RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES
ISSN 2221-1896
www.roavs.com

Seasonal influence on some blood and biochemical parameters of Jerboa (*Jaculus jaculus*) in Saudi Arabia

M.S. AL-Eissa[1] and Saad Alkahtani[2]

[1]Department of Biology, Faculty of Science, Hail University, Riyadh 11362, Saudi Arabia
[2]Departement of Science, Teachers College, King Saud University, Riyadh 11352, Saudi Arabia

Abstract

The aim of this study was to investigate the effect of seasonal variation on the haematological and biochemical parameters in adult wild Jerboa (*Jaculus jaculus*) in Saudi Arabia. Blood samples of 40 Jerboa were collected in January and August for analyzing hematological and biochemical parameters. In hematological parameters, haemoglobin, mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and white blood count (WBC) were significantly increased in winter compared with summer season. Whereas, only mean corpuscular volume (MCV) was significantly decreased in winter compared with summer season. Sodium, chloride, bicarbonate, calcium, albumin, globulin and total protein were significantly decreased in winter compared with summer season. Whereas, urea was significantly increased in winter compared with summer season. In conclusion, heat stress during summer caused deterioration in some hematological and serum biochemical constituents of Jerboa (*Jaculus jaculus*).

Keywords: Jerboa, Season, Haematology, Biochemical Parameters

Introduction

Several studies have found that conducting researches on rabbits are beneficial for farmer requirements and animal's welfare. Hence, haematology and serum chemistry are becoming increasingly important diagnostic tools. Blood parameters are used as an aid tool for the diagnosis of infectious and several parasitic diseases. In addition to assess the metabolic condition of animals, haematological and biochemical parameters could be affected by many factors including: sex, age, reproductive status and seasonal variations (Al-Eissa et al., 2008; Wells et al., 1999; Gill and Wanska, 1978; Mira and Mathias, 1994; Cetin et al., 2009). On the other hand, it was reported that haematological parameters were not influenced by sex (Schalm et al., 1975) and gestation (Egbe-nwiyi et al., 2000). In various studies, RBC count, haemoglobin and hematocrit parameters were reported to reach the highest levels during winter months in different rodents (Rewkiewiccz-Dziarska, 1975). In contrast, these parameters were reported to be at the lowest level during winter months in large animals such as horses (Gill and Wanska, 1978) and cows (Rusoff et al., 1954).

The physiological, nutritional and pathological conditions of animals are usually assessed, using haematological and biochemical analyses of their blood (Jain, 1986; Bush, 1991; Cetin, et al., 2010). Nutrition, age, sex, genetics, reproduction, housing, starvation, environmental factors such as stress and transportation are all known to affect haematological and biochemical parameters of tropical and temperate animals (Ogunrinade et al, 1981; Bush, 1991; Ogunsanmi et al, 1994).

Previous studies reported that there is no significant difference in haematological parameters between non-pregnant and pregnant rabbits (Brewer, 2006). Furthermore, haematological parameters for different spices of rabbits are reported by many researchers (Chineke et al., 2006; Cetin et al., 2009; Ahamefule et al., 2006; Solomon et al., 1998; Barlet, 1980). Not much is known about the breeding of jerboas due to their solitary and nocturnal nature. However, breeding is known to occur at least twice a year, between June to July and from October to December.

Due to the limitation and lake of information about jerboa specially (*Jaculus jaculus*), therefore, this study was undertaken to investigate the effect of seasonal variation on the haematological and biochemical parameters of wild Jerboa (*Jaculus jaculus*) in Saudi Arabia to know the best conditions for breeding and

conservation of this species and others similar mammals.

Materials and Methods

Forty healthy adult wild Jerboa (*Jaculus jaculus*) were used in this study, their age could not be determined as they were captured at south of Riyadh, Saudi Arabia. Animals were transferred to the animal house of the faculty of science, King Saud University, Saudi Arabia. Animals were maintained under standard laboratory conditions at a temperature of 22±1ºC, a relative humidity of 45±5% and photoperiod cycle of 10/14 h. They were fed summer ration *ad libitum*. The feed of jerboa was similar in both the summer and winter seasons, thereby limiting the variables to only the season while the other factors such as feed, housing and management of the Jerboa were kept constant. The Jerboas were acclimatized to their new environment for 30 days before the commencement of the study.

