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## ASSESSMENT OF CONSUMERS' PREFERENCE TO THE USE OF GARLIC AND CINNAMON OILS ON STORED BEEF AND CAMEL MEAT 'KILISHI'

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### ABSTRACT

**The effects of garlic, cinnamon and combination of garlic and cinnamon oils on storage quality of beef and camel meat Kilishi were determined. Meat from the Longissimus dorsi of the hind limb of camel and cattle were used for the experiment. Kilishi produced from each species was grouped into four parts of 2kg each and treated with garlic, cinnamon, combination of garlic and cinnamon oils (1:1) and control (Kilishi without treatment). The products were packed in a brown paper and stored at room temperature from May to September, 2012. Organoleptic assessment showed that there was no significant difference in the consumer preference for the products. However, fresh Kilishi were more acceptable at the beginning of storage in May than at the end of storage in September 2012. It was concluded that garlic and cinnamon oils had no effect on the overall acceptability of Kilishi. It was recommended that garlic and cinnamon oils should be used to extend the shelf life of Kilishi during storage.**

**Keywords: Meat, Kilishi, Garlic Oil, Cinnamon Oil, Longissimus dorsi, Nigeria, Organoleptic**

### INTRODUCTION

More than 80% of the world's 6.892 billion people live in the developing countries (Abubakar, 1998). Nigeria's current population of 158.3 million will reach 217.4 million and 326.4 million by 2025 and 2050, respectively. The feeding of the current 6.892 billion people in the world (8.108 billion in 2025 and 9.485 billion in 2050) is an enormous task that must be done. The provision of adequate food, especially of animal origin, to the teeming population of the world is a great challenge to mankind (Abubakar, 1998). Foods of animal origin such as meat and meat products contain important nutrients like amino acids, vitamins, minerals and fatty acids which are essential for growth and development. Meat processing offers an opportunity to improve food safety and extend shelf-life (FAO, 2010).

Reduction of protein malnutrition in many sub-Saharan African countries that are low income earners with low life-expectancy rates require evaluation of simple, appropriate and affordable technologies applicable to local situations. Modern techniques of meat preservation mostly used in developed countries require infrastructure such as portable water and reliable power supply which are lacking in most developing countries like Nigeria. Animal products such as dressed carcasses and milk are highly perishable (Prescott *et al.*, 2002) due to microbial activities. Microorganisms cause spoilage of food and is controlled by both intrinsic (food related) and extrinsic (environment related) factors. The intrinsic factors include pH, moisture content, water activity, oxidation-reduction potential, physical structure of the food, available nutrients, and the presence of natural

antimicrobial agents. The extrinsic factors include temperature, relative humidity, gases (Carbon dioxide, Oxygen) present, and the types and numbers of microorganisms present in the food. Meat products, have high nutritional value and easily utilizable carbohydrates, fats, and proteins, provide ideal environment for microbial growth, and spoilage. In order to reduce spoilage, meat is usually processed into other products such as low moisture food *Kilishi*.

The use of garlic (*Allium sativum*) for both medicinal and culinary purposes has been reported (Yin and Cheng, 2003). Garlic is a broad spectrum antibiotic affecting a very wide range of microorganism (Fung and Ceylan, 2004) and a potent antioxidant (Lin *et al.*, 1991) commonly used ingredients as a flavour enhancer in meat products. In addition to its flavouring properties, garlic possesses a wide range of medicinal attributes. Ankri and Mirelman (1999) reported that garlic has beneficial effects on the human cardiovascular and immune systems (Karem, 2007).

*Cinnamon* (*Cinnamomum verum*, synonym *C. zeylanicum*) is a small evergreen tree, 10-15 meters (32.8-49.2 feet) tall, belonging to the family Lauraceae, native to Sri Lanka and South India. The flowers, which are arranged in panicles, have a greenish colour and have a distinct odour. The fruit is a purple one-centimeter berry containing a single seed. Fung and Ceylan (2004) reported antimicrobial effects of various spices of cinnamon and garlic on *E. coli* in raw ground beef and sausage. Tzortzakos (2008) reported that essential oils from cinnamon and garlic inhibit growth of some micro-organisms in meat.

