Effect of Graded Levels of *Sorghum bicolor* on Proximate Composition, Lipid Oxidation, Microbial Load and Sensory Properties of Rabbit Meat Floss

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ABSTRACT

Consumers are increasingly seeking healthier and more sustainable meat products. Rabbit meat is generally considered a healthier alternative to red meat because of its low fat and cholesterol content. However, people accustomed to consuming red meat may find it less visually appealing because of its pale appearance. Plants rich in beneficial phytochemicals like Sorghum bicolor (Sorghum) have been used to impart desirable colouration and sensory properties to processed foods.

In this study, Rabbit Meat Floss (RMF) was prepared with graded levels of powdered sorghum stalks thus: Treatment 1/Control (RMF+0% Sorghum), Treatment 2 (RMF + 1%Sorghum), Treatment 3 (RMF+2%Sorghum) and Treatment 4 (RMF+3% Sorghum). The RMF were analysed for Yield (%), Microbial load (logCFU/g), Lipid oxidation (mgMDA/kg), Proximate composition (%), and Sensory properties at intervals of 0, 10, and 20 days. The RMF analysed on days 10 and 20 were packed in Ziploc bags and kept at room temperature. The experimental design was completely randomised, and all analyses were done in triplicates.

All treatments with Sorghum inclusion had higher yields than the Control, with Treatment 3 (RMF+2%Sorghum) having the highest yield (107.98). All RMF with Sorghum had higher crude protein than the control. Treatment 2 (RMF+1% sorghum) had the highest crude protein at days 0 (50.67) and 20 (47.85). Ash content was also higher in RMF with sorghum, and Treatment 4(RMF+3%Sorghum) had the highest values at days 0 (9.00) and 20 (8.49). At day 0, Treatment 3 (RMF+2%Sorghum) was rated highest in tenderness (7.00) while Treatment 2 (RMF+1%Sorghum) was rated highest in juiciness, and Treatment 4 (RMF+3%Sorghum) rated highest in colour (8.10). On day 20, all RMFs with sorghum had higher colour scores, with Treatment 4 (RMF+3% Sorghum) having the highest score (8.10). There were no significant differences in microbial load during the study.

The inclusion of *Sorghum bicolor* in rabbit meat floss significantly improved its crude protein and ash content. It also improved visual appeal, while overall acceptability was not severely comprised up to 20 days of storage.

Keywords: Rabbit meat, Rabbit Meat floss, *Sorghum bicolor,* Red meat, Phytochemicals

INTRODUCTION

Meat is a crucial component of a varied diet because it guarantees proper delivery of important micronutrients and amino acids that participates in the processes that control how the body generates and utilises energy(1,2).

A significant proportion of meat and processed meat products consumed globally are sourced from cattle, sheep and goats, which are also classified as red meat (3). Due to its relatively high-fat content and perception as a food that causes cancer, in the case of red meat, beef is commonly linked to an unfavourable health image. In order to reduce the risk of cancer, obesity, and metabolic syndrome, it is often advised to consume little to no meat, particularly red meat (4). The fact that meat is a significant source of some micronutrients, including selenium, iron vitamins A and B12, and folic acid, is ignored in this discussion. These micronutrients either do not exist in plant-based foods or have a low bioavailability (1).

Nowadays, consumers are more health conscious and interested in the components of what they consume. Regardless of the lack of evidence to substantiate some of the claims against the consumption of red meat, many consumers who want to continue deriving the nutritional benefits offered by meat are shifting towards increased consumption of healthier white meat alternatives like rabbit meat. Given that it is lean, full of high-biological value proteins, low in cholesterol, and high in linolenic acid, rabbit meat is prized for its nutritional qualities (5).

Due to its highly nutritious and perishable nature, meat is often processed into more shelf-stable meat products as a means of preservation and to create variety in taste for consumers (6). One such product is meat floss, commonly produced from beef and called *danbunama* (7). However, meat floss has also been successfully produced from other meat types like chicken, pork, and rabbit meat (8-11).

During meat processing, several ingredients are added for different purposes, e.g. improvement of flavour, colour, and oxidative stability. Again due to increasing consumer awareness, there is growing discontent towards the use of synthetic/chemical additives in foods because of potential adverse effects, in favour of more natural and healthier substitutes (12,13).

