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Sensory and Physicochemical Evaluation of *Suya* Produced From Various Round Muscles

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Target Audience: Animal Scientist, Meat Scientist, Extension Officers and Meat Processors

Abstract

A study was conducted to evaluate Suya produced from various round muscles (Rectus femoris, Semi-tendinosus, Biceps-femoris, Semi membranosusand Vastus lateralis) for organoleptic and physiochemical properties. The study was carried out using a completely randomized design. The result from the experiment showed that the fat content was not significantly (P>0.05) affected by the muscle types. The score for overall acceptability on a five point hedonic scale indicated that the consumers preferred Bicepsfemoris which was significantly (P<0.05) different from other round muscles. Water holding capacity was observed to have influence on other qualities such as flavor, juiciness and tenderness. Product yield was lowest (70.20 %) in Vastuslateralis, indicating a good yield from all muscles. It was concluded that the prime cuts, apart from resulting in Suya with high prices are not necessarily better than Suya from less choice parts of the carcass (Rectus femoris, Semi-tendinosus, Biceps-femoris, Semi membranosus and Vastus lateralis) in terms of product yield and eating qualities.

Key Words: *Suya*, Beef, Organoleptic, Proximate

Description of Problem

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 (1). A daily intake of 100 g of meat can supply up to 50% of the recommended daily allowance for Iron, Zinc, Selenium, Vitamins B_1, B_2, B_6, B_{12} and 100% of vitamin A (2).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 (3).

Suya is a spicy barbecued, smoked or roasted meat product. *It is* an Intermediate Moisture Meat (IMM)

product that is easy to prepare and highly relished (4). It originated from the Hausa people of northern Nigeria, where rearing of cattle is an important occupation and a major source of livelihood for the people with the preparation process carried out under largely unhygienic conditions with high risk of contamination (5).

Traditionally, most *Suya* producers use expensive cuts of meat (examples is the Longissimus dorsi muscle) resulting in higher prices of the products beyond the reach of the common man. The prime cuts

apart from resulting in product with high prices might not be better than cuts from less choice parts of the carcass in terms of product yield and eating qualities. Hence, the need to convert low priced meat cuts into relished processed products by meat processors. This paper therefore reports the result of a study which evaluated the organoleptic and physico-chemical properties of beef *Suya* prepared from different round muscles

Materials and Methods

The study was conducted at the Animal Product Laboratory, Department of Animal Science, Ahmadu Bello University, Zaria. Zaria is located within the Northern Guinea Savannah Zone of Nigeria on latitude 11° 9'45" N and Longitude 7°38'8"E, at altitude of 610m above sea level (0vimaps, 2012).

Sample Preparation for Suya

The muscles for this study were excised from the carcass of a three (3) years old White Fulani bull weighing 350 kg. The slaughtered animal was conventionally skinned and cut into wholesale cuts while the muscles needed were carefully removed. The round muscles used for this study were; *Rectus femoris, Semitendinosus, Biceps femoris, Semimembranosus* and *Vastus lateralis,* also referred to as *Jigiya, FarinMakari, Katara, Bishi* and *Tuwonkundu* in Hausa language respectively. The muscles were trimmed of all visible bones and connective tissues. Muscles were sliced into thin sheets of 0.15-0.30 mm thickness and 5-9 cm length. The spices used were purchased individually from specialized spice market in Sabon Gari, Zaria. The spices/additives used on the *Suya*include; Curry (5g), Red pepper (169g), Maggi seasoning (92g), Onga spice (30), salt (160g) and Groundnut oil.

Preparation of Suya

The thin sheets of beef from various muscles were inserted into thin sticks about 30 cm long. A total of 40 sticks of *beef samples weighing 33.67- 43.16g* were prepared from each muscle type. Sticks of *Suya* made from each muscle type (treatment), were labeled for easy identification. The average weight of ingredient per stick meat was measured after proper coating with the ingredient. Five to ten mills of groundnut oil was sprinkled on each *Suya* sample prior to roasting.

The labeled *Suya* samples were arranged around a glowing, smokeless fire. The distance of the stick meat from the fire point was 21.96 - 23.3 cm. *Suya* samples were allowed to stay by the fire for 20 minutes with intermittent turning of the samples. Additional groundnut oil was sprinkled on the meat while roasting continued. The weight of each *Suya*was recorded before and after roasting and used in calculating the percentage loss

and the product yield. Samples for the determination of the physical and chemical properties of *Suya* were taken to the Animal Products Laboratory (in A.B.U.) for analysis.

