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DAWADAWA (*PARKIA BIGLOBOSA*) PULP AS AN EXTENDER IN BEEF SAUSAGE

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Abstract

This study was conducted using dawadawa (Parkia biglobosa) pulp powder as an extender in beef sausage to determine the effect of dawadawa pulp powder on sensory characteristics as well as the proximate composition of beef sausages. Four treatments beef sausage-products were formulated. The inclusion levels of dawadawa pulp powder in the various treatments were 0 g, 20 g, 25 g and 30 g of dawadawa pulp powder per kilogram minced beef for (T1), (T2), (T3) and (T4), respectively. The minced meat mixed with the various spices was stuffed into natural casings, linked to a length of about 10 cm, smoked, cooled and stored at -10^{o}C for future use. Sensory characteristics: colour, flavour intensity, juiciness, taste, texture, cohesiveness, pulp flavour and overall liking of the beef sausages were evaluated. Significant differences ($P < 0.05$) were recorded in juiciness and flavour of the beef sausage. Juiciness of T1 was significantly higher ($P < 0.01$) than T3 and T4 but not T2. Also juiciness of T2 was significantly higher ($P < 0.01$) than T4 but not T3. T3 and T4 did not differ significantly ($P > 0.05$) from each other. Flavour of T1 was significantly higher ($P < 0.05$) than T4 but not T2 and T3. Flavour of T2 and T3 did not differ significantly ($P > 0.05$) from T4. All other sensory parameters were not significantly ($P > 0.05$) affected. The crude protein, moisture and fat content of the product were significantly different ($P < 0.05$). T1, T2, T3 and T4 were all significantly different ($P < 0.001$) from each other in terms of moisture, protein and fat. Moisture and crude protein contents of T1 were significantly higher ($P < 0.001$) than T2, T3 and T4. Crude fat content of T4 was significantly higher ($P < 0.001$) than T1, T2 and T3. pH of T2, T3 and T4 were significantly higher ($P < 0.05$) than T1.

Key words: **Beef sausage, Proximate composition, Sensory characteristics, Dawadawa pulp**

Introduction

The flesh of domestic and wild animals described as meat has been used as food for human beings from antiquity to present (Stufflebeam, 1983). The importance of meat lies in the fact that, when digested, the protein is reduced to its ultimate amino acids which when assimilated by the system suffice as building units for the repair of cells and tissues and the formation of new growth (Taylor & Field, 1998). Meat is processed by the addition of ingredients and/or mechanical action to convert it into specific products which may include sausages and, burgers to meet the desires of consumers (Teye, 2007; Adu-Adjei *et al.*, 2014; Teye *et al.*, 2014). The aims of meat processing are to preserve meat for a longer period of time, improve the flavour and the texture, and to increase variety in the diet (FAO, 1991). Meat processing also adds value to meats of poor quality (PSE and DFD meats) (Adzitey, 2011; Adzitey & Nurul, 2011; Adzitey & Huda, 2012). Meat extenders are non–meat materials added in such an amount that they are able to increase yield, modify and improve the quality of meat products or lower the cost of the products (FAO, 1990).

Dawadawa pulp is a yellowish edible flour and can serve as a good source of nutrients for humans (Gernah *et al.*, 2007).

With the world population rising at an ever increasing rate, it is becoming increasingly difficult to produce sufficient high quality animal protein foods such as beef, pork, chevon, mutton, etc for human nutrition. Although attempts are being made to increase the supply of high quality animal protein

foods, it is highly unlikely that the required quality of animal protein foods will be obtained because of the economic problem involved in raising and feeding these animals. Dawadawa pulp has a moisture content of 8.41%, protein 6.56%, fat 1.80%, crude fibre 11.75%, ash 4.18%, carbohydrate 67.30%, carotenoids 49.175ug/100g and ascorbic acid (vitamin C) of 191.20 mg/100g (Gernah *et al.,* 2007).

