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ALTERATION IN ERYTHROCYTE COUNT AND ERYTHROCYTE SIZE IN *FELIS DOMESTICUS* AND *FUNAMBULUS PALMARUM* WITH REFERENCE TO NATURAL AND ARTIFICIAL DIET

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Abstract

The paper deals with an experiment on the morphological variation which shows that when the animals (*Felis domesticus*, a carnivore and *Funambulus palmarum*, a herbivore) were fed with artificial diet that contains food preservatives and additives shows a significant ($P < 0.05$) increase in their erythrocyte size and a significant ($P < 0.05$) decrease in their erythrocyte count in the blood of both mammals under artificial diet in all three seasons (Summer, Rainy and Winter Seasons).

INTRODUCTION:

In the present study an attempt has been made to observe changes in erythrocyte size and erythrocyte count in blood of two mammal species *Felis domesticus* and *Funambulus palmarum* differing in their dietary habit after feeding with natural and artificial diet. *Felis domesticus* is a house cat species of Felidae family. Cats are carnivorous and are highly specialized for hunting. The domestic cat hunts and eats kill birds,mice, grasshopper, cockroaches but most of the cats like milk. *Funambulus palmarum* (Squirrel) is a rodent species of sciuridae family. Generally the Squirrels are categorized as omnivore in feeding habit. They feed on seeds, ground nuts, fruits and buds, insects etc. These two mammals were selected because of the denote variation in blood composition as a result three observation on three levels - kind of food habit,specific dietary provision and seasonal fluctuation in blood. The rate of erythrocyte production determines the size of red cell mass, which in turn determine the haemoglobin concentration, determines the degree of the tissue oxygenation and the degree of tissue oxygenation determines the rate of erythrocyte production. A variation in size is known as anisocytosis. The small size and the great number of the red cells are of considerable importance. This makes the available surface area very large and thereby facilitates rapid exchange of gases and other materials between the cells and the plasma. Food additives and preservatives are used in present days which create adverse effects on blood of living being. Such experiments are also conducted on other aspects related to blood in these

mammals after administrating artificial diet (Agarwal, 2014 & 2015). The blood is sole carrier of nutrients that are absorbed from the digested food ingredients of the alimentary canal of the animals. Food additives and preservatives are used in present days which create adverse effects on blood of living being. Such experiments are also conducted on mammals after administrating artificial diet.

MATERIAL AND METHODS:

In the present investigation two different food habit mammals namely, *Felis domesticus* (a carnivore) and *Funambulus palmarum* (a herbivore) were selected as experimental animals. Both selected mammals may prove to be good experimental objects to denote the variations in the blood composition.

As twenty *Felis domesticus* (cat) with an average starting weight of 2.8 kg and *Funambulus palmarum* (Squirrel) with an average starting weight 95 g were selected for the laboratory stock. Both the mammals were allowed to acclimatized to the laboratory condition for 10 days. During acclimatization the *Felis domesticus* and *Funambulus palmarum* fed with natural diet. Both group of mammals were housed in two group of 10 separately.

Second group of *Felis domesticus* was transported to laboratory. *Felis domesticus* was fed with a diet of cat food (Premium cat food of PETCO) mixed with 3% BHA (food preservative) and 2% artificial dyes (food colourant – Red Led, Copper Arsenite). The second group of *Funambulus palmarum* were also transported to laboratory and fed with a mixed diet of ground nut water adlibitum, 3% BHA (food preservative) and 2% artificial dyes (food colourant- Red Led, Copper Arsenite). The mammals were given 2-3 days acclimation period before taking blood for haematological and biological studies, each animal of both mammals was weighted to nearest gram.