Sorghum bicolor is a versatile, drought-tolerant crop commonly produced in Africa, Asia, Australia, and North and South America semi-arid regions. Despite sorghum's exceptional qualities, its use is not as widespread as it could be, especially for food (14). In West Africa, dye sorghum/red sorghum is a kind of sorghum typically cultivated along the edges of agricultural fields and has distinctive dark red leaf sheaths. These leaf sheaths are highly valued for extracting a colouring component which imparts bright red colouration to foods. 3-deoxyanthocyanidins, such as apigeninidin and luteolinidin, as well as phenolic acids, such as 4-hydroxybenzoic acid and p-coumaric acid, are present in substantial concentrations in extracts from dye sorghum leaf sheaths (15). Apigeninidin is a phenolic phytoalexin that aids in plants' defence against pathogens and has been linked to cancer prevention and other salutary benefits(16). Phenolic acids are typically weak acids used as preservatives in the food industry, such as 4-hydroxybenzoic acid and p-coumaric acid. Hence, the natural extract from coloured sorghum leaf sheaths has the potential for use in more food and pharmaceutical applications. In the West African region, sorghum extract has a variety of uses. It is used to colour porridges, a significant staple dish, and soft cheese, locally referred to as wagashi. Dyeing wagashi with sorghum extract is an endogenous practice used, presumably also to increase shelf life. The inhibitory effect of apigeninidin present in sorghum on fungi and bacteria suggests its potential as a food antimicrobial (17,18). Therefore, the incorporation of sorghum into the production of Rabbit Meat Floss (RMF), in addition to generating colouration more likely to appeal to consumers of red meat, was also expected to combine the health benefits of both into developing a more natural and healthful product in accordance with the growing awareness of consumers.

MATERIALS AND METHODS

Experimental Site

This experiment was carried out at the Department of Animal Science, University of Ibadan, Nigeria, in the Animal products and processing laboratory.

Sample Collection

Dried *Sorghum bicolor* (Sorghum) stalks were bought from Bodija market in Ibadan, Nigeria. The sorghum stalks were further dried in an oven till constant weight was achieved. Thereafter, the oven-dried sorghum stalks were milled, pulverised and stored in an airtight container until needed.

Ten unsexed and mature chinchilla rabbits were purchased from a reliable breeder in Ibadan, Oyo State. The rabbits were fasted and rested before slaughtering. They were slaughtered under hygienic conditions in the Animal products and processing laboratory of the Department of Animal Science using the kosher means of slaughtering as described by (19). After slaughter, the rabbits were hoisted for efficient bloodletting by gravitational force and the pumping effect of the heart. The rabbits were skinned, eviscerated, trimmed of excess fat and deboned.

Meat Floss Preparation

This involved all the steps involved in the conversion of the carcass to the final product, which is the meat floss, such as spice mixture preparation, meat preparation, cooking, shredding, frying, de-oiling (draining of excess oil) and packaging.

Spice Mixture Preparation

Two spice mixtures were prepared, Cooking Recipe and Shredding Recipe, as shown in Table 1 and Table 2 below. The recipes were adapted from previous work by (7), where similar recipes were used in the production of meat (beef) floss. All the ingredients for the spice mixtures were locally sourced from a well-patronised open market. Each ingredient was pulverised, measured and thoroughly mixed as needed for the two recipes. The cooking and shredding recipes were kept separate in airtight plastic containers until used.

Table 1: Composition of the cooking recipe used for meat floss production (g/100g)

* All botanical names according to (20)

Table 2: Composition of the shredding recipe used for meat floss production (g/100g)

* All botanical names according to (20)

Cooking

The already cleaned meat was weighed, put into a pot and placed on the gas burner for cooking and the cooking recipe was added in the ratio of 1g of spice to 100g of meat, and water was added in the ratio of 25cl to 1000g of meat. The meat was cooked until the broth dried in the meat, ensuring the meat was adequately cooked for about 40 minutes. The meat was removed and allowed to cool at room temperature. Afterwards, the meat was weighed and divided into four (4) equal parts according to the treatments in the experiment thus; Treatment 1/ Control (RMF+0% Sorghum), Treatment 2 (RMF+1%Sorghum), Treatment 3 (RMF+2%Sorghum) and Treatment 4 (RMF+3%Sorghum).