In August and January, blood was collected from the saphenous vein into a vessel containing ethylene diamine tetraacetic acid (EDTA) (2mg/ml of blood). RBC and WBC were counted with a haemocytometer. PCV was determined by using the microhaematocrit method. Hb concentration was measured by cyanmethaemoglobin method. MCV, MCH and MCHC were calculated from the parameters of RBC, PCV and Hb. The remaining blood samples were centrifuged at 3000 g for 10 minutes to obtain plasma. Serum electrolytes were determined by standard flame photometry. Chloride was assessed by the method of Schales and Schales (1941), and bicarbonate according to (Toro and Ackermann, 1975). Total protein was determined by using biuret method (Reinhold, 1953). Globulin was calculated by subtracting albumin from total protein. Urea was determined according to method described by Harrison (1947).

Statistical analysis

Data were analyzed by using the SPSS (SPSS Inc., Chicago, IL, USA). Statistical significances between winter and summer were determined by t-test. A P value less than 0.05 was considered significant as mention by Cetin et al. (2009).

Results

Heamatological parameters of jerboa are illustrated in table 1. Hb and MCHC, MCH, WBC were significantly increased in winter compared with summer season. In contrast, mean MCV was significantly decreased compared with summer season. Red blood cells (RBC) count and packed cell volume (PCV) did not differ between the seasons.

Serum sodium, potassium, chloride, bicarbonate and calcium of jerboa are shown in table 2. The levels of sodium, chloride, bicarbonate and calcium were significantly decreased compared with summer season. No significant difference was recorded in serum potassium concentration.

Mean serum total protein, albumin, globulin, albumin and globulin ratio and urea concentration of Jerboa in the two seasons have been presented in table 3. Total protein and albumin decreased significantly in winter seasons. In contrast, only urea increased significantly in summer season. No significant changes in globulin and albumin/globulin ratio were observed.

Table 1: Mean haematological Parameters (Mean ± SE) in Jerboa (*Jaculus jaculus*) in summer and winter seasons

Parameters	Summer season (n=20)	Winter season (n=20)
RBC ($X10^6$/µl)	8.4 ± 0.2	9.09±1.58
PCV (%)	41.7 ± 1.35	38.84±4.02
Hb (g/dl)	14.2± 0.3	17.27±2.63*
MCV (fl)	72.4± 6.9	56.59±17.52*
MCH (pg)	22.0± 3.2	24.32±6.57**
MCHC (g/dl)	34.0± 1.2	41.45±5.52*
WBC ($\times10^3$/µl)	10.733.±8.0	12.22±2.51**

Value significantly different from summer season at *P<0.001 and **P<0.05

Table 2: Plasma electrolytes and minerals (Mean ± SE) in Jerboa (*Jaculus jaculus*) in summer and winter seasons

Parameters	Summer season (n=20)	Winter season (n=20)
Sodium (mmol/l)	138±3.8	65.6±5.3*
Potassium (mmol/l)	4.5±0.13	5.48±0.49
Chloride (mmol/l)	99.3±3.3	54.65±2.33*
Bicarbonate (mmol/l)	25.5±1.8	9.88±0.57*
Calcium (mg/dl)	9.50±0.88	1.25±0.60*

Value significantly different from summer season at *P<0.001 and **P<0.05

Table 3: Serum biochemical parameters (Mean ± SE) of Jerboa (*Jaculus jaculus*) in summer and winter seasons

Parameters	Summer season (n=20)	Winter season (n=20)
Total protein (g/dl)	7.3±1.7	4.77±0.42**
Albumin (g/dl)	4.00±0.60	3.24±0.22*
Globulin (g/dl)	4.11±0.47	4.01±0.44
Albumin/globulin ratio	0.89±0.09	0.89±0.22
Urea (mg/dl)	16.7±3.4	22.32±3.53*

