QUALITY CHARACTERISTICS OF FRESH AND FROZEN MEAT FROM RABBITS FED DIFFERENT LEVELS OF *GLIRICIDIA SEPIUM*

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ABSTRACT

This study compares the effects of different levels (0 to 50%) of *Gliricidia sepium* leaves on the processing, proximate composition, and organoleptic characteristics of male and female rabbits using a 3 x 2 x2 factorial design. The effect of 8 weeks of cold storage at - 20±2^0 C on acceptability of the rabbit meat was also evaluated. The data obtained showed that the live-weight, dressing percentage, and fat content of the rabbits fed 25% *Gliricidia sepium* were higher than those from 0 % (control) or 50 % level at 10 weeks old. The total cooking losses were higher by 15 to 24% in the frozen roasts, due mainly to increased drip and evaporative losses which were also slightly higher in the female carcasses. The expressible moistrue index (EMI) increased in the frozen samples, and no significant difference (P>0.05) was found to be attributable to diet. The final moisture content and cook yield of the frozen samples decreased, whereas the ash content was not significantly affected by sex or diet. However, the protein and fat contents, and pH increased regardless of sex in all the cooked samples. The sensory evaluation results are summarized as follows: (1) fresh roasts from rabbits fed 25% *Gliricidia sepium* were preferred, possibly, influenced by tenderness scores and slightly higher fat content; and (2) meat roasts from the frozen samples did not differ on overall acceptability, although the palatability scores diminished at the end of 8 weeks of frozen storage, and panelists did not detect any significant differences (P>0.05) attributable to diet or sex.

Key words: Rabbit, meat Quality, *Gliricidia sepium* organoleptic characteristics, frozen storage.

INTRODUCTION

Rabbit meat is an excellent source of protein. It is low in total fat, saturated fat, cholesterol and sodium (Rao *et al.,* 1979). The ease with which rabbits may be bred within a small land area, their rapid growth rate, high feed efficiency, and early marketing age (56 days) make them an economic source of animal protein (Holmes *et al.,* 1984). Furthermore, rabbits are non-ruminant herbivores and can feed efficiently on roughages which are not directly used by man.

Research in rabbitry in Nigeria, in the last decade or so has focused on the effects of diets on growth, reproductive performance, chemical composition, carcass yield and eating qualities (Omole, 1983; Omole and Onwudike, 1983; Oluokun, 1985; Aduku *et al.,* 1986; Awosanya and Okubanjo, 1991). The performance of three breeds of rabbits was reported recently (Iyeghe, 1992), and data on the chemical composition of a wide range of plants eaten by rabbits in some parts of Africa were recently summarized (Ayoade *et al,* 1985; Carew *et al.,* 1989). The use of *Amaranthus hypochodriacus,* sunflower and alfalfa forages in feeding trials for rabbits has also been widely reported (Holmes *et al.,* 1984; Harris *et al.,* 1981). Hence, it is widely accepted that feeding rabbits on certain forage crops would increase their weight gains and reduce enteric problems. Thus, there is a growing interest in the use of *Gliricidia sepium,* a medium-sized, deep rooted, legume plant (Nochebuena and 0'Donovan, 1986) as high-protein forage for livestock feeds (*Mishra et al.,* 1977; Mba *et al.,* 1982; Melton, 1990). However, information on the effect of *Gliricidia sepium* in the diets of rabbits is limited in contrasst to that on other plant species.

