EFFECTS OF GESTATION STAGE ON SOME HEMATOLOGICAL PARAMETERS OF RATS IN MUBI, ADAMAWA STATE, NIGERIA

[1]Addass, P. A., [2]David, D. L. and [1]Adati, Y.

[1]Department of Animal Breeding and Physiology, College of Animal Science
University of Agriculture, Makurdi
PMB 2373, Makurdi, Benue State, Nigeria

[2]Department of Biological Sciences, Adamawa State University, Mubi,
PMB 25, Adamawa State, Nigeria.

Abstract

Thirty (30) young female albino rats sourced from Biology Department Adamawa State University, Mubi were randomly selected for the study. Three (3) stud males were used for mating, in the ratio of 1:10 male to females. Total of thirty three (33) rats comprising of 30 females and 3 males formed the foundation stock. Blood samples were collected before mating (day 1) and subsequently on 5 days interval up to 20 days of gestation. Palpation for pregnancy test was carried out on days 10 – 12 after mating. Significant stage of pregnancy effects were observed on most parameters studied. Packed cell volume (PCV) was observed to decrease with increase in gestation period. Highest (9.87±0.26%) PCV value was observed on day 1 and least (7.63±0.26%) was on day 20. Highest (71.97±1.27%) hemoglobin (Hb) value was recorded on day 1 and least (54.93±1.27%) on day 20. Highest (231.03±4.08mm) red blood cell count (RBC) was recorded on day 1 as well as white blood cell count WBC (8.10±0.33mm). Highest (7.31±0.01) power of hydrogen (pH) value was also observed on day 1. Generally, it was observed that hematological and blood chemistry parameters of rat decreases with advancement in pregnancy.

Keywords: Hematology, Blood chemistry, Rats, Pregnancy, Gestation State

Introduction

The great adaptability and hardness of rat had made it a suitable model for a variety of different types of researches which include endocrinology, physiology, biochemistry, pharmacology, neurophysiology (Anway, *et al*., 2006). Due to high tolerance to depreciation during pregnancy in rats, it has become the principal animal for pregnancy study. The rat has recently been found to be particularly suitable for research and training in microsurgery and embryo transplantation procedures. Their body have been found to be similar in some physiological data with human beings which include: respiratory frequency (breath/min) 85 – 110, blood pressure (mmhg) 60-90, heart beat frequency (beat/min) 320 – 480, ambient temperature tolerance range (^{o}C) 5 – 32 and rectal temperature (^{o}C) 38 – 39, (Anway, *et al* ., 2006). The pregnancies of rabbits affect most hematological and serum biochemistry variables such as reduction in erythrocyte count (Kim, *et al.*, 2002). Reduction in the erythrocyte count and hemoglobin values in pregnant animals was also reported by Nuwayhid (1979) which he said to be as a result of related physiological anaemia occurring due to haemodilution. A shorter erythrocyte life span within circulation during gestation was also reported (Brecher and Stohlman, 1961). Increase in mean corpuscular volume (MCV) was also

reported in rabbit by Rewkiewiccz-Dziarka (1975) and Kim, *et al.* (2002). In group of pregnant rabbits, the following changes were observed: - blood coagulation – related parameter and platelets increased progressively and fibrinogen also increased slightly from organogenesis, prothrombin tune was significantly prolonged during organogenesis and shortened in the late foetal growth stage. Asteriated partial thromboplastin tube was significantly prolonged during the foetal growth stage and antithrombin III increased during and after late organogenesis (Kim, *et al.,* 2002, Mizoguchi, *et al.,* 2008). Total protein, albumin, glucose, cholesterol, calcium, blood, urea, nitrogen and creatine decreased significantly during the middle and/or late periods of gestation (Mizoguchi, *et al.,* 2008). Calcium and phosphorus levels of pregnant rabbits were reported lower than that of non-pregnant (Barlet, 1980, McGill and Rowan, 1989).