The effects of dawadawa pulp as an extender in meat products is not known; therefore this experiment had its main objective to determine the effect of dawadawa pulp powder as an extender in meat products. Furthermore, this study sought to determine the sensory characteristics and proximate composition (moisture, crude protein and fat content) and pH of the products.

Materials and methods

Study area

The study was conducted at the Meat Processing Unit of the University for Development Studies (UDS), Nyankpala Campus. Chemical analysis of the meat products were conducted at the Spanish Laboratory of UDS, Nyankpala.

Processing and preparation of dawadawa pulp powder

Matured African locust bean (*Parkia biglobosa*) fruits were obtained from Nyankpala market in the Northern Region of Ghana. The fruits were opened to obtain the yellowish pulps. The yellowish pulps were sun-dried for seven days to enhance pounding. The pulps were pounded in using mortar and pestle until well defined particles were obtained. This was followed by packaging and storage until it was ready for use.

Beef sausage preparation and packaging

Four kilograms (4 kg) of beef was used for the sausage. The meat was obtained from the meat processing unit of UDS and thawed overnight at room temperature, cut into smaller sizes and minced using a 5 mm sieve table top mincer (Talleres, Ramon, Spain). The minced meat was divided into four (4) treatments of 1.0 kg each. The treatments were Treatment 1 (T1) - (Control) no pulp powder; Treatment 2 (T2) - (20g) pulp powder; Treatment 3 (T3) - (25g) pulp powder; and Treatment 4 (T4) - (30g) pulp powder. Each kg of meat also contained 15 g curing salt, 0.5 g red pepper, 1.0 g white pepper, 1.0 g black pepper, and 2.0 g adobo® (commercial mixed spices). The study was replicated thrice. The spices and extender were thoroughly mixed with the meat and immediately stuffed into natural casing, using a hydraulic stuffer and manually linked into equal lengths of about 10 cm. The sausages were hung on smoking rack and smoked for 40 minutes. They were then scalded for about 20 minutes at 70°C and allowed to cool for 30 minutes. The products were bagged in transparent polythene bags and vacuum sealed using an electronic vacuum sealer, labeled and frozen at -10°C for sensory and chemical analysis.

Selection and training of panelists

Twenty prospective panelists were randomly selected, screened and trained for their tasting ability or acuity. The selection was done by presenting the potential panelists with three products wrapped in coded aluminium foil; two of which were the same products. Those who were unable to accurately detect the odd product were disqualified.

Product reparation for sensory evaluation

The products were removed from the freezers and allowed to thaw in about three hours under room temperature. They were then warmed in an electric oven (turbofan, Blue Seal, UK), sliced into uniform sizes of about 2cm in length and wrapped with coded aluminium foils to keep them warm and maintain the flavour.

Sensory evaluation of products

A total of fifteen (15) panelists were selected and trained according to British Standard Institute (BSI, 1993) guidelines for panel training to form the sensory panel for the evaluation of the products. Sensory evaluation of the product was carried out on the second day after the product was formulated. The products were presented to each of the panelist under conditions of controlled lighting, and examination so that a panelist would not be influenced by one another. Each panelist was provided with water and pieces of bread to serve as neutralizers between the products. The panelists were provided with a 5-point category scale questionnaires (Table 1) to indicate their remarks.

Table 1: Five (5) -point scale used for the sensory evaluation

Attribute	Scale				
Texture	1-Very Smooth	2-Smooth	3-Intermediate	4-Rough	5-Very Rough
Taste	1-Very Pleasant	2-Pleasant	3-Intermediate	4-Bitter	5-Sour
Juiciness	1-Very Juicy	2-Juicy	3-Intermediate	4-Dry	5-Very Dry
Flavour	1-Very Strong	2-Strong	3-Intermediate	4-Weak	5-Very Weak
Colour	1- Red	2- Light Red	3-Intermediate	4-Dark Red	5-Very Red
Pulp flavour	1-Very Strong	2-Strong	3-Intermediate	4-Weak	5-Very Weak
Cohesiveness	1- Very much together	2- Together	3-Intermediate	4- Apart	5-Very Apart
Overall liking	1-Like Very Much	2-Like	3-Intermediate	4-Dislike	5-Dislike Very Much

Laboratory analyses of products

The products were analysed for moisture, crude protein and crude fat (ether extract) contents according to the method of the International Association of official Analytical Chemist (AOAC, 1999).

