Quality characteristics of beef sausage containing varying levels of ginger (*Zingiber officinale*) powder

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Abstract

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Quality of beef sausage with varying levels of ginger powder as seasoning was investigated. Batch 1 was the Control (0% Ginger powder), Batch 2 had 25% of the seasoning as Ginger powder, Batch 3 had 50% of the seasoning as Ginger powder of total seasoning, Batch 4 had 75% of the seasoning as Ginger powder and Batch 5 had 100% of the seasoning as Ginger. Parameters measured were all subjected to one-way analysis of variance. Results obtained were significantly ($P < 0.05$) different. For cooking and refrigeration weight losses, batch 1 (0% ginger powder) had the lowest percentage cooking weight loss of 9.01% while batch 2 (25% ginger powder) had the lowest percentage refrigeration weight loss of 0.73%. Sensory evaluation showed that meaty flavour in batch 1 was highest (6.50) compared to other batches. Crude protein was highest in batch 5 (100% Ginger powder) with a value of 26.66% and lowest for batch 1 (0% Ginger powder) with 18.40%. Up to 100% ginger inclusion improved refrigeration stability and protein content of fresh beef sausages.

Keywords: Beef Sausage, *Zingiber officinale*

Introduction

Sausages can be defined as products in which fresh comminuted meats are modified by various processing methods to yield desirable organoleptic and keeping properties. Sausages are comminuted (ground seasoned meats, stuffed or unstuffed into casing. Merinoff, (2007), also defined sausages as a food made from ground meat, with back fat, salt, herb, and spices. Different spices and herbs have been added to various food products for centuries, mainly to contribute to the characteristic flavour of the end product. Several spices are used for the production of sausages in various concentrations, depending on the type of sausage. The end product in sausage production is greatly influenced by the spices added. Furthermore, some spices- for example ginger contains [6]-Gingerol, a powerful anti-oxidant that can extend the shelf life of

dry-fermented sausages. Indeed, the oxidation of lipids in foodstuffs results in the development of off-flavors, resulting in a product that is unacceptable for human consumption (Fernandez *et al.*, 1997). Besides the anti-oxidant activity of ginger, it also displays anti-microbial activities. It is worthy of note that the antiseptic potential of spices like ginger resides in the essential oils (Verluyten, 2004).

There has been an increase in consumer awareness regarding the use of chemical additives in food and food products (Tiwari *et al.*, 2009; Kurkubic *et al.*, 2014; Chaves Lopez *et al.*, 2015). This has resulted in an increase in research on new and unique spice flavorings that will meet the rising global demand for authentic ethnic and cross-cultural cuisines. Consumers are also in quest of natural foods and natural preservatives for healthier lifestyles and natural ways of preventing ailments.

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(Philips *et al.*, 1993; Slattery *et al.*, 2000; Karre *et al.*, 2013). To this end, spices like ginger are being sought for their medicinal value, as anti-oxidants and as anti-microbial. Ginger has been widely used as a dietary spice, as well as in traditional oriental medicine (Surh *et al.*, 1999). There is little or no knowledge about the acceptable levels if included in fresh sausages production, hence this study.

Materials and methods

The experiment was carried out in the Meat Processing Laboratory of the Department of Animal Production and Health, Federal University of Agriculture, Abeokuta, Ogun state.

The equipment used were Kenwood (Hampshire UK) mincing machine, water bath, artificial casings, bowls, plates and knife.

Processing of ginger

The rhizomes of ginger (*Zingiber officinale*) were procured, washed with water and chopped into tiny pieces of about 0.5cm diameter. These were sun-dried for 3 days, until constant weight was attained

and milled into fine powder using a mechanical grinder. Proximate analysis was also noted to determine the moisture, protein, fats, carbohydrate contents as well as ash and fibre values of the rhizome using the method described by AOAC (2005).

Preparation of beef sausage

Fresh beef was bought from a healthy source. It was washed, weighed and cut into smaller. A 1kg batch of beef sausage for each treatment was produced. The meat was divided into 5 treatments, with each weighing 500g. The measured and prepared meat was then run through a 5mm plate in a Kenwood (Hampshire UK) mincing machine. Similar amounts of beef, wheat flour, oil and water were added to each batch of the beef sausages. Only the seasoning was varied as follows; Batch 1 was the Control (0% Ginger powder), Batch 2 had 25% of the seasoning as Ginger powder, Batch 3 had 50% of the seasoning as Ginger powder of total seasoning), Batch 4 had 75% of the seasoning as Ginger powder and Batch 5 had 100% of the seasoning as Ginger. See table 1.

Table 1: Recipe (%) of beef sausage

Ingredients (%)	Batches				
	1	2	3	4	5
Beef	50.00	50.00	50.00	50.00	50.00
Wheat flour	25.00	25.00	25.00	25.00	25.00
Oil	10.00	10.00	10.00	10.00	10.00
Water	13.00	13.00	13.00	13.00	13.00
*Seasoning	2.00	1.50	1.00	0.50	0.00
Ginger	0.00	0.50	1.00	1.50	2.00
Total	100	100	100	100	100

Determination of refrigeration weight loss

Replicated treatment samples of uncooked beef sausages were labelled and weighed prior to refrigeration. The weight of each replicate in each treatment was taken after 24 hours of refrigeration at 2°C.

