EVALUATION OF THE QUALITY OF SOME PROCESSED MEAT PRODUCTS: KILISHI, BEEF SUYA AND CHICKEN SUYA

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ABSTRACT
Ready to eat kilishi, beef suya and chicken suya samples were collected from different locations within Enugu state and Abuja district part of Nigeria. Studies on the physicochemical properties, lipid profile and microbiological of kilishi, beef suya and chicken suya quality were carried out. Results showed that there were significant differences in all the physiochemical properties (moisture content, water activity, and relative humidity, protein and water absorption capacity) of all the meat samples. There were also significant differences among the samples in total cholesterol and triglycerides. Significant differences equally showed in microbial counts (total microbial count and coliforms. The results revealed that meat products have inherent capacity of being contaminated by microorganisms
Key words: quality, processed meat, Kilish, Beef suya and Chicken suya

INTRODUCTION
Meat is the edible part of an animal used as food obtained after slaughter (Lawrie, 1998).According to Hui *et a*l. (2001) it is the whole or part of the carcass of animals. Processed meat means a product containing no less than 30% moisture, that has undergone a method of preservation other than freezing, and includes manufactured meat and cured and/or dried meat (e.g. sausages, salami, canned meats) (Brown, 2009). The quality of these processed meats has to be taking into consideration for healthy living. This study therefore aimed at evaluating the quality of some processed meat in the market.

MATERIAL AND METHODS
The study was conducted in the Food Science and Technology Laboratory University of Nigeria Nsukka.

Sample collection

- Beef suya was procured from Ogige market, along Enugu road, Nsukka.
- Kilishi was procured from Abuja Northern part of Nigeria.
- Chicken suya was procured from Ogige market, along Enugu road, Nsukka.

Determination of pH: The pH was determined using pH meter model 20 (Denver instrument).
Determination of water activity: The water activity (aW) of the meat was determined using water activity meter (Model 5803
Determination of moisture content: This was determined by the hot air oven method of AOAC (2010).
Determination of soluble proteins: The nitrogen content of each fraction of the filtrate (T_1) and the residue (T_2) were determined according to micro – kjeldahl method.
Relative humidity: The relative humidity of the meat sample was measured using digital relative humidity indicator (Vaisala temperature and relative humidity indicator HM131, Vantaa, Finland).
Mould count determination: this was determined according to Harrigan and McCance (1976),
Determination of total microbial count: Nutrient agar was used to determine total microbial count.
Experimental design and data analysis: The study was conducted using a completely randomized design (CRD). Data generated were subjected to the analysis of variance (ANOVA) using statistical product for social sciences (SPSS 2003) version 16.0.

Result and Discussion

The analysis of physicochemical properties (moisture content, water activity, pH, relative humidity, protein and water absorption capacity) of kilishi, beef suya and chicken suya are presented in **table 1 below**.

Moisture content (MC): Smoked chicken had significantly ($p<0.05$) higher moisture content (59.05±0.14%) than suya (29.9±0.01%) and kilishi at (4.52±0.01%). Kilishi had the least moisture content.

Water activity (WA): The water activity (0.13±0.01) of kilishi was significantly ($p<0.05$) lower than that of suya (0.25±0.01) and that (0.55±0.01) chicken. This result indicated that smoked chicken had the highest water activity, while kilishi had lowest water activity.

pH: The results indicated that the pH (8.0±0.03) of smoked chicken was significantly ($p<0.05$) higher than the Ph of suya (7.10±0.14) and the pH of kilishi (5.80±0.14). This showed that kilishi was slightly acidic with pH 5.8; suya meat had a neutral pH at 7.1, while smoked chicken was slightly alkaline.

Relative humidity (RH): Smoked chicken had significantly ($p<0.05$) higher percentage of water vapour (55.0±1.41) than suya and kilishi, followed by suya with water vapour %of (25.0±1.41). Kilishi had the least percentage of water vapour (5.80±0.14).

Protein (%): The result showed that the protein content (95.19±0.01) of suya was significantly ($p<0.05$) higher than those of kilishi and smoked chicken, followed by kilishi with a protein content of (43.37±0.01). Smoked chicken had least protein content.

Water absorption capacity (WAC): The water absorption capacity value of kilishi was significantly ($p < 0.05$) higher than the values for chicken (167 ± 1.41) and suya (95.19 ± 0.01).

Table1. Shows the physicochemical properties of the meat samples evaluated

Samples	MC%	WA	pH	RH%	Protein	WAC%
KS	4.52^{c}±0.01	0.13^{c}±0.01	5.80^{c}±0.14	13.2^{c}±0.14	43.37^{a}±0.01	175.0^{a}±1.41
BS	29.9^{b} ±0.01	0.25^{b}±0.01	7.10^{b} ±0.14	25.0^{b}±1.41	95.19^{b}±0.01	95.19^{b}±0.01
CS	59.70^{a}±0.14	0.55^{a}±0.01	8.0^{a}±0.03	$55.o^{a}$±1.41	24.0^{c}±0.01	167.0^{b}±1.41

MOISTURE CONTENT: Kilishi had the least moisture content. The low moisture content of kilishi compared to that of raw meat could be attributed to the step-wise drying in kilishi processing technique (Ogunsola and Omojola, 2008)**.** The reduction in moisture content of kilishi is desirable as this can affect the storage quality (Apata *et al.,* 2013). The essential feature of this method of preservation is that the water activity of the meat is reduced to a level below that at which microorganisms cannot grow (Konieczny and Bilska, 2006).

