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PROCESSING EFFECT ON THE MICROBIAL AND PROXIMATE COMPOSITION OF KILISHI AT SOUTH EAST NIGERIA

Peter Anyigor Okorie [*1]
[*1] Department of Food Science and Technology Ebonyi State University, Abakaliki, Nigeria

Abstract

The proximate and microbiological compositions of kilishi, a processed meat at Abakaliki, southeast of Nigeria was determined in this study. The moisture, protein, fat, and ash contents, including the microbial count of the raw meat and kilishi in the study area were investigated to ascertain the processing effect. The results show that kilishi has higher protein content, fat content and ash content relative to the raw meat with the difference of 17.04 %, 4.66 % and 1.94 %. The moisture content and microbial count of kilishi are lower compared to the raw meat with a difference of 62.00 % and 17.33 cfu/g. The analysis suggests that the kilishi sold at Abakaliki is safe for human consumption.

Keywords: Proximate Composition; Microbial Properties; Kilishi; Sun Dried Meat Processing.

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1. Introduction

Meat is the flesh of animals that is suitable for use as food. It is the skeletal muscles glands and organs of animals. In Nigeria, the main sources of meat are cow, goat, equine, chicken. The texture, taste and physical appearance of meat could be changed through processing. Processing slows or halts deterioration of meat, so that the essence of preservation, which is among others to retain the good taste of meat, could be easily achieved (Clucas and Ward, 1996). However, inadequate and poor meat processing and handling pose high risk of food poisoning. The relevance of meat as a food for humanity coupled with the incessant use of different processing methods to achieve the objectives of meat preservation have attracted research attention of scholars.

Ogunsola and Omojola (2008) evaluated the quality and studied the proximate composition and the organoleptic characteristics of kilishi prepared from beef and pork at Ibadan, the south west of Nigeria. The effects of packaging materials like polyvinyl chloride, aluminium foil and plastic container on the microbial isolates of the meat after thirty-six week of storage at room temperatures were investigated. The results show that Kilishi from beef is significantly different from that of

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pork in colour and juiciness with the values of 2.33 ± 0.22 and 2.93 ± 0.30 for beef kilishi against 3.70 ± 0.32 and 3.93 ± 0.21 for pork kilishi. The kilishi from beef and pork have similar moisture, protein and fat compositions. The findings show that the aluminium foil packaged products gave the highest microbial load relative to the polyvinyl chloride and plastic container package products.

Egbunike and Okubanjo (1999) measured the qualitative effects of processing on the quality of kilishi, unam inung and processed rabbit meats in southwest Nigeria. The results indicate that the drying behaviour before and after infusion were similarly for kilishi. The yields after dehydration for the oven-dried was 39.88 % and 38.75 % for the sun-dried kilishi. There was higher bacterial devastation in the oven-dried kilishi relative to the sun-dried kilishi. There was no adverse effect on the chemical composition of the kilishi meat. Curing treatment reduced the moisture and protein contents of unam inung meat, but increased lipid content. There was a broad dehydration of rabbit meat during the curing, smoking and ageing stages. The findings show that processing enhances the quality and adequacy of meat products.

Chukwu and Imodiboh (2009) investigated the influence of storage methods on the shelf life of Kilishi at the ambient conditions of north central Nigeria for a period of 42 days. The study compares the conventional production and packaging system with an anti-fungal agent treatment to the modern packaging system. The results show significant variation in the proximate composition and microbial counts for the control and treated kilishi. Treating kilishi with 10 % potassium sorbate results to the low and satisfactory level of mould growth during the storage period. The findings indicated that kilishi is not vulnerable to extreme mould infestation.

Although researchers have studied the effects of processing on characteristics of kilishi at some regions in Nigeria, there exists a little literature about processing of kilishi under the ambient conditions of southeast Nigeria. Therefore, this study seeks to evaluate the effects of processing on kilishi meat at Abakaliki in southeast Nigeria.

2. Materials and Methods

The major raw material was beef meat that was obtained from the Abakpa market in Abakaliki town of Ebonyi state, Nigeria. The blood sample of the beef meat was collected for microbiological evaluation. The kilishi was purchased from Hausa quarters in Abakaliki, Ebonyi state of Nigeria. The fresh meat and processed meat were subjected to proximate composition determination.

2.1. Proximate Analysis

2.1.1. Moisture Content

The method of AOAC (1990) was used. 2g of the fresh meat and kilishi samples were weighed into an evaporating dish and placed inside an oven for 3 hours at a temperature of 100 ℃. After which they were removed from the oven and dried at hourly interval, cooled and weighed until constant weight was achieved. The percentage moisture content was calculated as:

$$\text{Moisture content} = \frac{\text{weight difference}}{\text{initial weght of sample}} \times 100$$

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2.1.2. Crude Protein Content

The method of AOAO (1990) was used. 2g of the fresh meat and kilishi samples were digested with 10 ml of concentrated H_2SO_4. The digest were diluted up to 50 ml with distilled H_20. The digest were neutralized with NaOH and distilled into boric acid. The distillate was titrated with NH_2SO_4. The crude protein content was determined using the formula.

$$\% \text{ CrudeProtein} = \frac{\text{titre value x } 0.0014 \text{ x } 6.25}{\text{weight of sample}} \text{ x } 100$$

2.1.3. Ash Content

The method of AOAC (1990) was used. The crucibles were washed thoroughly, dried in hot oven at 100 ℃, cooled in a desiccator and weighed. 2g of the raw meat and kilishi were weighed into the crucibles and put in the furnace. Heating started gradually until the temperature of 600 ℃ was reached. The temperature was maintained for 6 hours. After burning to ashes, the furnace was switched off and the temperature allowed to drop before the crucibles were removed. The crucibles were then put inside a desiccator and cooled. After cooling, they were weighed. The percentage ash was thus calculated as:

$$\text{Ash } (\%) = \frac{X - Y}{Z - Y} \text{ x } 100$$

Where Y = weight (g) of crucible, Z = weight (g) of the crucible + sample before burning to ashes, X = weight (g) of crucible + sample after burning to ashes.

