

Effect of Various Additives on Proximate Composition and Acceptability of *Kilishi* made from Semitendinosus Muscle of White Fulani Cattle.

O.A. Isah, Ph.D.¹ and A.O. Okubanjo, Ph.D.²

¹Department of Animal Nutrition, College of Animal Science and Livestock Production, University of Agriculture, Abeokuta, Ogun State, Nigeria.

²Department of Animal Science, University of Ibadan, Nigeria.

E-mail: bukkyisah@yahoo.com

ABSTRACT

Kilishi is a traditionally processed intermediate moisture or semi dry, ready-to-eat, meat product made from beef in Northern Nigeria. The semitendinosus muscle of hot de-boned beef was trimmed of all visible fats, and connective tissue. The cleaned muscle was weighed and sliced into thin sheet of 0.17-0.20cm thick and 60-80cm long. The sliced meat was sun dried and infused with locally available spices, condiments, and other materials such salt, sugar, *magi* seasoning, peanut paste and water. The local spices and condiments used include; onion, alligator pepper, cloves, chilies, ginger, African nutmeg, black pepper, locust beans, groundnut powder and dry pepper.

The experiment comprised of six (6) treatments. Treatment one (T₁), served as the control with all ingredients present while ginger, alligator pepper, cloves, African nutmeg and black pepper were absent in T₂, T₃, T₄, T₅ and T₆, respectively. The result of the taste panelist showed that in terms of flavor, the *Kilishi* where alligator pepper was absent was most preferred. The results also showed that one or two of the spices could replace each other without any marked difference in flavor, juiciness, pungency, tenderness and overall acceptability.

Results of chemical composition of raw dried meat and the various *Kilishi* products showed that raw dried meat had the highest ($p < 0.05$) % crude protein content of 73.74% compared to the various finished *Kilishi* product which ranged from 53.41% to 64.53% crude protein. However, ash and ether extract contents of the various *Kilishi* followed similar trend ($p > 0.05$), but lower values ($p < 0.05$) were observe in the raw dried meat. Moisture content of the raw meat and the various finished products were not significantly different.

(Keywords: *Kilishi*, spice mixture, chemical composition, acceptability, meat science, nutrition, health, meat processing)

INTRODUCTION

There is a high demand for animal products due to the ever-increasing population size. The production and preservation of meat in warm climate regions are associated with some specific problems, which differ greatly from those encountered in the temperate zones. The processing of meat originated from the desire of man to preserve meat for consumption at a later date. Different methods exist for preserving meat; however, the selection of an economic and effective method requires a careful weighing of the many technical factors involved as well as local needs and collections.

In Nigeria, recent developments involve a greater use of refrigeration in extending the shelf life of meats. This however, requires high capital outlay. The erratic power supply in the country also compounds the problem. The use of seasoning such as salt, spices, herbs, fermented sauces, and others can be employed to enhance the acceptability of traditionally processed meat product like *Kilishi*.

Kilishi is a sun dried traditional meat product made principally from beef. It is an intermediate moisture or semidry meat product. The product appears to have developed as a means of preserving meat in the absence of refrigeration facilities by the early Fulani and Hausa herdsmen of Northern Nigeria and the Sahelian Africa. As a ready-to-eat convenience meat product, *Kilishi* possess an excellent shelf life. According to (2) *Kilishi* has a shelf life of 12 months at room temperature. This makes the handling and

marketing of the product very convenient for consumers and retailers. This study was therefore designed to evaluate the effect of various spice mixtures commonly used in processing of *Kilishi* on the consumer acceptance and proximate composition of the product in order to have a scientific approach to develop and modify the product.

MATERIALS AND METHODS

The experiment was carried out during the months of September to November at the meat laboratory of the University of Ibadan, southwestern Nigeria (7°30'N: 3°54'E). The location has a subhumid climate with total annual rainfall of 1250mm. However, the total amount of rainfall during the study period was 418.5mm.

The meat used was the semitendinosus muscle obtained from hot de-boned beef. The infusion ingredients used comprised of the locally available spices, condiments and other ingredients such as salt, sugar, magi seasoning, peanut paste, and water. The local spices and condiments used include onions, alligator pepper, cloves, chillies, ginger, African nutmeg, black pepper, locust bean, and groundnut powder.

Experimental Design: The design was a completely randomized designed with 6 replicates per treatment.

Meat preparation: The semitendinosus muscle of beef was trimmed of all visible fat bone and connective tissues and then weighed. The weighed meat was sliced into thin sheets of 0.17-0.20cm thick and 60-80cm long using the local butcher's knife with a very sharp thin blade. The thin sheets of meat were dried in the sun for about seven hours.

