Spices and Condiments in Ghana: Their Utilization in Comminuted Meat Products

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Abstract
Local spices were collected from seven major markets across Ghana, compiled and identified by their Scientific, Common and Local names, properties, part used and area found. Seven fresh pork sausages prepared using differing compositions of these spices were sensorily evaluated in a pre-trial and four selected and further evaluated in triplicate to determine their acceptability. A 10 member panel assessed the external appearance of uncooked products, internal colour, aroma, taste and the overall acceptability of cooked products. The data was analysed as a completely randomized block design using the nonparametric analysis as employed in Friedman’s method and Wilcoxon’s signed rank test. A total of fourteen local spices were collected. A 1.52% level of inclusion of the different composite spice mixes in the products was acceptable. The prekese based product was significantly judged the most acceptable \( (P=0.05) \) while the dawadawa based product the least acceptable. In conclusion, preparing Ready to use composite-spice mixes from local spices to promote comminuted meat processing among meat handlers is feasible but must be done safely in order to keep the health value of the meat products.

Keywords: Spices, condiments, comminuted meat products, Ghana

Introduction
Studies have shown that pigs can yield on the average four to five times more meat than cattle per ton of live weight (Eusebio, 1980). Generally, presentation of meat is one of the factors that affect its marketing particularly pork marketing. In Ghana, marketing of pork is a major problem that thwarts the expansion of the pig industry. Processing of pork to give it the desired form utility is lacking. The technical know-how of meat processing in Ghana is low. To encourage meat processing, it will be necessary to make processing easy for farmers and meat handlers. This can be achieved by the production of Ready-to-use composite spice mixes and formula e.g. sausage mixes. Such spice mixes will allow meat handlers with even minimal knowledge of processing to be able to process meat products safely and correctly for the market in order to boost consumption as well as improve their incomes. Fortunately, Ghana is endowed with a lot of spices with the potential of being used in developing good seasoning mixes for meat products but in the light of that, much work has not been done to exploit these local spices to make the mixes.

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Spices are known and used for flavouring and preserving food ever since the ancient times (Bauer et al., 2001). According to Lemay et al. (2002) and Farag et al. (1989), the addition of spices to meat and its products helps in development of colour and flavour as well as inhibit microbial growth. Rosemary, oregano, cinnamon, cloves and other spices act as antioxidants in meat and poultry products and retard rancidity in fatty foods (Karre et al., 2013). In earlier food applications, Madsen and Bertelsen (1995) used spices as antioxidants and Lee et al. (1989) highlighted the importance of using ginger as an antioxidant in meat products. Rosemary spice increases the redness of pork sausage making it more desirable but may not be appropriate in poultry products (Karre et al., 2013). The addition of spices to meat products according to Hand et al., (1981) increased the overall desirability of the products. Spices remove the rawness in meat, masking the unpleasant smell, and add a tang and flavour to otherwise insipid foods.

Spices such as paprika, nutmeg, ginger, mace, the peppers (black, red, white), and garlic when added to some food systems enhance fermentation by promoting growth of lactic acid bacteria which alters the pH and subsequently prevents the growth of some other microorganisms (Ockerman and Basu, 2010). This anti-microbial property of spices helps to preserve food. Some spice oils are known to show better antibacterial properties than others when it comes to meat applications. Eugenol, coriander, clove, oregano and thyme oils are found to be effective at levels of 5–20 μl g⁻¹ in inhibiting Lactobacillus monocytogenes and Staphylococcus aureus (Kang and Gung, 2000; Bacus, 1984; Zaika and Kissinger, 1984).

