

## AGE AND SEX EFFECTS ON BLOOD BIOCHEMICAL PROFILE OF LOCAL RABBITS IN SUDAN

**Khalid M. Elamin**

*Department of Animal Breeding; Faculty of Animal Production; University of Gezira-Sudan*

\*Corresponding author: [khalid1130@yahoo.com](mailto:khalid1130@yahoo.com)

This study was conducted to evaluate blood biochemical profile of local rabbits in Sudan. Blood samples from 15 rabbits belonging to three age groups (at 3, 4 and over 5 months of age) were collected at slaughter. Studied traits were protein (g/dl), urea (mg/dl), Creatinine (mg/dl), Cholesterol (mg/dl), Calcium (mg/dl), Magnesium (mg/dl), Phosphorus (mg/dl) and (potassium mmol/l). The Sex affected ( $P < 0.05$ ) protein concentration in rabbits of over 5 months of age (male:  $6.40 \pm 0.85$  and female:  $7.70 \pm 0.26$  g/dL). The age affected ( $P < 0.05$ ) urea and phosphorus concentration at 4 months of age. Age and sex affected ( $P < 0.05$ ) cholesterol and magnesium concentration. Concentration of cholesterol was observed  $90.37 \pm 16.85$ ,  $86.40 \pm 19.94$ ,  $52.60 \pm 12.30$  and  $126.47$ ,  $94.47 \pm 9.81$ ,  $87.73 \pm 3.17$  for male, females at 3, 4 and over 5 months respectively. Concentration of magnesium was  $4.45 \pm 0.42$ ,  $3.87 \pm 0.23$ ,  $2.33 \pm 0.16$  and  $3.37$ ,  $3.02 \pm 0.15$ ,  $2.56 \pm 0.54$  for male, females at 3, 4 and over 5 months respectively. It can be concluded the result might be useful for health and production studies of this breed.

**Keywords:** Calcium, Creatinine, Plasma, Protein, Rabbit, Urea

Blood biochemical parameters could be used to assess the health status of rabbits. The serum indices are an important measure of protein adequacy. The serum proteins which are, easily obtainable in the animal body are of value in diagnosis, treatment and diagnosis of many diseases (Elamin 2011). Local rabbits in Sudan are not fully studied. Chineke et al (2003) concluded that breed was not important source of variation in

rabbit biochemical indices and serum protein (globulin and albumen) values were influenced by age whereas albumen was also affected by sex, other factors such as nutrition, environment and hormones might cause differences in serum biochemical values. Ameen et al (2012) studied changes in serum minerals concentration in rabbits as affected by experimental infection with *Trypanosoma*. Onu and Aja (2011) and Ozung et al (2012) demonstrate that nutritional factors can alter rabbit blood profile. Values of serum protein, albumen, globulin glucose, urea, creatinine and various minerals were studied by many scientists e.g. Champe and Maurice, 1983), Marai et al., (2005) and Iheukwumere et al (2005). Reference of rabbit haematology is available (Van Praag 2004). The objective of this study was to investigate normal blood profile of healthy local rabbits by sex and at various ages (3, 4 and >5 month

## MATERIALS AND METHODS

### Study location

This experiment was conducted within the premises of the Extension and Rural Development Centre, Faculty of Animal Production, University of Gezira in Managil town, Gezira Province. .

### Experimental Animals

This study was conducted using 15 rabbits at different ages (at 3, 4 and over 5 months of age) 5 rabbits from each age group. The animals were housed in metal cages constructed in large rabbit building and each animal was identified by plastic ear tag. Plastic feeders and drinkers were used. Feed and fresh water were given ad libitum. Concentrate diet containing 16% crude protein was used in addition to fresh fodder

being given at frequent intervals. Blood samples were collected aseptically from each rabbit at slaughter, send to laboratory where serum was separated and stored at -20°C until analyzed for the concentrations of total protein, cholesterol, urea, creatinine and trace minerals.

### Traits studied

Traits studied were protein (g/dL), urea (mg/dL), Creatinine (mg/ dL), Cholesterol (mg/dL), Calcium (mg/ dL), Magnesium (mg/dL), Phosphorus (mg/ dL), and (potassium mmol/l).

