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Effect of Different Feeding Performance on Some Blood Constituents of Sudanese Camels *(Camelus dromedarius)*

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ABSTRACT

This work was designed to study the effect of different feeding performance on blood constituents of the one- humped camel (*Camelus dromedaries)*. 45 camels (18-24 months) of age, weighing 190-260 kg body weight were utilized in this study. The camels were divided into two groups, zero grazing group (15 *Darfurian* and 10 *Butana*) fed concentrate ration composed of traditional ingredients such as sorghum as the main source of energy, groundnut cake as a source of protein, Dura whitings as roughages, sugar cane molasses and urea as major sources of energy and nitrogen.The 2nd group was a free grazing camel (11 *Darfurian* and 9 *Butana*) with out any supplement. Blood was collected weekly for 120 days after two weeks that served as adaptation period. Different blood constituents were estimated using standard analytical methods. The results revealed a significant increase ($p< 0.05$) in the concentrations of plasma glucose, cholesterol, serum urea, creatinine, sodium, glutamate oxaloacetate transaminase in the blood of the zero grazing group compared to the free grazing group. However, highly significant increases ($p< 0.05$) in triglycerides were found in the blood of the free grazing group. Availability of feed could induce significant physiological and biochemical changes in the camel and therefore, it is beneficial to provide concentrate feed to camels kept under controlled management system.

INTRODUCTION

Sudan is one of the largest camel (*Camelus dromedarius)* populated countries in the world. The total camel population of Sudan is estimated as 3 million heads (MAR Sudan, 1999). In Sudan Camels provide

mankind with a range of products and services, like wool, meat, milk and draught power. The one humped camel (*Camelus dromedarius)* has the capacity of being a better provider of food in the desert areas of the world than the cow which can be severely affected by heat and scarcity of feed and water. They are adapted themselves to the ecosystem of dry and arid zones where are subjected to harsh conditions in addition to the severe fluctuations in the nutritional status, which in turn affect their general performance (Wardeh, 2004). The methods of camel keeping are now fast changing due the very severe and historical drought that hit several camel producing countries. These natural disasters had forced many camel herders to start settling (Abbas and Omer, 2005; Darosa, 2005). Moreover, In order to reduce the alarming nutritional crisis, to make the ration economic and to have sustainable camel rearing practice, attempts were made to formulate concentrate ration for camels. Thereafter, attempts regarding formulation of complete rations and their densification have been taken up successfully to develop a drought proofing technology for camels (Sharma and Dhuria, 2007).

The concentrations of blood metabolites are sensitive to changes in nutrient supply. Therefore, they could be used as indicators of nutritional status Serum total protein and albumin levels are usually considered as useful indices of the nutritional status of animals (Lynch and Jackson, 1983). In camels, serum triglycerides concentration has been reported to be affected by diet (Wasfi *et al.,* 1987). Food deprivation decreases plasma glucose levels in both monogastric mammals and ruminants of similar size as the camel (Evans, 1971, Rule *et al.,* 1985). However, serum glucose level of camels was maintained during fasting and was increased after feeding had commenced (Wensvoort *et al.,* 2004).There is a lack of data about the effects of feeding concentrate ration on serum biochemical values in dromedary. This initiated the undertaking of the present study to investigate, whether the nutritional status could induce significant changes in the blood metabolic and minerals profile in camels kept under controlled management systems and fed concentrate ration.

MATERIALS AND METHODS

Forty five male camels (*Camelus dromedarius)* with age of (18-24 years) and mean body weight of (190-260 kg) were divided into two groups as zero grazing and free grazing group, twenty five as zero grazing (15 *Darfurian* and 10 *Butana* breeds). According to breed, age and weight, the animals were divided into five subgroups, five animals of each. Whereas free grazing were 11 *Darfurian* and 9 *Butana* breeds. All animals were clinically healthy. After arrival at the site of the experiment (Camel Research Centre Tumbool) all animals were sprayed against ecto-parasites, drenched with the Albendazol, and injected with a complete prophylactic course of ivermectin and Oxytetracycline HCL. The first two weeks served as adaptation period. The camels were injected with multivitamins monthly.

