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Analysis of Effects of Breed, Sex and Age on some Serum Biochemical Parameters in Rabbits

Chineke[1] C.A; Adeniran F.A; Ologun[1]A.G; Ikeobi[2], C.O.N and Oseni, O.A.

[1]*Department of Animal Production and Health*

Federal University of Technology P.M.B. 704, Akure, Ondo State, Nigeria

[2]*Depertment of Animal Breeding and Genetics. University of Agriculture, Abeokuta, Nigeria.*

Target Audience: Rabbit Farmers; Health Personnel; Animal Scientists

Abstract

The effects of breed, sex and age on serum protein, albumin, globulin and calcium of domestic rabbits were determined. Fifty rabbits, 22 males and 28 females used in the study comprised 24 New Zealand white x New Zealand white (NZW-NZW); 11 New Zealand white x Chinchilla (NZW-CHA), 7 New Zealand white x Dutch-belted (NZW - DBD) and 8 New Zealand white x Croel (NZW-CRL) were aged 42,56,63,77 and 365 days plus. The overall mean serum protein (7.37 ± 2.11gm/100ml); albumin (4.5 ± 1.29gm/100ml);globulin(2.95 ± 1.65/100ml) and calcium (10.89±3.12gm/100ml) were similar to reports in literature. There was no breed difference (P>0.05) in serum biochemical parameters. Sex exerted significant (P<0.05) effect only on albumin where male recorded higher value than female. The serum parameters with respect to age were significantly different (P<0.05). Serum protein and globulin were consistent with age. The rabbits aged between 365days and above had highest mean serum protein, albumin and globulim values. The result obtained in the study suggested that breed was not important source of variation in rabbit serum biochemical parameters. While age was important in serum protein, albumin, globulin values; and sex in albumin. However the study might be useful in rabbit health management.

Keywords: *Rabbits, serum biochemistry, sex, age.*

Description of Problem

The life of all flesh is the blood and its usefulness for atonement for human soul (1); for assessing the health status (2;3); clinical evaluation for surgery (4); physiological/pathological conditions (5,6); diagnostic and prognostic evaluation of various types of disease in animals (7,8,9,10,11,12,13), have been reported. The examination of blood provides the opportunity to clinically investigate the presence of several metabolites and other constituents in the body of animals and it plays a vital role in the physiological, nutritional and pathological status of an organism (14,15,16,). It also helps in distinguishing normal states from state of stress, which can be nutritional, environment of physical (17). Several genetic and non-genetic factors affecting biochemical and hematological parameters in animals have been observed (13,18,19). Schalm *et al* (20) reported that blood pictures of animals might be influenced by certain factors such as nutrition, management, breeds of animals, sex, age and stress factors. Tembleson *et al* (15) identified the various physiological and environmental factors that might affect blood values as age of the animal, estrus cycle, pregnancy/parturition, genetics, method of breeding, breeds of animal, housing, feeding, fasting extreme climatic conditions, stress, exercise, transport, castration and diseases.

A lot of work had been carried out on the blood parameters of various domestics animals and livestock such as poultry (16,21,22,23) pig (15,17) goat (18,24,25), cattle (20,26,27),camel (28), cat (13,29), dog (9,12,19) and sheep (10). But there is dearth of information no the reference haematological and serum biochemical values of rabbit breeds and crosses in warm humid environment. No doubt, rabbit has received little or no attention in different parts of developing nations. This study attempts to investigate the influence of breed, sex and age on serum protein, albumin, globulin and calcium in New Zealand white rabbit and its crosses.

Materials and Methods

Experimental Location and Animals

The experiment was carried out between 1998 and 1999 at the Teaching and Research farm (Rabbit Section) Federal University of Technology, Akure, Nigeria. The fifty rabbits sampled for this work were obtained from a crossbreeding experiment involving 12 does and 6 bucks. The experiment was designed primarily to examine some factors that would influence serum biochemical indices in rabbits. Mating of animals was done early in the morning. The 12 does which comprised 5 New Zealand white, 3 Chinchilla, 2 Dutch belted and 2 Croel were randomly assigned to the 6 New Zealand white bucks for mating. Pregnancy diagnosis by abdominal palpation were carried out 10 days later. Non pregnant does were returned for mating. Sex was recorded at 21 days while weaning was done at 35 days. About 50 rabbits; 24 New Zealand White x New Zealand white (NZW-NZW), 11 New Zealand White x Chinchilla (NZW-CHA); 7 New Zealand White x Dutch-belted (NZW-DBD) and 8 New Zealand White x Croel (NZW-CRL) evolved from the mating procedure.