Different diets may affect meat flavour, tenderness and juiciness, and different dietary levels may also produce widely differing growth rates (*Mishra et al.*, 1977). Any feed that affects the concentration of flavour precursors or deposits unique components in the fat would affect the meat flavour when cooked. Such influence is dependent on the type of diet and, to a large extent, on sex, age and animal species (Melton, 1990). When the matured rabbits are slaughtered, the meat may be consumed fresh or preserved. Freezing and cold storage appear to be commonly used since they maintain a quality comparable to the fresh product. The maxium shelf life of vacuum packaged rabbit meat at -20C was 20 days (Cantoni, 1976) as cited by Ockerman *et al.* (1980). In another study (Sunki *et al.*, 1978), palatability scores of cooked rabbits diminished significantly as the storage period increased at 5^0 c. Proper packaging and storage of meat at - 30^0C could maintain its quality for 6 months with slight deterioration (Ockerman et al., 1980). Indeed, spoilage by oxidative rancidity in meat and meat products depends on the lenght of storage and fat content of the meat (Igene *et al.*, 1979), freezing rate and meat quality prior to freezing (Awonorin and Ayoade, 1992).

The research reported here had the following objectives: (1) to evaluate the effect of *Gliricidia sepium* concentration in the diet on carcass characteristics and meat quality; and (2) to examine the effect of frozen versus fresh processing on meat quality.

MATERIALS AND METHODS

Source of rabbit meat

The live rabbits used in this study were raised on graded levels of *Gliricidia sepium* leaves in the rabbitry unit of the Teaching and Research farm, University of Agriculture, Makurdi. A total of thirty six New Zealand White X Chinchilla rabbits (18 males, female) at the age of 10 weeks were transferred to the Food Science and Technology Department, where both processing, cold storage, and sensory evaluation were carried out. The composition of the rabbit diets is presented in Table 1.

Slaughtering and dressing

The rabbits were fasted for 24 h, but were supplied with water, and the slaughtering was carried out by a blow to the back of the neck. The carcasses were scalded by burning of the fur in fire (Aduku *et al.*, 1986). The live-weight of each rabbit, the weights of the blood, abdominal fat, head, viscera, and internal organs were recorded, and expressed per kilogram of the liveweight of each animal. The right and left thigh muscles were separated within 30 min after slaughter for the heat processing and storage experiments.

Freezing and cold storage

The thighs of carcasses from each sex group and dietary levels were divided into two sub-groups; one sub-group was for the freezing and cold storage studies, and the other for heat processing in fresh condition. The meat for freezing experiments was chilled in water containing ice blocks for 30 min until the internal temperature reached 5 ± 1^0c. The samples were removed, and excess water was drained before packaging and sealing them in polyethylene bags. Thereafter, samples were transfered into an empty domestic chest freezer operating at -20^0c. The carcasses attained a temperature of -20^0C within 2.5h. These samples were kept in the freezer for 8 wk at -20 $\pm 2^0$c, and weight measurements were taken prior to chilling, after chiling, and at the end of cold storage.

Heat processing

Fresh or frozen samples from each group (male or female), weighing 0.85 kg were roasted separately in a conventional electric oven (GENLAB 2 F 82 B5151, UK) at 163^0c. The samples were spaced in the oven to ensure uniform heating of individually cooked products. The time required was approximately 60 min as determined by a series of preliminary cooking trials. Similar procedure was used in a previous study on meat roasts (Awonorin and Rotimi, 1991). Two categories of roasts were obtained in this study; (1) roasts from fresh/raw meat samples here-in referred to as "fresh roasts"; and (2) frozen raw samples which were stored for 8 weeks at -20^{0}C before thawing and roasting, referred to as " frozen roasts". The summary of relevant heat processing data for the rabbit roasts are as follows: oven heating capacity, 1.5 KW; oven temperature, 163±2^{0}C; initial temperature of meat samples, 23±1^{0}C; final internal temperature of roasts, 72±3^{0}C; total mass of roasts per batch, 0.85 kg; average rate of heating per batch, 21 W; and ratio of heating time to mass of sample, 70.6 min/kg. All samples were roasted until the desired degree of doneness was well done. The degree of doneness of each roast was evaluated on a scale based on 1 = rare; 5 = medium; and 9 = well done.

