International Journal of Basic Science and Technology October 2015, Volume 1, Number 1, Pages 35 - 38

Evaluation of Production Techniques and Quality Assessment of Kilishi in some parts of Kano, Kano state, Nigeria

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Article Information

Article history:
Received: 5 June, 2015
Accepted: 16 June, 2015
Available online:

Keywords:
Kano State,
Kilishi,
Kilishi processing,
Meat,
Sensory quality

Abstract

This study evaluated different techniques of Kilishi production and quality of Kilishi produced in Agadasawa, Dala and Jakara areas of Kano State, Nigeria through oral interviews, observations, proximate composition and sensory evaluation. Results showed Kilishi producers used similar production techniques but slight variations were observed in raw meat and ingredients used for Kilishi production. Beef was mostly used while goat and ram meats were occasionally used. Ingredients were groundnut cake, water, bouillon cubes, salt, garlic and spices such as pepper, ginger and onion. No significant differences were observed in moisture, lipid and ash contents of the three raw meat sources ($p \geq 0.05$). However, significant drop in moisture contents of meat for each source were observed between first and second stage drying ($p \leq 0.05$). Also no significant difference ($p \geq 0.05$) was observed between the fat contents of fresh meat used in three sources. No significant change was observed in the fat contents of meat after first stage drying ($p \geq 0.05$), except for Kilishi from Dala. In general, no significant differences were observed among the fat contents of these finished Kilishi ($p \geq 0.05$). Significant differences ($p \leq 0.05$) existed between protein contents at different stages of processing, yet no significant difference in protein contents of Kilishi from three sources ($p \geq 0.05$). Sensory scores of Kilishi on 7-point Hedonic scale were acceptable (> 4.00) for all sensory factors, but no significant difference was observed for each sensory factor ($p \geq 0.05$).

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Introduction

Kilishi is a Nigerian traditional dry meat product prepared from beef, mutton, goat meat and other types of meat. However, beef is mostly used (Igene *et al*., 1990). It consists of thinly sliced fresh lean strips/slice of muscle of about 0.17 - 0.5cm thick whose processing entails first spreading the sliced meat on racks (made of corn stalk). On a regular time interval the strip is turned to avoid sticking on the mat. Then, the dry strips / slices are immersed into slurry made up of defatted groundnut powder, spice and other seasonings. It is then dried again in the sun to reach a moisture level of 10 - 20% or less depending on the drying conditions (Igene, 1988). Kilishi is reported to consist of 46% meat and 54% non-meat ingredients and is composed of 50% protein, 18% fat, 9.6% ash and 7.6% moisture, the Kilishi product can be stored for over sixty week in dry environment (Kibon, 2006, Muhammad and Muhammad, 2007). Curing ingredients used in Kilishi production have high levels of triglycerides, phospholipids and polyunsaturated fatty acids and subsequently high amounts of malonaldehyde. It is also moderately acidic yet it has stable shelf life, which is enhanced by its low moisture contents and improved storage conditions (Igene *et al*., 1990; Chukwu and Imodiboh, 2009).

In Nigeria the production of Kilishi is concentrated in the north, where there is abundant livestock production (Igwe, 2005). Kilishi production in Nigeria is left in the hands of traditional producers. Previous efforts to ascertain the production techniques of these producers have been made mostly in northeastern Nigeria (Igene, 1988; Igene *et al*, 1990, Negbenebor *et al*., 1990; Kibbon 2006). However information baseline data on Kilishi processing and proximate composition in Kano, Nigeria is lacking or at best scanty. Therefore this research is designed to study in selected parts of Kano State of Nigeria the handling, processing and storage conditions of Kilishi for quality (proximate composition and sensory) evaluation. This will provide basis for up-grading these traditional processing techniques.

Materials and methods

Kano, the capital of Kano State of North-West region of Nigeria was the place of study. Kilishi samples were procured from the three study areas i.e. Dala, Jakara and Agadasawa towns in Kano.

These were the major areas of Kilishi production from previous unpublished studies. Samples for laboratory analyses were collected from the above three study locations. These samples were fresh meat, raw meat after first and second drying stages and finished Kilishi. They were transported to laboratory under aseptic condition for analysis. Oral interview, personal observations, laboratory analyses and sensory evaluations were the instruments of data collection used in this research.

