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Full Length Research Paper

Effects of Moringa (*Moringa oleifera*) leaf powder and dawadawa (*Parkia biglobosa*), on sensory characteristics and nutritional quality of frankfurter-type sausages – A preliminary study.

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Dawadawa (*Parkia biglobosa*) seed powder and Moringa (*Moringa oleifera*) leaf meal are commonly used in Ghana as flavouring agents in local dishes. This study was conducted to determine the effects of these local food flavouring agents on sensory characteristics and nutritional qualities of frankfurter-type sausages. The sausages were formulated in a Completely Randomized Design, where dawadawa and moringa leaf meal were added at three levels of inclusions (2g, 4g and 6g/kg meat), and were compared with standard sausages. Sensory and chemical analyses were conducted on the products to determine their acceptability and nutritional quality. Dawadawa up to 6g/kg meat had no effect on sensory characteristics and acceptability of products. However, it improved the crude protein, but had no effect on the fat content of the products. Moringa up to 6g/kg meat imparted (P<0.05) green colouration to the products, but did not have significant (P>0.05) effect on flavour and acceptability. The moringa products however, had improved (P<0.01) crude protein and reduced (P<0.05) fat contents. Dawadawa inclusion up to 6g/kg meat did not have much impact on the products. The benefits may be realized if the levels are increased beyond 6g/kg meat. Moringa leaf powder could be used in meat products if the green colouration could be masked, to make the product more appealing to the consumer.

Keywords: Moringa, Dawadawa, frankfurter sausages, spices, flavouring agents

INTRODUCTION

Spices are pungent or aromatic seasonings obtained from the bark, buds, fruits, roots, seeds or stems of various plants and trees (Herbst, 1995). Unfortunately, most of the spices and flavouring agents used in processed meat products are of chemical origin, and are feared could have adverse health effects on consumers when these are consumed over a long period of time (McCarty, 2004; Smith and Young, 2007). In Ghana, there are indigenous plants and plant parts which are used as spices and flavour enhancers in food preparation. Although these ingredients have been in use for centuries, little has been known about their effects on meat products. Some of such ingredients include Dawadawa (*Parkia biglobosa*) and Moringa (*Moringa oleifera*) leaf powder.

Dawadawa is the fermented seeds of *Parkia biglobosa* or the African locust bean plant. It is used as a flavouring

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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* is 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 D*awadawa* (Campbell-Platt, 1980).

Moringa (*Moringa oleifera*) plant is an exceptionally nutritious tree with a variety of potential uses (Fahey, 2005). The leaves can be consumed either raw or cooked, or dried over a screen for several days and ground into a fine powder that can be added to almost any food as a nutrient supplement (Makkar and Becker, 1996). Moringa leaf is rich in iron, potassium and vitamins especially vitamin A. A 100g serving of the fresh cooked leaves is adequate to provide the daily requirements of calcium, about 75% of iron and half of the protein requirement of a 3 year old child (Tree for life, 2005). Moringa balances the cholesterol level in the body, gives feelings of wellness and promotes energy, balances the level of blood sugar and promotes digestion (Jahn, 1996). These nutritional and health qualities of moringa have resulted in its use in the processing of moringa oil, moringa toothpaste, moringa tea, moringa soap and moringa gin bitters among others. There is however, little information on its effect as flavour enhancer in meat products.

This study was therefore conducted to determine the effects of Dawadawa and Moringa leaf powder on the sensory characteristics and nutritional composition of frankfurter-type sausages.

MATERIALS AND METHODS

Study site

The experiment was conducted at the Meat Processing Unit and Laboratories of the University for Development Studies, Nyankpala Campus, Tamale.

Acquisition of dawadawa and moringa Leaf Powder

Dawadawa powder was obtained from the local market for use. Fresh green moringa leaves were harvested, washed and spread on plastic trays under room conditions to dry. This was to maintain its greenish colour and nutritive value. At a moisture content of about 15 percent, the leaves were pounded using a domestic mortar and pestle and then sieved with a fine netting to obtain the moringa leaf powder. The dawadawa and moringa leaf powder were used to formulate products at three levels of inclusion (2g, 4g and 6g/kg meat), and were compared with standard sausages.