Feeds and Feedings:

In this study the camels supplemented with concentrate ration (Table 1) formulated according to National Research Council, (NRC) (1994) to meet the camel's requirements. The former diet was composed of traditional ingredients of crushed sorghum grains as the main source of energy and groundnut cake as the major source of protein, so as to reduce the cost of feeding; sugar cane molasses and urea were incorporated as major sources of energy and nitrogen respectively. Wheat bran was added to the diets to adjust their total metabolizable energy (ME) and crude protein contents. In addition, a Dura whiting

(semema) was added to the concentrate diet as roughage. The food, salt licking stones, and water were offered *adlibitum* for three months (120 days).

Table 1: Ingredients percentage of the experimental diets (as fed basis)

Ingredients	%
Molasses	10
Crushed sorgum grains	15
Dura whitings	5
Wheat bran	5
Urea	2
Bsgas	12
Common salt	1
Total	100

Sorghum grains, groundnut cakes were milled to facilitate their mixing with each other and the other ingredients. Molasses and urea were added to the ration at each meal preparation (every 3 days) after dissolving urea in water in order to reduce urea accumulation in animal rumen which could lead to urea toxicity.

Table 2: Chemical composition and energy concentration of the experimental diet (as % of DM)

Parameters	Experimental diet
Dry matter	96.5
Crude fiber	9.22
Crude protein	16.4
ME,MJ/KgDM	11.32MJ/KgDM
	2466Kcal/Kg
Ca	0.77
P	0.14

* Metabolizable energy was calculated according to MAFF (1975)

Formulae for experimental diets was: ME (MJ/kg DM) = 0.012CP+ 0.03EE+ 0.005CF+ 0.014NFE.

Where, CP is crude protein, g/kg DM; EE is ether extract, g/kg DM; CF is crude fiber, g/kg DM; and NFE is nitrogen free extract, g/kg DM. Where crude protein (CP) and the other components of the equation were expressed as g/kg DM. Throughout the experimental period, daily feed allowance were offered to each group ad-libitum in one meal at 8:00 a.m. The feeding period was extended for 120 days during which different measurements were conducted.

Samples collection:

The blood samples were taken from jugular vein using anticoagulant coated vacutainers as well as empty sterile tube to obtain plasma and serum, respectively. The plasma and serum samples were recovered from blood by centrifugation (3000 rpm at bench centrifuge for 10 minutes) and stored till analyzed at -20 °C. Blood samples were immediately used for determination of plasma glucose concentration.

The total cholesterol was determined by (cholesterol oxidase, phenol & aminoantipyrine) CHOD-PAP- enzymatic

colorimetric method using commercial kits (Ellefson and Caraway, 1976). Triglyceride determined by GPO- PAP enzymatic colorimetric method, using commercial kit after (Bucolo and David, 1973). GPT was performed according to the method of (Reitman and Frankel, 1957).GOT was performed according to the method of (Reitman and Frankel, 1957). Urea was performed according to the method of (Patton and Crouch, 1977). Sodium and potassium were estimated by flame photometery as described by Gowenlock (1988) using corning 410 (USA) flame photometer.

Serum creatinine was kinetically performed according to the method of (Henry, 1974). Serum uric acid was measured using colormetric method, by commercial kit (Koch, 1937). Total protein concentration measured by colorimetric method (Biuret reagent) (Cannon *et al*., 1974). Serum albumin was performed according to the method of Bartholomew and Delany, (1966) and the concentration of serum globulins was calculated by subtracting the serum albumin from the concentration of serum total protein.

