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Quality Characteristics of Chevon Sausage Obtained from Goats Fed a 50% Inclusion Level of Melon (*Colocynthis citrillus*) Husk and Palm (*Elaeis guineensis*) Oil Slurry

Research Article

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ABSTRACT

A study was undertaken to determine effect of nutritional value of Melon husk (MH) and Palm oil slurry (POS) on quality of chevon obtained from West African Dwarf (WAD) goats fed finishing diets as follows: diet 1(0% MH, 0% POS); diet 2 (50% MH, 0% POS); diet 3 (0% MH, 50% POS) and diet 4 (50% MH, 50% POS), along with *Panicum maximum* basal diet for all dietary treatment groups. After 60 days of feeding, eight goats (two goats per treatment) were slaughtered and muscles from the forelegs were used to produce chevon sausages, respectively. Proximate composition, sensory evaluation, cooking and refrigerated weight losses of sausages were determined. All data generated were analyzed as a oneway analysis of variance in a completely randomized design using SPSS statistical package. The study showed that values obtained for dry matter contents of the diets ranged from 89.53% to 89.81%. Cooking weight loss of the chevon sausages showed no significant (P>0.05) difference but refrigerated weight loss was lowest for sausages from goats fed diet 3 at 0.37%, with a high crude fat content of 13.30%. In conclusion, palm oil slurry reduced refrigerated weight loss in chevon sausage while organoleptic properties of chevon sausage, such as flavor, juiciness, saltiness e.t.c. were not influenced by dietary treatments.

KEY WORDS chevon sausage, goats, melon husk, palm oil slurry.

INTRODUCTION

Meat, which is defined as the flesh of animals suitable for use as food (Forest *et al.* 1975), is a high quality protein source that contains almost all the essential amino acids required in the human body. Animal proteins are known to provide a better balance of essential amino acids incurring an advantage over plant proteins which are deficient in lysine, tryptophan, methionine-cystine or a combination of two or more of them (Lawrie, 1985). It is one of the many foods that need to be processed in order to prevent its spoilage, and this can be done by means of smoking, drying, curing, or cooking.

It can also be processed into a product called sausage. A sausage is a food made from ground meat and often salt, herbs and spices. Typically the sausage is formed in a casing traditionally made from intestine, commonly of pigs or goats, but sometimes synthetic. Some sausages are cooked during processing and the casing may be removed afterwards. In many peasant cultures, the largely vegetarian diet is enhanced by small quantities of sausage while in modern diets, sausages although high in fat and sodium content are utilized to impart flavor and variety in the diet (Allen, 2004).

Meat and meat products are important sources of proteins, fats, vitamins and minerals (Colmenero *et al.* 2001) and studies have shown that animal nutrition is a key factor that affects meat quality (Ikeme, 1990).

The need for reducing feed cost in livestock production has lead to the use of alternative feed resources, which are cheaper and of no dietary importance to man (Fetuga and Tewe, 1985). In this study, melon seed husk and palm oil slurry were considered as alternative feed resources for goats. Melon husk (*Colocynthis citrillus*) is the dried seed coat that is left as waste when the oil-rich cotyledon and germ of the melon seeds are harnessed as human food, while palm oil slurry (POS) is the liquid effluent obtained as byproduct during the extraction of palm oil from the palm fruits (*Elaeis guineensis*) at the rate of 2-3 tonnes per tonne of finished oil.

Melon husk (MH) and palm oil slurry (POS) have been incorporated successfully into monogastric diets at various levels to substitute for maize (Fanimo and Fashina-Bombata, 1997; Akinola and Abiola, 1999; Abiola and Adekunle, 2001). POS has also been successfully incorporated into ruminant (e.g. goat) diets at recommended levels between 20-40% (Hutagalung, 1981).

Abiola *et al*. (2002), in a study on utilization of alkali treated melon husk by broilers, recorded an increase in feed intake of birds and best meat / bone ratio at 20% maize replacement levels while 10% maize replacement level with MH was recommended for broilers with untreated melon husk. Fanimo and Fashina-Bombata (1997) in their report on the response of weaner pigs found diets containing POS observed a respective increase in feed intake, weight gain and back fat thickness in subjects.