Spice mixes or preparations for processing meat must however be affordable so that the aim of promoting meat processing and increasing incomes of meat handlers and processors is not defeated. It is therefore pertinent to base any such formulation on local spices. However, this potential has not been exploited probably because there is not enough reliable information available on these spices in different parts of the country. The mere identification of these local spices by name both in local and English; Common and Scientific are not well documented. This creates an initial difficulty in identifying whatever potential is available for their use as composite spices for the meat industry. Information on the sensory properties of these spices does exist in literature but are scattered. As an initial step towards the formulation of composite-spices for the meat industry, the identification by name and compilation of sensory properties of local spices was found to be a necessary objective for this study. The study thus restricts itself to two main objectives: Compilation and identification of all the common local spices found on the Ghanaian market; and to develop Ready-to-use composite spices or seasonings for producing comminuted meat products using pork.

Materials and methods

Spices were collected from seven major markets across the country: Bolgatanga, Tamale, Techiman, Kumasi, Accra, Cape Coast and Takoradi. During the collection of spices, interviews were conducted to find out from sellers the sensory properties, uses and local names of these spices. Spices collected were sorted and cleaned. Those with testa example Monodora myristica were removed before grinding. Spices with high moisture content like onions and ginger were peeled, cut into pieces and sun-dried
before grinding. Spices were ground into micro-ground flour using an electric blender and packed into tightly closed clean containers and stored in the freezer until use.

**Preparation of composite spices**
Spices were broadly grouped into three based on their dominant sensory properties for example, spicy spices are the peppery-tasting-spices (e.g. paprika, ginger and West African Black pepper). Spices were selected from each of these groups and used to prepare different formulations of composite mixtures with a commercial composite-spice as the reference. Seven different formulations of composite-spices were then prepared under the following code-names:- Nugcoft (reference composite spice), Nugcoft ‘D’ (Dawadawa based composite spice), Nugcoft ‘Pe’ (Pepper based composite spice), Nugcoft ‘K’ (Karandafi based composite-spice), Nugcoft ‘A’ (Ayerewamba based composite-spice), Nugcoft ‘0’ (Onion based composite-spice), and Nugcoft ‘P’ (Prekese based composite-spice).

**Pre-trial test**
An amount of 1.52% each of the above formulated composite-spices was used to prepare seven types of fresh pork sausages to give seven-product types. A 5-member panel was used to obtain acceptability scores for the seven product types. Out of this, four products; Nugcoft (control), Nugcoft ‘0’, Nugcoft ‘D’ and Nugcoft ‘P’ were selected for the main study.

**Preparation of experimental products**
Pork used for the study was obtained from a sow carcass of 80 kg weight produced at the University of Cape Coast Teaching and Research farm, Cape Coast. Preparation of the fresh pork sausages was carried out at the meat laboratory of the University Teaching and Research farm, Cape Coast. The above selected product types were prepared in three batches (replications) on different days. The preparation of all the four-product types followed the same procedure. Lean pork and fat were minced through a grinder with 5mm diameter holes in its plate. The minced lean and fat plus the other ingredients were mixed in a bowl (at a very low temperature) in the following order: lean, fat, salt, spices and cold water. Immediately after mixing, the dough was stuffed into a 40-80 mm diameter hog casings with a manual stuffer. The stuffed products were linked into 6-8 cm lengths to give sausages of about 35-40 grams each. The sausages were packed into polythene bags, sealed and kept under freezing temperature (-18°C) prior to sensory evaluation the next morning.

**Sensory evaluation**
A 10-member panel consisting of 5 males and 5 females was used. Panel members were schooled as regards the following steps of sensory analysis:

- i. individual assessment.
- ii. washing of mouth after each tasting.
- iii. waiting a few minutes after each tasting before the next.

These panel members were thus dabbed ‘trained’ panel members.

**Criteria for selection**

- i. Sex
- ii Members must be able to know what to expect of sausages (i.e. members must be sausage eaters and know what to expect from the organoleptic characteristics).

