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Proximate composition, pH value and microbiological evaluation of 'Kundi' (dried meat) product from beef and camel meat.

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Introduction

The dearth of animal protein in the diets of persons living in developing countries has been an issue of concern to Governments and individuals over the years. This is because what is obtained from the major sources of meat apply can no longer sustain the growing demand due to increases in human population (Vietmeyer, 1985). In order to bridge the gap between demand and supply of animal protein, preservations of meat is therefore very necessary. The process of meat drying is a compose phenomenon influenced by a number of factors individual including meat composition, its water activity, heat transfer medium, pH, redox potential and various microorganism found on meat before and after handling (Lawrie 1998) .

Meat with a high ultimate pH is generally very susceptible to microbial growth even under the best management condition and practices (Hedrick *et al*., 1994). Lawrie (1991) stated that all micro organisms will not grow well below pH of 4.0 and above pH of 9.0.

The focus of this study is therefore to investigate the pH valve, microbiology and chemical composition of 'Kundi' an intermediate moisture meat.

Material and Methods

Meat Processing: 3kg of muscles from beef (White Fulani) and camel (*Camelus dromedarius)* of 2-3 years old were trimmed of all external fats, blood vessels, nerves, excess epimysial connective tissues and deboned with a sharp knife. The chunks were held overnight for 24 hours at 4 ^{0}C and later cut into sizeable smaller portion within the range of 70 – 90 grams of 6 cm to 8 cm wide.

Boiling and Smoking method: Cut meat samples (3 kg) from both muscles were separately boiled in water (5 times weight of meat sample), for 30 minutes at 100 ^{o}C. Boiled samples were smoked using charcoal at 200 ^{o}C – 360 ^{o}C, for 6 hours and covered with a tray to impact the smoky compound

Ingredient Inclusion: Ingredients used includes; 75.6 % onions (fresh bulb of *Allium* cepa), 3 % thyme (*Thyme Vulgaris*), 3 % curry powder (*Zingiber officinale*), 9.8 % maggi (monosodium glutamate) and 8.6 % salt (*Sodium chloride*). The ingredients were added during the boiling process.

pH Determination: pH of fresh meat and 'kundi' products were determined according to the method described by Bendall (1973). pH was measured in the aqueous extract in 1g of the dried samples, homogenized in 10 ml distill water. It was measured using checker pH meter. pH of the fresh meat was measured by immersing the pH meter into the muscle

Microbial Analysis: Microbial status was determined by isolating, identifying and characterizing organism according to method describe by Meynelle and Meynelle (1970).

Statistical analysis: Data collected were subjected to analysis of variance (ANOVA) and significant differences between means were separated using Duncan's Multiple range text (SPSS). The SAS (1999) software package was used for all statistical analysis.

RESULTS

Table 1: Proximate composition of fresh beef and camel meats (g / 100 g Dm)

Parameter	Treatment			
	C.K	LPCK	LPBK	SEM
Moisture	23.29^{c}	30.21^{b}	35.09^{a}	0.42
Ash	4.82^{a}	1.86^{c}	2.40^{b}	0.21
Ether extract	5.43^{a}	4.86^{b}	4.41^{b}	0.65
Protein	66. 79^{a}	63.07^{b}	58.10^{c}	0.25

$^{ab:}$ means in the same row with different superscript are significantly different ($p<0.05$).

CK – Commercial 'Kundi'

LPCK – Laboratory prepared Camel 'Kundi'

LBCK - Laboratory prepared Beef 'Kundi'

Table 2 pH value of smoked 'kundi'

	Meat under storage				
	Beef		Camel		
Period	*seasoned*	*Unseasoned*	*seasoned*	*Unseasoned*	*SEM*
Raw meat	6.20^{ax}	6.20^{ax}	6.07^{bx}	6.07^{bx}	0.11
0 month	5.43^{ay}	5.32^{by}	5.33^{by}	5.11^{cy}	0.01
3 Month	5.43^{ay}	5.33^{by}	5.34^{by}	5.11^{cy}	0.02
6 Month	5.43^{ay}	5.33^{by}	5.34^{by}	5.11^{cy}	0.02
	0.03	0.02	0.02	0.01	

^{ab}; means in the same row with different superscript are significantly different ($p<0.05$).

