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Effects of slurries on the quality of *Kilishi*

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ABSTRACT: In a bid to evaluate the effects of slurries on the quality of *Kilishi*, fresh beef was procured, sliced and sun-dried. Thereafter, the groundnut, Bambara nut and soybean slurries were prepared with the addition of spices and seasonings. Afterwards, they were taken to the laboratory for proximate analysis. The dried beef samples were weighed and divided equally into three groups. The first group was infused into the groundnut slurry, the second group was infused into the Bambara nut slurry and the third group was infused into the soybean slurry and sundried. The dried infused beef slices were roasted, cooled and packaged for proximate, microbial and sensory analysis. The results showed a significant difference ($p<0.05$) in the proximate composition of the slurries. However, the effects of the slurries on the proximate composition of the *Kilishi* showed no significant difference ($p>0.05$) across the treatments. No significant difference ($p>0.05$) was also found in the effect of the slurries on microbial counts of the *Kilishi* except for bacterial counts. Microbes such as *Escherichia coli*, *Staphylococcus* and *Fungi* were isolated from the *Kilishi* samples while *Salmonella*, Fecal coliform and *Clostridium* were not found. *Kilishi* made with soybean slurry had the highest microbial load compared to other treatments. In addition, no significant difference ($p>0.05$) was found in the effects of the slurries on the sensory quality of the *Kilishi* except in juiciness and overall acceptability. *Kilishi* made with groundnut slurry was overall accepted by the sensory panelist compared to other treatments. Therefore, from the study, Bambara nut and soybean should be used as *Kilishi* slurries since they can achieve similar results as groundnut. The *Kilishi* samples were safe for consumption since they fell within the acceptable range of 2.5×10^5 to 1.0×10^8 cfu/g for consumable products.

Keywords: *Kilishi*, microbial counts, processing, proximate composition, sensory.

INTRODUCTION

Meat is prone to spoilage due to its nutritional enrichment and availability of moisture which aids the growth and proliferation of harmful microorganisms (Anas *et al*., 2019). To prevent this from occurring, value addition to meat is essential (Gómez *et al*., 2020). This involves processing and preserving meat to prolong its shelf-life, preserve its nutritional composition, improve its sensory quality and acceptability (Kumar *et al*., 2017; Roohinejad *et al*., 2017) and safety for consumption (Dinçer, 2021). Additionally, meat processing can improve meat quality by adding value to raw meat, which may be sold in a variety of ways thereby promoting economic efficiency. Among several methods used in meat processing and preservation is the drying method. This method is simple, affordable and suitable to the local environment in terms of social and economic conditions. Drying is the process of removing water or other solvents from a solid, liquid, or gas (Calín-Sánchez *et al*., 2020). It is one of the oldest methods of food preservation as it eliminates moisture by air or sun drying, hence, inhibiting microbial development and prolonging the shelf life of the product (Ryoba *et al*., 2013). Among several meat products that have been produced by drying, *Kilishi* is increasingly gaining widespread acceptance and importance recently both in Nigeria and some other countries in sub-Saharan Africa (Iyiola *et al*., 2023). *Kilishi* is a sundried meat that is made from beef, mutton or chevon. However, beef is mostly used (Abubakar *et al*., 2011). It is a rich nourishing snack with a supplementary plant protein that is formulated using hurdle technology (Iheagwara and Okonkwo, 2016). *Kilishi* is not just only a snack but a cultural icon deeply ingrained in the country's culinary heritage. It originated from the northern regions of Nigeria and has transcended regional boundaries to become a delicacy enjoyed across the nation (Youngstedt, 2013). Its preparation involves a meticulous process that transforms raw meat into highly flavoured and shelf-stable snacks (Sathya, 2018). Traditionally, *Kilishi* is produced by carefully selecting high-quality lean meat, typically beef. The meat is then sliced into thin strips, maximizing the surface area for the infusion of flavours, where the meat undergoes a bath of rich, aromatic marinades known as slurries (Behera *et al*., 2020). These slurries are composed of a medley of spices, herbs, and other seasonings (Espinosa-Ramírez, 2022) which not only impart complex flavours but also serve as tenderizers to the meat, ensuring a succulent texture upon drying (Stiffman, 2023). The importance of these slurries cannot be overstated; they are the essential parts of *Kilishi*, infusing each bite with the essence of tradition and craftsmanship. As such, understanding the effects of different slurries on the quality of *Kilishi* is paramount, offering insights into the nuanced interplay of ingredients and techniques that shape the product. Despite the cultural significance of *Kilishi* as a traditional Nigerian delicacy, there exists a notable gap in scientific understanding regarding the role of different slurries in shaping its quality attributes. There is limited empirical evidence regarding the specific effects of different slurry compositions on proximate composition, sensory qualities and microbial count of *Kilishi*. This lack of scientific knowledge hinders efforts to optimize *Kilishi* production methods, ensure consistency in quality, and meet consumer preferences and market demands. In addition, the principal material for *Kilishi* slurry (deffated groundnut paste) is expensive and may not be readily available in the future due to its use by both man and livestock. Therefore, there is a need to explore alternative slurry materials that are cheap and locally available. In this research, we delve into the intricacies of various slurry compositions, exploring their effects on sensory qualities, proximate composition and the microbial loads of *Kilishi*.

