

## Effect of time and temperature on the proximate and sensory parameter of roasted beef (suya).

### Efecto del tiempo y la temperatura sobre el parámetro sensorial y próximo del rosbif (suya).

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#### ABSTRACT

In this study, different time and temperature effect were examined on the proximate and sensory parameter of roasted beef (suya). The proximate composition, and sensory evaluation (appearance, tenderness, juiciness, flavour and overall acceptability) of the meat roasted using different time and temperature were assessed. Two kilograms of beef-round from a freshly slaughtered cow was used for the study. The meat was trimmed, cut into small pieces weighing 250g was cured manually with experimental ingredients before roasting with Century Electric Oven at different time that is 40, 50, 60 and 70 minutes at temperature of 250, 230, 210 and 190°C respectively, with groundnut oil sprinkled intermittently.

Key Words: Time, Temperature, Effect, Proximate, Sensory, Parameter, Roasted Beef (suya).

#### RESUMEN

En este estudio, se examinaron diferentes efectos de tiempo y temperatura sobre el parámetro sensorial y proximal de la carne asada (suya). Se evaluó la composición próxima y la evaluación sensorial (apariencia, ternura, jugosidad, sabor y aceptabilidad general) de la carne asada usando diferentes tiempos y temperaturas. Para el estudio se utilizaron dos kilogramos de carne de res de una vaca recién sacrificada. Se recortó la carne, se cortó en trozos pequeños de 250g de peso se curó manualmente con ingredientes experimentales antes de asar con el Horno Eléctrico Century a diferentes tiempos que son 40, 50, 60 y 70 minutos a temperatura de 250, 230, 210 y 190°C respectivamente, con maní aceite rociado intermitentemente.

Palabras clave: tiempo, temperatura, efecto, próximo, sensorial, parámetro, carne asada (suya).

## INTRODUCTION

Meat has been defined as the flesh of animals which is suitable as food. Meat makes a valuable contribution to diets because of its high biological value and an excellent source of amino acids, vitamins and minerals (CAST, 1997). A daily intake of 100g of meat can supply up to 50% of the recommended daily allowance for Iron, Zinc, Selenium, Vitamins B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub> and 100% of vitamin A (Biesalski and Nohr, 2009). Meat plays an important role in human diet by contributing both macro and micro nutrients that are required for growth and good health maintenance. The rate of increase in per capita consumption of meat was found to be very high in developed countries when compared with developing nations. (Anjaneyulu Thomas and Kondaiah, 2007). In Nigeria, there is a preferential consumption of different types of meat by communities due to a combination of factors bordering on religious belief, culture, food habits, sex of animal, age at slaughter, socio-economic factors and individual variation (Ajiboye, Alhassan, Adedayo, Majekodunmi, Kolawole, Olatunji and Oladosu, 2011).

Meat being nutritious with high moisture content and nearly neutral pH is a good culture medium for many micro-organisms (bacteria, yeasts and moulds) and as such, classified among perishable foods whose contamination with spoilage organisms are almost unavoidable (Anna *et al.*, 2005). This makes meat preservation more difficult than other types of food as it may result in oxidative rancidity, discolouration, off flavor and sliminess. The kind and amount of spoilage organisms in meat depends upon the availability of nutrients, presence of oxygen, temperature, pH at storage and generation interval of the spoilage microorganism under given environment. (Forrest, Aberle, Gerrard, Mills, Hedrick, Judge and Merkel, 2001).

Suya (Hausa language for roasted meat) is a popular spicy, smoked, or roasted meat which is a popular food item in West Africa (Eke, Ariahu and Okonkwo, 2012). It is traditionally prepared by the Hausa people of Northern Cameroon, Nigeria, Niger, and some parts of Sudan (where it is called agashe) (Egbebi and Seidu, 2011; Eke *et al.*, 2012). In Nigeria and other countries surrounding Northern Nigeria like Chad, Sudan, and Niger, suya is street meat (Inyang *et al.*, 2005). Generally, suya is excellent in supplying high quality protein, vitamins, and minerals and salts such as iron and zinc (Kramiliah, Pearson, and Tauber, 1973).

