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Monogamous and Polyandrous Mating Systems: Effects on Growth and Haematological Indices of The Albino Rat

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Citation

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Abstract

Thirty albino rats (20 males and 10 females) of the Wistar strains were used in a sixteen week trial to evaluate the effects of monogamous and polyandrous groupings on growth and haematological variables. The monogamous group (MG) comprised 5 males and 5 females while the polyandrous group(PG) was made up of 15 males and 5 females.

Final weights of the monogamous and polyandrous groups were 222.11g and 212.33g with a total weight change of 151.83g and 148.77g respectively. The final weight of males in the two groups gave statistically significant (P< 0.05) values of 257.32g for the MG as compared with 232.38g for the PG. The weight change in males was also significantly higher (P< 0.05) in the monogamous than in the polyandrous group (192.20g versus 168.16g).

The packed cell volume (PCV), haemoglobin concentration(Hb conc.) and percentage neutrophil were significantly increased (P< 0.05)in the MG whereas the percentage lymphocyte content of the blood was significantly higher (P< 0.05) in the PG when the two sexes were considered together. The PCV and percentage lymphocyte differed significantly (P< 0.05) among males in the two social groups in which the MG showed higher values (47.67% vs. 44.11% and 35.67% vs. 32.89%) for these two haematological indicators respectively

The monogamous male(MM) rats also recorded higher but statistically insignificant (p> 0.05) values for red blood corpuscles(RBC), white blood corpuscles(WBC), Hb.conc., mean corpuscular haemoglobin concentration(MCHC), %lymphocyte and %monocyte than the polyandrous males(PM). The PM on the other hand gave higher but insignificant values for mean corpuscular haemoglobin(MCH), mean corpuscular volume(MCV), %eosinophil and %basophil than in the MM.

Higher values (P< 0.05) of PCV, MCH, MCV and %neutrophil were obtained for the monogamous females (MF) while the polyandrous females(PF) recorded a higher (P< 0.05) %lymphocyte (53.00% vs. 59.00%) The RBC, WBC, MCHC, %eosinophil and %basophil increased slightly (P> 0.05) in the PF. Values for %monocyte and Hb.conc. showed slight (P> 0.05) increase among the MF.

It may be concluded that monogamy promotes better weight change(growth) in males while polyandry influences better weight change in the female rats. Also monogamous groupings could result in increased PCV, Hb.conc. and %neutrophil content of the blood while polyandry could lead to a high % blood lymphocyte when the sexes are taken together. The increased circulating leucocytes observed in the polyandrous females could be as a result of their physiological adjustment to social stress.

INTRODUCTION

The role of social biology in the evolution of mating systems that culminate in reproductive success in animals cannot be overemphasized. What is of clarity in sexual reproduction is that the male and the female sexes must come together in one way or the other to effect the fusion of the male and female gametes as a prerequisite for bringing another life form into being. The mediator of this coming together of the germinal cells is the pheromone ([1]). This coming together of two sexually dimorphic organisms is rather very complex and varied and its variants as observed in diverse mating systems which have evolved over the years are to give each species that mating system which will afford it the continuity of expressing its reproductive success in successive generation.

Attempts to carry out this reproductive success to its logical conclusion that will benefit either or both sexes have been studied in spiders ([2]), crickets ([3]), sparrows ([4]) and even the evolution of cuckoldry and sperm competition in mammals and even man ([5;6;7]).

Monogamy and polyandry as two variants of mating systems are employed as strategies for championing the course of reproductive successes of animal species that engage in them ([8;9]). Monogamy is however very rare among animal species ([10]) and more so difficult to adhere to by the males which are always out to increase their inclusive fitness by mating with as many available females as possible ([11]). Majority of animal species therefore engages in polygamy with its many variants like polygyny, polygyandry and polyandry ([12];[13]).

Polygyny is favoured by sexual dimorphism in which the males are bigger than the females and could therefore use their sheer size and strength to acquire and maintain a harem of matured females. Polyandry on the other hand is at the behest of the female sex at whose whims it can metamorphosed into cuckoldry, prostitution polyandry ([14]), resource defence polyandry ([15]) and female defence polyandry ([16];[17]).

