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Full Length Research Paper

Yield and quality evaluation of kundi (an intermediate moisture meat) prepared from camel, beef and chevon

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Kundi is an intermediate moisture meat (IMM) product conventionally prepared from camel meat (CM). There is a dearth of information on the production as well as the nutritional and eating qualities of kundi from other meat types. An experiment was conducted in a completely randomized design to evaluate yield, nutrient composition and sensory characteristic of kundi prepared from CM, beef and chevon. The protein content of fresh CM (22.58%) was higher ($p < 0.05$) than the values of 19.57 and 20.83% obtained for beef and chevon respectively. The result showed that fresh beef has at least ($p < 0.05$) drip loss value of (2.46%) as against 4.03 and 3.53% obtained for CM and chevon respectively. Cooking loss values were 19.30, 21.26 and 20.36% for beef, CM and chevon respectively. Beef gave the least shear force value (6.68 kg/cm^3) as compared to 8.39 kg/cm^3 for CM and 7.06 kg/cm^3 for chevon. The product yield ranged from 33.61 to 38.93%. Kundi from each of the 3 meat types contained about three times the protein in their respective raw meat. The ash content increased from 1.50, 1.05 and 1.31% in raw beef, CM and chevon to 5.80, 4.37 and 4.40% in kundi from corresponding meat type. Kundi from chevon was rated highest ($p < 0.05$) for flavour juiciness and tenderness while beef kundi (BK) was rated highest ($p < 0.05$) for colour. Camel kundi (CK) was rated least by the panelist in virtually all parameters scored. The possibility of producing Kundi from beef and chevon will increase the consumption of the product especially by majority of consumers with aversion to camel meat

Key words: Kundi, camel meat, beef, chevon, organoleptic properties.

INTRODUCTION

Preservation of meat has always been a problem in Nigeria as in other African countries. Meat sellers and processors hardly have access to cold room facilities and even when they do, the cost is considerably high. Also, erratic power supply limits the use of cold rooms and refrigerators in most part of Africa.

One of the oldest methods of meat preservation is salting and drying which aims at reducing moisture content to produce intermediate moisture meat products. Such products usually have between 30 to 60% moisture and water activity of between 0.85 and 0.90 (Barret and Briggs, 2002). Kundi is one of such product.

Kundi is an intermediate moisture meat product conventionally produced from camel meat by the Hausas in the Northern part of Nigeria (Fakolade, 2008). There is a dearth of information on the production as well as the nutritional and eating qualities of kundi from CM, beef and chevon. The production of kundi from beef and chevon will increase the animal protein intake of the common man in the street and also give the product a wider acceptance especially by those with aversion to CM. However, kundi manufacture lacks standardized procedures and consistency in quality attributes. Its consumption is also limited by certain individuals' aversion to CM. The present study is therefore aimed at evaluating kundi prepared from CM, beef and chevon for yield, nutrient composition and sensory characteristics.

MATERIALS AND METHODS

Kundi preparation

Chunks of meat (3 - 4 cm) from the semi-membranosus muscle of hot boned

Carcasses of matured male cattle, camel and goat were used for the study.

Samples were trimmed of excess fat and connective tissue. The meat samples were separately boiled for 15 min to an internal temperature of 72°C after which they were drained and cooled to

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Table 1. Proximate composition (g/100g) of raw beef, camel and chevon used for kundi preparation.

Parameters	Meat types		
	Beef	Camel	Chevon
Moisture	76.58	75.68	76.85
Crude protein	19.57^{b}	22.58^{a}	20.83^{b}
Ether extract	2.90	3.10	2.82
Ash	1.50	1.05	1.31

Means in the same row with similar superscripts are not significantly different (P > 0.05).

Table 2. Proximate composition (g/100g) of kundi types.

Parameters	Kundi types		
	Beef	Camel	Chevon
Moisture	39.44^{a}	33.40^{b}	39.81^{a}
Crude protein	52.29^{b}	58.89^{a}	53.42^{b}
Ether extract	4.00^{b}	4.60^{a}	3.80^{b}
Ash	5.80^{a}	4.37^{b}	4.40^{b}

Means in the same row with similar superscripts are not significantly different (P > 0.05).

room temperature. Samples were then dried on a wire mesh over hard wood embers for 5 h with regular turnings at 10 min intervals.

Chemical composition

Percent moisture, crude protein, ether extracts and ash content of fresh meat samples and kundi were determined according to the procedures of AOAC (1990).

