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Full Length Research Paper

Yield and organoleptic characteristics of *Suya* (an intermediate moisture meat) prepared from three different muscles of a matured bull

Omojola, A. B.

Meat science Laboratory, Department of Animal Science, University of Ibadan, Ibadan, Nigeria.
E-mail: omojolababs@yahoo.com.

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High cost of choice meat used in *suya* production makes the product an exclusive meat for the rich. In order to make *suya* (an intermediate moisture meat) available and affordable to the common man thereby increasing their animal protein intake, this experiment therefore become imperative. Meat from the semimembranosus (SM), biceps femoris (BF) and psoas major (PM) muscles were used for the study. The muscles were carefully excised and trimmed of all visible connective tissue. The meat was sliced into thin sheet of 0.15 – 0.30 cm thick and between 5 – 9 cm long. The experiment comprised of three treatments in a completely randomized design. A total of 30 sticks of *suya* were prepared from each muscle-type. The percent cooking loss was highest (P < 0.05) in the PM (23.91 ± 0.38) as against the values of 20.70 ± 0.36 and 18.52 ± 0.38 obtained for SM and BF respectively. The water holding capacity (WHC) was highest in the SM followed by BF and PM with values of 79.99 ± 2.05, 71.11 ± 8.30 and 68.17 ± 1.72% respectively. BF gave the highest (P < 0.05) product yield (87.72 ± 2.51) while SM and PM gave values that were statistically similar (P > 0.05). SM gave the highest (P < 0.05) values for tenderness, juiciness and overall acceptability. *Suya* can be produced from other muscles than the traditional SM muscle without compromising quality.

Key words: Suya, organoleptic, muscle, product yield, bull.

INTRODUCTION

Meat and meat products are high in nutritive value and because of the high nutritive value, dressed carcass or fresh meat can only remain fresh for a short time before spoilage sets in, and to prevent this, meat are processed into products. All avenues of meat preservation must be exploited to meet the animal protein requirement of the increasing world population. The need for effective, cheap and simple preservative techniques cannot be over emphasized. One of such simple preservative technique is intermediate moisture food processing. Obanu et al. (1981) observed that intermediate moisture meat (IMM) are shelf stable under the tropical climate without refrigeration and may be eaten directly with or without rehydration.

Suya is one of such intermediate moiture product that is easy to prepare and highly relished (Omojola et al., 2004). There are three types of suya namely, tsire, kilishi and balangu. Of the three types, tsire, which is boneless meat pieces that are staked on slender wooden sticks and cooked by roasting, using a glowing fire from char-coal is the most popular with consumers in Nigeria (Igene and Mohammed, 1983).

Meat processing enables the processor to convert low priced meat cuts into high priced processed products (FAO, 1995). Traditionally, most tsire suya producers use expensive cuts of meat, resulting into high prices of the products beyond the reach of the common man in the street. The prime cuts, apart from resulting in products with high prices might not be better than cuts from less choice parts of the carcass in terms of product yield and eating qualities. It is therefore the objective of this study to prepare tsire suya from 3 different muscle types (beef) with a view to assessing their suitability for suya production as regard the product yield and their eating/organoleptic characteristics.

MATERIALS AND METHODS

Meat preparation

The meat used for this study were the semimembranosus (SM), bicep femoris (BF) and the psoas major (PS) muscle obtained from a four year old White Fulani bull weighing 350 kg as at the time of slaughter. The slaughtered animal was conventionally skinned and cut into wholesale cuts while the muscles needed were carefully excised. The meat was trimmed of all visible bones and connective tissues. Thereafter, the meat was sliced into thin sheet of 0.15 - 0.30 mm thick and between 5 – 9 cm long for suya preparation. Samples for the determination of the physical properties of the meat were also removed and taken to the laboratory for analysis.

Determination of physical properties of meat

Samples were taken from the three muscle types for the determination of cooking loss, shear force value, thermal shortening and water holding capacity.

