1). Animals were pre indentified in the stockyard of slaughter house, one day before their slaughter. A total of 288 samples were collected from 36 animals. These animals were divided into two breed of local cattle (*Dajal* and *Dhanni*). Within each breed, three age groups, and both sexes including animals were selected. Eighteen samples per *Dajal* and *Dhanni* breed and three sample each male and female (Table 1). Samples were obtained from Longissimus dorsi muscle 12-13 rib area of the cattle.

Labeling, Storage and Transportation of samples

Cattle beef samples (n=288) obtained from preidentified animals and labeled & stored in Polyethylene bags and transported to University Lab for storage at 0°C in freezer till further analysis. Samples were evaluated for the following sensory properties i.e. tenderness, juiciness, flavor, taste, aroma, color and overall liking through ten panelists.

Sensory Evaluation

For sensory evaluation 10 panelists were selected including postgraduate students and faculty members from the University of Agriculture Peshawar. Sensory evaluation was carried out in department of Livestock Management, Breeding & Genetics, and University of Agriculture Peshawar. Total four sessions were performed for sensory evaluation. First session was conducted with 12 samples, second session with 12 samples and rest two sessions were performed with 6 samples. 20grams of samples were barbequed. All samples were cooked in traditional way of *(siekh tikka)* barbeque with uniform heat and time at *Traskoon* restaurant Peshawar. After cooking each sample was wrapped in Aluminum Foil with identification code read for Test. Evaluation was conducted at 10 am.

All Panelists were trained regarding evaluation their precautions practices during evaluation. Panelists were provided evaluation scale proforma, fresh plain water, tissue paper and plates with identification code. Samples were evaluated through *Hedonic Scale*. Where 1-9 values indicate the level of Likeness (Detail is given in appendix-2). Before each sample mouth was rinsed with simple water, about 3 to 5 minutes before evaluating next sample.

Statistical Design

Sensory evaluation data of the ten experts Panelists were recorded in Excel sheet. For analysis the data was exported to SPSS software version 20. Analysis of variance for breed and sex effect on the sensory properties were tested through the *Mann-Whitney* test used as there was only two breed to be compared. Whereas the age was grouped at three levels, therefore *Kruskal Wallis* test was used for non-Parametric data in SPSS. Spearman's correlation test was carried out to investigate the correlation of various quality parameters such as tenderness, juiciness, flavor, taste, aroma, cooked color and overall liking.

Results and Discussion

The current research was carried to determine the impact of breed, age and sex on the sensory parameters of local cattle beef slaughtered in abattoirs at Peshawar. Two local breeds were selected for research i.e. *Dajal* and *Dhanni*. Three age groups were selected within each breed and within age group animals were selected for both sexes. Beef samples were cooked and experts of panelists evaluated the beef samples for beef quality parameters such as tenderness, juiciness, flavor, aroma, taste, cooked color and overall Liking. The results presented in this chapter discuss the effect of breed, age and sex on the quality parameters as mentioned below.

Color, Marbling and Texture of Raw beef

Table 2. represents color, marbling, and texture of raw beef. Results indicated that marbling score was higher in *Dajal* breed; However breed didn't show significant influence on marbling. Similarly raw color was found higher in *Dajal* as compare to *Dhanni* but breed had no significant influence on raw color. *Dhanni* breed were tougher than *Dajal* breed but no significant influence was seen between both breeds. Modika (2014) worked on raw beef. He revealed that color, marbling and texture had minor effect on raw

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beef. It may bay due to genetics or environmental effect. Average mean value of tenderness was found higher (6.08±0.18) for *Dajal* breed than *Dhanni* (5.81±0.15) as shown in Table 2. Similarly mean value for juiciness (6.17±0.11), flavor (6.96±0.16), taste (6.84±0.13), aroma (6.86±0.16), color (6.14±0.11) and overall liking (6.17±o.11) also higher in *Dajal* as compare to *Dhanni* (i.e. tenderness 5.81±0.15, juiciness 5.65±0.14, aroma 5.63±0.12, taste 5.63±0.12, cooked color 5.13±0.10 and overall liking 5.27±0.10) respectively as shown in Table 3.

