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Effect of Moringa (*Moringa oleifera*) leaf powder and sweet basil (*Ocimum basilicum*) leaf paste on sensory and nutritional qualities of beef and ham burgers – A preliminary study

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ABSTRACT

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Moringa leaf powder and sweet basil leaf paste are commonly used in local dishes in Ghana for purposes of flavour enhancement and nutrient supplements. This study was conducted to determine the effects of Moringa (*Moringa oleifera*) leaf powder (MLP) and Sweet basil (*Ocimum basilicum*) leaf paste (SBLP) on the sensory characteristics and nutritional compositions of beef and hamburgers. MLP and SBLP were incorporated at 0g (Control, T1), 2g, 4g and 6g/kg meat (T2, T3 and T4 respectively) during the production of the burgers. The burgers were vacuum-packed and frozen for sensory and laboratory analyses. The *M. oleifera* leaf powder had significant ($P<0.001$) effect on the colour and flavour intensity, but had no effect ($P<0.05$) on product acceptability. Results from the proximate analysis indicated that MLP had no significant ($P<0.05$) effect on the nutritional composition of the products. The SBLP significantly enhanced ($P>0.01$) the crude protein content but no significant effect on sensory characteristics of the products.

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1. Introduction

Spices are dried plant substances (seeds, fruits, root, bark, leaves or vegetative parts) used in small quantities as food additives for the purposes of flavour, colour, or as preservatives that suppress microbial activities (Scully, 1995; Thomas, 2007). FAO, (2010) reported that spices in food minimize the rate of rancidity, improve colour and flavour intensity of food and food products. Most of these additives are however, not locally available and have to be imported at higher costs, and sometimes creating production inconveniences due to their scarcity. Meanwhile, there are some indigenous spices and condiments used in most Ghanaian homes for enhancing the flavour of traditional dishes (Dieu *et al.*, 2006). Some of these local additives include moringa leaf powder and sweet basil leaves.

Moringa (*Moringa oleifera*) leaf is a natural ingredient reported to be high in crude protein content (Bey, 2010). Anwar *et al.* (2007) reported that moringa leaf powder could be used as food or for medicinal and therapeutic purposes. It is used for improved wound healing, gastric ulcer, diarrhoea, sore throat and cancer (Grever, 2001). In many countries, moringa leaves are used as traditional medicine for treating common ailments (Trees for Life, 2005). Teye *et al.*, (2012) reported an increased crude protein content of frankfurters incorporated with moringa leaf powder. Its effect on nutritional and sensory characteristics of beef and ham burgers is however, not known.

Sweet basil (*Ocimum basilicum*) is a commonly cultivated plant in the Mediterranean region (Ganasoundari *et al.*, 1997). It is a popular aromatic bushy herb spice which is locally known as 'Akokobesa' among the Akans of Ghana because it is mostly used for steaming chicken and also for enhancing the flavour of food (Dokosi, 1998). There is however, inadequate information on its potential as flavour enhancer in beef and ham burgers.

This study was therefore aimed at determining the potentials of moringa leaf powder and sweet basil leaf paste on the sensory and nutritional characteristics of beef and ham burgers.

2. Materials and methods

2.1. Location of study

The study was conducted at the Meat Processing Unit and Laboratories of the University for Development Studies, (UDS), Tamale, Ghana.

2.2. Processing of moringa leaf powder (MLP) and sweet basil leaf paste (SBLP)

Fresh moringa leaves were harvested and the leaflets stripped from the leaf petioles. They were washed thoroughly with clean fresh water. The leaves were again washed in a 1% saline solution for 3-5 minutes, to kill any microorganism that may be present. They were rinsed and spread on plastic sheets to dry under room temperature to maintain the green colour and the nutritive value (Doerr and Cameron, 2006). The dried leaves were pounded with domestic mortar and pestle and then sieved with a fine netting to obtain the moringa leaf powder (MLP).

Fresh basil leaves were harvested and washed in water to get rid of dirt and pathogens. The leaves were blended into fine paste with a domestic blender.