Most of the research works on mating system in animals have always revolved around monitoring their behaviour in their social environment in relation to sexual reproduction i.e. their reproductive behaviour. If attainment of reproductive success is the ultimate goal and long term optimality focus of any animal species, the short term process of attaining such long term optimality depends on such day to day activities like foraging for food, evasion of potential preys and looking for the most energy –efficient ways of performing these activities ([10]). Pivotal to all these daily chores is satisfying its food needs for growth which will engender its sexual maturity since it is known that body size and not age plays a very important role in the attainment of sexual maturity and hence mate selection ([18]).

Comparative studies on mating systems vis-à-vis their contribution to growth and attainment of sexual maturity have been a much neglected aspect of research in the field of behavioural physiology and socio-biology in this pat of the world. The same thing can also be said when haematological indices of animals in different social environment are taken into consideration, whereas much stands to be gained about the physiological functionality of these animals as occasioned by their social environment or the type of mating system they evolved or are subjected to if their blood parameters are investigated.

Certain males animals engage in violent attempts to force themselves on sexually resistant females ([19]). Such sexual harassment has been known to lead to damaging consequencies on the harassed females ([20], [21]). This issue of coercive mating or sex has raised a lot of question on the emotional trauma that such females are made to pass through. This emotional trauma, marked by the release of the stress indicator hormones (the corticosteroids) has great impact on the blood parameters with a tendency of causing leucocytosis, neutrophilia, lymphopenia and eosinopenia ([22]). A very easy way of monitoring or knowing whether the female animal has been traumatized in her sexual relationship with her male mating partner is to check her haemogram as a reliable indicator of these sexually induced stress factors.

Apart from coercive mating with the females, some adult males compete violently for dominance thus inflicting serious injuries on each other whenever they engage in these costly struggles ([23]). This costly struggle is the order of the day in female-induced polyandry where the males slug it out among themselves for the only available female with the concomitant release of epinephrine into the blood circulation by these animals. The secretion of epinephrine in these animals increases the circulation of blood and lymph and consequent sequestration of leucocytes into the peripheral blood causing leucocytosis accompanied by neutrophilia and/or lymphocytosis ([22],[24],[25]). It is in realization of the effect of this physical exertion on animals that Schwabenbauer ([26]) recommended the tail vein sampling blood technique in rats.

Hamilton and Zuk ([27]) found a correlation between plumage brightness and the incidence of blood parasites in some species of birds. This has served as a signal of healthiness on the part of the males to their choosy female partners. Also Zuk and Johnson ([28]) linked sexual behaviour with immunity, which essentially unraveled what goes on in the leucocyte component of the blood and their ability to be sensitized to initiate immunological response.

This study was therefore undertaken to provide the much needed linkage between the social environment in which animals develop as it relates to their growth and haematological indices using the albino rats as the animal model.

MATERIALS AND METHOD.

Experimental location: This trial was carried out in the “Rat House”(a unit designated for rat studies) of the Department of Animal Production and Health, Federal University of Technology, Akure-Nigeria. The site is located in the hot and humid equatorial climate with nine months of rains and three months of drought. The rainfall pattern is bimodal and the two peaks nearly coincide with the equinoxes. The site (Akure) is located between latitude 70 52/ N and longitude 50 12/ E of Greenwich meridian.

Experimental animals and their management: Thirty albino rats of the Wistar strains were used for this study. They were purchased from the faculty of Veterinary Medicine, University of Ibadan, Ibadan-Nigeria. The rats were bought at their 5th week of age when they averaged 63.92 ± 0.34g in weight. They were housed in two separate cages constructed with wire nettings and reinforced with 3" x 4" wooden frames. Each cage measured 200cm x 100cm x 45cm (for length, width and height respectively). Each cage was further divided into five compartments measuring 40cm x 100cm x 45cm (for length width and height respectively. These cages were supported with six wooden legs, 60cm above the cemented floor.

The animals were divided into two groups- the monogamous group (MG) and the polyandrous group(PG). The MG that comprised 10 rats (5 males + 5 females) was assigned into one of the cages after the rats have been balanced for weight such that each of the five compartments housed a pair (one male + one female) of rats. The PG that consisted of 20 rats (15 males + 5 females) was also balanced for weight and allotted into five compartments in such a way that each compartment contained 3 male and 1 female rats.

