

HAEMATOLOGICAL STUDIES ON THE YOUNG AND ADULT ARABIAN CAMEL (*CAMELUS DROMEDARIUS*) FROM KUWAIT.

I. SOME HAEMATOLOGICAL CONSTANTS

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Abstract. The blood of 10 adult male, and 10 young male camels has been examined. It is found that the red and white blood cell counts, haemoglobin content and packed cell volume are significantly higher in the young than in the adult camel, the coefficient of variation being highest in the packed cell volume. Differential leucocyte count also shows a higher percentage of lymphocytes, and a lower percentage of neutrophils, in the young than in the adult camel. The mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration are also presented. Whereas the mean corpuscular haemoglobin is more or less the same in the young and adult camel, the mean corpuscular volume is much higher, and consequently the mean corpuscular haemoglobin concentration much lower, in the young than in the adult camel.

INTRODUCTION

Normal values of the constituents of the blood of most of the domestic animals have been worked out by previous workers, but the information on this aspect of camel's blood is rather meagre. It seems hard to believe that, except for a few scattered references here and there, hardly any detailed investigation work has been done to study the physiology of the camel in general, and of its blood in particular. Moreover, although the effect of factors like sex and season on constituents of camel blood has been investigated, no worker has ever attempted a study of the effect of age on the blood picture of camels.

As far as one could make out from the available literature, no work has ever been done on the haematology of the Arabian camel (*Camelus dromedarius*) which inhabits the Arabian Gulf. Durand and Kchouk (1959) determined some haematological constants of the Tunisian dromedary. Holler and Hassan (1966) carried out haematological studies on the camel inhabiting Sudan. Barakat and Abdel-Fattah (1970) carried out a biochemical analysis of normal camel blood. More recently, (1971), they reported on a study of seasonal and sexual variations of certain constituents of normal camel blood. In their study, the two authors used the one-humped Egyptian camel.

Other haematological studies were carried out on camels living elsewhere. Little *et al.* (1969) studied blood electrolytes in the Australian camel. They used camels from stock imported, more than 90 years ago, from Afghanistan and India. Gudat (1964) reported on a

study of the blood picture of camels, both Bactrian and Dromedary, living at the Berlin-Friedrichfeld zoological garden. Soni and Aggarwala (1958), Banerjee *et al.* (1962), Soliman and Shaker (1967), and many others presented haematological studies on the Indian camel.

In view, therefore, of the insufficient information found in the available literature regarding the haematology of the Arabian camel, and in particular the effect of age on its blood picture, the present investigation has been undertaken. This paper, which forms the first part of the investigation, deals mainly with measurement of some corpuscular constants of the blood of both the young and adult Arabian camel.

MATERIAL AND METHODS

In all, 10 adult male camels (*Camelus dromedarius*) of various ages, and 10 young male camels (2 years old) were used. The mean body weight of the adult camels was 460 kg, and of the young 132 kg. The study was conducted in the months of April and May 1972. Fresh blood samples were obtained from the jugular vein of the camels, and collected in heparin-coated, screw-capped bottles. The following estimations were then carried out in the laboratory :

- (a) Packed cell volumes (haematocrit) were determined in duplicate. The haematocrit tubes were centrifuged for 30 minutes at 3000 r.p.m.
- (b) Haemoglobin content, expressed as g per 100 ml, was determined by Sahli's haemoglobinometer, using N/10 HCl as the diluting fluid.
- (c) Red blood cell counts were made in a

TABLE 1. Some Haematological Measurements in the Camel

Character	Unit	Young Mean \pm S.D.	Adult Mean \pm S.D.	*Coefficient of Variation
Red blood cell count	10 ⁶ /mm ³	14.08 \pm 1.77	12.48 \pm 1.35	- 11.36
Haemoglobin content	g/100 ml	12.60 \pm 1.02	10.20 \pm 0.91	- 19.05
Packed cell volume	%	49.00 \pm 3.12	32.30 \pm 2.61	- 34.08
Total leucocyte count	1000/mm ³	7.00 \pm 0.31	5.00 \pm 0.12	- 28.57
Mean corpuscular volume	c. micron	34.80	21.55	- 38.07
Mean corpuscular haemoglobin	picogram	8.95	8.17	- 8.72
Mean corpuscular haemoglobin concentration	%	25.72	31.58	+ 22.78

* A negative coefficient of variation indicates a decrease in value of the character examined with age, a positive coefficient an increase in value with age.

standard haemocytometer, using a counting chamber with improved Neubauer ruling. Hayem's solution was used as the diluting fluid.

- (d) Total leucocyte counts were made in the standard haemocytometer, using 1% acetic acid tinged with methylene blue as the diluting fluid.
- (e) Differential count of the leucocytes was made from freshly-prepared blood films stained with Giemsa's stain. A total of 100 cells was counted.

For statistical analysis, the standard deviation of the means and t values (tv) were computed for testing the differences between each two means of young and adult camels. The 0.01 level has been used for significance. The tv values were determined following the method outlined by Finney (1964).

RESULTS AND COMMENT

Red Cell Count, Haematocrit and Haemoglobin Content

The means for all animals, the standard deviation of the means, and the coefficient of

variation are given in Table 1. It is clear from this table that the red and white blood cell counts, haemoglobin content and packed cell volume are significantly higher in the young than in the adult camel. The coefficient of variation (adult from young %) is highest in the packed cell volume. It is also clear from this table that whereas the mean corpuscular haemoglobin is more or less the same in both the young and adult camels, the mean corpuscular volume is much higher, and consequently the mean corpuscular haemoglobin concentration much lower, in the young than in the adult camel. For testing the differences between each two means of young and adult camels, t values (tv) are computed. The results are summarized in Table 2. The table clearly shows a significance at 0.01 level for all the variables.