Effect of Breed on Tenderness of Cooked Beef

Total *Mann-Whitney* test score value was recorded higher (155.58) for *Dajal* than *Dhanni* breed (133.42). *Dajal* breed was (16%) more tender than *Dhanni* for tenderness as shown in Table 4. Tenderness was also significantly effected by breed (P<0.05) as shown in Table 4. Results of other scientists such as Monson *et al.,* (2005) reported similar findings. Koohmaraie et al., (1995) also determined that beef of Holstein was tender as compare to Charolais or Angus meat. Koch et al., (1976) worked on Limousine crosses with Angus. They concluded that Limousine were less tender than Angus crosses. Koch further revealed that tenderness in a breed is effected

by several factors such as quality of collagen, fatness (Marbling), calpain and calpastatin activity in muscle.

Effect of Breed on Juiciness of Cooked Beef

Total *Mann-Whitney* test score value of juiciness for *Dajal* breed was (156.40) and *Dhanni* breed was (132.60) as shown in Table 4. Juiciness was also significantly effected by breed (P<0.05) as shown in Table 4. Results of other scientists such as Monson *et al.,* (2005) reported similar findings. Destefanis *et al.,* (1996) found that breed had significant effect (P<0.05) on juiciness of beef by comparing Piemontese and Belgian Blue White.

Effect of Breed on Flavor of Cooked Beef

Total *Mann-Whitney* test score value for *Dajal* breed was recorded higher (163.50) than *Dhanni* breed (125.5). Result indicates that *Dajal* cattle were 17% more flavored as compare to *Dhanni* as shown in Table 4. Juiciness was also significantly effected by breed (P<0.05) as shown in Table 4.Vatansever *et al.,* (2000) did not determine significant differences for flavor between Welsh Black. However results of other scientists such as Mandell *et al*., (1997) & Winer et al., (1981), recorded similar findings. Moore and Bass (1978) conducted a research

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in New Zealand. They concluded that jersey score more for flavor than other breed (P<0.05).

Effect of Breed on Taste of Cooked Beef

Total *Mann-Whitney* test score value for beef taste, of *Dajal* and *Dhanni* breed was found (159.51) and (129.49) respectively as shown in Table 4. Taste was also effected by breed (P<0.05) as shown in Table 4.3. Results of other scientists such as Frank *et al.,* (2014) agreed with the current results. They compared wagyucross with anguscross and found that wagyucross cattle were better in taste as compare to anguscross cattle (P<0.05).

Effect of Breed on Aroma of Cooked Beef

Total *Mann-Whitney* test score value for aroma of *Dajal* breed was recorded higher (156.98) than *Dhanni* breed (132.02) as shown in Table 4. Aroma was also effected by breed (P<0.05) as shown in Table 4.3. Results of other scientists such as Frank *et al.,* (2014) reported similar findings. Shahidi (1994) identified more than 55 compounds that contribute specifically to "meaty" aromas.

Effect of Breed on Color of Cooked Beef

Total *Mann-Whitney* test score value for color of *Dajal* breed was found higher (156.86) than *Dhanni* breed (133.14) as shown in Table 4.3.

Cooked color was also significantly effected by breed as shown in Table 4. Results of other scientist such as Gasperlin *et al.,* (2001) & Graham, (2008) reported similar findings. They revealed that breeds were different in cooked beef color.

Effect of Breed on Overall liking of Cooked Beef

Total *Mann-Whitney* test score value for overall liking of *Dajal* and *Dhanni* breed was recorded as (166.50) and (122.50) as shown in Table 4. Overall liking was also effected by breed (P<0.05) as shown in Table 4. Monson *et al.,* (2005) found that overall liking of beef did not effect by breed (P>0.05). It may be due to the genetics, environmental or country origin effect of the region. Research conducted on country origin for sensory evaluation. Results of other scientists such as Boles *et al.,* (2002) reported that US consumer panel found minimum sensory differences for country of origin. Mean score of tenderness (7.83±0.18), juiciness (7.63±0.24), and overall liking (6.81±0.18) for age group one was higher than age group two (tenderness 6.19±0.16, juiciness 5.75±0.13), and overall liking (6.38±0.21) and age group three (i.e. tenderness (4.75±0.44), juiciness (4.63±0.37) and overall liking (5.13±0.37) in *Dajal* males

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respectively. Results revealed that mean of flavor (4.92±0.39), taste (4.79±0.39) and aroma (5.56±0.33) were found better in old age followed by middle age (i.e. flavor 6.00±0.21, taste 5.88±0.20, aroma 5.63±0.10) and young age groups (i.e. flavor 6.50±0.38, taste 6.63±0.44, aroma 5.63±0.23) as shown in Table 5. Similarly mean value reported for age groups of *Dajal* females showed that the tenderness, juiciness, and overall liking were higher for age group one than other groups as shown in Table 5. whereas flavor, taste, aroma were higher in old age group followed by middle and young age as reported in Table 5. Overall *Dhanni* cattle revealed higher mean value of flavor, taste and aroma for old age than middle and young age group, however young age groups were found better in tenderness and juiciness followed by middle and old age group as shown in Table 5.