Water activity: In this present study, the lower value of the water activity of kilishi implied that klish is likely to last long in terms of storage and its quality conserved than beef and chicken suyas. This is in agreement with Van Den Berg and Bruin (1981) who reported that water activity plays a critical role in the fungal spoilage of meat.

PH: The results of the present study indicated that the pH of smoked chicken was higher than the pH of suya and Ph of kilish. This showed that kilishi was slightly acidic with pH of 5.8. This supports the assertion of FAO, (2007) that reported that the shelf-life of meat and meat products will be longer when the pH-value is low. This indicates that the process of drying kilish more than other sample affected it and it suggests that it will last longer in preservation.

Protein (%): The result of this study indicates that suya had higher nutritional value (in terms of protein) than kilishi and smoked chicken. According to Ikeme, (1990), the protein content of fresh meat is 19%. This indicates that processing meat into suya improves the percentage protein of the product thus increasing nutrient density. The protein content obtained can be attributed to the various ingredients utilized in the suya and *kilishi* preparation like groundnut cake paste, which was not used in smoked chicken and this is in agreement with report by Igene *et al.* (1993) that reported that Groundnut cake has 55.85% crude protein.

Relative humidity: Smoked chicken had significantly higher percentage of water vapour at than suya and kilishi. Generally, the higher humidity, the more rapid the chemical attack. However, shelf-life is limited by water-vapour loss, which is diminished in the presence of high humidity (Rabinow and Roseman, 2000). Contamination from liquid moisture can then encourage mould and bacterial growth.

Table 2 shows the results of lipid profile of the meat samples evaluated

The Lipid contents of the beef suya, kilishi and chicken suya were analysed in terms cholesterol and triglyceride contents of the meat samples.

Total cholesterol (TCH): This result showed that the cholesterol of suya (113.0±7.07) was significantly higher than the total cholesterol in kilishi (85.00±1.41) and smoked chicken (79.00±7.07

Triglycerides (TRG): Results indicated that the triglyceride content of (98.50±13.43) suya was significantly ($p<0.05$) higher than that of smoked chicken (1.18±1.41) and kilishi (1.25±1.41).

Table 2: shows the lipid profile of the meat samples evaluated

SAMPLES	TCH(Mg/dl)	TRG(Mg/dl)
Kilishi	85.00^{b}±1.41	1.25^{a}±1.41
BS	113.00^{a}±7.07	98.50^{b}±13.43
CS	79.00^{b}±7.07	1.18^{b}±0.71

Total cholesterol: The high cholesterol in beef suya from this experiment may be due to the known fact that red meat is high in cholesterol as proposed by (Hui *et al*.., 2000).

Triglycerides: Higher fat content of suya in this study could be due to the residual oil in the defatted groundnut cake used in the preparation of suya and kilishi coupled with the fact that beef has more lipid content than chicken. Igene (1988) noted that kilishi is very high in lipid content on dry matter basis (25.23%), this consisting mostly of triglycerides.

Table 3 shows the results of microbial counts of the meat samples evaluated

Total microbial count (TMC): The colony formimg unit per gram of the total microbial count were determined and the results indicated that the total microbial count (2.50±0.01) of smoked chicken was significantly ($p<0.05$) higher than that of (1.70±0.01) suya and that of (2.00±0.01) kilishi. While the TMC of (2.00±0.01) kilishi is significantly ($p<0.05$) higher than (1.70±0.01) suya.

Coliforms: The results of the coliforms indicated that the colony forming unit per gram of meat of suya was significantly ($p<0.05$) higher than that of smoked chicken (3.00±0.01) and kilishi (0.00±0.00).There was also a significant difference between the cfu values of smoked chicken and kilish

Table 3: The microbial counts of the meat samples evaluated

Samples	TMC(cfu/g)	Coliforms(cfu/g)	Mould(cfu/g)
KS	$2.00±0.01^{C}$	$0.00±0.00^{c}$	0.00±0.00
BS	$1.70±0.01^{b}$	$6.00±0.01^{a}$	0.00±0.00
CS	$2.50±0.01^{a}$	$3.00±0.01^{b}$	0.00±0.00

Total microbial count: The results signified that that there was bacterial contamination of smoked chicken, kirishi and suya. This contamination could be as a result of processing method used or cross contamination by meat handlers or due to the unsanitary condition of the workers. This is in agreement with the report of Clarence *et al.* (2009) who stressed on the need to improve the hygienic and sanitary practices employed in production of ready to eat food products.

Coliforms: The relatively higher bacterial counts on smoked chicken could be due to higher moisture content and methods of processing. This supports the findings that the degree of meat spoilage is usually influenced in part by the microbial load at the beginning of production, packaging and handling of the finished product Uzeh *et al.*, (2006).

.CONCLUSION

The results revealed that meat products have inherent capacity of being contaminated by microorganisms. It is therefore recommended that effective precautionary measures must be taken to prevent the contamination of sampled meat ready to eat by microorganisms.

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