Effects of chemical composition and type of panelists on sensory properties of fried minced meat (*Dambun nama)* processed from red and white meat

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Target Audience: Researchers, consumers, entrepreneurs, meat processors

Abstract

This research was done to evaluate the potential of different meat sources in producing acceptable dambun nama when compared with the traditional beef dambun nama in Nigeria. Five meat types viz: beef, mutton, chevon, camel and broiler chicken meat were used for this experiment. Sensory evaluation was conducted on the dambun nama samples with panel of judges (both staff and postgraduate students) to assess the taste, juiciness, colour, aroma, appearance and acceptability of the samples. The result showed that chevon and camel meat significantly maintained a better taste and juiciness (p<0.05) followed by broiler chicken, beef and mutton. All other parameters showed no significant differences among the animal species. There were high and significant (P<0.001) positive correlations among all the sensory attributes investigated. It is apparent from the overall results that chevon, camel, mutton and broiler chicken meat could successfully substitute for beef in the production of acceptable dambun nama. The quality characteristics generally showed that all the meat samples were comparable to the beef sample.

Key words: *Dambun nama, red and white meat*

Description of Problem

Nigerian farmers are engaged in the rearing and fattening of 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 diets and foods. Husbandry practices have direct and indirect impact on meat quality (2), and these lead to changes in the consumption or marketing of meat. However, these factors and meat quality are closely related to consumers' behaviour as well as with some sensory attributes (3).

It has been indicated that meat preservation is more difficult than other kinds of food as it may result in oxidative rancidity, discolouration, mouldiness, off-flavour, sliminess etc (4). It is reported that meat processing enables the processor to convert low-priced meat cut into high-priced product (5).

It is stated that consumers are becoming increasingly prepared to pay for improved and better quality product from the local meat industry (6). In Nigeria, despite the huge benefits of these meat products, especially *dambun nama,* 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. Handling and storage methods are therefore primarily concerned with minimizing microbial contamination and retarding microbial growth and activities (7). It is suggested that all meat samples meant for consumption should be adequately heat-treated to enhance processing and preservation/storage (8). Meat products that are properly handled through good sanitation, maintenance of a clean production environment and heat treatment are prerequisites for extended shelf-life, reduced microbial load and improved acceptability.

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 (6). The peasants and the have-nots on the other hand are also finding ways of solving their own problems. There is paucity of information on proximate compostion of *dambun nama* (minced meat) processed from different animal species and its subsequent sensory evaluation in literature (9, 10).

However, *dambun nama* is a specialized Nigerian meat product that is not commonly available in markets across the country. The processing and handling of this meat product are usually done traditionally, in which sanitary practices are not adhered strictly to guaranty consumption locally and internationally. There is also low awareness of this product in other parts of Nigeria with respect to consumption. It is also imperative to standardize the processing/production of *dambun nama* in order to boost the local meat industry and enable its all-year availability and supply at affordable price

for enhanced quality protein intake for normal human growth, reproduction and good health. The objective of this study was to compare the chemical compostion and sensory properties/ and quality of *dambun nama* processed from various species of animals.

Materials and Methods

The study was conducted at the Department of Animal Science, Faculty of Agricuture, Ahmadu Bello University, Samaru, Zaria. Fresh raw meat of high grades from *Longissimus dorci* muscle of adult males were obtained as per the procedures laid down by (11), 5kg each, of beef, mutton, chevon, and broiler chicken were purchased from 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 various varieties of *dambun nama.*

Samples of *dambun nama* (minced meat) processed from the five chosen livestock species (cattle, sheep, goats, camel and broiler chicken) were taken to laboratory for analysis of proximate composition as per the procedures laid down by (12).

Beef, mutton, chevon, camel and broiler meat (chicken) were sourced to produce the various *dambun nama.* *Dambun nama* (minced meat) was prepared from meat of these animals using the procedures of (10. 13). Fresh meat of good grade was cut into pieces of approximately 4 cm by 2.5 cm dimensions and washed thoroughly with clean water, mixed with spices and ingredients (maggi, salt curry, ginger and thyme), 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 frying pan to obtain *dambun nama*, which is usually brownish in colour.

The data for this study were collected sequentially over a period of four (4) months (November, 2015 to February, 2016). The indices considered were moisture, dry matter, crude protein, ether extract and ash. *Dambun nama* meat products were subjected to sensory evaluation for their acceptance. Sensory judges both staff (15) and postgraduate students (22) only familiar with quality attributes of meat products were constituted for evaluation, as per the methods described by (9).

