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Values of WBC during Reproductive Cycle in Megachiropteran bat *Rousettus Leschenaulti* (Desmerest)

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Abstract

The white blood corpuscles circulate throughout the body and tissues providing protection against foreign organisms and matter. These cells are highly mobile, could squeeze through the pores in the capillaries and move into the tissues. When a foreign organism / antigen enters the body, chemical substances are released that stimulate the white cells and cause them to be attracted to the area of invasion. Their fundamental job is to provide defence against bacteria, fungus, parasites, viruses and cancer. In the present work leukocyte count was found to be variable according to the reproductive status of the male and female. Thus the average mean white cell counts for the females were (4,700 – 9,000mm³) and for the male (7,000 – 16,500mm³).

Keywords: Rousettus leschenaulti, WBC, blood, reproductive cycle.

Introduction

Blood is considered a tissue consisting of red blood corpuscles (erythrocytes), white corpuscles (leukocytes), platelets and the liquid plasma. It is a carrier for gases, oxygen, carbon dioxide, metabolites, and products of digestion, hormones, enzymes and clotting factors. The blood composition be used an indicator for evaluating the health and well–being of mammals or in other words blood variables when correlated with physical condition ratios (PCR) may be useful nutritional indicators[1,2,3]. Studies on the nutritional status of animal populations often use composition of the blood plasma for evaluation of its physiological condition[4-7].

Chiroptera, more than any other mammalian order, provides an opportunity to examine physiological systems operating under diverse conditions. Assessment of environmental stresses, rapid food–passage time, and oxygen–consumption data support the hypothesis that there is a great capacity for change in blood morphology and blood chemistry of bats[8].

The blood profile is affected by various factors such as age, gender and reproductive state, by endogenic rhythms of various metabolites as well as by external factors such as season, time of the day, food availability and quality[9,10,11].

Since there is no information so far concerning the blood and its formed elements in any Indian bat excepting a small note on the haematology of the Indian false vampire, *Megaderma lyra lyra*[12,] only in adult male and female and juvenile bats, but not during the reproductive cycle, during different phases of male maturity and oestrous cycle, pregnancy and lactation period. Thus the present work is an attempt to correlate the profile of blood and reproduction.

The objective of this present study is to investigate the relationship between the reproductive status of the male and female and the WBC count in blood throughout the reproductive cycle.

Material and methods

Rousettus leschenaulti has a widespread distribution extending from Sri Lanka and Pakistan to Myanmar, Vietnam, Southern China, Java and Bali. In the Indian subcontinent, almost all states show localities of *Rousettus leschenaulti*. In Maharashtra *Rousettus leschenaulti* are distributed in Ghatmatha; Chikalda; Elephanta; Jogeshwari; Kanheri; Khandala; Alibag; Mahabaleshwar; Aurangabad; Ratnagiri[13]; Marathwada; Satara ; Pune; Mansar; Kandri; Ellora[14]. This old world Indian fruit bat, *Rousettus leschenaulti* (Desmerest) is selected for the present study because of its easy availability in the vicinity of Nagpur city.

The specimens of *Rousettus leschenaulti* were collected with the help of mist net placed at the entrance of Mansar / Kandri mines near Nagpur once every calendar month throughout the complete reproductive cycle.

Blood sample (2 ml) were collected in Eppendorf tubes and into 6 to 8 heparinized capillary tubes after puncturing a wing vein. After blood sampling each bat was released. The blood was analysed at the Shri Sainath Diagonosis and Research Center, Nagpur using cell counter machine to determine hematological characterstics: total Leukocyte count (WBC).

Table-1
W.B.C. values for male *Rousettus leschenaulti* during reproductive cycle (2003 – 2004)

Date of Collection	Reproductive Status	W.B.C. (cu mm)
31/07/03	Male Inactive	16500±3824
29/08/03	Male Inactive	7000±686
29/09/03	Male approaching Maturity	8500±986
21/10/03	Male approaching Maturity	9400±1045
20/11/03	Male Active	8400±211
29/12/03	Male Active	7000±686
25/01/03	Male Active	8200±211
28/02/03	Male Active	7900±167
25/03/04	Male Active	7400±298
25/04/04	Male Active	7100±298
27/05/04	Male regressed	8200±211
24/06/04	Male regressed	7600±260

Table-2
W.B.C. values for female *Rousettus leschenaulti* during reproductive cycle (2003 – 2004)