Refrigeration loss was the difference between the pre and post-refrigeration weights of the samples as shown;

Refrigeration loss (g) =
weight of samples before refrigeration -
weight of sample after refrigeration

$$\text{Refrigerated loss (\%)} = \frac{\text{weight before refrigeration} - \text{weight after refrigeration}}{\text{Weight before refrigeration}} \times 100$$

Determination of cooking losses and changes in thickness

Treatment samples of beef sausage with 3 replicates in each treatment were prepared alike. Artificial casing stuffed with each sample and sealed at both ends to prevent leakage of the content, in the artificial casing. The initial weight of each sample replicated in each treatment was recorded, before pan frying for 15 minutes. Internal temperature attained for cooked sausage was 80°C. Final weights and change in weights of cooked sausages was calculated as follows;

$$\text{Cooking loss (g)} = \text{Weight before frying (g)} - \text{Weight after frying (g)}$$

$$\text{Cooking loss (\%)} = \frac{\text{Weight before frying} - \text{Weight after frying}}{\text{Weight before frying}} \times 100$$

Sensory Evaluation

A brief group session was held to orient the panelists. Sensory evaluation of samples of fried beef sausages was assessed by seven (7) panelists. Bite size portion of three replicates in each treatment was served at room temperature to panelists who were asked to comment freely on each sample served. Each panelist was required to masticate one sample per treatment with ranked preferences in the following categories: colour, juiciness, meaty flavour,

tenderness, saltiness, overall flavour and overall acceptability and then awarded scores using a 9-point Hedonic scale Hedonic (1= Dislike extremely, 2 = Dislike very much, 3 = Dislike moderately, 4 = Dislike slightly, 5 = Intermediate, 6 = Like slightly, 7= Like moderately, 8= Like very much, 9 =Like extremely). Cross *et al.* (1975)

Proximate analysis

Proximate composition of beef sausages was determined. Parameters evaluated include dry matter, crude protein, ether extract, ash using the procedure outlined by AOAC, 1995.

Statistical Analysis

All data generated in this study was subjected to one-way analysis of variance in a completely randomized design using the statistical package (SPSS, 1999) while significant differences were separated using Duncan Multiple Range Test at 5% level of significance.

Results

Table 2 shows that all the parameters were significantly ($P < 0.05$) different amongst the various treatment batches. Although, refrigerated weight losses were all less than 5%, the control batch of 0% level of Ginger powder inclusion recorded highest ($P < 0.05$) weight losses of 3.10% while batch 2 sausages with 0.5% level (25%) of Ginger powder inclusion recorded the lowest value (0.73%).

Table 2: Effect of varying levels of Ginger powder inclusion on refrigeration weight loss of beef sausage

Parameter	Batches					SEM
	1 (0%GP)	2 (0.5%GP)	3 (1.0%GP)	4 (1.5%GP)	5 (2.0% GP)	
Initial weight (g)	50.00	50.00	50.00	50.00	50.00	0.00
Final weight (g)	48.45 ^c	49.63 ^a	48.36 ^c	48.68 ^{bc}	49.06 ^b	0.14
Weight loss (g)	1.55 ^a	0.37 ^c	1.64 ^a	1.32 ^{ab}	0.94 ^b	0.14
Weight loss (%)	3.10 ^a	0.73 ^c	3.28 ^a	2.64 ^{ab}	1.88 ^b	0.28

^{a, b, c, d} means along the same row with different superscripts are significantly ($P < 0.05$) different. SEM: Standard Error of Means.

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Table 3: Effect of varying levels of Ginger powder inclusion on cooking weight loss of beef sausage

Parameters	Batches					SEM
	1 (0% GP)	2 (0.5%GP)	3 (1.0%GP)	4 (1.5%GP)	5 (2.0%GP)	
Initial weight (g)	50.00	50.00	50.00	50.00	50.00	0.00
Final weight (g)	45.50 ^a	43.73 ^{ab}	42.16 ^b	43.60 ^{ab}	43.95 ^{ab}	0.44
Weight loss (g)	4.50 ^b	6.27 ^{ab}	7.84 ^a	6.40 ^{ab}	6.05 ^{ab}	0.44
Weight loss (%)	9.01 ^b	12.55 ^{ab}	15.68 ^a	12.81 ^{ab}	12.11 ^{ab}	0.88

^{a, b, c, d} means along the same row with different superscripts are significantly (P<0.05) different. SEM: Standard Error of Means.

Table 3 also shows significant differences (P<0.05) in all the parameters measured in cooking weight losses of beef sausage, as affected by varying levels of Ginger powder inclusion. Although no particular pattern of cook loss was followed, final weight of the sausage samples was significantly different (P<0.05) among the treatment batches with the lowest weight of 9.01% recorded for 0% level of Ginger powder inclusion. However, the highest weight loss (15.68%) was recorded in batch 3 sausage.