Each compartment was fitted with a detachable feeder and drinker that permit daily cleaning and refilling with fresh feed and water. The animals were fed ad libitum with feed and water daily and kept in this compartment for a week to acclimatize them with their new environment before the commencement of data collection.

Experimental diet: Commercial rat-growers' pellets (Guinea Feeds), formulated by Bendel Feed and Flour Mill Limited, Benin-City-Nigeria was used to feed these rats throughout the duration of the experiment. The “guaranteed” analysis of the commercial pellets as supplied by the Company is as given in Table 1

Figure 1

Table 1: Guaranteed analysis of the growers' rat pellets

Ingredient	Composition
Crude protein	14.50%
Crude fat	4.80%
Crude fibre	7.20%
Crude ash	8.00%
Calcium	0.80%
Phosphorus	0.60%
Available Phosphorus	0.33%
Lysine	0.60%
Methionine	0.29%
Methionine + Cystine	0.52%
Vitamine A	8,000 IU
Vitamine D_3	2,400 IU
Vitamine B_2	15 mg
Vitamine E	4 mg
Vitamine C	50 mg
Manganese	30 mg
Zinc	30 mg
Sodium	0.15%
Metabolizable	2,300kcal/kg

Data collection: Data were collected on growth parameters by weighing the animal on a weekly basis to determine the weekly weight change. Data were also collected on blood analysis in the 16th week of the experiment.

Haematological analysis: Blood samples were taken from all the animals in the 16th week of the experiment by nipping off the end portion of the tail and allowing the blood to flow out freely. Blood collected this way was used to determine blood parameters like PCV, Hb.conc. RBC, WBC and differential white blood cell counts. Values of MCH, MCHC and MCV were calculated from PCV, Hb,conc, and RBC values by the method described by Schalm et al ([29]). PCV was determined by the haematocrit method as described by Alexander and Griffith([30]) while Hb.conc. was assayed using the cyanomethaemoglobin method of Alexander and Griffith ([31]). The estimation of RBC and WBC was by the improved

Neubauer counting chamber according to the method of Dacie and Lewis (32). The differential WBC was determined by the method described by Jain (33)

Statistical analysis: All data were subjected to statistical analyses Results were expressed as Means ± standard error of the mean (SEM). Test of significance between means was determined using the standardized t-test with SAS (34) package and results were considered as significant (P< 0.05) at 5% level.

Ethical Consideration: Ethical clearance for the use of the experimental rats was sought and obtained from the Ministry of Agriculture and Natural Resources of the Federal Republic of Nigeria under the Criminal Code Edict of 1964, CAP 30, Chapter 50 (Cruelty to Animals).Pp.183-185, Paragraph 495-499.

RESULTS AND DISCUSSION

GROWTH PERFORMANCE

Figure 2

Table 2 shows the growth performance of the monogamous and polyandrous groups of rats

Parameters	Monogamous Group	Polyandrous Group	± SEM
Initial wt/rat(g)	64.29	63.56	0.34
Final wt/rat(g)	222.11	212.33	17.07
Total wt change/rat(g)	157.83	148.77	14.24
Daily wt change /rat(g)	1.41	1.33	0.14
Initial wt of male(g)	65.12	64.22	3.86
Initial wt of female(g)	63.37	60.59	4.02
Final wt of male(g)	257.32[a]	232.38[b]	5.98
Final wt of female(g)	186.9	192.27	4.63
Wt change of male(g)	192.20[a]	168.16[b]	3.36
Wt change of female(g)	123.53	131.68	11.51
Daily wt change of male(g)	1.72	1.5	0.17
Daily wt change of female(g)	1.1	1.16	0.1
Mortality	Nil	-	-
Morbidity	Nil	-	-

[a,b] = Means on the same row with different superscripts are statistically different.($p < 0.05$).

The total change per rat was 157.83g for the MG and 148.77g for the PG. The daily weight change per rat for these two groups were 1.41g and 1.33g respectively. These showed that the MG had a better though insignificant (P> 0.05) overall weight change than the PG and hence a relatively faster rate of growth. This trend was also reflected in the final weight per rat which gave values of 222.11g and 212.33g for the MG and PG respectively. The reason for this better rate of growth for the MG might not be unconnected with reduced rate of social attrition and conflict in this group. The works of Bartos and Brian (35) and Aro and Adejumo (11) revealed that the more the number of individuals in a social group, the more the conflicts over resources and the more the aggression. Since the number of individuals in the PG was more than in the MG, the concomitant increase in social conflict and the ensuing aggression generated over available resources within the cage environment might have led to the difference in the final weight observed between these two social groups.

