

## ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF AFRICAN NUTMEG, PEPPER AND BLACK PEPPER EXTRACT ON THE QUALITY AND SHELF-LIFE OF CHICKEN NUGGETS

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### ABSTRACT

A study was conducted using five kilogrammes of manually deboned and comminuted broiler meat to determine the antimicrobial and antioxidant activities of Pepper, Black pepper and African nutmeg extracts on the quality and shelf-life of nuggets stored at 4°C for 12 days in a completely randomised design. The results for the antioxidant effect revealed that lipid oxidation of chicken nuggets were improved by the inclusion of the extracts compared to the control. Total plate count, coliform count and fungal count were significantly ( $P < 0.05$ ) reduced with the addition of African nutmeg extracts during storage. It is concluded that extracts of Pepper, Black pepper and African nutmeg led to retarded oxidative rancidity and microbial growth during refrigerated storage, thereby improving the quality and shelf-life of chicken nuggets.

### INTRODUCTION

The aims of preservation methods are to inhibit the microbial spoilage and to minimize the oxidation and enzymatic spoilage. Utilization of spices in various forms like powder, extract or essential oils has been well documented for its preservative ability by inhibiting lipid oxidation, growth of many spoilage bacteria and fungi in foods (Meena and Sethi, 1997; Subbulakshmi and Naik, 2002; Rajkumar and Berwal, 2003). Their addition also affects the taste, flavour, texture, water activity, pH and colour of some meat products (Zhang *et al.*, 2009; Ibrahima *et al.*, 2011). Examples of such spices include Pepper and Nutmeg. Pepper is a good source of antioxidant, contains vitamin C and beta carotene (Coon, 2003). In Nigeria and other African countries, the kernel obtained from the seeds of African Nutmeg is a popular spicing agent to improve flavor of food resembling that of nutmeg (*Myristica fragrans*) as well as an aromatic stimulating addition to medicine (Ekeanyanwu *et al.*, 2010). It is reported to possess valuable economic and medicinal value (Okafor, 1987). *Monodora myristica* is rich in glycosides, flavonoids, saponins and steroids but with very little cyanogenic glycosides, tannins, oxalates and phytates. Flavonoids, saponins and tannins are known to have antimicrobial activity, as well as other physiological activities (Ekeanyanwu *et al.*, 2010). Flavonoids possess anti-inflammatory, antioxidant, anti-allergic, hepatoprotective, antithrombic, antiviral and anticarcinogenic activities (Middleton *et al.*, 2000). This study was therefore

conducted to determine the antimicrobial and antioxidant activity of Pepper, Black pepper and African nutmeg extracts on the keeping quality of chicken nuggets. The objectives of these studies were to determine the antioxidant activities of Ginger, African nutmeg, Pepper, Black pepper and Cloves on the quality and shelf-life of chicken nugget, stored at 4°C for 12 days and to determine the antimicrobial activities of ginger, African nutmeg, pepper, black pepper and cloves on the quality and shelf-life of chicken nugget, stored at 4°C for 12 days.

### MATERIALS AND METHODS

#### Preparation of extracts

pepper (*Capsicum frutescens*), black pepper (*Piper guineense*) and African nutmeg (*Monodora myristica*) were purchased from Kurmi market in Kano State. The spices were washed with water, air dried overnight and ground into powder using a hammer mill. The spice extracts were prepared as follows: Aliquots (50 g each) of pulverized and dried spices were mixed into 400 ml of 95% (v/v) ethanol for 12 h in enclosed flasks with constant shaking (100 rpm) using a flask (Stuart: SF1). After filtration with a Whatman No. 2 filter paper, the residue was re-extracted with an additional 200 ml of 95% ethanol for an additional 12h and then filtered. The combined filtrates were concentrated on a rotary evaporator (RE- 100, Bibby Sterilin Co., Ltd., U.K.) at 50°C with a vacuum pump. The extracts were further evaporated on water bath using Petri dishes. Dried extracts were placed in

sealed bottles and stored at 4°C before use (Zhang *et al.*, 2009).

#### Chicken nugget preparation

Meat was deboned manually and cut into small pieces and minced in a meat mincer (Breville, UK) with a 3 mm plate. Emulsion of each formulation was prepared using bowl chopper (Breville®, UK). All the nugget formulations consisted of broiler meat, 60%; soy bean oil, 10%; ice flakes, 10%; refined wheat flour, 2.5%; skim milk powder, 2%; whole egg liquid, 5%; table salt, 2%; sugar, 1%; sodium tri-polyphosphate, 0.2%; condiments/spice mix, 2.5%; and spice extract, 4.8%. The formulation obtained was carefully cut in nugget size pieces (4×1.5×1.5 cm) and baked at 160°C for 15 minutes. The cooked product was cooled and weighed. The nuggets were packed in sterilized aluminum foil plates and stored at refrigerated temperature (4±1°C) for analysis (Kumar and Tanwar, 2011).