All parameters evaluated for sensory characteristics were not significantly different (P>0.05) except meaty flavour which was significantly different (P<0.05) as shown in Table 4. Batch 1 with 0% Ginger powder inclusion level had the

highest score for meaty flavour with a score of 6.50 which indicates slightly meaty while batch 2 sausages with 0.5% (25%) Ginger powder inclusion level had the lowest score of 4.00.

Table 5 shows the effect of Ginger powder inclusion at varying levels on Proximate Composition of beef sausage. There was significant difference (P<0.05) in all the parameters measured among the treatment batches of sausages produced.

The lowest value for Crude protein was recorded in batch 1 (control) with a value of 18.40%, all other treatment groups (2, 3, 4 and 5) had statistically similar values of 25.52%, 22.03%, 24.06% and 26.66% respectively. Ether extract was higher (P<0.05) in Ginger powder sausages than 0% ginger Sausage.

Table 4: Sensory Properties of Beef Sausage produced with Ginger inclusion at varying levels

Parameters	Batches					SEM
	1 (0% GP)	2 (0.5%GP)	3 (1.0%GP)	4 (1.5%GP)	5 (2.0%GP)	
Colour	5.50	5.50	4.50	5.00	5.00	0.57
Juiciness	4.50	4.00	4.50	4.50	5.00	0.71
Meaty Flavour	6.50 ^a	4.00 ^c	5.00 ^{bc}	4.50 ^{bc}	5.50 ^{ab}	0.99
Tenderness	6.00	5.50	5.00	4.00	6.00	1.06
Saltiness	4.50	4.50	4.50	4.00	4.50	0.52
Overall Flavour	6.00	4.50	5.00	5.00	5.00	0.74
Overall Acceptability	6.00	5.00	5.00	5.00	5.00	0.79

^{a, b, c} means along the same row with different superscripts are significantly (P<0.05) different. SEM: Standard Error of Means

Table 5: Effect of Ginger powder inclusion at varying levels on Proximate Composition of Beef Sausage

Parameters	Batches					SEM
	1 (0%GP)	2 (0.5%GP)	3 (1.0%GP)	4 (1.5%GP)	5 (2.0%GP)	
Dry Matter (%)	67.75 ^a	67.25 ^{ab}	67.50 ^a	67.50 ^a	66.75 ^b	0.13
Crude Protein (%)	18.40 ^b	25.52 ^a	22.03 ^a	24.06 ^a	26.66 ^a	1.74
Ash (%)	3.75 ^a	3.50 ^{ab}	3.75 ^a	3.25 ^{ab}	3.00 ^b	0.12
Ether (%)	20.00 ^b	22.00 ^b	21.00 ^b	21.00 ^b	31.00 ^a	1.04

^{a, b} means along the same row with different superscripts are significantly (P<0.05) different. SEM: Standard Error of Means

Discussion

The values recorded for refrigerated weight losses were all within the range of 1-10% refrigerated weight loss. This could be attributed to gingerol, which is natural oil in ginger as oils are known to help in binding. This observation was corroborated by Lamya *et al.* (2012) who reported that ginger powder inclusion at varying levels favoured the product's resistance to diffusion, thus maintaining storage stability. However, this was observed to be contrary for the pan fried sausages which gave higher cook loss values in all the sausage batches having Ginger powder included at varying levels except for Batch 1 with 0% Ginger powder inclusion level. This findings was also contrary to the report of Sheard *et al.* (1998) that sausages with less fat loose more of its water content regardless of the cooking method adopted than the more oil containing sausages as well as Naveena and Mendiratta (2001) that Ginger extract treatment increased the pH, moisture, cooking yield, total pigments, water holding capacity, collagen solubility, protein extractability, muscle fibre diameter and decreased the share force values of meat and meat products.

Meaty flavour was the only sensory evaluation affected by ginger inclusion. This observation was contrary to reports by Lee *et al.* (1986) that tenderness in meat was improved by an addition of ginger at 30% inclusion of the seasoning. According to the authors, ginger rhizome protease is an effective meat tenderizer and the tenderization is achieved through preferential degradation of thin filaments and that tenderness improved with the addition of Ginger extract according to Naveena and Mendiratta (2001).

In Table 5, the highest value of crude protein was recorded in Batch 5 which had 100% (Ginger powder) inclusion of the

total seasoning. This result agreed with the report of Pil – Nam Seong *et al.* (2016) who replaced 1% of ground garlic to total seasoning in fermented sausage production and had a higher crude protein value of 23.34% when compared with sausages with no added spice.

Conclusion

The inclusion of ginger (*Zingiber officinale*) as a seasoning up to 100% improved refrigeration stability and had no consumer bias on sensory characteristics. The use of ginger in sausage production did not reduce cooking loss. However, if nutrient composition is to be considered, inclusion of 0.5% ginger powder (25%) will help improve crude protein in sausage.

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