HAEMATOLOGICAL PROFILE AND BIOCHEMICAL RESPONSE OF WEANER RABBITS FED GRADED LEVELS OF AFRICAN STAR APPLE *CHRYSOPHYLLUM ALBIDUM* SEED MEAL

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Abstract
This study was carried out to determine the haematological profile and serum biochemical indices of rabbits fed graded level of African star apple (Chrysophyllum albidum) seed meal. The study involved forty eight (48) mixed breed weaned rabbits of seven - eight weeks old, with average weight of 186.87±0.03g.The rabbits were allotted into four dietary treatments comprising twelve (12) rabbits per treatment. The dietary treatments were 0%, 5%, 10% and 15% ASASM inclusion levels. The experimental diet contained 15% crude protein and 2488.68 Kcal/Kg metabolizable energy. The feeding trial lasted eight weeks, during which period feed and water were provided ad – libitum. Data generated were subjected to analysis of variance. Results obtained from this study revealed that the haematological profile and serum biochemical indices of rabbits recorded no significant (P > 0.05) differences among dietary treatments except cholesterol, AST and ALT (P <0.05) . The study concludes that inclusion of graded levels of C albidum seed meal up to 15% will not pose any adverse effects on the blood characteristics of rabbits.

KEYWORDS: Weaner rabbits, *C albidum*, haematology, serum biochemistry

Introduction
Feed scarcity has remained a major limitation to livestock production and productivity (Agbede and Aletor, 2003). The high cost of animal feeds precipitated by the ever increasing cost of feed ingredients has resulted in poor nutrition leading to declining productivity of animals in developing nations like Nigeria (Nodu *et al*., 2014). According to Fetuga (1997) there is a disappointing rate and low level of performance in the Nigerian livestock industry, due to high cost of feeds, poor quality feeds and inefficiency in production and distribution in the feed industry. The low level of livestock production has affected adequate protein intake. However, intensive rabbit production and domestication can help bridge the meat supply gap in Nigeria and ensure animal protein adequacy. Increase in meat production can be achieved through proper nutrition, inclusion of feed ingredients at normal or required levels (Etim and Oguike, 2010).

The domestic rabbit (*Oryctolagus cunniculus*) is an important non-ruminant herbivore for meat production. Rabbit meat is a source of healthful food as it is low in cholesterol, but high in protein, 22g/100g (Aduku, and Olukosi 1990). Rabbits can also utilize the available proteins in cellulose rich plants, whereas it is not economical to feed these to chicken and turkeys. Since there is high demand for additional source of food worldwide the exploitation of plants of low economic importance would be a step towards better resource utilization (Telek, and Martin 1983) which is in line with the strategy to achieve sustainable animal production systems by matching them with locally available feed resources (Preston and Sansoucy 1987).

African star apple (*Chrysophyllum albidum)* is a dominant canopy tree of lowland and mixed rainforests, sometimes, riverine (Madubuike and Ogbonnaya, 2003). The plant is propagated by seedlings, wildings and direct sowing. It is a seasonal fruits-bearing tree. The fruit is fleshy and juicy, producing whitish gummy exudates (Adewusi, 1997). It is widely eaten in South Western Nigeria, popular among women and children (Amusa *et al.*, 2003).

The seeds of *C. albidum* are about 1-1.5 x 2 cm, beanlike, shiny when ripe, compressed, with one sharp edge and a star-shaped arrangement in the fruits (Orwa *et al.*, 2009). The seed coat is hard, bony, shiny, and dark brown, and when broken reveal white-colored cotyledons (Amusa *et al.*, 2003).

The physiology of farm animals is affected by several factors, one of which is nutrition (Ajao *et al.*, 2013). Nutritional status of an individual is dependent on dietary intake and effectiveness of metabolic processes. These can be determined by either or combinations of chemical, anthropometric, biochemical or dietary methods (Bamishaiye *et al.,* 2009). Haematology refers to the study of the numbers and morphology of the cellular elements of the blood – erythrocytes, leucocytes, and thrombocytes and the use of these results in the diagnosis and monitoring of disease (Merck Manual, 2012). Haemtological studies are useful in the diagnosis of many diseases as well as investigation of the extent of damage to blood (Onyeyili, *et al.,* 1992; Togun *et al.,* 2007). Haematological parameters are good indicators of the physiological status of animals (Khan and Zafar, 2005). Haematological parameters are those parameters that are related to the blood and blood forming organs (Waugh *et al*., 2001; Bamishaiye *et al*., 2009). Blood act as a pathological reflector of the status of exposed animals to toxicant and other conditions (Olafedehan *et al.,* 2010). As reported by Isaac *et al.* (2013) animals with good blood composition are likely to show good performance.
However, there is no information on the effect of seeds of *C. albidum* on haematology and serum biochemical parameters of rabbits. Therefore, this study was carried out to investigate the effect of feeding graded levels of seeds of *C. albidum* on the haematological and serum biochemical parameters of rabbits.