Preparation of infusing ingredients: Each of the spices was ground into powder with an electric grinder. The onions were sliced into small thin cubes. The fresh peanut paste was prepared from grains of dry uncooked groundnut after extraction of oil by pressing. The peanut powder was made from roasted ground nut cake. The various ingredients were mixed together with water according to the method of (1) with some modification (Table 1).

Preparation of *Kilishi*: The dried thin sheets of meat were soaked into the infusion slurry for about 30 minutes, after which it was taken out and spread in the sun to dry. After drying; the infused meat was roasted in an oven at a temperature of 100°C for 10-15 minutes. The finished products were cooled at room temperature, packed and heat sealed in cellophane bags and allowed to age for two weeks before the sensory evaluations was carried out.

Analysis of Nutrient Composition of raw meat and *kilishi*: The Crude protein, Ether extract, Ash and Moisture content of the raw dried meat and the various *Kilishi* products were determined according to AOAC (2000).

Taste Panel Evaluation

Taste panel evaluation was carried out using 36-screened individual panelists. These panelists were randomly allocated to the six treatments of the *Kilishi*. The panelists were made to rate each of the 6 replicates of the meat product. Equal bite size samples from the six treatments were coded and served on a plate to each of the panelists. Each sample was evaluated independent of the other. The panelist rated the samples on a 9-point hedonic scale for flavor, tenderness, juiciness, pungency, and overall acceptability.

Statistical Analysis: An analysis of variance (ANOVA) of the data was carried out using the ANOVA procedure from (7). The least significant difference test was applied to compare the means.

RESULTS AND DISCUSSION

Proximate Composition: The nutrient composition of the dried meat and the finished *Kilishi* products is presented in Table 2. No significant different was observed in the moisture contents of the various samples This showed that the moisture absorbed during soaking with infusion ingredients was lost during the second stage of drying and the short period of roasting. This also indicated that the presence of the various infusion ingredients had no effect on the moisture retention of the meat.

Table 1: Composition of Infusion Mixtures used in *Kilishi* Preparation.

Spices or condiments	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Ginger <i>Zingiber officinale</i>	3.30	-	3.30	3.30	3.30	3.30
Alligator pepper <i>Aframomum melegueta</i>	1.20	1.20	-	1.20	1.20	1.20
Cloves <i>Eugenia caryophyllata</i>	0.80	0.80	0.80	-	0.80	0.80
African nutmeg <i>Monodora myristica</i>	1.00	1.00	1.00	1.00	-	1.00
Black pepper <i>Piper guineense</i>	2.00	2.00	2.00	2.00	2.00	-
Dried pepper <i>Capsicum annum</i>	2.00	2.00	2.00	2.00	2.00	2.00
Onion <i>Allium cepa</i>	12.00	12.00	12.00	12.00	12.00	12.00
Chillies <i>Capsicum frutescens</i>	1.00	1.00	1.00	1.00	1.00	1.00
African locust bean seed <i>Parkia biglobosa</i>	1.00	1.00	1.00	1.00	1.00	1.00
Powdered peanut	2.80	2.80	2.80	2.80	2.80	2.80
Peanut paste	31.00	31.00	31.00	31.00	31.00	31.00
Magi seasoning	0.30	0.30	0.30	0.30	0.30	0.30
Salt (Sodium chloride)	4.50	4.50	4.50	4.50	4.50	4.50
Cane sugar	3.00	3.00	3.00	3.00	3.00	3.00
Water	35.00	35.00	35.00	35.00	35.00	35.00

Key T₁; All spices present
T₂; Ginger absent
T₃; Alligator pepper absent
T₄; Cloves absent
T₅; African nutmeg absent
T₆; Black pepper absent

Table 2: Percentage Proximate Composition of *Kilishi* and Dried Meat.

Treatment	Moisture	Ether extract	Crude Protein	Ash
T ₁	23.300±0.6	9.78±0.4 ^a	64.53±0.3 ^b	7.900±0.8 ^a
T ₂	21.175±2.3	9.85±0.4 ^a	58.41±0.4 ^d	8.525±1.5 ^a
T ₃	21.750±3.3	10.10±0.3 ^a	54.69±0.4 ^e	7.925±1.5 ^a
T ₄	19.750±0.8	10.03±1.4 ^a	59.28±0.4 ^d	8.100±2.2 ^a
T ₅	22.350±1.3	10.13±0.4 ^a	62.52±0.6 ^c	9.425±1.7 ^a
T ₆	20.230±0.9	8.95±0.5 ^a	53.41±0.7 ^f	7.975±0.4 ^a
T ₇	16.650±0.8	2.40±0.7 ^b	73.74±0.6 ^a	4.975±1.1 ^b