RESULTS

Table (3) shows the biochemical parameters of zero grazing and free grazing animals. The results revealed that a significant effect ($p < 0.05$) was recorded for concentrations of plasma glucose, serum urea and creatinine concentrations. These were higher in zero grazing group (88.1mg%, 24.04mg/dl,1.34mg/dl) than the free grazing (57.2mg%, 15.8mg/dl, 1.2mg/dl). A serum albumin concentration was slightly higher in zero grazing (4.3mg/dl) camels when compared with the free grazing (4.0mg/dl). However the differences was not statistically significant in globulin (3.5mg/dl), uric acid (2.9mg/dl) in zero grazing when compared with free grazing (3.2mg/dl) and (2.8mg/dl) respectively. However, there was a significant effect ($p < 0.05$) for concentrations of cholesterol in zero grazing group (41.32mg/dl) compared with the free grazing (36.98mg/dl) and a highly significant effect ($p < 0.05$) was recorded on concentrations of Triglycerides in free grazing (49.71±1.046mg/dl) when compared with zero grazing animals (44.59 mg/dl).

Table 3: Mean ± standard error of biochemical parameters zero grazing camels and free grazing serum (n=45)

Parameters	Unit	zero grazing	Free grazing	Sig.
Glucose	mg%	88.10±1.662	57.20±1.269	S*
Total protein	mg/dl	7.035±0.2771	7.91±0.3159	NS
Albumin	mg/dl	4.318±0.1498	4.006±0.1183	NS
Globulin	mg/dl	3.518±0.2233	3.200±0.1551	NS
Creatinine	mg/dl	1.34±0.01105	1.24±0.01088	S*
Urea	mg/dl	24.04±0.5893	15.80±0.3826	S*
Uric acid	mg/dl	2.94±0.04328	2.87±0.04965	NS
Triglycerides	mg/dl	44.09 ±1.085	50.71±1.046	S*
Total cholesterol	mg/dl	41.32±0.6310	36.08±0.8419	S*

S* indicates significant difference ($P \leq 0.05$). NS = non significant.

Table (4) shows the biochemical enzymes and minerals in zero grazing camels and free grazing. A significant effect ($p < 0.05$) was recorded for concentrations of sodium concentrations and glutamate oxaloacetate transaminase (GOT). These were higher in zero grazing group (147.5 mEq/L, 32.98 U/L) compared with free grazing (141.3

mEq/L, 28.71 U/L). The differences was not statistically significant in Potassium and glutamate pyruvate transaminase (GPT), for zero grazing (4.194 mEq/L 20.69 U/L) for free grazing (3.973 mEq/L, 19.51 U/L) respectively.

Table 4: Mean ± standard error of some biochemical enzymes and minerals in zero grazing camels and the free grazing (n = 45)

Parameters	Unit	zero grazing	Free grazing	Sig
GOT	U/L	32.98±0.9595	28.01±0.6455	S*
GPT	U/L	20.69±0.5060	19.51±0.4767	NS
Sodium	mEq/L	147.5±1.656	141.3±2.247	S*
Potassium	mEq/L	4.194±0.1260	3.973±0.1124	NS

GOT= glutamate oxaloacetate transaminase; GPT =glutamate pyruvate transaminase

Table (5) shows the biochemical parameters of Darfuri & Butana in zero grazing animals. The results revealed that there is no significant effect in all parameters.

Table 5: Mean ± standard error of biochemical parameters in Darfuri and Butana (zero grazing) camels serum (n=25)

Parameters	Unit	Darfuri	Butana	Sig.
Glucose	mg%	88.91±1.59	86.62±2.88	NS
Total protein	mg/dl	7.56±0.128	8.00±0.314	NS
Albumin	mg/dl	4.27±0.18	4.28±0.127	NS
Globulin	mg/dl	3.08±0.21	3.41±0.172	NS
Creatinine	mg/dl	1.82±0.027	1.88±0.024	NS
Urea	mg/dl	67.26±3.45	65.92±7.72	NS
Uric acid	mg/dl	2.99±0.07	3.043±0.08	NS
Triglycerides	mg/dl	43.17±1.315	46.17±1.88	NS
Total cholesterol	mg/dl	41.25±0.726	41.47±1.29	NS

Table (6) shows the biochemical enzymes and minerals of Darfuri & Butana in zero grazing camels. The results indicated that there is no significant effect in all other parameters.