MLP and SBLP were used to formulate beef and ham burgers in four (4) different treatments: T1 (Control) products were formulated without MLP or SBLP. T2 products contained 2g, T3 products contained 4g and T4 products contained 6g of either MLP or SBLP per kilogram minced meat. The following ingredients were also added in equal amounts (g/kg) to the various formulations: 15.0g curing salt, 0.5g red chillies, 1.0g black pepper and 1.0g white pepper. The minced beef and pork for the beef and ham burgers respectively were obtained from the Meat Processing Unit of UDS.

2.3. Product formulation

The products were formulated in duplicates. The minced meat was divided into portions of 1.5kg and randomly assigned to the treatments. The spices were thoroughly mixed with the meat. The spiced meat was moulded into circular shapes with average diameter of 9.0cm, thickness of 2.0cm and average weight of 110g. The products were frozen at -10°C, then vacuum sealed and stored for sensory and chemical analyses.

2.4. Product evaluation

2.4.1. Sensory evaluation

Sensory evaluation of the products was conducted on the 1st and 8th days of storage. A total of fifteen panellists were selected and trained according to the British Standard Institution (BSI, 1993) guidelines to evaluate the products.

The burgers were removed from the freezers and allowed to thaw for two hours under room temperature. They were then grilled in an electric oven (Turbofan, Blue seal, UK), sliced into uniform sizes of about 2cm³ and wrapped with coded aluminium foils to keep them warm and retain the flavour. The products were presented to each of the panellists, under controlled lighting, and examination conditions, so that a panellist was not 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 impression about the products using 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)

Moringa flavor: very weak (1), weak (2), intermediate (3), strong (4), very strong (5)

Sweet basil flavor: 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)

2.5. Laboratory analyses of products

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

2.6. Statistical 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 (Minitab, 2007). Where significant differences were found, the means were separated using Tukey Pair Wise comparison, at 5% level of significance.

3. Results and discussion

3.1. Sensory characteristics of products

The sensory characteristics of the products are indicated in Tables 1 and 2.

Table 1
Sensory characteristics of the moringa products

Product	Parameter	T1	T2	T3	T4	SED	SIG
Beef burgers	Colour	2.50 ^b	3.20 ^b	4.08 ^a	4.30 ^a	0.59	***
	Aroma	3.90	3.90	3.92	4.00	0.39	ns
	Flavour	1.90 ^c	2.80 ^c	3.67 ^b	4.30 ^a	0.47	***
	Flavour liking	3.90	4.00	3.67	3.70	0.44	ns
	Acceptability	3.70	4.10	3.58	3.60	0.60	ns
Ham burgers	Colour	2.10 ^d	3.10 ^b ^c	3.70 ^b	4.70 ^a	0.57	***
	Aroma	3.80	3.70	3.90	4.00	0.39	ns
	Flavour	1.60 ^d	2.80 ^c	3.70 ^b	4.40 ^a	0.51	***
	Flavour liking	4.00	3.80	3.90	4.00	0.53	ns
	Acceptability	4.10	3.60	3.90	3.90	0.56	ns

Means in the same row with similar superscripts are not significantly different ($P < 0.05$). SED= Standard Error of Difference, SIG = significance; ns=not significant($P > 0.05$); ***= ($P < 0.001$)

Table 2

Sensory characteristics of sweet basil products

Burger	Parameter	T1	T2	T3	T4	SED	SIG
Beef burgers	Colour	3.10	3.20	3.00	2.70	0.73	ns
	Aroma	4.00	3.90	3.80	3.60	0.64	ns
	Flavour	2.80	3.30	3.40	3.30	0.55	ns
	Flavour liking	4.30	4.10	3.90	4.00	0.43	ns
	Acceptability	4.30	4.10	4.00	4.10	0.62	ns
Ham burgers	Colour	2.00	1.60	1.40	1.60	0.56	ns
	Aroma	4.00	4.10	4.20	4.20	0.62	ns
	Flavour	3.70	3.80	3.30	3.30	0.81	ns
	Flavour liking	4.20	4.40	4.60	4.40	0.42	ns
	Acceptability	4.20	4.40	4.70	4.70	0.40	ns