Oral interviews and personal observations were conducted in the three different areas that are known to be popular in Kilishi processing and marketing. The observation focused on the personal hygiene of Kilishi processors, processing areas and processing equipment and utensils used for Kilishi processing. For the oral interview, one popular professional in traditional Kilishi production each from Dala, Jakara and Agadasawa towns were selected as respondents in the oral interview. Questions were asked on their background status, methods of Kilishi production and storage, and post processing handling of the product. Similarly, Kilishi samples from these processors were procured.

For proximate composition, the percentage moisture, crude protein, fat and ash contents were determined according to the method of AOAC (1990). The total carbohydrate content of the samples was determined by difference method. For sensory evaluation, the 7-point Hedonic sensory scale with 1 representing "least liked" and 7 representing "liked most" and using fifteen (15) semi-trained panelists was used to evaluate the fresh Kilishi samples from the three locations. Samples were rated for colour, taste, mouth-feel, aroma and overall acceptability.

Statistical analysis

For data analyses, percentages, Analyses of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) were used in the statistical computation of the data using Statistical Package for Social Sciences (SPSS).

Results and Discussion

Results of Survey Studies

Results of oral interview and personal observations showed that except for some slight variations, Kilishi producers in Kano metropolis adopted same procedure throughout the production

International Journal of Basic Science and Technology October 2015, Volume 1, Number 1, Pages 35 - 38

processes. In general, the entire results of survey studies are discussed under the following subheadings:

Meat raw material

Cow meat (Beef) was the most popular, though mutton and goat meat were occasionally used. This is in agreement with the earlier report of Igene *et al* (1990) that Kilishi is a traditional low moisture meat product prepared from beef, mutton, goat meat and other types of meat and that beef is mostly used.

Ingredients used in Kilishi processing

The condiments used in Kilishi processing in Kano metropolis consisted of groundnut cake, water, bouillon cubes, salt, garlic and spices such as pepper, ginger and onion. Slight variations were observed in the formulation of condiment among the three areas of Kano metropolis studied. For example, ingredients used in Dala consists of defatted groundnut powder, spices, seasoning, salt, oil and tiger nut, while in Agadasawa and Jakara sugar crystal was used instead of tiger nut. In Dala and Jakara; pepper, ginger, and onion are used as spices, while in Agadasawa garlic was used in addition. It was only in Agadasawa that monosodium glutamate was used for seasoning. Kilishi processors reported that the use of these condiments added taste and flavour to the product as well as functioning as antimicrobial agents.

Kilishi production

This starts with trimming off of all visible fats from the procured raw meat. This is followed by thin slicing of the meat to flat thin sheet of about 20mm thickness. There are first and second stage drying. Producers of Kilishi reported that the drying time for Kilishi varies with season of the year. They dry faster during the dry season when compared to the rainy season. After slicing, the first stage drying is usually completed in 5 - 10 hours depending on the humidity, temperature and air flow within the drying environment. After first drying stage, the meat slices were infused with condiment made of groundnut cake, water, bouillon cubes, salt, garlic and spices such as pepper, ginger and onion through dipping. This provides the desirable taste and flavour of the Kilishi. The spices therein also functions as antimicrobial agents. The treated slices were then spread for the second and final drying. This drying phase is usually completed in 2 - 4 hours depending on the drying conditions. These meat slices were finally roasted over a glowing fire for 4 - 5minutes. These Kilishi production operations as reported by Chukwu and Imodiboh (2009) and Negbenebor *et al* (1990) are to enhance desirable flavour development and inactivation of contaminating microorganisms.

Keeping quality and contamination of Kilishi

Findings showed that Kilishi in Kano has good keeping quality, except when not properly dried or roasted, inappropriately packaged or exposed to humid environment and higher temperatures. The survey result also indicated that well processed Kilishi can be stored for more than one year. This is in agreement with FAO report of 1996.

The reported high shelf life of Kilishi of about sixty weeks is in agreement with reports of previous workers (Igene, 1988; Negbenebor *et al* 1990; FAO, 1996). But the reported higher values of lipid (17.91 – 18.31%) in the fresh Kilishi seem to contradict the high level of shelf stability. However, Igene (1988) reported the lipid and fatty acid composition of Kilishi to be stable to lipidautoxidation despite its higher level of unsaturated fatty acids. Also Igene *et al.* (1990) reported that the oxidative stability of Kilishi is attributed mainly to the antioxidant properties of the phenolic substances contributed by array of spices and other plant products namely *Capsicum frustescens, Piper guineense, Capsicum annum, Allium cepa, Eungenia caryophyllata,* and *Afromomum officinale* used in the formulation of the product, which are concentrated due to low water activity levels.