Total serum protein was determined by the Biuret technique (Sapan et al 1999). The Berthelot method was used to determine blood urea content (Wybenga et al., 1971). The cholesterol and creatinine were determined by the enzymatic colorimetric (Kayamori et al 1999), and Kinetic method (Lustgarten and Wenk 1972) respectively.

Biochemical traits, calcium, phosphorus, magnesium and potassium were analyzed by semi- automated clinical chemistry analyzer Micro-lab 300VilatScientific, Dieren, Vilat Scientific, the Netherlands.

### Statistical analysis

Data set was analyzed by SPSS Version 17 to obtain means, standard errors, and coefficients of variation. Sex and age effects were assessed by GLM model. Means were compared at (p 0.05) level of significance. The mean separation test used was least square test. Phenotypic correlations were obtained.

## RESULTS AND DISCUSSION

Table (1) least square means, standard deviations, minimum, maximum and coefficients of variations of blood traits studied.

Table 1. least square means, standard deviations, minimum, maximum and coefficients of variation of blood traits

Traits	Mean± SE	S.D.	Mini.	Maxi.	C.V.%
Protein g/dl	7.28±0.18	0.67	5.80	8.40	9.20
Urea mg/dl	37.68±2.80	10.49	20.40	59.40	27.84
Creatinine mg/dl	2.16±0.10	0.38	1.69	2.81	17.59
Cholesterol mg/dl	87.29±5.47	20.48	43.90	126.40	23.46
Calcium mg/dl	11.40±0.29	1.08	9.40	12.70	9.47
Magnesium mg/dl	3.28±0.23	0.85	2.15	4.84	25.91
Phosphorus mg/dl	5.50±0.43	1.59	2.83	8.10	28.91
potassium mmol/l	5.85±0.23	0.87	4.20	6.94	14.87

The blood concentration protein average was 7.28±0.18 g/dl which agreed with Van Praag. (2004), Adu et al (2009), and Marai et al (2006) who reported 5-7, 6.63- 7.33, 7.25 respectively but higher than the result reported by Elsiddig (2008) , Ewuola and Egbunike, 2008) and Olayemi and Nottidge, 2007) which reported between. 5.03 and 6.86. It is lower than the results reported by El-Gendy, (1999) in New Zealand White rabbits (8.1g/dL).

Urea blood concentration of the rabbits was 37.68±2.80 mg/dl this is higher than values of Adu et al (2009), Ewuola and Egbunike, 2008) and Olayemi and Nottidge, 2007) .

The average creatinine in this study was 2.16±0.10 mg/dL. This result was in agreement with Van Praag. (2004) (0.5-2.6 mg/dL). This value is higher than the value reported by Adu et al (2009), Ewuola and Egbunike, 2008), Olayemi and Nottidge, 2007) and Marai et al (2006).

Cholesterol value was 87.29±5.47 mg/dL. This is estimate is higher than the results depicted by Adu et al (2009), Van Praag. (2004), and El-Gendy, (1999), this may be due to the effect of age factor.

The average serum level of calcium, magnesium, phosphorus and potassium in this study were 11.40±0.29 mg/dl, 3.28±0.23

mg/dl, and  $5.50 \pm 0.43$  mg/dl and  $5.85 \pm 0.23$  mmol/l respectively.

Table 2. least square means, standard deviation, minimum, maximum and coefficients of variation of blood traits (age and sex effects)

