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Determination of Contamination Level of Jerky (Kilishi) Sold in Mubi, Adamawa State

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Abstract

Kilishi is a crispy jerky, low moisture meat product with high nutrient content, prepared traditionally through different processes (slicing, drying, infusion, further drying and mild roasting), to which its contaminant is mostly bacteria and heavy metals. These study was aimed at determining quantitatively the contamination of kilishi by heavy metals and bacteria. Kilishi samples were digested using concentrated nitric acid at 80-90°c for 5 minute on heating mantle, then raised to 150 ^{o}C for 5 minute. Heavy metals were then determined using atomic absorption spectrophotometer. Fresh kilishi samples were sliced and homogenized. The homogenate were inoculated in various media and grown before enumeration using colony counter. The result of these study was obtained by counting the viable colony growth, on Mac-Conkey and nutrient agar media after culturing and the subjection of digested kilishi samples to atomic absorption spectrophotometer. These study showed a considerable quantity of *Enterobacteriaceae sp., Escherichia coli, Staphylococcus Aureus* and variable amount of Iron (Fe), manganese (Mn), copper (Cu), Lead (Pb) and Zinc (Zn) from samples of kilishi analyzed. The contamination of kilishi in Mubi is mostly contaminated by the exposure of the sliced beef to the environment at preparation stage known as drying. It is recommended that more appropriate means of drying the sliced beef should be employed through further studies.

Keywords: Kilishi; heavy metals; bacteria; Mac-Conkey; nutrient agar

Introduction

Jerky (Kilishi) is a rendition of jerky that began in Hausa land. It is a dried type of suya, produced using deboned dairy animals, sheep or goat meat. Traditionally sun-dried with nourishing item comprising of meat and non-meat plant fixings (John *et al.*, 1990). A complete processed kilishi (jerky) contains about half protein, 75% dampness, 18% lipid and 9.8% fiber/debris (Okonkwo, 2013). It is arranged basically from meat cuts, imbued in a slurry of defatted groundnut glue and flavors then sun-dried (Morounke *et al*., 2017). It is set up by first, spreading of meagerly cut crisp slender strips cut of muscle of about 0.17 - 0.5 m thick on racks in the sun which is turned on a standard time interim to evade the strip from adhering to the tangle (Ernest *et al*., 2015). Followed by submersion in slurry of defatted groundnut glue and expansion of certain fixings before a second time of sun drying and incomplete cooking (Adeboye *et al*., 2017). According to John *et al.* (1990), Nigeria is the source and the biggest maker of kilishi in Africa. Kilishi creation in Nigeria, is exceptionally packed in the northern Nigeria, as a result of the accessibility of enough animals present there. Kilishi creation in Nigeria is left in the hands of customary makers. Past endeavors to find out the creation strategies of these makers have been made for the most part in northeastern Nigeria (Ernest *et al*., 2015). Tragically, this delicacy is for the most part prepared and taken care of in an unhygienic way as vendors here and there convey this meat in an open wide plate, presented to flies and tidies. Most peddlers are ignorant, they don't have logical thoughts on nutritional dealing (Okwori *et al*., 2009). The risk of heavy metals and bacterial contamination in meat during handling, is of great concern for both food safety and human health, because of the toxic nature of these metals and bacteria at relatively minute concentration. Heavy metals and bacteria, contaminating kilishi was determined quantitatively in order to enlighten the general public, on the health risk of consuming improperly prepared kilishi snack and subsequently recommending the enhancement for the development of scientific methods for the production of healthier kililshi. The consumption of

healthier and well prepared kilishi is very important to prevent the death risk associated with the consumption of improperly prepared kilishi.

Materials and Methods

Collection of Kilishi Sample

Kilishi were obtained from different preparation sites in mubi metropolis both from hawkers roaming about, and the road standby site, packaged so as to prevent further contamination during collection, and transported to the laboratory (Ahmad, 2016).

Heavy Metals Analysis

The wet digestion method was performed by adding concentrated nitric acid (HNO_3) into the kilishi samples. The 3.0 g of meat samples and 30.0 mL of concentrated HNO_3 was taken in to the digestion flask. Heating mantle was used for digestion at 80-90 ^oC and raised to150 ^oC. More acid was added up to 3-5 mL until clear solution is obtained. The samples was cooled at room temperature and filtered through filter assembly and the volume was raised up to 50 mL with the help of distilled water. The blank sample was also prepared. Atomic Absorption Spectrophotometer (AAS) (Buck scientific model 2010 VGP) was used for the detection of heavy metals present in the meat samples (Ahmad, 2016)

Determination of Bacteria

Homogenization

Dried sliced meat samples (kilishi), were aseptically weighed and transferred to sterile blender to which a sterile solution consisting of 0.85% NaCl and 0.1% peptone (Oxoid) was added and homogenized for 1minute (Karoki *et al.*, 2018).

