Faculty of Agriculture, Ibrahim BadamasiBabangida University, Lapai 2018
Lapai International Journal of Agriculture Vol. 1(1) June 2018 pp 140- 150

HEAMATOLOGICAL AND SERUM BIOCHEMICAL PROFILE OF WEANER RABBITS FED GRADED LEVELS OF SESAME SEED CAKE DIETS

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ABSTRACT

In a feeding experiment, 45 weaner rabbits (*Oryctolagus cuniculus*) of mixed breeds with an average weight of 722-750g were used to evaluate the inclusion of different dietary levels of sesame seed cake diets on haematology and blood chemistry profile of weaner rabbits. The rabbits were randomly assigned to the dietary treatments in a completely randomized design with nine rabbits per treatment at three rabbits per replicate and fed with diets containing 0, 25, 50, 75 and 100 % sesame seed cake in diets designated as T1 (control), T2, T3, T4 and T5, respectively. At the end of the feeding trial (8 weeks), blood samples were collected from the marginal ear vein of three rabbits selected from each treatment, one from each replicate for haematological' and biochemical analysis. Proximate analysis of the sesame seed cake on dry matter basis indicated that it contained 4.80 % moisture, 25.50 % crude protein 29.33 % ether extract 4.50 % crude fibre 5.25 % ash and30.62 % nitrogen free extract. There were no significant ($P>0.05$) effect on haemoglobin, Packed Cell Volume (PCV), Red Blood Cell count (RBC), White Blood Cell count (WBC) between treatment groups except for neutrophil, lymphocyte and eosinophil that showed significant ($p<0.05$) differences between treatments. There were no significant ($P>0.05$) differences for blood glucose globulin, cholesterol, creatinine, albumin, total protein urea, bicarbonates, potassium and chlorine but there was significant $P<0.05$) differences in the sodium values among treatments. This study revealed that sesame seed cake is rich in protein and could be used to partially or totally replace groundnut cake as protein source in rabbit diet without any adverse effect on the serum biochemical and haematological indices.

Keyword: Rabbits, haematology, blood serum, Sesame, diet

INTRODUCTION

The insufficient supply of animal source of protein from the principal livestock species (cattle, sheep, goats, pigs and poultry) has made it of the utmost importance that attention needed to be shifted to other micro-livestock. Hence Rabbit, because of its high fecundity, fast growth rate and the ability to utilize forages and turn out low cost of high quality proteins.

The daily rate of gain of rabbits is high in proportion to the body weight and this gives them a fast growth rate, and early sexual maturity. These factors result in rabbits reaching sexual maturity weight 30 % faster than other animals (Ajayi *et al*., 2005) and this can therefore make rabbits suitable as meat producing small livestock in developing countries (Arijeniwa *et al*., 2000). In spite of all these advantages, rabbit production has not achieved its potential as cheap animal protein source in developing countries as a result of poor quality and high cost of feed.

Usage of other alternative feed source is fast gaining popularity in Nigeria and many other developing countries. One of such feed is sesame seed which is rich in protein, carbohydrate fibre and some minerals and has amino acid profile with good nutritional value similar to soybean (Omar *et al*., 2002).The nutritive value of sesame seed can also be comparable with that of groundnut cake if the anti-nutritional factors are reduced or eliminated by heat treatment.

Sesame *(Sesamum indicum L*.), also known as benniseed, belongs to the family *Pedaliaceae*, and is reputed to be one of the most ancient oil seeds crop known since historic times and plays an important role in human nutrition. The high nutritional content of sesame seed cake meal makes it a potential source of livestock feed as it contain relatively good source of crude protein, (Omar *et al*., 2002).

Blood parameters are an essential and reliable medium that can be used to monitor and improve health and nutritional status of animals (Gupta *et al*., 2007).The haematological and biochemical indices are an indication and reflection of the effects of dietary treatment on the animals. Blood parameters are therefore essential in the assessment of the quality and suitability of feed ingredients in farm animals (Maxwell *et al*., 1990). Studies carried out on inclusion of up to 12% sesame seed meal in to the diets of growing rabbits has no adverse effect on haematological parameters, serum biochemical indices and carcass characteristics of growing rabbits (Njidda *et al*., 2011). Also in a similar studies carried out on inclusion of sesame seed cake in rations has been reported to have positive effects on calves' performance (Omar *et al*., 2002).