Effect of Age on Tenderness of Cooked Beef

Total *Kruskal* test score value Among three age groups of cattle, age group one was (25%) more tender than age group two, similarly age group two was (21%) more tender than age group three as shown in Table 6. Tenderness was significantly influence by age (P<0.05) as shown in Table 6. Similar results were found by Rao *et al.,* (2009). They worked on buffalo for sensory meat quality. Research was conducted on three age groups. Result found that the tenderness of buffalo beef was effected by age groups (P<0.05). Tenderness in age group one was higher followed by age group two and age group three. Shouthose and Harris (1990) reported that animal age significantly affected tenderness.

Effect of Age on Juiciness of Cooked Beef

Total *Kruskal* test score vale for Juiciness in three age groups of cattle, age group one was recorded (220.53) higher followed by age group two (137.52) and age group three (75.46) as shown in Table 6. Juiciness was significantly affected by age (P<0.05) as shown in Table 6. Rao *et al.,* (2009) conducted a study to know the meat quality parameters of non-descript buffaloes in different age groups viz. 6 months to 2 years, 2 to 4 years and above 4 years was carried out. Result indicates that the juiciness of buffalo beef was effected by age groups (P<0.05). Age group one was more juicer than other groups.

Effect of Age on Flavor of Cooked Beef

Total *Kruskal* test score value among three age groups of cattle, age group three was (12%) more flavored than age group two, whereas age group two was (27%) more flavor than age group one as in Table 6. Total

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Kruskal test score value for taste in age group three was higher (184.96) than age group two (152.96) and age group one (95.59) as shown in Table 6. Flavor was significantly effected by age (P<0.05) as shown in Table 6. Results of other scientists such as Rao *et al.,* (2009) reported similar findings.

Effect of Age on Aroma of Cooked Beef

Total *Kruskal* test score value for aroma in age group one was recorded lower (83.57) a compare to age group two (145.58) and age group three (204.35) as shown in Table 6. Aroma was significantly effected by age (P<0.05) as shown in Table 6. Schonfeldt *et al.,* (2011) revealed that the aroma of beef did not effect by age groups (P>0.05). Schonfeldt *et al.,* (2011) further revealed that it may be due to the genetics, nutritional (grain feed and grass feed) and environmental factors of the region that effect the physiology of animal.

Effect of Age on Color of Cooked Beef

Total *Kruskal* test score for color in three age groups of cattle, age group one was (138.89), age group two was (141.52) and age group three was (158.11) as shown in Table 6. Analysis of variance indicates that age did not significantly effect color (P>0.05) as shown in Table 6. Results of other scientists such as

Nicola and Rosemary (2006) reported that age had significant effect on cooked beef color.

Effect of Age on Overall liking of Cooked Beef

Total *Kruskal* test score value for overall liking in three age groups of cattle, age group one was 138.89, age group two was (141.52) and age group three was (158.11) as shown in Table 6. Overall liking was significantly effected by age (P<0.05) as shown in Table 6. Rao *et al.,* (2009) conducted a research on non-descript buffalo to determine age impact on sensory characteristics of buffalo meat. They concluded that age groups (P<0.05) have significant effect on the overall liking of buffalo beef. Present study findings were similar with the results of Rao *et al.,* (2009). Mean value of tenderness (6.48±0.22), juiciness (6.23±0.21) and overall liking (6.28±0.15) for *Dajal* males reported higher than *Dajal* females (i.e. tenderness 5.73±0.24, Juiciness 5.59±0.22 and overall liking 6.08±0.16) respectively as shown in Table 7. However flavor (6.20±0.24), taste (6.03±0.23), aroma (6.08±0.21) and cooked color (6.30±0.17) found more in *Dajal* females as compare to males as shown in Table 7. Mean value of tenderness, juiciness, color and overall liking for *Dhanni* males scored higher than *Dhanni* females (i.e.

