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SOME HAEMATOLOGICAL VALUES IN RABBITS FROM SUBTROPICAL TRINIDAD, WEST INDIES

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ABSTRACT: Blood samples from a total of 129 rabbits comprising fatteners (4-24 weeks) and adults (>24 weeks), males and females, and two breeds (New Zealand White and mixed) were analysed for haemoglobin concentration (Hb), haematocrit (Ht), mean corpuscular haemoglobin concentration (MCHC), white blood cell count (WBC), differential WBC (neutrophils (N), lymphocutes (L), eosinophils (E), monocytes (M), and Basophils (B)), and plasma protein (PP) concentration. Mean values for these parameters were given as : Hb : 123.0 gm/l ; Ht : 38.6% ; WBC : 6.9 x 10^3/µl ; N : 46.9% ; L : 39.2% ; E : 0.9% ; M : 4.4% ; B : 2.1% ; PP : 66 gm/l and MCHC : 319 gm/l. These mean values were found to be comparable to those reported from other, normally temperate, countries. However, mean values in our study for Ht, N and M were found to be higher and that for L to be lower than previously reported. Significant differences were found between New Zealand White and mixed breed for WBC (8.1 *vs.* 6.4 x 10^3/µl) and for L (36.7 *vs.* 28.9%). Significant differences were observed between males and females for M (6.0 *vs.* 3.7%) and for B (1.4 *vs.* 2.6%). Fatteners differed significantly from adults in mean values for M only (3.8 *vs.* 5.9%). It is proposed that mean haematological values from this study can serve as a benchmark for domestic rabbit populations in the wider Caribbean.

RÉSUMÉ : Quelques paramètres sanguins chez le lapin de Trinidad (sub-tropiques), Antilles.
La concentration en hémoglobine (Hb), le taux d'hématocrite (Ht), la concentration moyenne d'hémoglobine globulaire (MCHC), le nombre de globules blancs (WBC), la composition des globules blancs (neutrophiles (N), lymphocytes (L), eosinophyles (E), monocytes (M), et basophyles (B)) ainsi que la taux de protéines du plasma (PP) ont été analysés sur des échantillons de sang provenant de 129 lapins, comprenant des sujets à l'engraissement (4-24 semaines) et des adultes (> de 24 semaines), mâles et femelles, de deux races (Néo-zélandais Blancs et croisés). Les valeurs moyennes de ces différents paramètres sont : Hb : 123.0 gm/l ; Ht : 38.6% ; WBC : 6.9 x 10^3/µl ; N : 46.9% ; L : 39.2% ; E : 0.9% ; M : 4.4% ; B : 2.1% ; PP : 66 gm/l et MCHC : 319 gm/l. Ces valeurs moyennes sont comparables à celles enregistrées dans des pays tempérés. Cependant, dans notre étude, les valeurs moyennes de Ht, N et M sont supérieures et celle de L inférieure à celles déjà connues. Il a des différences significatives entre les races Néo-zélandais Blancs et croisés concernant WBC (8.1 *vs.* 6.4 x 10^3/µl) et L (36.7 *vs.* 28.9%). On observe aussi des différences significatives entre mâles et femelles pour M (6.0 *vs.* 3.7%) et pour B (1.4 *vs.* 2.6%). Les jeunes à l'engraissement diffèrent significativement des adultes seulement pour les valeurs moyennes de M (3.8 *vs.* 5.9%).Ces valeurs hématologiques moyennes peuvent être proposées comme référence pour les populations de lapins domestiques dans toutes les Caraïbes.

INTRODUCTION

The government of Trinidad and Tobago has identified rabbit meat as an alternative source of animal protein for the human population. Through the Ministry of Agriculture, it supplies advice on production methods and a veterinary service to rabbit farmers. Most rabbit enterprises are small; however, a relatively large well managed rabbitry was sought to establish baseline haematological data for use as a reference for normal values since no previous work had been reported for the Caribbean area. The rabbitry of the Department of Food Production, University of the West Indies (UWI) was selected for this purpose. The breeds represented were New Zealand White (NZW), Californian, Checkered Giant and Flemish Giant, and there was much cross-breeding between them.

MATERIALS AND METHODS

One hundred and twenty-nine (129) rabbits, four weeks and older, were bled over a period of four months from either the middle or marginal ear vein using an established technique (OKERMAN, 1988).

The pure white rabbits were regarded as having a high percentage of New Zealand White (NZW) inheritance and were identified as belonging to that breed. The other colours were either black, brown, grey, or combinations of these colours and white and they were identified as being of mixed breed. The existing management and production practices had the animals grouped by age as fatteners (4-24 weeks) and adults (>24 weeks). The sex of the rabbits was noted.