Meat used

Fresh boneless beef and pork were obtained from the Meat Processing Unit to formulate frankfurter-type sausages.

Product Formulation

The boneless beef and pork were thawed overnight at a temperature of 1°C, cut into smaller sizes and minced separately using a 5mm sieve table top mincer (Talleres Ramon, Spain). The minced meats were apportioned into groups of four (3kg each), comprising 1kg beef and 2kg pork. The following ingredients were added in equal amounts (g/kg) to the various formulations of sausage meat: 15.0g curing salt, 0.5g red chilies, 1.0g black pepper, 1.0g white pepper and 2g “adobo” (pre-formulated spices).

Crushed ice (1.2kg) was added to each of the products during comminution to obtain the desired consistency of meat batter. The mixture was comminuted in a 3-knife bowl chopper (Talleres Ramon, Spain) until a meat batter temperature of 17°C was attained. The meat batter was immediately stuffed into natural casings, using a hydraulic stuffer (Talleres Ramon, Spain) and manually linked into similar sizes of about 10cm. The sausages were weighed and then hung on smoking racks and smoked for an hour after which they were scalded to a core temperature of 70°C. The sausages were cooled in cold water and hung on the racks again for excess water to drain; after which they were reweighed, packed, labelled and stored in a refrigerator at 2°C for sensory and chemical analyses.

Selection of taste panellists

A total of fifteen (15) panellists, comprising staff members and students of the University for Development Studies, Nyankpala campus, were randomly selected and trained according to the British Standard Institution (1993) guidelines to evaluate the products.

Sensory evaluation

Sensory evaluation was conducted on days 1, 8 and 15 of storage. The sausages were warmed in an electric oven (Turbofan, Blue seal, UK), sliced into uniform sizes of about 2cm in length and wrapped with coded aluminium foils and presented to the panellists. Each panellist was provided with water and pieces of bread to serve as neutralizers in between tasting of the products. A five (5)-

Table 1. Sensory characteristics of products

Product	Parameters	Control	T1	T2	T3	SED	Sig.
Dawadawa	**Colour**	2.66	2.73	2.86	2.86	0.60	ns
	Off-odour	4.86	4.00	4.00	4.53	0.80	ns
	Flavour	3.06	2.93	2.81	2.76	0.69	ns
	Flavour liking	3.86	3.63	3.28	3.09	0.58	ns
	Acceptability	3.80	3.66	3.40	3.46	0.52	ns
Moringa	**Colour**	2.13_b	2.73_a	3.13_a	3.40_a	0.75	*
	Off-odour	4.00	4.27	3.96	4.40	0.74	ns
	Flavour	3.40	3.00	2.93	2.93	0.94	ns
	Flavour liking	3.67	2.07	2.27	2.27	0.60	ns
	Acceptability	3.33	3.00	2.40	2.33	0.73	ns

$_{ab}$= Means in the same row with common subscripts are not significantly different, SED= Standard error of difference, ns= ($P>0.05$), *= ($P<0.05$)

point category scale was used for the evaluation of the products:

Colour: (1) very light red; (2) light red; (3) intermediate; (4) dark red; (5) very dark red.

Off-odour: (1) very strong, (2) strong, (3) intermediate (4) weak (5) very weak.

Moringa/Dawadawa Flavour: (1) very weak, (2) weak, (3) intermediate, (4) strong and (5) very strong.

Flavour liking: (1) like very much; (2) like; (3) intermediate; (4) dislike; (5) dislike very much.

Overall liking: (1) like very much; (2) like; (3) intermediate; (4) dislike; (5) dislike very much.

Laboratory analyses of products

The sausages were analyzed for moisture, protein and fat according to the methods of the AOAC (1999). Analyses were conducted in duplicates.