Cooking losses and yield

Total cooking losses (drip plus evaporative) were determined by pre - and post- weight measurements during heat processing. Drip was determined from the measured weight of drippings, and evaporative losses were obtained as the differences between the total and drip losses. Both the yield and cooking losses were expressed as percentage of the initial weight of samples prior to cooking. The yield was calculated by subtracting the total cooking losses in percentage from 100%. The average values of three measurements were recorded.

pH determination

The pH of the fresh carcasses was measured directly from three points in the thigh muscle of each sample at room tempeture using a digital ph meter with electrode (Awonorin and Ayoade, 1992). The pH of the cooked sample was measured by mincing small cuts (30 g) at room temperature in 100 ml of distilled water for 2 to 3 min. The homogenate was filtered using Whatman No 4 paper, and the pH of the filtrate was measured. Mean values of three replications per sample were recorded.

Expressible moisture index (EMI)

The EMI has been used by a number of researchers, including Awonorin and Ayoade (1992) as a measure of the water-holdidng capacity (WHC) in muscle food. this was determined by subjecting 5 g of sample to a pressure of 2.5 kN/m^2 for 1.5 h. The EMI was computed directly as the ratio of the meat area to juice area from ten measurements and average values were recorded. Hence. WHC was obtained by subtracting EMI values from unity.

Proximate analysis

The standard AOAC (1960) procedures were used to determine moisture (23,003), protein (20.036), fat (22.033), and ash (29.012) contents of the fresh or cooked meat samples.

Sensory evaluation

Trained panelists (N = 10) were selected among students and staff in the Deparments of Food Science and Technology, and Home Economics after three training sessions. The panelists were screened for their ability to detect accurately, the sensory attributes of meat, including the identification of colours and ranking of samples close to the mean of several trial scores. The evaluation was based on a 9 - point hedonic scale for juicines, tenderness, colour, flavour, and overall acceptability, where 1 = dislike extremely; and 9 = like extremely. The roasts were cooled to about 35^{0}c and were presented randomly to individual panelists for evaluation.

Statistical analysis

The experiment was planned as a randomized block with a 3 x 2 x2 factorial design involving the three dietary treatments (0,25,50% *Gliricidia sepium*), two sexes (male, female), and two storage conditions (0,8 weeks). Analysis of variance was applied to the processing traits and sensory scores according to the procedure described by Snedecor and Cochran (1989). Any significant differences among the mean data points were separated (Duncan, 1955).

RESULTS AND DISCUSSION

The proportions of ingredients, calculated metabolisable energy, and chemical analysis of the experimental diets are shown in Table 1.

The major variations in the composition of these diets were due to the proportions of *Gliricidia sepium* (0.25,50%), maize (51, 37,28%), soybean (15,8.5,13%) and brewer's dried grains (29.3,24.8, 4.3%) in the Control diets A and B, respectively. It is clear from Table 2 that the inclusion of *Gliricidia sepium* in the diets of male rabbits by as much as 25% (sample A) produced significantly larger live-weights than at 0 % (Control) or 50% (diet B) level. Concerning the dressisng losses, the roasted dressing percentage was higher in both male and female rabbits fed 25% level (Table 2). The differences in the percentage of evisceration losses between rabbits were not statistically significant ($P > 0.05$). Abdominal fat deposits were higher ($P < 0.05$) in the male and female rabbits fed 25% level. This gives an insight to the possibility of excessive fat deposition in these rabbits at a particular level of inclusion of *Gliricidia sepium*, and is in fact a general problem facing the broiler industry (Panda and Singh, 1990). However, such hypothesis may not hold should the fat deposition change with age or weight of these animals when bred beyond 10 weeks in order to get a slightly less tender meat. This is a common practice in most African countries (Awonorin and Ayoade, 1992), but our results are comparable to those obtained in a previous study on rabbits fed three levels of alfalfa meal (Holmes *et al.,* 1984). Moisture, protein and fat contents were also of the same order of magnitude as those reported on fryer and senior rabbits (Coppings and Godwin, 1990.)