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tenderness 6.13±0.24, juiciness 5.96±0.21, color 6.44±0.14 and overall liking 6.00±0.15) as shown in Table 7. Whereas mean value of flavor (5.89±0.18), taste (5.88±0.19) and aroma (6.13±0.14) found better for *Dhanni* females than *Dhanni* males (i.e. flavor 5.10±0.19, taste 5.29±0.20, and aroma 5.34±0.18) respectively as shown in Table 7.

Effect of Sex on Tenderness of Cooked Beef

Total *Mann-Whitney* test score value of tenderness for female was higher (147.15) than male as shown in Table 8. Tenderness was not significantly effected by sex (P>0.05) as shown in Table 8. Similar result was found by Choat *et al.,* (2006). They worked on sensory characteristics of gender (male, Female). Finally they revealed that sex did not influence beef tenderness (P>0.05). Destefanis *et al*., (1996) further revealed that sometime tenderness in sexes is effected due to marbling.

Effect of Sex on Juiciness of Cooked Beef

Total *Mann-Whitney* test score value of juiciness was found higher in female (145.90) than male (143.10) as shown in Table 8. Juiciness was not influenced by sex (P>0.05) as shown in Table 8. Kapituła and Nogalski (2014) studied Semimembranous muscle of Polish Holstein-Friesian x Limousine crossbred bulls and heifers for juiciness. They concluded that there was no significant difference in juiciness for SM between bulls and heifer (P>0.05).

Effect of Sex on Flavor of Cooked Beef

Total *Mann-Whitney* test score value reported that female cattle were found (6%) more flavored than male as shown in Table 8. Flavor was not influence by sex significantly (P>0.05) as shown in Table 8. Kapituła and Nogalski (2014) carried a research on Polish HF x Limousine crosses bulls. They did not found significant difference (P>0.05) in Semimembranosus muscle of Polish HF x Limousine crosses male and female for flavor. However Zaujec *et al*., (2012) reported that the flavor of Longissimus dorsi muscle was better in flavor for bulls than cows.

Effect of Sex on Taste of Cooked Beef

Total *Mann-Whitney* test score value of taste for male and female was recorded as (140.34), (148.66) as shown in Table 8. Taste didn't significantly effected by sex of animal (P>0.05) as shown as in Table 8. The current results agree with Kapituła and Nogalski (2014). They did not found difference (P>0.05) between Polish Holstein-Friesian x Limousine crossbred bulls and heifers in Semimembranosus muscle for taste.

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Effect of Sex on Aroma of Cooked Beef

Total *Mann-Whitney* test score value for aroma in male was (144.10) and female (144.90) as shown in Table 8. Aroma was not significantly effected by sex (P>0.05) as shown in Table 8. Weglarz (2010) noted that bull muscles showed better aroma than heifers. However Hoving *et al.*, (1999) worked on Longissimus dorsi muscle of bulls and heifers. They did not see major differences (P>0.05) for aroma between bulls and heifers.

Effect of Sex on Color of Cooked Beef

Total *Mann-Whitney* test score value for color in male was (141.63) and female (147.37) as shown in Table 8. Color was not effected significantly by sex (P>0.05) as shown in Table 8. Similar result was reported by Kapituła and Nogalski (2014). They worked on bulls and heifer cross breed of Polish HF x Limousine, results showed no significant difference (P>0.05) in Semimembranosus muscle of Polish Holstein-Friesian x Limousine crossbred bulls and heifers for color.

Effect of Sex on Overall liking of Cooked Beef

Total *Mann-Whitney* test score value for overall liking in male was (146.12) and female (142.89) as shown in Table 8. Overall liking

did not influence significantly by sex (P>0.05) as shown in Table 8. Kapituła and Nogalski (2014) studied the sensory properties. They concluded that semimembranosus muscle of Polish Holstein-Friesian x Limousine crossbred was not effected by sex of animals (P>0.05). The results agreed with present research findings.