Sensory Evaluation

Suya samples were each cut into bites sample sizes and served in plates to a twenty member semi-trained panelists. The organoleptic parameters that were evaluated include appearance, taste, odour, texture and provision for a score on overall acceptability. A 5 point hedonic scale was used with a score of 5 indicating 'extremely acceptable', 4 'very acceptable', 3 'acceptable', 2 'fairly acceptable', 1 'not acceptable'. A score below 2 was considered not acceptable. The meat products were coded with numbers of 2 digits indicating no information about the samples to avoid bias in preferred treatments. The panelists received each sample separately, rinsing their mouth in-between samples.

Determination of Physical Composition of Suya samples

Percentage cooking loss was determined by evaluating the differences in weight of initial sample from cooked divided by the weight before cooking multiplied by 100.

$$\% \text{ cooking loss} = \frac{\text{initial sample wt.} - \text{cooked sample wt}}{\text{initial sample wt}} \times 100$$

Percentage moisture content was determined by the air oven method using 10 grams of meat samples at 80°C to a constant weight. The difference in weight before and after cooking divided by weight before roasting multiplied by 100 was recorded (AOAC, 1990).

$$MC(\%) = \frac{WFS - WCS}{WFS} \times 100$$

Where:

MC = Moisture Content (%)

WCS = Weight of Cooked Sample

WFS = Weight of Fresh Sample

Determination of Thermal shortening was carried out according to the procedure described by (1). Cores taken from beef round and length measured prior to broiling in a fire stand for 10 *min. After broiling, the beef cut* was allowed to cool to room temperature and the length measured again with the difference in length expressed as percentage thermal shortening.

Thermal shortening (%) = (initial length – final length) × 100

Percentage water holding capacity was determined following a slightly modified method of Suzuki *et al*., (7). Intact samples (10 x 10 x 5 mm) were weighed individually from the 5 muscle types on two filter papers and pressed for a minute using a 10 kg weight. The amount of water released from the sample was measured indirectly by measuring the area of the filter paper wetted relative to the area of pressed sample. The water holding capacity (WHC) of the meat was calculated using the formulae developed by (7)

$$WHC = \frac{100 - (Aw - Am) \times 9.47}{Wm \times Mo} \times 100$$

Where:

Aw = Area of water released from meat (cm^2)

Am = Area of meat sample (cm^2)

Wm = Weight of meat in mg

Mo = Moisture content of meat %, 9.47 is a constant factor.

The pH of fresh beef and *Suya* were determined according to the method described by (8) and sited by (9). pH was measured in an aqueous extract from 1g of the *Suya* samples homogenized in 10 ml distill water. The pH was measured using a Checker pH meter.

Proximate composition of Suya

Proximate analyses were carried out using (10) methods which include protein determination using Kjeldahl, fat extraction via Soxhlet, crude fiber determination using digestion with sulphuric acid, moisture determination by drying the sample for 16-18 hours at 100-102°C in an oven and mineral, by ashing the sample at 550°C for 9 hours in a furnace oven at the Animal Science Departmental Laboratory of Ahmadu Bello University, Zaria.

Statistical Analysis

All data obtained were subjected to analysis of variance (ANOVA), and significant means separated using the Duncan's Multiple Range (DMR) test. The SAS computer package was used for all statistical analysis (11).