Suya is generally made with skewered beef, ram, or chicken. Innards such as kidney, liver, and tripe are also used (Eke *et al.*, 2012). The thinly sliced meat is marinated in various spices which include peanut cake, salt, vegetable oil, and other flavorings, and then barbecued

(Egbebi and Seidu, 2011; Eke *et al.*, 2012). Suya is served with further helpings of dried pepper mixed with spices and sliced onions. Halal meat preparation methods are normally used, especially in the northern parts of Nigeria (Egbebi and Seidu, 2011), where the suspicion of nonconformity to Muslim dietary prohibitions in suya preparation has been known to cause riots. There is no standard recipe for the production of the complex mixture of spices and additives which make up the suya marinade (called Yaji) and the spice mix served with it (Akpamu, Nwaopara, Izunya, Oaikhen, Okhiai, Idonije and Osifo, 2011). Ingredients may vary according to personal and regional preferences (Egbebi and Seidu, 2011), and may include clove, ginger, red pepper, black pepper, table salt, and groundnut cake, as well as food additives such as monosodium glutamate (Akpamu *et al.*, 2011).

Foods such as meat come edible and more digestible when they are subjected to cooking. However, heat treatment can lead to undesirable modifications, such as the loss of the nutritional value of foods due mainly to lipid oxidation, and changes in some components of the protein fraction. The aim of this study is therefore to examine the effect of roasting time and temperature on the proximate and sensory evaluation of beef (suya).

## MATERIALS AND METHODS

*Experimental site:* The experiment was conducted at the Meat Science Unit of Ambrose Alli University, Ekpoma, Edo State, Nigeria. Ekpoma is within the south-geo political zone of Nigeria, experiencing tropical climate with mean annual rainfall of about 1556mm.

*Experimental Materials:* The materials that were used for the experiment includes meat (beef), groundnut oil, spices; curry, red pepper, monosodium glutamate (maggi), sodium chloride (common salt), oven, knives, trays, hand towels, serviette, foil and serving plates.

*Experimental Design:* Two kilogram of beef-round from a freshly slaughtered cow was purchased from Irrua market. After excising muscle from carcass, meat was trimmed off all extra muscular fat and washed thoroughly with water. The meat (beef) was cut, sliced into pieces weighing 250 was cured manually with the experimental ingredients before roasting with Century Electric Oven at different time and temperature with groundnut oil been sprinkled intermittently.

## RESULTS

*Time and temperature effect on proximate composition of roasted beef (suya):* Table 1 shows the proximate composition of roasted beef (suya) at different time and temperature. Percentage Dry Matter content was significantly highest ( $P < 0.05$ ) in beef roasted for 70

minutes at 190°C (T<sub>4</sub>) and beef roasted for 50 minutes at 230°C (T<sub>2</sub>) having 74.88 and 73.88 values each while beef roasted for 40 minutes at 250°C (T<sub>1</sub>) and beef roasted for 60 minutes at 210°C (T<sub>3</sub>) having 72.8 values each were not significantly (P > 0.05) different. Crude ash content was significantly (P < 0.05) highest in treatment 1 (8.20%) and 4 (8.10) followed by 2 (7.91%) which had statistical (P > 0.05) similar value with T<sub>4</sub> while the least was recorded in treatment 3 (7.28%). Ether extract was highest in treatment 3 (12.22) while values 10.74, 10.53 and 10.89% for treatment 1, 2 and 4 respectively were not significantly (P > 0.05) different. The result for crude fibre followed the same pattern as observed in ether extract. Values of 5.06, 5.13, 6.22 and 5.11 for treatment 1, 2, 3 and 4 respectively was highest in treatment 3. However, crude protein ranged between 20.57 – 23.32% with treatment 4 having the highest significant (P < 0.05) value of 23.32%.

Table 1. Effect of Temperature and Time on Proximate Composition of Suya Meat

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	SEM ±
Dry Matter	72.88 <sup>b</sup>	73.88 <sup>ab</sup>	72.88 <sup>b</sup>	74.88 <sup>a</sup>	0.43
Crude Ash	8.20 <sup>a</sup>	7.91 <sup>a</sup>	7.28 <sup>c</sup>	8.10 <sup>ab</sup>	0.08
Ether Extract	10.74 <sup>b</sup>	10.53 <sup>b</sup>	12.22 <sup>a</sup>	10.89 <sup>b</sup>	0.16
Crude Fibre	5.06 <sup>b</sup>	5.13 <sup>b</sup>	6.22 <sup>a</sup>	5.11 <sup>b</sup>	0.13
Crude Protein	21.38 <sup>c</sup>	20.57 <sup>d</sup>	22.37 <sup>b</sup>	23.32 <sup>a</sup>	0.06
NFE	54.62 <sup>b</sup>	55.86 <sup>a</sup>	51.91 <sup>d</sup>	52.58 <sup>c</sup>	0.20
Moisture	27.13 <sup>a</sup>	26.13 <sup>b</sup>	27.13 <sup>a</sup>	25.13 <sup>b</sup>	0.43