Field studies showed that sources of contamination could result from poor post-slaughter handling of meat, non-observance of good manufacturing practices in Kilishi production such as long time exposure to air, dust and flies during drying and the use of unhygienic equipment and utensils. Others may include poor personal and environmental hygiene during Kilishi processing.

Results of proximate composition and sensory evaluation

Table 1 shows the proximate composition of fresh meat samples for Kilishi production from the three study locations Dala, Agadasawa and Jakara. Also proximate composition of meat samples after first and second stage drying and that of the finished Kilishi are also given in Table 1.

Table 1: Proximate composition of fresh meat, meat after first and second stages of drying and fresh Kilishi

No	Kilishi Source	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)
I	***Fresh meat***					
1	Agadasawa	75.31 ± 0.01^{k}	1.11 ± 0.01^{a}	2.52 ± 1.53^{a}	19.78 ± 0.05^{a}	1.25 ± 0.06^{a}
2	Dala	75.36 ± 0.11^{k}	1.30 ± 0.01^{a}	2.45 ± 0.00^{a}	20.24 ± 0.14^{b}	1.05 ± 0.05^{a}
3	Jakara	75.29 ± 0.01^{k}	1.31 ± 0.10^{a}	2.23 ± 0.03^{a}	20.27 ± 0.07^{b}	1.06 ± 0.06^{a}
II	***After 1st drying***					
4	Agadasawa	35.88 ± 0.01^{g}	3.67 ± 0.15^{b}	2.48 ± 0.75^{a}	22.36 ± 0.14^{c}	35.18 ± 0.07^{f}
5	Dala	37.55 ± 0.01^{h}	4.34 ± 0.10^{c}	3.30 ± 0.82^{b}	22.52 ± 0.15^{c}	32.76 ± 0.00^{e}
6	Jakara	37.87 ± 0.01^{j}	4.36 ± 0.03^{c}	2.47 ± 0.05^{a}	23.37 ± 0.07^{d}	31.63 ± 0.14^{d}
III	***After 2nd drying***					
7	Agadasawa	10.47 ± 0.05^{d}	7.66 ± 0.05^{f}	15.30 ± 0.00^{c}	29.48 ± 0.14^{f}	37.12 ± 0.00^{g}
8	Dala	11.43 ± 0.01^{e}	6.45 ± 0.07^{e}	16.65 ± 0.14^{d}	30.32 ± 0.85^{g}	35.00 ± 0.03^{f}
9	Jakara	10.47 ± 0.05^{d}	5.88 ± 0.02^{d}	17.35 ± 0.00^{de}	28.83 ± 0.07^{f}	35.49 ± 0.08^{f}
IV	***Fresh Kilishi***					
10	Agadasawa	8.83 ± 0.01^{c}	9.60 ± 0.00^{h}	18.37 ± 0.14^{f}	50.24 ± 0.14^{h}	13.80 ± 0.57^{b}
11	Dala	7.54 ± 0.14^{a}	8.34 ± 0.14^{g}	18.00 ± 0.00^{ef}	50.33 ± 0.07^{h}	16.57 ± 0.85^{c}
12	Jakara	7.80 ± 0.02^{b}	7.88 ± 0.02^{f}	17.91 ± 0.01^{ef}	50.20 ± 0.05^{h}	16.46 ± 0.35^{c}

Note: Figures are means of three determinations ± standard error of means

Figures with same superscripts and in the same column are NOT significantly different from each other ($p \geq 0.05$)

The proximate values of meat irrespective of sources were within the reported values of fresh lean meat (Igwe, 1987). Similarly, significant differences were not observed for moisture, lipid and ash contents among the various fresh meat sources ($p \geq 0.05$). However, significant drop in moisture contents of meat from the different sources were observed after the first and second drying. For example, moisture content of fresh meat from Agadasawa dropped from 75.31% to 35.88% after first stage

International Journal of Basic Science and Technology October 2015, Volume 1, Number 1, Pages 35 - 38

drying to 10.47% after second stage drying and finally to 8.83% following roasting over the fire. Similarly, moisture content of fresh meat from Dala decreased from 75.36% to 37.55% after first stage drying to 11.43% after second drying stage and finally to 7.54% after roasting over the fire. Also the moisture content of fresh meat from Jakara dropped from 75.29% to 37.87% after first stage drying to 10.47% after second drying and finally to 7.84% after roasting over the fire.