Cooking loss

The meat were cut into equal sizes, weighed and broiled in a gas oven to an internal temperature of 72^{o}C. Each cooked sample was cooled to room temperature, blotted dry and weighed.

$$\text{Cooking loss} = \frac{\text{Weight before cooking} - \text{Weight after cooking}}{\text{Weight before cooking}} \times 100$$

Shear force determination

Warner Brazter shear force (WBSF) determination was performed on the broiled 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

Thermal shortening

This was carried out according to the procedure described by Mahendraker et al. (1988). Cores of 0.5 cm in diameter were taken from each muscle type. The length was measured prior to broiling in a gas oven for 5 min, after broiling, the broiled meat was allowed to cool to room temperature and the length measured again. The difference in length was expressed as percentage thermal shortening.

Water holding capacity

Water holding capacity was determined following a slightly modified method of Suzuki et al. (1991). In the process, intact samples (10 x 10 x 5 mm) were weighed individually from the 3 muscle type onto two filter papers and pressed between two plexi glasses for a minute, using a vice. The samples were then oven dried at 80^{o}C for 24 h in order to determine the moisture content. The amount of water released from the sample was measure 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 then calculated as follows (Suzuki et al., 1991)

$$\text{WHC} = \frac{100 - [\,(Ar - Am) \times 9.47}{Wm \times Mo} \times 100$$

Where Ar = Area of water released form 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.

Ingredient preparation

The spices used were purchased individually from specialized spice market. The spices/additives include curry, ginger, white pepper, red pepper, common salt (NaCl) maggi seasoning, monosodium glutamate, groundnut powder and groundnut oil. All the spices were mixed together in a specific proportion (Table 2).

Preparation of *Suya*

An individual *suya* stick, which was about 30 cm long, was weighed and the thin sheets of meat inserted into the *suya* stick. A total of 30 sticks of *suya* were prepared from each muscle type. The average weight of the meat per stick was between 33.67 to 43.16 g. The formulated ingredient was spread on a neat flat tray and each stick meat was properly dusted with the ingredient. Sticks of *suya* made from each muscle type (treatment) were labeled for easy identification. The average weight of ingredient per stick meat was between 4.64 0.31 g and 5.08 0.46 g.

After proper coating with the ingredient, the stick meats were re-weighed and spread back on the tray. About 5 - 10 ml of groundnut oil was sprinkled on each meat prior to roasting.

Roasting

The labeled stick meats were arranged round a glowing, smokeless fire made from charcoal. The distance of the stick meat from the fire point was 21.96 2.3 cm. The sticks meats were allowed to stay on the fire for 20 min with intermittent turning of the product. Additional groundnut oil was sprinkled on the meat while roasting continued. The weight of each *suya* was determined after roasting and this was used in calculating the percentage loss and the product yield.

Taste panel evaluation

A total of twenty trained individuals aged between 25 and 40 years (12 males and 8 females) were used to assess the tsire *suya* prepared from the three muscle type. The panelists were made to rate each of the ten replicate of the meat product. Equal bite size from each treatment (muscle type) were coded and served in an odourless plastic plate. The panelist rated the samples on a nine-point hedonic scale with maximum score of 9 to extremely high condition while the lowest score of 1 was assigned to the poorest condition (Mahendraker et al., 1988). The parameters evaluated for included flavour, tenderness, juiciness, texture and overall acceptability.

Statistical analysis

All data obtained were subjected to analysis to variance appropriate for the design and where statistical significance were observed, the means were compared using the Duncan's Multiple Range test (Duncan 1955). The SAS computer software package (1999) was used for all statistical analysis.

RESULTS AND DISCUSSION

The properties of the three muscle types used in this study are shown in Table 1. The thermal shortening ranged form 0.50 to 1.47% with the least value obtained from the BF. There were no significant difference (P >

Table 1. Properties of raw beef used for suya preparation.

Parameter	Muscle type		
	SM	BF	PM
Thermal shortening (%)	1.47± 0.29[a]	0.50± 0.07[b]	1.30± 0.06[a]
Cooking loss (%)	20.70± 0.36[b]	18.52± 0.38[c]	23.91± 0.26[a]
Shear force (kg/cm^3)	7.82± 0.21[b]	8.52± 0.94[a]	6.96± 0.33[c]
Water holding capacity (%)	79.99± 2.05[a]	71.11± 2.30[b]	68.17±1.72[b]
Moisture (%)	76.65± 1.11	73.73±1.02	72.33± 0.71

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

Table 2. Ingredient composition (g/100 g).

