PALATABILITY PROFILE OF SELECTED BUFFALO AND BOVINE MUSCLES

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Received : 30.06.2016
Accepted : 05.07.2016

Abstract

A study was undertaken to assess the palatability attributes of ten selected buffalo and bovine muscles and to compare these attributes within and between the two species. Four to six years old female Murrah buffaloes and cross-bred female cattle were slaughtered scientifically, carcasses were electrically stimulated, hot deboned and the muscles aged for 72 h. The cooked muscles were assessed for palatability attributes, viz. appearance, tenderness, juiciness, flavour, amount of connective tissue and overall acceptability by a semi-trained taste panel. There was considerable variation in the sensory attributes of the selected buffalo and bovine muscles within each species. The Psoas major (PSM), Longissimus dorsi (LNG), Infraspinatus (INF), Serratus ventralis cervicis (SEV) and Rectus femoris (REF) of both species had tenderness scores of higher than 6.0 corresponding to the perception of moderate or higher degrees of tenderness. Tenderness being a much desired sensory attribute, these muscles are potentially marketable at a premium price. Between the two species, the all-muscle mean sensory scores showed significant difference only with respect to the amount of connective tissue.

Key words: *Buffalo meat, beef, palatability, sensory attributes*

In India, most of the cattle and buffalo meat produced is derived from spent and unproductive animals. Studies have shown that different muscles of beef carcasses differ substantially in their palatability characteristics. Palatability profile studies of different beef muscles have revealed the superior sensory quality of some lesser known muscles e.g. *Infraspinatus* (Carmack *et al.,* 1995). India ranks first in world livestock population and it is home to about 56 per cent of world's buffalo population. The large population of buffaloes together with absence of any religious or social discrimination has made the buffalo meat an extremely valuable commodity for both domestic trade and export. However, most of the palatability studies on buffalo meat have been performed on a couple of buffalo muscles like *Longissimus dorsi* or *Semimembranosus*. Comprehensive studies on the palatability profiles of various other buffalo muscles are scarce in the literature. Hence, profiling of buffalo muscles will help identify muscles of potentially superior palatability-related attributes, thus facilitating their marketing at a premium price. Therefore, the present study

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was undertaken to compare the sensory traits of selected buffalo and bovine muscles within and between the two species.

Materials and Methods

Six female Murrah buffaloes from University Buffalo Farm, KVASU, Mannuthy and six cross bred female cattle from Cattle Breeding Farm, Thumburmuzhy were utilized in this study. All the animals were in the age group of four to six years. The animals were reared intensively under similar management practices. The animals were slaughtered at the Meat Technology Unit, Kerala Veterinary and Animal Sciences University, Mannuthy after 12-24 h fasting as per scientific slaughter procedures. Ante-mortem and post-mortem inspections were conducted for each animal. The carcasses were electrically (low voltage 100-110 V for 1.5-2 min) stimulated and the following muscles were immediately harvested from each carcass by hot deboning, *viz. Serratus ventralis cervicis* (SEV), *Supraspinatus* (SPS), *Infraspinatus* (INF), *Triceps brachii* (TRI), *Longissimus dorsi* (LNG), *Psoas major* (PSM), *Vastus lateralis* (VAL), *Rectus femoris* (REF), *Semimembranosus* (SEM) and *Biceps femoris* (BIF). The muscles were aged for 72 h at 4±1 °C and were then prepared for the sensory evaluation.