Despite the fact that a lot of successes have been made in incorporating this feed resources into both monogastrics and ruminant feed, (Hutagalung, 1981; Fanimo and Fashina-Bombata, 1997; Akinola and Abiola, 1999; Abiola and Adekunle, 2001), little cognizance is being given to the effect of these feed resources on the quality of meat these-animals produce and their effects on the organoleptic properties of this meat when further processed. Since consumers are now conscious of the quality of meat being consumed, the aim of this study was to examine the nutritional value of a specific MH and POS concentrate-based diet on the quality of chevon sausage obtained from West African Dwarf goats.

MATERIALS AND METHODS

The feeding experiment was conducted at the small ruminant experimental unit of the Teaching and Research Farms, University of Agriculture, Abeokuta. Sixteen West African Dwarf goats between the ages of 19-20 months which were intensively managed for 60 days were quarantined for 32 days during which they were treated against ectoparasites with Asuntol® and also against endoparasites by injecting them subcutaneously with Kepromec at the rate of 0.2 mL/10kg body weight. Oxytetracycline (LA) antibiotic was also administered against pneumonia, respiratory and urinary tract infections. The goats were vaccinated against (*Peste des Petit Ruminant*) PPR with tissue cultured Rinderpest vaccine. After quarantine, the goats were transferred into individual experimental pens which had been disinfected with Morigad® solution. Experimental animals were divided into four treatment groups (n=4) and each treatment balanced for body weight. The goats were randomly allotted into four dietary treatment groups of four replicate each (a goat per replicate) in a completely randomized design. They were finished off on diets as follows: diet 1 (control): 0% MH, 0% POS; diet 2: 50% MH, 0% POS; diet 3: 0% MH, 50% POS and diet 4: 50% MH, 50% POS, with grass (*Panicum maximum*) fed as the basal diet for sixty days (Table 1). Two goats per treatment were slaughtered and meat from the muscles of their hind limbs was processed into chevon sausages for quality assessment. Treatment samples of chevon were replicated 3 times.

Table 1 Chemical composition of experimental diets (% DM)

Nutrients	Diets			
	1	2	3	4
Dry matter	89.78	89.81	89.53	89.69
Crude protein	12.65	12.52	12.84	11.94
Crude fibre	18.68	33.73	30.58	32.13
Ether extract	3.75	8.34	12.85	15.73
Ash	5.82	8.32	7.47	8.58
Nitrogen free extract	59.10	37.09	36.26	31.62

Chevon sausage preparation

Four batches of chevon sausages (1 kg per batch) were prepared using lean meat from the hind legs of goat carcasses. Five hundred grams (500g) of meat from each treatment sample was measured. The prepared meat was run through a 5 mm plate in a Kenwood (Hampshire U.K.) mincing machine. Similar amounts of melon seed meal, seasoning, water and flour were added to each batch of chevon sausage. The compositions of the sausage recipe are presented in Table 3.

Determination of cooking loss of chevon sausage

Samples of the sausage mixes were stuffed separately into 35 mm cellulose (Devro Ltd, Scotland). Casing was tied at both ends after labeling and samples were replicated thrice for both cooking and refrigeration.

Initial weights of treatment samples were recorded before cooking in the water bath at a temperature of 70 ˚C for 15 minutes. Final weights of the replicate samples were taken after allowing cooked samples to cool at room temperature for 20 minutes, for the determination of cooking weight loss. Samples from each replicate were later cut into small sizes for quality assessment by panelists using the Hedonic scale.

% Cooking loss= (weight before cooking-weight after cooking) / weight before cooking × 100

Determination of refrigeration loss of chevon sausage
Replicated treatment samples of uncooked chevon sausage were labeled and weighed before refrigeration and re-weighed after 24 hours of refrigeration at 2 ˚C. Refrigeration loss was the difference between the pre and post-refrigeration weights of the samples.