MATERIALS AND METHODS

Source of experimental materials

The research was carried out at the Laboratory of Soil Science, Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State Nigeria. Fresh beef meat, ingredients (soybean, Bambara nut, groundnut, seasonings and spices) and other equipment used in the study were purchased at the old market in Wukari Metropolis.

Meat preparation

This was carried out according to the method described by Alamuoye (2019) with little modification. 6 kg of beef from the round of freshly slaughtered carcass was trimmed free of fat, bones and excess connective tissues. The chunk was cut into smaller portions of about the size of 150-200 g. Thereafter, each portion was sliced along the fibre axis into thin slices of about 2 mm thickness in continuous sheets. The pieces of sliced meat were then spread on the wooden mat and sun-dried. This was the first stage of drying which lasted for about one to two days depending on the relative humidity, intensity of the sun and air velocity. The meat stripes were turned over every hour to allow them to dry properly and prevent them from getting stuck to the drying surfaces. The dried meat was kept in airtight containers for further processing.

Defatted groundnut, Bambara nut and soybean paste preparation

The major ingredient in processing *Kilishi* is the defatted groundnut paste. The defatted groundnut paste was obtained from the dehulled seed and roasted for 10-15 minutes and cooled. The testa was removed, cleaned, and milled into a paste with a grinding machine. The milled paste was put in a bowl on a table and kneaded, and the oil was extracted as the kneading proceeded. The defatted groundnut paste obtained after the extraction was used in slurry preparation. The same method was used in the preparation of Bambara nut and soybean paste except warm water was added to Bambara nut and soybean paste to allow easy extraction of their oils.

Slurry preparation

This was done according to the procedure described by Iyiola *et al*. (2021). To the resultant pastes from defatted groundnut, Bambara nut and soybean respectively, the blended spices and seasonings were added as shown in Table 1. The different mixtures were mixed with 35 ml of clean water using a mortar and pestle until a uniform paste was formed. The slurries were produced on the day of *Kilishi* production to prevent microbial spoilage and minimized the possible development of rancid flavour. Thereafter, they were taken to the laboratory for proximate analysis.