The rabbitry was reasonably well managed where rabbits were housed in all-wire cages, fed on poultry broiler pellets (18% crude protein) and wilted grass free choice. The animals were apparently in good health.

The climate of Trinidad and Tobago is humid, subtropical with mean day-night temperatures varying between 32-21°C.

Blood samples were collected on anticoagulant (EDTA) and submitted to the laboratory where estimations were done for haemoglobin concentration (Hb) using the

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Table 1 : Means, standard errors and ranges for various haematological parameters for all rabbits.

Parameter	No	Mean (± S E)	Range
Haemoglobin (gm/L)	129	123.0 (± 1.20)	85.0-160.0
Haematocrit (%)	129	38.6 (± 0.33)	29-50
White Blood Cells (x10^3/µL)	128	6.9 (± 0.23)	1.4-14.0
Neutrophils (%)	127	46.9 (± 1.24)	17-86
(x10^3/µL)		3.3 (± 0.14)	0.56-8.1
Lymphocytes (%)	127	39.2 (± 1.32)	6-74
(x10^3/µL)		2.7 (± 0.12)	0.34-72
Eosiniphils (%)	127	0.9 (± 0.12)	0-6
(x10^3/µL)		0.1 (± 0.01)	0.00-06
Monocytes (%)	127	4.4 (± 0.39)	0-22
(x10^3/µL)		0.3 (± 0.03)	0.00-21
Basophils (%)	127	2.1 (± 0.22)	0-14
(x10^3/µL)		0.1 (± 0.02)	0.00-09
Plasma Protein (gm/L)	127	66.0 (± 1.00)	0-90.0
Mean Corpuscular Haemoglobin Concentration (gm/L)	127	319.0 (± 2.0)	264.0-466.0

Spencer Haemoglobinometer, haematocrit (Ht) by the microhaematocrit method, mean corpuscular haemoglobin concentration (MCHC), white blood cell count (WBC) using the leukocyte-diluting pipette and differential WBC (neutrophils - N; lymphocytes - L; eosinophils - E; monocytes - M; basophils - B) as described by Benjamin (1969).

A small portion of each sample was centrifuged and its plasma protein concentration (PP) was determined using the Goldberg refractometer (TS Meter) as described by JAIN (1986).

All observations were recorded and analyzed using the GLM procedure in MINITAB Release 11 (MINITAB Inc., 1996). The analysis of variance (ANOVA) was done to test for any differences due to breed, sex and age of rabbits. The ANOVA also included possible first-order interaction among these.

RESULTS

Table 1 shows the means, standard errors and ranges for the parameters studied. Table 2 shows mean values, associated standard errors and levels of significance for the animals according to breed, sex, and age.

The analysis of variance revealed that there was no significant difference ($P > 0.05$) between NZW and mixed breed except for WBC and lymphocyte percent ($P < 0.05$) and absolute lymphocytes ($P < 0.01$). Significant sex effects were observed on the monocyte percentage ($P < 0.01$) and the monocyte absolute value, and both basophil values ($P < 0.05$). There were also significant age effects on percent and absolute monocyte values ($P < 0.05$). For the monocyte values, the interaction between age and sex was significant ($P < 0.01$) and values for male adults were

Table 2: Effect of breed, sex and age on mean haematological values in rabbits.