The final weight of males in the two groups gave values of 257.32g and 232.38g for the MG and the PG respectively. This parameter revealed a significantly superior performance (P< 0.05) by the MG. The males of the MG were heavier than those of the PG. The trend of observation among the males of the PG was that one out of the three males had a more superior weight (i.e. heavier) than the two other males. This would then mean that hierarchy or dominance among the males was played out even at this relatively small male population. .The heaviest male in the PG was probably the alpha male whose chemical cues or pheromones suppressed the growth and sexual development of the other males called the subordinate males (36;35,37).The statistical significant difference (P< 0.05) in weight change (i.e. 192.20g versus 168.16g) between the males of these two groups followed the same pattern shown by the final weight in males.

The polyandrous females grew faster than the monogamous females as shown by the final weights of females (192.27g versus 186.90g) for the two groups respectively. The weight change for females in the two groups also followed the same pattern i.e. 131.68g for the polyandrous females and 123.53g for the monogamous females. This faster but statistically insignificant (P> 0.05) growth rate exhibited by polyandry in females might have been caused by the “heavy dosage” of pheromones and other sexual cues released by the consortium of males at once to help prime the female for rapid physical growth and sexual development (38). The higher concentration of chemical cues and more tactile signals unleashed by the males on the females of the PG would have caused this observable faster growth so as to attune the females to an accelerated sexual development and maturity (11).

The daily weight change per male and female in the two groups were 1.72g versus 1.50g and 1.10g versus 1.16g for the MG and PG respectively. These figures corroborated those obtained for weight change for both males and females in the two social groups with a revelation of the same trend i.e. males of the MG had a better weight gain while females of the PG gained more weight than their monogamous counterparts.

HAEMATOLOGICAL INDICES

(a). Combined Sexes: Table 3 shows the blood parameters of the monogamous and polyandrous groups of rats with the sexes (male and female) considered together.

The packed cell volume (PCV) or haematocrit for the MG and PG were 47.67% and 43.50% respectively. These values showed a statistically higher (P< 0.05) PCV for the MG. Values for Hb.conc. and neutrophils were also significantly increased (P< 0.05) in the monogamous than in the polyandrous group. Since the PCV and Hb.conc. provide a more direct measurement of the volume of red blood cells and haemoglobin content of the blood, higher values for these parameters in the MG would then translate to higher oxygen carrying capacity of the blood in this group of rats. The values for these two parameters for both the MG and PG are however within the range given by several other researchers ($_{39}$;$_{40}$) thus establishing the facts that the discrepancies observed between these values in this trial were not sufficient to jeopardize the physiological status of these animals but rather are a pointer to the fact that these values are better enhanced by monogamy as opposed to polyandry. Table3 also revealed a higher (P< 0.05) lymphocyte content (56.58 versus 54.50) in the polyandrous than in the monogamous group. The lymphocyte values for these two groups fell short of the normal value recorded by Jain ($_{22}$) and is suggestive of sub clinical lymphopaenia in the two social groups.

Values for RBC, MCH, MCV, WBC and monocytes were consistently higher but similar (P> 0.05) in MG as compared with the PG while basophils, eosinophils and MCHC showed comparatively increased but similar (P> 0.05) values in the PG. The red blood cell values for rats in the two groups were 5.87x106/mm3 for the MG and 5.66x106/mm3 for the PG and were slightly inferior to the values given by most researchers in literature ($_{42}$;$_{43}$) and when these values wee compared with correspondingly higher MCV than recorded in literature ($_{44},_{45},_{46}$), one may be tempted to opine that a case of borderline macrocytic anaemia was implicated whose probable cause could be attributed to the diet that was conspicuously lacking in vitaminB_{12} and folic acid supplementation.

Figure 3

Table 3: Haematological indices of the monogamous and polyandrous rats (combined sexes).