Product yield

The weight of kundi samples as a proportion of the weight of fresh meat samples from which each of the kundi type was made was taken as the product yield (Fakolade, 2008).

Physicochemical properties

3 replicate samples were used for the determination of all physicochemical properties. Cooking loss was determined as the percent loss in weight of kundi after boiling in the manner outlined by Okubanjo et al. (2003).

Shear force determination

Warner Brazter shear force (WBSF) determination was performed on the boiled meat samples using the modified Warner Brazter shear force procedure (Bouton and Harris, 1978). Three cores (1 cm^2 in diameter) were removed using an electrical coring machine. Each core was sheared at three locations parallel to the orientation of muscle fiber.

The methods of Tsai and Ockerman (1981) and that of Barton-Gade et al. (1993) were used for water holding capacity and drip loss determination respectively.

Sensory evaluation

A total of 20 semi-trained individuals (10 males and females) aged between 35 and 40 years, evaluated four replicates of the meat product on a 9-point hedonic scale for colour, flavour, juiciness, tenderness and overall acceptability. The samples were blind-coded and order of presentation randomized.

Statistical analysis data obtained were subjected to analysis of variance and where statistical significance was observed, the means were compared using Duncan multiple range (DMR) test. The SAS computer software package (1998) was used for all statistical analyses.

RESULTS AND DISCUSSION

Chemical composition

The proximate composition of raw meat samples and the corresponding kundi are shown in Tables 1 and 2 respectively. Moisture content of fresh samples ranged between 73.68 and 76.86%, which compared well with the values of 72.4 - 76.2% reported by Ezekwe et al. (1997), while that of kundi ranged between 33.40 to 39.81%. There was no significant difference (P > 0.05) in the moisture content of the raw meat samples. This may be attributed to the constancy in chemical composition of muscles (Forrest et al., 1975). Kundi prepared from beef and chevon were similar in moisture content and differed from kundi prepared from CM. The observed high reduction in moisture content of the product might be attributed to the effect of cooking loss during boiling and additional moisture loss during drying.

Mean crude protein content of fresh beef, chevon and CM were 19.57, 20.83 and 22.58% respectively. The figure for camel meat fell within the range (20.50 - 22.70%) reported by Kadim et al. (2006), while that of fresh beef is comparable to the range of 18.90 - 19.70 observed by Ezekwe et al. (1997) in beef from mature Sokoto Gudali bull. Kundi prepared from the three meat types had higher crude protein value ranging between 52.29 – 58.89%. The increase in protein content due to the removal of moisture is in line with the report of Egbunike and Okubanjo (1999) that intermediate moisture meats are low in moisture and contain three to four times the protein of the equivalent raw meat.

The crude protein content of kundi types in this study was lower than the 64.80 – 72.10% reported by Soniran and Okubanjo (2002) for pork loin roas but higher than the 34.60 - 44.60% reported by Paleari et al. (2003) for cured meat products.

Ether extract content of the fresh meat types is not significantly different but the numerical trend observed was reflected in the finished product with camel meat (4.60%) significantly higher than beef (4.00%) and chevon (3.80%). The high fat content obtained for kundi as compared to fresh meat, was due to low moisture

Table 3. Physico-chemical properties of raw meat and product yield of Kundi types.

Parameters	Meat types		
	Beef	Camel	Chevon
Cooking loss (%)	19.30 ± 0.16	21.26 ±1.25	20.36 ±2.33
Water holding capacity (%)	68.12 ±1.08^a	43.35±1.01^c	57.67±1.15^b
Drip loss (%)	2.46±0.16^c	4.03±0.89^a	3.53±0.40^b
Shear force (kg/cm^3)	6.68±0.29^c	8.39 ±0.35^a	7.06±0.43^b
*Product yield (%)	38.93±0.96^a	33.61±1.49^c	35.77±1.10^b

Means in the same row with similar superscripts are not significantly different (P > 0.05); *kundi types.

Table 4. Sensory evaluation rating of kundi as affected by meat types.

Organolptic properties	Meat types		
	Beef	Camel	Chevon
Colour	6.30 ± 0.18^a	2.67 ±0.45^c	5.30 ±0.30^b
Flavour	3.40 ±0.12^b	3.80 ±0.18^b	4.90 ±0.20^a
Juiciness	4.60 ±0.24^b	2.20 ±0.05^c	5.60 ±0.65^a
Tenderness	3.00±0.41^b	2.60±0.15^c	4.40±0.30^a
Overall acceptability	6.00 ±1.01^a	4.10 ±0.85^b	5.60 ±1.10^a

Means in the same row with similar superscripts are not significantly different (P > 0.05).

content which according to Solomon et al. (1994) relates inversely to fat content in meat.