MATERIALS AND METHODS

Experimental Site and Location

The experiment was conducted at the Rabbitry unit of the Livestock Farm of Niger State College of Agriculture, Mokwa. Mokwa is located on latitude 9^{o} 17'14-35^{0} N and longitude 5^{o}13'14-83^{0}E, (Usman, 1998)

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Source of Feed Ingredients and

Preparation
White variety of sesame seed was obtained from Mokwa central market in Mokwa Local Government Area of Niger state Nigeria. Other ingredients used for formulating the experimental diets which include groundnut cake, fish meal, maize, groundnut haulms, maize bran, rice offal, bone meal, salt and vitamin premix, were obtained from the same market. The experimental animals were sourced from the Rabbit Multiplication Centre, Ministry of Livestock and Fisheries Resources, Bosso, Minna, Niger State.

Processing of Sesame Seed
Seeds were thoroughly cleaned to remove extraneous materials like pebbles and dead leaves. The sesame seeds were roasted using the local coal pot for about 5 minutes until the seed coat can be removed by rolling the seed between the thumb and fore finger; then milled. National Agricultural Extension and Research Liaison Service, (NAERLS, 2010). Oil was pressed out by adding ordinary water to the milled sesame seed and mixed vigorously and thoroughly. The oil floated to the surface from where it was removed by decanting and the process was repeated until negligibleoil was formed. After extracting the oil, the residue was dried in the sun and then milled to obtain the sesame seed cake.

Experimental Design and Experimental Treatments
A complete randomized design was used for the experiment. Forty-five (45) weaner rabbits were randomly allotted to five (5) dietary treatments comprising of three replicates per treatment at three rabbits per replicate The diets were formulated on weight to weight bases to include 0 % sesame seed cake in the control diet while, other diets contain 25 %, 50 %, 75 % and 100 % sesame seed cake, respectively.

Statistical Analysis
The data collected during the experiment were subjected to analysis of variance (ANOVA) the statistical analysis software for windows (SAS 2006). Significant differences ($P<0.05$) among treatment means were determined using Duncan's Multiple Range Test

RESULTS
Proximate analysis and Anti-Nutritional factors of raw and processed sesame seed meal
Proximate analysis and anti-nutritional factor analysis were carried out for both raw and processed sesame seed meal. The proximate compositions of the experimental diets were determined by the AOAC (1990) method (table 1) where feed samples were analyzed for crude protein crude, fibre, ash, ether extract and nitrogen free extract was calculated. Anti-nutritional factor analysis was carried out at the National Cereal Research Institute, Baddegi, Niger state.

Proximate Composition of Raw Sesame Seed and Sesame Seed Cake
The proximate composition of both the raw and the sesame seed cake are shown in table 2.The crude protein was numerically higher in the sesame seed cake (25.50 %) than in the raw

sesame seed (19.86 %).The level of crude protein found in raw sesame seed qualifies it as a good source of protein.

Anti-Nutritional Factors in Raw Sesame Seed and Sesame Seed Cake

Table 3 shows the anti-nutritional contents of both raw sesame seed and sesame seed cake. All the anti-nutritional factors were reduced in the sesame seed cake with an increase in the flavonoid content. Therefore, it is probable that roasting has a significant effect in reducing the oxalate level in sesame seed which will in turn make available the nutrients in sesame seed. Flavonoids possess significant antioxidant capacities that are associated with reducing occurrence of several human diseases and lowering mortality rates (Anderson *et al*., 2001; Djeridane *et al*., 2006).