The oils were tested for antifungal activities and showed promising results (Idowu *et al.*, 2010). It was suggested that essential oil from cinnamon may be used as a preservative in certain food applications. Essential oils are known to be effective against a wide spectrum of micro-organisms and leave no detectable residues (Tzortzakis, 2008). The current practice was against use of chemical-based anti-fungal additives for food, opening up opportunities for alternatives from natural sources. The reasons for changes were manifold and include general consumer preferences for natural foods, legislative changes, and the isolation of antibiotic resistant pathogens (Bhutani, 2003).

*Kilishi* is a popular, traditionally processed ready to eat Nigerian meat product, originally produced from beef and later extended to other ruminant animals. Exploitation of all avenues of meat preservation has been suggested towards meeting the animal protein requirement of the increasing African population (Omojola., 2008). It is a tropical low moisture meat product that is prepared essentially from beef slices, infused in slurry of defatted groundnut paste and spices and sundried (Idowu *et al.*, 2010). The ability of *Kilishi* to be kept for several months at room temperature is fast making it a house-hold name in Nigeria and Africa as a whole (Leistner, 1987). *Kilishi* production and storage under conditions free of microbial contamination has been seen as a process usually difficult to achieve in Africa. This is due to the nutrient content of the product which attracts agents of microbiological spoilage and pest ( Igene *et al.*, 1990). Salting, dehydration and packaging are applied in sequence to inhibit deterioration of *Kilishi* caused by microorganisms (Biscontini *et al.*, 1996). The increased production and consumption of *Kilishi*

makes it imperative to conduct research on quality attribute of *Kilishi* stored in different conditions at room temperature.

The aim of this study was to assess the consumers' preference to stored beef and camel meat *Kilishi* treated with garlic and cinnamon oils.

## MATERIALS AND METHODS

### Sample Collection

Raw meat samples were collected from the metropolitan abattoir in Kano. The meat samples collected were from the *Longissimus dorsi* of the hind limb of two different animal species: Cattle and Camel.

### Processing of Camel Meat and Beef into *Kilishi*

The *Longissimus dorsi* of the hind limb of a bull aged 4 years old and a male camel carcasses aged of 5 years (Muhammad and Muhammad, 2007) were used for the study. The meats were trimmed free of fat and excess connective tissues. Slicing was effected along the fibre axis of each portion to obtain very thin slices of 2 mm thickness in a continuous sheets. The pieces of sliced meat were thinly spread on silver trays and sun dried at a temperature of 29 to 31°C as described by Ogunsola and Omojola,(2008). The first stage of drying lasted 18 hours to dry to 40% moisture (Muhammad and Muhammad, 2007). The meat slices were turned over every hour to allow for even drying and to prevent them from getting stuck to the drying surface. The weight of the fresh meat slices were then taken before and after the first stage drying. The dried pieces were kept in airtight containers for the next step of processing. The key ingredient used in processing *Kilishi* are shown in Table 1.

Table 1: Composition of Ingredients Used for Slurry (g/kg)

English Names	Scientific Names	Composition (g/kg)
Groundnut cake	<i>Arachis hypogea</i>	350
Red pepper	<i>Capsicum frutescens</i>	40
Black pepper	<i>Piper guinease</i>	11
Cloves	<i>Eugenia caryophyllata</i>	5
Ginger	<i>Zingiber officinale</i>	24
Alligator pepper	<i>Aframomum meleginata</i>	5
Onion	<i>Allium cepa</i>	120
Big pepper	<i>Capsicum esculentum</i>	45
Thyme seasoning	<i>Fagara xanthoxyloides</i>	5
Salt	<i>Sodium chloride</i>	15
Magi seasoning	<i>Sodium glutamate</i>	20
Decorticated groundnut Seed		60
Water		300

Source: Muhammad and Muhammad (2007)

Meat from each species of animals were processed into *Kilishi* (Dry meat product) according to the procedure of Abubakar *et al.*, (2011) as shown in figure 1. The pieces of dried meat were soaked in the slurry for one hour after which they were removed and carefully spread out one by one on trays. A

drying rack screened from flying insects was used to dry the products as shown in plate 1. After drying for 6hr 40% moisture level (Muhammad and Muhammad, 2007), the infused meat slices were slightly roasted for 10 minutes ( Igene, 1983) to heat-seal the ingredients in the products. It was left to cool in the trays.

