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Research Article
Haematology of the Asian Elephants

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Abstract

Asiatic Elephants are the largest terrestrial mammals in India. They require large amount of space and water and hence, most of the elephants are confined to large forest cover. Mostly the elephant habitats are coming under four regions, Northern, North – eastern, Central and Southern India, in general. The wild elephant populations of Southern India have been well studied and judged, than those in other parts of the country. The highest populations are seen in Western and Eastern Ghats of Tamil Nadu, Kerala, Karnataka and more recently in Andhra Pradesh. It is a known fact that captive elephants may have increased probabilities for acquiring various pathogens due to varied management related measures, in addition to the existing variations in the feeding practices and habitat-related condition. There is paucity in the data on the hematological profile of the asian elephant, hence this study will be useful in estimating the hematological quotients that are essential indicators to therapeutic applications. Further packed cell volume (PCV), Haemoglobin (Hb) and blood cell counts will serve as prognostic indicators that will guide clinicians to potentiate the therapeutic procedure.

I.INTRODUCTION

The word "**elephant**" is derived from the Latin words "*ele*" meaning **arch** and "*phant*" meaning **huge**. In short it's a "***Huge Arch***". Elephants are the largest warm-blooded, terrestrial and most primeval mega herbivore with evolutionary history of more than 60 million years.Asian Elephants (*Elephas maximus*) are considered as "Flagship Species" in terms of their long and complex cultural relationship with homosapiens and their survival maintains the biological diversity and ecological integrity in the environment, in which they live. Elephants are also referred as "Umbrella Species" because of its large home range. India and elephants are almost inseparable from each other, as it frequently associates with the religion, myths and history of India. Besides a large population of free ranging elephants, a good number of elephants are maintained in captivity in India. There is a wide variation in how animals respond to captivity. Captive animals receive ample food and water, veterinary care and protection from predation and conflict. Consequently they are often healthier, live longer and breed more successfully.

Establishment of normal hematological values is prerequisite for proper interpretation, diagnosis and treatment of diseases. This paper aims at providing concrete knowledge on the normal blood values in elephants which will be useful for veterinarians who play a pivotal role in the conservation of elephants by assessing the health status both in the wild as

well as in captivity. Further the values recorded will be useful in enriching the health related database in these mega herbivores.

II.MATERIALS AND METHODS

2.1 Place of study:

The study was carried out in various temples having elephants, Circuses, biological parks and forest camps wherein captive elephants were maintained.

2.1.2 Description

Asiatic elephants were included in this study.

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Place	Males	Females
Circus	4	1
Banerghatta biological park	8	4
Temple elephants	2	15
Forest camp elephants	18	16
Total	**32**	**36**

The study was carried during the month of September 2014. Samples were collected from elephants once during the study period. The animals were all apparently healthy and grouped into two males and females.

Blood was collected from the superficial vein of external aspect of the ear, using a clean, sterile 16 G disposable hypodermic needle into a vaccutainer with EDTA anticoagulant. (AcCuvet EDTA.K_3). Blood smear was made on clean, dry slide, with a drop of blood from the ear by pricking with a sterile needle, Jain [1]

2.1.3 Haematological Examination

Packed cell volume was determined by using the microhaematocrit tube and expressed in per cent. Haemoglobin was estimated by acid haematin method using Sahle's apparatus and expressed in Gram per cent Schalm et. al. [2] .Erythrocyte sedimentation rate was measured by wintrobe haematocrit method and was observed for one hour. Total erythrocyte count was done by haemocytometry and expressed in 10^6 per cmm. Total leucocyte count was done by haemocytometry and expressed in 10^3 per cmm Jain, [1]. Differential leucocyte count were carried out as per the method described by Schalm et al [2].Clotting time was estimated by using the capillary tube method Sastry, [3]. Erythrocyte indices namely MVC, MCH, MCHC were calculated.

III.RESULTS:

The data recorded during the investigation of haematological parameters like PCV, haemoglobin, erythrocyte sedimentation rate, total erythrocyte count, total leucocyte count involving lymphocytes, monocytes, neutrophils, eosinophils , erythrocyte indices such as MCV, MCH, MCHC and blood clotting time were subjected to statistical analysis and non- paired "t" tests. In addition the overall mean values were also calculated.(Table 1,2,3).