Means in the same row with different superscripts are significantly different (P<0.05)

Key T₁; All spices present
T₂; Ginger absent
T₃; Alligator pepper absent
T₄; Cloves absent
T₅; African nutmeg absent
T₆; Black pepper absent
T₇; Dried meat without ingredient

The moisture contents ranged from 19.75% to 23.30% in the final *Kilishi* product and 16.65% in the raw dried meat. However, lower moisture contents of 7.5% and 4.2% were recorded by Igene *et al.*, (1990) and Abubakar *et al.*, (2011), respectively in Northern Nigeria with a drier climate. Similar but higher values of ether extract and ash content were recorded for the final *Kilishi* compared to the raw dried meat.

The ether extract content of the *Kilishi* ranged from 8.95% in *Kilishi* without black pepper to 10.13% in *Kilishi* without cloves, while the raw dried meat had a value of 2.40% ether extract. Igene *et al.*, (1990) recorded ether extract values of 17.8% while Abubakar (2011) reported 26.1 % ether extract but the type of muscle used for their *Kilishi* was not specified. The differences observed in the ether extract contents of the final *Kilishi* and the raw dried meat might be as a result of inclusion of peanut as one of the infusion ingredients. Peanut contained high fat and oil content. Also, the higher ash content observed in the various *Kilishi* might due to the contribution of the ash content of the curing ingredient especially the spices. Pruthi, 1980 gave the ash content of clove powder to be 5.26% and red pepper to be 17%.

Significant difference occurred in the crude protein content of the raw meat and the final *Kilishi* products. Highest crude protein value (73.74%) was observed in the raw dried meat while the crude protein content of the various *Kilishi* products ranged from 53.41% in *Kilishi* without black pepper to 64.53% in *Kilishi* with all the spices. The high crude protein observed in the raw dried meat might be due to the presence of various ingredients used in the preparation of the *Kilishi*, which might have diluted the concentration of the crude protein content of the final products.

Flavor: Significant ($P < 0.05$) differences were observed in the flavor of the different *Kilishi* prepared with various spice mixtures. The highest flavor score (6.38) was observed in T_3 (*Kilishi* without alligator pepper). This revealed that the presence of alligator pepper in the spice mixture was not desired as adjudged by the taste panel. This might be due to the pungency of the alligator pepper. The alligator pepper could be omitted from the spice mixture to give a product, which is significantly better than the control in terms of flavor rating. The lowest flavor score was

obtained when ginger (T_2) was absent and this was comparable to the control. This result showed that the presence of ginger in the spice mixture contributed greatly to the flavor of the finished product especially at the level of incorporation. The flavor of *Kilishi* when ginger (T_2), African nutmeg (T_5) and black pepper (T_6) were absent, respectively, from the spice mixture were similar ($P > 0.05$). This implies that any of these three spices could be substituted for each other depending on which one is readily available and to reduce cost of *Kilishi* product without much difference in flavor compared to the control.

Pungency: As shown in Table 3, there was no significant ($P > 0.05$) difference in the pungency of *Kilishi* when the mixture of all spices were used and when their compositions were varied. However, T_3 where alligator pepper was absent had least numerical value. This showed that the result of the pungency might not be due to the inclusion of any single one of the various spices that were tested. It might probably be due to a combined effect of all the spices or the effect of other spices such as chilies (6). Chilies are widely used throughout the tropics as a pungent spice for domestic purposes. This spice is priced for its pungency and the pungency of the spice increases as the plant matured (3).

Juiciness: Juiciness is made up of two effects viz; the impression of moisture released during chewing and also the salivation produced by flavour factor. Juiciness scores of 4.75, 4.43, 5.25, 4.68, 4.53 and 5.25 were obtained for T_1 , T_2 , T_3 , T_4 , T_5 and T_6 respectively. Abubakar, (2011) reported higher juiciness score of 6.0 in his research. The absence of alligator pepper (T_3), black pepper (T_6) and cloves (T_4) gave final *Kilishi* product with similar juiciness to the control ($P > 0.05$). Also, the absence of ginger (T_2) and African nutmeg (T_5), in the spice mixture gave *Kilishi* with similar juiciness ($P > 0.05$). The result showed that the effects of both alligator and black pepper on juiciness of *Kilishi* were similar and therefore both spices could be substituted one for another. The same applied to Ginger and African nutmeg. This indicated that cloves and Alligator pepper could be successfully omitted from the spice mixture without noticeable effect on the juiciness of the final product since their result is comparable to the control (T_1).

