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Effects of Varying Levels of High Quality Cassava Flour on Quality Characteristics of Chicken Sausage Produced

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Abstract
A laboratory experiment laid out in a complete randomized design was conducted in the school laboratory in the department of Animal production and health in the Federal University of Agriculture Abeokuta. To determine the Effect of high-quality cassava flour and quality characteristics on proximate composition, sensory evaluation and micro waved and refrigeration weight losses on chicken sausage produced. It included five treatments with three replicates each. The first treatment having 25% wheat flour varied with O% cassava flour, treatment 2 has 18.75% wheat flour varied with 6.25% of cassava flour, treatment 3 has 12.5% of wheat flour varied with 12.5% of cassava flour, treatment 4 has 6.25% of wheat flour varied with 18.75% of cassava flour, treatment 5 has 0% wheat flour varied with 25% of cassava flour. Results obtained show that high quality cassava flour can be supplemented with wheat flour at a percentage of 6.25% given a higher crude protein of about 13.56% in treatment 2. The highest fibre and fat content was recorded in treatment 1 with 5.28% and 19.90%. The refrigeration weight loss ranged from 0.53% - 1.03% while microwave weight loss ranges from 5.9% - 7.59%. It also shows that the overall acceptability was the highest in treatment 1 having no % of cassava flour. Therefore, high quality cassava flour cannot replace wheat flour in a 100% ration.
Keywords: Cassava Flour, Quality Characteristics, Chicken Sausage
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INTRODUCTION

The ultimate purpose of agriculture is to provide human beings and animals with the food, and also help in the development of agro based industry. One of such industry is the poultry industry. Which is one of the fastest growing segments due to increase in demand for high quality meal products as a result of increasing world population (Oyenuga, 1998). Chicken meat and products have grown in popularity due to their nutritional characteristics. While also providing an excellent source of animal protein for consumers in developing countries (Deumier and Collignan, 2003). Chicken meat provides high protein and low fat, and chicken lipids are characterized by relatively high levels of unsaturated fatty acids, which are considered to be positive and healthy by consumers (Bonoliet al., 2007; Hwang et al., 2011). In particular, chicken emulsion sausage is a popular chicken meat-based product. Chicken meat processors are responding to the marketplace demand by producing reduced fat chicken meat products (Hwang et al .. 2011). The production and consumption of chicken sausages has been increasing globally. These sausages are becoming more popular due to their sensory characteristics and ease of preparation. which reflects the development of more functionality-enhanced chicken emulsion sausages with added dietary fibre.

Cassava (Manihot esculenta Crantz) is one of the most important crops in Africa, and Nigeria is the leading producer globally. Cassava tubers can be kept in the ground for up to two years prior to harvesting, but once harvested, they begin to deteriorate because of the high moisture content of the fresh roots. To prevent early deterioration, and because of its bulky nature, cassava is usually traded in a processed form, such as high-quality cassava flour (HQCF), which is a major intermediate product. (MAFF 2005 - 2013) In 2003. A presidential initiative was launched in Nigeria with the aim of adding HQCF (l 0% w/w) to the wheat flour used in bread. The purpose of this initiative was to restrict the outflow of funds for the importation of wheat and to encourage research on cassava/wheat composite breads. (MAFF 2005 - 2013). In previously published works, different wheat flours were diluted with various proportions of cassava starch and flour. Defloor et al..2005 reported that the 30% (w/w) inclusion of cassava flour into wheat flour could yield an acceptable fresh loaf of bread, depending on the source of the flour. Recently, the International Institute of Tropical Agriculture (lITA) reported that they successfully produced 40% cassava flour bread that had similar eating qualities to 100% Wheat flour bread. This innovation, if adopted, will help Nigeria-Africa's largest oil producer-save about $252 million annually and improve the livelihoods of cassava farmers in the country (Detloor 1.'1 al .. 2005). According to S.S Abiola and O.O Ewebanjo an experiment was conducted to investigate the effects of substituting wheat flour (WF) for cassava flour (CF) on chemical composition, storage stability and sensory qualities of beef sausage. The Wheat flour in the sausage was replaced with Cassava flour at 0, 25, 50, 75 and 100% levels. The results showed that Wheat flour in beef sausage can be substituted with 100% Cassava flour without adverse effects on chemical composition, processing yield or sensory qualities. This approach will satisfy the growing demand of consumers for gluten-free meat products, thereby minimizing the incidence of celiac disease in humans. In the

past, various researches have been done on how wheat flour can be substituted without any adverse effect on the chemical composition, processing yield or sensory qualities. Wheat Hour has been substituted with plantain flour at varying levels of 0, 25, 50, 75 and 100% by Sanwo et al. 2013, which brought about acceptability in substituting wheat flour with plantain flour at 75% inclusion. if nutrient composition is to be considered 100% inclusion is acceptable in beef sausage production. And also, substitution of wheat flour with cassava flour by S.S Abiola and 0.0 Ewebajo which shows that wheat flour can be replaced by cassava flour at 100% inclusion without any adverse effects..