Shredding

The cooked and cooled meat samples were shredded by pounding with a local mortar and pestle. The shredding recipe, mixed with the corresponding proportion of powdered sorghum per treatment, was added in the ratio of 50g of spice to 1000g of meat. These were weighed and added gradually as pounding progressed to ensure proper and uniform mixing of the recipe and sorghum. The pounding was intense and consistent until the meat strands disengaged and were beaten to shreds.

Frying

The shredded meat was separately deep-fried in Soya bean oil and preheated to 180ºC (the ratio of oil to meat was 1litre to 1000g of meat). The meat samples were fried until a golden brown colouration was obtained.

Draining of Excess Oil

After frying each batch of shredded meat until golden brown, the products were poured into a colander, allowed to cool to room temperature and pressure applied. The product was later transferred into a cheesecloth, which was pressed with clean and dry hands to remove more excess oil to prevent the final product from sticking together. The meat floss from each treatment was poured into separately marked trays and separated into strands.

Storage

Each rabbit meat floss with graded levels of sorghum were divided into three equal parts. Two parts of each were stored at room temperature in Ziploc bags. After that, the rabbit meat floss was evaluated for lipid oxidation and sensory properties on days 0, 10 and 20 of storage.

Chemical, Microbial and Sensory Analyses

Lipid oxidation

This was evaluated using the method described by(21). 1g of sample was weighed into a test tube and homogenised with 2mls of distilled water. 2.5mls of Trichloroacetic acid (TCA) was added into each test tube and centrifuged at 2000 revolutions per minute for 10 minutes. 1 ml of the centrifuged sample was decanted into a test tube, and 1 ml of Thiobarbituric acid (TBA) was added to the test tubes. The mixture was further boiled for 35mins and poured into a curvet. A UV-VIS spectrophotometer was used to read the samples at 532nm wavelength. The results were expressed as mg malondialdehyde (mgMDA/kg) sample.

Proximate composition

This was determined in the RMF according to the methods described by (22).

Microbial load evaluation

28g of Nutrient Agar was dissolved in 500cm3 of distilled water and boiled in a water bath for 30 minutes. The medium was then cooled to 45°C before pouring into the plate under sterilised conditions for culturing bacteria. 1g of each sample was dissolved 9mls of sterilised water in test tubes and serially diluted up to 10-9. Sterile pipettes were used to measure 1cm3 out of the 10-7 and 10-9 dilution fractions, and these were pipetted into two different labelled sterile Petri dishes and molten agar at 45°C was poured into them (using the pour plate method). It was swirled gently by hand for even distribution; the plates were inverted and incubated in an incubator at 37˚C for 24 hours. After which, they were examined under a microscope. Colonies that appeared at the end of the incubation period were counted, and the data was expressed as logarithms of the colonies forming unit (logCFU/g) sample. All analyses were done in triplicates following the procedures described by (23).

Sensory Analysis

This was evaluated by panellists consisting of a 15-member semi-trained panel, according to the protocol described by AMSA(24). They comprised males and females from the Department of Animal Science, University of Ibadan, undergraduate and postgraduate students. They were given unsalted cracker biscuits and water to clean their mouths between tasting the rabbit meat floss samples. On a clean saucer, the panellists were presented with rabbit meat floss with graded levels of sorghum sequentially.

Each treatment's meat floss was evaluated independently of the other. Colour, flavour, tenderness, juiciness, texture, and overall acceptability were all rated on a 9-point hedonic scale by the panellists using the protocol described by (25).

Experimental Design and Statistical Analysis

A completely randomised design was used for this experiment. All data obtained were subjected to statistical analysis using SAS 2000 package, while means were separated with Duncan Multiple Range Test. Statistical significance was set at $P<0.05$.

RESULTS

Table 3 shows the product yield and oil retention of rabbit meat floss prepared with graded levels of Sorghum bicolor. Oil retention increased in order of increasing the graded level of Sorghum. Product yield followed the same trend, except for treatment 4 (3% Sorghum), which was lower than Treatments 2 (1% Sorghum) and 3 (2% Sorghum) but still higher than the control (Treatment 1(0% Sorghum).

Table 3: Product Yield and Oil Retention of rabbit meat loss with graded levels of Sorghum bicolor

Table 4 shows the effect of graded levels of Sorgh*um bicolor* on the microbial load of rabbit meat floss. No significant differences ($P>0.05$) were recorded for microbial load throughout the study.