Table 1: Composition of Experimental Diets

Ingredients	T1	T2	T3	T4	T5
Maize	44.95	44.95	44.95	44.95	44.95
Rice offal	20.00	20.00	20.00	20.00	20.00
Maize bran	10.00	10.00	10.00	10.00	10.00
Groundnut cake	18.00	13.50	9.00	4.50	0.00
Sesame seed cake	0.00	4.50	9.00	13.50	18.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30	0.30
TOTAL	100	100	100	100	100
Calculated nutrient composition					
ME (kcal/kg)	2594.60	2599.60	2604.50	2609.50	2614.40
Crude protein	18.28	18.26	18.01	17.88	17.74
Crude fibre	10.09	10.27	10.21	10.15	10.32

Composition of premix (Bio-mix) supply the following per kg diet: Vitamin A 500,000 I.U. Vitamin D, 800,00IU, Vitamin E, 12,000mg Vitamin K, 5000mg, Biotin 10,000mg, Vitamin B, Biotin 10,000mg, Vitamin B2 200mg, Vitamin B6 15000mg, Niacin, 12,000mg, Pantothenic Acid, 20,000mg, Biotin 10m000mg, Vitamin B12, 30,000mg, Folic Acid, 150,000mg, Chloride, 60,000mg, Manganese 10,000mg, Iron 15,000mg, Zinc 80,000mg Copper 400mg, Iodine 80,000mg Selenium 8,000mg.
*Where T1 = 0 % Sesame seed cake (SSC), T2 = 25 % Sesame seed cake (SSC), T3 = 50 % Sesame seed cake (SSC), T4 = 75 % Sesame seed cake (SSC), T5 = 100 % Sesame seed cake (SSC)

Table 2: Proximate Composition of Raw Sesame Seed, Sesame Seed Cake and Groundnut cake

Parameters (%)	Raw sesame seed	Sesame seed cake	Groundnut cake
Moisture Content	4.80	3.60	_
Crude Protein	19.86	25.50	45.00
Crude Fibre	5.71	4.50	3.81
Ether Extract	51.67	29.33	9.16
Ash	4.22	5.25	5.51
Nitrogen Free Extract	14.94	30.62	_

Source of proximate composition of Groundnut; Aduku, 1993

Table 3. Anti-Nutritional Substances in both Raw Sesame Seed and Sesame Seed Cake

Parameters	Raw sesame seed	Sesame seed cake	% Reduction	% Increase	RSL
Tannin (%)	1.11	0.61	45.05	_	31.20
Phytate (%)	1.67	0.50	70.06	_	23.40
Oxalate (mg/g)	3.53	1.69	52.12	_	0.54
Hydrogen Cyanide (%)	0.012	0.011	8.33	_	0.15
Alkaloid (%)	5.34	1.40	73.78	_	0.80
Saponin (%)	2.52	0.85	66.27	_	7.02
Flavonoid (%)	3.34	5.93	_	43.68	22.00

Recommended Safe Levels (RSL) = Kumar *et al*. (2010)

Table 4 shows the heamatological components of rabbits fed graded level of sesame seed cake diets. From the results there were no significant ($p<0.05$) differences in the PCV, HB, RBC and WBC within treatment groups. There were significant ($p>0.05$) differences in the Nuetrophills, lymphocytes and eosinophills components within treatments groups. Treatment (50% SSC) has the highest value (26.67%) of nuetrophills while treatment (0 % SSC) has the lowest value (14.00% SSC).Treatment (0% SSC) has the highest lymphocyte content (86 %) and the lowest been recorded by treatment (50% SSC) with (72%). Eosinophill content was highest in treatment (25% SSC) having (3.67%) value while it was completely absent in treatment (0%SSC).

Table 4. Heamatological Indices of Rabbits Fed Graded Levels of Sesame Seed Cake Diets