Ash content of the three meat types were similar (P > 0.05). The values of 1.50, 1.05 and 1.31% obtained in this study for raw beef, camel and chevon respectively were comparable with the range of 1.1 – 1.4% reported by Abdelbary and Mohammad (1995) for Najdi camel meat. However, the values were relatively lower than 1.4 – 1.6% reported by Ezekwe et al. (1997) for Ndama cattle. The range of 4.40 – 5.80% ash obtained for kundi in the present study is lower than the value of 6.72% reported by Jones et al. (2001) for kilishi, another intermediate moisture meat product.

Physicochemical properties and product yield

The result of the physicochemical properties of the different meat types used for kundi production in this study is shown in Table 3. The mean cooking loss obtained varies from 19.30 to 21.2% and was not found to differ (P > 0.05) between the three meat types. The cooking loss percents observed in this study were lower than the values of 39.5 and 43.0% reported by Abdelbary (1995) for roasted braised camel meat.

Water holding capacity (WHC) followed a trend of beef > chevon > CM. Meat with low WHC will have high drip loss (Forrest, 1975). This holds true for the present study where beef with the highest WHC had the least drip loss (2.46%), while camel meat which had the least WHC had the highest drip loss of 4.03%. Chevon was intermediate both in drip loss (3.3%) and WHC.

Shear force values differed significantly between fresh meat types. Camel meat had the highest (8.39 kg/cm^3) followed by chevon (7.06 kg/cm^3) while the least value (P < 0.05) was obtained in beef. The values obtained in this study compared with the value of 7.73 – 8.10 kg/cm^3 obtained by Abdelbary (1995) for Najdi camel meat. Camel muscle had earlier been reported to have higher amounts of connective tissue than beef (Babiker and Yousif, 1990); this was probably why CM was less tender than beef. Miller et al. (2001) in establishing consumer threshold values for tenderness classified beef with Warner Bratzler shear value of 5.7 as being very tough, 4.9 – 5.7 as intermediate and below 3.0 as tender. Based on these classifications, all the three meat types may be considered to be tough.

Product yield

Product yield differed between kundi made from the different meat types (P < 0.05). It was highest in beef kundi (38.93%), intermediate in chevon kundi (35.77%) and lowest in camel kundi (33.61). The product yield was highest in meat with the highest water holding capacity, which incidentally had the least cooking loss. There was a direct relationship between the WHC and the product yield probably because of the high amount of moisture retained in the product. The product yield obtained for Kundi in this study was lower than the value of 63.35 – 74.95% obtained for suya by Omojola et al. (2003) most probably because in kundi preparation, there was no addition of spices or ingredients to increase the yield.

Sensory evaluation

The sensory evaluation (Table 4) rating showed that beef kundi differed significantly from camel kundi in all organoleptic characteristics except flavour while beef kundi significantly differed from chevon kundi in all the parameters measured with the exception of overall acceptability. Colour rating was highest in beef kundi (6.30%) followed by chevon kundi (5.30) and least in camel kundi (2.67). In fresh muscles, the colour of meat is related to the level of pigmentation (myoglobin) present in the muscle when meat is processed however, the colour changes. The colour of kundi from beef appeared brighter than kundi from the other two meat types while camel kundi had the least colour rating as adjudged by the panelists.

Tenderness rating followed the order chevon > beef > CM. The presence of more connective tissue in CM when compared to beef (Babiker and Yousif, 1990), might explain the observed difference in tenderness.

Juiciness rating among the three kundi types followed a similar trend as tenderness. A possible reason for the higher juiciness rating for chevon kundi over camel kundi might probably be due to its high WHC. Chevon and beef kundi were juicier, tenderer and rated higher for flavour than camel kundi. The two kundi types were rated higher in overall-acceptability than camel kundi.

Conclusion

Processing meat into kundi improves the protein, fat and ash compositions thus making its nutrient dense. Beef kundi had similar moisture, crude protein and ether extract content as chevon kundi while camel kundi had higher protein than kundi from the other two meat types. Organoleptic study revealed consumer preference for kundi from chevon in terms of flavour, juiciness and tenderness while both beef and chevon kundi were preferred over camel kundi in terms of overall acceptability.

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