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Effects of Two Leaf Extracts on Sensory Quality of Minced Meat (Dambun Nama) Processed from Various Animal Sources

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Target Audience : Meat Processors, Handlers, Consumers, Entrepreneurs

Abstract

This study was conductedto investigate the effects of sabara and zogale teated dambun nama(minced meat) processed from fresh raw meat of high grades, 5kg each, of beef, mutton, chevon, and broiler chickenon sensory quality and acceptance. The two leaf extracts (zogale; Moringa oleifera and sabara; Guiera senegalensis) used in the study were analyzed for anti nutritional factors (tannin, saponin, phytate, alkaloid and flavonoid). There were significant differences (P<0.05) with respect to species in sensory attributes with chevon and camel meat being more preferred followed by beef, mutton and broiler chicken. However, Sensory attributes of sabara treated (SDN), zogale treated (ZDN) and non treated dambun nama (NDN) were significantly (P<0.001) different; with NDN being superior in all the attributes investigated. For instance, taste, flavour, appearance, colour, aroma and acceptability were better (P<0.001) in the NDN than SDN and ZDN; values being (7.56±0.11 vs 6.84±0.14 and 7.16±0.13), (7.31±0.11 vs 6.77±0.12 and 6.81±0.13), (7.34±0.11 vs 6.78±0.11 and 6.71±0.12), (7.32±0.11 vs 6.75±0.12 and 6.76±0.12), (7.16±0.12 vs 6.57±0.13 and 6.59±0.12), (7.42±0.12 vs 6.62±0.15 and 6.82±0.14), respectively. There were high and significant (P<0.001) positive correlations among all the sensory attributes investigated. For instance, aroma vs acceptability (r= 0.79; P<0.001), colour vs aroma (r= 0.71; P<0.001), appearance vs acceptability (r= 0.65; P<0.001), flavour vs appearance (r= 0.66; P<0.001), appearance vs aroma (r= 0.66; P<0.001).The study concludes that sabara and zogale leaf extracts had very low anti nutritional factors and can be incorporated in processing dambun nama without any deliterious effect. Beef, mutton, chevon, camel and broiler chicken meat had excellent nutritional values in processing dambun nama.

Key words: *Dambun nama*, Nigerian meat product

Description of Problem

Nigerian farmers engage in the rearing and fattening various species of livestock for production of quality meat. The meat from these fattened livestock is a major source of quality animal protein and it is also important part of the diet of most people (1). Meat is a complex and nutritionally significant component of human diet and foods.It is reported that meat is one of the nutritious foods used for human consumption (2). It is an excellent source of high quality protein and also contains large amounts of minerals and essential vitamins, as well as fats(2). Meat supply in Nigeria is currently undergoing tremendous transformation; a supermarket system is presently organizing the supply of pre-packed meat cuts in standard qualities especially for the elites in the society (2). The peasants and the have-nots on the other hand are also finding ways of solving their own problems.

However, *dambun nama* is a specialized minced meat of Nigerian origin that is not commonly available in markets and usually not well-packaged. *Dambun nama* is processed from fresh meat of good grade and is cut into pieces of approximately 4 cm by 2.5 cm dimensions and washed with water, mixed with spices and ingredients, boiled for about 90 minutes and pounded into shreds using a mortar and pestle. This was then shallow fried using groundnut oil in a stainless steel pot to obtain *dambun nama*, which is usually brownish in colour (3, 4).Meat being nutritious and having high moisture content with nearly neutral pH serves as good culture medium for most bacteria and fungi, and as such classified among perishable foods whose contamination with spoilage organisms is almost unavoidable (5).

In Nigeria, despite the huge benefits of these local meat products played in terms of provision of quality nutrients for normal growth and reproduction, less significance is attached to the possible effects on health due to product adulteration /contaminations.Meat preservation is more difficult than other kinds of food as it may result in oxidative rancidity, discolouration, mouldiness, off-flavour, sliminess etc (6). Meat processing enables the processor to convert low-priced meat cut into high-priced product (7). It has also been shown that processing of meat to products facilitates the packaging, handling, distribution and marketing of the product (8).

The main objection to consumption of locally processed meat products lies with the poor sanitary conditions associated with their production and handling processes. It has been reported that the high micro-flora count commonly observed in meat products is indicative of poor hygiene and handling practices (4, 9). Salmonellosis has been shown to infest a number of animal products (10). Similarly, (11) reported that many diseases such as anthrax, *Escherichia coli*, leptospirosis, tuberculosis, brucellosis, diphtheria, scarlet fever; Q (Query) fever and gastroenteritis are known to be transmitted via meat and meat products. This study wasdesigned to investigate the effects of two leaf extracts; zogale (*Moringa oleifera)*and *sabara* (*Guiera senegalensis*) on

sensory quality and acceptance of *dambun nama* processed from various species of animals.