The 50 rabbits, 22 males and 28 females, weighed between 550 to 2500g were reared for over a year. They were caged, fed *ad libitum* on mash diet of 19% crude protein supplemented with sweet potato *(Ipomea batata)* leaves and Aspillia *(Aspillia africana)*, Clean water was also provided regularly.

The rabbits were monitored regularly for clinical physiological parameters such as rectal temperature, respiratory rate and pulse rate, and also for haematological values. To ensure absence of haemoparasites, internal and external parasites, they were treated with Ivomec injection. Based on physiological data and absence of parasites before and during the investigation, the rabbits were adjudged clinically healthy.

Collection of Blood

Blood samples from the 50 rabbits were collected at various ages namely 42,56,63,77 and 365 days plus as the experiment lasted. The samples were collected before feeding them in the morning with an assistant restraining the animal. About 5ml blood withdrawn form ear vein of each rabbit by means of 5ml sterile needle and syringe was expelled into labeled sterile universal bottles with screw caps. The blood sample were allowed to clot and serum specimens were decanted, centrifuged at 12000 G and sera obtained were stored at -20^0c until analysis was carried out.

Serum Biochemistry

The following serum biochemical constituents were determined: Serum protein, albumin, globulin and calcium. The method described by (29) was employed.

Statistical Analysis

The serum biochemical data obtained were subjected to one way analysis of variance to determine the effects of breed, sex and age on serum protein, globulin, albumen and calcium. Where significant differences existed mean separation was done using Duncan multiple range tests. (30).

Results and Discussion

Serum Biochemical Parameters by Breed.

The serum biochemical values for the various breeds are presented in Table 1. The highest serum protein (18.49 ± 1.77gm/100ml), albumin (5.14 ± 1.47gm/100ml, globulin (3.35±0.21gm/100ml) and calcium (11.78 ± 4.91gm/100ml) levels were recorded for NWZ-

DBD. The NZW breed recorded lowest serum protein (7.02±1.08) and albumin (4.15 ± 0.26) concentrations while least globulin (2.63 ± 0.68) and calcium (9.27 ± 0.47) values were observed for NZW-CHA. The study having over all 7.37 ± 2.11gm/100ml; 4.50 ± 1.29gm/100ml; 2.95 ± 0.72gm/100m and 10.89 ± 2.31gm/100ml serum protein, albumin, globulin and calcium values respectively agreed with values in domestic animals as reported by 21, 20 and 32.

The analysis of variance technique showed that there was no significant difference between the means of each of the four breeds of rabbits (P>0.05). This is contrary to significant breed effect observed between New Zealand white and wild Jack rabbits in a study conducted by (20), where the total plasma protein was lower in wild Jack rabbit than in the laboratory-raised New Zealand white rabbits. The variations could be due to the environmental difference during the experimental period because one was raised in the laboratory while the other was not. Non significant (P>0.05) breed effect on serum protein, albumin, globulin and calcium in this study was similar to reports on dog (12), cat(13) and goat (18). However, the serum protein, albumin, and calcium in rabbits used in this study were higher than figure reported in these studies.

Table 1: Mean and Standard error of means (SEM) for the serum biochemical parameters by rabbit breeds.

Breeds	No	Serum protein	Albumin	Globulin	Calcium
NZW x NZW	24	7.02 ± 1.08	4.15 ± 0.26	2.86 ± 0.71	11.58 ± 1.88
NZW x CHA	11	7.29 ± 0.60	4.66 ± 0.37	2.63 ± 0.68	9.27 ± 0.47
NZW x DBD	7	8.49 ± 1.77	5.141 ± 1.47	3.35 ± 0.21	11.78 ± 4.91
NZW x CRL	8	7.84 ± 1.50	4.26 ± 0.64	3.22 ± 1.28	11.63 ± 1.97

Table 2: Mean and Standard error of means (SEM) for serum biochemical parameters by Rabbit Sex

Sex	No	Serum protein	Albumin	Globulin	Calcium
Male	22	9.19 ± 1.13[a]	5.92 ± 0.51[a]	3.26 ± 070[a]	10.0 ± 1.3[a]
Female	28	14.64 ± 1.14[a]	4.26 ± 0.36[b]	4.36 ± 1.08[a]	9.5 ± 1.32[a]

Means with different superscripts under the same parameter are significantly different (P<0.05).