**Panel-testing**
Samples of the experimental products were removed from the freezer and cooked. To cook, samples were steamed for about 1-2 minutes and deep fried for about 3-5 minutes to a yellowish-brown colour. Four samples, one of each product type were placed on a side plate in two forms: (1) raw state (2) cooked state and presented to each panel member. Samples were blind-coded as ABCD in the first batch, 1,2,3,4 in the second and w, x, y, z, in the third. A questionnaire was self developed and provided to panel members to score products
on a 10-point rating scale ranging from 1 (poor) through 10 (excellent) for external appearance of uncooked products, internal colour, aroma and taste of cooked products. They were also required to rank samples in decreasing order from ‘1’ through ‘4’ based on the overall acceptability. The overall acceptability was judged as the overall impression of the product in terms of external appearance of the uncooked product, internal colour, aroma and taste of cooked products.

Experimental design and statistical analysis
The experiment involved four treatments evaluated in three replications with sex as block. The data collected was analyzed as a completely randomized block design (CRBD) using the non-parametric analysis as employed in Friedman’s test and Wilcoxon’s signed-rank test.

Results presentation and analysis

Table 1: Identification of local spices

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Part used</th>
<th>Properties and Uses</th>
<th>Area found</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piper guineense</strong></td>
<td>West African Black Pepper</td>
<td>Seeds</td>
<td>Eugenol essential oil Flavouring soups, rice etc. its oil is utilized in perfumery and soap making</td>
<td>Closed forests of Ashanti and Eastern Regions</td>
</tr>
<tr>
<td></td>
<td>Twi/fanti Suro-wisa</td>
<td></td>
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<td></td>
<td>Ga Gbowisi/Gbowyei</td>
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<td></td>
<td>Ewe Kate/Kukuli</td>
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<td></td>
<td>Hausa Masoro</td>
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</tr>
<tr>
<td><strong>Aframomum melegueta</strong></td>
<td>Grains of Paradise.</td>
<td>Seeds</td>
<td>Paradol and volatile oils Flavouring food, alcoholic liquors and veterinary medicines</td>
<td>Forest areas of Eastern, Western and Ashanti Regions</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Fam-wisa/Wisa</td>
<td></td>
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<td></td>
<td>Ewe: Awusa/ Dzekuli.</td>
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<td></td>
<td>Hausa: Yaagyí</td>
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<tr>
<td><strong>Fructus foeniculi</strong></td>
<td>Thyme/Fennel.</td>
<td>Fruit</td>
<td>Phenol ether anethol ketone fenchome Seasoning meat, foods used as a carminative and aromatic</td>
<td>Forest areas of Ashanti and Eastern Regions</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Nketenkete</td>
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<td></td>
<td>Ga: Nketenkete</td>
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<tr>
<td></td>
<td>Ewe: Nketenkete</td>
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</tr>
<tr>
<td><strong>Parkia clappertoniana</strong></td>
<td>West African locust Bean</td>
<td>Pulp and seeds</td>
<td>Alkaloids, cyanogenic glycoside Condiment in soups and in ‘Dozim’ drink.</td>
<td>Savanna and deciduous regions of Ghana/Tamale.</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Osonkoran</td>
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<td></td>
<td>Ga: Ateomi</td>
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<td></td>
<td>Ewe: Ewa/ewo</td>
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<td></td>
<td>Hausa: Dawadawa</td>
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<tr>
<td><strong>Eugenia caryophyllata</strong></td>
<td>Cloves</td>
<td>Dried un-opened flower bud</td>
<td>Eugenol Baking, gravies, and flavouring meat</td>
<td>Thick forest of Ashanti Region.</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Pepple/Prekomba</td>
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<tr>
<td></td>
<td>Ga: Pepple</td>
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<tr>
<td></td>
<td>Ewe: Pepple</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Hausa: Kananfari</td>
<td></td>
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</tr>
<tr>
<td><strong>Xylopia aethiopica</strong></td>
<td>Ethiopian pepper (Peppercorn)</td>
<td>Fruits and seeds</td>
<td>Avoceine’, ‘rubersole’ fat Flavouring porridge and meat; ground seeds are added to snuff; mixed with Piper guineense</td>
<td>Forest of Western and Ashanti Regions</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Hwentia</td>
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<td></td>
<td>Ga: So</td>
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<td></td>
<td>Ewe: Tsuo</td>