Kilishi preparation

This was done according to the procedure described by Iyiola *et al*. (2021). The dried beef samples were weighed

Table 1. Ingredient composition of the slurries

Ingredients	Groundnut slurry (g)	Bambara nut slurry (g)	Soybean slurry (g)
Groundnut	36.00	0.00	0.00
Soybeans	0.00	0.00	36.00
Bambara nut	0.00	36.00	0.00
Ginger	3.00	3.00	3.00
Garlic	1.00	1.00	1.00
Black pepper	2.00	2.00	2.00
Red pepper	2.00	2.00	2.00
Sweet pepper	2.00	2.00	2.00
Alligator pepper	1.00	1.00	1.00
Onion	5.00	5.00	5.00
African nutmeg	2.00	2.00	2.00
Curry	2.00	2.00	2.00
Salt	3.00	3.00	3.00
Knorr ©	2.00	2.00	2.00
Sugar	3.00	3.00	3.00
Water (ml)	36.00	36.00	36.00
Total	100	100	100

and divided equally into three groups (1, 2 and 3). The first group of dried beef was infused into the groundnut slurry (Treatment 1), the second group was infused into the Bambara nut slurry (Treatment 2) and the third group was infused into the soybean slurry (Treatment 3). Each of the treatments was done one after the other and replicated thrice. They were left for 1 hour in other to allow the slurries to penetrate the sliced beef. After which they were carefully spread out on the wooden mat and allowed to sun-dry. After drying for 10-12 hours, the infused beef slices were roasted for 5-10 minutes to heat seal the ingredients in the products and destroy any microorganisms that might have contaminated the meat samples during drying. Thereafter, they were cooled on a tray and packaged in different air-tight containers for further analysis.

Proximate analysis of the slurries and *Kilishi*

The proximate composition of the slurries and *Kilishi* samples were analyzed according to the methods described by AOAC (2006) to determine moisture content (MC), crude protein (CP), total ash (TA), crude fat (CF) and crude fibre. Moisture content was determined by drying 5 g of *Kilishi* sample in an oven at a temperature of 105°C to a constant weight. The crude protein of the *Kilishi* and slurries samples were determined by Kjeldahl methods while Ether extract/lipid was obtained by Soxhlet extraction method using petroleum ether. Ash content of *Kilishi* and slurry was obtained by igniting 1 g of *Kilishi* and slurry samples in a Muffle furnace at 500°C for 5 to 6 hours until ashes were produced.

Microbial counts analysis

This was done according to a procedure described by Buhari *et al.* (2012). Using a sterile knife, 10 g of the sample was cut and transferred aseptically into 90 ml of 0.1% sterile peptone water (Stock solution). It was allowed to sock for about 10 minutes after which 1 ml was transferred into a bottle containing 0.1% sterile peptone water (10-1) dilution. This was severally diluted with 10^{-7} dilution and obtained with the aid of a sterile pipette. 0.1 ml of 10^{-5} dilution was aseptically transferred onto a surface of a Plate count agar (PCA), Eosin methylene blue agar (EMB), *Salmonella* and *Shigella agar* (SSA), Manito salt agar (MSA), Macconkey agar, blood agar base and potato dextrose agar plates and were spread evenly on the surface by using a spreader. The plates were then incubated at 37˚C for 24 hours. At the end of the incubation period, the bacterial colonies grown on all of the media were counted and the results were expressed as colony forming unit per gram (CFU/g) by using the formula:

$$\mathrm{CFU/g} = \frac{\text{Total No. of colonies counted x dictation factor}}{\text{Volume of inoculate}}$$

Sensory analysis of *Kilishi*

This was performed according to the method described by Nasiru *et al*. (2011). 10 samples from each of the *Kilishi* produced from different slurries were served randomly to 15 staff panelists drawn from the Department of Animal Production and Health in the Faculty of Agriculture and Life

Sciences, Federal University Wukari. Membership of the panel was voluntary while their selection was based on interest and ability to understand the test procedures. Each staff evaluated the *Kilishi* samples and each of the samples was given one at a time and evaluated using the sensory questionnaires. The samples of the *Kilishi* were evaluated for overall appearance, colour, tenderness, juiciness, flavour and overall acceptability characteristics using a 9-point hedonic rating scale as described by Ranganna (2001). The sensory evaluation was carried out a day after production due to the availability of the panelists.

Statistical analysis

The data generated were statistically analyzed using one–way analysis of variance (ANOVA). The differences in means were separated using LSD. The Statistical Package SPSS Version 20 was used.