The data generated from the study were subjected to analyses of variance (14). Means with significant differences were seperated using Duncan's Multiple Range Test (DMRT).

Results

Table 1 depicts data on proximate composition (%) of *dambun nama* (minced meat) processed from different animal species.The values for the moisture content were 9.9, 6.4, 2.8, 10.6 and 3.9 % for beef, mutton, chevon, camel and broiler chicken meat (P< 0.05) respectively. The dry matter contents did not show significant difference as presented in Table 1. The per cent crude protein content of *dambun nama* was higher in camel (58.0%) and mutton (56.3%) than in the other animal species; beef (50.%), chevon (51.20%) and broiler chicken meat (52.9%). The ash content values were 5.7, 6.0, 6.8, 7.0 and 5.8% (P< 0.05) for beef, mutton, chevon, camel and broiler chicken meat, respectively. Mutton (26.0%) and chevon (27.1%) had the highest values among the five meat types than in the other species; beef (23.5%), camel (23.5%) and broiler chicken meat (22.5%).

Table 1: Proximate composition (%) of *dambun nama* (minced meat) from different   animal species

Meat type	Moisture	Dry matter	Protein	Ether extract	Ash
Beef	9.9[a]	90.1	50.8	23.5[b]	5.7[b]
Mutton	6.4[b]	93.6	56.3	26.0[a]	6.0[ab]
Chevon	2.8[cd]	97.2	51.2	27.1[a]	6.8[a]
Camel	10.6[a]	89.4	58.0	23.5[b]	7.0[a]
Broiler chicken	3.9[c]	96.1	52.9	22.5[b]	5.8[b]
LOS	*	NS	NS	*	*

[abc]means across column having different superscripts differed significantly at 5 %, NS = Not significant at 5 %, LOS = Level of significance

Table 2: Sensory evaluation of *dambun nama* by academic staff processed from various animal species

Treatment	Palatability	Juiciness	Tenderness	Colour	Aroma	Acceptability
Beef	6.91[b]	6.84[bc]	6.66[b]	6.70[b]	6.80	6.66[c]
Mutton	6.96[b]	6.74[c]	7.37[a]	7.09[ab]	6.70	6.79[bc]
Chevon	7.74[a]	7.43[ab]	7.13[ab]	7.15[ab]	7.39	7.57[a]
Camel	7.72[a]	7.61[a]	7.30[a]	7.31[ab]	7.19	7.41[ab]
Broiler chicken	7.25[ab]	7.14[abc]	7.45[a]	7.55[a]	6.95	7.34[abc]
LOS	**	*	*	*	NS	*

[abc]means across column having different superscripts differed significantly at *P< 0.05; **P< 0.01; NS = Not significant at 5 %; LOS = Level of significance

Tables 2 to 4 show results on sensory attributes of *dambun nama* (minced meat) of five different animal species (beef, mutton, chevon, camel and broiler chicken). The sensory attributes considered were palatability, juiciness, tenderness, colour, aroma and acceptability.Results on sensory attribute of palatability by academic staff are presented in Tables 2. The results showed that palatability taste by academic staff was significantly (P< 0.05) thesame. This follow similar trend with that of postgraduate students as shown in table 3. Table 4 shows no significant differences among both staff and postgraduate students in terms of palatability (7.31 and 7.05). Tables 2 and 3 show results on juiciness of *dambun nama* from the five different species which differed significantly (P< 0.05) among the species. Camel, chevon and broiler chicken meat were higher in values with respect to both staff and postgraduate student panellists. The respective values were 6.84 vs 6.39, 6.74 vs 6.86, 7.43 vs 7.36, 7.61 vs 6.92 and 7.14 vs 6.37 (Tables 2 and 3). The combined results (staff and postgraduate students) were significantly (P< 0.05) different in terms of juiciness of *dambun nama* as shown in Table 4. Results on tenderness of minced meat (*dambun nama*) were shown in Tables 2 to 4. However, tenderness of *dambun nama*

