

**NSAP****47<sup>th</sup> Annual  
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(JOS 2022)****CONFERENCE  
PROCEEDINGS**THEME  
**SECURING ANIMAL  
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GLOBAL CHALLENGES****SENSORY CHARACTERISTICS AND MICROBIAL PROFILE OF KILISHI FROM  
DIFFERENT LOCATIONS IN NIGERIA**Iyiola, V.O. <sup>1\*</sup>, Ejimadu, J.C. <sup>2</sup>, Aladi, N.O. <sup>2</sup>, Okoli, I.C. <sup>2</sup>, Okeudo N.J. <sup>2</sup>.<sup>1</sup>*Department of Animal Production and Health, Federal University Wukari, Nigeria*<sup>2</sup>*Department of Animal Science and Technology, Federal University of Technology, Owerri, Nigeria*\*C author: +234 8030893878, [vivila4me@yahoo.com](mailto:vivila4me@yahoo.com)**ABSTRACT**

The methods of production and handling of kilishi have been a source of concern for consumers who consider many of the practices unwholesome. In this study, freshly produced kilishi samples were purchased from Kano, Kaduna, and Sokoto, and from vendors in FCT, Abuja, and compared to the 2 most popular brands retailed in supermarkets in Owerri, Imo state. The samples were stored in tightly sealed transparent containers and kept in a typical kitchen cabinet. After one week of storage, the kilishi samples were subjected to sensory evaluation and microbial assay. No significant differences were observed in the panel sensory score in the kilishi gotten from different locations but panelists generally preferred samples made in the northern parts of the country. Kilishi samples from Owerri had lower microbial counts when compared to those from the northern parts of the country. However, the total microbial counts were lower than the safe limits recommended for a dried meat products.

**Keywords:** Kilishi, sensory, microbial, meat, Nigeria**INTRODUCTION**

Fresh meat has a very short shelf life of 24 hours or less at storage temperatures of 20 to 30°C (Lambert *et al.*, 1991), hence the need for preservation to avoid spoilage by multiplication of microorganisms (Lawrie, 1991). Drying is one of the oldest methods used in prolonging the shelf-life of foods. It reduces the moisture content of the products to very low levels thereby limiting the growth and proliferation of spoilage microbes (Ryoba *et al.*, 2013). Drying is core to the production of traditionally processed ready-to-eat meat products in Nigeria, such as balangu (roasted meat), kilishi, dan-bu-nama, tsire, jirga, ndako, banda, suya, etc. These products are highly cherished due to their unique flavours (Biscola *et al.*, 2013) and cultural significance (Thomas *et al.*, 2014). In Nigeria and some other countries in sub-Saharan Africa, kilishi is increasingly gaining widespread acceptance and importance in recent times (<https://timbuktuchronicles.blogspot.com>).

Kilishi, a traditional sun-dried jerky made from beef, mutton, or chevon, is a rich nourishing snack with a supplementary animal protein that is formulated using hurdle technology (Iheagwara & Okonkwo, 2016). It is made from thinly sliced fresh lean strips or slices of muscle which is dipped into slurry and sundried (Igene, 1988). Kilishi production is mainly localized in the northern parts of Nigeria due to abundance of livestock and relatively dry weather and is largely in the hands of traditional producers (Kibbon, 2006). The sensory qualities of kilishi is known to vary due to the meat type and cuts, ingredients used, seasoning, methods of processing (cutting, drying and smoking) etc. These variations have over the years created varieties with peculiar taste and characteristics across different parts of the kilishi producing areas. In recent times however, concerns have been raised on safety of kilishi as it is largely produced by locals, using sundry techniques and often in very unhygienic environments. It has therefore becomes necessary to constantly and routinely gather information not only on the sensory characteristics but also monitor microbial profile of kilishi marketed in Nigeria. Such information will not only help to boost confidence of consumers and stimulate trade but provides data to public health personnel for monitoring and evaluation purposes.



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## MATERIALS AND METHODS

### *Source of the kilishi samples*

The kilishi samples were purchased from local processors in three locations in northern Nigeria (Kano, Kaduna, Sokoto), and vendors in Abuja. Two most popular kilishi brands sold in Owerri, Imo state was purchased. The samples were transferred into tightly sealed transparent containers and kept in a typical kitchen cabinet for one week.

### *Organoleptic Evaluation*

Two types of sensory evaluations were done. In the first one, the panelists used a 9 point category rating (AMSA, 2016) to compare the characteristics of the kilishi samples to those of typical kilishi they had eaten in the past. The parameters evaluated are appearance, colour, colour tone, texture, hotness, tenderness, juiciness and overall degree of likeness. In the second was a hedonic rating in which, the panelists were asked to score their degree of likeness () for the parameters evaluated using a 5 point category rating. The panelists were drawn from the 500 level students of the Department of Animal Science and Technology, FUTU.