Materials and Methods

Study Area

The study was conducted at the Department of Animal Science, Faculty of Agricuture,Ahmadu Bello University, Samaru, Zaria. Samaru is part of the Northern Guinea Savannah Ecoogical Zone of Nigeria. It is on latitude 11°C 12' North, longitude 07°C 33' East and at an altitude of 610meters above sealevel (12). The mean annual rainfall is between 1100 and 1200mm. The mean minimum and maximum temperature ranges between 14.5 and 39.5°C, respectively (13). March to May are the hottest months of the year but November to February, harmattan is usualy experienced, which is characterized by low ambient temperatures and hazy climate. The relative humidity is highest between July and September.

Collection of Meat Samples

Fresh raw meat of high grades, 5kg each, of beef, mutton, chevon, and broiler chicken were purchasedfrom various abattoirs/locations in Zaria town, while camel meat was sourced from Kano Metropolitan abattoir. The samples were preserved under cold storage and immediatey transported for onward processing/production into three varieties of *dambun nama*.

Analysis for Chemical Composition

Raw meat samples freshly obtained from the five chosen livestock species (cattle, sheep, goats, camel and broiler chicken) were immediately taken to laboratory for analysis of gross composition (Table 1), as per the procedures laid down by (14).

Table 1 : Proximate composition (%) of various meat sources used in processing *dambun nama*

Meat type	Dry matter	Crude protein	Ash	Ether extract
Beef	29.73	48.38	2 .41	6.52
Mutton	27.46	47. 94	2.50	6.98
Chevon	31.6	48.81	5.04	8.13
Camel	41.75	47.06	7.38	7.92
Broiler chicken	54.96	47.56	3.90	5.87

Analysis for Anti-Nutritional Factors

The two leaf extracts (*zogale*; *Moringa oleifera* and *sabara*; *Guiera senegalensis*) used in the study were analyzed for anti-nutritional factors, as per the methods of (14). The anti-nutritional factors analysed were tannin, saponin, phytate, alkaloid and flavonoid, as presented in Table 2.

Table 2 : Some anti-nutritional factors (mg/100g) in *Moringa oleifera* and *Guiera senegalensis*

Anti-nutritional factor	*Sabara* (*G. senegalensis*)	*Zogale* (*M oleifera*)
Tannin	1.45	1.60
Saponin	1.22	1.38
Phytate	2.84	3.10
Alkaloid	9.36	11.58
Flavonoid	0.66	0.84

Preparation ofleaf extracts

Leaf extracts from *zogale* (*Moringa oleifera)* and *sabara* (*Guiera senegalensis*) were prepared andtested ina sensory evaluation trial. Fresh leaves from these plants were sourced and sun-dried. The dried leaves were then ground into powder form. 1 teaspoon was measured and poured into a measuring cylinder containing 100 ml of water and wasthen boiled. These solutions of leaf extracts were used in cooking the various meat samples to processthe three varieties of *dambun nama.*

Processing of Dambun Nama

Beef, mutton, chevon, camel and broilerchicken meatwere sourced to produce the various *dambun nama*. Guidelines for a successful fattening of livestock to produce good carcass quality have been produced (15).*Dambun nama*was prepared from meat of these animals using the procedures of (3) and (4).

Data Collection

The data for this study were collected from two experiments conducted sequentially over a period of four (4) months (November, 2015 to February, 2016). These were as follows:-

The three varieties of *dambun nama* processed were: (1) non-treated (NDN), (2) *sabara*-treated (SDN) and (3) *zogale*-treated (ZDN) for each of beef, mutton, chevon, camel and broiler chicken meat to give a total of 15 meat products, which were subjected to sensory evaluation.A total of 38 sensory judges comprising of both staff and postgraduate students onlyfamiliar with quality attributes of meat products were constituted for the evaluation, using methods described by (16).

Statistical Analysis

The data generated from the study were subjected to simple descriptive statistics, percentages and analyses of variance (17). Significant means were seperated using Duncan's Multiple Range Test (DMRT).

Results

Overall data on sensory evaluation of *dambun nama* processed from various animal species are presented in Table 3. Sensory attributes were taste, flavour, appearance, colour, aroma and acceptability. The results showed significant differences ($P<0.05$) with respect to species in terms of these attributes. For instance, in terms of taste, chevon and camel meat were more preferred followed by beef, mutton and broiler chicken meat. Aroma and acceptability exhibited similar trend. Conversely, meat appearance, colour and aroma were significantly ($P<0.001$) higher in *dambun nama* from broiler chicken, camel meat and chevon than in other species.