2.1.4. Fat Content

Soxhlet apparatus was used. 2g of the raw meat as well as the kilishi was treated with petroleum ether in a reflux apparatus. It was allowed to reflux until all the possible lipids were extracted from the sample into a 500 ml round bottom flask. The solvent was recovered and the flask containing the oil was weighed to determined fat content and calculated as:

$$\% \text{ fat} = \frac{\text{weight of lipid}}{\text{weight of sample}} \quad 100$$

2.2. Microbiological Analysis

A reasonable quantity of the prepared meat was soaked in 2 ml of distilled water for a period of 1 hour and was filtered off by decanting. Blood agar was the required medium for the culture of meat samples. 2g of the nutrient agar was dispensed into 1000 ml of distilled water and stored for proper mixing. The medium was autoclaved with temperature of 121 ℃ for 15minutes and was allowed to cool to 55 ℃ before the whole blood from the raw meat added and mixed well and then poured into plates.

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The sample of the processed meat was spread on the surface of the blood agar medium plates, while the raw meat was inoculated, cooled and used to collect samples from the raw meat. The plates were incubated in the incubator at a temperature of 37 ℃ for 24 hours.

3. Results and Discussions

The results of the proximate composition of the meat are presented in Table 1. The table shows that kilishi has higher protein content relative to the fresh meat with the difference of 17.04 %. The protein content of raw meat is 13.60 %, which is lower than the value reported by Ihekoronye and Ngoddy (1985) who reported the value of 19.00 %. The difference in value might be due to age long difference and changes in the environmental conditions of place and period. However, the higher protein content of kilishi indicates that processing meat into kilishi improve the percentage content of the product, which in turn increase the nutrient density. Meanwhile the groundnut cake paste, a major ingredient in kilishi production, which has 55.89 % crude protein according to Badau et al. (1997), may have contributed the high value. Thus, this high protein content of kilishi makes it suitable to be combined with rice that has low protein content but high carbohydrate content. Hence, making kilishi and rice to be nutritionally complementary.

Table 1: Proximate composition of meat

Sample	Protein (%)	Moisture (%)	Fat (%)	Ash (%)
Raw meat	13.60	72.33	17.67	5.73
Kilishi	30.64	10.33	22.33	7.67
Difference	+ 17.04	- 62.00	+ 4.66	1.94

The moisture content of kilishi was significantly lower compared to the raw meat with a difference of 62.00 %. Excessive moisture increase or loss causes substantial deterioration change in food. The low moisture content of kilishi compared to that of raw meat could be attributed to the stepwise drying in kilishi processing technique. Thus, the processing method had a significant effect on the moisture content of the sample. It increases the preservative capacity of the meat. According to Ingram and Simonsen (1980), drying fresh lean meat to 20 % moisture inhibits most bacteria, yeast and mould while a level of 15 % moisture inhibits some species of fungi. More so, Banwart (1979) reported that water activity plays a critical role in the fungal spoilage of meat.

There was a significant increase in the fat content of kilishi relative to the raw meat with a difference of 4.66 %, probably because of the residual oil in the defatted groundnut cake used in preparation. Igene (1988) and Jones et al (2001) noted that kilishi is very high in lipid content (about 25.30 %). On the other hand, the work of Ockeman and Li (1999) connotes that the types of oil as well as the level of inclusion influence meat flavour.

The ash content of kilishi was higher relative to the raw meat with a difference of 1.94 %. Result supports the submission of Matz and Beachell (1969) on raw meat. The high ash content of the kilishi could be attributed to the ingredients added, which is similar to the observation reported by Khalid et al. (1987). The processing of beef into kilishi alters the ash content of the meat as reported by Ogunsola and Omojola (2008), and Chukwu and Imodiboh (2009).

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Table 2 shows the microbiological evaluation of raw meat and kilishi. It shows that processing method has a significant effect on the microbial count of the sample. The microbial count of kilishi is lower relative to the raw meat with a difference of 17.33 cfu/g, probably because of to the processing method and the spices added during processing. The results are in agreement with the report of Vernia et al. (2006) for dehydrated kilishi stored for 2 days post-production. It also concurs with Kembi and Okubanjo (2002) who submitted a change of 4 cfu/g from raw and steam cooked beef before dehydration. It is also similar to the result of Okonkwo (1998) on quality attributes of kilishi produced from minced meat.

Table 2: Microbiological evaluation of meat

Sample	Dilution	Microbial count	Number of organism (Cfu/g)
Raw meat	10^{-1}	65.33	6.53
Kilishi	10^{-1}	48.00	4.80
Difference		17.33	1.73

4. Conclusions

The study reveals that the percentage protein, ash and fat were higher in kilishi (processed meat) than in raw beef. It also reveals that the raw meat has a higher water activity than the kilishi. The microbial count in kilishi falls that of raw meat. The findings of the research show suggest that the kilishi sold at Abakaliki is safe for human consumption.

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*Corresponding author.
E-mail address: paokorie@ yahoo.com