RESULTS AND DISCUSSION

Proximate composition of slurries

The proximate composition of the different slurries presented in Table 2 showed significant differences ($p<0.05$) across the slurries. Soybean slurry had the highest moisture content (8.05%), crude protein (39.60%) and crude fibre (3.46%) compared to other slurries while groundnut slurry had the highest lipid content (46.79%) across the treatments. In addition, Bambara nut slurry had ash and carbohydrate contents of 4.87 and 56.21%, respectively. The highest moisture and crude protein contents found in soybean slurry could be attributed to the soybean seeds used. According to Etiosa *et al*. (2017), the moisture and crude protein content of soybean seeds were 8.07% and 37.69%, respectively which are higher than that of groundnut seeds (4-7 and 20-30%) and Bambara nut with 23% of protein (Trinh *et al*., 2023; Detzel *et al*., 2022). The low moisture content found in groundnut slurry could also be attributed to the groundnut seed used. More so, no water was used to extract the oil from the groundnut paste, unlike the soybean and Bambara nut paste for which water was used to extract their oils. This agrees with the range of 4-7% moisture content of groundnut reported by Trinh *et al*. (2023) which translates to a longer shelf life, making it a convenient and energy-dense snack option (Hassanally, 2020). Similarly, the highest lipid content found in groundnut slurry is also attributed to the groundnut seeds used. According to Opio and Photchanachai (2018), groundnuts contain impressive fat content, ranging from 40 to 50%. The low crude protein and fat content found in Bambara nut could also be attributed to its chemical composition because the crude protein and fat content of Bambara nut range from 18-23% and 5.8-6.3%, respectively (Detzel *et al*., 2022; Veldsman *et al*., 2023) which is low compared to other treatments.

The differences found in the proximate composition of the slurries could be attributed to the variation in the chemical composition of the groundnut, Bambara nut and soybean seeds used in their production. Producers can tailor slurries to suit regional preferences, consumer tastes, and market trends, resulting in a diverse range of *Kilishi* variations that meet the needs of a wider audience. This flexibility enables *Kilishi* producers to differentiate their products in a competitive market while preserving the authenticity and heritage of this traditional delicacy (Stevanovic and Wanyang'Ochieng, 2023).

Proximate composition of *Kilishi*

The proximate composition of foods which includes moisture, ash, fat, protein and nitrogen-free extract contents are food components which may be of interest in the food industry for product development, quality control or regulatory purposes. The effects of different slurries on the proximate composition of *Kilishi* presented in Table 3 show no significant difference ($p>0.05$) across the treatments. This is an indication that the different slurries used in the production had a similar ($p>0.05$) effect on the proximate composition of *Kilishi*. However, *Kilishi* made with soybean slurry had the highest moisture (6.13%) and crude protein content (50.71%) compared to other treatments. This might be linked to the slurry composition of the treatment (Table 2).

Crude protein is a measure of all the protein in the food through a chemical analysis that measures the amount of nitrogen present as a way of estimating the protein content. The range of crude protein content (48.57-50.71%) in this study was steadily lower than the range of 51.62 to 55.84% reported by Iheagwara and Okonkwo (2016), 66.61 to 69.92% reported by Iyiola *et al*. (2021), 53.41 to 64.53% reported by Isah and Okubanjo (2012), 55.47 to 62.33% reported by Olusola *et al*. (2012), 60.6±0.11 to 60.9±0.16% reported by Daminabo *et al*. (2013) and 51.62 to 55.84% reported by Mgbemere *et al*. (2011). The concentration of nutrients during the drying process is the cause of this high protein content (Apata *et al*., 2013). Protein is crucial for building and repairing tissues, producing enzymes and hormones, and supporting a healthy immune system (Adeyeye *et al*., 2021). In areas where animal protein is scarce, *Kilishi* emerges as a valuable source of nutrients (Adeyeye, 2016).