Sensory evaluation

The sensory evaluation was conducted in a partitioned booth by a semi trained taste-panel (n=10). They were briefly explained about the nature of the experiment without disclosing the identity of samples. Meat samples used were approximately equal sized (1.5 x 1.5 x 1.9 cm) and they were cooked by indirect pressure cooking in small stainless steel boxes. Each panelist received two cubes each from the cooked bovine or buffalo muscles with three digit codes and score card (AMSA, 1983). The panelists were asked to rate the cooked muscles on an eight point hedonic scale for appearance (1=extremely poor, 8=excellent) tenderness (1=extremely tough, 8=extremely tender), juiciness (1=extremely dry, 8=extremely juicy), flavour (1=extremely bland, 8=extremely intense), amount of connective tissue (1=abundant, 8=none) and overall acceptability (1=extremely unacceptable, 8=extremely acceptable). The sensory scores were averaged and analyzed statistically using SPSS Version 21.0 as per Snedecor and Cochran (1994).

Results and Discussion

The mean sensory scores for appearance, tenderness and juiciness of

Table 1. Mean sensory scores for appearance, tenderness and juiciness of selected buffalo and bovine muscles

Muscle	Appearance		Tenderness		Juiciness	
	Buffalo	Bovine	Buffalo	Bovine	Buffalo	Bovine
SEV	6.05±0.18^{ab}	5.93±0.12^{a}	6.13±0.05^{c}	6.20±0.07^{d}	5.56±0.10^{ab}	5.42±0.31^{a}
SPS	6.16±0.14^{abc}	6.57±0.13^{ab}	4.95±0.11^{abA}	5.40±0.27^{cB}	5.49±0.19^{ab}	5.46±0.24^{a}
INF	6.27±0.08^{bcd}	6.31±0.11^{bc}	6.32±0.15^{cd}	6.41±0.12^{e}	5.74±0.19^{bc}	5.95±0.11^{bc}
TRI	6.11±0.22^{ab}	6.33±0.11^{bc}	5.21±0.07^{b}	5.25±0.29^{bc}	5.40±0.23^{ab}	5.38±0.23^{a}
LNG	6.56±0.14^{d}	6.57±0.08^{cd}	6.57±0.14^{d}	6.89±0.08^{f}	6.19±0.15^{cd}	6.29±0.12^{c}
PSM	6.47±0.06^{cd}	6.74±0.09^{d}	7.19±0.04^{e}	7.22±0.12^{f}	6.33±0.13^{d}	6.36±0.20^{c}
VAL	6.00±0.08^{ab}	6.16±0.15^{ab}	5.01±0.14^{b}	5.10±0.08^{bc}	5.54±0.19^{ab}	5.25±0.10^{a}
REF	6.31±0.12^{bcd}	6.29±0.30^{bc}	6.08±0.08^{c}	6.20±0.15^{de}	5.55±0.16^{ab}	5.58±0.09^{ab}
SEM	6.16±0.10^{abc}	6.12±0.29^{ab}	5.08±0.14^{b}	4.89±0.21^{b}	5.36±0.20^{ab}	5.21±0.12^{a}
BIF	5.84±0.14^{a}	6.14±0.20^{ab}	4.61±0.09^{a}	4.37±0.20^{a}	5.15±0.24^{a}	5.35±0.25^{a}
Mean	6.20±0.05	6.28±0.06	5.70±0.11	5.77±0.13	5.63±0.07	5.63±0.08

Table 2. Mean sensory scores for flavour, amount of connective tissue and overall acceptability of selected buffalo and bovine muscles

