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Carcass Traits and Organoleptic Properties of Weaner Rabbits (*Oryctolagus cuniculus*) Fed Cooked Rubber Seed Meal-based Diets

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Abstract: The carcass traits and organoleptic properties of meat obtained from crossbred weaner rabbits fed cooked rubber seed meal (CRSM)-based diets were investigated. The rabbits were reared in hutches placed under mature rubber plantation. A total of 72, 8-week old weaner rabbits were randomly allotted, two per cell of 6-celled rabbit hutch, with 6 replicates per diet or treatment in a completely randomized design to 6 CRSM-based diets containing 16% dietary protein. The CRSM was included at 10, 20, 30, 40, and 50% levels in diets 2, 3, 4, 5 and 6 respectively. Diet 1 without CRSM (0%) served as the control. Feed and water were served ad libitum for 10 weeks. The carcass weights of rabbits fed up to 10% CRSM-based diets were similar and significantly higher than that of rabbits on 20% CRSM-based diet (740.30 g) which in turn was higher ($p < 0.05$) than what obtained for those fed 30-50% CRSM-based diets. Other carcass traits varied significantly. The weight of bled and de-furred rabbits (92.77-94.54%), carcass (56.98-60.78%), fore limb (9.72-10.69%), lung (0.66-0.79%), kidney (0.62-0.75%) and the heart (0.26-0.29%) expressed as percentage of live weight were similar ($p > 0.05$) across board. Feeding beyond 30% CRSM-based diets had significant effects on the cooked meat's juiciness, chewiness and texture. The inclusion of CRSM in rabbit diets had no detrimental effect on the proportion of carcass, limbs and internal organ weights. Meats from rabbits fed CRSM-based diets were well accepted by sensory evaluators but the taste, flavor, juiciness and acceptability decrease with increasing levels of CRSM in the diet.

Key words: Rubber seed, rabbit, organoleptic properties, carcass trait.

1. Introduction

Rubber seed is the round brownish and hard substance that is released when the mature and dried rubber fruit capsule dehisce by explosive mechanism usually as from late August to October of the year. Rubber seed is cheap and available at a lower cost as it is not consumed or used directly by humans and could substitute the scarce and expensive conventional feed ingredients like soybean meal and groundnut cake in livestock diets especially rabbits, thereby reducing the cost of production and the cost of the meat produced. Rubber seed meal had been used to substitute coconut meal in broilers rations up to the level of 20% [1]. Various researches have used rubber seed meal to feed different classes of livestock like pullet and laying hens [1], scavenging chickens [2], finishing pigs [3], sheep [4], and goats [5]. There is paucity of information on the nutritive value of Cooked Rubber Seed Meal (CRSM) in rabbits and the effect of CRSM on the carcass traits and organoleptic properties of rabbits' meat. The objectives of this study were to assess the carcass traits and organoleptic properties of meats from rabbits fed CRSM-based diets.

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2. Materials and Methods

2.1 Procurement and Processing of Rubber Seeds

Rubber seeds were collected from rubber plantation of Rubber Research Institute of Nigeria (RRIN), Iyanomo, Benin City and sun dried for 5 days before being boiled in water at 100 °C for 15 min. After boiling the seeds were allowed to cool before milling to get the CRSM that was used in this study. The CRSM contained 22.9%, CP; 18.6%, EE; 4.1%, ash; 3.4%, CF and 39.6% NFE [6].

2.2 Experimental Design, Feed Formulation and Rabbit Management

A total of 72, 8-week old crossbred (Chinchilla x New Zealand White) weaner rabbits bred at the Rabbitry unit of Rubber Research Institute of Nigeria, Benin City, Nigeria were randomly allotted, 2 per cell of 6-celled rabbit hutch, with 6 replicates per diet or treatment in a completely randomized design to 6 CRSM-based diets containing 16% dietary protein. The CRSM was included at 10, 20, 30, 40, and 50% levels in diets 2, 3, 4, 5 and 6 respectively as replacement for other feed ingredients (corn, full fat soybean, palm kernel cake and wheat offal). Diet 1 without CRSM (0%) served as the control as shown in Table 1. Prior to the commencement of the feeding trial, the rabbits were administered oral prophylactic dose of antibiotics against gram-positive and gram-negative bacteria. They were also given 0.25 mL of injectable Ivomec® sub-cutaneously to prevent internal and external worms. Other rabbit management practices were observed, feed and water were served ad libitum for 10 weeks and data were collected on the live body weights of the rabbits. The composition of experimental diet is as shown in Table 1 below.