Preparation of Decimal Dilution

Decimal dilutions in 0.85% NaCl, 0.1% peptone was prepared, and 0.1 mL samples of decimal dilution in 85% NaCl, 0.1 mL peptone was spread on Nutrient agar (Oxoid) and MacConkey agar (Oxoid) for the enumeration of total bacteria, *Enterobacteriaceae*, *Staphylococcus aureus* and *Escherichia coli* respectively (Thomas *et al.*, 2015).

Enterobacteriaceae Count

For *Enterobacteriaceae* counts, 0.1 mL of 10^{-3} dilutions was transferred to sterile MacConkey agar plates and spread on the surface using sterile bent glass rod. Inoculated plates were incubated at 37 °C for 24 hr before colonies were counted and reported as colony forming units/g (cfu/g) (Daminabo *et al*., 2013).

Staphylococcus Aureus Count

Staphylococcus aureus Enumeration were presumptively enumerated on the basis of their appearance on nutrient agar (Oxoid). An aliquot of 0.1 mL volumes of relevant dilutions were spread on duplicate agar plates using sterile bent glass rod. The inoculated plates were incubated at 37 °C for 48 hr. Samples of 10-15 colonies from each batch of experiment were confirmed as coagulase-positive *Staphylococus aureus* using the agglutination test (Raji, 2006).

Bacteria Representative Colonies Identification

Representative bacterial colonies from the inoculated agar plates were picked and transferred onto nutrient agar slants and stored at 4 °C prior for further use. The isolates were identified based on colonial morphology and biochemical characteristics. The test carried out were: coagulase, motility and Gram staining tests (Raji, 2006).

Results and Discussion

Bacterial Viable Count

From table 1, the total variable count (TVC) of the specie *Escherichia coli (E.coli),* on the sample obtained from sabon tasha was higher when compared to those obtained from wuro jabbe and layin yan gonjo. Similarly the TVC of *Staphylococcus* species was low in the sample collected from wuro jabbe in comparison to samples obtained from layin yan gonjo and sabon tasha. *Eterobacter species* TVC shows uniformity in value with all samples collected. The presence of these organisms on meat parts and subsequently on kilishi in large quantity could be attributed to the fact that meat contains abundance of all nutrients required for the growth of bacteria in adequate quantity (Ukut *et al.,* 2010). Kilishi samples from different preparation site used in this study showed considerable high value of bacterial count with a mean value of 64.46×10^3 kg/mg which is in agreement with the result reported by Okonko *et al*. (2013). The average low count in bacterial colony form in the sample obtained from sabon tasha was assumed to be due to certain aseptic measures taken by the butcher, proving to show less contamination by bacteria. This assumption is in accordance with the study reported by John *et al*. (1990).

Heavy Metals

A considerable amount of Iron (Fe) (mg/kg) was present in all the collected kilishi samples, while a trace amount of manganese (Mn) (mg/kg) and

copper (Cu) (mg/kg) was present in all the samples, Lead (Pb) (mg/kg) show distinct amount from all the samples, which is higher amount in sample collected from layin yan gonjo, low amount in sample collected from wuro-jabbe and non was found in the sample collected from sabon-tasha. Zinc Zn (mg/kg) was on average amount all through the samples analyzed as shown in table 2. The high value of Zinc (Zn) observed in this study could be attributed to the high content of Zn present in red meat. Low level of Fe (mg/kg) observed in this research could be traced to the butchers ability to closely reduce dust contamination (major source of iron contaminant). While Manganese and Copper appearered to be very low quantitatively (With range value of 0.00-0.09 mg/kg) in kilishi analyzed. Lead (Pb) showed a variable range of value in all the samples analyzed, from non-detected to 1.15 mg/kg. This may be due to the type of water (contaminated by lead or not contaminated) used by the butchers to prepare kilishi or contamination by polluted dust during drying of sliced beef.

Table 1: Total Viable Count of Bacterial Growth

Samples collected	**Total viable count (TVC) cfu/mL**	***Staphylococus aureus* count cfu/mL**	***Enterobacteriaceae species* count cfu/mL**	***Escherichia coli* count cfu/mL**
Wuro jabbe	21.7×10^3	1.00×10^3	4.50×10^2	6.22×10^2
Layin yan gonjo	3.2×10^3	2.90×10^3	5.50×10^2	4.18×10^2
Sabo- tasha	38.3×10^3	3.4×10^3	7.00×10^2	9.70×10^3

Table 2: Quantity of Heavy Metals Detected

Element Sample	Zn (mg/kg)	Fe (mg/kg)	Mn (mg/kg)	Pb (mg/kg)	Cu (mg/kg)
Sabon Tasha	3.21	4.58	0.50	ND	0.27
Layin yan gonjo	2.42	5.93	0.96	1.15	0.44
uro jabbe	3.46	9.49	0.94	0.77	0.96

Conclusion

In this research work, it was observed that the contamination of kilishi prepared in Mubi metropolis is mostly caused by the presence of bacteria and heavy metals which is due to the traditional method involved in it preparation (involves exposing sliced fresh beef to atmospheric dust and microbes). This finding leads to the enlightenment against the consumption of contaminated kilishi. The study led in recommending a scientific means of kilishi preparation to avoid contamination from the surrounding in the traditional means.

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