Data analysis

The data obtained were analyzed using the General Linear Model (GLM) of 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

The sensory characteristics of the products are indicated in Table 1.

The use of dawadawa in sausages had no significant ($P>0.05$) effects on the sensory characteristics and acceptability of the products. Dawadawa is commonly used as a flavour enhancer of local dishes in the northern sector of the country. It was expected that its inclusion in meat products would enhance their flavour intensity, but this was not the case. The highest level of inclusion was 6g/kg meat (T4). This level might be too low to have any flavour enhancing effect on the products. There was no adverse effect on the acceptability of the products, indicating that dawadawa has prospects as an additive in meat products if the inclusion rates are increased beyond 6g/kg meat.

The use of moringa however, imparted green colouration to the product, making them appear greenish. Moringa leaf powder is dark green in appearance and therefore, its addition to the products resulted in their appearing greenish. Several reports indicated that colour is a major indicator of quality of meat, as the appearance of the product influences consumer acceptance (Van Oeckel *et al.,* 1999; Bell and Weaver, 2002). When the colour of a new product differs from the standard products, consumers may see it as a sign of spoilage, and consequently reject them.

The flavour intensity, flavour liking and acceptability of the moringa products appeared to reduce with increasing

Table 2. Proximate composition of the products

Product	Parameter (%)	Control	T1	T2	T3	SED	Sig
	Moisture	69.65	70.67	69.69	70.42	0.49	ns
Dawadawa	**Crude protein**	19.26_b	19.39_b	20.85_b	22.33_a	0.26	***
	Ether extract	13.17	14.22	14.06	12.81	1.17	ns
	Moisture	63.51	68.93	70.79	73.00	0.74	**
Moringa	**Crude protein**	19.63_c	20.48_c	21.92_b	23.96_a	0.61	**
	Ether extract	12.29_a	10.65_b	9.42_{bc}	8.66_c	0.93	*

abc= Means in a row with a common subscript are not significantly different. SED=standard error of difference; Sig.= significance; ns= (P>0.05); *= (P<0.05); **= (P<0.01); ***= (P<0.001)

inclusion level, but the differences were not significant (P>0.05). This observation may be due to the seemingly flavourless nature of moringa, which tends to dilute the meat flavour intensity of the products.

Proximate composition of the products

The proximate composition of the products is indicated in Table 2.

The dawadawa had no significant (P>0.05) effects on the moisture and fat contents of the products (Table 2). The crude protein content of the products however, increased (P<0.001) with increasing dawadawa inclusion. According to Campbell-platt (1980), dawadawa contains high level of crude protein and contributes to the protein intake of consumers. Its addition to the meat products consequently increased their crude protein level.

The moringa products had higher moisture content than the control products. During product formulation, the moringa products required more water than the quantity added to the control products. This might have contributed to the higher moisture contents of the moringa products. The fat contents of the moringa products however, reduced with increasing levels of moringa inclusion. The crude protein contents also increased (P<0.01) with increasing inclusions of moringa (Table 2).

The higher moisture contents of the moringa products may enhance juiciness of the products in storage. This is because Serdaroglu and Rmencioglu (2004) reported that moisture is lost from products during storage, and therefore a product with higher initial moisture content is likely to have good level of juiciness as storage prolongs.

The higher crude protein content of the dawadawa and moringa products is advantageous to the consumer, because proteins are required in higher levels in growing children and also for productive functions such as pregnancy and lactation because of increased output of proteins in the products of conception and in milk (Pond *et al.,* 1995, Heinz and Hautzinger, 2007). Therefore, with higher crude protein levels in moringa products, a small quantity will be required by consumers to meet their nutrient requirement and hence reduce expenditure on meat and meat products.

CONCLUSIONS

Dawadawa inclusions up to 6g/kg meat had no effect on the sensory characteristics and acceptability of frankfurter-type sausages. The products however, had improved crude protein content, indicating that dawadawa sausages would be more nutritious than traditional sausages. The moringa sausages had an unusual green colouration;

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