Therefore, substitution of wheat with high quality cassava flour has not been done. This experiment is aimed at the effects of high-quality cassava on chicken sausage produced in the aspect of taste, cooking and chemical composition.

OBJECTIVES

To determine:

The Proximate composition such as dry matter, crude protein, crude fibre, ether extract. Ash and moisture content of wheat flour, High quality cassava flour of chicken sausage produced from substituting with High quality cassava flour.

The Micro waved and Refrigeration weight losses of chicken sausage produced from substituting with High quality cassava flour.

The Sensory characteristics such as flavor, tenderness, colour, juiciness, and acceptability of chicken sausage produced from substituting with High quality cassava flour.

MATERIALS AND METHOD

Experimental Site

This experiment was carried out at the meat processing laboratory of the Department of Animal Production and Health of the Federal University of Agriculture Abeokuta Ogun state.

Experimental procedure

Fifteen adult birds of fifteen weeks old of exotic strains of broiler chicken were purchased from the poultry unit at the directorate of school farm and were managed under an intensive system of management. Birds of fifteen weeks old were slaughtered by slitting the jugular vein in the neck and complete bleeding of the carcass was done. They were scalded in hot water of temperature of about 60°c for 10 seconds for effective de-feathers. Evisceration was also done immediately. Meat samples obtained from breast muscles weighing 500g was used to prepare each treatment of five sausage batches when each batch was replicated thrice.

Preparation of Chicken Sausages

Three replicates of chicken sausages from each treatment were prepared using lean meal obtained from the chicken breast. Each treatment weighing 500g was prepared and ran through a 5mm plate in a ken wood (Hampshire UK) mincing machine. Similar amount of seasoning (pepper. salt'. coriander, nutmeg) water and wheat flour were constantly added to each batch of chicken sausage except for the high-quality cassava flour as shown in table 2.was varied. The high quality Cassava flour was purchased from FUNAAB consult.

Table 1. Showing recipe (%) of chicken sausages

Ingredients (%)			Sausage batches		
	1	2	3	4	5
Chicken	50	50	50	50	50
Wheat flour	25	18.75	12.5	6.25	0
Cassava flour	0	6.25	12.5	18.75	25
Oil	10	10	10	10	10
Seasoning	1.89	1.89	1.89	1.89	1.89
Water	13.11	13.11	13.11	13.11	13.11
Total	100	100	100	100	100

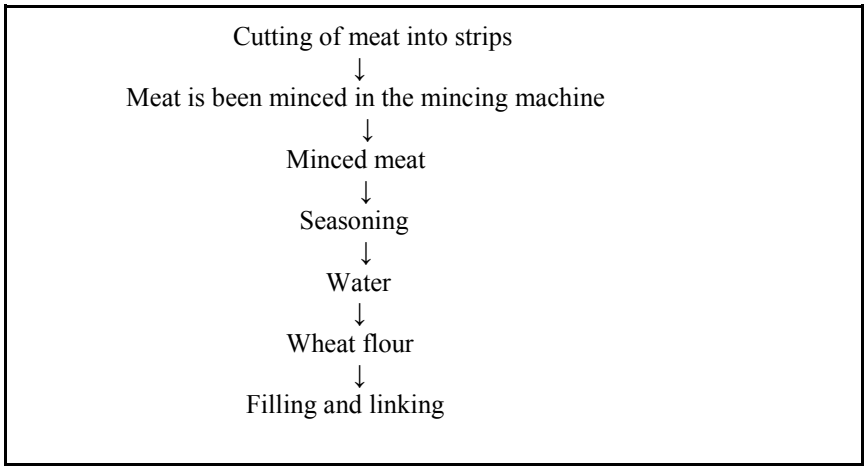

Figure l: Flow chart of chicken sausage flow chart.

Determination of microwaving weight losses of chicken sausages

chicken sausage mixture were put separately into cellulose casings which were weighed before microwaving. The microwave used was Samsung. The samples were labeled and microwaved at internal temperature of 76°c for 30 minutes, (i.e each side was microwaved for fifteen minutes). After allowing the samples to cool at room temperature for 20 minutes, final weight was taken. Samples from each of the replicates were cut into small pieces for sensory quality assessment.