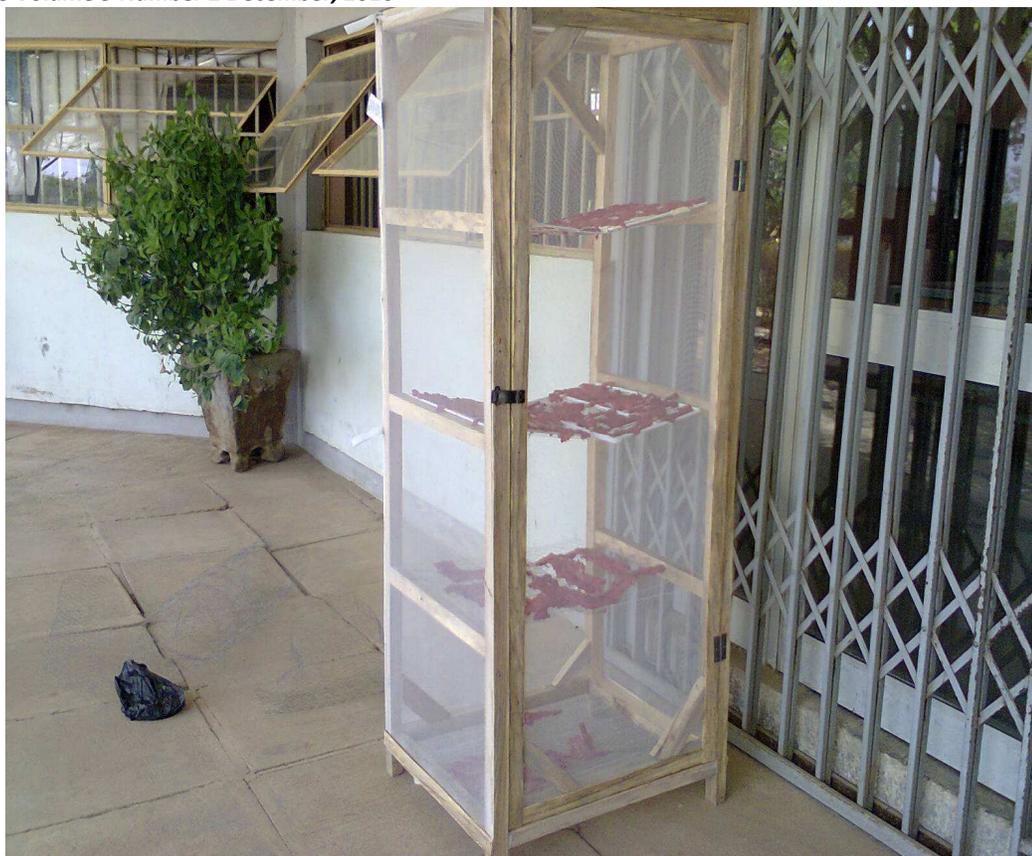
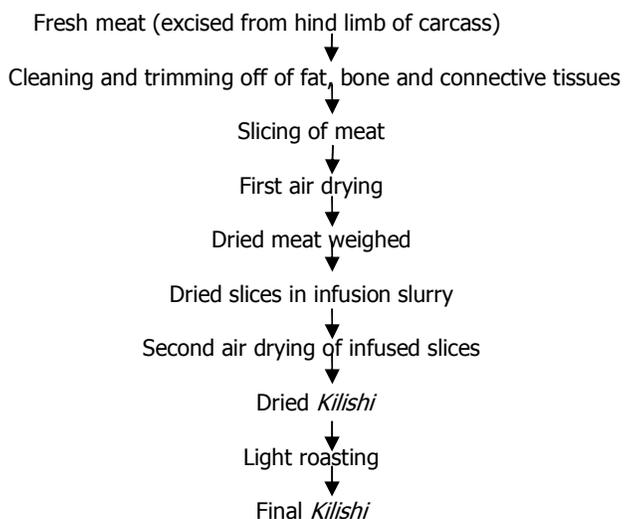


Plate 1: Screen Rack



The flow chart summarizing *Kilishi* production process (Abubakar *et al.*, 2011).

8kg of sample of *Kilishi* processed from each of the species was collected. Cinnamon and garlic oils were added at the rate of 10ml/kg. Garlic (T1), cinnamon (T2), garlic-cinnamon in ratio 1:1 (T3) and untreated products were labeled as T4. The treatments were replicated three times.