2.3 Determination of Carcass Traits

At the end of the study, six rabbits per diet or treatment were randomly selected, starved overnight to clear the gut, weighed, stunned and slaughtered or ensanguinated by severing the jugular vein. The carcasses were eviscerated by removing the visceral (internal organs) and other gut contents. The dressed body weight (carcass) and internal organs were weighed and expressed as percentage of the live weight [7].

Table 1 Composition of the experimental diets (%).

Diets/treatments	1	2	3	4	5	6
Feed ingredients (%)						
Corn	25.00	9.00	1.00	1.00	1.00	0.00
Full fat soya meal	8.50	3.50	1.00	1.00	1.00	0.00
Palm kernel cake	25.50	26.50	23.00	18.00	3.00	1.00
Wheat offal	20.00	26.00	30.90	18.90	24.00	14.80
Rice bran	17.00	21.00	20.00	27.00	26.90	30.00
CRSM	**-**	**10**	**20**	**30**	**40**	**50**
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00	1.00
Grower premix*	0.30	0.30	0.30	0.30	0.30	0.30
Table salt	0.50	0.50	0.50	0.50	0.50	0.50
L-Lysine	0.10	0.10	0.20	0.20	0.20	0.20
DL-Methionine	0.10	0.10	0.10	0.10	0.10	0.20
Total	**100**	**100**	**100**	**100**	**100**	**100**
Crude protein (%)	16.10	16.08	16.32	16.23	16.39	16.32
ME (kcal/kg)	2,503	2,509	2,584	2,890	3,101	3,125

ME = metabolizable energy.

*Supplied per kg diet: Vit. A, 8×10^6; Vit. D3, 1.2×10^6 I.U; Vit. E, 7×10^3 mg; Vit. K3, 1.5×10^3 mg; Vit. B1, 2,000 mg; Vit. B2, 2.5 mg; Niacin, 15 g; Pantothenic acid, 5.5 g; Vit. B6, 2 g; Vit. B12, 10 mg; Folic acid, 500 mg; Biotin H2, 500 mg; Choline chloride, 175 g; Cobalt, 200 mg; Copper, 3 g; Iodine, 1 g; Iron, 21 g; Manganese, 40 g; Selenium, 200 mg; Zinc, 31 g; Anti-oxidant, 1.25 g.

2.4 Determination of Organoleptic Properties

Meat from the thigh or hind limb of the carcass was cut into bite sizes, cooked at 100 °C for 20 minutes and subjected to organoleptic evaluation by 20 trained panelists using a seven point hedonic scale to score the appearance, taste, aroma, juiciness, chewiness, and overall acceptability as used by Vasanthakumar et al. [8]. Data obtained were subjected to statistical analysis of variance (ANOVA) using the procedure of GENSTAT [9] and the means were separated by Duncan option of the software.

3. Results and Discussion

The carcass traits of rabbits fed CRSM-based diets are shown in Table 2. The body live weights of rabbits fed up to 20% CRSM-based diets at the end of the study were similar and significantly ($p < 0.05$) higher than those fed beyond 20% CRSM-based diets. The carcass weights of rabbits fed up to 10% CRSM-based diets were similar and significantly higher than that of rabbits on 20% CRSM-based diet (740.30 g) which in turn was higher ($p < 0.05$) than what obtained for those fed 30-50% CRSM-based diets (601.50-621.00 g). The proportion of the hind limbs was similar except for rabbits fed 50% CRSM-based diet that was significantly lower (15.98%). The weights of bled and de-furred rabbits (92.77-94.54%), carcass (56.98-60.78%), fore limb (9.72-10.69%), lung (0.66-0.79%), kidney (0.62-0.75%) and the heart (0.26-0.29%) expressed as percentage of live weight were similar ($p > 0.05$) across board. Values obtained for carcass weight and hind limbs, heart, liver, and the lung expressed as percentage of live weight were within the range of values reported by Akinnusi and Alade [10] for rabbits raised on two different housing systems. Values obtained for body weight and weights of carcass, liver, lung, heart, and kidney were also within the range of value reported [11] for weaner rabbits fed graded levels of *Moringa oleifera* leaf meal.