trait	sex	Age (Month)r	Mean± SE	S.D.	Mini.	Maxi.	C.V.%
protein g/dl	Male	3	7.20±0.30	0.66	6.46	7.93	9.17
		4	6.85±0.32	0.71	5.95	7.75	1.03
		Over5	6.40 <sup>*</sup> ±0.32	0.85	5.50	7.30	13.28
	Female	3	7.20±0.37	.0.37	5.92	8.47	5.13
		4	7.83±0.29	0.60	7.10	8.57	7.66
		Over5	7.70±0.29	0.26	6.96	8.44	3.38
urea mg/dl	Male	3	39.57 <sup>ab</sup> ±4.45	4.55	30.54	48.60	11.50
		4	56.35 <sup>a</sup> ±4.80	4.31	45.29	67.41	7.65
		Over5	26.45 <sup>b</sup> ±4.80	8.56	15.39	37.51	32.36
	Female	3	34.70 <sup>ab</sup> ±5.61	.4.52	19.06	50.34	13.02
		4	37.40 <sup>a</sup> ±4.29	3.63	28.37	46.43	9.71
		Over5	32.10 <sup>b</sup> ±4.29	10.21	23.07	41.13	31.81
creatinine mg/dl	Male	3	2.12±0.20	0.43	1.62	2.62	20.28
		4month	1.70±0.21	0.01	1.09	2.30	0.59
		Over5	2.36±0.21	0.05	1.75	2.96	2.12
	Female	3	1.87±0.25	.0.25	1.01	2.73	13.36
		4	2.23±0.19	0.53	1.73	2.72	23.77
		Over5	2.39±0.19	0.32	1.89	2.89	13.39
cholesterol mg/dl	Male	3	90.37 <sup>*a</sup> ±7.14	16.85	73.20	107.53	18.65
		4	86.40 <sup>*ab</sup> ±7.70	19.94	65.38	107.42	23.08
		Over5	52.60 <sup>*b</sup> ±7.70	12.30	31.58	73.62	23.38
	Female	3	126.40 <sup>a</sup> ±9.00	8.60	96.67	156.13	6.80
		4	94.47 <sup>ab</sup> ±6.88	9.81	77.30	111.63	10.38
		Over5	87.73 <sup>b</sup> ±6.88	3.17	70.57	104.90	3.61
calcium mg/dl	Male	3	11.67±0.60	0.57	10.76	12.57	4.88
		4	9.55±0.65	0.21	8.44	10.66	2.20
		Over5	11.75±0.65	1.34	10.64	12.86	11.40
	Female	3	10.30±0.76	.0.45	8.73	11.87	4.32
		4	12.37±0.58	0.32	11.46	13.27	2.59
		Over5	11.53±0.58	0.71	10.63	12.44	6.16
magnesium mg/dl	Male	3	4.45 <sup>*a</sup> ±0.24	0.42	3.97	4.94	9.44
		4	3.87 <sup>*b</sup> ±0.26	0.23	3.28	4.46	5.94
		Over5	2.33 <sup>*c</sup> ±0.26	0.16	1.74	2.92	6.87
	Female	3	3.37 <sup>a</sup> ±0.30	.0.24	2.54	4.21	7.32
		4	3.02 <sup>b</sup> ±0.23	0.15	2.54	3.50	4.97
		Over5	2.56 <sup>c</sup> ±0.23	0.54	2.08	3.05	21.09
Phosphorus mg/dl	Male	3	6.06 <sup>ab</sup> ±0.71	1.18	4.57	7.55	19.47
		4	7.00 <sup>a</sup> ±0.76	1.20	5.17	8.83	17.14
		Over5	5.32 <sup>b</sup> ±0.76	1.22	3.49	7.14	22.93
	Female	3	8.10 <sup>a</sup> ±0.89	.0.75	5.52	10.68	
		4	5.04 <sup>ab</sup> ±0.68	1.02	3.55	6.53	20.24
		Over5	3.67 <sup>b</sup> ±0.68	1.06	2.18	5.17	28.88
potassium mmol/l	Male	3	5.47±0.46	1.16	4.17	6.77	21.21
		4	6.30±0.49	.28	4.71	7.890	4.44
		Over5	5.56±0.49	1.92	3.97	7.14	34.53
	Female	3	5.30±0.57	.0.65	3.05	7.55	12.26
		4	6.41±0.44	.459	5.12	7.71	7.16
		Over5	5.73±0.44	0.61	4.44	7.03	10.65

\*means within different sex are significantly different (p 0.05)

Means within same sex with different letters are significantly different (p 0.05)

The potassium level agreed with Chiericato et al, (2004) who reported 5.13-5.28 mmol/l. Fayez et al (1994) reported that, in NZW rabbits, the average blood calcium, magnesium and potassium were  $0.076 \pm 0.001$ ,  $0.024 \pm 0.001$  and  $0.087 \pm 0.003$  g/l sex significantly affected ( $P = 0.05$ ) protein, cholesterol and magnesium coefficients of variation for the traits were high indicating great variability in these traits.