Generally, pregnancy test has been one of the ways of managing pregnant animals and humans. Pregnancy has been known to be associated with some physiological changes which have prompted the study. It is therefore the intention of the study to come up with some likely ways through which blood parameters can be used in managing pregnancy in animals and to avert likely associated problems.

Materials and Methods

Thirty (30) matured, non-pregnant female albino rats, average age of 5-6 months were sourced from Biology Department Adamawa State University, Mubi for the study. Microhaematocrit centrifuge, PCV reader, capillary tubes, sealant, EDTA, Hb pipette, distilled water, N/10 HCl, sample bottles, electric microscope, haemocytometer, 2ml syringes and needles, pH meter, cell counter, WBC and RBC pipettes and diluting fluid were used for the study.

Experimental Animals

Initial blood samples (before mating) were taken from the non-pregnant matured female albino rats through the ear vein before taking them to a stud male for mating. After successful mating, the female rats were kept in individual cages. Confirmation of pregnancy test was carried out on days 10 – 12. If animal found not pregnant, it will be taken back to the stud male for re-mating. All the animals were fed *ad-libitum,* fresh and clean water provided, daily cleaning of pens carried out for the period of study.

Data Collection and Analysis

Initial blood sample (day 1) before mating were collected from each female rats (doe), then after every 5 days up to day 20 of gestation. Blood sample collected from each female was put into sample bottles containing anticoagulant. Blood samples collected were used to analyse for packed cell volume (PCV), haemoglobin (Hb), white blood cell (WBC), red blood cell (RBC) and power of hydrogen (pH). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) as described by Rietkert, *et al.*, (1994) was adopted. Data collected were subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1990) and means separation using Ducans Multiple Range Test (DMRT).

PCV was determined using the microhaematocrit method (Coles, 1986), Hb using Haemometer micrometer Sahlin Method, RBC and WBC using Neubeaur counting chamber (Brown, 1979), pH using pH meter, Jenway Model, 3505 Kurzanleitung, MCV, MCH and MCHC were determined by using the standard formular developed by Swenson (1970).

Results and Discussion

Shown on Table 1 are the means ± SE by stage of pregnancy of PCV, RBC, WBC and pH of albino rats. Significant ($p<0.001$) stage of pregnancy effects were evident on all the parameters studied. Highest (9.87±0.26%) PCV value was observed on day 1 (non – pregnant rats) followed by rats of 5 days pregnancy (8.37±0.26%) then similar values of PCV of rats at day 10 (7.67±0.26%) and day 15 (7.73±0.26%) of pregnancies while rats at day 20 of pregnancy had the least (7.63±0.26%) PCV values.

On RBC, day 1 (231.03±4.08mm) and day 5 (233.10±4.08mm) of pregnancy had similar values while pregnancy of days 10 (204.13±4.08mm), day 15 (205.19±4.08mm) and day 20 (199.23±4.08mm) recorded similar values. On WBC, non pregnant (day 1) had highest (8.10±0.33mm^3) value followed by day 5 pregnancy (7.27±0.33mm^3) then similar values of day 10 (6.40±0.33mm^3) and day 15 (6.90±0.33mm^3) while pregnancy at day 20 had the least (6.33±0.33mm^3). The power of hydrogen (pH) values showed that non-pregnant rats (day 1) had the highest (7.31±0.01) value followed by day 5 (7.20±0.01) while similar and least values were observed on days 10 (7.18±0.01), day 15 (7.18±0.01) and day 20 (7.19±0.01).