Table 4: Effect of graded levels of *Sorghum bicolor* on the microbial load of rabbit meat floss

Table 5 shows the effect of graded levels of *Sorghum bicolor* on the lipid oxidation of rabbit meat floss. Significant differences (P<0.05) were observed. At day 0, treatment 1 (0% Sorghum) had significantly lower lipid oxidation, while treatment 4 (3% Sorghum) had the highest lipid oxidation. On days 10 and 20, the same trend was observed for lipid oxidation.

Table 5: Effect of graded levels of *Sorghum bicolor* on the lipid oxidation of rabbit meat floss

Table 6 shows the effect of graded levels of *Sorghum bicolor* on the proximate composition of rabbit meat floss. Significant differences (P<0.05) were observed. At day 0, treatment 2 (1% Sorghum) had significantly higher crude protein, while treatment 1 (0% Sorghum) had the lowest crude protein content. A similar observation was also recorded on day 20. For Ash content, treatment 4 (3% Sorghum) was significantly higher, while treatment 1 (0% Sorghum) had the lowest at day 0. The same trend was repeated on day 20. The ether extract was higher in treatment 2 (1% Sorghum) at day 0, while treatment 3 (2% Sorghum) was the lowest. At day 20, treatment 2 (1% Sorghum) retained the higher ether extract, while treatment 4 (3% Sorghum) was the lowest.

Crude fibre had significant differences (P<0.05), at day 0, treatment 4 (3% Sorghum) had significantly higher Crude fibre than other treatments, with Crude fibre content increasing as the graded level of Sorghum inclusion increased. The same trend was repeated on Day 20. Dry matter was significantly higher (P<0.05) in treatment 1 (0% Sorghum) and lowest in treatment 3 (2% Sorghum) on both days 0 and 20. Nitrogen-free extract followed a similar trend but differed slightly at Day 20, with treatment 2 (1% Sorghum) having the lowest value.

Table 6: Effect of graded levels of *Sorghum bicolor* on the proximate composition of rabbit meat floss

Table 7 shows the effect of graded levels of Sorghum bicolor on the sensory properties of rabbit meat floss.

Aroma differed significantly (P<0.05) across all the evaluation intervals. Treatment 4 (3% Sorghum) had the highest aroma score on days 0 and 10, while treatment 2 (1% Sorghum) had the highest aroma score on day 20. No significant differences occurred for flavour among all treatments throughout the evaluation intervals.

Tenderness was only significantly different (P<0.05) at day 0, with treatment 3 (2% Sorghum) recording the highest score. Juiciness was also only significantly different (P<0.05) at day 0, with treatment 2 (1% Sorghum) recording the highest score.

Colour was significantly different (P<0.05) among the treatments throughout the evaluation intervals, and treatment 4 (3% Sorghum) had the highest colour score at days 0, 10, and 20.

Overall acceptability significantly differed on days 10 and 20, with treatment 2 (1% Sorghum) having the lowest scores.

Table 7: Effect of graded levels of *Sorghum bicolor* on the sensory properties of rabbit meat floss

DISCUSSION

The inclusion of powdered sorghum stalks improved oil retention and product yield in Rabbit Meat Floss (RMF) in all the treatments with added sorghum, particularly in treatment 3 (2% Sorghum), which had a yield of 107.98%. The product yields observed in this study were considerably higher than those reported in a similar experiment on RMF without sorghum inclusion by (8); this effect is likely due to the additional fibre component introduced by the sorghum, which improved oil and moisture retention in the RMF compared to the control, as it has been established that plant-based extenders improve the yield of meat products(26).

Despite being touted as a potential antimicrobial due to its inhibitory effect on bacteria and fungi (27,28), the inclusion of sorghum in RMF had no significant effect on microbial loads in this study. This is similar to observations by (29), who found no inhibitory effect of sorghum leaves extract on microbial growth in wagashi (West African soft cheese). But contradicts findings by (30) who reported that sorghum bran inhibited microbial growth in beef sausages for 10 days. This contrast is most likely due to differences in the sorghum plant parts used.