Spearman's correlation among various sensory parameters of cooked beef siekh tikka (barbeque)

Correlation of beef tenderness was found positive with beef juiciness and overall liking, was negative correlated with beef flavor, beef taste, beef aroma and relationship was significant except with beef color as shown in Table 9. Neely *et al.*, (1998) found that tenderness and juiciness are correlated with each other. Revilla and Quintana (2006) reported that with increasing tenderness, juiciness also increases. Consumer overall liking was related to beef tenderness, juiciness and flavor (Miller, 2013). Similarly correlation of beef juiciness was found positive with beef flavor and beef overall liking and negative correlated with beef taste, beef aroma and was found significant as shown in Table 9. Similar results were found by other scientists such as Schonfeldt *et al.*,

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(2011). They revealed that with increasing juiciness, flavor also increases. Correlation of beef flavor was found positive with beef taste, beef aroma, cooked color and overall liking, found significant as shown in Table 9. Wood *et al*., (2004) examined that when flavor of beef increases, taste substances found increases. Correlation of beef taste was found positive with beef aroma, cooked color and overall liking which show significant effect as shown in Table 9. Delwiche *et al*., (2004) concluded that aroma substances increases when taste become high. Similarly correlation of beef aroma was positive with beef cooked color and overall liking found significant. Finally correlation of beef cooked color was found positive with beef overall liking.

Table 1. Layout of Data Collection

Cattle	Age Group 1		Age Group 2		Age Group 3		Sub Total
	Male	**Femal**	**Male**	**Femal**	**Male**	**Femal**	
Dajal	3	3	3	3	3	3	18
Dhanni	3	3	3	3	3	3	18
Toral							36

Table 2. Color, marbling and texture of raw beef

Breeds	Dajal	Dhanni	P. value
Color	**	***	n.s
Marbling	**	***	n.s
Texture	***	**	n.s

n.s. =no significant effects; **p < 0.01; ***p < 0.001.

Table 3. Breed effect on meat quality of *Dajal* and *Dhanni* cattle beef through Experts Panelists using *Hedonic scale*.

Parameters	Mean±SE Beef Sensory Score	
	Dajal	*Dhanni*
Tenderness	6.08±0.18	5.81±0.15
Juiciness	6.89±0.16	5.65±0.14
Flavor	6.96±0.15	5.55±0.17
Aroma	6.86±0.16	5.78±0.13

Taste	6.84±0.13	5.63±0.12
Cooked Color	6.14±0.11	5.13±0.10
Overall liking	6.17±0.12	5.27±0.10

n= number of observation= 144 for each sex group, significant level α= 0.05

Table 4. Influence of cattle breed on the sensory parameters of *siekh tikka* (barbeque) using *Man-Whitney test.*

parameters	Breed	Total *Mann-Whitney* test Score for barbeque beef	P – Value
Beef Tenderness	*Dajal*	155.58	.022
	Dhanni	133.42	
Beef Juiciness	*Dajal*	156.40	.014
	Dhanni	132.60	
Beef Flavor	*Dajal*	163.50	.000
	Dhanni	125.50	
Beef Taste	*Dajal*	159.51	.002
	Dhanni	129.49	
Beef Aroma	*Dajal*	156.98	.009
	Dhanni	132.02	
Cooked Color	*Dajal*	155.86	.017
	Dhanni	133.14	
Overall liking of Beef	*Dajal*	166.50	.000
	Dhanni	122.50	

n= number of observation= 144 for each breed, significant level α= 0.05

Table 5. Age effect on meat quality of *Dajal* and *Dhanni* cattle beef through Experts Panelists in using *Hedonic scale*.

Breed	Age Groups	Mean±SEoof Tendernes	Mean±SE of Juiciness	Mean±SE of Flavor	Mean±SE of Taste	Mean±SE of Aroma	Mean±SE of Cooked Color	Mean±SE of Overall liking
Dajal Male	1	7.83±0.18	7.63±0.24	4.92±0.39	4.79±0.39	5.56±0.33	6.38±0.30	6.81±0.18
	2	6.19±0.16	5.75±0.13	6.00±0.21	5.88±0.20	5.63±0.10	5.88±0.19	6.38±0.21
	3	4.75±0.44	4.63±0.37	6.50±0.38	6.63±0.44	5.63±0.23	5.13±0.29	5.13±0.37
Dajal Female	1	8.00±0.30	7.44±0.31	5.88±0.34	5.56±0.32	4.75±0.40	6.75±0.35	6.63±0.33
	2	6.17±0.23	5.79±0.11	6.13±0.23	5.83±0.20	5.63±0.18	5.94±0.18	6.13±0.27
	3	3.79±0.45	4.17±0.43	6.50±0.34	6.54±0.41	7.19±0.32	6.44±0.15	5.75±0.32
Dhanni Male	1	7.63±0.30	7.25±0.31	3.19±0.34	3.69±0.32	4.63±0.40	6.13±0.35	6.38±0.33
	2	6.13±0.23	6.00±0.17	5.75±0.23	5.75±0.20	5.63±0.18	6.50±0.18	5.88±0.27
	3	4.63±0.45	4.63±0.43	6.38±0.34	6.44±0.41	6.50±0.32	7.00±0.15	5.38±0.32
Dhanni Female	1	7.75±0.21	7.56±0.20	5.38±0.40	5.44±0.42	5.25±0.27	6.00±026	5.75±0.25
	2	5.92±0.22	5.58±0.13	5.83±0.19	5.79±0.22	5.88±0.14	6.06±0.20	5.44±0.29
	3	3.79±0.43	3.83±0.38	6.29±0.35	6.250.33	6.81±0.23	6.63±0.26	5.45±0.93