Parameters	Monogamous Group	Polyandrous Group	± SEM
Packed cell volume (PCV) (%)	47.76^a	43.50^b	0.75
Red blood cells(RBC) x10^6/mm^3	5.87	5.66	0.31
White blood cells(WBC) x10^3/mm^3	19.6	15.7	0.22
Haemoglobin(g/100ml of blood)	15.88^a	14.51^b	0.23
MCHC(g/100ml of blood)	33.31	33.35	0.06
MCH(picogramme)	27.37	26.37	1.46
MCV(femtolitre)	82.16	79.05	4.39
Lymphocytes(%)	54.50^b	56.58^a	1.1
Neutrophils(%)	35.67^a	32.89^b	2.42
Monocytes(%)	8.33	7.67	0.98
Eosinophils(%)	2.67	2.78	0.44
Basophils(%)	0.33	0.89	0.35

^{a,b} = Means on the same row with different superscripts are statistically different (p< 0.05)

Though lymphocytes predominate in circulation in all rats in both social groups, the proportion of lymphocytes in circulation is lower than what is considered normal for rats. Jain ($_{22}$) gave values of 71.10±8.7 and 24.50±8.0 for circulating lymphocytes and neutrophils respectively. Since both lymphocytes and neutrophils account for more than 90% of the total leucocytes in circulation, the neutrophil-lymphocyte ratio provides the yardstick for assessing the leucocyte content of the blood. Edward and Fuller ($_{47}$) reported that in rats and mice, the neutrophil-lymphocyte ratio increases with age and that there is also a diurnal variation in leucocyte counts with lower counts occurring during periods of relative inactivity.

(b). Matured male albino rats. Table 4 shows the haematological indices of male rats in the two social groups. Values for the PCV for males of the MG and PG were 47.67% and 44.11% respectively. This parameter for the MG showed a significantly higher (P< 0.05) value than in the PG. The RBC, WBC, Hb.conc. MCHC, lymphocytes and monocytes values though higher in the MG were however similar (P> 0.05) to the PG. The percentage neutrophil varies significantly (P< 0.05) between the two social groups of rats with values of 35.67 and 32.89 for the MG and PG respectively. Values for MCH, MCV, eosinophils and basophils were higher in the PG but similar (P> 0.05) to the MG. The inverse relationship between RBC and MCV ($_{48}$) was revealed in these parameters that though values for the RBC for the two groups were slightly subnormal, the high MCV for both depicted a case of macrocytic anaemia which was probably made worse by polyandry. The growers' pellets for rats used in this study apparently lacked vitamin B_{12} and folate. It can therefore be argued that this might have resulted in macrocytic anaemia (diagnosed by high MCV values) that was implicated in the two groups of rats ($_{49}$). The similarity in values for the PCV, Hb.conc. and MCHC also agreed with the report of Hawkey (1991).

The leucocyte counts were very high within sexes as well as between sexes in the two social groups of rats. These high leucocyte values may not be unconnected with the site of collection in this trial. Jain [31] reported that leucocyte counts are markedly higher (about four folds) in the tail blood as compared to heart blood particularly when collected at the time of lowest muscular activity. In fact, Schwabenbauer [26] recommended the tail vein technique for routine blood sampling in rats. Since blood was collected by tail clipping and at 9.00 hours of the day (a time of reduced muscular activity by the nocturnal rats), this might have caused the apparent leucocytosis that was recorded in all rats in this trial. The higher leucocyte counts in the monogamous males as opposed to the polyandrous males might have therefore resulted from the relatively calm and serene milieu that prevailed in the group which culminated in calmer disposition and hence reduced muscular activity and therefore higher leucocyte counts than in the PG where the males preoccupied themselves with scurrying after the females and competing for food and space.

Figure 4

Table 4: Haematological indices of the male rats in the monogamous and polyandrous groups.

Parameters	Monogamous Group	Polyandrous Group	± SEM
Packed cell volume(PCV) (%)	47.67[a]	44.11[b]	0.64
Red blood cells(RBC) x10^6/mm^3	5.88	5.45	0.36
White blood cells(WBC) x10^3/mm^3	23.1	14.6	0.36
Haemoglobin(g/100ml of blood)	15.9	14.7	0.26
MCHC(g/100ml of blood)	33.35	33.33	0.09
MCH(picogramme)	27.13	27.72	1.38
MCV(femtolitre)	81.36	83.14	4.24
Lymphocytes(%)	56	55.78	0.66
Neutrophils(%)	35.67[a]	32.89[b]	2.42
Monocytes(%)	8.33	7.67	0.98
Eosinophils(%)	2.67	2.78	0.44
Basophils(%)	0.33	0.89	0.35

a, b = Means on the same row with different superscripts are statistically different (P< 0.05).