Materials and Methods
The study was carried out at the rabbitary unit of the Oke-Ogun Polytechnic, Saki. Oyo State, Nigeria.

African Star Apple seeds were collected from primary and secondary schools in Saki, Oyo State, Nigeria. The seeds were sun dried and further broken to obtain the cotyledons. The cotyledons were sun dried and milled for inclusion in diet mixture of growing rabbits.

Experimental Animals and Management
A total of Forty-eight (48) growing rabbits (7 – 8 weeks of age with average weight 186.87 ±0.03g) of mixed sexes were obtained from a reputable farm in Oyo State, Nigeria for the purpose this study. The animals were housed in wooden cages raised from the ground level. Before the animals were brought into the rabbitary, the cages were thoroughly washed and disinfected and allowed to dry. The floor of each cage was covered with wire mesh to allow for the passage of waste materials. Feed and water troughs were provided in each cage, while feed and water were provided *ad – libitum.* The rabbits were caged individually in clearly marked cells. The feeding trial lasted eight weeks.

3.3 EXPERIMENTAL DIET

Four experimental diets were formulated with the inclusion of 0%, 5%, 10% and 15% African Star Apple seed meal (ASASM) as substitute for maize in rabbit diet.

Parameters	0% (ASASM)	5% (ASASM)	10% (ASASM)	15% (ASASM)
Maize	40.00	38.00	36.00	34.00
ASAS	0.00	2.00	4.00	6.00
Maize offal	25.00	25.00	25.00	25.00
Rice offal	18.00	18.00	18.00	18.00
Soybean meal	2.00	2.00	2.00	2.00
Fish meal	1.20	1.20	1.20	1.20
Groundnut cake	10.00	10.00	10.00	10.00
Limestone	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00
Salt	0.20	0.20	0.20	0.20
Premix	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10
Total	100kg	100kg	100kg	100kg

Blood collection:

Blood collection was done at end of the 8th week of feeding trial from six rabbits per treatment. Blood samples were obtained from the prominent ear vein with the aid of a hypodermic needle and syringe. Two blood samples each were collected per rabbit; one set of the blood samples was collected into plastic bottles containing Ethylene Diamine Tetra acetic acid (EDTA) for haematological studies while the other sample was collected into plain sterile bottles for the serum biochemical indices determination. All haematological parameters were determined by conventional laboratory methods of Baker and Silverton (1982); Bitto and Gemade (2001), while serum biochemical indices were determined by methods described by Ochei and Kolhathar (2007).

STATISTICAL ANALYSIS

All data collected were subjected to analysis of variance (ANOVA) technique using statistical analysis software.

Results and Discussion

Table 2: Haematological indices of rabbit fed African Star Apple seed meal.

Parameters	0%ASASM	5%ASASM	10%ASASM	15%ASASM	SEM
PCV (%)	39.00	40.33	40.66	39.33	3.16
Haemoglobin(g/dl)	12.96	13.60	13.60	12.76	1.08
RBC($x10^{12}$/l)	6.33	6.60	6.64	6.44	0.53
WBC($x10^{9}$/l)	5.93	5.86	5.96	5.77	3.25
Platelet ($x10^{9}$/l)	128.33	146.00	125.66	115.00	0.83
Lymphocyte (%)	68.33	67.66	69.33	69.33	0.83
Neutrophils (%)	28.66	28.33	28.33	28.00	2.62
Monocyte (%)	2.00	2.00	1.00	2.00	0.43
Eosinphils (%)	1.00	2.00	1.33	0.66	0.41

KEY: Packed cell volume (PCV), White blood cell (WBC), Red blood cell (RBC), African Star Apple Seed Meal (ASASM).

Table 3: Biochemical indices of rabbit fed African Star Apple Seed Meal.