#### Sensory Evaluation of *Kilishi*

A group of 10-trained panelists with age range between 18 and 50 years old were used to evaluate the beef and camel *Kilishi*. A nine-point hedonic scale was used in the assessment of the fresh products in May 2012 and at the end of the storage in September 2012. 1 = extremely desirable, 2= very desirable, 3=

moderately desirable, 4= slightly desirable, 5= intermediate, 6= slightly undesirable, 7= moderately undesirable, 8= very undesirable and 9= extremely undesirable. Organoleptic parameters evaluated includes colour, texture, juiciness, flavour, and overall acceptability

**Experimental Design and Statistical Analyses**

The experiment was laid in a 2x2x4 factorial arrangement in a Completely Randomized Design (CRD). The factors were two species (cattle and camel), two forms (raw meat and *Kilishi*) and four treatments (garlic 10ml/kg, cinnamon 10ml/kg, garlic/cinnamon 10ml/kg and control). The data collected from sensory evaluation were subjected to Analysis of Variance (ANOVA) using SPSS 11.0 for Windows (Muhammad and Muhammad, 2007). The Duncan Multiple Range Test (DMRT) was used to separate the treatment means.

**RESULTS AND DISCUSSION**

**Organoleptic Evaluation of *Kilishi***

Table 2 shows the effects of garlic, cinnamon and combination of garlic and cinnamon oils on fresh beef and camel meat *Kilishi* immediately after production. No significant differences were recorded on the colour, texture, juiciness and flavour of *Kilishi* among the treatments at the beginning of storage in May, 2012. The overall acceptability showed that addition of garlic, cinnamon and combination of garlic and cinnamon oils had no significant effect on the consumers' preference at the beginning of storage among the treatments.

Table 2 : Effects of Garlic, Cinnamon and Combination of Garlic and Cinnamon Oils on Fresh Beef and Camel Meat *Kilishi*.

Parameters	Beef <i>Kilishi</i>				Camel Meat <i>Kilishi</i>				SE
	T1	T2	T3	T4	T1	T2	T3	T4	
Colour	2.2 <sup>a</sup>	2.2 <sup>a</sup>	3.6 <sup>b</sup>	2.4 <sup>a</sup>	2.6 <sup>ab</sup>	2.4 <sup>a</sup>	2.2 <sup>a</sup>	2.4 <sup>a</sup>	0.43
Texture	2.2 <sup>a</sup>	3.0 <sup>ab</sup>	3.0 <sup>ab</sup>	2.2 <sup>a</sup>	2.6 <sup>ab</sup>	2.8 <sup>ab</sup>	2.8 <sup>ab</sup>	2.6 <sup>a</sup>	0.42
Juiciness	5.2 <sup>a</sup>	4.4 <sup>a</sup>	5.8 <sup>ab</sup>	5.4 <sup>a</sup>	6.6 <sup>b</sup>	6.6 <sup>b</sup>	7.2 <sup>bc</sup>	7.4 <sup>bc</sup>	0.63
Flavour	3.4 <sup>a</sup>	4.0 <sup>ab</sup>	4.2 <sup>b</sup>	2.8 <sup>a</sup>	3.0 <sup>a</sup>	3.8 <sup>ab</sup>	3.6 <sup>ab</sup>	2.6 <sup>a</sup>	0.48
Overall Acceptability	2.8 <sup>ab</sup>	3.4 <sup>b</sup>	3.6 <sup>b</sup>	2.0 <sup>a</sup>	2.8 <sup>ab</sup>	4.0 <sup>bc</sup>	2.2 <sup>a</sup>	1.8 <sup>a</sup>	0.41

<sup>abcd</sup> means with different superscript within a row were significantly different (P<0.05)

T1 – Treated with garlic oil; T2 – Treated with cinnamon oil; T3 – Treated with garlic and cinnamon oils; T4 – Control

Table 3 shows the effects of garlic, cinnamon and combination of garlic and cinnamon oils on beef and camel meat *Kilishi* stored for five months. No significant differences were recorded on the colour, texture, juiciness and flavour of *Kilishi* among the treatments at the end of storage in September, 2012.

The parameters assessed showed that all the treatments at the end of storage were similar. The overall acceptability showed that addition of garlic, cinnamon and combination of garlic and cinnamon oils had no significant effect on the consumers' preference at the end of storage among the treatments.

Table 3 : Effects of Garlic, Cinnamon and Combination of Garlic and Cinnamon Oils on Beef and Camel Meat *Kilishi* stored for five months.