% Refrigeration loss= (weight before refrigeration-weight after refrigeration) / weight before refrigeration × 100

Sensory evaluation
Sensory evaluation of samples of cooked chevon sausages was done by ten (10) panelists meat qualities estimated include meatiness, color, juiciness, meaty flavor, tenderness, saltiness, overall flavor and overall acceptability.

Bite size portions were served at room temperature to panelists who were asked to comment freely on each sample served. For each parameter, the trained panelists awarded scores using a 9-point Hedonic scale (1= Dislike extremely, 2= Dislike very much, 3= Dislike moderately, 4= Dislike slightly, 5= Intermediate, 6= Like slightly, 7= Like moderately, 8= Like very much, 9= Like extremely).

Proximate analysis of chevon sausage
Chemical compositions of the raw chevon and boiled chevon sausage were determined. Parameters evaluated include dry matter, crude protein, ether extract and ash using the methods described in AOAC (1995).

Statistical analysis
All the data generated in this study were subjected to one-way analysis of variance using the statistical package (SPSS, 1999) while significant differences were separated using Duncan Multiple Range Test within the same package.

RESULTS AND DISCUSSION

Results of the chemical composition of experimental diets are presented in Table 1. Values obtained for dry matter contents of the diets ranged from 89.53% to 89.81%. Diets 1, 2 and 3 had the highest crude protein content of 12.65, 12.52 and 12.84%, respectively (P<0.05). The same was also observed for diet 2 which had the highest crude fiber content of 33.73% and diet 1 having the lowest crude fiber content of 18.68%. The proximate composition and pH of chevon obtained from the WAD goats fed the experimental diets are shown in Table 2.

Table 2 Proximate analysis and pH of chevon obtained from West African dwarf goats fed the experimental diets

Parameters (%)	50% inclusion levels				
	1	2	3	4	SEM
Dry matter	30.18^b	31.76^a	31.0^{ab}	30.74^b	0.21
Crude protein	23.19^a	22.91^b	21.51^c	22.79^b	0.19
Fat	7.85^b	8.02^a	7.96^b	8.10^a	0.27
pH	5.68^a	5.50^b	5.70^a	5.53^b	0.28

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
SEM: standard error of means.
Diet 1= 0% MH; 0% POS; Diet 2= 50% MH; 0% POS; Diet 3= 0% MH; 50% POS; Diet 4= 50 % MH; 50% POS; MH: melon husk; POS: palm oil slurry.

Sausage recipe and the chemical compositions of the four batches of chevon sausage are provided in Tables 3 and 4, respectively.

Table 3 Recipe composition (%) of chevon sausages

Ingredients	Batches			
	1	2	3	4
Chevon (0% MH, 0% POS)	50	-	-	-
Chevon (50% MH, 0% POS)	-	50	-	-
Chevon (0% MH, 50% POS)	-	-	50	-
Chevon (50% MH, 50% POS)	-	-	-	50
Wheat flour	20	20	20	20
Melon seed meal	15	15	15	15
*Seasoning	1.89	1.89	1.89	1.89
Water	13.11	13.11	13.11	13.11
Total	100.00	100.00	100.00	100.00

* Contains Salt: 200 g; Pepper: 115 g; Mace: 40 g; Nutmeg: 40 g; Corriander: 70 g and Monosodium: glutamate 5 g. MH: melon husk; POS: palm oil slurry.

Table 4 Chemical compositions of chevon sausages

Parameters (%)	50% inclusion levels				
	1	2	3	4	SEM
Dry matter	60.22	66.98	66.87	62.32	1.73
Crude protein	12.02^a	11.34^b	12.03^a	11.57^b	0.04
Crude fibre	0.99^{bc}	0.95^c	1.01^{bc}	1.11^a	0.02
Fat	11.18^d	13.36^b	13.30^c	13.49^a	0.03
Ash	2.02^c	2.06^b	1.98^d	2.04^a	0.01

The means within the same row with at least one common letter, do not have significant difference (P>0.05).