When results of the present study (for the adult camel) are compared with those of some of the previous workers, as is shown in Table 3, it will be seen that whereas our figure for red cell count is much higher than that obtained by previous workers, our figures for haemoglobin content and total leucocyte count are much lower. On the other hand, the packed cell volume, as

TABLE 2. t values of differences between means of young and adult camels

Variable	tv	Significance level
Red blood cell count	2.91	significant at 0.01 level
Haemoglobin content	11.57	" " " "
Packed cell volume	9.08	" " " "
Total leucocyte count	12.27	" " " "

TABLE 3. Results of four independent studies of adult camel haematology

Character	Arabian ¹ camel	Indian ² camel	Indian ³ camel	Australian ⁴ camel
Red blood cell count	12.48	7.24	8.20	9.12
Haemoglobin content	10.20	13.10	15.50	15.51
Packed cell volume	32.30	27.00	—	30.60
Total leucocyte count	5.00	18.10	20.07	—
Mean corpuscular volume	21.55	37.90	—	35.90
Mean corpuscular haemoglobin	8.17	17.40	—	18.00
Mean corpuscular haemoglobin concentration	31.58	47.00	—	50.30

1. Present study. 2. Banerjee *et al.* (1962). 3. Soni and Aggarwala (1958). 4. Little *et al.* (1970).

determined in the present study, almost approximates the values given by other workers. It is also evident from Table 3 that the values for mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration are much lower in the present study than in those by previous workers.

Differential Count of leucocytes

Camel blood, like that of other ruminants, shows a predominance in lymphocytes. This is different from that of monogastric animals, like the horse, dog and cat, where the neutrophils are the most abundant leucocytes. Table 4 gives the mean and standard deviation of percentage of different leucocytes in young and adult camel blood, and compares the same with similar values (for the adult only) obtained by Soni and Aggarwala (1958), Durand and Kchouk (1959), and Banerjee *et al.* (1962).

It is clear from Table 4 that camel's blood, according to the results of the present study, shows a much higher percentage of lymphocytes and a lower percentage of neutrophils in the young than in the adult camel. The other types

of leucocytes maintain more or less the same percentage in the adult as in the young camel.

GENERAL DISCUSSION

The present study was conducted in the months of April and May 1972, i.e., in the late spring, when the average maximum daily temperature ranged from 35 to 40°C. The camels used for the present study were all living and working in the desert until they were slaughtered. In Kuwait, as in other Arab countries, camels are bred and later slaughtered for food, just as beef cattle in other countries. In the desert, camels often rest during the mid-day to avoid excessive heat. They feed on desert vegetation consisting of shrubs and low bushes which grow on the marshy stretches along the coast. The same vegetation provides the camels with water as well as food.

The question that naturally arises is whether the preceding conditions of the environment, e.g., prevailing temperature, water shortage, etc. would have any effect on haematology. In this connection it may be interesting to mention that when the camel becomes dehydrated, the loss of

TABLE 4. Mean and standard deviation in percentage of different leucocytes of camel blood

Type of leucocyte	Arabian Camel ¹		Indian ² camel (Adult)	Indian ³ camel (Adult)	Tunisian ⁴ camel (Adult)
	Young	Adult			
Lymphocytes	53.0 ± 7.3	47.0 ± 8.3	39.7 ± 5.80	46.0 ± 9.7	32.2
Neutrophils	32.0 ± 8.4	38.0 ± 9.7	50.6 ± 8.44	38.7 ± 8.8	58.8
Monocytes	6.0 ± 3.3	6.0 ± 2.0	3.05 ± 1.33	5.7 ± 3.3	—
Eosinophils	9.0 ± 4.4	8.0 ± 4.3	6.5 ± 3.80	9.5 ± 4.7	1 — 3
Basophils	0	0.5 ± 0.1	0.05 ± 0.11	<1	0

1. Present study. 2. Banerjee *et al.* (1962). 3. Soni and Aggarwala (1958). 4. Durand and Kchouk (1959).

water is not accompanied by a proportional loss in plasma volume. The maintenance of a high plasma volume facilitates circulation, which is one of the first functions to suffer during dehydration of other animals in hot environments (Schmidt-Nielsen 1965). It therefore seems most unlikely that such preceding conditions would have any effect on the haematology of the camel.

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دراسات في دم الجمل العربي الصغير والبالغ

الجزء الاول : تعيين بعض ثوابت الكريات

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خلاصة

أجرى الباحثان بحثا تحليليا على الدم المأخوذ من عشرة جمال بالغة وعشرة جمال صغيرة السن . وقد قاما بتعيين عدد كريات الدم الحمراء ، وتركيز الهيموجلوبين في الدم والنسبة المئوية لحجم خلايا الدم وعدد خلايا الدم البيضاء ، ووجدوا أن هذه الكميات جميعها أعلى في الحيوان صغير السن منها في الحيوان البالغ . كما وجدوا أن النسبة المئوية للخلايا البيضاء الليمفاوية أعلى في الحيوان الصغير ، بينما النسبة المئوية للخلايا البيضاء المتعادلة أقل في الحيوان الصغير منها في الحيوان البالغ . وقام الباحثان بحساب متوسط حجم الكرية الواحدة ، ومتوسط تركيز الهيموجلوبين داخل الكرية الواحدة في كل من الحيوان الصغير والبالغ . وقد اتبع الباحثان الطريقة الاحصائية العلمية في تسجيل نتائج البحث .