For haematological investigation, the blood was collected from left branchial vein using micro syringe with 24 or 25 gauge needle. The blood was used for evaluating the haematological parameters. On every season the experiment were conducted on 15 day of month at 10 O' clock to avoid any variation due to circadian rhythm. All the haematological estimation were done by haemocytometer. Now take the pipette mean for R.B.Cs which is already rinsed with alcohol or spirit or either and thoroughly dried. Suck the blood in the pipette up to 0.5 mark taking care that air bubbles are not included. The excess of blood, if any, may be run out by touching the mouth of pipette to the palm. The blood which is sticking to the outer side of pipette should also be carefully cleaned. The pipette should now be transferred to the container of Hayem's solution which is carefully sucked upto 101 mark. The pipette is now held horizontally between the fore-finger and thumb or palm surfaces of the hand and rotated several times so that blood thoroughly mixes with Hayem's fluid. The red bead in the pipette also helps in mixing. In this way dilution of blood becomes 200 times.

Before starting to count red blood corpuscles(RBCs) in this diluted blood, place the coverslip on the counting chambers. The coverslip is supported upon the side platform but remains separated from the central platforms by a distance of 0.1 mm. First reject 3 or 4 drops of mixture from the pipette. Now apply the tip of the pipette between the coverslip and the platform and allow few drops of blood mixture to flow in the narrow space between the coverslip and the counting chambers. If necessary both chambers may be filled in this manner. Blood mixture remains up between the coverslip and the counting chambers because of capillary action. Air should not be taken into and also pouring excess blood mixture so that the H-shaped groove remains free from it.

When the counting chambers are properly flooded the slide may be kept aside for a few minutes so that the red blood corpuscles (RBCs) settled down on the bottom floor of the two counting chambers. Now

transfer the slide gently and carefully under the microscope without disturbing the settled red blood corpuscles (R.B.Cs) and start counting them.

COUNTING:

It is not necessary to count the red blood corpuscles (R.B.Cs) in all the 400 smallest squares or even in the 25 smaller squares, count them only in five smaller squares. i.e. in the 1st, 5th, 13th, 21st, and 25th, four in the corners and one in the centre, each sixteen small squares. The total count of eighty small squares multiplied by 10,000 to get the number of RBC/cubic ml. of the blood.

SIZE MEASURE

The size of erythrocytes are measured in µ on air dried methanol fixed blood film by calibrated ocular and stage micrometer. The average size of the erythrocytes can be determined from a film preparation with the help of an instrument known as Halometer. It can also be measured directly under the microscope by an instrument known as Micrometer. Under a microscope, stained red blood corpuscle (R.B.C.) with a high mean corpuscular volume (MCV) appear larger than cells with a normal (Macrocytic) under artificial diet.

OBSERVATION:

The following comparative blood parameters of the two mammals during summer, rainy and winter seasons were proposed to evaluated in the present study. It was observed that under natural diet in case of *Felis domesticus*, the erythrocyte size in blood was 5.60 µm per 100 ml in summer, 5.65 µm per 100 ml in rainy season and 5.68 µm per 100 ml in winter season. In *Funambulus palmarum* the erythrocyte size in blood was 6.80 µm per 100 ml in summer, 6.90 µm per 100 ml in rainy season and 6.99 µm per 100 ml in winter season under natural diet.

Table 1 Alteration in the erythrocyte size in the blood of *Felis domesticus and Funambulus palmarum* under natural and artificial diet during summer, rainy and winter seasons.

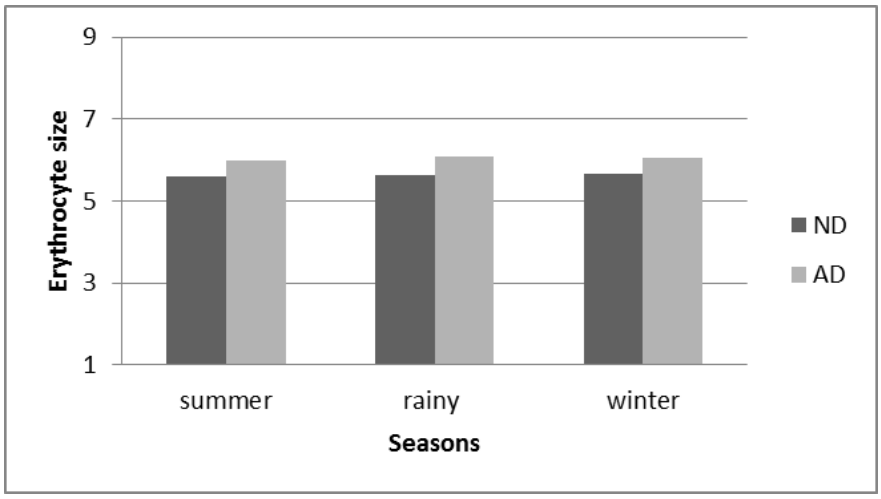
S.No.	Mammals	Summer		Rainy		Winter	
		ND	AD	ND	AD	ND	AD
1.	*Felis domesticus*	5.60±0.15	6.00±0.210	5.65±0.180	6.10±0.160	5.68±0.240	6.05±0.200
2.	*Funambulus palmarum*	6.80±0.35	7.30±0.28	6.90±0.20	7.35±0.32	6.99±0.17	7.25±0.30