The expressible moisture index (EMI) values shown in Table 3 are reflections of the water-holding capacity (WHC) of the uncooked intact meat. High EMI values indicate inability of muscle to retain its aqueous content. Hence, both the male and female rabbits fed either 25 or 50% level of *Gliricidia sepium* diet may be expected to have enhanced water retention during handling, storage and heat processing in comparison to the Control. Also there was no significant variation of EMI data between sexes in all groups (Tabel 3.). The mean protein, fat, and ash contents of the fresh carcasses were 21.4,3.6 and 3.1%, respectively, on wet weight basis, and are typical of most broiler rabbit carcasses (Holmes *et al.,* 1984; Coppings and Godwin, 1990). The pH of the raw meat was essentially the same for all the carcasses (pH 5.61 to 5.68, SE = 0.01).

In Table 4, data are presented on chilled water up-take, cooking losses and yield, expressible moisture index (EMI) and, pH of both the freshly roasted samples and the samples which were frozen for 8 weeks at -18^{0}c prior to roasting. The water up-take during 30 min of washing and chilling of carcasses prior to frozen storage was approximately 4% of the eviscerated weight of each carcass regardless of diet or sex.

The average values of EMI were higher in the two roasts (Table 4) than the raw meat (0.42, SE=0.01) as presented in Table 3. The frozen storage data on the index (0.57, SE=0.01) was also higher than that obtained from fresh roasts (0.48, SE=0.01). Since an increase in EMI would suggest a general decrease in water-holding capacity (WHC) of the muscles, therefore, the WHC of the rabbit meat decreased during 8 weeks of cold storage. This could be as a result of the expansion of freezing water in the muscles, thus causing structural damage to the meat fibres (Awonorin and Ayoade, 1992). However, this may depend on temperature stability during storage, but in the experiment reported here, the freezer temperature was stable throughout the 8 weeks of frozen storage. One distinctive observation on the data (Table 4), however, is that the EMI values are higher in the female rabbits at all dietary levels when compared with meat from the males. Apart from the fact that the initial moisture and fat contents of the females were slightly higher than the males, the final moisture contents of meat from the females after roasting were lower by about 0.5 to 3 % for the two roasts (Table 4). In addition, and as mentioned earlier on the effect of frozen storage, the moisture remaining in all the samples were also lower in the frozen roasts.

The pH of the meat roasts increased slightly from an average of 5.64 in the raw samples to 5.73, and 6.21 in the fresh and frozen roasts, respectively. This trend is in line with the findings of other researchers on meat roasts (Awonorin and Ayoade, 1992; Paul *et al.* 1966), and such increase may be attributed to the loss of free acidic groups by the formation of new stable cross linkages as explained elsewhere (Hamm and Deatherage, 1960). However, the pH values (Table 4) are still close to the isoelectric point of cooked meat proteins (Hamm and Deatherage, 1960).

The effect of heat processing of frozen meat samples on cooking losses and yield are also shown in Table 4. The proportions of the drippings, volatile and total cooking losses, as expected, were higher in the frozen roasts than fresh roasts. Hence, the cook yield of the frozen roasts decreased by about 9% of the fresh roasts (Table 4). Additionally, the drippings were higher in the female carcasses than the males by about 2 to 37% in the fresh roasts or 5 to 40% in the frozen roasts. The total cooking losses when compared between sexes and among diet groups remained practically the same (Table 4). Therefore, cooking losses were not significantly affected by the level of *Gliricidia sepium* in the rabbit diet *per se*, but were rather influenced by cold storage and thermal processing. Furthermore, excessive fluid losses can lead to increased nutrient losses, particularly, the water soluble vitamins, and could also cause flavour changes (Khan and Lentz, 1977; Awonorin and Ayoade, 1993). However, the cooking losses of fresh roasts obtained from this investigation are of the same order of magnitude as those reported for fresh rabbit roasts (Holmes *et al.*, 1984).

The protein content of the roasts increased from an average of 21.5% in the raw sample to 26.3 and 31.4% in the fresh and frozen roasts, respectively (Table 4). The fat content also increased slightly from 3.6% (Table 3) to 3.8 and 4.9% in the two roasts, respectively (Table 4). These increases might have been influenced by moisture loss in the fresh (7%) and frozen (16%) roasts (Table 4). The ash content remained practically the same in all samples.

