

Sensory Evaluation Attributes of Ginger and Alligator Pepper Treated Dried Beef

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Abstract: *The study was carried out at the Department of Food Science and Technology, Federal University of Agriculture Abeokuta (FUNAAB), Ogun State, Nigeria, to investigate attributes of ginger and alligator pepper treated dried beef. Values of GE colour parameters L^* , a^* and b^* of the meat were 39.86-63.59, 11.49-19.30 and 11.02-19.41, respectively. Scores of appearance, taste, aroma, texture and overall acceptability were 4.38-7.17, 4.92-7.10, 5.42-6.70, 5.06-6.43, 4.33-6.73 and 5.16-6.90 respectively. Significant ($p < 0.05$) differences were recorded for appearance and the scores of sensory attributes of the products. Drying at higher temperatures above 65°C significantly reduced the sensory acceptability of the product ($p < 0.05$). Samples containing GE were more acceptable than those containing AP. Dried meat at 75 and 85°C had no viable microbial count. It can be concluded that using 70% GE and drying at 75°C showed greater potential for meat preservation.*

Keywords: Sensory, attributes, acceptability, ginger, alligator pepper

1. Introduction

Meat is defined as the flesh of animals used as food. Fresh meat refers to meat from recently processed animals as well as vacuum-packed meat or meat packed in controlled-atmospheric gases, which has not undergone any treatment other than chilling to ensure preservation [25]. It is a nutritious, protein-rich food which is highly perishable and has a short shelf-life unless preservation methods are used. It is the first-choice source of animal protein for many people and its consumption is continuously increasing worldwide. Significant portion of meat and meat products are spoiled every year due to microbial spoilage ([10]. Varied nutrient composition of meat makes it an ideal environment for the growth and propagation of meat spoilage micro-organisms and common food-borne pathogens. It is therefore indispensable that sufficient preservation technologies are applied to maintain its safety and quality [3]. The processes used in meat preservation are principally concerned with inhibiting microbial spoilage, although other methods of preservation are sought to minimise other deteriorative changes such as colour and oxidative [25]. Deterioration of meat and its products is influenced by a number of interrelated factors that influence the shelf life and keeping quality of meat. These include temperature, atmospheric oxygen (O_2), endogenous enzymes, moisture (dehydration), light and, most importantly, micro-organisms either alone or in combination, can result in detrimental changes in the colour odour, texture and flavour of meat ([8] Although deterioration of meat can occur in the absence of micro-organisms (e.g., proteolysis, lipolysis and oxidation), microbial growth is by far the most important factor in relation to the keeping quality of fresh meat [13].

Natural organic products such as spices with antioxidant and antimicrobial properties can serve as alternative to the use of synthetic chemicals preservatives to preserved beef. Ginger (*Zingiber officinale*) and alligator pepper (*Aframomum melegueta*) spices are edible plant materials (leaf in onion and garlic, rhizome in ginger) that have anti-oxidative, antiseptic and bacterio-static properties when added to foods such as fish, meat delay the onset of rancidity

and reduce microbial proliferation and impact flavour to the foods [7, 12]; Ginger is widely used in the local food industries to improve flavour, shelf-life and consumer acceptability of delicacies [17]. Alligator pepper seeds on the other hand have pungent peppery taste due to aromatic ketones [21,9] commonly used across tropical Africa including Nigeria, Liberia, Sierra Leone, Ghana, Cameroon, Cote D'ivoire and Togo. Several research has been conducted using both natural and synthetic preservatives in the preservation of meat and meat products. Alligator pepper and ginger are important spices known for characteristic anti-tumor, anti-proliferative, amphitensive, larvicidal and nematocidal properties due to its 6-gingerol, 6-paradol, shagaols and zingiberene content. The presence of phenolic compounds in the seed of Alligator pepper and Ginger indicate that these plants are antimicrobial agents and this is because phenols and phenolic compounds have been comprehensively used in disinfections and remain the standard with which other bactericides are compared. Therefore, evaluating the preservative efficacies of these substances and their possible effects on freshly-processed and dried beef quality cannot be overstated

2. Materials and Methods

The study was conducted at the Department of Food Science and Technology, Federal University of Agriculture Abeokuta (FUNAAB), Ogun State, Nigeria from November 2014 till April, 2015.

Source and preparation of the meat used

Meat used for this experiment comprised of cut from the thigh region of a male healthy cow slaughtered in a certified abattoir at Kuto market, Abeokuta, Ogun State. The animal was subjected to slaughtering through the use of a sharp knife driven across the neck region of the animal and it was laid flat on clean polythene while blood was allowed to drain completely from the carcass for fifteen (15) minutes. Afterwards, the carcass was de-skinned, eviscerated and deboned while flesh was cut into one-kilogram in separate well-labelled bags. One hundred (100) gram of fresh

beef cut from the thigh region was cut into 1x5x10 cm size in length, width and thickness on a sterile glass surface using a sharp knife. Adequate care was ensured to prevent contamination at every point of post-slaughtering handling.