Names of spices and condiment	Composition (%)
Groundnut powder	52.00
Ginger	10.00
Dried pepper	10.00
Curry	5.00
White pepper	5.00
Salt	8.50
Maggi seasoning	7.50
Groundnut oil*	2.00
Total	100.00

*5 – 10 ml of groundnut oil was added to each stick of meat during roasting.

0.05) between the values obtained for SM and PM. Cooking loss percent was highest (P < 0.05) in the PM with a value of 23.91% as compared to 20.70 and 18.52% obtained for SM and BF, respectively.

Shear force measures the degree of toughness, the higher the value the tougher the meat. The shear force values obtained in this study were 7.82, 8.52 and 6.96 kg/cm^3 for SM, BF and PM, respectively. The PM was the most tender followed by the SM while the BF was the least tender among the 3 muscle types. Tenderness is considered as the most important trait of meat quality (Cross et al., 1986). It has also been identified as the most critical eating quality that determines whether consumers are repeat buyer. It is however worthy of note that as a result of the heat treatment and the use of spices with tenderizing effect, the degree of tenderness observed in the fresh meat might differ greatly from that of the product.

The result of the water holding capacity (WHC) showed that SM has the highest (P < 0.05) value followed by BF while PM has the least among the 3 muscles types. The WHC, which is the ability of meat to retain its water during application of external forces (Hedrick et al., 1994), is important in meat processing and the overall eating quality of meat revolves around the WHC. WHC has a direct relationship with most other qualities such as the flavour, juiciness and tenderness.

The result of the effects of different muscle types on yield and physical changes in the final product (tsire *suya*) is shown in Table 3. The amount of ingredient uptake varies, with the SM and the BF having similar (P > 0.05) values of 4.64 and 4.68 g, respectively. The PM has the highest amount of ingredient uptake. There is an inverse relationship between ingredient uptake and WHC of raw meat. The PM had the least WHC indicating that the amount of drip loss was highest in this muscle which translates to a higher "weep" and a greater medium for the uptake of more ingredient. The result of the meat to ingredient ratio was 8.42: 1, 7.19: 1 and 8.50: 1 for SM, BF and PM, respectively.

PM was the tenderest muscle with a shear force score of 6.96 kg/cm^3 followed by SM with a value of 7.82 kg/cm^3 while the toughest was BF. The result of the taste panelist contradicts that of the Waner Braztler Shear force results obtained for broiled meat samples probably because of the effect of spices on meat tenderness or because *suya* is highly relished but cannot be afforded by many and the taste panel scoring could be affected by their eagerness to taste the delicacy.

The product yield was highest in the suya prepared from BF most probably because of the low cooking loss of the muscle (Table 1). The product yields obtained were 71.37, 87.72 and 71.85% for SM, BF and the PM, respectively.

Taste panel evaluation results are shown in Table 4. The flavour ratings were 4.25, 4.50 and 4.00 for SM, BF and PM, respectively. The results obtained were not significantly different (P > 0.05) from each other. The panelist gave the highest (P < 0.05) tenderness ratings to suya made from the SM followed by suya from BF with the least tenderness score given to suya from PM.

The muscle type affected the juiciness ratings. The highest score was given to the SM which incidentally has the highest WHC. Juiciness is made up of two effects viz the impression of moisture released during chewing and also the salivation produced by flavour factor (Omojola et al., 2003). There seemed to be a direct relationship between juiciness and tenderness score obtained in this work.

The texture rating was highest in the product from SM where a value of 6.75 was obtained. This score was significantly higher (P < 0.05) than the score of 4.88 and

Table 3. Effect of different muscle type on yield and physical changes in the final product (*Suya*).