among postgraduate student panellists differed significantly (P< 0.05); values being 6.25, 6.52, 6.69 and 6.82 for beef, mutton, chevon, camel and broiler chicken meat, respectively. There were significant (P< 0.001) differences in Table 4 among the two panellists (staff and postgraduate students) with better tenderness among staff (7.18) than students (6.71). Table 2 shows results on meat colour of *dambun nama* which differed significantly (P< 0.05) among the five species (beef, mutton, chevon, camel and broiler chicken meat). The colour of broiler chicken meat was more preferred (7.55) followed by camel (7.31) and chevon (7.15) and lowest in beef (6.70). Similarly, the colour of *dambun nama* were significantly (P< 0.05) different among postgraduate student panellists with broiler chicken, camel, chevon and mutton (7.07, 6.75, 6.92 and 6.59, respectively) being more cherished than beef (6.32), as shown in Table 3. However, colour was also significantly better among staff than postgraduate student panellists as presented in Table 4. There were no significant differences in terms of aroma among staff panellists as shown in Table 2. For instance, there were significant (P< 0.05) differences in aroma among postgraduate student panellists (Table 3).

Table 3: Sensory evaluation of *dambun nama* by postgraduate students processed from various animal species

Treatment	Palatability	Juiciness	Tenderness	Colour	Aroma	Acceptability
Beef	6.67[b]	6.39[b]	6.25[b]	6.32[b]	6.19[b]	6.47
Mutton	7.05[ab]	6.86[ab]	6.52[b]	6.59[ab]	6.75 [ab]	6.82
Chevon	7.49[a]	7.36[a]	7.24[a]	6.92[ab]	6.95[a]	7.24
Camel	7.41[a]	6.92[ab]	6.69[ab]	6.75[ab]	6.44 [ab]	6.69
Broiler chicken	6.61[b]	6.37[b]	6.82[ab]	7.07[a]	6.44[ab]	6.51
LOS	*	**	*	*	*	NS

[abc]means across column having different superscripts differed significantly at *P< 0.05; **P< 0.01; NS = Not significant at 5 %; LOS = Level of significance

Table 4: Sensory evaluation of *dambun nama* by academic staff and postgraduate students processed from various animal species

Treatment	Palatability	Juiciness	Tenderness	Colour	Aroma	Acceptability
Academic staff	7.31	7.14	7.18	7.16	7.00	7.15
Postgraduate students	7.05	6.78	6.71	6.73	6.56	6.75
LOS	NS	**	***	*	**	*

[abc]means across column having different superscripts differed significantly at *P< 0.05; **P< 0.01; ***P< 0.001, NS = Not significant at 5 %; LOS = Level of significance

However, in the combined results (both staff and students); aroma differed significantly (P< 0.01) in favour of staff panellists (Table 4). The overall acceptability of *dambun nama* from the five species as influenced by staff panellists differed (P< 0.05) significantly: values being 6.66, 6.79, 7.57, 7.41 and 7.34 for beef, mutton, chevon, camel and broiler chicken meat, respectively, as shown in Table 2. Conversely, there were no significant differences in the overall acceptability of *dambun nama* among postgraduate student panellists as shown in Table 4.

Discussion

The proximate composition of *dambun nama* (minced meat) was significantly (P< 0.05) different in moisture, crude protein, ash and ether extract contents. These values were in conformity with the reports of (9) who reported dry matter contents of 93.8 – 95.9% using both ruminant and non-ruminant *dambun nama*. This worker investigated chemical composition of *dambun nama* processed from goat, beef, mutton and broiler chicken meat and reported variations among these species in terms of their moisture content, even though this worker did not include camel meat in the investigation.

The dry matter content was not different among the five species investigated in the present study, but the values so obtained followed similar trend with the findings of (9). Similarly, the protein content of *dambun nama* followed similar trend with the dry matter and was in agreement with the reports of (9, 10), other parameters such as ether extract and ash contents followed similar trend to the work of (11) using a variety of local meat products. These differences observed among the five secies might be due to muscular fat content of the animals.

Sensory attributes such as palatability, juiciness, tenderness, colour, aroma and acceptability are important components of consumer preferences and meat consumption which may vary from product to product and also the locality of the meat product. Chevon *dambun nama* had the highest palatability among both staff and student panellists. This agrees with the 7.5 score reported by (9) using the same product and animal. It has also been reported that palatability is an index to be considered in meat sensory evaluation for its value in overall meat acceptance (10). The processing method of *dambun nama* might have also influence its significant contribution on local meat industry and also for basis of meat products comparison in nutritional values as well as consumer

acceptance among individuals or groups of peoples or locality.