SED= Standard Error of Difference; SIG=Significance; ns=not significant(P>0.05)

The colour and the moringa flavour intensity of MLP products increased ($P<0.001$) with increasing levels (Table 1). A darkening of the products due to the greenish colouration of the moringa powder resulting from the chlorophyll content of the leaves was observed at the 4 and 6g/kg MLP levels. Colour and product appearance are very important criteria that influence consumer patronage (Pearson, 1994). Colour is the single most important factor of meat products that influences consumer buying decisions, as it indicates the freshness or otherwise of the product (Boles and Pegg, 2010). It was expected that the darker colouration of the moringa products would have an adverse effect on acceptability, but on the contrary, flavour liking and acceptability were not significantly ($P>0.05$) affected by the dark colour. This is an indication that the use of MLP up to 6g/kg meat in beef and ham burgers would have no adverse effect on consumer patronage of products.

The sweet basil products had no significant ($P<0.05$) differences in colour, aroma, flavour and acceptability as compared with the control products (Table 2). The use of SBLP up to 6g/kg meat resulted in products with similar characteristics as the control products probably because the levels of inclusion were not high enough for its flavour and effects to be felt in the burgers.

3.2. Proximate composition of the products

The crude protein, moisture and crude fat contents are presented in Tables 3 and 4.

Table 3

Nutritional composition of the moringa products.

Product	Parameter	T1	T2	T3	T4	SED	SIG
Beef burgers	Moisture	72.70	72.65	71.80	70.60	1.66	ns
	Fat	10.57	11.16	11.96	12.27	0.42	ns
	Protein	20.25	20.60	20.60	21.05	0.15	ns
Ham burgers	Moisture	40.40	44.19	43.73	42.31	0.63	ns
	Fat	28.05	29.05	29.95	30.45	0.46	ns
	Protein	18.85	18.90	19.20	19.75	1.5	ns

SED = Standard Error of Difference, SIG= significance

There were no significant ($P<0.05$) differences in the moisture, crude protein and fat contents of the moringa products (Table 3). The crude protein and fat contents of the products however, increased marginally as MLP level increases. Teye *et al.* (2012) reported significantly ($P<0.01$) high crude protein content in frankfurters formulated with moringa leaf powder. In the present study, the increase in crude protein content was not significant ($P>0.05$).

This may imply that the crude protein content of moringa leaf may vary from one location to the other, or the drying and milling process might have had an effect on the crude protein availability.

There were significant ($P>0.01$) differences in the crude protein contents of the sweet basil products. It can be observed that as SBLP levels increased, crude protein content also increased with T4 becoming significantly ($P<0.001$) high. According to Farrel (1990), sweet basil leaves contain about 14.4% crude proteins, therefore, its inclusion improved the crude protein content of the products. The fat and moisture contents were however, not significantly ($P>0.05$) different from the control products.

Table 4
Nutritional composition of sweet basil products.

Product	Parameter	T1	T2	T3	T4	SED	SIG
Beef burgers	Moisture	75.00	76.00	76.00	77.94	0.79	ns
	Fat	11.05	10.94	10.84	11.93	0.72	ns
	Protein	21.33 ^{cd}	23.09 ^{bc}	24.53 ^{ab}	24.88 ^a	0.30	**
Ham burgers	Moisture	50.30	55.70	57.18	61.00	1.86	ns
	Fat	26.84	23.98	25.21	24.66	0.49	ns
	Protein	15.27 ^c	16.91 ^{bc}	17.94 ^b	19.87 ^a	0.33	***

Means in the same row with similar superscripts are not significantly different ($P<0.05$). SED= Standard Error of Difference, SIG = significance; **=($P<0.01$); ***= ($P<0.001$)

4. Conclusion

The use of moringa leaf powder up to 6g/kg meat in burgers had no effect on product acceptability and nutritional composition. The use of sweet basil leaf paste up to 6g/kg meat had no effect on sensory characteristics and acceptability of beef and ham burgers, however, it significantly increased the crude protein content of the products. It is recommended that the inclusion levels be increased beyond 6g/kg meat in further studies to determine the effect on product acceptability, storability and nutritional composition.

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