BUFFALO MEAT IN FRANKFURTER TYPE SAUSAGE

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Summary: Deboned shoulder from buffalo entire males (i), from buffalo cull cows (ii), and from castrated Zebu cattle (iii) were used as main meat raw-materials in Frankfurter type sausages. Processing losses ranging from 11.8 to 13.3% did not differ significantly among sausages, although buffalo sausages presented greasy surfaces. Emulsion stabilities on cooking measured as released liquid were lower for buffalo sausages (i) and (ii) (around 11.0%) than for beef sausage (iii) (6.5%). The expressed juice contents ranged from 48.6 to 52.4%, and it was higher in young buffalo (i) sausage, and differed only between buffalo sausages. Sausages from young animals were less firm than from buffalo cull cow, measured objetively by Warner-Bratzler shearing measurement. Under organoleptic evaluation on a scale from 0 to 10, 5 as ideal for firmness and juiciness, and 10 for other attributes, the sensorial firmnesses were lower for young animals (4.0 and 5.7 for buffalo and beef, respectively) than for older (7.0). Young buffalo sausage scored lower in flavor (6.7) than buffalo cull cow and beef sausages (7.2 and 8.9, respectively), but only the first score differed significantly from the last score. Young animal sausages presented higher texture homogeneity (around 8). All sausages were acceptable (5.8 to 7.2), although buffalo sausages scored lower than beef.

Introduction: CARPENTER (1988) reported the utilization of buffalo and bovine (bulls of 18 months of age) meats in sausages and concluded that there were no detectable difference in their binding capacity, emulsion properties, texture, firmness or flavor between wieners (made from lean trimming standardized to 30% fat) from water buffalo meat and from wieners made from Charolais beef. CARPENTER et al. (unknown) concluded that meat from buffalo carcasses not used for higher price retail cuts can be used effectively in a processed product.

Some publications have stated that buffalo meats has different characteristics from beef and that meat of young animals differs from older (VALIN et al., 1984; ROBERTSON et al., 1984 and 1986).

Thus it can be expected that the use of buffalo meat with different characteristics replacing traditional meats as raw-material in emulsion type products need some technological adjustments particularly when critical formulations are used.

The production of emulsion type sausages is the second (after "charque" with 82 thousand tons) main meat industry activity in Brazil, with 69 thousands tons annually. Usually, the meats used as raw-materials are from forequarters and those obtained from slaughtering and trimming operations.

The objective of this work was to evaluate Frankfurter type sausages formulated with meat from buffaloes of different lots, representative of those for meat purpose, compared to beef.

Material and Methods: Raw-materials and formulations: Deboned shoulder from 2 lots of buffalloes 24 months old entire males (i) and more than 15 years old cull cows (ii) and one of 3 years old castrated Zebu bovine (iii), all at the normal age for meat purpose were used. Other components used in each formulation were pork shoulder 13%, salt 2.34%, spices 0.74%, corn starch 2%, sodium nitrite 0.02%, erythorbate 0.05% and tripolyphosphate 0.5%. Batters were formulated to contain 20% fat and a moisture protein ratio of 4.5 using pork back fat and ice. In two trials, batters were comminuted reaching a maximum temperature of 16°C, stuffed into 22mm cellulose casings, cooked to an internal temperature of 72°C, showered for 15min, and peeled after being chilled to 10°C.

Analysis: Proximate analysis and pH of meat raw-materials, batters and cooked sausages were determined as recommended by KONIECKO (1985). Emulsion stability by PARKS & CARPENTER (1987), process yields by weight differences between stuffed raw sausages and both, cooled sausages after thermal processing and final peeled sausages according to MITTAL & USBORNE (1986).

Firmness as Warner-Bratzler shear force through the diameter of the sausage and through 0.5in core diameter. Sensorial evaluation in firmness, juiciness, texture homogeneity, flavor and overall quality with an 11 members taste panel using 10cm non structured scale. The score 5 was considered ideal for firmness and juiciness and 10 for other sensorial attributes. The physical and chemical data were submitted to variance analysis considering 3 treatments, 2 replicates and treatment x replicate interactions. The sensory analysis results were evaluated according to nested-crossed design. When F values were significant ($P < .05$), Tukey's Least Significant Difference Method was used to locate differences ($P < .05$) between the mean of various treatments.

Results and Discussion: The characteristics of meat raw-materials are shown in Table 1. These results were used to define the proportion of each component to obtain the required 20% fat and 4.5 moisture-protein ratio.

Table 1. Proximate analysis and pH values of meat raw-materials for buffalo and beef sausages.