Parameters	T1	T2	T3	T4	T5	SEM	RSL	LS
Pack cell volume (%)	51.00	41.00	33.37	32.67	46.00	1.25	30.0-50.0	NS
Heamoglobin(g/dl)	17.00	13.79	11.20	10.89	15.33	0.73	8.0-17.5	NS
Redblood Cell(10^6mm)	9.58	6.03	8.62	6.33	5.87	2.72	4.0-8.0	NS
WhiteBlood Cell(10^9/l)	14.20	9.87	12.62	9.22	11.42	2.87	5.0-12.0	NS
Neutrophill (%)	14.00^{b}	21.00^{ab}	26.67^{a}	19.00^{ab}	19.67^{ab}	0.84	35.0-55.0	*
Lymphocytes (%)	86^{a} .00	75.67^{ab}	72^{b}.00	80.33^{ab}	79.33^{ab}	0.92	25.0-50.0	*
Eosinophill (%)	0.00^{b}	3.69^{a}	1.33^{ab}	0.67^{ab}	1.00^{ab}	0.48	0.0-5.0	*

^{abc}Means in the same row with different superscripts differ significantly ($p<0.05$)
RSL = Recommended safe levels _ Hillyer (1994)

Biochemical Indices of Rabbits Fed Graded Levels of Sesame Seed Cake

The results of the blood chemistry are presented in Table 5. Only values of Sodium showed significant difference ($P<0.05$) among treatments. The remaining biochemical parameters, Blood Urea, Blood Glucose, Cholesterol, Total Protein, Albumin, Creatinine, Globulin, Bilirubin, Bicarbonate Chloride and Potassium, all showed no significant ($p>0.05$) differences among treatment groups.

Table 5. Biochemical Indices of Rabbits Fed Graded Levels of Sesame Seed Cake

Parameters	T1	T2	T3	T4	T5	SEM	LS
Blood Urea (mmol/l)	8.00	9.23	6.60	9.43	9.37	0.60	NS
Total Protein (g/dl)	5.17	7.40	5.50	5.03	6.83	0.42	NS
Cholesterol (mmol/l)	1.97	2.30	1.30	1.13	1.70	0.41	NS
Blood glucose (mmol/l)	2.57	5.33	4.17	4.30	5.03	0.44	NS
Albumin (g/dl)	3.17	3.53	3.43	3.07	3.23	0.26	NS
Creatinine (mg/dl)	0.99	0.80	0.92	1.29	0.80	0.36	NS
Globulin (g/dl)	2.00	3.80	2.07	1.97	3.60	0.44	NS
Bilirubin (mg/dl)	0.27	0.12	0.22	0.22	0.13	0.16	NS
Bicarbonate (mmol/l)	62.03	47.70	34.93	49.53	46.00	1.37	NS
Potassium (mmol/l)	9.57	9.73	9.10	8.43	10.43	0.44	NS
Sodium (mmol/l)	149.40^{a}	134.67^{ab}	129.93^{b}	141.53^{ab}	139.77^{ab}	1.08	*
Chloride (mmol/l)	96.93	97.03	103.93	100.43	104.20	1.35	NS

^{abc}Means in the same row with different superscripts differ significantly ($p<0.05$)

DISCUSSION

Haematological parameters

The percent PCV value for treatment groups ranges between 32.67 % - 51.00 % in rabbits fed graded levels of sesame seed cake diets with no significant (P>0.05) difference observed within treatment groups. The values fall within the normal range of 30-50 % for growing rabbits reported by Hillyer (1994) and Jenkins (1993). Reduction in the concentration of PCV in the blood usually suggests the presence of a toxic factor (heamagglutinin) which has adverse effect on blood formation (Oyawoye and Ogunkunle, 1998). The PCV values obtained suggests that, the processing method employed was adequate for detoxification of the anti-nutritional factors present in sesame seed.

The values of heamoglobin ranges from 10.89 -17.00 g/dl with treatment 0 % recording the highest heamoglobin content (17.00 g/dl). There were no significant (P>0.05) differences observed within treatment groups. The heamoglobin values falls within the normal range of 8.00-17.00 g/dl reported by Hillyer (1994) and Jenkin (1993). Normal range of heamoglobin indicates that the vital physiological relationship of heamoglobin with oxygen in the transport of gases to and from the tissues of the body has been maintained (Njidda *et al*., 2006).