Overall data on sensory attributes of treated *(sabara* and *zogale*) and non-treated *dambun nama* are shown in Table 4. The results exhibited very high significant differences ($p<0.001$) among the three treatments; non-treated *dambun nama* (NDN), *sabara*-treated *dambun nama* (SDN), *zogale*-treated *dambun nama* (ZDN). However, taste, flavour, appearance, colour, aroma and acceptability were better ($p<0.001$) in the NDN than SDN and ZDN; values being (7.56±0.11 vs 6.84±0.14 and 7.16±0.13), (7.31±0.11 vs 6.77±0.12

and 6.81±0.13), (7.34±0.11 vs 6.78±0.11 and 6.71±0.12), (7.32±0.11 vs 6.75±0.12 and 6.76±0.12), (7.16±0.12 vs 6.57±0.13 and 6.59±0.12), (7.42±0.12 vs 6.62±0.15 and 6.82±0.14), respectively.

Table 3 : Overall sensory evaluation of *dambun nama* processed from various meat sources

Meat type	Taste	Flavour	Appearance	Colour	Aroma	Acceptability
Beef	6.79± 0.16^{b}	6.61± 0.15^{b}	6.45± 0.15^{b}	6.50± 0.15^{b}	6.50± 0.16^{b}	6.57± 0.18^{b}
Mutton	7.01± 0.16^{ab}	6.80± 0.15^{ab}	6.95± 0.16^{ab}	6.84± 0.15^{ab}	6.73± 0.16^{ab}	6.81± 0.18^{ab}
Chevon	7.61± 0.16^{a}	7.39± 0.15^{ab}	7.19± 0.15^{a}	7.02± 0.15^{ab}	7.16± 0.16^{a}	7.40± 0.18^{a}
Camel	7.56± 0.16^{a}	7.25± 0.15^{ab}	6.98± 0.15^{ab}	7.02± 0.15^{ab}	6.80± 0.16^{ab}	7.04± 0.18^{ab}
Broiler chicken	6.93± 0.16^{b}	6.75± 0.15^{a}	7.13± 0.15^{a}	7.31± 0.15^{a}	6.70± 0.16^{ab}	6.92± 0.18^{ab}
LOS	***	***	***	***	***	*

*P< 0.05, ***P< 0.001, LOS = Level of significance

Table 4 : Overall sensory evaluation of non-treated and treated *dambun nama* processed from the five animal species

Treatment	Taste	Flavour	Appearance	Colour	Aroma	Acceptability
NDN	7.56± 0.11^{a}	731± 0.11^{a}	7.34± 0.11^{a}	7.32± 0.11^{a}	7.16± 0.12^{a}	7.42± 0.12^{a}
SDN	6.84± 0.14^{b}	6.77± 0.12^{b}	6.78± 0.11^{b}	6.75± 0.12^{b}	6.57± 0.13^{b}	6.62± 0.15^{b}
ZDN	7.16± 0.13^{b}	6.81± 0.13^{b}	6.71± 0.12^{b}	6.76± 0.12^{b}	6.59± 0.12^{b}	6.82± 0.14^{b}
LOS	***	**	***	***	***	***

**P< 0.01, ***P< 0.001, NDN = Non-treated *Dambun Nama*, SDN = *Sabara*-treated *Dambun Nama,* ZDN = *Zogale*-treated *Dambun Nama,* LOS = Level of significance

Table 5 shows the results on sensory evaluation of NDN as influenced by the five animal species. It is shown that taste and flavour differed significantly (P<0.05) ; with chevon, camel meat and broiler chicken being more preferred. However, other parameters such as appearance, colour, aroma and acceptability were not significantly influenced by the species.

Table 6 presents the results on sensory evaluation of SDN as affected by beef, mutton, chevon, camel and broiler chicken meat. There were significant (P<0.05) differences with respect to all the sensory attributes studied. For instance, *dambun nama* from camel and broiler chicken meat were more preferred than the *dambun nama* products from other species in terms of taste, appearance and colour. However, mutton and chevon were more preferred in terms of aroma and acceptability. Beef was least cherished in terms of taste, flavour, appearance, colour, aroma and acceptability when treated with *sabara* extract (Table 6).