The highest fat content was found in *Kilishi* made with groundnut slurry (14.90%) while *Kilishi* made with soybean slurry had the lowest fat content (13.44%). The range of fat content in this study is lower than 17.34 to 19.20% reported by Iheagwara and Okonkwo (2016), 25.36±

Table 2. Proximate composition of the slurries.

Parameters	Groundnut slurry (%)	Bambara nut slurry (%)	Soybean slurry (%)	SEM	P value
Moisture	5.43^{c}	7.03^{b}	8.05^{a}	0.48	0.000027
Crude protein	38.42^{c}	18.35^{b}	39.60^{a}	4.36	0.000000
Lipids	46.79^{a}	8.15^{c}	28.22 ^{b}	7.06	0.000000
Ash	3.24^{c}	4.87^{a}	4.25^{b}	0.30	0.000009
Crude fibre	3.63^{c}	5.40^{b}	5.46^{a}	0.38	0.000000
Carbohydrate	2.50^{c}	56.21^{a}	14.43^{b}	10.30	0.000000

SEM: Standard Error of Mean, abc Means in the same row with different superscripts are significantly different (p<0.05).

Table 3. Effects of slurries on proximate composition of *Kilishi*.

Parameters	Groundnut *Kilishi* (%)	Bambaranut *Kilishi* (%)	Soybean *Kilishi* (%)	SEM	P value
Crude protein	49.63	48.57	50.71	0.43	0.12
Crude fibre	1.38	2.10	1.53	0.15	0.10
Fat	14.90	14.69	13.44	0.44	0.38
Ash	5.77	6.33	6.51	0.17	0.21
Nitrogen free extract	22.20	22.88	21.68	0.38	0.86
Moisture	6.12	5.43	6.13	0.19	0.23

SEM: Standard Error of Mean.

1.35% reported by Jones *et al*. (2001), and 17.91 to 18.31% reported by Igwe *et al*. (2015). The highest fat content found in *Kilishi* made with groundnut slurry could be attributed to the slurry used (Table 2) which will enhance the sensory quality of the sample. This is in agreement with Iyiola *et al*. (2021) that the particular recipe utilized or slurry used might affect the fat content of *Kilishi* which is the most important precursor of cooked meat flavour (Resconi *et al*., 2013). Fat is mainly used to determine the energy value of food products by food processors. It also contributes to the flavour, texture, and mouth feel of *Kilishi*.

Though there is no significant difference (p>0.05) in ash contents among the treatments but *Kilishi* made with soybean slurry had the highest ash content (6.51%) followed by *Kilishi* made with Bambara nut slurry (6.33%) which is an indication that both treatments had better mineral contents than that of *Kilishi* made with groundnut slurry and could be due to the composition of the slurry used (Table 1). This is in agreement with the report of Elizabeth (1995) that the ash content of any processed meat would be the ash content of the muscle tissue in addition to that of the ingredients used. Okorie (2018) reported that the ash content of *Kilishi* was higher, relative to the raw meat with a difference of 1.94%. The range of ash content in this study is higher than the range of 4.54 to 5.58% reported by Mgbemere *et al*. (2011) but lower than 6.72+0.13% reported by Jones *et al*. (2001).

The moisture content found in this study is very low which will aid in its preservation and inhibit microbial spoilage. Moisture content is a critical factor influencing the texture, flavour, and shelf life of *Kilishi*. This dramatic reduction in moisture is the very essence of the drying process. Proper dehydration during the drying process for a long period is essential for reducing moisture content to levels that inhibit microbial growth and prevent spoilage (Yusuf *et al*., 2020). Thereby significantly extending the shelf life of *Kilishi* and making it a valuable food source in regions with limited access to refrigeration (Aworh, 2023). According to Iheagwara *et al*. (2021), *Kilishi* typically has a low moisture content, ranging from 10 to 20%, depending on processing conditions and desired texture. The low moisture content of *Kilishi* could be attributed to the two-stepwise drying in *Kilishi* processing. According to Ogunsola and Omojola (2008), this processing method had a significant effect on the moisture content of the sample and also increased the preservative capacity of the product.