Microwaving Weight loss (g) = Weight before cooking(g) _ Weight after cooking(g)

Percentage Weight loss = Weight before cooking·- Weight after cooking x 100 / Weight before cooking

Determination of refrigeration weight loss of chicken sausages

Samples of sausages from each treatment were weighed before refrigeration. After 24 hours of refrigeration each of the replicate samples were re weighed to determine the weight loss due to refrigeration.

Refrigeration weight loss(g) = weight before refrigeration(g) - Weight after refrigeration(g)

Percentage Refrigeration = weight before refrigeration(g) - Weight after refrigeration(g) x 10(, / weight before refrigeration(g)

Sensory Evaluation

Each chicken sausage was evaluated for color, meaty flavor, juiciness, tenderness, meatiness overall acceptability and flavor (Choi *et al.,* 2008) Sausages were cooked until an internal temperature of 76°C, and the microwaved samples were cooled to room temperature, cut into small sizes and served to panelists (7) in random order. Each sample was coded with randomly selected 3-digit numbers. Sensory evaluations were performed by the panelists. Panelists were instructed to cleanse their palates with water between samples. The meat qualities measured were Juiciness. tenderness, meaty flavor, meatiness, color, overall flavor, and acceptability.

Proximate Composition

Moisture content. protein, ether extract, ash was carried out using the AOAC guidelines. (1990)

Statistical Analysis

The collected data was subjected to one way analysis of variance (ANOVA) 111 a complete randomized design (CRD) according to the statistical package.

RESULTS AND DISCUSSION

Effect of varying levels of cassava flour on chemical composition of chicken sausage

Results of the chemical composition of sausage is shown in table 2. The value of ash. ether extract and crude fibre showed high significant difference ($P<0.05$) with treatment 1 recording the highest value in treatment. However, for Ash content, the order of value in descending order is treatment L 4, 5, 3 and 2. While for Ether extract there wasn't much significance difference between the treatment 5 and 3 but there was significant difference between the treatments with treatment 1 showing the highest value followed by treatment 2,3,5 and 4 in order. Crude fibre of treatment I was significantly different having recorded the highest value. followed by treatment2 and 4 but there was not any significant difference between treatment 3 and 5. This findings confirms that Cassava flour has higher fibre content than WF. Ibeawuchi and Echumba. record 'value of 3.4% crude fibre

for Cassava flour while Malwinder et al. report 0.55% crude fibre for WF. The' used in cooked meat products to increase the cooking yield due to its water binding and fat-binding properties to improve texture. The result obtained from crude protein showed that there was significant difference in the treatment, with treatment 2 recording the highest value followed by treatment 1,5, 4, and 3 in that order. This suggests that the Wheat flour and Cassava flour used in this study probably had comparable amounts of protein content. Narpinder et al. report protein content of 8.60% for Wheat flour (WL-I562 variety) and report a comparable value of 6.50% protein for Cassava flour. Cereal flour obtained from wheat or corn is usually low in protein and poor in emulsification ability. Dry matter for the treatment observed showed significant difference with treatment 3 showing the highest value, although there wasn't much difference between treatment 4 and 5 but they were still significantly different from treatment 1 and 2 with treatment 2 recording the lowest dry matter value. The moisture content with treatment 2 showing the highest value followed by treatment 1 However, there wasn't much significant difference between treatment 4 and 5, but they were significantly different from treatment 3, which has the least value for moisture content. The high-water binding quality of cassava flour has been documented. Annor-Frempong et al. report that products with Cassava flour had higher water contents due to the higher water binding and retention capacity of cassava, The authors recorded moisture content of 56-64% for cassava products.

Table 2: Proximate composition of High-quality cassava flour, wheat flour and chicken sausage.

Parameter/ Treatment (%)	1	2	3	4	5	Cassava	Wheat	S.E.M
Ash	7.02[a]	4.39[e]	5.38[d]	6.31[6]	5.55[c]	87.12	0.93	0.24
Ee	19.90[a]	18.13[b]	16.68[c]	17.87[b]	16.80[c]	1.00	0.42	0.32
CF	5.28[3]	4.49[b]	3.65[d]	4.14[c]	3.60[d]	4.25	0.084	0.17
CP	12.96[c]	13.56[a]	12.51[e]	12.77[d]	13.17[b]	2.00	1.08	0.97
DM	91.80[c]	90.48[d]	94.09[3]	92.86[b]	93.28[b]	3.40	97.57	0.34
MC	8.20[b]	9.52[a]	5.91[d]	7.14c	6.72[c]	76.47	12.76	0.34

