COMPARATIVE ASSESSMENT OF THE QUALITY OF KUNDI, DRIED MEAT PRODUCTS PRODUCED USING TRADITIONAL AND IMPROVED METHODS

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ABSTRACT

Production of Kundi, an Intermediate Moisture Meat (IMM) with about 55 - 65% protein content could help reduce malnutrition problem among the populace, and if Nigerian women both in the northern part of the country as well as in Oyo State are fully involved in its production, the price of the product may be reduced, thereby granting the poor access to good protein intake. The study evaluates and compares the quality of Kundi, a dried meat product from beef and camel meat produced by traditional and improved methods. Ten kilogramme of fresh semi-membranosus muscle of White Fulani cattle and Camel (Camelus dromedarous) animals were used. The meat was trimmed to remove connective tissues, blood stains and bone patches. The meats were cut into pieces of 6 – 8cm long and 50 – 90g weight. Beef and camel meat were boiled for 20 minutes at 100^0C and then either smoked-dried using firewood at 200 - 360^0C for 3 hours or oven dried at 220^0C for 5 hours. The products were then compared with commercial samples sold by market women in a completely randomized design. The fresh camel meat samples had the highest value ($p < 0.05$) for moisture and protein (76.01% and 21.39 % respectively) than beef (73.69% moisture and 18.95% protein), while the ether extract was highest in beef (6.28%) than what obtained in camel (2.12%) meat. The products had the highest value for protein and ether extract for commercial samples, smoked camel and smoked beef Kundi than oven-dried beef and oven dried camel Kundi. Ash content was highest in commercial samples (4.34%) than smoked camel Kundi (2.92%), smoke beef Kundi (2.80%), oven dried camel Kundi (2.86%) and oven-dried beef Kundi (1.40%). Kundi products from both oven and smoke had the nutrients increased to about 3 to 4 times its fresh samples despite the processing methods used. Involvement of women in such products will help to improve family protein intake, and eradicate or lessen malnutrition in Nigeria.

Keywords: Kundi, Beef, Camel meat, Proximate composition, Product yield, Rehydratability.
J. Agric. Prod. & Tech.2014, 3:8-14

INTRODUCTION

Reducing malnutrition in Nigeria should be the concern of everybody, the youth and adult, educated and non – educated. Hunger and malnutrition are major problems in the world today, especially in the third world countries. About 30% of the world's population suffers from some forms of malnutrition (Olojede and Njoku, 2007). It has been observed that women play critical roles in the reduction of malnutrition through their involvement in livestock production (Adebuoye, 1991) which supply animal proteins much desired globally for their value and taste. It has also been documented in many parts of Africa and other developing countries, the significant role women play in raising livestock and marketing. Although the range of their production action vary among the ethnic groups.

In order to meet up with the FAO recommendation of 56g/caput/day animal protein for adult human being, the local production and development of livestock industry become inevitable with active involvement of women. Nigerian women account for almost 50% of the population in the rural area (Kotze, 2003)). Many of them, service multiple roles of holding forth for their husbands who have left for the urban centre in search for white collar jobs, and at the same time carry out their normal duties of child bearing and household maintenance (IFAD,1993). It has been observed that some women in Oyo State are involved in carrying out different activities in rural and agricultural development project as producers, processors and marketers of agricultural products. In Ibadan, Oyo State, Nigeria, some women are involved in selling/marketing of Kundi, a dried meat product, but not in its production. Ojewola, (1992) observed that shortage of protein has resulted in adverse economic effects which has manifested as reduction in human productivity, infant mortality, pronounced malnutrition and wastage diseases, such as maramus among others which are so common throughout the developing countries.

Women in Oyo State, are known to be involved only in the marketing of Kundi, in many of the large markets spread across the state, reasons maybe that, meat slaughtered in Oyo State are more expensive than those sold in the northern part of Nigeria. Several other types of animal besides sheep, pig, cattle and goat were slaughtered in the northern part of the country such as camel, buffalo and horse which are very cheaper to meat from other domesticated animal. And up till now, because of these reasons Kundi products are still being brought or transported from the north to the southern part of the country, Oyo State inclusive.

In order to reduce the malnutrition problem in Oyo state, women need to be exposed not only to production and marketing of agricultural products but to processing of livestock products to a more durable kundi. Therefore women's participation becomes crucial in Oyo State and in Nigeria as a whole. If women in the southern part of the country are to be involved in Kundi production, there is the need to compare the quality of such products produced in the north with those produced with a controlled processing environment in the south. Thus, this study evaluates and compares the quality of Kundi, a dried meat product from beef and camel meat produced by traditional and improved methods.