Parameters	Beef <i>Kilishi</i>				Camel Meat <i>Kilishi</i>				SE
	T1	T2	T3	T4	T1	T2	T3	T4	
Colour	5.0 <sup>c</sup>	5.6 <sup>c</sup>	5.4 <sup>c</sup>	3.8 <sup>b</sup>	4.8 <sup>bc</sup>	4.8 <sup>bc</sup>	5.2 <sup>c</sup>	4.8 <sup>b</sup>	0.43
Texture	6.2 <sup>c</sup>	5.8 <sup>c</sup>	5.6 <sup>c</sup>	4.4 <sup>b</sup>	5.0 <sup>b</sup>	5.2 <sup>bc</sup>	5.0 <sup>c</sup>	4.6 <sup>b</sup>	0.42
Juiciness	6.2 <sup>ab</sup>	5.2 <sup>a</sup>	5.8 <sup>ab</sup>	7.6 <sup>bc</sup>	5.2 <sup>a</sup>	5.2 <sup>a</sup>	6.2 <sup>ab</sup>	6.8 <sup>b</sup>	0.63
Flavour	5.6 <sup>bc</sup>	6.0 <sup>c</sup>	6.0 <sup>c</sup>	3.6 <sup>ab</sup>	5.2 <sup>bc</sup>	5.0 <sup>bc</sup>	4.4 <sup>b</sup>	4.8 <sup>b</sup>	0.48
Overall Acceptability	5.8 <sup>d</sup>	6.8 <sup>d</sup>	5.2 <sup>cd</sup>	3.0 <sup>ab</sup>	5.2 <sup>cd</sup>	4.8 <sup>c</sup>	4.8 <sup>c</sup>	4.2 <sup>bc</sup>	0.41

<sup>abcd</sup> means with different superscript within a row were significantly different (P<0.05)

T1 – Treated with garlic oil; T2 – Treated with cinnamon oil; T3 – Treated with garlic and cinnamon oils; T4 – Control

Table 4 shows correlation of the parameters assessed in the Organoleptic evaluation of stored treated *Kilishi* that colour of were positively correlated to texture, flavour and overall acceptability except juiciness that is negatively correlated to colour of *Kilishi*. Texture of *Kilishi* also showed positive correlation to colour, flavour and overall acceptability except juiciness that

is negatively correlated. Juiciness is negatively correlated to all the parameters studied in the Organoleptic test by the test panelists while flavour of *Kilishi* showed positive correlation except juiciness that is negatively correlated. Overall acceptability of *Kilishi* showed positive correlation to colour, texture, juiciness and flavour.

Table 4: Correlations of the Parameters Assessed in the Organoleptic Evaluation of the Stored Treated *Kilishi*

Parameters	Colour	Texture	Juiciness	Flavour	Overall
<b>Acceptability</b>					
Colour					
Texture	0.34**				
Juiciness	-0.04*	-0.08 <sup>ns</sup>			
Flavour	0.35**	0.33**	-0.12*		
Overall	0.34**	0.37**	0.15*	0.66**	
Acceptability					

The strong flavor possessed by garlic and cinnamon oils showed no difference in the result of overall acceptability. Hamid *et al.* (2012) reported that when garlic and cinnamon oils were added to food, it showed no significant difference in the general acceptability. However, despite its strong flavor in food it was consumed due to an increased awareness that garlic, as a natural herb, could be used to extend the shelf-life of meat products, providing the consumers with food containing natural additives, which might be seen as healthier than those of synthetic origin as also observed by Yang *et al.* (1993).

This results were in line with the report of Mohamed and Mansour (2012) who revealed that addition of essential oils to beef shows no significant effect on the sensory characteristics and combined with specific storage conditions, showed very desirable effects Viuda-Martos *et al.* (2010, 2011). Sallam *et al.* (2004) reported that storage time has no significant ( $P > 0.05$ ) effect on the intensity of garlic flavor, tenderness or the acceptability scores of food.

### CONCLUSION

It was concluded that no effect of treatment was recorded on the organoleptic properties of the product under storage conditions and natural oils could be

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used to extend the shelf-life of meat products, providing the consumer with food containing natural additives, which might be seen more healthful than those of synthetic origin.

### RECOMMENDATION

It was therefore, recommended that garlic, cinnamon and combination of garlic and cinnamon oils could be used to improve the storage quality of *Kilishi*. Further researches should increase the concentration of garlic and cinnamon oils to about 20ml/kg and keep the *Kilishi* for a longer period of about one year to see if the higher concentration will further extend the shelf life of the product.

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### CONFLICT OF INTEREST

None declared

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