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<td></td>
<td>Hausa: Kimba</td>
<td></td>
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<tr>
<td><strong>Plant</strong></td>
<td><strong>Local Names</strong></td>
<td><strong>Uses</strong></td>
<td><strong>Regions</strong></td>
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<tr>
<td><strong>Myristica fragrans</strong></td>
<td>Nutmeg</td>
<td>Dried kernel</td>
<td>Alcohols, myristicin and eugenol, flavouring foods and baking; used as a carminative</td>
<td>Aburi areas in the Eastern region.</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Nutmeg</td>
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<tr>
<td></td>
<td>Ga: Nutmeg</td>
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<td></td>
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<tr>
<td></td>
<td>Ewe: Nutmeg</td>
<td></td>
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<tr>
<td><strong>Capsicum annuum</strong></td>
<td>Paprika/Chili/cayenne</td>
<td>Fruit</td>
<td>Phenolic substance Capsicin, used as condiment in stews and soups.</td>
<td>Found across the country</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Meko/muoko</td>
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<td></td>
<td>Ga: Shito</td>
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<td></td>
<td>Ewe: Atadji</td>
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<td></td>
<td>Hausa: Tankwa</td>
<td></td>
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<tr>
<td><strong>Monodora myristica</strong></td>
<td>Monodora</td>
<td>Seeds</td>
<td>Used as condiment in soup, seasoning meat and medicine.</td>
<td>Evergreen and deciduous Forest of Western Region</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Ayerewa</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Ayerewam-amba</td>
<td></td>
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<tr>
<td></td>
<td>Ga: Maalai</td>
<td></td>
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<tr>
<td></td>
<td>Ewe: Ayiku</td>
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<td></td>
<td>Hausa: Elmiya</td>
<td></td>
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</tr>
<tr>
<td><strong>Allium cepa</strong></td>
<td>Onions</td>
<td>Bulb</td>
<td>Antioxidants quercetin and sulfur, used as seasoning in meat.</td>
<td>Found across the country</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Gyeene/Anyoo</td>
<td></td>
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<tr>
<td></td>
<td>Ga: Sabolai</td>
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<tr>
<td></td>
<td>Ewe: Asabolai</td>
<td></td>
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<tr>
<td></td>
<td>Hausa: Al-basa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Allium sativum</strong></td>
<td>Garlic</td>
<td>Bulb</td>
<td>Sulfur compounds – allicin, ajoene, alin etc., used as seasoning in meat and meat products.</td>
<td>Found in dry sandy soils across the country</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Garlic</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Ga: Garlic</td>
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<tr>
<td></td>
<td>Ewe: Garlic</td>
<td></td>
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<tr>
<td></td>
<td>Hausa: Talfanur-wa</td>
<td></td>
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</tr>
<tr>
<td><strong>Zingiber officinale</strong></td>
<td>Ginger</td>
<td>Rhizome</td>
<td>Gingerol, used in seasoning meat, for drink preparation and in medicines.</td>
<td>Found across the country</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti Akakaduro</td>
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</tr>
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<td></td>
<td>Ga: Kakatsofa</td>
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<td></td>
<td>Ewe Nkrama/Nkrawusa</td>
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<tr>
<td></td>
<td>Hausa Tsita/Kakadoro</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sorghum halepense</strong></td>
<td>Sorghum leaves</td>
<td>Leafy stalk</td>
<td>Phenols, antibiotic properties, used in colouring rice, beans etc.</td>
<td>Found in Savanna areas of Northern and Upper regions of Ghana</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Ewio/Ahaban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ga: Karundafi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ewe: Karundafi</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Hausa: Karundafi</td>
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<tr>
<td><strong>Tetrapleura tetraptera.</strong></td>
<td>Tetrapleura</td>
<td>Fruits</td>
<td>Aridanin, flavouring soups and porridge, jam production.</td>
<td>Thick forest of Ashanti Region</td>
</tr>
<tr>
<td></td>
<td>Twi/Fanti: Prekese/Esem</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Ga: Prekese</td>
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</tr>
<tr>
<td></td>
<td>Ewe: Aprekese</td>
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</tbody>
</table>