Date of Collection	Reproductive Status	W.B.C. (cu mm)
31/07/03	Late pregnancy/just delivered	4700±1168
29/08/03	Lactating female	7400±1974
29/09/03	Anaestrous	8000±1974
21/10/03	Proestrus	9000±1974
20/11/03	Female at Oestrous	8000±1974
29/12/03	Ovulation / Early pregnancy	6400±1974
25/01/03	Mid pregnancy	7800±2076
28/02/03	Advanced pregnancy	7400±2076
25/03/04	Just delivered / Post portum oestrous	6300±2083
25/04/04	Lactation / Early pregnancy/ Abortion	7200±2050
27/05/04	Mid pregnancy	8000±2043
24/06/04	Advanced pregnancy / Abortion	7300±2069

Observations: White blood cells circulate throughout the body and tissues providing protection against foreign organisms and matter. Leukocytes (leukos = white, cytes = cells), are also called white blood corpuscles, WBC. Fundamental job of the WBCs is to provide defence against, bacteria, fungus, parasites, virus, cancer. They also remove debris and foreign protein. For these, WBCs either directly attack the bacteria, or produce antibodies which attack the antigen.

In the female during the 1st phase of reproduction, anestrous (September), proestrous (October), oestrous (November), the mean leukocyte count was significantly higher which declined insignificantly during early pregnancy (December + January), mid-pregnancy (February/May); Advanced pregnancy (March/June) late pregnancy / delivery / Abortion (April). As mentioned above the variability in the WBC count during pregnancy, the bats are more vulnerable to diseases therefore a rise in leukocyte count was encountered. Such changes also have been observed in the second phase of pregnancy as well as during lactational anoestrous (July and August).

In the adult males the testes show spermatogenic activity and an increase in the interstitial tissue from October to the following April, although there are two distinct peaks of activity, once during October-November and a second during February-March. These two periods correspond to the period immediately prior to the two periods of copulation. The significantly higher values during July (16500, inactive male) may be the result of subclinical disease or of natural day to day fluctuations or may be for phagocytosis of sperm debris / undivided spermatogenic elements / various spermatogenic elements like sperm mother cells, spermatocytes, round and long spermatids, sperm tail or heads, atrophied Leydig cells by the leukocytes. All this support the significant decrease of WBC during testicular activity since they are needed least for phagocytosis. During other months the WBC count was almost stable. The WBC count during the remaining all months revealed a constant milieu in the male. (Haemogram)

