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RESEARCH ARTICLE

Effect of Dawadawa (*Parkia Biglobosa*) as a Spice on Sensory and Nutritional Qualities of Meat Products: – A Preliminary Study

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ABSTRACT

Dawadawa is a fermented seed meal of a tropical tree plant; *Parkia biglobosa.* It is commonly used in Ghanaian homes as flavour enhancers in varieties of meals. This study was conducted to determine the effects of *dawadawa* as a spicing agent on sensory characteristics and nutritional qualities of meat products (smoked pork sausage and burgers). Fresh boneless beef and pork were minced separately and were used to formulate burgers and smoked pork sausages, with various levels of *dawadawa* inclusions. The Control products (Treatment 1(T1) were formulated with a standard flavour enhancer [Adobo at 2g/kg meat], Treatment two (T2) products were formulated with 2g *dawadawa* and 2g adobo/kg meat, Treatment three (T3) products were formulated with 2g *dawadawa*/kg meat, while Treatment four (T4) products were formulated with 4g *dawadawa*/kg meat. All other ingredients were added in equal amounts to the meat and thoroughly mixed. The products were bagged and refrigerated for sensory and chemical analyses at later dates. The use of *dawadawa* up to 4g/kg meat in the meat products increased the crude protein content significantly ($P<0.001$) and had no effect ($P>0.05$) on the sensory characteristics of the products. *Dawadawa* could be used in meat products up to 4g/kg meat for improved crude protein content.

INTRODUCTION

Spices are dried seeds, fruits, root, bark, leaves or vegetative substances used in small quantities as food additives for the purposes of flavour, colour, or as preservatives (Thomas, 2007). FAO, (2010) reported that spices in food minimizes the rate of rancidity, improve colour and flavour intensity of food and food products. Most of the additives used in commercial meat formulations are not locally available and have to be imported at higher costs; sometimes creating production inconveniences due to their scarcity or unavailability. However, there are some indigenous spices and condiments used in Ghanaian homes for enhancing the flavour of traditional dishes. One of such ingredients is *Dawadawa*. *Dawadawa* is the fermented seeds meal of *Parkia biglobosa* or the African locust bean plant. It is used mainly as a flavouring agent but also improves the nutritional composition of poor-protein diets (Ikenebomeh *et al*., 1986; Odunfa, 1986; Dike and Odunfa, 2003). *Dawadawa* is currently used in local homes as a protein additive in most stews and soups (Shao, 2002). Its crude protein content is reported to range between 23.5 to 33.4%, depending on the duration of fermentation (Dike and Odunfa, 2003). *Dawadawa i*s also an important source of Vitamin B (Shao, 2002). Vitamin B in the form of riboflavin is generally deficient in most African diets, but a substantial amount of this is available in *Dawadawa* (Campbell-Platt, 1980). Traditionally, *dawadawa* is also used extensively in the treatment of hypertensions and other infections (Covi, 1971). An aqueous extracts from *dawadawa* has been reported to have inhibiting effect on platelet secretion and aggregation (Rendu *et al.,* 1993). The effect of *dawadawa* on the nutritional and sensory characteristics of meat products is however, yet to be exploited. This study was therefore conducted to determine the effects of *dawadawa* on sensory characteristics and nutritional qualities of smoked pork sausage, beef and ham burgers.

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MATERIALS AND METHODS

The study was conducted at the Meat Processing Unit of the University for Development Studies (UDS), Nyankpala Campus. Freshly prepared *dawadawa* was obtained from the local market in Nyankpala, Tamale. The dawadawa was crumbled on a tray and solar dried for 48 hrs. Fresh boneless beef and pork (*Longissimus dorsi, Semitendinosus, Semimembranosus, Quadriceps femoris* muscles) were obtained from the Meat Processing Unit of the UDS. The meats were trimmed of excess fat and connective tissues, chopped into smaller sizes and minced using a 5mm-sieve table top mincer (Talleres Ramon, Spain). The current standard commercial meat flavour enhancer being used in the Meat Processing Unit is "Adobo". *Dawadawa* was therefore used in graded levels as substitute for "Adobo". The treatments were: Treatment 1 (T1, control product) was formulated with 2g Adobo/kg meat, no *dawadawa* added; Treatment 2 (T2) had 2g Adobo and 2g *dawadawa*/kg meat (Treatment 3 (T3) had 2g *dawadawa*/kg meat, no adobo; Treatment 4 (T4) had 4g *dawadawa*/kg meat, no adobo. The following ingredients were also added in equal amounts (g/kg) to the various formulations: 15.0g curing salt, 0.5g red chilies, 1.0g black pepper, 1.0g white pepper.