Treatment 1 (0% Sorghum) throughout the study had significantly lower lipid oxidation values than the RMF with added sorghum. This is likely due to the higher oil retention in the RMF with added sorghum, as foods with higher lipid contents are more susceptible to lipid oxidation. However, the values for lipid oxidation observed in this study were substantially lower than in observations by (8), where RMF without sorghum was stored in different types of packaging. This suggests an inhibitory effect of sorghum on lipid oxidation despite higher oil retention in the RMF with added sorghum, as reported by (17) and other researchers.

RMF with added sorghum, particularly treatment 2 (1% Sorghum), had significantly higher crude protein than the control throughout the study. This points to the potential value of Sorghum bicolor, being rich in phytonutrients, as a valuable extender in the formulation of healthier and more sustainable meat products where meat consumption can be reduced without necessarily sacrificing protein intake, in addition to its other potentials as antioxidant, antimicrobial and so on (26). Also, RMF with added sorghum, particularly treatment 4 (3%), had significantly higher ash content than the control, affirming sorghum as a rich source of beneficial phytonutrients (14,31)

At day 0, all the treatments had comparable aroma, flavour and overall acceptability. However, the RMF with added sorghum had higher scores for colour in increasing order of inclusion, with treatment 4 (3% Sorghum) being the highest throughout the study due to the red pigmentation imparted by anthocyanins in the sorghum(29). The RMF with added sorghum also had significantly higher juiciness, as rated by panellists. This is probably due to the fibre from the sorghum, which led to higher moisture and oil retention.

On day 20, sorghum with RMF had an aroma comparable with the control, with treatment 2 (1% Sorghum) having the best aroma score. Overall acceptability had generally declined, but there was no significant difference between treatment 3 (2% Sorghum), treatment 4 (3% Sorghum) and the control. This is not out of place as the quality of stored products are known to undergo some decline with the passage of time. This observation was generally comparable to observations by (8) where RMF was stored in different packaging materials for a period of 21 days. The application of sorghum in extracted form may probably be able to inhibit decline in overall acceptability better.

CONCLUSION

It was observed that rabbit meat floss with added sorghum was preserved well and had above-average sensory scores up to 20 days of storage. Sorghum inclusion had no effect on microbial load throughout the study. However, in addition to increasing yield, sorghum inclusion increased crude protein and ash contents of rabbit meat floss, thereby further highlighting the potential of sorghum as an animal product extender in achieving the goal of healthier meat products with reduced environmental impact.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Table 1: Composition of the cooking recipe used for meat floss production (g/100g)

Ingredients/seasoning	Scientific/Botanical names	Quantity (g/100g)
Salt	Sodium Chloride	10.00
Maggi	Maggi	10.00
Thyme	*Thymus vulgaris L.*	10.00
Curry	*Murraya koenigii (L.) Spreng.*	10.00
Turmeric	*Curcuma longa L.*	10.00
Onions	*Allium cepa L. var. cepa*	50.00
Total		**100.00**

* All botanical names according to (20)

Table 2: Composition of shredding recipe used for meat floss production (g/100g)

Ingredients/seasoning	Scientific/Botanical names	Quantity (g/100g)
Red Pepper	*Capsicum annum* L.	20.00
Black Pepper	*Piper nigrum* L.	20.00
Maggi	Maggi	30.00
Ginger	*Zingiber officinale Rosc.*	3.50
Garlic	*Allium sativum* L.	3.50
Curry powder	*Murraya koenigii* L.	3.00
Thyme leaves	*Thymus vulgaris* L.	3.00
Salt	Sodium Chloride	5.00
Onions	*Allium cepa* L. var. cepa	12.00
Total		100.00

* All botanical names according to (20)

Table 3: Product Yield and Oil Retention of rabbit meat floss with graded levels of *Sorghum bicolor*

TREATMENTS	1 (0% Sorghum)	2 (1% Sorghum)	3 (2% Sorghum)	4 (3% Sorghum)
Oil retained (%)	25	30	40	45
Yield (%)	82.61	101.26	107.98	97.80

Table 4: Effect of graded levels of Sorghum bicolor on the microbial load of rabbit meat floss