Table 6: Mean ± standard error of some biochemical enzymes and minerals in Darfuri and Butana zero grazing camels (n = 45)

Parameters	Unit	Darfuri	Butana	Sig.
GOT	U/L	43.21±1.47	43.80±0.82	NS
GPT	U/L	35.81±1.93	33.00±1.88	NS
Sodium	mEq/L	146.7±2.43	149.00±1.58	NS
Potassium	mEq/L	4.28±0.18	4.56±0.19	NS

Figure (1) shows the biochemical parameters of zero grazing and free grazing: The concentraion of creatinine, urea and sodium were increased ($P<0.05$) in zero grazing group when compared with the free grazing. Where as, there was no variation in uric acid and potassium concentraion between the two groups.

Figure (2) shows significant elevation ($P<0.05$) in blood glucose, total protein and

GOT levels in zero grazing when compared with free grazing group. However, Serum globulin, albumin and GPT levels showed no significant difference.

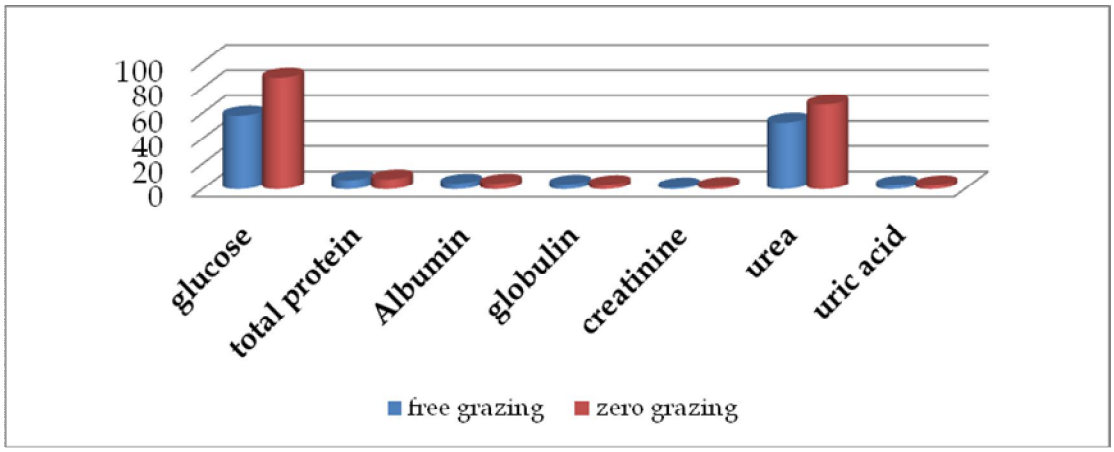

Figure 1: Serum lipids and lipoproteins in zero grazing and free grazing

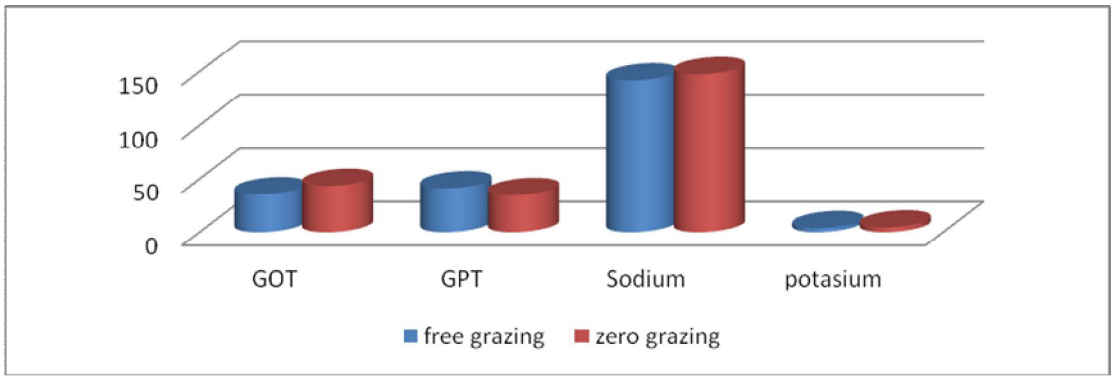

Figure 2: Some biochemical enzymes and minerals in zero grazing and free grazing

DISCUSSION

The present investigation has been designed to study the effect of feeding status in dromedary camel. The difference in feeding status showed a marked effect ($p < 0.05$) on the plasma biochemical constituents after feeding high quality diet when compared to control maintenance diet (Table 3). The observed increase in the level of plasma glucose ($p < 0.05$) in the group fed with high quality diet could be due to the increased energetic value (Wensvoort *et al*., 2004). Abdel-Fattah *et al*., (1999) reported that the glucagon level in camels is higher than that in other mammals including man, and suggests that this is a probable species specificity, which would explain the higher level of glucose in the blood of camels than in that of other ruminants. The disappearance curve of injected glucagon in camel with exponential two-compartment function as previously reported in other mammals might explain the well-developed anti-insulin hormonal control in this creature. The hormone was rapidly distributed and was eliminated with a high rate of clearance. In this study, the plasma glucose concentration is in agreement with that previously reported by Sazmand *et al*., (2013); Mohammed *et al*.,

(2007); Aichouni *et al*., (2013) and Amin *et al*. (2007) with lower value than that found by Osman and Al-Busadah (2003); Al Sultan, (2008) and Hassan *et al*., (2011).