Camel meat had slightly high score in juiciness among staff panellists while chevon was slightly higher among student panellists. This varied assessment show an index of preferences of the various meat types among the panellists. These differences were similarly reported by (6) using 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 juiciness which shows that the best *suya* was obtained from beef in terms of juiciness. Juiciness score has the highest acceptance value of juiciness in terms of preferences of beef and camel meat as reported by (10). In the present study, chevon and camel were a little high in the overall juiciness scores (7.65 each), which agrees with earlier reports by (9, 10). However, the variation in the juiciness scores obtained in this study might have been due to less familiarity of *dambun nama* (minced meat) among the panellists who belong to various cultural and ethnic groups. The overall tenderness score showed that mutton (7.57) and broiler chicken meat (7.57) were most preferred in terms of tenderness which was also applicable among staff panellists showing higher preferences for tenderness than student panellists, but no differences between the two panelists. This was similarly reported by (9) and attributed the high score of tenderness largely due to marbling effect of muscle fat. This also agrees with the report of (15) that mode of marbling had a significant effect on meat tenderness. However, the sensory properties of meat like tenderness may have a significant impact on meat quality acceptability. This attribute (tenderness) is one of the primary factors influencing consumer satisfaction, for instance, the tenderness 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 (16). Therefore, the observed differences in meat colour and tenderness in the present investigation might have being due to differences in the marbling content in meat of these species, for example, broiler chicken meat being a white meat is expected to appear differently from other species which produce red meat based on their myoglobin content. Meat colour is an important attribute in meat consumption as it positively relate to their sensory attribute of meat. Chicken meat is the most preferred attribute and with a slight high score among both staff (7.14) and students (7.07) in terms of meat colour. This preference of chicken meat among the panellists might have being due to familiarity of broiler chicken meat (white meat) than the other species (red meat) and also due to marbling effect. It is observed that meat colour is considered as an important parameter that attracts consumer to buy meat(17). The meat colour is also affected by method of slaughter as the level of blood left in the carcass. The high colour scoring in broiler chicken meat in this study was in conformity with the high colour score of 8.3 of broiler *dambun nama* reported by (9). This study and earlier studies were favourably inclined to broiler chicken meat than the red meat. The reason, probably, is the fear of some panellists towards consumption of red meat associated with heart diseases. However, the appearance of meat, especially colour, has been used by consumers as an important indicator of

meat quality. Good aroma values for chevon (6.95) by students and (7.39) by staff have been obtained in the present study which may be linked to varied cultural background and familiarity of the chevon meat across Nigerian market. It is reported that aroma is made up of varieties of different classes of chemicals that are either present in the food ingredients or are formed during processing(18). Flavour which is linked to aroma is defined as the combined perception of taste; smell and mouth feel, as reported by (18). Flavouring ingredients may be used to enhance meat aroma, therefore, aroma represents a major sensory attribute and possibly a major factor for improved meat palatability and consumption. Chevon meat has slightly the high score of acceptability among both staff (7.57) and student (7.24) panellists exhibited in the present study. This overall acceptance of chevon meat may not be unconnected with the aroma generally associated with chevon which most panellists are familiar with and can easily identify the meat. This was similarly reported by (10) that familiarity of a product has positive influence on its acceptability. It is reported highest acceptability scores among panellists assessing varieties of *dambun nama* (minced meat) processed from both red and white meat (9). It is also reported that type of meat is a primary motivator for consumer acceptance (19). Similarly, (6) reported higher values (acceptance) in beef with respect to overall acceptability. However, the present study contradicts the report of (6) where chevon and camel meat were most preferred in terms of acceptability than other meat types (beef, mutton and broiler chicken). This work also agrees with the works of (20) who reported that goat meat was more preferred and attributed to its low fat content. These workers also reported that goat contains higher amounts of polyunsaturated fatty acids compared with sheep meat (mutton). It is reported that consumers' preferences for a product have determined the process of meat quality improvement (3).

Conclusions and applications
Based on the results obtained, the following conclusions were made:-
1. Processing of meat into *dambun nama* had no influence on the protein content of the meat. It however, influenced ether extract content probably due to addition of oil in processing of the *dambun nama*.
2. Processing of beef, mutton, chevon, camel and broiler chicken meat into dambun nama standardized the products' acceptability in terms of palatability, juiciness, tenderness, colour and aroma.
3. It is suggested that a proper storage/ packaging materials be devised for *dambun nama* for improved acceptance among Nigerians

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