Determination of the pH of the products

The samples (10g each) were grounded with a laboratory mortar and pestle, and homogenized with 50 ml distilled water. The pH values were measured with a digital pH-meter (CRISON, Basic 20, Spain).

Data analyses

The data obtained were analysed using the General Linear Model (GLM) of the Analysis of Variance (ANOVA) of the Minitab statistical package, Version 15 (Minitab, 2007). Where significant differences were found, the means were separated using Tukey Pair-Wise Comparison, at 5% level of significance.

Results and discussion

Sensory characteristics of beef sausages

The texture, colour, pulp flavour, cohesiveness and overall liking of the sausages were not significantly different ($P > 0.05$) from the control product (Table 2). This result indicates that, dawadawa pulp powder as an extender would not have adverse effects on beef sausage at the levels used in this work. Products quality will therefore not be compromised since these parameters are essential for consumer acceptability of a product.

The colour of a product refers to what is perceived visually by the consumer, and is an important factor in determining the quality of meat/products (Lawrie & Ledward, 2006). The sight of a product either attracts or repulses consumers to a product. The colour of meat is determined by variety of factors such as the chemical state of the myoglobin molecules and the species of animal.

Table 2: Sensory characteristics of the products

Parameter	T1	T2	T3	T4	SED	P-Value
Texture	2.73	2.40	2.47	2.73	0.356	0.694
Taste	2.40	2.47	2.00	1.73	0.302	0.060
Juiciness	3.27^{c}	2.93^{bc}	2.27^{a}	2.60^{ab}	0.286	0.007
Flavour	3.07^{b}	2.53^{ab}	2.73^{ab}	2.20^{a}	0.301	0.042
Colour	2.33	2.53	2.47	2.53	0.354	0.934
Pulp Flavour	3.27	2.73	2.87	2.80	0.396	0.538
Cohesiveness	2.60	2.47	2.60	2.13	0.296	0.352
Overall liking	2.200	2.20	2.00	1.93	0.292	0.722

Means in the same row with common superscripts are not significantly different ($P > 0.05$) SED: - Standard error of difference

Alteration of colour of meat and their products as per consumers' previous knowledge may affect acceptability. Texture is the sensory manifestation of the structure of the inner make-up of a product, in terms of its reaction to stress, and mechanical properties such as hardness, firmness, adhesiveness and cohesiveness by the kinaesthetic sense in the muscles of the hand, finger, tongue, jaws or lips (Meilgaard *et al.,* 1991).

There was significant difference ($P < 0.05$) in juiciness and flavour. Juiciness of T1 was significantly higher ($P < 0.01$) than T3 and T4 but not T2. Also juiciness of T2 was significantly higher ($P < 0.01$) than T4 but not T3. T3 and T4 products did not differ significantly ($P > 0.05$) from each other. Flavour of T1 was significantly higher ($P < 0.05$) than T4 but not T2 and T3. T2 and T3 did not differ significantly ($P > 0.05$) from T4. Juiciness of T3 and flavour of T4 were best liked by the panelists. Flavour refers to the taste of food substance perceived by the use of the tongue. This involves simultaneous multisensory integration from touch and auditory receptors with those for chemical senses, odour, taste as well as sight and various psychological factors such as experience and expectation (Moncrieff, 1951). Consumer's willingness to eat a product and also purchase such products depends on many factors such as aroma, flavour, and colour.