n= number of observation= 144 for each sex group, significant level α= 0.05

Table 6. Influence of cattle age on the sensory parameters of *siekh tikka* (barbeque) using *Kruskal Wallis test.*

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Parameters	Age groups	Total *Kruskal* test score for barbeque beef	P – Value
Beef Tenderness	1	216.80	.000
	2	144.64	
	3	72.06	
Beef Juiciness	1	220.53	.000
	2	137.52	
	3	75.46	
Beef Flavor	1	97.01	.000
	2	152.11	
	3	184.38	
Beef Taste	1	95.59	.000
	2	152.96	
	3	184.94	
Beef Aroma	1	83.57	.000
	2	145.58	
	3	204.35	
Cooked Color	1	133.88	.105
	2	141.52	
	3	158.11	
Overall liking of beef	1	152.08	.024
	2	155.29	
	3	126.13	

n= number of observation= 96 for each age group, significant level α= 0.05

Table 7. Sex effect on meat quality of *Dajal* and *Dhanni* cattle beef through Experts Panelists using *Hedonic scale*.

Parameters	Mean±SE Beef Sensory score			
	Dajal		*Dhanni*	
	Male	Female	Male	Female
Tenderness	6.48±0.22	5.73±0.24	6.13±0.24	5.58±0.26
Juiciness	6.23±0.21	5.59±0.22	5.96±0.21	5.42±0.23
Flavor	5.68±0.21	6.20±0.24	5.10±0.19	5.89±0.18
Taste	5.63±0.23	6.03±0.23	5.29±0.20	5.88±0.19
Aroma	5.59±0.15	6.08±0.21	5.34±0.18	6.13±0.14
Cooked Color	5.94±0.16	6.30±0.17	6.44±0.14	6.28±0.15
Overall liking	6.28±0.15	6.08±0.16	6.00±0.15	5.50±0.16

n= number of observation= 144 for each sex group, significant level α= 0.05

Table 8. Influence of cattle sex on the sensory properties of the *siekh tikka* (barbeque) using *Mann-Whitney test*.

Parameters	Total *Mann-Whitney* test scores for barbeque beef	P – Value

	Male	Female	
Beef Tenderness	141.85	147.15	0.585
Beef Juiciness	143.10	145.90	0.773
Beef Flavor	138.15	150.85	0.189
Beef Taste	140.34	148.66	0.390
Beef Aroma	144.10	144.90	0.933
Cooked Color	141.63	147.37	0.547
Overall liking of beef	146.12	142.88	0.735

n= number of observation= 144 for each sex group, significant level α= 0.05

Table 9. Spearman's correlation among various sensory parameters of cooked beef *siekh tikka* (barbeque).

Parameters	Beef tenderness	Beef juiciness	Beef flavor	Beef taste	Beef aroma	Cooked color	Overall liking
Beef tenderness	1.00	0.86**	- .21**	- .22**	- .43**	- .08	0.25**
Beef juiciness		1.00	0.28**	- .301**	- .43**	- .09	0.21**
Beef flavor			1.00	0.89**	0.43**	0.30**	0.17**
Beef taste				1.00	0.43**	0.26**	0.17**
Beef aroma					1.00	0.36**	0.15**
Cooked color						1.00	0.33**
Overall liking							1.00

n= number of observation= 144 for each sex group, significant level α= 0.05

Conclusions

The followings are the main conclusions of study *Dajal* was found better than *Dhanni* in the respect of tenderness, juiciness, flavor, taste, aroma, cooked color and overall liking).Among the three ages groups of cattle breed, results indicated that beef from age group one was more tender and juicier followed by age group two and age group three, similarly age group three was higher in flavor, taste and aroma but less tender. Marbling was higher in *Dajal* breed as compare to *Dhanni* breed, whereas *Dhanni* found tougher than *Dajal*.

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