Shown on Table 2 are the means ±SE by stage of pregnancy of Hb, MCH, MCV, and MCHC of albino rats. Non-pregnant rats (day 1) had the highest (71.97±1.27%) Hb values followed by day 5 of pregnancy (57.87±1.27%), while similar values were obtained on days 10 (56.57±1.27%), 15 (54.83±1.27%) and 20 (54.93±1.27%). Significant ($p<0.01$) stage of pregnancy effect was pronounced on MCH with the highest value (74.57±2.41pg) on day 20 of pregnancy followed by similar values of day 1 (74.13±2.41pg) and day 5 (71.82±2.41pg) while day 10 (71.37±2.41pg) and 15 (71.32±2.41pg) had the least similar MCH values. Non-significant MCV effect was observed on stage pregnancy. Significant ($p<0.001$) stage of pregnancy effect was observed on MCHC with highest (0.32±8.37g/dl) value recorded on day 1 followed by day 5 (0.29±8.37g/dl) then similar values on day 10 and 20 (0.28±8.37 g/dl) each while least (0.27±8.37g/dl) value was recorded on day 15 of pregnancy.

It has been observed in rats that except MCH all the other hematological parameters studies tends to decrease with increase in gestation length. Highest values were recorded mostly on the non-pregnant stage (day 1) and decrease thereafter. The findings of this study agrees with the study of Nuwayhid (1979) and Matt (1993) who reported that there were reduction in the erythrocyte count and hemoglobin values in pregnant animals which might have been as a result of physiological anaemia occurring in pregnant females due to haemodilution. Brecher and Stochlman, (1961) also reported that a shorter erythrocyte life span within circulation during gestation might be another cause of reduction of erythrocyte count in pregnant females.

In support of the study are the findings of Chauchy and Webster (1992) and Kim *et al.* (2002) who reported increase in MCH which they said was as a result of immature corpuscles in the pregnant rabbit.

Generally, hematology and blood chemistry indices of rats decrease with increase gestation length which may likely suggesting for intensive management besides good feeding during pregnancy in rats and other female animals.

Table 1: Means ± SE by stage of pregnancy of PCV, RBC, WBC and Hb of Albino Rats

SV	N	PCV (%)	RBC (mm)	WBC (mm^3)	pH
SP (days)		***	***	***	***
1	30	9.87±026a	231.03±4.08a	8.10±0.33a	7.31±0.01a
5	30	8.37±026b	233.10±4.08a	7.27±0.33b	7.20±0.01b
10	30	7.67±026d	204.13±4.08b	6.40±0.33cd	7.18±0.01c
15	30	7.73±026d	205.17±4.08b	6.90±0.33c	7.18±0.01c
20	30	7.63±026c	199.23±4.08b	6.33±0.33d	7.19±0.01c

Note: N = Number of observation, PCV = Packed Cell Volume, RBC = Red Blood Cell Count, WBC = White Blood Cell Count, pH = Power of Hydrogen, *** = $p<0.001$, SV=Source of Variation, SP=Stage of Pregnancy

Table 2: Means ± SE by Stage of pregnancy of Hb, MCH, MCV and MCHC of Albino Rats.

SV	N	Hb (%)	MCH (Pg)	MCV (Fl)	MCHC (g/dl)
SP(days)		***	**	NS	***
1	30	$71.97±1.27^{a}$	$74.13±2.41^{ab}$	$4.32±4.25^{a}$	$0.32±8.37^{a}$
5	30	$57.87±1.27^{b}$	$71.82±2.41^{ab}$	$4.15±4.25^{a}$	$0.29±8.37^{b}$
10	30	$56.57±1.27^{c}$	$71.37±2.41^{b}$	$4.02±4.25^{a}$	$0.28±8.37^{bc}$
15	30	$54.83±1.27^{c}$	$71.32±2.41^{b}$	$3.70±4.25^{a}$	$0.27±8.37^{c}$
20	30	$54.93±1.27^{c}$	$74.57±2.41^{a}$	$3.78±4.25^{a}$	$0.28±8.37^{bc}$

Note: N = Number of observation, Hb = Haemoglobin Concentration, MCH = Mean Corpuscular Haemoglobin, MCHC = Mean Corpuscular Haemoglobin Concentration, NS = Not Significant, ** = $p<0.01$, ***= $p<0.001$,SV=Source of Variation, SP=Stage of Pregnancy

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