Serum Biochemical Parameters by Sex

The mean serum parameters by rabbit sex are given in Table 2. The sex effect on serum protein, globulin and calcium was similar. The males were significantly (P<0.05) higher in albumin than females.

Although, the females recorded higher serum protein and globulin values with no significant (P>0.05) difference. In dogs, higher protein, albumin, globulin and calcium values were obtained in female than males (12). This agreed with study carried out on cats (13). Schalm *et al* (20) found no sex effect on rabbits and sheep haematology. In another study sex difference among New Zealand white rabbits was recorded (32).

Serum Biochemical Parameters by Age.

The mean serum parameters by age are shown in Table 3. The significant influence ($P<0.05$) of age on the serum parameters studied was obvious. The mean serum protein increased with age from 4.5± 0.2gm/100ml at 42 days to 9.07 ± 1.8gm/100ml at 356 days and above.

This is similar to Schalm *et al.* (20) who indicated mean total plasma protein to increase from 5.4± 0.6g/dl at 36 to 60 days of age 6.7g/dl in adults. Also globulin concentration increase with age from 1.32 ± 0.49gm/100ml at 42days to 3.88 ± 1.81gm/100ml at 365days and above. The values of albumin and calcium were not consistent with age. They agreed with report on dog (6) that globulin and total protein increased white albumin decreased with age.

Table 3: Mean and standard error of means (SEM)for serum biochemical parameters by rabbit age.

Age(days)	Serum Protein	Albumin	Globulin	Calcium
42	4.50 ± 0.24^{a}	3.18 ± 1.41^{a}	1.23 ± 0.49^{a}	11.50 ± 3.18
56	5.45 ± 0.00^{ab}	4.07 ± 0.80^{a}	1.32 ± 0.08^{a}	14.50 ± 8.8^{a}
63	5.33 ± 0.03^{a}	3.86 ± 0.18^{a}	1.47 ± 0.08^{a}	12.00 ± 7.51
77	5.68 ± 0.08^{ab}	4.19 ± 0.05^{ab}	1.49 ± 0.26^{a}	13.00 ± 0.00^{a}
84	5.95 ± 0.52^{b}	3.76 ± 0.49^{a}	2.38 ± 0.29^{b}	11.00 ± 3.27
91	6.81 ± 0.12^{bc}	3.78 ± 0.19^{a}	2.41 ± 0.22^{b}	12.82 ± 3.00
365 and above	9.07 ± 1.70^{c}	5.22 ± 1.33^{bc}	3.88 ± 1.81^{c}	9.32 ± 2.61^{b}

Means with different superscripts under the same parameter are significantly different ($P<0.05$)

Conclusions and Application

Conclusion

1. Breed was not important source of variation in rabbit biochemical indices. However, serum protein, albumin and globulin values were influenced by age. Albumin was also affected by sex.
2. Other factors such as nutrition, environment and hormones might cause differences in serum biochemical values.
3. The results obtained in the study compared favourably with reports in available literature.

Applications

1. The blood biochemical parameters could be used as reference values to asseses the health status of rabbits at a particular point in time.
2. Serum indices is an indirect measure of protein adequacy through which protein metabolism can be studied by measuring variety of parameters such as serum protein, albumin, globulin and calcium.
3. Serum parameters were important in the maintenance of the proper osmotic pressure between the circulation fluid and the fluid in the tissue spaces; so that exchange of materials between blood and the cells was facilitated, and contribute to the viscosity and maintenance of normal blood pressure and pH. These importance were better obtained in older animals as evidenced in the study.
4. The serum proteins which are most easily obtainable in the animals body are of value in diagnosis, treatment and prognosis of many diseases.

5. Changes in the nutritional status would be more easily reflected in albumin rather than globulin fraction of the blood. A fall in serum albumin concentration would be a relatively late event in protein depletion since there seemed to be a mechanism that tends to protect the total albumin mass when protein supply is low. Albumin is specifically influenced by protein shortage but it is not sensitive enough for early detection of protein malnutrition. Protein - energy malnutrition depressed serum protein and albumin, which could be, uncovered through blood biochemical studies.

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