Table 3: Sensory Evaluation of the Different 'Kilishi' Products.

Sensory traits	Sensory scores*					
	T ₁	T ₂	T ₃	T ₄	T ₅	T
Flavor	5.30±0.3 ^{ab}	5.03±0.6 ^c	6.38±0.5 ^a	6.18±0.6 ^{ab}	5.40±0.9 ^{abc}	6.05±0.9 ^{ac}
Pungency	4.53±0.6	4.20±0.5	3.95±0.5	5.08±0.4	4.63±0.3	4.65±0.5
Juiciness	4.75±0.6 ^{ab}	4.43±0.4 ^b	5.25±0.7 ^a	4.68±0.6 ^{ab}	4.53±0.7 ^b	5.25±0.8 ^a
Tenderness	4.48±0.5 ^b	3.80±0.4 ^c	5.53±0.6 ^a	4.75±0.4 ^b	4.35±0.2 ^{bc}	4.95±0.7 ^{ab}
Overall acceptability	5.17±0.4	4.55±0.3	5.85±0.8	5.33±0.7	5.13±0.8	5.40±0.9

Means in the same row with different superscripts are significantly different (P<0.05)

*Rated on a nine-point hedonic scale. Higher value indicates higher preference.

Key T₁; All spices present
T₂; Ginger absent
T₃; Alligator pepper absent
T₄; Cloves absent
T₅; African nutmeg absent
T₆; Black pepper absent

Tenderness: Tenderness is the degree of toughness of meat. It could be described as the ease with which the teeth sink into the meat when chewed. The variation in tenderness of meat depends on factors such as the age of the animal, sex, post mortem changes in the carcass, the part of the meat used and the processing methods to which the meat is subjected. Although tenderness varies within muscles, it is almost uniform in biceps femoris and semitendinosus (5). The variation in tenderness of the *Kilishi* was therefore dependent to a large extent on the variations in the ingredients used since processing method was the same and semitendinosus muscle was used throughout the experiment. It was observed that there was no significant (P>0.05) difference in the tenderness of the final *Kilishi* product when alligator pepper T₃ and black pepper T₆ were absent in the spice mixture.

Also, the absence of black pepper T₆, cloves T₄ and African nutmeg T₅ from the spice mixture gave similar results which were comparable to that obtained when no spice was absent (control). The result showed that any of three spices could be omitted from the spice mixture without much effect on the tenderness of the final product. Alligator pepper tends to have the least tenderizing effect while Ginger and African nutmeg had the highest tenderizing effect on the meat product. This might be due to the fact that these spices are of vegetable origin with plant proteolytic enzyme-zingibain (3 and 4). The

activity of the enzyme on collagen and actinomyosin results in significantly (P<0.05) more tender meat. Levels of ginger extract that was added to the meat appear to be sufficient to enhance the tenderization of the meat (3 and 8).

Overall Acceptability: The mean panel ratings for overall acceptability are shown in table 2. the result revealed no significant (P>0.05) difference in the overall acceptability of the *Kilishi* when the spice composition was varied. The result obtained was similar in numerical value to those of flavor, juiciness and tenderness attribute of the *Kilishi*. The inability of the taste panelist to detect any noticeable (P>0.05) difference might probably be due to the fact that *Kilishi* is a delicacy cherished by many but afforded by few people, as a result, people are eager to consume the product. Therefore, regardless of the difference in flavor, tenderness and juiciness, it was acceptable to consumers. The product is now a commodity exported from Nigeria to Saudi Arabia, particularly during the annual pilgrimage to Mecca and Medina (1).

CONCLUSION

Kilishi is a product highly acceptable to consumers. *Kilishi* without alligator pepper was most preferred by consumers while ginger contributed greatly to the flavor of the final product. From the result of this work, it was noted

that the cost of production could be reduced as one or two of the spices under investigation could replace each other without marked difference in the organoleptic and overall acceptability of the final product.

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ABOUT THE AUTHORS

Dr. Olubukola Isah, is a Senior Lecturer and former Acting Head of Animal Nutrition Department, Federal University of Agriculture, Abeokuta. She holds a Ph.D. from the University of Ibadan, Nigeria. She is a member of Animal Science Association of Nigeria and a registered member of the Nigerian Institute of Animal Science.

Prof. Ademola Okubanjo, is a retired Professor of Meat Science and Animal By-Products of the University of Ibadan, Nigeria and currently on contract assignment with Olabisi Onabanjo University, Ago Iwoye, Nigeria.

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