CHEMICAL PROPERTIES OF ROASTED BEEF (*tsrie*) FROM FORE AND HIND LIMB PREPARED WITH DIFFERENT WOOD TYPES

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ABSTRACT
Analysis on the effect of different wood type on the nutritive quality of roasted beef (*tsire*) from fore and hind limbs was carried out. Raw beef from fore and limbs were collected from 2 years old White Fulani cattle and was roasted with mahogany (*khaya senegalensis*), shea butter (*Vitellaria paradoxa*) and locust bean (*Parkia biglobosa*) trees. Ninety sticks of *tsire* samples were prepared, thirty sticks of beef were roasted with each of the wood type as fifteen sticks were made from each part. A 2 x 3 factorial design was used for the study. The chemical composition of all the *tsire* samples from each part and wood type were carried out in the laboratory. The result of the study shows that the chemical composition comprising of the dry matter, moisture, crude protein, ash, ether extract and nitrogen free extract of *tsire* from the fore and hind limbs were altered by the mahogany, shea butter and locust bean trees significantly ($P < 0.05$). *Tsire* from the fore limb roasted with mahogany tree had the highest ($P < 0.05$) moisture with the lowest in hind limb roasted with the same mahogany while the dry matter ($P < 0.05$) was vice-versa in the former and in the later respectively. Crude protein (39.44%) was highest ($P < 0.05$) in the fore limb roasted with mahogany tree while it was lowest ($P < 0.05$) in the hind limb roasted with shea butter tree. Ash only shows the highest ($P < 0.05$) in the fore limb roasted with mahogany tree while the rest were low ($P < 0.05$). Also, the ether extract shows the highest ($P < 0.05$) in the *tsire* from the hind limb roasted with mahogany tree and the lowest in the hind limbs roasted with shea butter and locust bean tree while the nitrogen free extract was highest ($P < 0.05$) in the *tsire* from hind limb roasted with mahogany tree and the lowest ($P < 0.05$) in the *tsire* from the fore limb roasted with the same mahogany. Conclusively, wood type used for roasting beef should be carefully selected in other to retain a good *tsire* quality after preparation.
Key words: chemical, *tsire*, fore, hind, limb, mahogany, locust bean, shea butter, wood.

INTRODUCTION
Animal products have always been a mainstay of the Nigerians' diet (Dave and Ghaly, 2011). About 36 percent of the food energy and between 36 and 100 percent of each of the major nutrients in the food supply come from animal products (FAO, 2001).
Beef is one of the most commonly animal products eaten by humans with some parts such as the fore limb and the hind limb as the choice of more than average of buyers. Based on the fact that, it gets spoilt on time when it is neither processed nor preserved, there is need for effective, cheap and simple processing and preservative technique such as roasting (an intermediate moisture food processing method) into *tsire*. Meat preservation is very important in order to meet the animal protein requirement of the increasing world population.
Tsire, a traditionally prepared meat product, is a popular West African stick meat pieces that are staked on slender wooden sticks and cooked by roasting, using a glowing fire from wood (Omojola *et al*., 2004). It is traditionally prepared by the Hausa people of Northern Cameroon, Nigeria, Niger, and some parts of Sudan. However, it is better found in the south, just about anywhere in Nigeria. Many spices such as groundnut cake, salts, ginger and pepper are usually used as additives during preparation of *tsire* (Olaoye and Onilude, 2010). *Tsire* is also reported by Apata *et al.* (2013) to have 63.95 % dry matter and 39.61 % crude protein meanwhile, Abubakar *et al*. (2011), subjected four suya products *kilishi, tsire, dambu* and *Balangu* to proximate analysis in Bauchi state and reported that *tsire* has a fairly average dry matter of 92.3 % and a crude protein value of 49.8 %. It

has different nutritional composition due to several choice parts and the wood type used for its processing. That is, the processing methods and materials (firewood from locust bean, mahogany and shea butter tree) have an effect on the nutritive value since they are not of the same scent, smoke and chemical composition.