Products formulation

The products were formulated in triplicates. The minced meat was divided into portions of 2kg and randomly assigned to the treatments.

Smoked pork sausage

The spices were thoroughly mixed with the minced meat and were immediately stuffed into natural casings, using a hydraulic stuffer (Talleres Ramon, Spain) and manually linked into similar lengths of about 10cm. The sausages were hung on smoking racks and smoked for an hour.

Burgers

The minced pork was used for the formulation of hamburgers while the minced beef was used for beefburgers. The spice-minced meat mixture was moulded into circular shapes with average diameter of 9.0cm, thickness of 2.0cm and an average weight of 110g. The products were then frozen at -10°C for 24hrs before the sensory and chemical analyses.

Packaging of products

The products were bagged in transparent polythene bags, vacuum-sealed with an electronic vacuum sealer (Busch, RAMON), labelled and frozen for storage at -10^{0}C for sensory and chemical analyses.

Product evaluation

Sensory evaluation

Sensory evaluation of the products was conducted on the 1st and 8th days after product formulation. A total of fifteen panellists were selected and trained according to the British Standard Institution (BSI, 1993) guidelines, to evaluate the products. The frozen products were removed from the freezers and allowed to thaw for three hours under room temperature. They were then grilled 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 retain the flavour. The products were presented to each of the panellists, under conditions of controlled lighting and panellists were made to sit under examination conditions, so that a panellist would not be influenced by another. Each panellist was provided with water and pieces of bread to serve as neutralizers between the products. The panellists were provided with a five-point category scale to indicate their reaction to the products, based on the following parameters.

Colour: - very pale red (1), pale red (2), intermediate (3), dark red (4), very dark red (5)

Aroma: - very offensive (1), offensive (2), intermediate (3), pleasant (4), very pleasant (5)

Dawadawa flavour: - very weak (1), weak (2), intermediate (3), strong (4), very strong (5)

Flavour liking: - dislike very much (1), dislike (2), intermediate (3), like (4), like very much (5)

Overall liking: - dislike very much (1), dislike (2), intermediate (3), like (4), like very much (5)

Laboratory analyses of products

The products were proximately analyzed for moisture, crude protein and crude fat contents according to the methods of the AOAC (1999). All analyses were conducted in duplicates.

Data analyses

The data obtained from the study were analysed using the General Linear Model (GLM) of the Analysis of Variance (ANOVA) component 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 products

The colour of the *dawadawa* spiced burgers was not significantly (P> 0.05) different from the control products (Tables 1 and 2). The smoked pork sausage with the highest *dawadawa* inclusion (T4) was significantly (P<0.05) darker than the control products (Table 3). The aroma, *dawadawa* flavour intensity, flavour liking and acceptability of the burgers and sausages formulated with *dawadawa* did not differ (P>0.05) from their respective control products (Tables 1, 2 and 3). Sensory parameters are very important qualities consumers look out for when buying meat products. Colour is the visual appraisal of meat products, and is an important criterion consumers look out for when making purchasing decisions (Feiner, 2006; Van Oeckel *et al*., 1999). At the retail level, colour is important because consumers relate it to freshness and overall quality of a product (FAO, 2010). It was anticipated that the darker nature of the *dawadawa* smoked pork sausage may have an adverse effect on the acceptability of these products, but their level of acceptability was similar to the control products. Various reports indicated that *dawadawa* flavour may be offensive to some consumers (Achi, 2005; Afribiz, 2011), but in the present study, its level of inclusion of up to 4g/kg meat had no adverse effect on the aroma of the burgers and smoked pork sausages. In addition, the *dawadawa* flavour intensity in the products was not offensive to the panellists, and therefore, indicated the same level of acceptability for all dawadawa products.