Values given in the table are the mean of 9 observations each

Values are significant at $P < 0.05$

ND = Natural diet Ad = Artificial diet

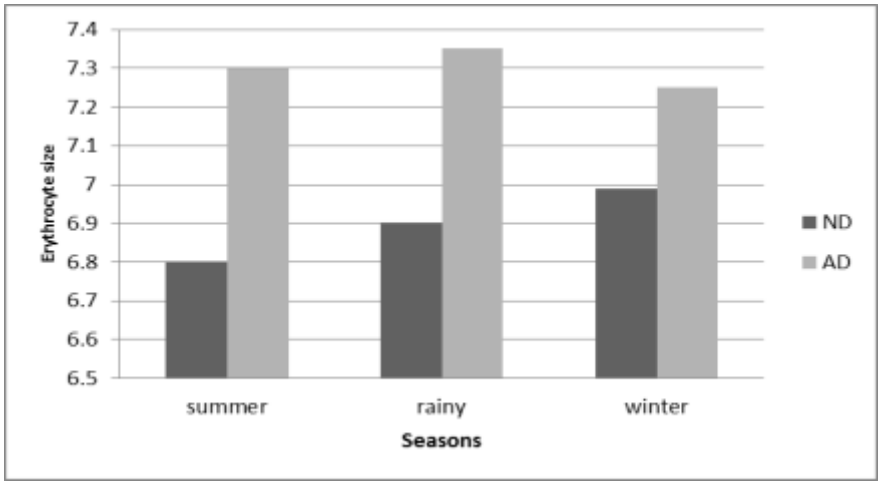
It was observed that under artificial diet in case of *Felis domesticus*, the erythrocyte size in blood was 6.O0 µm/100 ml in summer, 6.10 µm/100 ml in rainy season and 6.05µm/100ml in winter season. In Funambulus palmarum the erythrocyte size in blood was 7.30µm/100 ml in summer, 7.35µm/ 100 ml in rainy season and 7.25µm/100 ml in winter season under artificial diet (TABLE-1).



ND = Natural Diet

AD = Artificial Diet

Fig 1 Alteration in erythrocyte size in the blood of *Felis domesticus* under natural and artificial diet.



ND = Natural Diet

AD = Artificial Diet

Fig II Alteration in Erythrocyte size in *Funambulus palmarum* under artificial diet during summer, rainy and winter seasons.

After artificial feeding there was a increase in erythrocyte size in blood in *Felis domesticus* and *Funambulus palmarum* in three season (summer, rainy and winter seasons) (Fig I, Fig II).

Table 2 Percentage alteration in the erythrocyte size in the blood of *Felis domesticus* and *Funambulus palmarum* under artificial diet during summer, rainy and winter seasons.

S.No.	Experimental animals	Summer	Rainy	Winter
1	*Felis domesticus*	+17.89%	+17.169%	+18.870%
2	*Funambulus palmarum*	+13.72%	+14.22%	+23.32%

After artificial feeding there was a drastic increase in erythrocyte size in blood (Table -2) .

In *Felis domesticus* the elevation in Erythrocyte size in blood was +17.89% in summer, +17.169% in rainy season and +18.870% in winter season similarly in *Funambulus palmarum*, the elevation in erythrocyte Size in blood was +13.72% in summer, +14.22% in rainy season and +23.32% in winter season.