Data on sensory attributes of *zogale*-traeted *dambun nama* as affected by various animal species are depicted in Table 7. The results showed significant differences in terms of taste and appearance (P<0.01), flavour and aroma (P<0.05). Chevon and camel meat were

better with respect to taste, flavour and appearance, while beef and broiler chicken were least preferred in taste, flavour, appearance and aroma. There were also no significant differences in colour and acceptability of *dambun nama* processed from beef, mutton, chevon, camel and broiler chicken.

Table 5 : Sensory evaluation of non-treated *dambun nama* processed from various meat sources

Treatment	Taste	Flavour	Appearance	Colour	Aroma	Acceptability
Beef	7.41± 0.29^{ab}	7.27± 0.26^{ab}	7.08± 0.28	7.14± 0.27	7.22± 0.26	7.14± 0.30
Mutton	7.14± 0.28^{b}	6.73± 0.26^{b}	7.57± 0.28	7.16± 0.26	6.92± 0.29	7.14± 0.31
Chevon	7.92± 0.24^{a}	7.65± 0.24^{a}	7.16± 0.27	7.27± 0.21	7.35± 0.28	7.65± 0.26
Camel	7.76± 0.18^{ab}	7.65± 0.19^{a}	7.30± 0.22	7.46± 0.23	7.30± 0.21	7.57± 0.25
Broiler chicken	7.57± 0.19^{ab}	7.24± 0.27^{ab}	7.57± 0.23	7.57± 0.28	7.03± 0.29	7.62± 0.25
LOS	*	*	**NS**	**NS**	**NS**	**NS**

*P< 0.05, NS = Not Significant at 5%, LOS = Level of significance

Table 6 : Sensory evaluation of *Sabara*-treated *dambun nama* processed from various meat sources

Treatment	Taste	Flavour	Appearance	Colour	Aroma	Acceptability
Beef	6.36± 0.35^{b}	6.26± 0.31^{b}	6.08± 0.26^{b}	6.05± 0.27^{b}	6.18± 0.27^{b}	6.08± 0.34^{b}
Mutton	6.74± 0.31^{ab}	6.82± 0.26^{ab}	7.03± 0.22^{a}	6.95± 0.22^{a}	6.64± 0.28^{ab}	6.74± 0.31^{ab}
Chevon	7.10± 0.29^{ab}	7.10± 0.24^{a}	6.97± 0.25^{a}	6.74± 0.28^{ab}	7.08± 0.30^{a}	7.13± 0.30^{a}
Camel	7.36± 0.25^{a}	7.05± 0.24^{ab}	6.85± 0.27^{a}	6.82± 0.27^{a}	6.49± 0.29^{ab}	6.72± 0.33^{ab}
Broiler chicken	6.64± 0.31^{ab}	6.64± 0.26^{ab}	7.00± 0.24^{a}	7.18± 0.26^{a}	6.49±0.28^{ab}	6.41± 0.33^{ab}
LOS	*	*	*	*	*	*

*P< 0.05, LOS = Level of significance

Table 7 : Sensory evaluation of *Zogale*-treated *dambun nama* processed from various meat source

Treatment	Taste	Flavour	Appearance	Colour	Aroma	Acceptability
Beef	6.62± 0.34^{b}	6.32± 0.31^{b}	6.22± 0.29^{b}	6.35± 0.27	6.11± 0.27^{b}	6.51± 0.30
Mutton	7.16± 0.24^{ab}	6.84± 0.25^{ab}	6.24± 0.26^{b}	6.41± 0.28	6.62± 0.27^{ab}	6.54± 0.34
Chevon	7.84± 0.19^{a}	7.43± 0.19^{a}	7.43± 0.24^{a}	7.08± 0.29	7.05± 0.22^{a}	7.43± 0.24
Camel	7.57± 0.21^{a}	7.05± 0.25^{ab}	6.81± 0.23^{ab}	6.78± 0.24	6.62± 0.32^{ab}	6.84± 0.31
Broiler chicken	6.59± 0.36^{b}	6.38± 0.34^{b}	6.84± 0.28^{ab}	7.19± 0.27	6.57± 0.24^{ab}	6.76± 0.36
LOS	**	*	**	**NS**	*	**NS**

*P< 0.05, **P< 0.01, NS = Not Significant at 5 %, LOS = Level of significance

However, Table 8 shows the overall correlation matrix (when data for the five species were combined). There were many positive and significant correlations among these attributes. For instance, aroma vs acceptability (r= 0.79; P<0.001), colour vs aroma (r= 0.71; P<0.001), appearance vs acceptability (r= 0.65; P<0.001), flavour vs appearance (r= 0.66; P<0.001), appearance vs aroma (r= 0.66; P<0.001) as presented in Table 8.