There were significant (P<0.05) differences in the neutrophil values which range from 14-26.67; the values fell short of the normal values (35-55 %) reported by Hillyer (1994) and Jenkins (1993) for clinically healthy rabbits. There were significant (P<0.05) differences in the lymphocytes values ranging from 72-86 % among treatment groups. The values were higher than the normal range of 25-50 % recommended by Hillyer (1994) and Jenkin (1993). The eosinophil were however within the normal range of 0-5 % reported by Hillyer (1994) and Jenkins (1993). There were no significant (P>0.05) differences among treatment groups in the white blood cell and red blood cell count values. The white blood cell values ranges from 9.22 – 14.20 and the red blood cell values ranges between 5.87 –9.58. A decrease in the number of white blood cell below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism while elevated values (leukocytosis) indicates the existence of a recent infection usually with bacteria (Ahamefule *et al*., 2008).

Blood chemistry

Serum biochemical analysis is used to determine the level of heart attack, liver damage and to evaluate protein quality and amino acid requirements in animals (Harper *et al*., 1999).

The blood urea ranged from 6.60 to 9.43 mmol/l. The values were higher than the range (2.50 to 5.80 mmol/l) reported by Njidda and Isidahomen (2011) when they fed sesame seed meal to rabbit in semi-arid environment. The values however, falls within the range obtained in temperate regions (4.6 to 10.4) reported by Duncan and Prasse (1986). Decreased blood urea may be associated with

severe liver disease or protein malnutrition (Bush, 1991). The albumin values showed no significant difference (P>0.05) among treatments and the values ranges between 3.07-3.53 g/dl which fall within the normal range of 2.5 to 4.0 g/dl reported by Anon (1980). Abnormal serum albumin usually indicates an alteration of normal systematic protein utilization (Apata, 1990) and low dietary protein intake (Onifade and Tewe, 1993).

The globulin values (1.97 to 3.80 g/dl) showed no significant differences (P>0.05) among treatments but falls within the normal range (1.90-3.50) reported by Hillyer (1994) and Jenkins (1993) for growing rabbits.

The total protein values (5.03 to 7.40 g/dl) were within the range (5.40 to 7.50 g/dl) reported by Hillyer (1994) and Jenkins (1993) for growing rabbits and the range (5.81to 6.75 g/dl) reported by Onifade and Tewe (1993) who fed various tropical energy feed resources to growing rabbits. The normal values for albumin, total protein and globulin obtained in this study indicates nutritional adequacy of the dietary proteins for the rabbits.

The values for blood glucose and cholesterol (Table 5) recorded in this study ranged from 2.57 to 5.33mmol/1 and 1.13 to 2.30mmol/l, respectively. The blood glucose (4.2-8.9 mmol/1) was within the range reported by Fudge (1999), Since glucose and cholesterol levels were within the normal range, possibilities of anorexia, diabetes, liver dysfunction and mal-absorption of fat, which are the symptoms of abnormal glucose and cholesterol levels in the blood (Bush, 1991) are ruled out.

The creatinine levels (0.80 to 1.29 mg/l) were below the normal range of 8.1 - 25.0 mg/l and 1.4 - 16.6 mg/l reported by Kronfield and Mediway (1975) for rabbits reared in the temperate climate. The creatinine level obtained for rabbits on 75 % sesame seed cake based diets (1.29 mg/l) is in consonance with the findings of Omole and Sonaiya (1981), and suggest that there was no muscle wasting or catabolism of the muscle tissues, and that the animals were not surviving at the expense of body reserve.

Total bilirubin levels (0.12 to 0.27) mg/dl was below the normal range of 0.43-3.0 mg/dl recorded by Kronfield and Mediway (1975).

The results for sodium showed significant difference (p<0.05) among treatments. The values of sodium and bicarbonates in the blood were generally higher than the values reported by (Ogbuewu *et al.,* 2008) who fed graded levels of neem leaf to weaner rabbits. The chlorine falls within the range of 96.40 to 103.60 mmol/l reported by.(Ogbuewu *et al.,* 2008).

CONCLUSION

The result of the experiment indicates that sesame seed cake is safe and can be included partially or fully as protein source replacement for groundnut cake in the diets of weaner rabbits with no adverse effect on haematological and biochemical indices of growing-rabbits.

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