The sensory evaluation results are presented in Table 5. Panelists found no significant difference ($P>0.05$) in juiciness, colour, and degree of doneness among the fresh or refrigerated roasts regardless of rabbit sex. Also no significant flavour differences ($P>0.05$) were noted among the fresh roasts, and in fact tenderness scores improved in the male and female groups of rabbits fed 25% *Gliricidia sepium* (diet A) when compared with any of the fresh roasts (Table 5). Incidentally, rabbits fed diet A also had the highest fat content in the two types of roasts (Table 4). Thus, the fat would be expected to interact with other nutrients during heat processing, and enhance flavour and overall acceptability of the roasts. However, such interaction may influence objectionable flavour changes in frozen meat during cold storage (Igene *et al.*, 1979). In addition, the major differences in sensory scores of the fresh roasts without considering the overall acceptability were due to tenderness scores (Table 5) which could be a cultureal factor as reported by Awonorin and Ayoade (1992). Hence, the fresh meat roasts from rabbits fed diet A which had the highest overall acceptability and tenderness scores of 7.1 (Table 5) were most acceptable. However, with regard to meat roasts from the frozen samples, no significant differences ($P>0.05$) were found based on colour and degree of doneness as observed for the fresh roasts (Table 5). In fact, both attribute are complimentary because colour development is important in assessing doneness - rare, medium, well done.

Juiciness scores (5.4 to 5.9) were lower in the frozen raosts when compared with fresh roasts (6.3 to 6.7). Also among the frozen roasts, no significant difference ($P>0.05$) was found, however, the female rabbit from diet B group received significantly lower ($P<0.05$) score of 5.1 (Table 5) for juiciness. In fact the mean scores for tenderness and flavour of the frozen roasts almost segregated the meat roasts into the three distinct dietary groups numerically (Table

5). But finally the overall acceptability scores for the frozen roasts did not differ (P>0.05) regardless of diet or sex, and the scores diminished slightly when compared with those of the fresh roasts.

In conclusion, it would appear from our results that if *Gliricidia sepium* leaves must be included in the rabbit diet as an economical source of protein, it is recommended at about 25% level (diet A) from the stand-point of the marginal increase in carcass and cooked yields, water-holding capacity, and palatability.

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Table 1: COMPOSITION OF EXPERIMENTAL DIETS FED TO RABBITS.

Ingredients/Chemical Composition	Experimental diets		
	Control	A	B
Ingredients:			
Gliricidia sepium leaves (%)	0.0	25.0	50.0
Maize (%)	51.0	37.0	28.0
Soybean (%)	15.0	8.5	13.0
Brewer's dried grains (%)	29.3	24.8	4.3
Bone meal (%)	4.0	4.0	4.0
Salt (%)	0.2	0.2	0.2
Vitamin/Mineral Premix[1] (%)	0.5	0.5	0.5
Total	100.00	100.00	100.00
Chemical composition:			
Moisture (%)	5.0	4.0	7.0
Crude Protein[2]	17.5	17.5	17.5
Crude fibre[2] (%)	9.8	11.6	12.5
Ash [2] (%)	4.0	5.5	5.0
Ether extract (%)	7.0	7.0	7.5
Nitrogen-free-extract (%)	56.7	53.9	53.5
Calcium(%)	1.08	1.08	1.08
Phosphorous (%)	0.52	0.52	0.52
Metabolisable energy[3], kcal/kg	3769	3667	3701

[1] Vitamin - mineral premix, ADVIT SUPER, Spain, contained the following per kg of diet: vitamin A, 10000 IU; D3' 2000 IU; B_1, 0.75 mg; B2, 5 mg; Nicotinic acid, 25 mg; Calcium - pantothenate, 12.5mg; B_{12}, 0.015mg; K_3, 2.5mg; E, 25 mg; Biotin, 0.05mg; Folic acid, 1.0mg; Choline Chloride, 250mg; Cobalt, 0.4 mg; Copper, 8 mg; Iron, 32 mg; Iodine, 0.8 mg; Manganese, 64 mg; Zinc, 40mg.