Therefore, the findings of this study will help to generate useful information on the chemical composition of *tsire* influenced by the part used such as fore and hind limb and firewood made from different wood type such as Mahogany, Locust bean and Shea butter tree since there is no literature yet on it.

MATERIALS AND METHODS

Study Location

The study was carried out at the Animal production laboratory of the Federal University of Technology, Minna latitude 9° 37' North and longitude 6° 33' East; 258.5 m above sea level, in the southern Guinea savanna zone of Nigeria. The climate of the area is sub-humid with a mean maximum temperature of 42°C particularly between March and June. The lowest minimum temperatures 38°C occurs between December and January when the influence of tropical continental air mass blows from the North (Global Positioning System).

Source of Materials

Two years old White Fulani bull was slaughtered at Bosso abattoir in Minna, Niger state, Nigeria and fresh samples of beef from the fore limb and the hind limb that was used for this research work were obtained from the bull. They were brought to the laboratory in sterile polyethylene bags for immediate use. The meat was conveyed using ice crystals to prevent possible deterioration due to microbial activity. The samples were then thoroughly washed in clean cool water. The spices (ginger (*Zingiber officinales)*, alligator pepper (*Afromomum melegueta*), black pepper (*Piper guineense*), red pepper (*Capsicum fructescens*) and other ingredients (groundnut cake powder (*Arachis hypogea*), salt (*Sodium chloride*) and seasoning (*Monosodium glutamate*) with the sticks were purchased from the Minna Central market while mahogany, shea butter and locust bean trees were gotten from Gidan Kwano village.

Experimental Design

The experimental design that was used for this study was 2 x 3 factorial design of completely randomized design (2 – part of beef: hind and fore limb; 3 – wood type: mahogany, shea butter and locust bean trees). The proximate composition of the *tsire* was analysed.

Preparation of *tsire* Ingredients

According to Igene and Ekanen (1985) and used by Apata *et al.* (2013), the ingredients were grinded individually and mixed in a specific proportion similar to that of the *tsire* processors in Minna Niger State.

Table 1. Proportion of *tsire* Ingredients

Ingredient	Proportion by weight (g)	Percentage proportion in mixture (%)
Groundnut cake powder	450	63.83
Ginger powder	60	8.51
Alligator pepper	10	1.42
Black pepper	10	1.42
Red pepper	60	8.51
Salt	70	9.93
Monosodium glutamate	45	6.38
Total	705	100.00

Source: Igene and Ekanem (1985).

Processing of *Tsire*

Ninety sticks of *tsire* were prepared in the roasting section of the Animal Production Laboratory of the Federal University of Technology, Minna using beef muscle from the hind and fore limb cut as described by Omojola (2008). Meat samples were sliced into thin sheets (strips) with the following dimensions, 1 cm thickness, 5 cm wide and 8 cm long and were inserted into the weighed *tsire* sticks. The ingredient was spread on a flat tray and each stick of meat was pressed on the ingredient to be properly soaked into the meat. The sticks of meat were labeled as T1A - fore limb roasted with mahogany tree, T1B - hind limb roasted with mahogany tree, T2A - fore limb roasted with shea butter tree, T2B - hind limb roasted with shea butter tree, T3A - fore limb roasted with locust bean tree and T3B - hind limb roasted with locust bean tree as 5ml of groundnut oil was sprinkled on each meat stick before roasting.

Roasting of *Tsire*

Labeled sticked meats were arranged round a glowing fire made from Mahogany, shear butter and locust bean tree. The sticked meats were allowed to stay on the fire for 40 minutes at a distance of 90cm from the centre of fire and intermittent turning of the product at 5 minutes interval. Additional groundnut oil was sprinkled on the meat while roasting continued (Omojola, 2008). All necessary hygienic precautions were observed.

Proximate Composition

According to the method described by AOAC (2000), proximate composition such as moisture, dry matter, fat, protein, ash and nitrogen free extract content of the freshly processed roasted meat (*tsire*) was determined.