MATERIALS AND METHODS

Meat procurement, preparation and processing of Kundi: 10 kg semi-membranosus muscles of cattle (beef) were obtained from the Teaching and Research farm, Osun State University, Osogbo, Osun State and camel meat was purchased from

Agege Abattoir in Lagos State. The freshmeat were deboned, trimmed of all external fat, blood vessels, nerves and excess epimysial connective tissues and later washed with clean water from the tap. Samples were cut into sizes of about 70 - 90g and of 6 - 8cm wide and held for 24hours under 4 ^{0}C. The cut samples from both cattle and beef were separately boiled in water and stirred at intervals for uniform doneness. The liquid was thereafter drained off and meat samples were allowed to cool by spreading it on a tray in an open aerated environment. The boiled meat samples were later smoked and oven dried; a part was smoked dried using fire wood, at 200 ^{0}C – 360 ^{0}C (using the oven thermometer to control the temperature) for 3 hours, and the other were oven dried at 200 ^{0}C for 3 hours. Fifty (50) pieces of Commercial smoked Kundi (CK) samples (which could not be ascertained if it was produced from camel or cattle meat) were bought from women in Aleshinloye and Bodija markets in Ibadan, Oyo State, Nigeria**.** They were subjected to chemical analyses and compared with Kundi produced from camel and beef in the laboratory, using firewood and oven as the heat source. The Kundi samples from camel meat and beef produced in the laboratory using firewood were referred to as Smoked Camel Kundi (SCK), and Smoked Beef Kundi (SBK) respectively while those produced by Oven-drying were referred to as Oven-dried Camel Kundi (OCK) and Oven-dried Beef Kundi (OBK).

Rehydratability: Rehydratability of 'Kundi' was measured by the modification of the method described by Kembi and Olorunkoya (1991). Water (5 times the weight of 'kundi' samples) was allowed to boil at 100 ^{o}C for 10 minutes after which the 'Kundi' was immersed and allow to boil for 10 minutes. The heat sources were removed after 10 minutes of boiling and the 'Kundi' samples were allowed to stay in the hot water for 10 more minutes. The 'Kundi' samples were finally removed, mopped dried and reweighed. Rehydratability is expressed in gramme water / 100 g sample which was estimated as follows:

$$\textbf{RH (\%)} = \frac{\textbf{100Hw – Dw}}{\textbf{Dw}}$$

Where:
Hw = hydrated weighted
Dw = dehydrated weight of smoked meat
RH = Rehydatability.

Product yield: The product yield of 'kundi' was measured using the method described by Kembi and Okubanjo (2002). It was expressed as the ratio of the final weight of the product ('Kundi') to the initial fresh meat samples.

Proximate Composition: The crude protein, moisture content, ether extract, and ash contents were determined according to AOAC. (2000).

Statistical analysis: The experiment design used was a completely randomized design. Data collected were subjected to analysis of variance (ANOVA) of SAS (1999) and treatment means were separated using Duncan's multiple range test of the same statistical package.

RESULTS AND DISCUSSION

The proximate composition of fresh beef and camel meat (g/100gDM) is as shown in table 1 below. Crude protein content of 21.96% for camel meat and 18.95% for beef contradicted and lower than the values (22.58% CP for camel meat and 19.57% CP for beef) earlier reported by Kassim (2006), but agreed with the findings of Deawood and Alkanhal (1995) who recorded 18.95 - 20.55% for camel meat. Warris (2010) revealed that muscle tissues consist of 20% protein, 75% water and large part of the remaining is fat together with very small amount of carbohydrate

(glycogen) with free amino acids, dipeptides and nucleotides. The meat used ought to have a good percentage of nutrients with protein content ranging from 18 - 22% to give a considerable protein intake when consuming the final products. The moisture content obtained was 76.01% for camel meat and 73.10% for beef which was higher than 55 - 70% moisture content reported by Wariss (2010), but agreed with the findings of Kassim (2006), who obtained 70.68 to 76.86% for different meat type (beef, camel, goat, port, chicken and rabbit) used for Kundi production. The amount of moisture content in the meat influences the water holding capacity and water activity of the meat.

Ether extract obtained was 2.12% for camel meat and 6.28% for beef. The higher ($p < 0.05$) value obtained for beef could result from variation in breeds and nutrition of the animal. Fat has higher influences on meat texture and palatability as it increases the juiciness and tenderness of the final products. Camel meat appears to be lean, the type of meat that is readily acceptable to consumers than fatty meat products. The lower the fat content of the fresh meat used, the faster the drying processes and the longer the shelf life. The values obtained are comparable to values (1.5 -13%) reported by Hedrick *et al*, (1994). The ash content supported the findings of Kassim (2006) who revealed 0.98% - 1.60% for different meat types used for Kundi production. There were no significant differences ($p > 0.05$) in the values obtained for ash in both animal meats used; this shows that the mineral content of camel meat and beef are almost the same. .

Table 1: Proximate composition of fresh beef and camel meat (g/100gDM)

	Treatments		
Parameters	**Camel meat**	**Beef**	**SEM**
Moisture	76.01[a]	73.19[b]	0.64
Ash	1.05	1.64	0.04
Ether extract	2.12[b]	6.28[a]	0.27
Crude protein	21.96[a]	18.95[b]	0.03

[ab]Means in the same row with different superscripts are significantly ($p < 0.05$) different.

