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Male Buffalo Calf: Potential Emerging Meat Animal- A Review

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ABSTRACT

With 109.85 million heads, India ranks first in world buffalo population. Because of its extremely nutritive milk, leaner meat and top draught power for wet conditions, buffalo proposes extreme ability for the enhancement of living standard of mankind. Buffaloes are well known for their diet versatility, remarkable defiance to disease and flexibility to a wide range of dwelling, feeding and managemental circumstances. Meat of buffalo calf; have no religious prohibitions and is lean and liked by most of the segments of populations. The meat obtained from young male buffalo calves has more tenderness than that from higher age and connective tissue in the meat contributes to its toughness. Despite, the little toughness of buffalo meat than corresponding beef owing to existence of substantial proportion of connective tissue in buffalo, yet emulsified products like sausages, patties, loaf, nuggets, patties etc. can be nicely prepared from buffalo meat. The deliciousness of buffalo calf meat is almost identical to that of buffalo meat. Thus, rescue of buffalo calf for meat production can enhance the employment, revenue and export prospective.

HIGHLIGHTS

- Buffalo calf meat have no religious prohibitions.
- The meat of male buffalo broilers has more tenderness than aged buffaloes.

Keywords: Buffalo calf meat, valuable asset, export potential, tenderness, product development potential

The livestock farming and processing that involve only low to moderate facilities, can potentially improve rural livelihood, alleviate poverty and also provide food guarantee. The growth of human population in the world has been coupled with remarkable economic growth which has permitted boost in earnings and buying power, and thus, changes in food desires (Cruz, 2010). The total livestock population in India as per the 20th livestock census done in 2019 is 535.78 million with 109.85 million buffaloes (20.45%) having first rank in world in buffalo population (BAHFS, 2019). India exported 1.23 million tons of buffalo meat, worth ₹ 25091 crores (APEDA, 2019). Buffalo (*Bubalus bubalis*) meat has high protein levels, low fat content and cholesterol as compared to beef (Murthy and Devadason, 2003). Owing to domestic consumption and export prospective, buffalo meat has justified its significance in the recent times in India. Buffaloes are well known for their diet versatility, remarkable defiance to disease and flexibility to a wide range of dwelling, feeding and managemental circumstances (Wanapat and Kang, 2013). Because of its extremely nutritive milk, leaner meat and top draught power for wet conditions, buffalo proposes extreme ability for the enhancement of living standard of mankind (Pasha and Hayat, 2012). The growth in the buffalo meat sector also assists to augment the potential of the leather industry.

The Indian female buffalo population with 100.57 million has increased by 8.61% whereas male buffalo (9.28 million) population declined drastically by 42.35% over

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previous census, 2012 (BAHFS, 2019). This diminishing males buffalo population over the years is relating to the fact that the male buffaloes used for draught are meager 21% as the animal draught power has been decreasing due to mechanization and the total farm power from cattle and buffaloes is lower than 10% of the available total animal power from all sources such as tractors, tillers, electrical and man power (Mehta, 2007; Srivastava and Kakra, 2009); also, the males needed for breeding is modest of total number (the male requirement will also be much fewer with preference of artificial insemination). This obviously shows that the use of male calves is very limited and the dairy farmers do not wish to grow them for miscellaneous grounds. They are kept with dispassion, not nourished properly and are perished before they attain 1 year of age without realizing their full potential.

In India, buffalo meat is chiefly obtained from used up dairy buffalo at the end of their fruitful life after complete exploitation. Such a meat drawn from spent animals is dark, rough and tough in texture and has substandard sensory and processing attributes (Kandeepan *et al.*, 2009; Naveena *et al.*, 2011). These difficulties can be resolved by utilizing meat of young male buffalo calf (below 1.5 years) having greater collagen solubility (Kandeepan *et al.*, 2009) since the collagen cross links become stabilized and the collagen become much less soluble with advancement of age (Maltin *et al.*, 1998). Growing and usage of such a valuable asset for meat production would further enhance the employment, revenue creation and export prospective. This strategy will also settle the matter of dairy farmers of growing male buffalo calves. In addition, heighten availability of valued meat may aid in defending the plight of starvation in the country and ameliorate the export capability of this precious element. It is approximated that there is ability for nurturing around 19 million male buffalo calves per annum, together with that of an estimated 10 million male calves be rescued from demise with relevant arbitrations. This will also necessitate the blossoming of technology which would not only help in stimulating the taste buds of consumers towards calf meat but also result in healthier, nutrient rich and value added finished meat products.