Value significantly different from summer season at *P<0.001 and **P<0.05

Discussion

The obtained data showed significant changes in some heamatological parameters which is in according to the study of Kim et al. (2002) who also reported heamatological changes in rabbits during winter season. Theses changes may be due to the lower water intake during winter season compared to summer season. Previous studies reported that this variation may be related to environmental acclimatization because the winter low ambient temperatures requires a higher metabolic rate for body temperature regulation could stimulates erythropoiesis which would be of great advantage in oxygen transport and delivery to the tissues (Sealander, 1964; MacLean and Lee, 1973; Berry and Jakobson, 1975; Wells et al., 1999; Kim et al., 2002). Total WBC numbers was significantly higher in the Jerboa during the winter season. In contrast, in summer season, Kim et al. (2002) observed decrease in the number of WBC numbers in rabbits. On the other hand, some studies demonstrated that haematological parameters reached the highest value during winter months in rodents (Rewkiewiccz-Dziarska, 1975), whereas, these parameters reached the lowest level in large animals such as horses and cows (Rusoff et al., 1954; Gill and Wanska, 1978; Al-Eissa, 2011). These differences may be due to from the difference in species, intensity of season, diet and other environmental factors.

We observed significant difference in electrolytes in this study. Nevertheless, Jerboas could manage with low levels of plasma electrolyte in the winter season. From this study it seems the Jerboas have adaptive mechanism to manage with the variation in the plasma electrolytes in the summer and winter seasons. Total protein and albumin concentrations were higher during summer than winter season. since the ambient temperatures was higher and relative humidity was lower during summer season, the Jerboas may be dehydrated during summer season which might have elevated the concentration of the plasma proteins as described by Finco, (1989), and Akerejola (1980). Urea was higher in winter season than summer season. This result is similar to observation made Akerejola (1980) and Gring (1991). The increase of serum urea level maybe due to the efficient digestion of dietary protein.

This study is the first report on Jerboa in Saudi Arabia. There are considerable alterations in the haemotoligical and serum biochemistry in both seasons. We suggest further studies on other aspects of this mammal under Saudi Arabia conditions which will help in understanding the disease controlling strategies as this rodent may be a vector of many parasitic diseases in human and other domestic animals.

References

Ahamefule, F., Edouk, G., Usman, A., Amaefule, K. and Oguike, S. 2006. Blood biochemistry and haematology of weaner rabbits fed sun-dried, ensiled and fermented cassava peel based diets. *Pakistan Journal of Nutrition*, 5: 248-253.

Akerejola, O., Umuna, N. and Denis S.M. 1980. Serum biochemical levels of cattle in Northern Nigeria. *Nigeria Veterinary Journal*, 9: 26-31.

Al-Eissa, M., Al-Hamidi, A. and Kandeal, S. 2008. Assessment of reproductive efficiency of the Arabian sand gazelle males (Gazelle Subgutturosa marica). Saudi J. Biological Sci., 15: 85-95.

Al-Eissa, M. 2011. The effect of gestation and season on the haematological and biochemical parameters in domestic rabbits (*Oryctolagus cuniculus). British Biotechnology Journal*, 1(1): 27-34.

Barlet, P. 1980. Plasma calcium, inorganic phosphorus and magnesium levels in pregnant and lactating rabbits. *Reproduction, Nutrition and Development*, 20: 647- 651.

Berry, R.J. and Jakobson, M. 1975. Adaptation and adaptability in wild-living mice *(Mus ntuscirlus). Journal of Zoology*, 176: 391-402.

Brewer, N. 2006. Historical special topic overview on rabbit comparative biology. *Journal of American Association for Laboratory Animal Science*, 45: 8–24.

Bush, M. 1991. Interpretation of Laboratory Results for Small Animal Clinicians. Blackwell Scientific Publication, London.

Cetin, N., Bekyurek, T. and Cetin, E. 2009. Effects of sex, pregnancy and season on some haematological and biochemical blood parameters in angora rabbits. *Scandinavian Journal of Laboratory Animal Science*, 36: 155-162.

Cetin, E., Kanbur. M., Silici, S. and Eraslan, G. 2010. Propetamphos-induced changes in haematological and biochemical parameters of female rats: Protective role of propolis. *Food and Chemical Toxicology*, 48: 1806-1810.