DAYS	TREATMENTS/LEVEL OFSORGHUM INCLUSION	MICROBIAL COUNT (*log*CFU/g)	SEM
0	1 (0% Sorghum)	$1.10x10^{-8}\pm$	0.00
	2 (1% Sorghum)	$1.21x10^{8}\pm1.69$	0.00
	3 (2% Sorghum)	$6.8x10^{-8}\pm8.77$	0.00
	4 (3% Sorghum)	$1.34x10^{-8}\pm1.78$	0.00
10	1 (0% Sorghum)	$1.56x10^{-8}\pm2.18$	0.00
	2 (1% Sorghum)	$1.81x10^{-8}\pm2.53$	0.00
	3 (2% Sorghum)	$1.25x10^{-8}\pm1.75$	0.00
	4 (3% Sorghum)	$2.11x10^{-8}\pm2.95$	0.00
20	1 (0% Sorghum)	$2.36x10^{-8}\pm3.30$	0.00
	2 (1% Sorghum)	$2.11x10^{-8}\pm2.95$	0.00
	3 (2% Sorghum)	$1.61x10^{-8}\pm2.25$	0.00
	4 (3% Sorghum)	$2.76x10^{-8}\pm3.86$	0.00

^{a,b,c,d} means along the same column with different superscripts are significantly different (P<0.05)

SEM = Standard error of the mean

Table 5: Effect of graded levels of Sorghum bicolor on the lipid oxidation of rabbit meat floss

DAYS	TREATMENT/LEVEL OF SORGHUM INCLUSION	LIPID OXIDATION(mgMDA/kg)	SEM
0	1 (0% Sorghum)	0.94±0.01^{d}	0.01
	2 (1% Sorghum)	1.36±0.02^{b}	0.01
	3 (2% Sorghum)	1.02±0.04^{c}	0.01
	4 (3% Sorghum)	1.67±0.01^{a}	0.01
10	1 (0% Sorghum)	1.29±0.01^{c}	0.02
	2 (1% Sorghum)	1.91±0.08^{b}	0.02
	3 (2% Sorghum)	1.32±0.02^{c}	0.02
	4 (3% Sorghum)	2.32±0.04^{a}	0.02
20	1 (0% Sorghum)	1.36±0.05^{c}	0.04
	2 (1% Sorghum)	2.03±0.11^{b}	0.04
	3 (2% Sorghum)	1.44±0.03^{c}	0.04
	4 (3% Sorghum)	2.64±0.06^{a}	0.04

^{a,b,c,d} means along the same column with different superscripts are significantly different (P<0.05)

SEM = Standard error of the mean

Table 6: Effect of graded levels of Sorghum bicolor on the proximate composition of rabbit meat floss

DAYS	PARAMETERS	0% Sorghum	1% Sorghum	2% Sorghum	3% Sorghum	SEM
0	**Crude Protein (%)**	43.67±0.50^{d}	50.67±0.12^{a}	47.11±0.21^{b}	44.67±0.06^{c}	0.12
	Ash (%)	6.00±0.14^{c}	6.26±0.09^{c}	7.95±0.11^{b}	9.00±0.06^{a}	0.05
	Ether Extract (%)	8.78±0.18^{b}	9.95±0.21^{a}	8.65±0.14^{b}	8.30±0.14^{b}	0.09
	Crude Fibre (%)	0.10±0.01^{a}	0.07±0.01^{b}	0.08±0.01^{ab}	0.09±0.01^{ab}	0.00
	Dry Matter (%)	79.60±0.59^{a}	56.36±0.06^{c}	54.61±0.04^{d}	58.54±0.08^{b}	0.15
	Nitrogen-Free Extract (%)	41.46±0.17^{a}	33.07±0.19^{d}	36.22±0.03^{c}	37.95±0.25^{b}	0.09
20	**Crude Protein (%)**	39.95±0.08^{c}	47.85±0.13^{a}	42.00±0.08^{b}	40.16±0.11^{c}	0.05
	Ash (%)	5.51±0.09^{d}	6.09±0.15^{c}	7.30±0.06^{b}	8.49±0.09^{a}	0.05
	Ether Extract (%)	8.31±0.13^{b}	9.57±0.13^{a}	8.06±0.06^{bc}	7.82±0.17^{c}	0.06
	Crude Fibre (%)	0.02±0.01^{b}	0.03±0.01^{ab}	0.02±0.00^{ab}	0.04±0.01^{a}	0.00
	Dry Matter (%)	73.96±0.11^{a}	53.40±0.11^{c}	50.87±0.17^{d}	56.03±0.09^{b}	0.06
	Nitrogen-Free Extract (%)	46.23±0.30^{a}	36.46±0.40^{d}	42.62±0.08^{c}	43.51±0.04^{b}	0.16