Proximate composition of sausages

The proximate composition of the products is presented in Table 3. There were significant ($P < 0.001$) differences in the moisture, crude protein and fat contents of the sausages (Table 3). T1, T2, T3 and T4 were all significantly different ($P < 0.001$) from each other in terms of moisture, protein and fat. The moisture and protein contents of T1 were significantly ($P < 0.001$) highest, followed by T4, T3 and T2. In terms of fat, T4 was significantly the highest ($P < 0.001$), followed by T3, T2 and T1. pH of T2, T3 and T4 products were significantly higher ($P < 0.05$) than T1 products. Moisture is the amount of water molecules contained in products. Moisture has influence on the juiciness of meat products. Less moisture makes meat less juicy while high moisture content in meat makes it juicier. Moisture affects the palatability of meat; less moisture makes meat products unpalatable (Klincka, 1969). Moisture is necessary for microorganisms to grow and multiply (Rust, 1976). In general, the higher moisture content of the products could be due to the addition of ice water to the products during preparation for uniform mixture. Nonetheless the higher moisture content of T1 suggests that it will be juicier than the T2, T3 and T4. Also T1 will be more prone to spoilage as compared to T2, T3 and T4.

Table 3: Proximate composition of beef sausage

Parameter	T1	T2	T3	T4	SED	P-Value
Moisture	75.39^{d}	71.46^{a}	75.29^{c}	74.59^{b}	0.036	0.001
Protein	25.66^{d}	23.09^{a}	24.75^{c}	23.55^{b}	0.005	0.001
Fat	2.41^{a}	2.81^{b}	3.09^{c}	5.61^{d}	0.001	0.001
pH	5.68^{b}	5.74^{a}	5.73^{a}	5.73^{a}	0.012	0.026

Means on the same row with the same superscripts are not significantly different P > 0.05. SED: - Standard Error of Difference.

Fat is one of the most variable components in processed meat and it is important because it directly affect flavour, texture, shelf-life and profits (FAO, 2007). Drastic reduction in fat content could affect the products quality leading to negative impact on consumer acceptability. Fat acts as one of precursors of flavour by combining with amino acids from proteins and other components when heated (Pearson and Gillett, 1999). Gernah *et al.* (2007) found the crude fat content of *Parkia*

biglobosa to be 1.80%. The 1.80% fat found in *Parkia biglobosa* could have contributed to the fat content in the products formulated with dawadawa pulp. In this study the fat contents of T2, T3 and T4 (test products) were all significantly higher ($P < 0.001$) than T1 (control product). According to Anonymous (2014) the recommended daily fat intake is 73 g. This amount exceeds the fat content in the dawadawa pulp and the fat content of the sausages. The crude protein content of the products with dawadawa pulp powder decreased significantly ($P < 0.01$) with increasing dawadawa pulp powder content. Percentage decrease in the crude protein content between the control and the test products is between 3.55% to 10.02%.

pH of beef sausages

The addition of dawadawa pulp powder to beef sausages significantly ($P < 0.05$) increased the pH with the control product having a lower pH than the test products. Lawrie & Ledward (2006) refer to pH as the amount of acid or alkaline contained in a medium. The mean pH ranges of the products were between 5.6 and 5.7. These figures agree with the pH ranges of 5.8-6.0 and 5.2-6.02 reported by FAO (2007) and Warries (2010) respectively as ideal pH for quality meat and meat products. Meats and seafoods have a final ultimate pH of about 5.6 and above, causing these products to be susceptible to bacterial spoilage as well as to mould and yeast spoilage (Jay, 2000).

Conclusion

The addition of dawadawa pulp powder to beef sausage impacts a characteristic flavour, and juiciness on the sausage. The addition of dawadawa pulp powder also decreased the crude protein of the beef sausage and increased fat content. It is recommended that further research should investigate the yield, cost of production and water holding capacity of the products.

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