Chineke, C., Ologun, A. and Ikeobi, C. 2006. Haematological parameters in rabbit breeds and crosses in humid tropics. *Pakistan Journal of Biological Sciences*, 9: 2102–2106.

Egbe-nwiyi, N., Nwaosu, S. and Salami, H. 2000. Haematological parameters of apparently healthy sheep and goats as influenced by age and sex in arid zone of Nigeria. *African Journal of Biomedical Research*, 3: 109-115.

Finco, D.R. 1989. Clinical Biochemistry of Domestic Animals. 4th Ed. Academic press, Toronto.

Gill, J. and Wanska, E. 1978. Seasonal changes in erytrocyte, haemoglobin and leukocyte indices in

barren mares of thoroughbred horses. *Bulletin of the Polish Academy of Science*, 26: 347- 353.

Gring, E. 1991. Responses of dairy cows in early lactation to additions of cotton seed meal in Alfa Alfa-based diets. *Journal of Dairy Science*, 74:2580-2587.

Harrison, A. 1947. Chemical Methods in Clinical Medicine. 3rd Ed. Churchill, London.

Jain, N. 1986. Schalm's Veterinary Haematology, 4th Ed. Lea and Febiger, Philadelphia, U.S.A.

Kim, C., Yun, I., Cha, W., Kim, H. and Koh, S. 2002. Haematological changes during normal pregnancy in New Zealand White Rabbits. *Comparative Clinical Pathology*, 11: 98-106.

Maclean, G.S. and Lee, A.K. 1973. Effects of season, temperature and activity on some blood parameters of feral house mice *(Mus musculus). Journal of Mammalogy*, 54: 660-667.

Mira, A., Mathias, M. 1994. Seasonal effects on the hematology and blood plasma proteins of two species of *Mus musculus domesticus* and *M. spretus* (Rodentia: Muridae) from Portugal. *Hystrix-Italian Journal of Mammalogy*, 5: 63-72.

Ogunrinade, A., Fajimi, J. and Adenike, A. 1981. Biochemical indices in the White Fulani (Zebu) cattle in Nigeria. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, 4: 34-41.

Ogunsanmi, A., Akpavie, S., Anosa, V. 1994. Serum biochemical changes in West African Dwarf sheep experimentally infected with *Trypanosoma brucei*. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, 47 (*2*): 195- 201.

Reinhold, J. 1953. Standard Method of Clinical Chemistry. 1st Ed. Academic Press. New York. Pp: 88.

Rewkiewiccz-Dziarska, A. 1975. Seasonal changes in hemoglobin and erythrocyte indices in Microtus arvalis. *Bulletin of the Polish Academy of Science*, 23: 481- 486.

Rusoff, L., Johnston, J., Bronton, C. 1954. Blood studies on breeding dairy bulls. Hematocrit, hemoglobin, plasma calcium, plasma inorganic phosphorus, alkaline phosphatase parameters, erythrocyte count and leukocyte count. *Journal of Dairy Science*, 37: 30-36.

Schales, P. and Schales, S. 1941. A simple and accurate method for the determination of chloride in biological fluids. *Journal of Chemistry*, 140: 879-884.

Schalm, W., Jain, N. and Carroll, E. 1975. Veterinary Haematology 4th Ed. Lea and Febiger, Philadelphia.

Sealander, J. 1964. The influence of body size, season, sex, age and other factors upon some blood parameters in small mammals. *Journal of Mammalogy*, 45: 598-616.

Solomon, P., Monsi, A., Zitte, F. 1998. Physiological, haematological and biochemical evaluation of grasscutter and rabbit. Proceedings of the Silver Anniversary Conference of Nigerian Society for Animal Production, March 21-26, Abeokuta, Nigeria, 405-406.

Toro, G. and Ackermann P. 1975. Practical Clinical Chemistry. 1st Ed. Little Brown and Company, Boston.

Wells, Y., Decobecq, P., Decouvelaere, M., Justice, C. and Guittin, P. 1999. Changes in clinical pathology parameters during gestation in the New Zealand white rabbits. *Toxicological Pathology*, 27: 370-379.