Item	Breed			Sex			Age		
	NZW	Mixed	Sign.	Males	Females	Sign.	Fatteners	Adults	Sign.
	Mean (± S.E.)	Mean (± S.E.)		Mean (± S.E.)	Mean (± S.E.)		Mean (± S.E.)	Mean (± S.E.)	
No. of animals	53	26		46	82		72	42	
Hb (gm/L)	126 (± 2.1)	125 (± 2.8)	NS	124 (± 1.8)	122 (± 1.8)	NS	123 (± 1.9)	124 (± 2.3)	NS
Ht (%)	38.6 (± 0.59)	37.4 (± 0.78)	NS	38.3 (± 0.64)	38.2 (± 0.49)	NS	38.5 (± 0.52)	38.1 (± 0.62)	NS
WBC (x 10^3/µL)	8.1^{+} (± 0.41)	6.4^{+} (± 0.54)	*	6.7 (± 0.41)	6.8^{+} (± 0.32)	NS	6.6^{+} (± 0.33)	6.9 (± 0.40)	NS
N (%)	45.4^{++} (± 2.36)	53.0^{+} (± 3.06)	NS	43.4^{+} (± 2.31)	48.9^{+} (± 1.78)	NS	47.7^{++} (± 1.88)	44.6 (± 2.23)	NS
(x 10^3/µL)	3.7^{++} (± 0.27)	3.4^{+} (± 0.35)	NS	2.9^{+} (± 0.26)	3.3^{+} (± 0.20)	NS	3.2^{++} (± 0.21)	3.1 (± 0.25)	NS
L (%)	36.7^{++} (± 2.13)	28.9 (± 2.76)	*	40.9^{+} (± 2.14)	38.3^{+} (± 1.65)	NS	37.4^{++} (± 1.75)	41.8 (± 2.07)	NS
(x 10^3/µL)	3.0^{++} (± 0.22)	1.9 (± 0.28)	**	2.7^{+} (± 0.21)	2.6^{+} (± 0.16)	NS	2.4^{++} (± 0.17)	2.9 (± 0.20)	NS
E (%)	0.5^{++} (± 0.20)	1.0 (± 0.26)	NS	1.0^{+} (± 0.23)	0.9^{++} (± 0.18)	NS	0.9^{++} (± 0.19)	1.0 (± 0.23)	NS
(x 10^3/µL)	0.04^{++} (± 0.02)	0.06 (± 0.02)	NS	0.07^{+} (± 0.02)	0.06^{++} (± 0.01)	NS	0.07^{++} (± 0.01)	0.06 (± 0.02)	NS
M (%)	6.1^{++} (± 0.73)	5.9 (± 0.95)	NS	6.0^{+} (± 0.88)	3.7^{+} (± 0.52)	**	3.8^{++} (± 0.55)	5.9 (± 0.65)	*
(x 10^3/µL)	0.5^{++} (± 0.06)	0.4 (± 0.08)	NS	0.4^{+} (± 0.05)	0.3^{+} (± 0.04)	*	0.3^{++} (± 0.04)	0.4 (± 0.05)	*
B (%)	2.4^{++} (± 0.38)	2.0 (± 0.49)	NS	1.4^{+} (± 0.41)	2.6^{+} (± 0.31)	*	1.6^{++} (± 0.33)	2.4 (± 0.39)	NS
(x 10^3/µL)	0.2^{++} (± 0.03)	0.1 (± 0.04)	NS	0.1^{+} (± 0.03)	0.2^{+} (± 0.02)	*	0.1^{++} (± 0.02)	0.2 (± 0.03)	NS
PP (gm/L)	68^{+} (± 1.9)	65 (± 2.5)	NS	67 (± 2.1)	65^{+} (± 1.6)	NS	64^{+} (± 1.7)	68 (± 2.0)	NS
MCHC (gm/L)	325 (± 3.1)	329 (± 4.1)	NS	321 (± 3.7)	320 (± 2.9)	NS	318 (± 3.0)	323 (± 3.6)	NS

Hb=Haemoglobin; Ht= Haematocrit; WBC=White Blood Cell Count; N=Neutrophils; L=Lymphocytes; E=Eosinophils; M=Monocytes; B-Basophils; PP=Plasma Protein; MCHC=Mean Corpuscular Haemoglobin Concentration

NS : Not significant at P>0.05; *P < 0.05; **P < 0.01. $^{+}$One fewer animal than recorded in first row, $^{++}$Two fewer animals than recorded in first row (N.B.: Breed not identified for 50 animals, sex not identified for 1 animal, age not identified for 15 animals).

Table 3 : Mean (and S.E.) for monocyte values in rabbits for sex by age subclass

	Sex	
Age	**Male**	**Female**
Fatteners(%)	3.5 (± 0.86)	4.0 (± 0.68)
($x10^3/\mu L$)	0.27 (± 0.07)	0.28 (± 0.05)
Adults (%)	8.5 (± 1.04)	3.3 (± 0.79)
($x10^3/\mu L$)	0.59 (± 0.08)	0.25 (± 0.06)

Interaction significant at $P<0.01$

higher than other categories (Table 3). No other significant interactions were observed.

DISCUSSION

This study sought to establish normal values for haematological parameters in subtropical rabbits in Trinidad in the hope that the values could be applicable to the wider Caribbean. The rabbits sampled were healthy and met production expectations of the livestock scientists (RASTOGI, 1984, 1987).

In general, values obtained were similar to those reported for NZW rabbits by FOWLER (1986). However, our mean values for haematocrit, neutrophils and monocytes were higher and those for lymphocytes were lower. A more meaningful comparison of results was difficult because of the omission of the standard errors associated with the mean values presented in FOWLER's study. Nonetheless, the mean values for the various parameters measured in this study always fell within ranges reported by Fowler, except in the case of lymphocytes which were less than the minimum and monocytes which exceeded the maximum.

When our results for the various white cell values were compared with those obtained by KABATA *et al.* (1991), it was found that our mean values were within the ranges reported by them. AYYAT and MARAI (1996) reported on total plasma protein concentrations in NZW rabbits, raised under subtropical Egyptian conditions on different dietary protein-energy levels, and observed values similar to ours.

Since the rabbits used for this investigation met production targets, it is suggested that the results be regarded as being acceptable for rabbits under similar management conditions in this part of the world.

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