Muscle	Flavour		Amount of connective tissue		Overall acceptability	
	Buffalo	Bovine	Buffalo	Bovine	Buffalo	Bovine
SEV	5.30±0.17^{bc}	5.31±0.34^{ab}	5.22±0.00^{de}	5.22±0.14^{d}	5.72±0.14^{cd}	5.66±0.27^{ab}
SPS	5.46±0.09^{bcd}	5.21±0.20^{ab}	5.38±0.00^{ef}	5.57±0.21^{e}	5.54±0.15^{bc}	5.66±0.27^{ab}
INF	5.45±0.15^{bcd}	5.57±0.14^{bc}	4.67±0.00^{cA}	5.47±0.03^{eB}	6.01±0.09^{d}	6.12±0.15^{c}
TRI	5.12±0.20^{b}	5.14±0.13^{ab}	5.55±0.00^{fgA}	4.91±0.05^{cB}	5.67±0.14^{cd}	5.81±0.20^{bc}
LNG	5.81±0.16^{cd}	5.63±0.23^{bc}	5.66±0.00^{g}	5.70±0.13^{e}	6.45±0.10^{e}	6.53±0.12^{d}
PSM	5.97±0.18^{d}	5.98±0.12^{c}	4.55±0.00^{cA}	5.65±0.07^{eB}	6.49±0.12^{e}	6.59±0.17^{d}
VAL	5.45±0.16^{bcd}	4.92±0.18^{a}	5.00±0.00^{d}	4.90±0.02^{c}	5.83±0.14^{cd}	5.79±0.14^{abc}
REF	5.37±0.21^{bc}	5.22±0.22^{ab}	4.55±0.00^{cA}	4.92±0.14^{cB}	5.98±0.16^{d}	5.90±0.23^{bc}
SEM	5.05±0.26^{ab}	4.96±0.15^{a}	3.88±0.00^{bA}	4.40±0.07^{aB}	5.25±0.19^{ab}	5.40±0.15^{a}
BIF	4.58±0.17^{aA}	5.71±0.66^{bcB}	3.11±0.00^{aA}	4.64±0.14^{bB}	5.06±0.07^{a}	5.40±0.21^{a}
Mean	5.36±0.07	5.37±0.08	4.76±0.10^{A}	5.14±0.07^{B}	5.80±0.70	5.89±0.08

Means for each attribute bearing different lower-case alphabets as superscripts in the column and upper case-alphabets as superscripts in the row indicate significant difference (p<0.05). SEV-*Serratus ventralis cervicis,* SPS- *Supraspinatus,* INF- *Infraspinatus,* TRI- *Triceps brachii,* LNG- *Longissimus dorsi,* PSM- *Psoas major,* VAL- *Vastus lateralis,* REF- *Rectus femoris,* SEM- *Semimembranosus* and BIF- *Biceps femoris*

selected buffalo and bovine muscles are shown in Table 1 and those for flavour, amount of connective tissue and overall acceptability are presented in Table 2.

Among the selected buffalo muscles**,** appearance score for LNG was significantly (p<0.05) higher when compared to other muscles and BIF scored the lowest. The appearance score of LNG obtained in the present study was similar to that reported by Kandeepan *et al.* (2009) for spent female buffalo muscles.

Among both buffalo and bovine muscles, PSM was the most tender and BIF the least tender muscle. Significant (p<0.05) variation in tenderness between the species was evident only for SPS with the bovine muscle being more tender. With respect to bovine muscles, appearance score for PSM was significantly (p<0.05) higher when compared to other muscles and SEV scored the lowest. The appearance score for bovine muscles in the present study was in agreement with Modzelewska and Nogalski (2014) who reported scores of 7.6±0.70 for *Infraspinatus* and 7.6±0.80 for *Semimembranosus* on a nine point hedonic scale. There was no significant difference in all-muscle mean appearance scores between the two species.

There was no significant difference in the all-muscle mean tenderness score between the species. Considerable muscle to muscle variation in tenderness has been reported. Robertson *et al.* (1986) reported that buffalo LNG muscle was rated to be less tender compared to beef LNG. Sullivian and Calkins (2007) reported that among bovine muscles, PSM was rated the most tender and BIF as the least tender muscle. The current study revealed that, PSM, LNG, INF, SEV and REF of both species had a score of higher than 6.0 corresponding to the perception of moderate or higher degrees of tenderness. An intermediate range of 5 to 5.99 was shown by TRI, SEM and VAL in case of buffalo and SPS, TRI and VAL in case of bovine muscles. Sensory score of 4.99 and below corresponding to slightly tough and further increased degrees of toughness was shown by SPS and BIF in buffalo and SEM and BIF in case of bovines.