Means in the same row with different superscripts (a,b,c & d) are significantly different (P < 0.05). SEM = Standard error mean

*Time and temperature effect on sensory evaluation of roasted beef (suya):* The sensory parameters of appearance, tenderness, juiciness, flavour and general acceptability for roasted beef at different time and temperature is shown in Table 2. Mean values obtained for appearance showed that beef roasted for 70 minutes at 190°C (T<sub>4</sub>) and 60 minutes at 210°C (T<sub>3</sub>) had the highest significant (P < 0.05) value 8.17 and 7.17 respectively followed by beef roasted for 50 minutes at 230°C (T<sub>2</sub>) and 40 minutes at 250°C (T<sub>1</sub>) which were statistically (P > 0.05) similar. Values obtained for tenderness revealed highest significant (P < 0.05) mean 7.69, 7.42 and 7.17 for treatment 4, 3 and 2 respectively followed by treatment 1 (6.25) which is statistically (P > 0.05) similar with treatment 2 and 3. Juiciness follows the same trend as observed in tenderness with the highest significant mean 7.83, 7.25 and 6.75 recorded in treatment 4, 3 and 2 respectively while treatment 1 (6.25) was not significantly

( $P > 0.05$ ) different from treatment 2 and 3. Flavour of roasted beef shows no significant ( $P > 0.05$ ) difference across treatments. However, highest value (7.42) was recorded in treatment 2 followed by 7.33, 7.33 and 6.85 for treatment 4, 3 and 1 respectively.

Table 2: Effect of Time and Temperature Effect on Sensory Evaluation of Suya Meat

Sensory parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	SEM±
Appearance	6.50 <sup>b</sup>	6.92 <sup>b</sup>	7.17 <sup>ab</sup>	8.17 <sup>a</sup>	0.38
Tenderness	6.25 <sup>b</sup>	7.17 <sup>ab</sup>	7.42 <sup>ab</sup>	7.67 <sup>a</sup>	0.43
Juiciness	6.25 <sup>b</sup>	6.75 <sup>ab</sup>	7.25 <sup>ab</sup>	7.83 <sup>a</sup>	0.45
Flavour	6.83 <sup>a</sup>	7.42 <sup>a</sup>	7.33 <sup>a</sup>	7.33 <sup>a</sup>	0.35
General acceptability	6.75 <sup>b</sup>	7.42 <sup>ab</sup>	7.75 <sup>a</sup>	8.25 <sup>a</sup>	0.33

Means in the same row with different superscripts (a,b,c & d) are significantly different ( $P < 0.05$ ). SEM = Standard error mean

## DISCUSSION

*Proximate composition of roasted beef:* Dry matter of roasted beef (suya) was higher in treatment 4. This could be as a result of the higher timing and at the right temperature which the meat stayed in the oven. Higher crude ash content was observed in T<sub>1</sub> (8.20) and T<sub>4</sub> (8.11) while the least was observed in T<sub>2</sub> (7.91) and T<sub>3</sub> (7.28). The difference observed in crude ash of suya from these treatments could be due to the effect of nutrient concentration due to moisture loss. Values of ether extract obtained in this study ranging between 10.53 – 12.22% are slightly higher than 8.40 – 9.50% reported by Apata *et al.* (2012). The higher values observed in this study could be as a result of excess application of groundnut oil.

*Sensory evaluation of roasted beef:* Tenderness ratings were highest in suya produced from Treatment 4, 3 and 2 having values of 7.67, 7.42 and 7.17 respectively on a 5 point hedonic scale, tenderness ratings were comparable to 5.97 on a 9 point hedonic scale reported by Apata *et al.*, (2012). Omojola (2008) reported that “tenderness is considered as the most important trait in meat quality. It has also been identified as the most critical eating quality that determines whether consumers are repeat buyers. However it is worthy of note that as a result of the heat treatment and the use of spices which have tenderizing effect, the degree of tenderness is affected when compared to fresh meat. The significant values 7.83, 7.25 and 6.75% for juiciness were recorded in Treatment 4, 3 and 2 respectively though highest value was recorded in T<sub>4</sub> which had the highest water holding capacity. The observed relationship

agrees with the statement by Omojola *et al.* (2003) who reported that juiciness is made up of two effects; the impression of moisture released during chewing and the salivation produced by flavour factor.

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