Table (2) shows least square means, standard deviation, minimum, maximum and coefficients of variation of blood traits. The age affected ( $p = 0.01$ ) urea, cholesterol, magnesium and phosphorus concentration in the blood. Rabbit sera at 4 month of age showed the highest urea content ( $56.35 \pm 4.80$ ,  $37.40 \pm 4.29$  mg/dl in males and females respectively), compared to rabbit of rabbits at over 5 month of age with  $26.45 \pm 4.80$ ,  $32.10 \pm 4.29$  mg/dL of urea concentration in the males and females. The cholesterol, magnesium and phosphorus concentrations in rabbit blood of 4 months-old not was different to animals of other ages. Rabbits at 3 month of age showed the highest Cholesterol level  $90.37 \pm 7.14$  and  $126.40 \pm 9.00$  in males and females compared to rabbits over 5 months-old with  $52.60 \pm 7.70$  and  $87.73 \pm 6.88$  mg/dl of

cholesterol concentration in males and females, respectively. Magnesium serum content was higher in rabbits at 3 months old in both sex ( $4.45 \pm 0.24$  and  $3.37 \pm 0.30$  mg/dL) and lower in rabbits over 5 month of age ( $2.33 \pm 0.26$  and  $2.56 \pm 0.23$  mg/dL). The blood phosphorus content was higher in rabbits at 4 month old in the males ( $7.00 \pm 0.76$  mg/dL) and females of 3 months-old ( $8.10 \pm 0.89$  mg/dl) compared to rabbits of over 5 months-old in both sex ( $5.32 \pm 0.76$  and  $5.04 \pm 0.68$  mg/dL respectively). These were not in agreement with the reported by Olayemi and Nottidge (2007) and Nottidge et al (1999) who noticed no significance differences in New Zealand White and Nigerian Local cats.

The sex affected ( $P = 0.05$ ) protein and cholesterol concentrations in blood. The protein concentrations was lower in males of over 5 months-old ( $6.40 \pm 0.32$  mg/dL) compared to females of same age ( $7.70 \pm 0.29$  mg/dL) and this result agreed with Cetin et al. (2009) Cholesterol level was high in the females than the males in all age groups ( $126.40 \pm 9.00$ ,  $94.47 \pm 6.88$ ,  $87.73 \pm 6.88$  in the female age groups versus  $90.37 \pm 7.14$ ,  $86.40 \pm 7.70$ ,  $52.60 \pm 7.70$  in the three male age groups). The contrary Sinha et al. (2008) reported higher cholesterol concentration in males compared to females.

Table 3. Phenotypic Correlations among Blood traits studied

Traits	PRO	UR	CR	CHO	CAL	MAG	PHOS	POTAS
PRO		-0.108	0.127	0.459	0.338	-0.006	-0.417	0.427
UR			0-.391	0.146	-.647**	0.481	0.298	0.148
CR				-0.216	0.371	-0.261	-0.254	0.397
CHO					-0.198	0.365	0.424	0.155
CAL						-0.243	-0.550*	0.147
MAG							0.521*	0.131
PHOS								-0.058
POTAS								

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

PRO= protein, UR= Urea, CR= Creatinine, CHO= Cholesterol, CAL= Calcium, MAG= Magnesium, PHOS= Phosphorus, POTAS= potassium

Table (3) shows that the phenotypic correlation is highly significant for the estimate of calcium with urea (-.647) and significant for the estimates of phosphorus with both calcium (-0.550) and magnesium (0.521).

## CONCLUSION

It is concluded that sex and age may have a significant effects on blood profile in local Sudanese rabbits; this must be in account concerning dealing with health and production studies of this breed.

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