Microbial counts of *Kilishi*

Effects of different slurries on microbial counts of *Kilishi* in Table 4 showed no significant difference (p>0.05) across the treatments except in bacterial count. Microbes such as *Escherichia coli* (*E. coli*), *Staphylococcus* and *Fungi* were isolated from the *Kilishi* samples while *Salmonella,* Fecal coliform and *Clostridium* were not found. The highest and lowest bacterial counts (3.03 and 1.37 cfu/ml) were found in Kilishi made with soybean and groundnut slurry

Table 4. Effects of different slurries on microbial counts of *Kilishi*.

Parameters	Groundnut *Kilishi* cfu/ml)	Bambara nut *Kilishi* cfu/ml)	Soybean *Kilishi* cfu/ml)	SEM	P value
Bacterial count (x 107)	1.37[b]	2.27[ab]	3.03[a]	0.29	0.04
E coli count (x 107)	2.40	2.30	3.03	0.50	0.85
Staphylococcus count (x 107)	1.97	2.61	3.70	0.61	0.56
Fungi count (x 106)	1.50	1.60	1.63	0.09	0.86
Salmonella count	0.00	0.00	0.00	0.00	0.00
Fecal coliform *count*	0.00	0.00	0.00	0.00	0.00
Clostridium count	0.00	0.00	0.00	0.00	0.00

[ab]Means in the same row with different superscripts are significantly different (p<0.05), SEM: Standard Error of Mean.

Table 5. Effects of different slurries on sensory quality of *Kilishi*.

Parameters	Groundnut Kilishi	Bambaranut Kilishi	Soybean kilishi	SEM	P value
Overall appearance	7.30	6.60	6.10	0.34	0.36
Colour	6.40	6.30	5.90	0.35	0.84
Flavor	7.30	6.80	6.20	0.25	0.20
Tenderness	6.80	6.90	5.80	0.27	0.19
Juiciness	7.20[a]	6.90[ab]	5.10[b]	0.35	0.02
Overall acceptability	7.60[a]	6.60[ab]	5.80[b]	0.30	0.04

[ab]Means in the same row with different superscripts are significantly different (p<0.05), SEM: Standard Error of Mean.

respectively. Although no significant difference (p>0.05) was found among the microbes, however, *Kilishi* made with soybean slurry had the highest microbial load while *Kilishi* made with groundnut slurry had the lowest microbial load compared to other treatments. This could be attributed to the soybean slurry used which could have the tendency to support microbial growth. The result is similar to the report of Iyiola *et al*. (2021) who observed the highest microbial count in oven-dried *Kilishi* made with soybean slurry. *Staphylococcus aureus, Staphylococcus epidermidis, Proteus vulgaris, Klebseilla pneumoniae, Escherichia coli, Candida spp, Salmonella enteritica* and *Enterobacter spp.* were found in *Kilishi* sold in Kano metropolis (Inusa and Said, 2017). Fonkem *et al*. (2010) isolated *E. coli* and *Staphylococcus aureus* from Cameroonian *Kilishi* while Okonko *et al. (2013)* identified *Bacillus spp*. and *Botryodiplodia theobromae* from freshly prepared *Kilishi*. The absence of microbes such as *Clostridium*, *Salmonella* and faecal coliform on the *Kilishi* samples could be attributed to the spices used in slurry preparation. According to Serna-Saldivar (2022), slurries serve as natural preservatives, safeguarding the meat against microbial spoilage and extending its shelf life without the need for artificial additives or preservatives. The antimicrobial properties of spices and herbs, coupled with the salt content in the marinade, create an unfavourable environment for bacteria and fungi, inhibiting their growth and ensuring the safety and quality of the *Kilishi* (Rai, 2022). The range of bacterial counts 1.37 – 3.03 x 10^7(cfu/ml) found in this study is higher than the range of 2.37- 2.65 × 10^3 (cfu/ml) reported by Iyiola *et al*. (2021) as the total viable count of oven-dried *Kilishi* made from different slurries. The *Kilishi* produced in this study is safe and wholesome for consumption since they fall within the acceptable range of microbial load 5.4 -8.0 log 10 cfu/g set for ready-to-eat food products (Jones *et al*., 2001) and 2.5 x 10^5 to 1.0 x 10^8 cfu/g as recommended by International Commission on Microbiological Specifications for Foods (ICMSF, 1996) for consumable meat products. Microbial quality and safety of meat products are very important in ensuring consumers' health and food security after production (Shamsuddeen, 2009). The microbiological safety of *Kilishi* starts with the selection and handling of raw materials, particularly meat. High-quality, fresh meats from reputable suppliers are essential to minimize the risk of contamination with pathogenic bacteria (Munekata, 2021). Therefore, to reduce the microbial load, proper sanitation practices including hand washing, sanitization of equipment, and separation of raw and cooked foods, help prevent cross-contamination during meat processing (Owusu-Apenten and Vieira, 2022).