The organoleptic properties of rabbit meat from rabbits fed CRSM-based diets are shown in Table 3. Feeding rabbits beyond 20% CRSM-based diets caused a significant reduction on the aroma or flavor of cooked rabbit meat. The reduction in flavor might be attributed to the impact of CRSM oil or flavor on the rabbit meat that changes the flavor from that on control diet.

Feeding beyond 30% cooked rubber-based diets had significant effects on the cooked meat's juiciness, chewiness and texture. The taste panel rating revealed that the overall acceptability of meat from rabbits fed

Table 2 Carcass traits of rabbits fed CRSM-based diets.

Treatments	1	2	3	4	5	6	
Levels of CRSM (%)	0	10	20	30	40	50	SEM
Parameters							
Final body weight/rabbit (g)	1463^{a}	1361^{a}	1216^{a}	1069^{b}	1047^{b}	1056^{b}	25.20
Bled & defurred wt. (%)	93.44	94.54	93.05	94.48	93.15	92.77	0.94
Carcass (g)	882.50^{a}	823.00^{a}	740.30^{b}	621.00^{c}	609.50^{c}	601.50^{c}	24.50
Carcass (%)	60.37	60.50	60.78	58.06	58.24	56.98	1.34
Hind limb (%)	19.21^{a}	17.32^{ab}	19.23^{a}	17.39^{ab}	17.49^{ab}	15.98^{b}	0.72
Fore limb (%)	9.99	9.72	10.65	10.69	10.09	10.23	0.51
Head (%)	9.67^{b}	10.54^{ab}	10.86^{a}	11.19^{a}	11.24^{a}	10.98^{a}	0.35
Liver (%)	2.80^{a}	2.65^{ab}	2.55^{bc}	2.37^{c}	2.33^{c}	2.40^{c}	0.08
Lung (%)	0.74	0.79	0.66	0.67	0.67	0.67	0.07
Kidney (%)	0.75	0.66	0.63	0.62	0.66	0.75	0.04
Heart (%)	0.28	0.26	0.28	0.29	0.29	0.26	0.02

^{abcd}* Mean values along the same row with different superscript(s) are significantly ($p < 0.05$) different.

Table 3 Organoleptic properties of rabbit meat from rabbits fed CRSM-based diets.

Treatments	1	2	3	4	5	6	
CRSM levels (%)	0	10	20	30	40	50	SEM
Parameters							
Appearance/colour	6.57[a]	6.57[a]	6.29[b]	6.29[b]	6.43[a]	5.00[c]	0.48
Taste	6.29[b]	6.57[a]	6.14[b]	5.71[c]	6.14[b]	5.86[bc]	0.43
Aroma/flavor	6.43[a]	6.57[a]	6.43[a]	5.71[b]	5.86[b]	5.57[b]	0.61
Juiciness	6.29[a]	6.00[a]	6.14[b]	5.71[b]	5.57[c]	5.57[c]	0.63
Chewiness	6.29[b]	5.71[c]	5.86[c]	6.14[b]	6.71[a]	6.86[a]	0.78
Texture	6.14[b]	5.86[c]	6.14[b]	6.00[b]	6.57[a]	6.71[a]	075
Acceptability	6.43[a]	6.43[a]	6.29[b]	5.86[c]	5.71[c]	5.57[d]	0.61

[abcd]* Mean values along the same row with different superscript(s) are significantly ($p < 0.05$) different.

CRSM based-diets was similar for those fed diets with 0-10% CRSM based-diet but significantly ($p < 0.05$) decreased with increasing dietary levels of CRSM from 20 to 50% CRSM-based diets (5.57-6.29). Since a 7-point hedonic scale was used and the mean scores were greater than the threshold value of 4, there is an indication that the rabbit meat was of good quality. The meats were generally accepted by member of the taste panel having rated it with 5.57-6.43 points.

4. Conclusions

CRSM in rabbit diets has no detrimental effect on the proportion of carcass, limbs and internal organ weights. Meats from rabbits fed CRSM-based diets are well accepted by sensory evaluators but the taste, flavor, juiciness and acceptability decrease with increasing levels of CRSM in the diet.

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