In the current study, buffalo BIF had the lowest sensory score for juiciness where as PSM had the highest. The juiciness scores obtained in the current study were in agreement with previous reports. Kandeepan *et al.* (2009) reported juiciness score of 6.50±0.09 for buffalo LNG muscle on a nine point hedonic scale. Robertson *et al.* (1983) reported a juiciness score of 4.94 for buffalo PSM muscle. On a seven point hedonic scale, Lapitan *et al.* (2008) reported a juiciness score of 4.42 for buffalo LNG. With respect to bovine muscles, LNG and PSM had significantly higher juiciness scores. Sullivian and Calkins (2007) reported INF, SEV and *Longissimus lumborum* as having higher juiciness scores. They also reported SEM as having the least juiciness. Carmarck *et al.* (1995) also reported SEM to be having the lowest juiciness score and higher juiciness for INF, PSM and *Longissimus lumborum*. The observations of the present study also concur with these reports.

Flavour scores among the buffalo muscles were significantly ($p<0.05$) lower for BIF and SEM when compared to others. The buffalo all-muscle mean flavour score was 5.36±0.07. Robertson *et al.* (1986) also found similar flavour scores for the buffalo LNG muscle on eight point hedonic scale. Among the selected muscles of bovine carcasses, VAL had the lowest flavour score and it was not significantly different from SEM, REF, TRI, SPS and SEV. The flavour scores between the species differed significantly only with respect to BIF and all-muscle means of the two species for flavour score did not differ significantly.

The sensory score for the amount of connective tissue was found to be the lowest for BIF and the highest for LNG. The connective tissue content differed significantly ($p<0.05$) between REF, PSM and INF and there was generally more variation with respect to amount of connective tissue in the buffalo muscles. There was significant ($p<0.05$) difference for all-muscle mean amount of connective tissue between the two species. This could be explained by the significant ($p<0.05$) lower solubility of intramuscular collagen obtained in the case of buffalo muscles (results not presented). Swelling and gelatinisation of intramuscular collagen during the process of moist cooking are highly dependent on the maturity of intramuscular cross links in collagen. Collagen with more mature cross-links is less soluble and residue of collagenous connective tissue is more perceived during sensory evaluation (Vasanthi *et al.* 2007).

Among the buffalo muscles, overall acceptability score was significantly ($p<0.05$) higher for LNG and PSM, and the lowest for BIF. The overall acceptability score in the present study was in agreement with Robertson *et al.* (1986) who reported a mean score of 3.77 scores for PSM from Achille's-tendon hung Murrah buffalo carcasses. Naveena *et al.* (2011) reported overall acceptability score of 5.59 for BIF from spent female Murrah buffaloes on an eight point hedonic scale. Among bovine muscles also, LNG and PSM had significantly ($p<0.05$) higher overall acceptability scores and SEM had the lowest overall acceptability score. These results are in agreement with Robertson *et al.* (1986). There was no significant difference between the species for the all-muscle mean overall acceptability scores which agrees with Robertson *et al.* (1986) and Lapitan *et al.* (2008). The latter authors also reported general acceptability scores of 5.40 and 5.16 for buffalo and bovine LNG respectively on a seven point hedonic scale.

To conclude, there was considerable variation in the sensory attributes of the selected buffalo and bovine muscles within and between the two species. The current study identified the PSM, LNG, INF, SEV and REF from both species as having tenderness scores of higher than 6.0 corresponding to the perception of moderate or higher degrees of tenderness. Hence these muscles are potentially marketable at a premium price. Sensory panel scores for majority of the muscles showed no significant difference between the species with respect to appearance, tenderness, juiciness, flavour and overall acceptability. There were significant differences within and between the species with respect to the amount of connective tissue for majority of the muscles. Among the selected muscles, PSM and LNG of both species scored higher for all the attributes, but LNG had significantly lower amount of connective tissue as compared to PSM.

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