Results and Discussion

Proximate composition of *Suya* from various round muscles i.e. *Rectus femoris*, *Semi-tendinosus*, *Biceps femoris*, *Semi Membranosus* and *Vastus lateralis* are shown in Table 1. The highest percentage crude protein was recorded in *Suya* produced from *Biceps femoris* having a value of 45.31 %. Crude Protein values of *Suya* products were within the range of 40 – 45 %. Protein found in *Suya* products were incomparable (69.8 %) with those reported (12) for protein content of meat cooked to three internal temperatures at 65°C, 75°C and 85°C, respectively. Protein contents of beef *Suya* samples in this study were equally observed to be greater than its fresh protein equivalent of 21.96 % for camel and 18.95% for fresh beef, the differences observed agrees with (13) who reported that Intermediate Moisture Meat are meat lower in moisture content which have higher protein than raw protein equivalent and are less bulky. The difference in protein content observed between *Suya* from different muscles may be attributed to the type and activity of the muscle, the function and type of tissue fiber that makes up the muscle. The higher value observed in the protein content reported by other authors may be due to the groundnut cake added as ingredient which is high in protein. Fat extraction showed *Suya* produced from *Vastus lateralis* had the highest value of 7.98 %, while the least was observed in *Suya* from *Semi-tendinosus* having 5.89 %. Difference observed in fat content of *Suya* from muscles may be due to the effect of nutrient concentration due to moisture loss or fat deposition in different tissues. Values obtained for Ether extract in this study (7.97-5.89 %) are slightly lower than 8.40 - 9.50 % reported by (14). The higher values observed from other studies may be due to the application of excess groundnut oil to the *Suya* sample to reduce mold infections. Values obtained for percentage ash content was highest in *Suya* produced from *Semi-tendinosus* (5.53 %), followed by *Vastus lateralis* (4.77 %), *Semi- membranosus* (4.48 %) *Biceps femoris* (4.04 %) and *Rectus*

femoris (3.38 %). Nitrogen Free Extract (NFE) values is observed to be high when compared to other reports. The values for percentage proximate composition of meat product (*Suya*) from different round muscles appeared

Table 1: Proximate and mineral composition of *Suya* muscles

*Suya*Samples	%D.M	%C.P	%Ether Extract	%Ash	%NFE
Rectus femoris	39.58	39.06	6.87	3.38	43.9
Semi-tendinosus	50.15	44.50	7.65	5.53	37.03
Biceps Femoris	60.21	45.31	7.39	4.04	38.63
Semi Membranosus	41.91	44.50	8.03	4.48	38.43
Vastus lateralis	43.61	38.37	8.23	4.77	43.44

The mean sensory score of colour, juiciness, taste, smoky flavour, texture and overall acceptability for *Suya* produced from various musclesis shown in Table 2. Mean values obtained for colourshowed that *Suya*f rom *Biceps femoris*had the highest mean of 4.21 which was statistically ($P > 0.05$) thesame with *Suya* produced from *Rectus femoris* (3.53).The least value was recorded in *Suya* from *Semimembranosus* (2.47). The muscle types used for *Suya* affected the Juiciness ratings as shown in Table 2. The highest score was recorded in *Suya* produced from *Vastus lateralis* which incidentally had the highest water holding capacity. The observed relationship agrees with the statement by (15) who reported that Juiciness is made up of two effects; the impression of moisture released during chewing and also the salivation produced by flavour factor.Meat juices play an important role in conveying the overall impression of palatability to the consumer. They contain many of the important flavour components and assist in the process of fragmenting and softening the meat during chewing (16). Mean tenderness ratings hadhighest values in *Suya* from *Semi-membranosus* and *Rectus femoris*(3.91 and 3.54, respectively), which are statistically similar to values obtained from *Vastus lateralis* and *Biceps femoris* (2.90and 3.00 respectively) on a 5 point hedonic scale. Tenderness ratings were comparable to 5.97 on a 9 point hedonic scale reported by (14).Variations observed among muscles may be due to the amount of connective tissue in the various cuts and amount of connective tissue present is due to the function of the muscle. Cross *et al*., (17) as sited by (18) who 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.Most citizens of developing countries like Nigeria prefer less tender meat or meat product probably for longer chew ability(19) as sited by (12). The results for smoky flavour and

saltiness were statistically the same. The result obtained for the OverallAcceptability indicate that the consumers havepreference for *Suya*from muscle 3 (*Bicepsfemoris*) which significantly ($P<0.05$) differed in value from *Suya*obtained from other round muscles. It was reported (20) that

Table 2: Organoleptic properties of *Suya* samples

Samples	Colour	Juiciness	Texture	Smoky flavor	Saltiness	Overall acceptability
Rectus femoris	3.53^{a}	3.47^{a}	3.54^{a}	3.16	2.42	3.95^{ab}
Semi-tendinosus	2.74^{ab}	2.84^{ab}	2.90^{b}	3.00	2.32	3.42^{b}
Biceps Femoris	4.21^{a}	3.37^{ab}	3.00^{ab}	3.26	2.42	4.26^{a}
Semi Membranosus	2.47^{b}	2.63^{b}	3.91^{a}	3.00	2.21	3.95^{ab}
Vastus lateralis	3.32^{ab}	3.58^{a}	2.95^{ab}	2.84	2.16	3.90^{ab}
SEM	0.27	0.23	0.70	0.17	0.57	0.20

[abc] Means in the same row with different superscripts are significantly different ($P<0.05$ *Rated on a five -point hedonic scale. Higher value indicates higher preference.