Differences in moisture contents after first and second drying of meat from different sources attested to the differences in sun drying times and conditions as well as the subjective evaluation (perception) of end of these drying times by these processors from Agadasawa, Dala and Jakara. These differences finally resulted in the significant differences ($p \leq 0.05$) observed in the moisture contents of the fresh Kilishi.

As with moisture contents of fresh meat used by different processors for Kilishi production, no significant difference ($p \geq 0.05$) was observed between their fat contents. They were 2.52% (Agadasawa), 2.45% (Dala) and 2.23% (Jakara) fats of their respective raw meats used for Kilishi processing by the three different processors. Except for Kilishi from processor at Dala, no significant change was observed in the fat contents of meat after initial drying ($p \geq 0.05$).

There was significant increase in the values of fat contents of each of the meats after second sun-drying ($p \leq 0.05$). For example, fat content of meat used for Kilishi in Agadasa increased from 2.48% to 15.30%. In Dala it rose from 3.30% to 16.65%and in Jakara, it rose from 2.47% to 17.35% (Table 1). These increases were due partly to infusion of fatty ingredients comprising of groundnut cake, groundnut-oil, seasonings and spices. Also, significant differences ($p \leq 0.05$) observed between the fat contents of these meats after second drying could be as a result of the differences in the infused ingredients as well as the sunshine, humidity, wind speed, intensity and length of drying.

The fat contents of the Kilishi from the three processing centres increased in the final Kilishi. Since there was no further addition of the fatty-based infusion to the meat after second drying, the increase in fat contents of the finished Kilishi could be attributed to the roasting process of the meat to produce the Kilishi. Also the decrease in water content could account for the increase in fat content since water has an inverse relationship with fat. It is indeed observed that despite the variation in fat contents of the meat at various stages of Kilishi processing, no significant difference was noticed between the fat contents of the processed Kilishi ($p \geq 0.05$).

Similar variation in protein contents of the meat from each source varied as in their fat contents. For example despite the observed significant differences ($p \leq 0.05$) between the protein contents at the different stages of Kilishi processing, yet no significant difference in the protein contents of the samples was observed ($p \geq 0.05$).

Table 2 gives the result of seven-point Hedonic sensory tests of the fresh Kilishi samples produced from the three different processors in Kano metropolis of Kano State, Nigeria.

Table 2: Results of sensory evaluation of Kilishi produced from different production centers in Kano, Kano State of Nigeria.

No	Kilishi-Source	Aroma	Colour	Taste	Mouth-feel	General acceptability
I	Agadasawa	5.20 ± 1.48	5.30 ± 2.45	4.50 ± 2.27	5.50 ± 2.51	5.50 ± 2.68
II	Dala	5.50 ± 2.55	5.60 ± 1.95	6.10 ± 1.91	4.80 ± 1.55	5.20 ± 2.20
III	Jakara	5.90 ± 2.48	6.00 ± 2.36	5.80 ± 3.01	5.60 ± 2.55	5.40 ± 3.13

Values are means ± S. E. of 15 sensory scores

No significant difference was observed at p = 0.05

All the Kilishi produced irrespective of the source of production, had high sensory ratings. For example, on a seven-point hedonic scale the sensory score ranged for aroma 5.20 – 5.90; colour 5.30 – 6.00; taste 4.50 – 610; mouth-feel 4.80 – 5.60 and general acceptability 5.20 – 5.50. In general, no significant difference ($p \geq 0.05$) was observed for each of the sensory factors among the Kilishi from Agadasawa, Dala and Jakara. This shows that despite differences in proximate composition at different stages of processing, no observable differences in the sensory quality of all the Kilishi samples from different sources were observed.

Conclusion

Several conclusions were drawn from this research. The first is that Kilishi producers in Kano metropolis adopted same procedure throughout the production irrespective of location. However, little variations were observed in condiment formulations, drying times and proximate compositions of samples at different stages of the different Kilishi samples. In conclusion, despite the differences in fat, water and protein contents during the different stages of processing, it did not have any significant differences in the proximate composition and organoleptic acceptability of final Kilishi.

It is also recommended that good manufacturing practices should be observed by the processors to avoid contamination during handling and also that safe means of drying should be developed to avoid prolong exposure to air and flies in order to reduce chances of contaminations.

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International Journal of Basic Science and Technology October 2015, Volume 1, Number 1, Pages 35 - 38

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