Buffalo male calf meat

Meat of suitably fed buffalo calves, having no religious prohibitions, is lean and also liked by almost all of the segments of population. Buffalo calf properly reared as meat animal and slaughtered at the age of 16-20 months yields a highly satisfactory top quality meat at a much lower price as in comparison to cattle (Pathak and Ranjan, 1979). The quality characteristics of buffalo calf meat are represented below:

Dressing percentage and carcass composition

There is substantial disparity in the live weight of buffalo calf which relies on its age, breed attributes, nutrition status and other managemental operations. The average live weight and dressing percentage of 10 months old male buffalo calf were reported to be 139.98 kg and 47.63% (Singh *et al.* (2018b).Whereas De Franciscis and Zicarelli (1974) noticed 154 to 163 kg live weight at 6 months of age. Young male buffaloes are usually slaughtered at the weight of 250-300 kg when they are 1-2 years old (Baruah *et al.,* 1990). The dressing percentage of buffalo carcass of 130 to 500 kg body weight ranged from 50 to 55% (Rosa *et al*., 1980). Dressing percentage on slaughter of buffalo broiler was found to be in the range of 61 to 64% (Bhat and Lakshmanan, 1998). Whereas Afif *et al.* (1974) observed average dressing percentage of male buffaloes slaughtered at various phases of maturity in the limits of 50 to 55%. The dressing percentage of Mediterranean-type of buffalo was 55.51% and that of Swamp buffalo was 53%. Ranjhan (2004) noticed growth rate of 900 g to 1 kg/day in murrah buffalo male calves and dressing percentage was about 65%.

The carcass composition varies with dressing percentage of buffalo carcass. A buffalo yielding dressing percentage of 43-44 is composed of 65-70% meat, 5-10% fat and 20-24% bone component whereas a buffalo calf having a dressing percentage of 51.4 furnishes 66.8% meat, 9.7% fat and 23.5% bone (Sharma, 1999). Sarma and Sharma (1997) revealed that shrinkage was not influenced by stage of slaughter or level of crude protein intake. The shrinkage losses were 5.25% and 4.68% at veal (11 months) and beef (19 months) stages, respectively and dressing percentage were 51.45% and 53.93% at veal and beef stage, respectively and variations between stages were significant. Lean: bone ratio was also significantly impacted by stage of slaughter and was recorded as 23.46 and 19.80 at veal and beef stages, respectively.

Composition and nutritional characteristics

Anjaneyulu *et al.* (1985) found moisture content of 76.36% in the meat of young male buffaloes fed with high protein diet. Male Buffalo calf Longisimus dorsus muscle has 74.2% moisture, 20.4% protein, 1.4% fat, 1% ash, 5.1% water soluble proteins, 7.2% salt soluble protein, 0.37% non protein nitrogen and 0.12% hydroxyproline (Lazar, 2001). Male buffalo calf slaughtered at 10 months of age has been reported to have moisture, protein, fat and ash as 76.64%, 19.76%, 1.02% and 1.23%, respectively (Singh *et al*., 2018b). The moisture, protein and fat levels of 1 year old buffalo calves were found to be in the range of 77.62-77.94%, 20.50-21.28% and 1.42-1.74%, respectively (Bawa and Sekhon, 2000). In another study, Ziauddin *et al.* (1994) reported moisture, protein, fat and ash contents of Longissimus muscle of buffalo as 77.75%, 19.11%, 0.45% and 0.99%, respectively. Meat from 24 months old male buffalo calves had moisture and fat content in the range of 1 to 3.5% (Kandeepan and Biswas, 2007).