Table3 shows the Physical changes in the final beef product (*Suya*). Values for meat to ingredient ratio for *Suya* samples were; 18:1, 14:1, 14:1, 13:1 and 13:1, across samples. Incidentally, weight of ingredient uptake was lowest (1.98 g) in *Suya* from *Vastus lateralis* which had the highest water holding capacity, this trend was also recorded in report by **(18)**. The amount of water loss when high in muscle, translates to a higher weep and a greater medium for the uptake of more ingredients. *Suya* produced from *Vastus lateralis* muscle had the lowest ingredient absorption. *Vastus lateralis* recorded the highest percentage weight loss after roasting (41.66). Percentage weight loss for beef *Suya* produced from *Rectus femoris, Biceps femoris, Semi-tendinosus*and *Semi membranosus* had values of 33.98 %, 20.27 %, 18.1 % and 15.98 %, respectively. pH values ranged between 5.70 to 6.50 across samples. The pH values for fresh beef were below the maximum accepted limit of 6.0 suggested by (21) and sited by (22) for fresh meat, suggesting that the products were produced from well-nourished and rested stock. Percentage water content ranged from 18.09 to 25.05 %, water holding capacity refers to the ability of meat to retain its water during application of external forces (23). Water holding capacity was highest in *Suya* from *Vastus lateralis* (25.05 %). It is important in meat processing as it influences the overall eating quality. Water holding capacity in this experiment was observed to have a direct relationship with other parameters such as the flavour, juiciness and tenderness which agrees with the report by (18). The values of the water holding capacity (i.e. 18 – 25 %) in this study are slightly lower than values reported by (14), having water holding capacity of 21 – 35 % for *Suya* samples. The slight difference observed in *Suya* from the muscle types may be due to the activity

of the muscles. *Suya* products with lower moisture content of about 30%-40% and a_w of 0.85 allow only the growth of fungi microbes(24). *Suya* from *Vastusl ateralis* had the highest fat content (8.23 %) and the highest water holding capacity (25.05 %) suggesting that leaner meat contain more protein and less fat, since water is a component of protein (but not fat).Percentage product yield values are 84.02 %, 82.81 %, 79 %, 74.63 % and 70.59 % (i.e. *Suya* produced from *Semi membranosus, Semi-tendinosus, Biceps femoris, Rectus femoris* and *Vastus lateralis*, respectively). The product yield was lowest in *Suya* from *Vastus lateralis* (70 %), indicating a good yield from all muscles. The structural changes

Table 3 : Shows the physical changes in the final product (*Suya*) produced from various muscles

Parameters	*Rectus femoris*	*Semi-tendinosus*	*Biceps femoris*	*Semi membranosus*	*Vastus lateralis*
Weight of stick (g)	5.00	5.00	5.20	5.30	5.00
Weight of meat (g)	58.70	72.01	58.59	57.70	35.98
Weight of ingredient (g)	4.39	4.99	4.13	4.20	1.98
Weight of *Suya* before roasting (g)	63.09	77.00	62.72	61.9	34.00
Meat: ingredient ratio	13.4:1	14.2:1	14.2:1	13.7:1	18:1
Weight after roasting (g)	47.09	63.76	50.01	52.01	24.00
Percentage weight loss	33.98	18.10	20.27	15.98	41.66
pH	5.70	6.50	6.20	5.80	6.00
Water Holding Capacity (%)	22.04	18.98	18.09	24.35	25.05
Product yield (%)	74.63	82.81	79.00	84.02	70.59

5-10 ml of groundnut oil was added to each stick of meat during roasting

Conclusion and Application

The prime cuts, apart from resulting in *Suya* with high prices are not necessarily better than cuts from less choice parts of the carcass (*Semi membranosus, Semi-tendinosus, Biceps femoris, Rectus femoris*and *Vastus lateralis*)in terms of product yield and eating qualities.

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