2.1. The source and Preparation of Alligator Pepper and Ginger Powder

Dried alligator pepper and fresh rhizomes of ginger were sourced from local farmers in Kuto market, Abeokuta. The processing of powder from fresh sample was achieved using the method of [2] as described by [1]. Ginger (*Zingiberofficinale*) rhizomes were peeled while alligator pepper (*Aframomummelegueta*) seeds were removed from the pods, sorted and cleaned from all extraneous materials and adhering particles. The samples were oven-dried in a hot air oven and crushed using an electric grinder 5 speed blender, (Model: BBK1051 RSH 0005494-124, Rank sharp industries Ltd, 1801). Ground samples were soaked in equal volume of distilled water for twenty-four hours for maximum extract recovery as described by [6]. Preparation of Alligator pepper and Ginger suspension

One hundred percent (100%) of the resulting powder crude extract of alligator pepper and ginger was prepared using the prescribed method of [11] by weighing the alligator pepper and ginger powder using a sensitive electronic scale (AND EK-4100i, A&D CO.LTD JAPAN). Equal volume (cm³)/weight (g) of distilled water and ground sample of the plant materials at one hundred millilitre (100mL) was poured into one hundred gram (100 g), then, the samples were then dissolved into an Erlenmeyer flask separately and labelled accordingly. These were left to rest for twenty four (24) hours for proper dissolution. Thereafter, dilution was done with varied proportion of distilled water making it each up to 100mL volume.

2.2. Experimental Design

The treatments consisted of two spices; alligator pepper and ginger. The spice were diluted with distilled water at concentration levels of 70: 30 and 50: 50 v/v respectively, while the untreated samples immersed in distilled water served as control. The soaked beef cuts were then dried at varied temperature 65, 75 and 85 °C in a locally-fabricated convective dryer for 18 hours till the samples were completely dried.

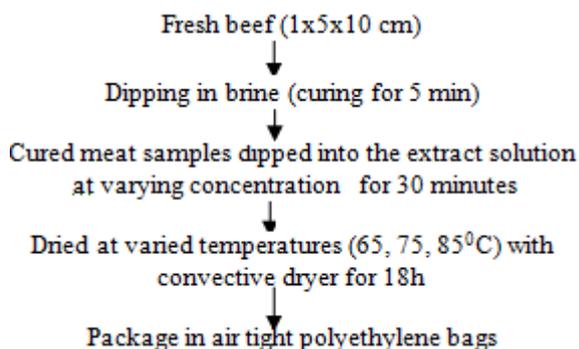


Figure 1: Flow Chart for Meat Treatment and Drying [5]

Table 1: Layout of the Experiment

Spice	Concentration	Temperature
Control	100	65 ⁰ C
GINGER (G ₁)	70:30	65 ⁰ C
GINGER (G ₂)	50:50	65 ⁰ C
(G ₁)	70:30	75 ⁰ C
(G ₂)	50:50	75 ⁰ C
(G ₁)	70:30	85 ⁰ C
(G ₂)	50:50	85 ⁰ C
ALLIGATOR PEPPER (A ₁)	70:30	65 ⁰ C
ALLIGATOR PEPPER (A ₂)	50:50	65 ⁰ C
(A ₁)	70:30	75 ⁰ C
(A ₂)	50:50	75 ⁰ C
(A ₁)	70:30	85 ⁰ C
(A ₂)	50:50	85 ⁰ C

2.3. Laboratory Sensory Acceptability Test of the Treated Dried Beef Samples

Laboratory sensory acceptability evaluation of the preserved beef was conducted in line with the method of [18]. A questionnaire which comprised of health-related information was prepared as olfactory cells like taste bud could have been affected by the use of narcotics like tobacco, anti-biotics and chemotherapies [14].

2.4. Colour

The colour of the dried meat samples were measured using a Konica Minolta Colour Measuring System (Chroma meter CR-410, Minolta LTD Japan) as described by [24]

The lightness (L*), redness, (a*) and yellowness (b*) values were obtained after calibrating the instrument using a white tile. Six replication readings were taken for each spiced and control dried meat samples and the average value reported. The results were expressed in accordance with CIELAB system where:

L* is known as the lightness [L=0 (black), L =100 (white)],

a* (-a = greenness , + a = redness)

b* (-b* values =blueness, + b* values = yellowness)

Selection of panel and sensory evaluation conduction

This trial was aimed at evaluating acceptability of the treated dried beef samples with each of ginger and alligator pepper spices in survey trial. A thirty (30) untrained panellists were randomly selected in the Department of Food Science and Technology, Federal University of Agriculture, Abeokuta. The samples were assessed for the following attributes; appearance, taste, aroma, tenderness, mouth feel and overall acceptability of the processed and dried beef. Each panellist was served with samples of each preserved meat, they were provided with water to rinse their mouth after the tasting of each sample in order to prevent “taste masking”.