### *Microbial counts*

1g of finely ground kilishi samples were added to 9ml of sterile distilled water and homogenized with a stirrer. This was used to inoculate nutrient agar. Isolation of microorganisms was done using the pour plate method following the methods described by Shamsuddeen (2009) for a fungal count of the kilishi samples.

### *Experimental design and data analysis*

The mean scores obtained from the organoleptic evaluation data and microbial analysis were subjected to Analysis of Variance (ANOVA) using completely Randomized Design (CRD) and significantly different means were separated using Duncan's multiple range test as described by Chew (1976).

## RESULTS AND DISCUSSION

The result obtained from the sensory analysis of kilishi purchased from different locations in Nigeria is represented in Table 1. Significant differences ( $p > 0.05$ ) were not observed in the kilishi gotten from Kano, Kaduna, Sokoto, Abuja, and Owerri. The kilishi were generally scored high in most of the parameters and the no significant effects of location suggest that the procedures for kilishi production are fairly uniform across these locations. This means that there is no significant difference in appearance, likeness, flavor, tenderness, juiciness, and hotness of the kilishi gotten from different locations in Nigeria.

Table 2: shows the result of 5-point hedonic rating tests of the Kilishi samples from the different locations in Nigeria. Significant differences were found for all the parameters except saltiness and the tenderness. The degree of likeness for colour of kilishi from Kano (3.46) was higher than those from Kaduna, and Sokoto while those from Abuja and Owerri were similar. In the overall flavor strength, there is a similarity in those from Kano, Sokoto and Owerri which is significantly different from Kano and they are higher than those from Abuja. The juiciness score of kilishi from Kano is significantly different from those from Abuja, Sokoto and Owerri, which are higher than those from Kaduna. The degree of hotness in Kano, and Owerri are similar to each other and they are higher than Abuja which is also higher than Kaduna and Sokoto which are similar.

**Table 1: Sensory Characteristics of Kilishi Purchased from Different Locations in Nigeria**

| Parameter  | Kano | Kaduna | Abuja | Sokoto | Comfort (Oweri) | 12 spices (Owerri) | SEM   |
|------------|------|--------|-------|--------|-----------------|--------------------|-------|
| Appearance | 7.08 | 7.08   | 6.77  | 7.38   | 7.00            | 6.77               | 0.405 |
| Colour     | 6.54 | 6.77   | 7.46  | 7.38   | 7.57            | 7.54               | 0.414 |
| Likeness   | 7.69 | 6.54   | 7.85  | 7.69   | 7.31            | 7.31               | 0.368 |
| Flavour    | 7.00 | 6.62   | 6.92  | 7.31   | 7.23            | 7.23               | 0.457 |
| Tenderness | 6.83 | 7.25   | 7.25  | 6.75   | 5.92            | 5.92               | 0.706 |
| Juiciness  | 6.62 | 6.15   | 7.38  | 7.00   | 7.08            | 7.08               | 0.473 |
| Hotness    | 5.08 | 4.15   | 6.00  | 5.00   | 5.08            | 5.08               | 0.686 |

9 point category rating was used; 9 = extremely high; 8 = very high; 7 = moderately high; 6 = slightly high; 5 = neither high nor low; 4 = slightly low; 3 = moderately low; 2 = very low; 1 = extremely low

**Table 2: Hedonic rating (score) of sensory characteristic of kilishi purchased from different locations in Nigeria (range 1- 5)**

| Parameters               | Kano              | Kaduna            | Abuja             | Sokoto            | A                 | B                 | SEM   |
|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------|
| Colour                   | 3.46 <sup>a</sup> | 3.00 <sup>b</sup> | 2.62 <sup>c</sup> | 3.08 <sup>b</sup> | 2.77 <sup>c</sup> | 2.77 <sup>c</sup> | 0.176 |
| Overall flavour strength | 3.23 <sup>b</sup> | 3.46 <sup>a</sup> | 2.62 <sup>c</sup> | 3.31 <sup>a</sup> | 3.31 <sup>a</sup> | 3.31 <sup>a</sup> | 0.179 |
| Saltiness                | 2.83              | 3.25              | 2.67              | 2.92              | 2.92              | 2.92              | 0.292 |
| Tenderness               | 3.77              | 2.85              | 3.08              | 3.08              | 2.77              | 2.77              | 0.28  |
| Juiciness                | 3.62 <sup>a</sup> | 2.62 <sup>c</sup> | 3.00 <sup>b</sup> | 2.92 <sup>b</sup> | 2.77 <sup>b</sup> | 2.77 <sup>b</sup> | 0.169 |
| Hotness                  | 3.31 <sup>a</sup> | 2.38 <sup>c</sup> | 2.69 <sup>a</sup> | 2.46 <sup>c</sup> | 3.23 <sup>a</sup> | 3.15 <sup>a</sup> | 0.2   |

a,b,c, Means within a row with different superscripts are significantly different ( $p < 0.05$ ).