Parameter	Muscle type		
	SM	BF	PM
Weight of stick (g)	4.20± 0.52	4.04± 0.26	3.56± 0.28
Weight of meat (g)	39.06 ±2.69^{a}	33.67± 2.46^{b}	43.16± 2.86^{a}
Weight of ingredient (g)	4.64 ±0.31^{b}	4.68± 0.22^{b}	5.08± 0.46^{a}
Weight before roasting (g)	47.90± 3.18^{ab}	42.39± 2.45^{b}	51.80±2.87^{a}
Meat : Ingredient ratio	8.42:1	7.19:1	8.50:1
Weight after roasting (g)	35.39± 2.46	37.68± 1.86	38.22± 2.98
Percent weight loss	28.63± 1.27^{a}	12.28± 1.49^{b}	28.15±2.23^{a}
Product yield (%)	71.37± 2.11^{b}	87.72± 2.51^{a}	71.85±1.84^{b}

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

Table 4. Organoleptic characteristics of *suya* prepared from 3 different muscle types.

Parameter	Muscle types		
	SM	BF	PM
Flavour	4.25 ± 0.94	4.50 ± 0.63	4.00 ± 0.63
Tenderness	6.36 ± 0.32^{a}	5.50 ± 0.80^{b}	4.88 ± 0.72^{c}
Juiciness	6.63 ± 0.22^{a}	5.63 ± 0.60^{b}	5.75 ± 0.59^{b}
Texture	6.75 ± 0.57^{a}	4.88 ± 0.69^{b}	4.50 ± 0.46^{b}
Overall acceptability	7.00 ± 0.19^{a}	5.50 ± 0.46^{b}	6.00 ± 0.42^{b}

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

4.50 from BF and PM, respectively.

The result obtained for the overall acceptability indicated that the consumers prefers suya made from the traditional suya making muscle than suya from the other 2 muscles, while the rating of the BF and PM were not significantly (P > 0.05) different from each other.

Conclusion

The result of this study showed that suya could be made from other muscles than traditional SM muscle. Although the panelist rated suya from SM higher in terms of tenderness, juiciness and overall acceptability but when the product yield was considered, the BF muscle had an advantage over the SM and the PM. Also in terms of ingredient uptake, the BF was preferred.

REFERENCES

Bouton PE, Harris PV (1978). Factors affecting tensile and Warner-Bratzler shear values of raw and cooked meat. J. Text. Stud. 9: 395-413.

Cross HR, Savell JW, Francis JJ (1986). National onsumer retail beef study. In Proceedings 38^{th} Annual Reciprocal Meat Conference 39: 112-114.

Duncan PB (1995). New Multiple range and multiple F-tests. Biometric Vol II: 1-42.

FAO (1995). Development and promotion value added meat products. Project document.

Hedrick HB, Aberle ED, Forest JC, Judge MD, Merkel RA (1994). Properties of Fresh Meat. In: Hedrick HB, Aberle ED, Forest JC, Judge MD, Merkel RA (Eds). Principle Meat Sci. Dubuque, I. A. Kendall/Hunt Publishing Company. pp 123-131.

Igene JO (1983). Annals of Borno Vol 1. In: Kassim OR (2004) Evaluation of the effect of various additives on the acceptability of Suya. B.Sc. Project. University of Ibadan, Ibadan, Nigeria.

Mahendraker NS, Khabade VS, Dani NP (1988). Studies on the effect of fattening on carcass characteristics and quality of meat from Bannu-lamb. J. Food Sci. Technol. 25: 228-230.

Obanu ZA (1981). The applicability of Intermediate Moisture Food (IMF) technology for preservation of meat and fish in Nigeria. Paper presented at the National Conference on " From Food Deficiency to Food Sufficiency" at the Rivers State University of Science and Technology. Port Harcourt, May 3-8.

Omojola AB, Kassim OR, Adewumi MK, Ogunsola OO, Adeyemo GO, deshiyan AB (2004).Evaluation of the effects of variation in ingredient composition on the eating qualities of suya. Afr. J. Livestock Ext. Vol 3: 28-32.

Omojola AB, Isah OA, Adewumi MK, Ogunsola OO, Attah S (2003). Evaluation of the effects of various additives on the acceptability of Kilishi. Trop. J. Anim. Sci. (2): 97-101.

SAS (1999). Statistical Analysis System Institutes. User's guide. SAS Institute Inc. Cary, N. C.

Suzuki A, Koima N, Ikeuchi Y (1991). Carcass composition and meat quality of Chinese purebred and European X Chinese crossbred pigs. Meat Sci. 29: 31-41.