[2] Based on dry matter content.

[3] Calculated using the modified formula of Carpenter and Clegg (1956), where: ME (kcal/kg) = 53 + 38 (%CP + 2.2 x % EE + 1.1 x % NFE + 0.22 x % CF) and assuming that rabbits are able to utilize 22% of dietary fibre.

Table2: PROCESSING DATA FOR RABBITS FED DIFFERENT LEVELS OF GLIRICIDIA SEPIUM DIET.

Processing traits	Levels of Gliricidia sepium (%)						
	0, Control		25		50		
	Male	Female	Male	Female	Male	Female	SE++
Liveweight (LW), kg	1.62^a	1.74^a	1.90^b	1.72^a	1.65^a	1.60^a	0.2
Roasted dressing weight, g/kg LW	718.1a	710.4a	785.0^b	756.7c	720.0^a	718.3^a	4.3
Skinned dressing weight+, g/kg Lw	572.5	574.2	580.3	58.1.1	580.3	578.3	0.2
Evisceration loss, g/kg LW	101.4	103.2	101.1	99.6	100.4	101.2	0.2
Abdominal fat, g/kg LW	20.4a	21.6a	23.5b	23.7b	20.4a	20.4a	0.3
Blood, g/kg LW	33.9^a	46.2b	42.6c	39.1d	41.4d	42.7c	0.7
Head, g/kg LW	112.8	113.2	111.4	111.6	112.5	113.0	0.1
Liver and heart, g/kg LW	11.4b	17.5a	19.0a	18.5a	17.2a	18.4a	0.5

+ Without head, skin and feet. ++ Standard error of mean values.

Values, within the same row of any of the processing traits, with different lower case characters are significantly different ($P<0.05$).

Table 3: EXPRESSIBLE MOISTURE INDEX, PH AND PROXIMATE COMPOSITION OF RAW MEAT FROM RABBITS FED DIFFERENT LEVELS OF GLIRICIDIA SEPIUM DIET.

	Levels of Gliricidia sepium (%)						
	0,Control		25		50		SE++
	Male	Female	Male	Female	Male	Female	
Expressible moisture index (EMI)	0.49	0.52	0.36	0.37	0.39	0.41	**0.01**
Moisture (%)	72.52	73.45	73.20	73.26	72.91	72.94	**0.76**
Protein+ (%)	21.23	21.21	21.10	21.03	21.90	21.96	**1.13**
Fat+ (%)	3.25	3.43	3.56	3.87	3.50	3.71	**0.36**
Ash+ (%)	3.00	2.97	**3.00**	3.02	3.50	3.36	**0.38**
pH	5.62	5.64	**5.65**	**5.61**	5.68	5.64	0.01

+Wet weight basis ++ Standard error of mean values.

Table 4: HEAT PROCESSING DATA, WATER UP-TAKE, pH AND PROXIMATE COMPOSITION OF ROAST MEAT PREPARED FROM FRESH AND FROZEN THAWED SAMPLES FROM RABBITS FED DIFFERENT LEVELS OF GLIRICIDIA SEPIUM DIET.