five point hedonic rating was used: 5 – like, 4-like slightly, 3-neither like nor dislike, slightly dislike, dislike

The variations in the values could be due to different in ingredients used in production. There is a significant difference in color, overall flavor strength, juiciness and hotness of the kilishi gotten from Kano, Kaduna, Sokoto, Abuja, and some from Owerri. Isah and Okubanjo (2012). had reported that the level of inclusion of the spices used in the kilishi production affected the consumer preference

### Microbial Profile

The microbial profile of kilishi samples from the different locations are shown in Table 3. *Fungi*, *salmonella*, *E.coli*, *staphylococcus* and *coliform* were isolated from the samples. This could be through contamination of the samples by microorganism through use of contaminated hands, surface and utensils and exposure of the samples to flies during sun drying. This agrees with the report of Igwe *et al.* (2015). The fungi (yeast and mould) count were low and the total viable bacteria count ranges from  $1.26 - 2.79 \times 10^3$  (cfu/g) is similar to the total aerobic plate counts of  $1.37 \times 10^3$  to  $1.72 \times 10^3$  (cfu/g) on day one of production reported by Iheagwara & Okonkwo (2016) and  $2.1 \times 10^2$  CFU/g reported by (Okonko *et al.*, 2013) but lower than  $1.2 \times 10^5 - 7.6 \times 10^5$  (Ogbonnaya & Imodiboh, 2009),  $4.32 \times 10^3$  cfu/ml reported for fresh kilishi samples from the vendors of locally processed in Port Harcourt, Nigeria (Okonko *et al.*, 2013). According to Health Protection Agency (2001) less than  $10^6$  cfu/g was set as satisfactory limit and  $<10^7$  cfu/g as acceptable range. The commission on microbiological specifications for foods (ICMSF, 1996) also recommended a range limit between  $2.5 \times 10^5$  to  $1.0 \times 10^8$  cfu/g for consumable meat products. Therefore the values of the samples obtained in this study fell within the satisfactory and acceptable range which indicates the kilishi samples from these locations are safe for consumption at week 1 of production. The hurdle technology and low moisture content of the kilishi samples must have been responsible for this. Jones *et al.* (2011) had reported that kilishi samples were sufficiently dried to minimize microbial growth. Iheagwara and Okonkwo (2016) reported that varying the percentage of ingredients used in the infusion slurry for the kilishi production significantly affects the physicochemical and organoleptic characteristics of the kilishi product.

**Table 43: Microbial profile of Kilishi samples from different locations in Nigeria**

| Parameters                          | Kano                | Kaduna              | Abuja               | Owerri             |
|-------------------------------------|---------------------|---------------------|---------------------|--------------------|
| Total Plate Count (CFU/g)           | $23.73 \times 10^3$ | $36.56 \times 10^3$ | $22.71 \times 10^3$ | $5.16 \times 10^3$ |
| Total Viable Bacteria Count (CFU/g) | $2.26 \times 10^3$  | $2.79 \times 10^3$  | $1.66 \times 10^3$  | $1.26 \times 10^3$ |
| Fungi (mould & Yeast) count (CFU/g) | $1.00 \times 10^2$  | $0.79 \times 10^2$  | $0.52 \times 10^2$  | $0.35 \times 10^2$ |
| <i>Salmonella</i> Count (CFU/g)     | $1.22 \times 10^2$  | $0.94 \times 10^2$  | $0.77 \times 10^2$  | $0.50 \times 10^2$ |
| <i>E. Coli</i> Count (CFU/g)        | $0.87 \times 10^2$  | $0.80 \times 10^2$  | $0.66 \times 10^2$  | $0.55 \times 10^2$ |
| <i>Staphylococcus</i> Count (CFU/g) | $0.60 \times 10^2$  | $0.88 \times 10^2$  | $0.26 \times 10^2$  | $0.14 \times 10^2$ |
| Total Coliform count (CFU/g)        | $0.36 \times 10^2$  | $0.53 \times 10^2$  | $0.26 \times 10^2$  | $0.42 \times 10^2$ |



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## CONCLUSION AND RECOMMENDATION

Based on the result of this study, kilishi from different locations in Nigeria did not vary much in sensory characteristics and are bacteriologically safe for human consumption after week 1 of production. Therefore it is recommended that this study should be carried out at some weeks and months of storage to know the safety and wholeness of the product by studying its sensory, microbial profile and proximate composition.

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