The following comparative blood parameters of the two mammals (*Felis domesticus* and *Funambulus palmarum*) during summer, rainy and winter seasons were proposed to evaluated in the present study.It was observed that under natural diet in case of *Felis domesticus* the erythrocyte count in the blood was 8.30 x 106 µl/ 100 ml in summer, 8.75 x 106 µl / 100 ml in Rainy season and 8.50 x 106 µl/ 100 ml in winter season. In *Funambulus palmarum*, the erythrocyte count in blood was 8.30 x 106 µl/100ml in summer, 8.00 x 106 µl/100 ml in rainy season and 8.20 x 106 µl/ 100 ml in winter season under natural diet.

Table 3 Alteration in the erythrocyte count in the blood of *Felis domesticus* and *Funambulus palmarum* under natural and artificial diet during summer, rainy and winter seasons.

S.No.	Mammals	Summer		Rainy		Winter	
		ND	AD	ND	AD	ND	AD
1.	*Felis domesticus*	8.30±0.25	6.98±0.45	8.75±0.45	7.50±0.36	8.50±0.17	7.90±0.28
2.	*Funambulus palmarum*	8.30±0.26	6.95±0.32	8.00±0.35	7.00±0.28	8.20±0.17	7.30±0.30

Values given in the table are the mean of 9 observations each

Values are significant at $P < 0.05$

ND = Natural diet Ad = Artificial diet

It was observed that under artificial diet in case of *Felis domesticus* the erythrocyte count in the blood was 6.98 x 106 µl/ 100ml in summer, 7.50 x 106 µl/100 ml in rainy season and 7.90 x 106 µl/ 100 ml in winter season. In *Funambulus palmarum*, the erythrocyte count in the blood was 6.95 x 106 µl/100 ml in summer, 7.00 x 106 µl/100 ml in rainy season and 7.30x106 µl/100 ml in winter season under artificial diet (Table -3).

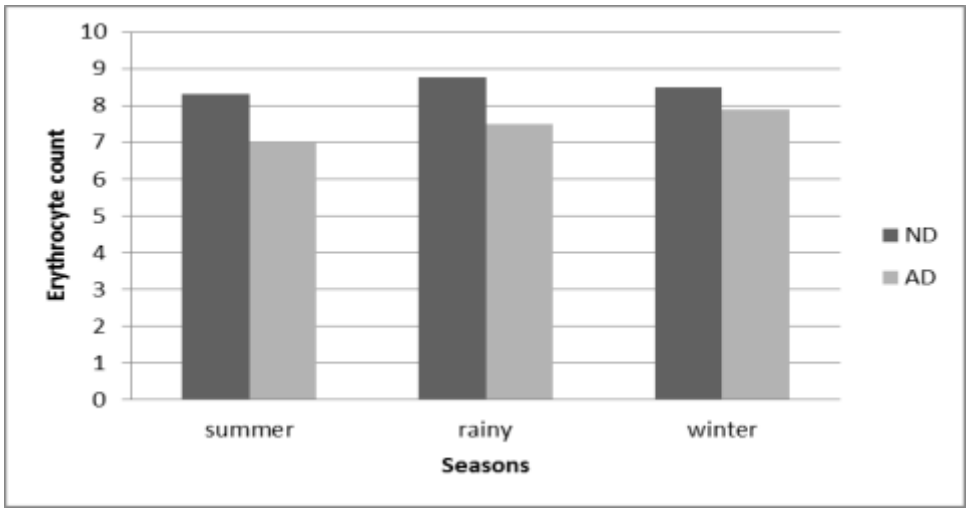


Fig III Alteration in Erythrocyte count in *Felis domesticus* under artificial diet during summer, rainy and winter seasons.