Key:
abc along the line represent the level of significance
S.E.M represents Standard error of mean
Ee represents ether extract
Cf represents crude fibre
Cp represents crude protein
Dm represents dry matter
Mc represents moisture content

Effect of varying levels of cassava flour on Refrigeration and Microwaving weight loss of chicken sausage.
Results of the refrigeration and microwave weight losses of sausage observed that the microwaving and refrigeration weight lost in the experiment was averagely low, ranging from 5.9- 7.59% and 0.53-1.03%. This according to Gerrard (1976) indicates good quality sausage as fresh sausage produced with good ingredients and satisfactory production techniques results in cooking weight loss of less than 10%. The lowest refrigeration weight loss was recorded in treatment I with a value of 0.53%. while treatment 2 had the highest refrigeration loss of 1.03%.

Table 3: Showing refrigeration and microwaving weight loss of chicken sausage

PARAMETERS/ TREATMENT	1	2	3	4	5	S.E.M
Refrigeration weight losses:						
Initial weight (g)	62.9[ab]	60.73[b]	64.57[ab]	67.93[a]	62.4[b]	0.89
Final weight (g)	62.57[3b]	60.1[b]	64.13[ab]	67.57[a]	62.0b	0.91
Weight loss (g)	0.33[a]	0.63[3]	0.43[3]	0.37[3]	0.40[a]	0.82
%Weight loss	0.53[a]	1.03[a]	0.67[a]	0.55[3]	0.64a	0.13
Microwave weight loss						
Initial weight (g)	66.77[a]	64.30[a]	68.33[a]	69.173	65.37"	0.93
Final weight (g)	61.83[3]	60.30[3]	63.97[a]	63.90[3]	61.50"	0.83
Weight loss (g)	4.93[ab]	4.0b	4.37[3b]	5.27a	3.87[b]	0.1
% Weight loss	7.40[a]	6.23[ab]	6.39[3b]	7.59[3]	5.9[b]	0.24

Key: abc along the line represent the level of significance; S.E.M represents Standard error of mean

Effect of varying levels of cassava flour o~ sensory evaluation of chicken sausage:

The results of sensory evaluation for the treatments of chicken sausages. All cassava products were superior in sensory properties compared to the control. The values obtained for colour in treatment 1.2.3.4 was significantly different from treatment 5. The juiciness had treatment 4 significantly different from treatment 1,2,3,5. Flavour decreased with increase in the levels of cassava flour in the sausage while the score for tenderness was the highest for sausage with 50% Cassava flour (Abiola and Ewebanjo).

Table 4: Sensory evaluation of chicken sausage

PARAMETERS/ TREATMENT	1	2	3	4	5	S.E.M
COLOUR	6.71^{a}	6.87^{a}	7.05^{a}	6.48^{a}	5.38^{b}	0.18
JUICINESS	5.71^{a}	6.14^{a}	5.72^{a}	4.72^{b}	6.14^{a}	0.15
FLAVOUR	6.43^{a}	5.76^{b}	5.86^{ab}	5.00^{c}	6.38^{ab}	0.16
TENDERNESS	6.33^{a}	6.81^{a}	6.38^{a}	5.14^{b}	6.67^{a}	0.18
SALTINESS	4.86^{b}	5.28^{ab}	5.28^{ab}	5.48^{a}	5.86^{a}	0.11
OVERALL FLAVOUR	6.52^{a}	5.86^{ab}	5.86^{ab}	5.29^{bc}	4.57^{c}	0.21
OVERALL ACCEPTABILITY	6.76^{a}	5.95^{b}	5.67^{bc}	5.05^{cd}	4.57^{d}	0.21

KEY: S.E.M represents Standard error of mean; abc represents level of significance
Treatment 1 represent 25% wheat flour and 0% cassava flour
Treatment 2 represent 18.75% wheat flour and 6.25% cassava flour
Treatment 3 represent 12.5% wheat flour and 12.5% cassava flour
Treatment 4 represent 6.25% wheat flour and 18.75% cassava flour
Treatment 5 represent 0% wheat flour and 25% cassava flour

CONCLUSION AND RECOMMENDATION

Wheat flour can be replaced at 6.25% in chicken sausage production by High quality cassava flour which is also known as tapioca flour without adverse effects on processing yield or sensory qualities Whereby reducing sausage production cost, which is one of the problems been encountered by sausage production companies, which will satisfy the increasing demand of consumers for gluten-free meat products thereby reducing the incidence of diseases such as coeliac.

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