**Sensory evaluation**

The results show the feasibility of using local spices found on the Ghanaian market in preparing composite seasonings for meat processing. There is a definite threshold of taste for every substance which varies with the individual and with environmental factors such as temperature. An experienced chef usually tastes his delicacies at the temperature at which they will be served, since heat and cold alter the flavour of many preparations. It is thus the responsibility of...
any compounding to take into consideration the sensitivity of each individual spice, temperature, taste and general appearance when selecting flavouring agents for preparation.

External appearance of products

Generally, the incorporation of different composite-spices into the meat products did not affect the external appearance of the uncooked products much giving them a similar appearance. Other factors like punctured casing, unequal sizes and hanging casing ends however contributed to some variations in the external appearance of the products. However, there was no significant difference in the external appearance of the different uncooked products.

Internal colour

The general trend for the internal colour of products is shown in Table 2. The dark colour of the prekese fruit could have been strongly imparted to the products to give the prekese based product (Nugcoft ‘P’) a slightly darker internal colour than the other products. On the whole however, the internal colour of the different products did not show any significant variations.

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Median Scores</th>
<th>Rank Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nugcoft (control)</td>
<td>7.0</td>
<td>9</td>
</tr>
<tr>
<td>Nugcoft ‘P’</td>
<td>7.0</td>
<td>9</td>
</tr>
<tr>
<td>Nugcoft ‘0’</td>
<td>7.0</td>
<td>7</td>
</tr>
<tr>
<td>Nugcoft ‘D’</td>
<td>6.3</td>
<td>5</td>
</tr>
<tr>
<td>Range</td>
<td>2–10</td>
<td></td>
</tr>
</tbody>
</table>

Rank Totals with the same superscript are not statistically significant at 95% level of testing.

Aroma of products

The same level, 1.52% of different composite-spices was used in each product type. The general trend for the aroma of products is shown in Table 3. Although the same level, 1.52% of different composite-spices was used in each product type, the aroma of the products differed. This indicates that certain types of spices are more appropriate to use in meat products than others. Rankings showed that the prekese based product (Nugcoft ‘P’) had the highest acceptable aroma compared to the dawadawa based product which was least accepted for its aroma probably because the associated smell of dawadawa could not mask the rawness of the pork contributing to a lower acceptable aroma of the product. Probably, reducing the percentage composition of the dawadawa and increasing that of the sharp spices like garlic and onions could help remove the rawness of the pork and improve upon the product by making the aroma more acceptable. However, there was no significant difference between the aromas of the different products.

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Median Scores</th>
<th>Rank Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nugcoft ‘P’</td>
<td>7.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Nugcoft ‘0’</td>
<td>7.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Nugcoft (control)</td>
<td>7.0</td>
<td>7.5</td>
</tr>
<tr>
<td>Nugcoft ‘D’</td>
<td>6.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Range</td>
<td>2 – 10</td>
<td></td>
</tr>
</tbody>
</table>

Rank Totals with the same superscript are not statistically significant at 95% level of testing.
Taste of products
Taste of the prekese based product was highly accepted. Prekese is very rich in easily assimilated carbohydrates with more than half being sugars. This might have contributed to the good taste of the prekese based product (Nugcoft ‘P’) making it a better acceptable product as shown by the ranking in Table 4. There was no significant difference between male and female rankings in this study.