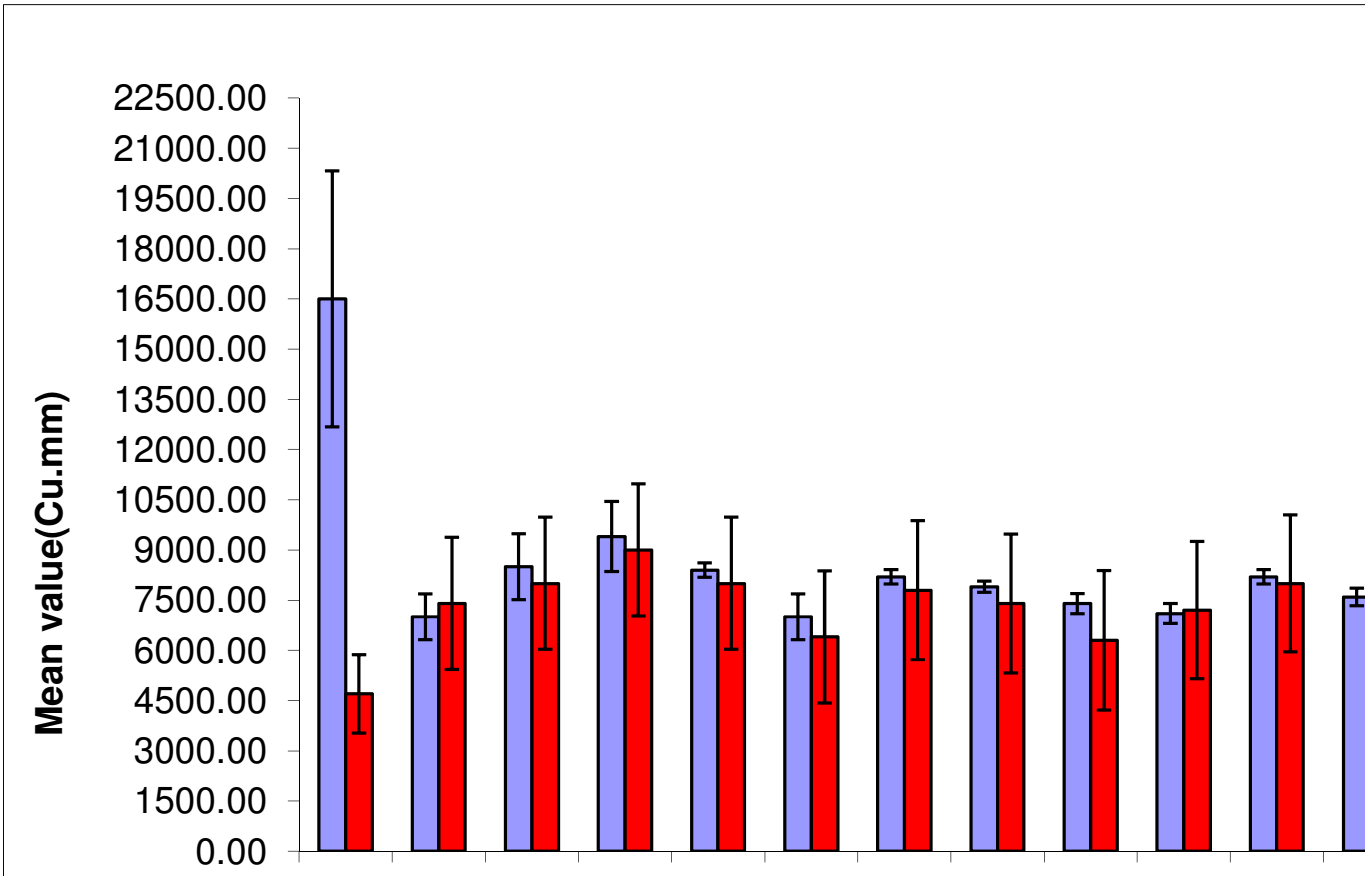

Figure-1
Haemogram of WBCs

Results and Discussion

In the present work leukocyte count was found to be variable according to the reproductive status of the male and female. Even though our results are comparable to the results of other bats but the ranges in the previous works were not emphasized on the reproductive status of either sexes. Thus the average mean white cell counts for the females were (4,700 – 9,000mm³) and for the male (7,000 – 16,500mm³). The figures reveal a striking difference between both the sexes, being significantly higher in the females. The striking differences ($P > 0.10$) noted in both the sexes of bats was not registered in *Ursus arctos*[15]. Our values are considerably higher than the insectivorous bats, *Myotis lucifugus*[16] (2 – 4000/mm³); in *Tadarida brasiliensis* (2.5 – 400/mm³) and in the vampire bat, *Desmodus rotundus murinus*[17] (3000 – 8000/mm³) Thus, it appears that in general, a lower white cell count is a characteristic of smaller species[18].

The leucocyte and other parameters may vary greatly from day to day in one individual and exceed differences in counts for a single species. The physiology of fruit and nector-eating bats differs from that of insect-eating species, this situation may arise by the effects of pathogens, parasites, daily fluctuations in temperature and other variables such as reproductive status[19]. Even though earlier authors have not correlated haematology with reproduction excepting[19] in fruit bat (gravid female, *Artibeus lituratus*, 8350; in gravid Phylostomus discolor 4350; in lactating P. discolor, 6575) but we have studied and correlated the complete breeding cycle. Thus in female during the 1st phase of reproduction anestrous (September), proestrous (October), oestrous (November), the mean leukocyte count was significantly higher which declined insignificantly during early pregnancy (December + January), mid-pregnancy (February/May); Advanced pregnancy (March/June) late pregnancy / delivery /abortion (April). As mentioned above the variability in the WBC count during pregnancy, the bats are more vulnerable to diseases therefore a rise in leukocyte count was encountered. Such changes also have been observed in the second phase of pregnancy as well as during lactational anestrous (July and August). In the adult males the testes show spermatogenic activity and an increase in the interstitial tissue from October to April, although there are two distinct peaks of activity, once during October-November and a second during February-March. These two periods correspond to the period immediately prior to the two periods of copulation. The

epididymis contains sperms from October to April. The significantly higher values during July (16500, inactive male) may be the result of subclinical disease or of natural day to day fluctuations or may be for phagocytosis of sperm debris / undivided spermatogenic elements / various spermatogenic elements like sperm mother cells, spermatocytes, round and long spermatids, sperm tail or heads, atrophied Leydig cells by the leukocytes. Infilteration of leukocytes from the mesenchyme via tunica propria in the epididymis is of common occurrence since the dead spermatogenic elements and sperm pass via the epididymis. All this support the significant decrease of WBC during testicular activity since they are needed least for phagocytosis. During other months the WBC counts was almost stable.

Conclusion

From the above study it is concluded that since bats can exceed or at least equal the capacity of any other mammal to mobilize energy within a brief period of time, tolerate high rates of water loss through evaporation and concentrate urine, these remarkable characteristics emphasize the fact that RBC value fluctuation may be the result of environmental factors and physiological system adjusting under considerable stress.

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