The proximate composition, product yield and rehydratability of commercial kundi and smoked or oven-dried camel and beef kundi (g/100g dry matter) is as shown in table 2 below. The table revealed the nutrient content of Kundi produced by smoking and oven-drying and the commercial kundi (CK) bought from the market women. The parameters observed for CK, reveals higher significant nutrients than other samples, but lower percentage of moisture content. Egbunike and Okubanjo (1999) reported that dried meat products are meat low in moisture content and contain three to four times the raw protein equivalent; hence they are less bulky. The highest nutrient obtained agreed with the findings of Warris (2010), who reveals that most protein are denatured at relatively low temperature (<60 ^{0}C) and also on exposure to acid conditions. They are most susceptible to denaturation at their isoelectric points, the point at which the electric charges on their amino and carboxyl groups exactly cancel one another. Denaturation leads to the loss of solubility in aqueous solutions and the loss of enzyme, immunological or hormonal properties.

Because proteins constitute such a large of muscle, denaturation and changes in their solubility have a major effect on the structure and characteristic of meat,

affecting its appearance and ability to hold or bind water.

The oven-dried samples were of lower nutrient but higher moisture content than the smoke-dried samples. The smoke-dried samples revealed that the products were very dried than the oven dried products, which could be as a result of the composition in the firewood that was used. Wikipedia (2002) reported that smoke had a preservative effect, derived from a combination of drying and deposition of naturally produced chemicals resulting from the thermal breakdown of wood. Elizabeth (1995) revealed that more than 390 individual's chemical compounds have been found in smoke foods. Ikeme (1990) and Alonge (1984) reported that the deposition of smoke on a meat product is affected by the smoke density, the humidity, and air movement in smoke and the surface of the meat to be smoked. They also said smoking of meat occurs at different temperature depending on the type of meat and the heat source used. They then concluded that the best quality smoke is produced at a combustion temperature range of 300 ^{0}C - 400 ^{0}C. In this study, the samples were produced at temperature of 200 ^{0}C - 360 ^{0}C, but the commercial samples temperature can't be known, since it's produced from the north and transported to the western part of Nigeria. Such meat products may be dangerous for human consumption, when the temperature is more than 400 ^{0}C. Alonge (1984), revealed that the decomposition of lignin and production of phenols are greater at temperature above 400 ^{0}C, when firewood is used for smoking and such high temperatures could favour the production of benz(a)pyrene and other poly–cylic hydrocarbons which are known to be health hazardous. Market women selling Kundi products could be educated and exposed to products that are temperature monitored to produce hygienic food for their families and the consumers as a whole. Oven dried products might not have such smoked compound and as such could be introduced to the women selling Kundi, though the price will be higher but more hygienic and safer. If consumers know this, they will patronize the products, no matter the price.

Table 2: Proximate composition, product yield and rehydratability of commercial Kundi and smoked or oven-dried camel and beef Kundi (g/100gDM)

	Treatments					
Parameters	**CK**	**SCK**	**SBK**	**OCK**	**OBK**	**SEM**
Moisture	22.29^c	26.01^c	33.77^a	30.71^b	36.09^a	0.42
Ash	4.34^a	2.92^b	2.80 ^{b}	1.86^c	1.40^c	0.21
Ether extract	6.94^a	5.88^a	3.20^c	6.36^a	4.41^b	0.65
Crude protein	66.43^a	65.19^a	60.93^b	63.07^b	58.10^c	0.25
Product yield	ND	40.00	42.00	41.22	41.98	0.49
Rehydratability (g water/ 100g)	80.59^a	77.09^b	73.00^d	75.34^b	71.02^d	1.16

^{abc}Means in the same row with different superscripts are significantly (P<0.05) different.
CK = Commercial Kundi; SBK = Smoked Beef Kundi; SCK - Smoked Camel Kundi; OBK = Oven dried Camel Kundi; OCK = Oven dried Beef Kundi; ND = not determined.

The products' yields were not significantly ($p > 0.05$) different from each other, the yield are the same despite the processing and type of meat used. Rehydratability explained the percentage of moisture content or fluid absorb or uptake into the tissue of the Kundi samples. It appeared higher for smoke-dried products

than oven dried products, since the smoked products were more dried than the oven-dried Kundi due to the temperature used and the component from the smoke.

The market women in Aleshinloye and other big markets in Ibadan were fully involved in the sales of Kundi produced from carcass of different animals in the northern states of Nigeria like Borno, Kano and Kaduna State among others which were thereafter transported to different markets in south western part of the country like Oyo, Osun, Lagos and Ogun State. Encouraging the women to produced Kundi on their own will be of great advantage to their families and the community (consumers) as a whole.

CONCLUSIONS

- Kundi products produced from both traditional and improved methods had higher nutrient especially for protein content.
- The improved methods could be introduced to market women, as it could help in food safety, increase protein intake of their families and consumers; and also increase production and take home income.

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