Table 1 ***MEAN±S.E VALUES FOR HAEMATOLOGY***

Sex	**PCV (%)**	**Haemoglobin (%)**	**ESR mm/ hr**	**Total erythrocyte count * 10^6/cmm**	**Total leucocyte count x 10^3/cmm**
Male	41.11±0.42	11.55±0.47	51.75±1.89	3.47±0.15	12.00±0.29
Female	40.50±0.64	11.56±0.38	52.44±1.2	3.16±0.18	11.19±0.23
"t" test	0.25^{NS}	0.22^{NS}	0.24^{NS}	1.85^{NS}	7.39**

Table 2 ERYTHROCYTE INDICES:

	ERYTHROCYTE INDICES		
	MCV (fl)	**MCH (pg)**	**MCHC (%)**
Male	112.22±5.5	37.24±1.57	28.26±0.10
Female	109.05±4.23	35.58±1.49	28.07±0.74
"t" value	0.25^{NS}	0.19^{NS}	0.38^{NS}

Table 3 MEAN±S.E VALUES FOR LEUCOCYTES

Groups	Differential leucocyte count in absolute numbers				Clotting time in minutes
	Lymohocytes	Neutrophils	Monocytes	Eosinophils	
Male	6319.84±319.83[a]	5057.44±336.78[a]	228.89±33.91	397.78±88.01	5.22±0.32**a**
Female	4886.25±153.53[b]	3800.63±198.51[b]	183.13±20.47	323.75±50.22	4.43±0.13[b]
"t" value	4.61**	3.41**	1.23[NS]	0.78[NS]	2.26*

**** Highly significant , * Significant, NS- Not significant.**

IV.DISCUSSION

4.1 Packed Cell Volume (PCV)

The overall mean PCV value obtained in this study was higher than the value reported in male and female elephants of SriLanka, Silva and Kuruwita, [4]. But the value obtained was in agreement with the range given by Lewis [5] and Fowler [6] and it was closer to the values obtained Young and Lombard [7]. The non-significant difference observed in between the male elephant group and the female elephant group under study was in agreement with the reports given by Nirmalan et al. [8] who estimated hematocrit values among baby elephants and non-lactating female elephants.

4.2 Haemoglobin

The overall mean haemoglobin value obtained in this study was little lower than the values quoted by Mikote et al. [9], in female Asian elephants and Lewis [5] in Indian elephants but the obtained overall mean value was in agreement with the values given Fowler [6] and the report by Yathiraj et al. [10] The non-significant changes in the sex groups observed in this study was further supported by Niemuller et al. [11] who observed that the haematological profile remained constant over a period of time and it was similar in different age group of Asian elephants.

4.3 Erythrocyte Sedimentation Rate (ESR)

The obtained mean ESR values in the young and adult elephant groups were in agreement to the range reported by Fowler [6]. The overall mean ESR value obtained in this study was found to be higher than the values reported by Benjamin [12]. The high ESR value obtained in this study could not be attributed only to the larger cell size noticed, but also a reasonably rapid ESR but relatively small red cells present like that of horses, as reported by Brown and White [13]. Schalm et al. [2] reported that the rate of sedimentation was being associated with the ability of the red cells to form rouleaux. Brown and White [13] supported the finding of high ESR value , was obtained in this study by revealing the rapid occurrence of rouleaux formation in elephant blood. Sreekumar and Nirmalan [14] also supported this by stating that the absolute viscosity of elephant blood was found to be twice higher than the values reported for other domestic animals and this was attributed to the rapid rouleaux formation in elephant blood. Usami et al. [15] also reported this by stating that the viscosity values for goat, sheep, dog and man were similar and only for the value for elephant was found to be higher than the others during the study with using an improved viscometer; Occurrence of larger size of aggregates in elephants blood than human and dog blood was favoured by the presence of high plasma fibrinogen concentration in elephants. Rapid formation of rouleaux or aggregates, high fibrinogen content, increased globulin value, increased viscosity value and to same extent the larger size of red cells might be attributed to the comparable higher ESR value obtained in elephants under study. Usage of one hour time for the assessment of ESR value throughout the course of this study was further supported by different authors (Brown and White, [13]; Fowler, 1986 [6]; Young and Lombard, [7]); However, Sreekumar and Nirmalan [14] quoted that 15 minutes can be used in particular as a clinical tool in diagnostic aid.