Logically, the increased level of both creatinine and blood urea in camels fed high quality diet when compared with maintenance fed group (however this increase does not exceed the normal value) could be attributed to the high renal threshold values of these nitrogenous compounds with possible nitrogen recycling of nitrogenous compounds of in this animal (Mousa *et al*., 1983) observed increase in the concentration of plasma creatinine in high fed group can be attributed to the higher intake of protein in the diet consumed by camels. Abokouider *et al*., (2001) reported lower concentrations of creatinine during the dry season. However, In this study, the plasma creatinine levels was within the range reported by AL-Sultan (2003), with lower value than that found by Osman and Al-Busadah, (2003).

The observed increase in the concentration of plasma total protein in control group could be attributed to the stresses to which camels were subjected under dry conditions. Abokouider *et al*., (2001) reported an increase in plasma total protein in camel during the dry season. Similar values of serum proteins in this study were obtained by other workers Al-Busada (2007); Sazmand *et al*., (2011); Salah El-Din *et al.*, (2005); Al-Sultan (2003) and Osman and Al-Busadah, (2003), higher than the reference values reported by Hassan, (2011) and Mohammed *et al*., (2007).

Serum albumin concentration was similar to values reported by Al-Busadah, (2007); Salah El-Din *et al.,* (2005). Serum globulin was similar to the reference obtained by Al-Busadah (2007); Salah EL-Din *et al.,* (2005) and higher than that obtained by Osman and Al-Busadah (2003); Mohammed *et al*., (2007) and Al Sultan (2008).

The observed increase in the concentration of plasma triglyceride in control group could be attributed to the poor dietary conditions. Triglycerides are known to provide the metabolic fuel for most tissues when the animal is in energy deficit (Beitz, 1993). Moreover, it was reported that reduced glucose metabolism is reflected on the performance of free fatty acids (Mayes and Bothman, 2003).

The plasma triglyceride reported in this study, was within the range reported by Hassan *et al*., (2011); Nazifi *et al*., (2000); Aichouni *et al*., (2010), lower than the values reported by Mohamed (2008); Asadi (2008), and higher than that obtained by Khajeh *et al*., (2008); Sazmand *et al*., (2011) and Osman and Al-Busadah (2003).
The observed increase in the concentration of plasma urea in high fed group could be attributed to the increased nitrogenous intake in the diet that catabolized into urea nitrogen by dromedary liver. It has been reported that the level of plasma urea is related to the forage intake and consequently the energy and crude protein concentration Grings *et al*., (1991). In this study, the plasma urea concentration is within the range of previous reports (Aichouni *et al*., 2013; Hassan *et al*., 2011; Omer *et al*.(2007), with lower values obtained by Osman and Al-Busadah (2003).