$_{xy}$; means in the same column, with different superscript are significantly different ($p<0.05$)

Table 3. Microbial Plate count ($x10^4$) of fungi in stored smoked 'kundi'

	Meat samples				
	Beef		Camel		
Storage time	**unseasoned**	**seasoned**	**Unseasoned**	**seasoned**	**SEM**
0 Month	3.00^{abz}	2.00^{bz}	4.00^{az}	2.00^{bz}	0.19
3 Month	5.00^{aby}	4.00^{by}	6.00^{ay}	5.00^{aby}	1.13
6 Month	9.00^{ax}	6.00^{cx}	9.00^{ax}	7.00^{bx}	1.22
SEM	1.21	1.12	1.22	1.10	

^{ab}; Means in the same row with different superscript are significantly different ($p<0.05$).

^{Xyz}; Means in the same column, with different superscript are significantly different ($p<0.05$)

DISCUSSION: Results obtained for moisture content of 'Kundi' fell within the range of 30 – 40 % reported by Alonge (1984). CK value fell in the range of 21.6 - 26.8 % for moisture in Majoran Sausage. The values were however higher than 8.2 % - 11.1 % observed for moisture of oven dried and sun dried 'Kilishi' reported by Egbunike and Okubanjo (1999). Egbunike and Okubanjo (1999) reported that IMM are low in moisture content and are shelf stable under tropical climates without refrigeration.

The mean ash content agreed with that reported by Igene and Ekanen (1985). These authors found that the ash content of meat increased with heat application. The highest ash content for commercial 'Kundi' may be due to resultant dirt on the meat pieces when sun drying on the ground in the open market. Torres *et al*. (1994) reported that ash content at the end of storage differ significantly to that at the onset. Fat content were observed to be lower than the range of 10.9 -29.6 % obtained for fat of alheria (Venia *et al* ., 2006). Increase in fat contents may be due to the effect of nutrient concentration due to moisture loss. Protein found in the 'Kundi' products were within the range of 69.8 -72.1 % reported by Soniran and Okubanjo (2002) for protein content of pork loin roast cooked to three internal temperatures at 65 ^{0}C, 75^{0}C and 85^{0}C respectively. The increase in protein content observed for 'Kundi' were in agreement with the report of Egbunike and Okubanjo (1999) that intermediate moisture meat are meats low in moisture content and contain three to four times the raw protein equivalent; hence they are less bulky.

pH values obtained for seasoned 'Kundi' were higher than unseasoned 'Kundi', these difference could probably be due to the effect of Nacl on meat proteins. Eoin (2006) observed that CL^- ion is strongly bound to protein than Na^t when salt is used in cooking of meat. This causes an increase in negative charges of proteins. Ogunsola and Omojola (2003) reported that the pH of freshly salted meat increases with increasing salts levels and that boiling and broiling of meat at different salt level showed an increase in pH. The results of seasoned and unseasoned products obtained in this work were comparable to 4.83 – 5.99 for pH value of seventeen Intermediate Moisture Meat (Jose *et al*., 1994), but lower than 6.48 – 7.20 for pH value of smoked meat (Alonge, 1984). Organic acid in smoke help to preserve meat and causes lowering of pH value of meat products (Wikipedia, 2002).

The results of microbial load obtained were in agreement with the report of (Venia *et al*., 2006) for dehydrated 'Kilishi' stored for 2 days post production and also were comparable with 3.25 – 7.27 reported by Kembi and Okubanjo (2002) for raw and steam – cooked beef and beef patties before dehydration. The higher microbial load obtained at 6 months of storage may be due to moisture absorption from the air or environment which in turns increases the growth of more microbes on the meat surface. As it was observed that the microbes increase as the storage time increases the results also shows that seasoned products had lower microbial load count to unseasoned products. Alonge (1984) reported that application of salt, apart from eliminating non-salt tolerant bacterial spp by osmotic extraction of liquids through the cell walls; it also binds water and makes it unavailable to microbes to grow. When smoking is combined with curing, the shelf life of such products is increase and decreases the microbial load especially on the meat surface (Lawrie, 1991). Smoke constituents play an important role in preserving the product against microbial spoilage.

Thus it is possible to produce 'Kundi' with low microbial counts as smoking, seasoning and adequate hygienic conditions are maintained.

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