4.4 Total erythrocyte count and erythrocyte indices

The mean values obtained during the course of study in both male elephant group and female elephant group were in agreement with the values reported Brown and White [13] and Fowler [6] and closer to the value reported by Simon [16] in adult elephants. Comparably the overall mean value obtained during the course of this study was found to be lower than the total erythrocyte count values reported by Benjamin [12] and Sastry [3] in other animal species like cattle, sheep, goat, dog, cat including horses. The finding of low total erythrocyte count in elephants under study than other mammals was further supported by Yathiraj et al. [10]. Though seasonal variation reported in total erythrocyte value by Ostrowska et al. [17], sampling in different seasons was however not carried out in this study. The mean overall total erythrocyte count value obtained in the captive elephants in this study was found to be lower than mean value reported by Young and Lombard [7] in African elephants. Comparable larger sized red cells were noticed in elephants under study. Presence of larger red cells in elephants blood was supported by Brown and White [13]. Ostrowska et al. [17] also opined that in the elephant red cells were large, possibly larger than in any other mammals having a mean diameter slightly greater than 9 µm. The overall MCV level regardless of the sex was

in close agreement with the higher range value given by Usami et al. [15] but however was found to lower than the value reported by Pillai et al. [18]. The mean value of MCV obtained during the study was found to be higher than the values quoted by Benjamin [12] in species like horses, cattle, sheep, goat, pig, dog and cat.

Though there was no significant increase in mean value comparably in male elephant group, was within the range reported by Wallach and Boever [19] and Silva and Kuruwita [20]. Likewise, during the different species wise comparison the overall mean MCH value obtained in this study was found to be higher than other species like horses, cattle, sheep, goat, dog and cat. This could be attributed to the larger size of erythrocytes in the samples obtained from elephants under study. This was in agreement with the reports given by Silva and Kuruwita [20].The overall MCHC level regardless of the group in close agreement with the range given by Sastry [3] and Silva and Kuruwita [20] but however was found to be higher than values reported by Uasmi et al. [15], Brown and White [13] and Jain[1]. The mean MCHC values of the adult young elephant group were non-significant of sex. Sex could not exert any influence on MCHC value.

4.5 Total leucocyte count and differential leucocyte count

The overall mean total leucocyte count obtained regardless of the grouping in this study was however found to be lower than the values reported by Lewis [5] but was in agreement with the findings given by Brown and White [13], Fowler [6] and Sastry [3]. However, Niemuller et al. [11] opined that the total leucocyte count in Asian elephants was constant over a period of time and it was similar in different age group of elephants. The overall total leucocyte count value in this study also was in agreement with the value reported for Asian elephants by Wallach and Boever [19].

The findings of significant total leucocyte count in the blood samples obtained from male elephants group than the female elephant group was in agreement to the reports given by Young and Lombard [7]. Likewise, Mikote et al. [9] also opined that captive Asian elephants of age group between 3 to 14 years had increased total leucocyte count and lymphocytes, except for the pregnant females, a decrease total leucocyte count was found in non-pregnant non-lactating female elephants when compared to the baby elephants (Nirmalan et al., [8]). Sood [21] opined that cause of reduced total leucocyte counts are usually accompanied by abnormal differential counts; However, no such abnormalities were observed in both the male and female elephants groups under study; The lymphocytes were the dominant white cells in samples obtained from elephants under study and when compared to other differential white blood cells, the monocytes were highly reduced numbers, then followed by eosinophlis, neutrophils and lymphocytes respectively; Throughout the course of this study, basophils were not encountered in any of the sample obtained from either young or adult elephant group under study; These findings were in agreement with reports given by Young and Lombard [7] who analysed the physiological values of African elephants. Additionally, the findings were supported by Ostrowska et al. [17] who revealed that basophils and monocytes are present in low numbers and had not been found by all authors. The presence of lymphocytes as the dominant white blood cell encountered during this study was in agreement to the reports given by Simon [16] and Brown and White [13] Ostrowska et al. [17]. Though pregnant captive female asian elephants were reported to have different blood picture as quoted by Nirmalan et al. [8], throughout the course of study, no pregnant animal was subjected to the haematological examination.

4.6 Clotting time

The variations observed in between the male and female elephants group in this study was in agreement within the Sreekumar and Nirmalan [14] who also reported that the reason for the increased coagulation time in male elephants was due to the inhibitory effect of testosterone on prothrombin synthesis. The overall mean clotting time observed in this study was in close agreement with the reports given by Fowler [6]. Benjamin [12] opined that clotting time may get prolonged because of factors like deficiency of coagulation factors and also in thrombocytopaenia, comparably no variations were noticed between the overall mean value obtained in this study and the values quoted by Benjamin [12] in other animal species. However, the wide variations in clotting time in elephants under study could be attributed to the multiple variables like temperature, clotting factors, quantity of blood etc; This was being supported by the reports of Johnstone [22] who quoted on the lack of sensitivity in the whole blood clotting time estimation and it was further quoted that the test of estimating the whole blood clotting time gets influenced by other variables like size of the tube, haematocrit of the blood, concentration of platelets, in addition to temperature.

V.CONCLUSION

The normal haematology of the elephants will support any veterinary manipulations. Further standardizations of these parameters is needed in order to conclude to concrete diagnosis.

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