Parameters	0%ASASM	5%ASASM	10%ASASM	15%ASASM	SEM
Glucose(mg/dl)	78.39	65.33	66.66	64.18	3.87
Cholesterol(mg/dl)	75.23[b]	113.33[a]	70.83[b]	87.59[b]	6.57
AST (IU/L)	51.66[b]	97.90[a]	55.69[b]	43.40[b]	4.47
ALT (IU/L)	41.59[a]	38.23[a]	28.07[b]	30.08[a]	1.58
Total protein (g/l)	7.14	5.93	5.97	5.28	0.5
Albumin (g/l)	3.14	3.42	3.89	3.49	0.6

Key: Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Alkaline Phosphatase (ALP),

Results and discussion

It is well established that changes in haematological and biochemical parameters reflect the physiological status of animal. Packed cell volume (PCV) values obtained in this study were not significantly ($p>0.05$) influenced by dietary treatments. The values (39 – 40.66%) were within the reference range of 33 to 50% reported by MediRabbit (2007). The red blood cell (RBC) range of 6.33 – 6.64x106/mm3 and haemoglobin (Hb) range of 12.76 to 13.60 were within standard range of 4 – 8.6 to 7.9 x 106/mm3 for RBC and 10 - 15g/dl for Hb respectively (RAR, 2009). This result indicates that *C. albidum* seed support red blood cell synthesis. The platelet counts recorded in this study ranged from115 to 146 $x10^9$/L for rabbits fed graded levels of *C. albidum* seed. The values were however lower than the normal range (250.00 – 600.00 $x10^9$/L) for rabbits reported by Medirabbit (2011). The white blood cell (WBC) values obtained in this study which were not significant among treatments were within the normal range of 4.5x 10^9 /l to 11 x 10^9 /l reported (RAR, 2009). The white blood cell differentials namely lymphocytes, neutrophils, monocytes and esonophils were not significantly influenced by dietary treatments.

Biochemical response of rabbits fed *C. albidum* seed was presented in table 3. No significant difference ($p>0.05$) was observed in the values of glucose, total protein and albumin. Values for glucose range from 64.18 to 78.39mg/dl, only animals on control diet falls within the standard range of 75 – 140mg/dl (Medirabbit, 2011) animals placed 5%, 10% and 15% had values below the standard range and this implies hypoglycemia in the rabbits. Values of total protein (5.28 – 7.14g/l) and values of albumin (3.14 – 3.89g/l) were within the standard reference of 5.0 – 7.5g/l and 2.7 – 5.0 g/l respectively (Medirabbit, 2011). This suggests that normal protein metabolism occurred in rabbits, since protein synthesis is related to the amount of protein available in the diet (Iyayi and Tewe, 1998). Cholesterol and Aspartate aminotransferase (AST) followed the same trend with animals placed on 5% having highest values, cholesterol ranged from 70.83 – 113.33 while AST value ranged from 43.40 – 97.90 values for the two parameters falls within the standard range of 10 to 80mg/dl and 10 to 98mg/dl respectively (Medirabbit, 2011). This implies no deleterious influence of ASASM on rabbit biochemical response.

Conclusion and Recommendation

Results obtained in this study have shown that *C. albidum* seed can be included in weaner rabbits' feed without adverse effects on their haematological profile and serum biochemical indices.

References

Adewusi H. A. 1997. The African Star Apple *Chrysophyllum albidum* Indigenous Knowledge from Ibadan, Southwestern Nigeria. *In: Proceedings of a National Workshop on the Potentials of the Satr Apple in Nigeria. (Eds.) Denton OA, Ladipo DO, Adetoro MA, Sarumi MB* pp. 25-33.

Aduku, A. O and Olukosi J. O. 1990. Rabbits Management in the Tropics, *Books Gospel Publication*, Abuja, pp 40.

Agbede, J. O and Aletor, V. A., 2003. Comparative evaluation of weaning food from glycerides and leucaena leaf protein concentrates and some commercial brands in Nigeria. *Journal of Science of Food and Agriculture*, 84: 21 – 34.

Ajao, B. H., Ola, S. I., Adameji, O. V. and Kolawole, R. F. 2013. The relationship of ambient temperature and relative humidity of thermo respiratory function of greater grasscutter. Proc. of the 18th *Annual Conf. of Anim. Sci. Assoc. of Nig*., 92.

Amusa N. A, Ashaye O. A and Oladapo M. O. 2003. Biodeterioration of the African star apple *(Chrysophyllum albidum)* in storage and the effect on its food value. *African Journal of Biotechnology*, 2: 56-59.

Baker, F S and Silverton, R. E., 1982. Introduction to Medical Laboratory Technology, 5th edition, *Butterworth S. C., London*, Pp. 481 – 494.