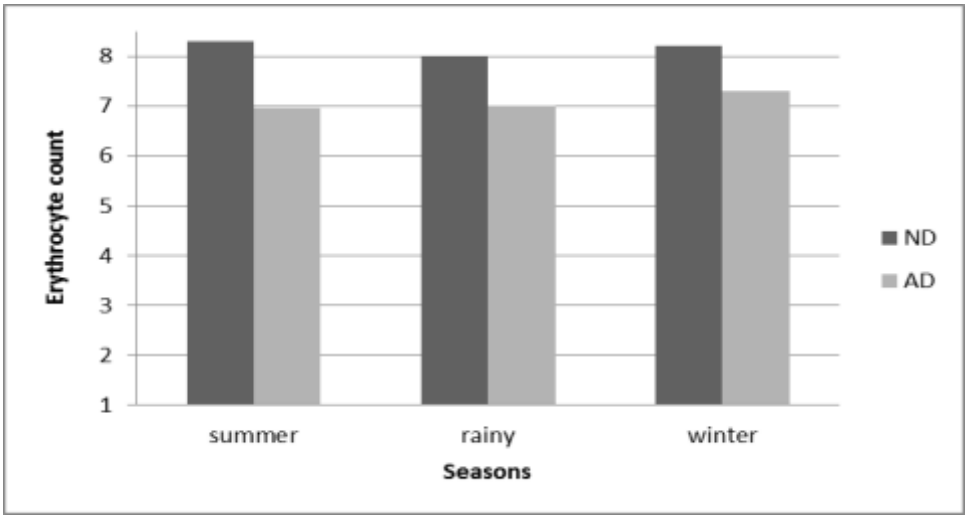


Fig IV Alteration in Erythrocyte count in *Funambulus palmarum* under artificial diet during summer, rainy and winter seasons.

After artificial feeding there was a drastic decrease in erythrocyte count in the blood of both mammals under summer, rainy season and winter seasons (Fig III, Fig IV).

Table 4 Percentage alteration in the erythrocyte count in the blood of *Felis domesticus* and *Funambulus palmarum* under artificial diet durning summer, rainy and winter seasons.

S.No.	Experimental animals	Summer	Rainy	Winter
1	*Felis domesticus*	-15.90%	-14.28%	-7.06%
2	*Funambulus palmarum*	-16.26%	12.50%	10.09%

(+) = Increase

(-) = Decrease

In *Felis domesticus* the depletion in erythrocyte count in the blood was -15.90% in summer, -14.28% in rainy season and -7.06% in winter season. Similarly in *Funambulus palmarum*, the depletion in erythrocyte count in the blood was -16.26% in summer, -12.50% in rainy season and 10.97% in winter season under artificial diet (Table -4).

DISCUSSION:

In the present study it was found that the size of erythrocyte in the blood was little bigger in both experimental animals under artificial diet. Yadav (1980) observed that the size of erythrocyte in male are smaller than female but simultaneously he also observed the size of erythrocyte become enlarged during summer.

In other vertebrates like Amphibians (Szarski and Czopek 1966), Reptiles and Birds, (Banerjee and Ahmad 1964), observed the size of erythrocyte was smaller in male than female.

Present study reflected a significant fall in erythrocyte count in the blood of *Felis domesticus* and *Funambulus palmarum* under artificial diet during summer, rainy and winter seasons. As such variation in

the value of total erythrocyte count (TEC) in *Felis domesticus* and *Funambulus palmarum* in different season may be due to the variation in the activity of *Funambulus palmarum* and *Felis domesticus*. Maximum decrease value of total erythrocyte count (TEC) during summer season indicated higher rate erythropoiesis in active *Funambulus palmarum* than less active *Felis domesticus*.

Engle and Davis (1964) also reported that in active vertebrate the total erythrocyte count (TEC) ranges from 1.21 to 3.54 x106/mm3, while in less active forms the total erythrocyte count (TEC) varies from 0.6 to 0.84x106/mm3 which is in agreement with present observation.

Ali and Abdul (1983) reported decrease in Red blood corpuscles (RBC) in Rabbit during malathion poisoning. Ahmad (1978) reported decrease in Red blood corpuscles (RBC) count in mice after exposure of methyl parathion, diazinon and dimethoate, reduction in RBC count in mice after monocrqtophos are report by (Gupta et al., 1982, Bilgrami et al. 1987) described significant fall in total red blood corpuscles (RBC) in critinin treated mice.

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