Table 4: Acceptability rating based on taste of products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Median Scores</th>
<th>Rank Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nugcoft ‘P’</td>
<td>7.0</td>
<td>8.5a</td>
</tr>
<tr>
<td>Nugcoft ‘0’</td>
<td>7.0</td>
<td>8.5a</td>
</tr>
<tr>
<td>Nugcoft (control)</td>
<td>7.0</td>
<td>7.0a</td>
</tr>
<tr>
<td>Nugcoft ‘D’</td>
<td>7.0</td>
<td>6.0a</td>
</tr>
<tr>
<td>Range</td>
<td>2 – 10</td>
<td></td>
</tr>
</tbody>
</table>

Rank Totals with the same superscript are not statistically significant at 95% level of testing.

Overall acceptability rating
Overall acceptability of products was based on the overall impression of the products in terms of external appearance of the uncooked products, internal colour, aroma and taste of cooked products. The general trend for overall acceptability is shown in Table 5. The prekese based product (Nugcoft ‘P’) was judged the best in terms of internal colour, aroma and taste. It was also judged as the best product in terms of overall acceptability. On the contrary, Nugcoft “D” was judged the least in terms of internal colour, aroma, taste and overall acceptability. There was a significant difference between Nugcoft ‘D’ and the other three products: Nugcoft ‘P’, Nugcoft and Nugcoft ‘0’ at 95% level of testing ($P = .05$).

Table 5: Overall acceptability rating of products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Median Scores</th>
<th>Rank Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nugcoft ‘P’</td>
<td>21.5</td>
<td>12a</td>
</tr>
<tr>
<td>Nugcoft (control)</td>
<td>21.5</td>
<td>8a</td>
</tr>
<tr>
<td>Nugcoft ‘0’</td>
<td>21.0</td>
<td>7a</td>
</tr>
<tr>
<td>Nugcoft ‘D’</td>
<td>21.0</td>
<td>3b</td>
</tr>
<tr>
<td>Range</td>
<td>8 – 29</td>
<td></td>
</tr>
</tbody>
</table>

Rank Totals with the same superscript are not statistically significant at 95% level of Testing.

Discussion of results
A total of fourteen local spices were collected and their local and English names identified as well as their Common and Scientific names. Documenting this information is a positive move towards identifying whatever potential is available for their use in formulating composite spices for the meat industry. Information on the sensory properties of these spices have also been compiled and included as an initial step towards helping meat processors determine an ideal level of inclusion of individual spices in the composite mixes for the meat industry. Although costing of the composite spice mixes was not done, they could still be considered “affordable” considering the fact that on the Ghanaian market, foreign or imported spices are often more expensive than local ones.

Sensory evaluation results showed that Nugcoft ‘P’, the prekese based product had the darkest colour which probably comes from the dark-coloured prekese fruit. Also, the prekese based product (Nugcoft ‘P’) was judged the best product in terms of internal
colour, aroma and taste. Sensory parameters are vital qualities that often play significant roles in consumers’ purchase of meat products. Feiner (2006) and Van Oeckel et al. (1999) report that consumers often consider colour the primary visual characteristic of meat and its’ products prior to deciding what to buy. Consumers often relate the freshness and overall quality of a product with its colour (FAO, 2010). The high content of easily assimilated carbohydrates mostly sugars found in prekese and the dark colouration it impacts to its products probably contributed to Nugcoft “P” being judged the overall best accepted product. However, there were no significant variations in the internal colour of the different products.