Figure I showed the graphic details of the variability of some of these parameters between the two social groups and between sexes. The MCHC was fairly uniform in both social groups and between sexes. Its values were 33.35%, 33.28%, 33.33% and 33.43% for the MM, MF, PM and PF respectively. These values were directly proportional to the RBC in circulation between sexes. The values for PCV did not show any variation between sexes in the MG (47.67% for both sexes) but there was a decrease in the PCV values between the PM and PF (44.11 versus 41.67). Polyandry thus caused a reduction in the PCV values in both the male and the female rats.

Lymphocyte values vary widely between the two social groups and between sexes. The MM had higher lymphocytes than their corresponding MF while the contrary held true between the PM and PF. The lymphocyte value was lowest for the MF and highest for the PF and yet underscored the relative blissful and stressful milieu of the monogamous and polyandrous social settings respectively. The neutrophil values followed similar trends with the PCV. It revealed that polyandry could cause a reduction in the circulating neutrophils in both males and females but this reduction tends to be more dramatic in females than in males. The highest value for monocytes was recorded in MF (i.e. 8.67%) and this depicted the reciprocal relationship between the lymphocyte and monocyte content of the blood in rats used in this study. Though the normal values of monocytes for rats reported by Jain [22] were lower than the ones observed in this study, there is an agreement with his report which emphasized that decrease in circulating monocytes may result from acute stressful condition especially to ample corticosteroid release and more so in humans and laboratory animals.

The values obtained for eosinophils revealed that this parameter is increased by polyandry. Transient eosinophilia may occur as a result of the endogenous release of hormones like epinephrine under physiological stress [22]. This explains the higher values for this parameter recorded for PM and PF. Percentage basophil counts were 0.33, 1.00, 0.89, and 1.67 for the MM, MF, PM and PF respectively. It would be observed that basophil content of the blood in rats was increased under polyandry. The concurrent occurrence of increased circulating eosinophils and basophils in the PG is a reflection of the functional similarity of the two types of cells and of the fact that increased number of the two especially of basophil and its variant: the mast cells have been associated with severely stressed animals [51].

(c). Matured female albino rats: Table 5 shows the haematological indices of female rats in the two social groups.

The PCV showed significantly higher values (P< 0.05) in the MF rats (47.67%) than in the PF rats (41.67%). The PCV values for the MG were higher than those reported in some literature [39; 40,42] but comparable to the data obtained on female Sprague-Dawley rats by Mukewar and Baile [43]. The PCV values for the PF rats were similar to values in consulted literature [39; 40,42]. Monogamy also resulted in significantly higher (P< 0.05) values for MCH, MCV and neutrophils but significantly lower (P< 0.05) value for lymphocytes in female rats than in polyandry.

Figure 5

Table 5: Haematological indices of the female rats in monogamous and polyandrous social groups.

Parameters	Monogamous Group	Polyandrous Group	± SEM
Packed cell volume (PCV) (%)	47.67^{a}	41.67^{b}	1.77
Red blood cells(RBC) x10^{6}/mm^{3}	5.87	6.3	0.66
White blood cells(WBC) x10^{3}/mm^{3}	32.3	37.9	0.68
Haemoglobin(g/100ml of blood)	15.87	13.93	0.65
MCHC(g/100ml of blood)	33.28	33.43	0.15
MCH(picogramme)	27.60^{a}	22.34^{b}	3.09
MCV(femtolitre)	82.95^{a}	66.78^{b}	9.05
Lymphocytes (%)	53.00^{b}	59.00^{a}	2.22
Neutrophils(%)	35.00^{a}	29.33^{b}	2.31
Monocytes(%)	8.67	6.33	1.79
Eosinophils(%)	2.33	3.67	1.56
Basophils(%)	1	1.67	0.56

^{a,b} = Means on the same row with different superscripts are statistically different ($p < 0.05$)