Statistical Analysis

Data obtained from this study were statistically analyzed with ANOVA, while the means were separated using Duncan multiple Range test of the SPSS, version 16 software.

RESULTS AND DISCUSSION

The results of chemical composition of *tsire* from the fore and hind limb roasted with mahogany, shea butter and locust bean tree are presented in (Table 2). The effect of mahogany, shea butter and locust bean tree was significant ($p<0.05$) on the dry matter, crude protein, ash, ether extract and nitrogen free extract of *tsire* from both fore and hind limb. *Tsire* from the fore limb roasted with mahogany tree had the highest ($P < 0.05$) moisture (34.69%) with the lowest (31.35%) in hind limb roasted with the same mahogany while the dry matter ($P < 0.05$) was vice-versa with (65.30%) in the former and (68.65%) in the later respectively. Crude protein (39.44%) was highest ($P < 0.05$) in the fore limb roasted with mahogany tree while it was (37.13%) lowest ($P < 0.05$) in the hind limb roasted with shea butter tree. Ash only shows (8.00%) the highest ($P < 0.05$) in the fore limb roasted with mahogany tree while the rest were low ($P < 0.05$). Also, the ether extract shows (14.00%) the highest ($P < 0.05$) in the *tsire* from the hind limb roasted with mahogany tree and the lowest (12.80% and 13.00%) in the hind limbs roasted with shea butter and locust bean tree while the nitrogen free extract (5.20%) was highest ($P < 0.05$) in the *tsire* from hind limb roasted with mahogany tree and the lowest (2.38%) ($P < 0.05$) in the *tsire* from the fore limb roasted with the same mahogany. The crude fibre was not analysed because meat has negligible or no fibre. The moisture content was vice versa to the dry matter content. Aduku and Olukosi (2000); Apata *et al*. (2010) reported that when the moisture of meat product lower the dry matter of the meat product will be raised as observed in this study. This result confirmed the fact that the cause of variation in the findings of Apata *et al*. (2013) and Abubakar *et al.* (2011) might be affected by the wood used for the roasting. The high ash value of *tsire* from the fore limb roasted with mahogany tree was due to the high crude protein value as reported by Apata *et al*. (2013). The high nitrogen free extract of the meat *tsire* was also as a result of high level of the nutrient in some of the constituents of the ingredient such as groundnut cake used in preparing the *tsire*. Similar result was reported by Omojola (2008).

Table 2: Chemical compostion of Roasted beef (*tsrie*) from Fore and Hind limb prepared with different wood types

Parameter	Mahogany		Shea butter		Locust bean		SEM
	Fore	Hind	Fore	Hind	Fore	Hind	
Moisture	34.69^{a}	31.35^{e}	32.00^{d}	34.34^{b}	32.01^{d}	32.01^{c}	0.31
Dry Matter	65.30^{e}	68.65^{a}	68.00^{b}	65.66^{d}	67.99^{b}	67.33^{c}	0.31
Crude Protein	39.44^{a}	38.740^{b}	37.38^{c}	37.13^{c}	38.45^{b}	38.61^{b}	0.20
Ash	8.00^{a}	7.00^{b}	7.50^{ab}	7.00^{b}	7.34^{b}	7.34^{b}	0.11
Ether Extract	13.50^{b}	14.00^{a}	13.60^{b}	12.80^{c}	13.70^{a}^{b}	13.00^{c}	0.10
Nitrogen Free Extract	2.38^{e}	5.20^{a}	3.92^{cd}	4.46^{b}	3.59^{d}	4.25^{bc}	0.21

*All values are means of quintet determinations. abcde= mean with different superscripts on the same row are significantly different (P<0.05), SEM= Standard error of mean.

CONCLUSION

Different wood types used for roasting had effect on the chemical composition of *tsire*. Therefore, to improve *tsire* quality knowledge on the proper selection of wood type for roasting should be put into consideration.

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