Although the same level, 1.52% of different composite-spices was used in each product type, the aroma of products differed. This indicates that the use of certain spices in meat and its products is more appropriate than others. According to Haywood (1982), prekese is associated with a strong caramel-like smell and might have contributed to the prekese based product (Nugcoft ‘P’) being selected as the best product in terms of aroma. According to Osei-Tutu and Nhancale (2010), when prekese is used in food and medicines, the sweet smell enhances the taste and increases its acceptability. Ratings for aroma of the dawadawa based product in this study were similar to that of other studies in which the aroma of dawadawa was reported to be offensive to some consumers (Achi, 2005; Afribiz, 2011). This offensive smell may have influenced ranking of the product by the panel. Teye et al. (2013) in a preliminary study to determine the effect of dawadawa (Parkia biglobosa) on sensory and nutritional qualities of meat products such as smoked pork sausage and burgers, reported that the use of dawadawa up to 4g/kg meat in the meat products increased the crude protein content significantly (P < .001) and had no effect (P = .05) on the sensory characteristics of the products. Thus, they recommend that dawadawa could be used in meat products up to 4g/kg meat for improved crude protein content. Hopefully, adapting the level of inclusion of up to 4g/kg of dawadawa as recommended by Teye et al. (2013) would make such products less offensive and more acceptable to panellists.

The associated smell of dawadawa could not mask the rawness of the pork. This probably contributed to the product being the least accepted by the panel in terms of aroma. In addition to the level of inclusion suggested by Teye et al. (2013), reducing the percentage composition of the dawadawa and increasing that of the sharp spices like the garlic and onions in this study could help reduce or completely remove the rawness of the pork and therefore improve the aroma and acceptability of the product. However, there was no significant difference in the aroma of all the different products.

Dawadawa is also rich in easily assimilated carbohydrates with less than half being sugars. These sugars are exploited and used to prepare a sweet drink called ‘Dozim’. With such properties, it’s surprising to find out that the taste of the dawadawa based product (Nugcoft ‘D’) was evaluated by the panel as the least accepted. One would have expected the darker nature of dawadawa to impart more colour to the dawadawa based product, Nugcoft ‘D’ as was the case in the prekese product and consequently increase the acceptability of the product. This was however not the case. The low level of acceptability may have resulted from the aroma of the dawadawa rather than the colour. If the aroma of the dawadawa product could be regulated, then probably an increase in the level of inclusion of the dawadawa could still enhance the taste of the product due to its assimilated carbohydrates and make it more acceptable.

Sex is often a factor which influences taste and thus was the basis for selecting equal number of males and females for the sensory evaluation. Generally, men are known to
evaluate products with bitter taste better than women, while women are known to evaluate sweetness in products better than males (University of Copenhagen, 2008). However, in this study, there was no significant difference between the scores provided for taste by both males and females. Taste is markedly affected by smoking and this was taken care-of by not selecting any smoker to serve on the panel. For overall acceptability, there was significant \( (P = .05) \) difference between Nugcoft ‘D’ and the other three products: Nugcoft ‘P’, Nugcoft and Nugcoft ‘0’.

**Conclusion**

Fourteen local spices were collected and identified. All these local spices were readily available on the Ghanaian markets and could be easily obtained by farmers and individuals for the preparation of Ready-to-use composite-spices-to enhance meat processing. The results establish the fact that Ready-to-use composite-spices make processing of meat easier by providing an appropriate amount of a particular type of spice required in meat products. The sensory evaluation results in terms of overall acceptability rating showed that the 1.52% level of inclusion of the different composite-spices was acceptable. However, an increase in the percentage composition of the sharp spices like garlic and onions in the Nugcoft ‘D’ product (Dawadawa based product) could increase its acceptability.

In view of enhancing the acceptability of the Nugcoft ‘D’ product, it is recommended that future research on composite-spices should be geared towards the combination of different levels of inclusion of the individual spices. Also to promote the use of these composite-spices:

1) The effect of storage on the composite spice mixes and that of the meat products prepared using these spice mixes must be considered. This is a very important food safety issue that must be critically looked into in order to keep the health value of the processed meat products.

2) The cost analysis due to processing and formulation of these composite spices must also be made to ascertain and confirm their feasibility and affordability.

**References**


Tsigarida, E., P. Skandamis and G. J. E. Nychas (2000). Behaviour of Listeria monocytogenes and autochthonous flora on meat stored under aerobic, vacuum and modified atmosphere packaging conditions with or without the presence of oregano essential oil at 5°C. Journal of Applied Microbiology, 89: 901–909