^{a,b,c,d} means along the same row with different superscripts are significantly different (P<0.05)

SEM = Standard error of the mean

Table 7: Effect of graded levels of Sorghum bicolor on the sensory properties of rabbit meat floss

DAYS	PARAMETERS	0% Sorghum	1% Sorghum	2% Sorghum	3% Sorghum	SEM
0	**Aroma**	$3.50{\pm}1.96^{b}$	$4.30{\pm}1.64^{b}$	$5.30{\pm}2.00^{ab}$	$6.20{\pm}2.10^{a}$	0.97
	Flavour	$4.60{\pm}2.01^{a}$	$6.30{\pm}1.42^{a}$	$6.30{\pm}1.77^{a}$	$5.80{\pm}2.04^{a}$	0.91
	Tenderness	$4.90{\pm}2.13^{b}$	$6.50{\pm}2.12^{ab}$	$7.00{\pm}2.54^{a}$	$6.20{\pm}1.40^{ab}$	1.04
	Juiciness	$4.90{\pm}2.02^{b}$	$7.00{\pm}0.94^{a}$	$6.60{\pm}1.71^{a}$	$5.90{\pm}1.91^{ab}$	0.85
	Colour	$3.00{\pm}1.83^{c}$	$5.90{\pm}1.67^{b}$	$6.00{\pm}2.05^{b}$	$8.10{\pm}1.10^{a}$	0.85
	Overall Acceptability	$7.40{\pm}1.17^{a}$	$6.80{\pm}1.48^{a}$	$7.20{\pm}0.92^{a}$	$7.00{\pm}0.94^{a}$	0.57
10	**Aroma**	$3.20{\pm}1.48^{a}$	$2.00{\pm}0.82^{a}$	$2.60{\pm}1.17^{a}$	$3.20{\pm}1.93^{a}$	0.71
	Flavour	$4.50{\pm}1.96^{a}$	$4.20{\pm}2.39^{a}$	$4.10{\pm}1.91^{a}$	$4.10{\pm}1.85^{a}$	1.02
	Tenderness	$4.10{\pm}0.74^{a}$	$4.40{\pm}1.58^{a}$	$5.10{\pm}1.79^{a}$	$4.20{\pm}1.81^{a}$	0.77
	Juiciness	$5.30{\pm}2.41^{a}$	$4.40{\pm}1.78^{a}$	$5.60{\pm}1.51^{a}$	$5.10{\pm}2.13^{a}$	1.00
	Colour	$4.20{\pm}0.79^{c}$	$6.01{\pm}1.26^{c}$	$6.60{\pm}0.97^{b}$	$8.10{\pm}0.99^{a}$	0.51
	Overall Acceptability	$7.00{\pm}1.05^{a}$	$4.00{\pm}1.56^{c}$	$5.50{\pm}1.58^{b}$	$5.70{\pm}1.70^{ab}$	0.75
20	**Aroma**	$4.00{\pm}1.94^{a}$	$5.10{\pm}2.47^{a}$	$4.10{\pm}1.10^{a}$	$3.90{\pm}2.02^{a}$	0.88
	Flavour	$5.80{\pm}2.04^{a}$	$4.80{\pm}2.74^{a}$	$5.30{\pm}1.64^{a}$	$5.70{\pm}1.57^{a}$	1.03
	Tenderness	$3.90{\pm}1.52^{a}$	$4.30{\pm}1.25^{a}$	$5.10{\pm}1.52^{a}$	$4.00{\pm}1.05^{a}$	0.67
	Juiciness	$3.80{\pm}2.44^{a}$	$2.80{\pm}1.40^{a}$	$4.30{\pm}2.16^{a}$	$2.60{\pm}0.84^{a}$	0.91
	Colour	$4.40{\pm}0.97^{c}$	$7.40{\pm}1.17^{b}$	$7.20{\pm}1.14^{b}$	$8.10{\pm}1.10^{a}$	0.55
	Overall Acceptability	$6.70{\pm}1.34^{a}$	$4.90{\pm}2.58^{b}$	$5.00{\pm}2.31^{ab}$	$5.50{\pm}1.58^{ab}$	1.01

^{a,b,c,d} means along the same row with different superscripts are significantly different ($P<0.05$)
SEM = Standard error of the mean