2.5. Statistical Analysis

Data were subjected to statistical analysis using SPSS version 21. Analysis of variance (ANOVA) was used to compare significant means. The Least Significance Difference (LSD) was used to determine the level of significance.

3. Result

3.1. Effect of Spiced, Concentrations and Drying Temperatures on Colour Parameters of The Processed Dried Beef

Table 2 shows the results of colour parameters of the processed and dried beef based on spiced solution concentrations as well as drying temperatures. There were significant differences ($p < 0.05$) in the mean values of lightness (L^*), redness (a^*) and yellowness (b^*) parameters of the beef samples. Lightness value ranged between 8.43-63.59, with beef treated with 70% ginger concentration and then dried at 75oC had the highest lightness value, while

sample treated with 70% alligator pepper concentration and dried at 85oC had the least value. In addition, redness parameter of treated and dried beef samples ranged from 5.73–19.30. Sample treated with 70% ginger concentration and dried at 65oC had the highest redness value(a^*) 23.63%, while samples treated with 70% alligator pepper concentration and dried at 75oC had the lowest value for redness. Yellowness parameters of treated and dried beef samples ranged from 2.81–23.91. Samples treated with 70% ginger concentration and then dried at 75oC and treatment with 50% ginger concentration dried at 75oC had similar values and was observed to have the highest, while sample treated with 70% alligator pepper and dried at 85oC had the lowest level for yellowness.

Table 2: Effect of Spice, Concentrations and Drying Temperatures on Colour Parameters on the Dried Beef Samples

Spice	Concentration	Drying Temperature (°C)	L^*	a^*	b^*
	Control	65	27.92±0.02 ^{gh}	11.61±0.01 ^{ef}	19.41 ±0.20 ^b
GINGER	70%	65	56.05±0.08 ^b	19.30±0.02 ^a	19.60±0.00 ^b
	50%	65	39.86±0.95 ^f	11.49±0.04 ^{ef}	19.41±0.01 ^b
	70%	75	63.59±0.94 ^a	16.58±0.08 ^b	23.91±0.16 ^a
	70%	75	63.59±0.94 ^a	16.58±0.08 ^b	23.91±0.16 ^a
	70%	85	49.16±0.18 ^d	13.97±0.01 ^{cd}	14.28±0.06 ^{cd}
	70%	85	50.42±0.03 ^c	17.45±0.12 ^b	11.02±0.03 ^{efg}
ALLIGATOR PEPPER	70%	65	47.42±0.03 ^d	13.97±0.01 ^{cd}	10.93±0.00 ^g
	50%	65	42.36±0.92 ^e	11.03±0.21 ^{ef}	9.02±0.62 ^h
	70%	75	25.64±0.65 ^{gh}	9.72±0.37 ^{gh}	11.56±0.01 ^{fg}
	50%	75	25.54±0.24 ^{gh}	5.72±0.00 ^{klm}	9.04±0.01 ^{klm}
	70%	85	8.43±0.57 ⁿ	5.70±0.08 ^{klm}	2.81±0.16 ^{kl}
	50%	85	18.03±1.15 ^l	9.96±0.13 ^{ij}	6.93±0.17 ^{ij}

Data: mean and standard deviations Mean values with different superscripts within the same column are significantly different at 5% level.

L^* =Lightness, a^* =Redness, and b^* =yellowness. Control=distilled water, G1= 70% ginger concentration, G2= 50% ginger concentration, A1=70% alligator concentration, A2= 50% alligator pepper concentration

3.2. Effect Of Spice, Concentrations and Drying Temperatures on the Sensory Attributes of Processed Dried Beef.

Table 3 displays the sensory attributes of treated and dried beef samples. Significant differences ($p < 0.05$) were observed among all the samples Result for appearance ranged from 4.00 -7.17. Samples treated with 70% ginger concentration and dried at 85oC was rated highest in terms of appearance while those treated with 50% alligator pepper concentration and dried at 65oC was rated lowest (4.00%). With respect to taste, samples treated with 70% ginger

concentration and dried at 85oC was the most preferred, while samples with 50% alligator pepper concentration and dried at 65oC was the least preferred.