The moisture level of young male murrah buffaloes was reported to be (Kandeepan and Biswas, 2007) and that of spent female murrah buffaloes was 76.51-79.69% (Naveena *et al.,* 2004). Male buffalo meat has higher protein level as compared to females (Mohan *et al.,* 1987). The proximate composition of 18 months old male buffalo calf was as moisture (74.99%), protein (21.20%) and fat (2.67%), respectively and the meat of intensively grown young buffalo had significantly higher moisture content than meat from spent male and female buffalo (Kandeepan *et al.,* 2009). The moisture content of buffalo meat decreased as the age advanced which was presumably linked with surge in fat content (Lawri, 1998).

Buffalo meat has few remarkable attributes like lower intramuscular fat, cholesterol, calories, high biological value, greater amount of essentials amino acid and iron (Anjaneyulu *et al.,* 1990). The pigment in meat of younger buffalo was significantly lower than that of spent male as well as female buffaloes. A minute increase in myoglobin concentration was noticed in the meat from spent male and females than younger ones and meat appeared darker in colour with age advancement (Valin *et al.,* 1984), as the meat pigment concentration increases with corresponding content of myoglobin (Mamino and Horn, 1996). Spent buffalo meats have significantly greater salt soluble protein than the meat from young male and spent female buffaloes (Kandeepan *et al.,* 2009). Salt soluble protein was related to the water holding capacity and moisture content of the meat.

An age linked increase in pyridinoline content of intramuscular collagen and cross link formation were affected by sex imparting to the toughness of meat in spent buffaloes (Bosselmann *et al.,* 1995). Buffalo meat carries 1% less intramuscular fat, 92% less saturated fat, 25% slighter calories, 67% fewer cholesterol, 11 to 30% greater protein, and 10% higher minerals than beef. The buffalo meat has been recorded to be high in iron and conjugated linoleic acids, which are crucial for good health. The cholesterol content (48.8 2.9 mg/100 g) was fewer than that revealed for Italian bovine genotypes with a capacity for meat production. The amount of myristic and palmitic acid, both having both atherogenic and thrombogenic activity, was also very low. Hence, regardless of the low values of oleic acid and polyunsaturated acid of the omega-3 and omega-6 fatty acid, both the atherogenic and thrombogenic indexes were very low (0.53 and 1.48, respectively) (Infascelli *et al.,* 2003). Owing to these notable facts, the nutritional quality of buffalo calf meat can be acknowledged of great value and curiosity.

pH and water holding capacity (WHC)

The meat received from male buffalo calves is asserted to be more appropriate for preservation by freezing, when assessed on basis of pH and thawing loss (Tateo *et al*., 2007). The deviation in pH may arise from physical activity, nutritional insufficiency, life stage, sex and/or other features of the animal (Zhang *et al*., 2010). The pH of the meat from young male buffaloes has been reported to be in the extent of 5.54 to 5.57 (Kandeepan *et al*., 2009). Lambertz *et al*. (2014) revealed pH in the limits of 5.77 to 5.94 after 24 hours of slaughter of the male buffalo veal.

Water holding capacity (WHC) of meat is defined as the ability of meat to retain the water when external force is exerted (Miller, 2007) and is extremely related to its pH. It is the most significant attribute in determining appropriateness of the meat for converting into food products and is directly associated to emulsion stability and juiciness of the meat products (Kandeepan *et al*., 2013). Naveena *et al*. (2011) concluded the WHC in buffalo meat lumps as 15.33 ml/100 g when the pH was 5.56. Whereas Das *et al*. (2006) noticed WHC of 12.56 ml/100 g in meat

samples of same species. A water holding capacity of 20.61% was documented in meat of male buffalo calves nourished with protein rich diet (Anjaneyulu *et al.,* 1985).

A little lower WHC in castrated buffaloes than entire male animals has been found owing to elevated protein denaturation in castrated animals (Dessou *et al.,* 1981). WHC of meat obtained from intensively reared male buffalo calves was greater than meat of spent female animals (Kandeepan *et al.,* 2009). Moreover, Reid and Swan (1995) also revealed that meat from intensively grown male buffalo calves had significantly extra water holding capacity in comparison to that from spent female buffaloes. Singh *et al* (2018b) reported water holding capacity as 20.87% in fresh meat after 24 h of slaughter of 10 month old male buffalo calf and pH was reported to be 5.95.