Sensory quality of *Kilishi*

The effects of different slurries on the sensory quality of *Kilishi* presented in Table 5 showed no significant difference (p>0.05) in some of the parameters analyzed except for juiciness and overall acceptability which were significant. The juiciness and overall acceptability in *Kilishi* made with groundnut slurry was significantly (p<0.05) higher than in *Kilishi* made with soybean slurry but comparable (p>0.05) to *Kilishi* made with Bambara nut slurry. This implies that the same sensory quality of *Kilishi* can be obtained with all the slurries except in juiciness. The highest sensory score and overall acceptability found in *Kilishi* made with groundnut slurry could be attributed to the highest fat content of the sample (Table 2) which is responsible for the increase in flavour and juiciness of the sample. Winger and Hagyard (1994) reported that juiciness is related to the fat content of the meat. Fats or fat-soluble precursors also contribute to meat flavour (Mottram, 1998; Resconi *et al*., 2013).

Sensory properties are essential because consumers need to be satisfied with the sensory properties before other elements become relevant. The sensory properties of meat and meat products have an impact on consumer appreciation of the meat which in turn affects their perception of its acceptability and quality (Simela, 2005). Sensory qualities are of economic value as they affect the amount of processed product sold and how often a consumer buys the same product (Aaslyng, 2009). Slurries play a crucial role in enhancing the overall sensory qualities of *Kilishi*, contributing to its unique flavour profile, tenderness, and preservation qualities (Alamuoye *et al.*, 2024).

Conclusion

In the evaluation of the effects of different slurries (groundnut, Bambara nut and soybean) on the quality of *Kilishi*, a significant difference (p<0.05) was found in the proximate composition of the slurries. However, no significant difference (p>0.05) was observed in the effects of the slurries on the proximate composition of the *Kilishi* across the treatments. Similarly, no significant difference was also found in the effects of the slurries on the microbial counts of the *Kilishi* except in bacterial counts. Microbes such as *Escherichia coli*, *Staphylococcus* and *Fungi* were isolated from the *Kilishi* samples while *Salmonella*, Fecal coliform and *Clostridium* were not found on the samples. *Kilishi* made with soybean slurry had the highest bacterial count (3.03 cfu/ml) compared to other treatments which could be attributed to the soybean slurry used in the production. Although microbes were isolated from the *Kilishi* samples but they were safe for consumption because the microbial counts fall within the recommended acceptable range for consumable products. In addition, no significant difference (p>0.05) was found in all the sensory parameters except in juiciness and overall acceptability. *Kilishi* made with groundnut slurry was overall accepted by the panelists compared to other treatments which is attributed to the slurry used. This study showed that the use of Bambara nut and soybean slurry can be used to achieve the nearly same result as groundnut slurry in proximate, sensory and microbial quality of *Kilishi*. Proper hygiene practice is recommended to reduce the microbial load during production.

COFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

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