Bamishaije, E., Muhammad, N. and Bamishaiye, O. 2009. Haematological parameters of albino rats fed on tiger nuts (*Cyperuss esculentus*) tuber oil meat based diet. *The Internet Journal of Nutrition and Wellness*, 10(1): 23-45

Bitto, I. I and Gemade, M., 2001. Preliminary investigations on the effect of pawpaw peel meal on growth, visceral organ and endocrine gland weights, testicular morphometry and haematology of male rabbits. *Global Journal of Pure and Applied Sciences*, 7 (4): 62 – 65.

Etim, N. N. and Oguike, M. A. 2010. Egg production of the domestic fowl (*Gallus gallus*): Implications for food security. *Proc. of the 35th Annual Conf. of the Nig. Soc. for Anim. Prod. (NSAP)*, 660.

Fetuga, B. L., 1997. Animal production in Nigeria and feed supplies. *Nigerian Journal of Animal Production*, 4 (1): 19 – 41.

Isaac, L. J., Abah, G., Akpan, B., & Ekaette, I. U. 2013. *Haematological properties of different breeds and sexes of rabbits* (p.24-27). *Proceedings of the 18th Annual Conference of Animal Science Association of Nigeria.*

Iyayi, E. A and Tewe, O. O., 1998. Serum total protein, urea, creatinine levels as indices in cassava diets for pigs.*Tropical Veterinary*, 8: 11 – 15.

Khan, T. A. and Zafar, F. 2005. Haematological study in response to various doses of estrogen in broiler production. *Int. J. Poult. Sci*., 40(10):748-751.

Madubuike FN, Ogbonnaya O (2003). The Potential Use of White Star Apple seed (*Chrysophyllum albidum*) and Physic Nut (*Jatropha Curcas*) as Feed Ingredients for Rats. *J. Fac. Agric. Vet. Med.* 1: 97-105.

Medirabbit , 2007. www.medirabbit.com/EN/Hematology/blood_chemistry.htm

Medirabbit., 2011. Complete blood count and biochemical reference values in rabbits. Retrieved from www.medirabbit.com

Merck Manual 2012. *Haematologic reference ranges*. Mareck Veterinary Manual. Retrieved from http://www.merckmanuals.com/.

Nodu, M. B., Okpeku, M. and Abezi, A. E., 2014. Haematological characteristics of rabbits fed a mixture of *Alchornea cordifolia*/ Pawpaw leaf meal. *Journal of Agricultural and Veterinary Sciences*, 7 (1): 92 – 96.

Ochei, J and Kolhatkar, A., 2007. Medical Laboratory Science Theory and Practice, 6th edition, *McGraw – Hill Publishing Company Limited, New York, USA*, 1338pp.

Olafedehan, C. O., Obun, A. M., Yusuf, M. K., Adewumi, O. O. Olafedehan, A. O., Awofolaji, A. O. and Adeniji, A. A. 2010. Effects of residual cyanide in processed cassava peel meals on haematological and biochemical indices of growing rabbits. *Proc. of the 35th Annual Conf. of the Nig. Soc. for Anim. Prod., 212.*

Onyeyili, P. A., Egwu, G. O., Jibike, G. I., Pepple, D. J., & Ohaegbulam, J. O. 1992. Seasonal variation in haematological indices in the grey-breasted guinea fowl (*Numida mealagris Gallata pallas*). *Nigerian Journal of Animal Production, 18*(2), 108-110.

Orwa C, Mutua A, Kindt R, Jamnadass R, Anthony S. 2009. Agroforestree Database: A tree reference and selection guide version 4.0. *World Agroforestry Centre, Kenya*.

Preston, T. R and Sansoucy R. 1987. FAO Animal Production and Health Paper , **1987**, 63: 32-41.

Research Animal Resource [RAR]. 2009. Reference values for laboratory animals: Normal haematological values. RAR Websites, RAR, University of Minnesota. Retrieved from http://www.ahc.umn.edu/rar/refvalues.html.

Telek, L and Martin F. W. 1983. Tropical Plants for leaf protein concentrate *Av 1 Pub. U.S.A.* PP 81-116.

Togun, V. A., Oseni, B. S. A., Ogundipe, J. A., Arewa, T. R., Hammed, A. A., Ajonijebu, D. C., Mustapha, F. 2007. Effects of chronic lead administration on the haematological parameters of rabbits – a preliminary study. *Proceedings of the 41st Conferences of the Agricultural Society of Nigeria.* (p. 341)

Waugh, A., Grant, A. W., & Ross, J. S. 2001. Ross and Wilson Anatomy and Physiology in Health and Illness *Churchill Livingston, an imprint of Elsevier Science Limited*. (9th ed., p. 59-71).