Tenderness

The meat received from male buffalo broilers had more tenderness than that from aged buffaloes and connective tissue present in the meat was accountable for its toughness (Robertson *et al*., 1986). The collagen content of muscle was significantly associated to chronological age of animal and its level increased significantly with advancing age of the male murrah buffaloes (Yadav and Singh, 1985). A hydroxyproline level of 0.12% was recorded in meat of male buffalo calves reared on rich protein diet (Anjaneyulu *et al*., 1985). Ziauddin *et al.* (1994) revealed that the muscle from buffalo of 1 to 2 years old had lower collagen content (0.91- 1.71%) than muscle of 12 years old buffalo (1.16- 2.23%). As animals get older, the collagen cross links are stabilized. Although following cooking, the collagen cross links diminish but do not shatter, so imparting to the toughness of meat from aged animal (Warriss, 2000).

Shear press value/ firmness and toughness

Shear press value is gently correlated with tenderness, WHC and texture of the meat. The buffalo meat received from young male animals indicated a significantly lower shear press value than the older animals (Kandeepan *et al.,* 2009). Shiba *et al*. (2004) revealed that the shear press value of the meat was declined by Intensive nourishing of animals. This value was reported to be positively linked with fibre diameter, hydroxyl proline level and toughness of the meat but negatively associated with the sarcomere length of the muscle (Biswas *et al*., 1989).

Emulsifying capacity

The quantity of myofibrillar proteins available in meat and their capability to emulsify added fat is a remarkable component linked with emulsion stability and better product attributes in terms of binding and texture. The emulsifying capacity of the meat from male buffalo calves was significantly lesser than spent male buffaloes (Kandeepan *et al.,* 2009).

Product development potential

Despite, the little toughness of buffalo meat than corresponding beef owing to existence of substantial proportion of connective tissue in buffalo muscle which adds to toughness of meat, yet emulsified products like sausages, patties, loaf, nuggets, patties etc. can be nicely prepared from buffalo meat (Sharma *et al.,* 1995). Jairath *et al.* (2018) successfully formulated sausages from buffalo male calf veal by utilizing up to 6% corn starch as fat substitute. Singh *et al.* (2018b) compared sensory quality of meat slices developed from meat of goat (chevon) and that of buffalo calf and concluded that both the slices had scores exceeding seven on 8 point descriptive scale and no significant variations were observed between them. Bishnoi *et al.* (2017) developed buffalo calf meat rolls by incorporating aloevera jel (4%) and arjun tree bark extract (2%) as natural antioxidant and summarized that developed meat rolls were organoleptically acceptable and microbiologically safe up to 21 days of refrigeration (4±1 °C) storage.

Low fat ground meat slices formulated by incorporating grape seed extract (0.2%) as natural antioxidant had significantly reduced thiobarbituric acid reactive substances (TBARS) and free fatty acids values on the 12th and 16th day of refrigeration ((4±1 °C) storage in contrast to control. The sensory evaluation revealed that the GSE incorporated samples had better scores along the advancement of storage period and the microbial counts such as total plate count, psychrotrophic count and yeast and mold count decreased significantly in GSE treated samples (Singh *et al*., 2018a). Berry and Abraham (1996)

revealed that the patties formulated by utilizing meat from young calf (below 24 months old) secured more points in all palatability traits (except for juiciness) and tenderness with less differentiable connective tissue than produced entirely from cow meat (greater than 2 years of age).

CONCLUSION

The deliciousness of buffalo calf meat is almost identical to that of buffalo meat. Even, the processing attributes of buffalo calf meat are superior to that of spent buffalo in terms of tenderness. Hence, on the one hand, utilization of enormous potential of buffalo calf for meat by rescuing and growing them for large weights rather than abandoning them, can fight the problem of nutritional insecurity and on the other hand, will enhance the export potential of the country. The rearing of this acknowledged wealth will further reduce the buffalo farmer's dispassion and will upgrade the socio-economic position of the poor farmers. Viable attitude of vital associates like dairy, meat, leather, feed and related sectors necessitate concentration on the rearing of male buffalo calves with more productivity for the reciprocal benefits.

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