The crude protein of chevon sausage for batch 3 obtained from goats fed diet 3, had the highest value of 12.03%, which was similar to the 12.02% for batch 1 sausage obtained from goats fed diet 1 (Table 4). Values obtained for crude fiber of chevon sausages were generally low. Significant (P<0.05) refrigerated weight loss was lowest for sausages from batch 3 (0.37%) but had a high crude fat content (Table 5). This could be as a result of the ability of proteins to trap moisture and thereby reduce moisture loss. On heating, gelatinization of proteins usually results in the formation of a matrix which entraps water and fat and stabilizes the sausage. The results agree with the reports of Hughes *et al.* (1997) who observed that decreasing fat content increases losses in processed meat.

Abiola *et al.* (2004) also observed highest refrigerated weight loss in low fat sausage whilst Acton *et al.* (1983) identified water and fat binding as the functional properties of proteins in sausages. Although, cooking weight losses of sausages were not significantly different as shown in Table 5, Honikel (1987) reported that cooking weight loss depended on the shape and size of the sample, temperature and cooking environment.

Table 5 Cooking and refrigeration weight losses in chevon produced from West African dwarf goats fed the experimental diets

Chevon sausage	50% inclusion level				
Cooked	1	2	3	4	SEM
Initial weight (g)	67.04	64.98	53.17	55.55	2.70
Final weight (g)	66.93	64.93	53.04	55.41	2.69
Weight loss (g)	0.11[ab]	0.05[b]	0.13[a]	0.11[ab]	0.03
Weight loss (%)	0.16[ab]	0.08[b]	0.24[a]	0.25[a]	0.05
Refrigerated					
Initial weight (g)	51.37[ab]	56.51[a]	50.97[ab]	43.22[b]	1.77
Final weight (g)	50.70[ab]	55.73[a]	50.78[ab]	42.68[b]	1.74
Weight loss (g)	0.66[b]	0.78[a]	0.19[c]	0.54[ab]	0.09
Weight loss (%)	1.28[ab]	1.38[a]	0.37[b]	1.29[ab]	0.18

The means within the same row with at least one common letter, do not have significant difference (P>0.05).

During cooking of sausages and burgers, protein is denatured and the resulting cellular structures disruption is strongly influenced by the method of heating and the final temperature which also affect the water holding capacity (Bendall and Restall, 1993). Table 6 provides the results for sensory evaluation of cooked sausages produced from goats fed experimental diets in which none of the parameters considered were significantly (P>0.05) different, but values obtained were numerically different from each other.

Table 6 Showing sensory evaluation of chevon sausage

Parameters	Batch number				
	1	2	3	4	SEM
Color	6.42	5.74	6.04	6.04	0.13
Juiciness	5.57	5.74	5.62	5.67	0.12
Flavor	6.04	5.93	6.04	6.00	0.21
Tenderness	6.09	6.22	6.30	5.96	0.08
Saltiness	4.59	4.48	4.93	4.52	0.08
Overall flavor	6.44	6.26	6.26	6.37	0.11
Overall acceptability	6.55	6.59	6.11	6.33	0.10

Batch 2 sausages obtained the highest score for juiciness; batch 3 had the highest score in flavor (6.04), tenderness (6.30) and saltiness (4.93), while batch 1(control) had the highest values for color (6.42), flavor (6.04), overall flavor (6.44) and overall acceptability (6.55). The sensory evaluation of chevon sausage produced from animals fed dietary treatments, indicated that color, juiciness, flavor, tenderness, saltiness, overall flavor and acceptability were not significantly affected by the dietary treatment.

CONCLUSION

In conclusion, both refrigerated and cooking weight losses were favored by the experimental diets; however, the inclusion of palm oil slurry in the goats' diets appears to reduce refrigerated weight loss in chevon sausage. The organoleptic properties of chevon sausage investigated were not influenced by dietary treatments and were at acceptable level. Therefore, palm oil slurry and melon seed husk can be included in concentrate diets for goats without any detrimental effect on sausage production.

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