Raw-material	pH	Percentage							
		Moisture		Protein		Fat		Ash	
		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Buffalo-Deboned shoulder									
Entire male	5.84	73.0	0.3	19.5	1.0	4.6	0.4	1.0*	-
Cull cow	5.60	75.8	0.3	16.9	0.7	4.2	0.4	1.1*	-
Bovine-Deboned shoulder									
Castrated male	5.5	75.4	0.2	18.8	1.1	4.8	0.5	1.0*	-
Pork									
Deboned shoulder	6.0	68.8	0.2	18.4	0.4	11.7	0.2	1.1*	-
Back fat	6.3	12.3	0.3	3.0	0.1	82.3	0.6	0.2	0.0

3 replicates   * 1 replicate   S.E. = Standard error of the mean.

The results of the determinations during sausage processing were shown in Table 2.

Table 2. The pH, emulsion stability and process yield of buffalo and bovine sausages.

Sausage	pH after cooked	Emulsion stability (% released liquid)	Losses		Visual
			Cooking	Total	
		Mean	Mean	Mean	
Buffalo					
Entire male (i)	6.42[a]	11.11[a]	10.45[a]	13.32[a]	++
Cull cow (ii)	6.41[a]	11.22[a]	9.80[a]	11.81[a]	+-
Bovine (iii)					
Castrated male	6.40[a]	6.54[b]	9.80[a]	12.04[a]	--
S.E.		0.24	0.44	0.47	

M = Mean.
S.E. = Standard error of the mean.
Means showing different superscripts in the same column were statistically different.
++, +- and -- = moderate, marginal and absent greasy surface.

Among evaluated parameters, emulsion stability was lower in buffalo sausages determined as percentage of released liquid from cooked batter, with 11.11, 11.22 and 6.54% for (i), (ii) and (iii), respectively. However processing yields measured as weight losses did not differ statistically among sausages. During the removal of cellulose casings it was observed that there was a visual separation of a small amount of gelatin/fat between the sausages surface and casing giving a greasy appearence. This feature was not observed in beef sausage. The objective juiciness as percentage of expressed juice, and firmness by shearing cross sections (both, whole and 0.5in core diameters) are shown in Table 3.

Table 3. Objective juiciness and firmness mean values of buffalo and beef sausages.

Sausages	Juiciness (%)	Firmness (kgf/cross section)	
		Whole section (22mm casing)	Core section (0,5in diameter)
Buffalo			
Entire male (i)	52.4^{a}	0.84^{c}	0.21^{b}
Cull cow (ii)	48.6^{b}	1.30^{a}	0.28^{a}
Bovine			
Castrated male (iii)	50.9^{ab}	1.18^{b}	0.22^{b}
S.E.	0.7	0.02	0.01

S.E. = Standard error of the mean.
Means showing different superscripts in the same column were statistically different.

Sausage of young buffalo (i) produced a higher value of 52.4% of released liquid different from a cull cow with 48.6%. Bovine sausage produced an intermediate value but did not differ from buffalo sausages.

Objective firmness without an outer layer effect did not differ between young animals (i) and (iii) but did differ from older (ii) that showed higher firmness. Whole sausage differed from each other, lot (i) being less firm, followed by (iii) and (ii), the older showing the highest value.

The subjective firmness evaluation of whole sausages showed the same results of objective evaluation, with sausages made from young animal being close to the ideal (Table 4). Buffalo sausages scored lower in flavor but, it was marginally better for (ii). Although statistical difference was observed in objective juiciness between (i) and (ii), subjective juiciness did not differ between sausages. Texture homogeneity scored lower for (ii) indicating a higher amount of large connective particles. Overall quality did not differ between buffalo sausages, but scored less than beef sausages.

Table 4. Organoleptical evaluation mean values of buffalo and beef sausages.

Sausages	Juiciness	Firmness	Flavor	Texture homogeneity	Overall quality
Buffalo					
Entire males (i)	5.0^{a}	4.0^{c}	6.7^{b}	8.2^{a}	5.8^{b}
Cull cow (ii)	4.0^{a}	7.0^{a}	7.2^{ab}	6.8^{b}	5.8^{b}
Bovine					
Castrated male (iii)	5.0^{a}	5.7^{b}	8.9^{a}	8.1^{a}	7.2^{a}
S.E.	0.3	0.3	0.4	0.3	0.4

S.E. = Standard error of the mean.
Means showing different superscripts in the same column were statistically different.
Non-structured scale of 10cm, ideal score 5 for juiciness and firmness, and 10 for other attibutes.

Conclusion: Sausages containing buffalo meat produced lower emulsion thermal stability compared to beef sausages. Sensorial sausage firmness was affected by the age and species of the animal. Young buffalo meat sausage was less characteristics in flavor compared with sausages from older animals and for the same age beef sausages. Buffalo sausages either from young or old animals produced lower scores in overall quality compared to beef, although they were still acceptable. However, further studies are needed to define the magnitude of the technological adjustments necessary to improve acceptability of buffalo meat as raw material for emulsion type products.

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