In terms of aroma, samples treated with 70% ginger concentration and dried at 85oC was the most preferred among others, while beef treated with 50% alligator pepper concentration and dried at 65oC was rated the lowest. Rating for tenderness for samples treated with 50% alligator pepper and dried at 75oC was the highest, while those treated with 70% ginger and dried at 65oC was rated the lowest. In terms of mouth feel, samples treated with 70% ginger concentration and dried at 85oC were highly appreciated as the highest while samples treated with 70% alligator pepper concentration and dried at 65oC was least appreciated. Samples treated with 70% ginger concentration and dried 85oC was recorded the highest values for overall acceptability while those treated sample with 50% alligatorpepper and dried at 65oC had the lowest rating for overall acceptability.

Table 3: Effect of Spices, Concentrations and Drying Temperatures on the Sensory Attributes of Dried Beef Samples

Spice	Concentration	Drying Temperature (C ^o)	Appearance (%)	Taste (%)	Aroma (%)	Tenderness (%)	Mouth feel (%)	Overall acceptability (%)
Control		65	6.53±1.68 ^a	5.70±2.20 ^{bcd}	5.60±1.69 ^{ab}	5.73±1.57 ^{ab}	5.46±2.14 ^{bcd}	5.96±1.97 ^{abcd}
Ginger	70%	65	4.38±2.36 ^b	4.92±2.32 ^{de}	5.42±2.41 ^{abc}	4.50±2.11 ^c	4.33±1.97 ^c	5.41±1.86 ^{cde}
	70%	65	4.83±2.39 ^b	5.77±1.76 ^{bcd}	6.10±1.84 ^{ab}	5.47±2.24 ^{abc}	5.60±1.90 ^{bcd}	5.93±2.19 ^{abcd}
	70%	75	4.93±1.89 ^b	5.40±1.90 ^{cde}	5.46±1.16 ^{abc}	5.50±1.61 ^{bcd}	5.16±2.00 ^{cd}	5.46±1.75 ^{abcd}
	70%	75	4.70±2.00 ^b	5.10±1.86 ^{bcd}	5.43±1.61 ^{abc}	5.30±2.04 ^{cde}	5.23±2.04 ^{cd}	5.16±2.05 ^{bcd}
	70%	85	7.17±0.95 ^a	7.10±1.56 ^a	6.70±1.49 ^a	6.20±1.58 ^a	6.73±1.70 ^a	6.90±0.99 ^a
	70%	85	6.70±1.21 ^a	6.36±1.38 ^a	6.30±1.12 ^{ab}	6.13±1.14 ^a	6.43±1.65 ^a	6.46±1.10 ^a

Alligator Pepper	70%	65	5.00±2.11 ^{bc}	4.96±2.10 ^{bc}	4.96±2.20 ^{bcd}	5.06±2.27 ^{bc}	5.10±2.18 ^{abc}	5.00±1.94 ^{bc}
	50%	65	4.00±1.94 ^c	4.73±2.03 ^c	4.73±2.12 ^{bcd}	5.30±2.03 ^{bc}	4.93±2.22 ^{bc}	4.56±2.12 ^c
	70%	75	6.66±1.42 ^a	5.73±1.34 ^{abc}	5.60±1.69 ^{abc}	6.16±1.82 ^{ab}	6.23±1.83 ^a	6.33±1.62 ^a
	50%	75	6.26±2.11 ^a	6.10±1.82 ^{ab}	5.60±1.45 ^{abc}	6.43±1.56 ^a	4.70±2.32 ^c	5.66±1.93 ^{abc}
	70%	85	6.33±1.29 ^a	6.20±1.39 ^a	5.66±1.58 ^{abc}	6.03±1.35 ^{ab}	6.26±1.46 ^a	6.13±1.25 ^{ab}
	50%	85	5.66±1.78 ^{ab}	5.23±2.12 ^{abc}	4.90±1.95 ^{bcd}	5.56±1.43 ^{abc}	5.93±1.72 ^{ab}	5.53±1.65 ^{abc}

Mean values with different superscripts within the same column are significantly different at 5%. Control=100% distilled water, G1=70% ginger concentration, G2= 50% ginger concentration, A1= 70% alligator pepper concentration, A2= 50% alligator pepper concentration

3.3. Discussion

One of the primary objectives of meat preservation is to prolong shelf-life while adding value to meat in terms of quality. The process will not be complete until the resulting products meet the general acceptability of the consumers in terms of taste, color, texture and nutritional value. Among several methods that have been reported to be available, use of drying methods as well as non-synthetic means through the use of natural plant materials have been reported to be effective [22, 4]

Also, the overall acceptability preference for beef treated with 70% ginger concentration and dried at 75°C is inconsistent with the finding of [19].

4. Conclusion

Deduction from the sensory evaluation revealed that 50% ginger concentration at 85°C was more preferred for appearance, taste, aroma, tenderness and overall acceptability than others.

4.1. Acknowledgement

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