Table 8: Overall correlation matrix for sensory parameters of*dambun nama*processed from meat sources

	1	2	3	4	5	6
1. Taste	-					
2. Flavour	0.82***					
3. Appearance	0.60***	0.66***				
4. Colour	0.54***	0.59***	0.80***			
5. Aroma	0.67***	0.71***	0.66***	0.71***		
6. Acceptability	0.74***	0.73***	0.65***	0.65***	0.79***	-

***P< 0.001

Discussion

The significant differences observed in *dambun nama* processed from various animal sources is a reflection of differences in species from which this product was processed. The sensory attributes were taste, flavour, appearance, colour, aroma and acceptability and exhibited great variation among the five meat types studied. These differences were similarly reported by (2) in their study with five different types of *suya* processed from pork, beef, chicken, rabbit and goat meat. These workers reported higher values (acceptance) in beef with respect to colour, flavour, texture and overall acceptability which shows that the best *suya* was obtained from beef in terms of these attributes. This was similarly reported by (16) using various animal species. However, the present study contradicts the reports of (2)where chevon and camel meat were most preferred than the other meat types (beef, mutton, and broiler chicken). This work also agrees with the work of (18) who reported that goat meat was more preferred and attributed it to its low fat content. Theauthors also reported that goat meat contains higher amounts of polyunsaturated fatty acids compared with sheep meat (mutton). It is shown that consumers' preferences for a product determined the process of meat quality improvement (19). The sensory properties like colour or tenderness may have a significant impact on meat quality acceptability. Therefore, sensory qualities of meat are one of the primary factors influencing consumers' satisfaction. For instance, the content of fat in meat is considered one of the decisive factors influencing the sensory quality of the meat, particularly where there are significant differences between the samples evaluated, as reported by (20). It wasobserved that meat colour is considered as an important parameter that attracts consumer to buy meat (21). The meat colour is mainly affected by the level and state of myoglobin. However, the observed differences in meat attributes in the present investigation might have been due to differences in the myoglobin content in meat of these species. Goat meat (chevon) is inherently less tender than sheep (mutton) (21). Lamb and mutton were found to be more tender with less fibrous tissue residue and a more intense

aroma than Angora and Boer goat meat (22). However, (23) stated that muscle of male Boer goat kids had higher collagen content with lower collagen solubility than male lambs of four sheep breeds.

Furthermore, the lower values of sensory attributes of treated than non-treated *dambun nama* have been reported in this study, as most panelists preferred non-treated beef than either *sabara* or *zogale*-treated beef *dambun nama*. The inclusion of these two leaf extracts had greatly lowered the acceptance of *dambun nama* with respect to taste, flavour, appearance, colour, aroma and acceptability; even though these products (*sabara* and *zogale*) had no any deleterious effect upon their consumption. However, *sabara* and *zogale* inclusions in processing *dambun nama* was found to have positive effect on storage quality, where *sabara* treatment in *dambun nama* production show significant effect on all the sensory attributes with varied effect among the five meat types used in this study. This was similarly observed when *dambun nama* was treated with *zogale* leaf extract during production.

Significant and very high positive correlations were observed among all the sensory attributes of all meat types investigated. These meat attributes can largely be used to improve quality of meat among panelists especially of diverse cultural backgrounds. This relationship was similarly reported by (24). However, this finding confirmed the relatively good quality or ability of the panelist to differentiate properties of meat attributes, as also reported by (25). For instance, colour, texture, odour, taste and acceptability were correlated with other factors and obtained very high and significant correlations among these attributes (19). The significance of correlating these attributes cannot be over-emphasized. For instance, acceptance of a meat product can be improved through improvement of its colour which attaches great significance to consumers. Good appearance of meat product can also appeal to consumers to achieve high preferences.Similarly, aroma can also be achieved through proper spicing of the meat product during processing. However, the strong relationship of these meat attributes is a positive indication that a low quality meat with low acceptance value can be improved through artificial manipulation of these sensory attributes to improve consumption and overall acceptability.

Conclusions and Applications

This study concludes :-

a. The *sabara* and *zogale* leaf extracts had very low anti-nutritional factors and can be incorporated in processing *dambun nama* without any deliterious effect.
b. Beef, mutton, chevon, camel and broiler chicken meat had excellent nutritional values in processing*dambun nama*.
c. *Dambun nama* meat product is well-cherished and enjoyed wide acceptability among the panelists.
d. There is the need for further study on sensory evaluation *dambun nama* processed from

these animal species as inluenced by age, sex and dietary feeding.

e. A further study is required to investigate inclusion levels of these extracts (*sabara* and *zogale* leaves) for their proper incorporation in procesing *dambun nama*.

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