Table 1. Sensory characteristics of Hamburgers

Parameter	T1	T2	T3	T4	sed	sign
Colour	1.80	1.63	1.66	1.70	0.47	ns
Aroma	3.40	3.63	3.33	3.50	0.52	ns
Dawadawa flavour	1.70	2.72	3.22	4.40	0.37	ns
Flavour liking	4.30	4.09	4.11	3.90	0.62	ns
Acceptability	4.30	4.18	3.66	4.10	0.59	ns

sed. = Standard Error of Difference; sign.=significant; ns = not significant

Table 2. Sensory characteristics of Beef burgers

Parameter	T1	T2	T3	T4	sed	sign
Colour	2.10	2.54	3.40	3.88	0.60	ns
Aroma	4.10	3.27	3.70	3.77	0.48	ns
Dawadawa flavour	2.20	2.48	2.45	4.52	0.49	ns
Flavour liking	4.40	4.00	3.70	3.88	0.52	ns
Acceptability	4.40	4.18	4.70	4.00	0.58	ns

sed. = Standard Error of Difference, sign=significant; ns = not significant

Table 3. Sensory characteristics of smoked pork sausage

Parameter	T1	T2	T3	T4	sed	sign
Colour	1.70^{b}	2.10^{ab}	1.90^{ab}	2.60^{a}	0.54	*
Aroma	3.90	3.80	3.70	3.50	0.48	ns
Dawadawa flavour	2.80	3.00	2.60	3.00	3.40	ns
Flavour liking	4.20	4.20	4.50	4.30	0.53	ns
Acceptability	4.20	4.00	4.50	4.10	0.53	ns

*sed. = Standard Error of Difference; sign=significant; ns = not significant; *Means in the same row with different superscript are significantly differently,*

Proximate composition of products

The proximate compositions of the products are presented in Table 4.

There were no significant (P>0.05) differences in the moisture and fat contents of the products. Moisture content of a product influences its juiciness and storability (Cross *et al*., 1986; McEwen and Mandell, 2011). The insignificant differences in the moisture contents observed in the present study, is an indication that *dawadawa* would not have any adverse effect on juiciness and storability of the products. The addition of *dawadawa* to the products significantly (P<0.001) increased the crude protein contents of the smoked pork sausage, beef and ham burgers. The crude protein contents increased with increasing *dawadawa* levels in the products. Salim *et al.* (2002) reported that, fermented *dawadawa* seeds have high protein contents, and are used as substitutes for meat and cheese in the diets of lower income earners. The higher crude protein content of the *dawadawa* products is therefore, due to the addition of the *dawadawa* to those products. This is good news to the general public because, proteins

are required in higher levels in growing children and also for productive functions such as pregnancy and lactation due to increased output of proteins in the products of conception and in milk (Pond *et al.,* 1995). Therefore, with a higher crude protein content in a product, a small quantity of it would be required by consumers to meet their nutrient requirements, and at a reduced expenditure on meat and meat products, as well as satisfy health concerns over excessive intake of meat.

Table 4. Proximate composition of Smoked pork sausage, Ham and beef burgers

Product	Parameter (%)	T1	T2	T3	T4	sed	sign
Ham burgers	Moisture	49.15	47.35	46.24	45.20	1.07	ns
	Crude fat	38.16	38.92	38.31	44.12	1.22	ns
	Crude protein	12.70^{b}	15.15^{a}	15.65^{a}	15.90^{a}	0.18	***
Beef burgers	Moisture	75.07	75.37	75.38	74.35	1.68	ns
	Crude fat	11.16	12.18	11.31	11.21	0.38	ns
	Crude protein	14.30^{b}	17.35^{a}	17.55^{a}	17.90^{a}	0.29	***
Smoked pork sausage	Moisture	59.00	60.00	56.50	59.50	0.98	ns
	Crude fat	39.50^{a}	37.00^{a}	32.50^{b}	37.00^{a}	1.06	*
	Crude protein	18.82^{b}	21.45^{a}	21.45^{a}	21.80^{a}	0.29	**

*sed = Standard Error of Difference; sign = Significance; ns = not significant Means in the same row with similar superscripts are not significantly different; *=P<0.05; **=P<0.01; ***=P<0.001*

Conclusions

The use of *dawadawa* up to 4g/kg meat in meat products had no significant (P>0.05) effect on the sensory characteristics of the products. *Dawadawa* as a spice in meat products however, increased (P<0.001) crude protein content of these products. It is recommended that further studies be conducted with higher inclusion levels of *dawadawa* to determine the effect on flavour liking, acceptability and storability of the products.

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