Diets	Sex	Expressible moisture index (EMI)	pH	Chilled water up-take (%)	Cooking losses(%) Dripp ings	Evapora tive	Total	Cook yield (%)	Proximate compositon (%) Moisture	Protein [2]	Fat[2]	Ash[2]
					FRESH ROASTES							
Control	M	0.43	5.67	NA	0.63	21.71	22.34	77.66	66.06	26.22	3.85	3.01
	F	0.51	5.88	NA	0.68	20.74	21.42	78.58	64.15	26.14	3.92	2.96
A	M	0.41	5.75	NA	0.57	20.79	21.36	78.64	65.62	25.96	3.96	3.02
	F	0.50	5.75	NA	0.56	21.58	22.14	77.86	65.36	26.62	3.94	3.01
B	M	0.47	5.68	NA	0.39	21.25	21.64	77.36	66.18	26.25	3.65	2.98
	F	0.54	5.66	NA	0.51	22.05	22.56	77.44	64.84	28.44	3.66	3.02
		(±0.01)	(±0.02)		(±0.2)	(±0.4)	(±0.2)	(±0.4)	(±0.3)	(±0.03)	(±0.02)	(±0.01)
					FROZEN ROASTS[3]							
Control	M	0.56	6.21	4.16	1.38	28.10	29.48	70.52	58.94	30.18	4.78	3.03
	F	0.58	6.13	3.97	2.28	27.76	30.14	69.86	58.38	31.22	5.04	2.97
A	M	0.52	6.68	3.88	2.33	26.45	28.78	71.22	57.36	30.61	5.13	3.01
	F	0.56	6.06	3.88	2.46	27.81	30.27	69.73	56.85	31.31	5.04	3.02
B	M	0.59	6.08	4.03	1.81	29.55	31.36	68.64	58.12	31.27	4.16	2.97
	F	0.59	6.12	4.01	2.47	28.97	31.44	68.56	56.41	32.33	4.94	2.98
		(±0.01)	(±0.04)	(±0.02)	(±0.07)	(±0.8)	(±0.04)	(±0.7)	(±0.4)	(±0.4)	(±0.06)	(±0.01)

[1] Calculated from: (Chilled weight - Eviscerated weight/Eviscerated weight.

[2] Wet weight basis.

[3] Frozen-stored samples at - 18^0 c for 8 weeks, thawed at 5^0c for 10 hours, and roasted.

NA = Not applicable; M = Male; and F= Female.

Diets: Control, A and B contained 0, 25 and 50% levels of *Gliricidia sepium* leaves, respectively. Values in parenthesis are the standard errors of mean values.

TABLE 5: PALATABILITY ATTRIBUTES OF FRESH AND FROZEN-THAWED MEAT ROASTS FROM RABBITS FED DIFFERENT LEVELS OF *GLIRICIDIA SEPIUM* DIET.

		Mean Sensory scores					
Diets	Sex	Juiciness	Tenderness	Colour	Flavour	Overall acceptability	Degree of doneness
				FRESH ROASTS			
Control	M	6.6	6.9^{a}	7.3	6.9	6.3c	6.8
	F	6.7	7.0^{a}	7.3	6.7	6.6^{c}	6.8
A	M	6.4	7.1^{a}	7.5	6.8	7.1^{a}	6.8
	F	6.4	7.0^{a}	7.4	7.0	7.1^{a}	6.8
B	M	6.3	6.7^{b}	7.3	6.9	6.3^{c}	7.0
	F	6.6	6.4b	7.4	6.8	5.9^{b}	6.7
		(±0.3)	(±0.05)	(±0.01)	(±0.02)	(±0.08)	(±0.02)
				FROZEN ROASTS[1]			
Control	M	5.4^{a}	7.1^{a}	7.3	6.3	5.6	6.6
	F	5.9^{a}	7.3^{a}	7.1	6.3	5.6	6.6
A	M	5.5^{a}	7.2^{a}	7.1	5.9	5.7	6.8
	F	5.9^{a}	6.8b	7.3	6.0	5.8	6.8
B	M	5.4^{a}	7.1^{a}	7.3	6.3	5.8	6.6
	F	5.1^{b}	6.5^{b}	7.1	6.0	5.8	6.8
		(±0.05)	(±0.05)	(±0.02)	(±0.03)	(±0.02)	(±0.02)

[1]Frozen-stored samples at - 18°c for 8 wk, thawed at 5°c for 10 hours, and roasted. M = Male; F = Female.

Values in parenthesis are the standard errors of mean values.

Values, within the same column of the same attribute, with different lower case characters are significantly different ($P < 0.05$) for each roast.