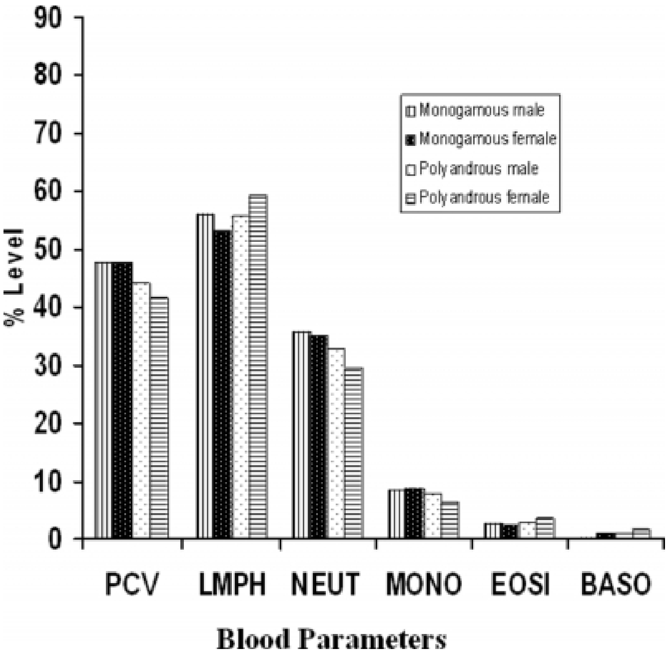
Values for Hb.conc. and percentage monocytes, though higher in the MG, were similar(P> 0.05) to those obtained in the in the PG. Monogamy in female rats resulted in lower but statistically insignificant (P> 0.05) values for RBC, eosinophils, basophils and MCHC. The lower ratio of lymphocyte-neutrophil (i.e. higher neutrophli-lymphocyte ratio) recorded for the monogamous female rats might have been caused by lower rate of social conflicts, reduced stress and hence lower muscular activity in the monogamous females than in the polyandrous females. In fact one can aptly say that the social environment in monogamy for the female is more blissful than in polyandry.

Though evidence of leucocytosis was shown in both social groups, it was more aggravated in the polyandrous females (37.90 x 103/mm3 in PG versus 32.30 x 103/mm3 in the MG). This might have been the direct result of the release of stress hormones (the glucocorticoids) by the polyandrous females as a result of the social stress they were subjected to due to the intense mating action of the males ([11]). This type of leucocytosis was described by Jain ([22]) as the reactive type characterized by neutrophilia with a left shift and monocytosis as observed in rats used in this study.

The trend of observations in the values for PCV, RBC, MCHC, MCH and MCV revealed that the female rats in the PG might have resorted to making physiological adjustment to beef up erythropoiesis under stressful social condition akin to that experienced under oxygen lack by which erythropoeitin is called upon to increase erythropoiesis due to this lack ([52]). The lower PCV (41.67% versus 47.67%), lower Hb.conc. (13.93 versus 15.87) and lower MCH (22.34 versus 27.60) were compensated for by higher RBC (6.30 versus 5.87) as a result of this subtle physiological adjustment.

Figure 6

Figure 1



CONCLUSION

Insights from the foregoing showed that the monogamous male rats recorded a significantly higher growth performance over their polyandrous counterparts. This highlights the implication of social conflicts and the resultant aggression that culminated in reduced growth rate among the polyandrous males coupled with pheromonally enhanced development of hierarchy that made it possible for the alpha males in the PG to suppress the growth of the subordinate males. Polyandry on the other hand promotes the growth rate of the female rats through chemical cues and tactile stimulation by the males.

Haematologically, monogamy resulted in consistently higher PCV, neutrophil and monocyte values in both the male and female rats. This study revealed that rats on low plane of vitamin B_{12} and folate supplementation face a worse risk of macrocytic anaemia under polyandrous social setting. The high leucocyte levels in rats under this study might be related to the site of collection and not to any untoward physiological malfunctioning. Monogamy could also result in lowered circulating lymphocytes in female rats, which is a pointer to the fact that this mating system is relatively less stressful, less physically tasking and more blissful for the females when compared with polyandry. Polyandry on the other hand increased the circulating leucocytes in female rats. The more aggravated social stress to which the polyandrous females were subjected might have accounted for this.

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