#### Microbial and Thiobarbituric acid assay

Nugget samples from each treatment were collected into sterilised plastic containers and transferred to the laboratory with the aid of ice bags, and analysed within an hour after collection (Nwachukwu *et al.*, 2008). The media used includes plate count agar, McConkey agar, potato dextrose agar, peptone water and nutrient agar which were prepared according to manufacturer's instructions (Oxoid, U.K.). The media were sterilized by autoclaving at 121°C for 15 minutes. Enumeration of TPC and TCC was carried out according to the method described by Cheesbrough, 2004 while the inoculated media for TFC was incubated at room temperature (28-32°C) for 7 days. The number of bacterial and fungal colonies were counted, recorded and expressed as colony-forming unit per gram (cfu/g).

$$cfu/g = \frac{\text{Total Number of Colonies Counted} \times \text{Dilution factor}}{\text{Volume of inocula}}$$

Thiobarbituric acid (TBA) was determined according to the method proposed by Kirk and Sawyer (1991).

#### Statistical analysis

Data obtained were subjected to analysis of variance procedure of SAS (SAS, 2002) and significant means were separated using Duncan

Multiple Range Test (Duncan, 1995). The following model was used:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where;

$Y_{ij}$  = dependent variable;  $\mu$  = overall mean;  $T_i$  = effect of the  $i^{\text{th}}$  treatment;  $e_{ijk}$  = random error.

## RESULTS AND DISCUSSION

#### Microbial count (Log cfu/g) and Thiobarbituric acid (malondialdehyde/kg) of chicken nuggets stored at 4°C for 12 days

The effect of spice extracts on the total plate count (TPC), total coliform count (TCC), total fungal counts (TFC) and thiobarbituric acid (TBA) of chicken nuggets stored at 4°C for 12 days are presented in Figures 1, 2, 3 and 4 respectively. Spice extracts inclusion in chicken nuggets decreased the TPC, TCC, TFC and TBA values. Extracts of pepper had exceptionally high activities against lipid oxidation and microbial growth as storage days increase.

#### Conclusion

The inclusion of spice extracts in chicken nuggets increased the shelf life and sensory attributes of the product.

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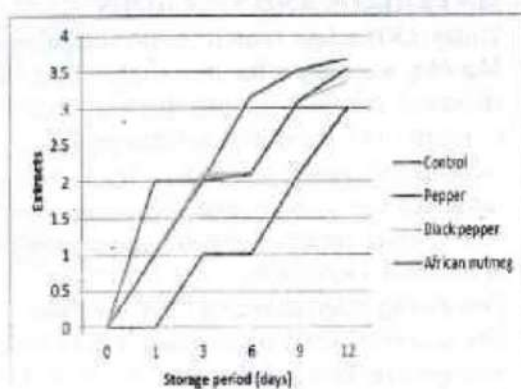


FIG 1: TPC

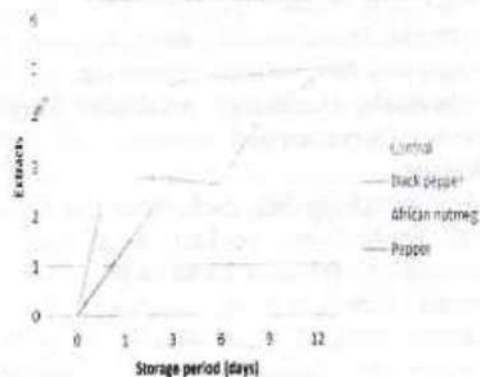


FIG 3: TFC

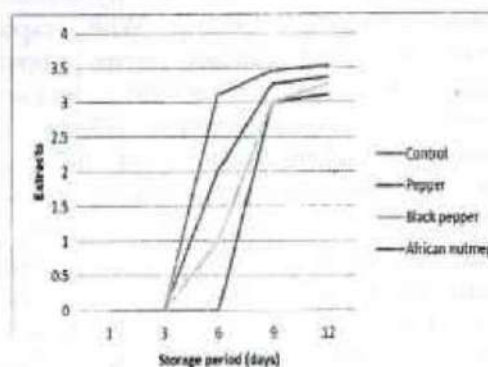


FIG 2: TCC

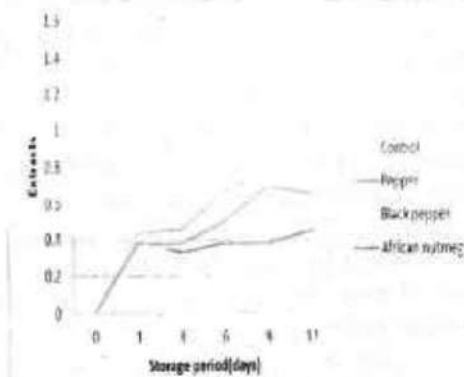


FIG 4: TBA