The level of uric acid in both groups was consistent with the previously recorded data (Omer *et al*., 2007).and higher than that reported by Hassan *et al*., (2011).

The observed increase in the concentration of plasma total cholesterol in high fed group it could be attributed to the lipid. In our study, the serum cholesterol concentration is similar to the values reported by Nazifi *et al* (2000) and Mohamed (2008), lower than the

values reported by Al-Busadah (2007), Al-Sultan (2003); Osman and Al-Busadah (2003) and Salah El-Din *et al.,* (2005) and higher than the values reported by Aichouni *et al*., (2013); Sazmand *et al*., (2011).

Serum sodium concentration and serum potassium concentration were within the range of values obtained by Al-Busadah (2007); Mohammed *et al*., (2007).with lower values than that reported by Sazmand *et al*., (2011); Osman and Al-Busadah (2003) Aichouni *et al*., (2010).

Potassium concentrations were similar to those obtained by Osman and Al-Busada (2003); Aichouni *et al*., (2010) and Mohammed *et al*., (2007), with lower values reported by Sazmand *et al*., (2011).

It appears from Table (4) and Figure (2) that plasma Glutamate Oxaloacetate Transminase (GOT)and Glutamate Pyruvate Transminase (GPT) assessed in blood serum, as an indicators of live function showed a significant between the two groups. However, high GOT and GPT levels were assessed for zero grazing group when compared with the free grazing group .but the levels indicating healthy liver functions for such groups. In general, the values recorded for GOT and GPT were within the normal range reported by Fouda (2008). Who reported values ranging from 24 to 65 and 14 to 37 IU/L for GOT and GPT, respectively, in goats and sheep. The activity of GOT reported in this study were also similar to the values reported for the Arabian dromedary by Al-Busadah (2007), and lower than that reported by Elrayah *et al.,* (2012); Osman and Al-Busadah (2003); Aichouni *et al*. (2010), and higher than that reported by Salah El-Din *et al.,* (2005). GOT lacks organ specificity but is present in skeletal muscle, cardiac muscle and liver of large animals and pathological changes in these organs elevate the activity of GOT in the blood (Kaneko 1989). Like other animals the serum level of GPT in conjunction with other enzymes may be useful indicator for hepatic or muscular damage (Kaeneko 1989), but Kerr (1989) considers GPT as non specific index for liver investigations. In the present study the GPT activity was similar in both groups and in the range of the result of Hassan *et al*. (2011);Osman and Al-Busadah (2003); Sazmand *et al*., (2011), but higher than the values obtained by Salah El-Din *et al*., (2005), Al-Busada (2007), Aichouni *et al*., (2010), and Elrayah *et al.,* (2012).

CONCLUSION AND RECOMMENDATIONS:

The values recorded for biochemical parameters were within the ranges reported for camels in Sudan. It could be concluded that concentrate diets could induce significant changes in the physiological responses of one humped camels. The available diet could promote the body condition, the blood metabolites and mineral profile of dromedary.

There are few variations between the findings of workers that may be attributed to the breed differences, nutrition, and husbandry or assay methodology. Findings of the current study provide baseline information for future work in this respect.

We recommend further research to examine the influence of the diet on the blood metabolites in large population of camels in different parts of the Sudan.

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REFERENCES

Abbas, B. and Omer, O. H. (2005). Review of infectious diseases of the camel. *Veterinary Bulletin,* **75**(8): 1 – 16.

Salah El Din, A.E., Shaddad, S.A. and Hassan, T. (2005). Status of Some

Chemical and Biochemical Parameters of Camel Blood in the Rainy Season in the Sudan. *Journal of Animal and Veterinary Advances* **4**(8):713- 715.

Abdel-Fattah, M., Amer H., Ghoneim M. A., Warda M., Megahed Y. (1999). Response of one-humped camel (*Camelus dromedarius*) to intravenous glucagon injection and to infusion of glucose and volatile fatty acids, and the kinetics of glucagon disappearance from the blood. *Zentralbl Veterinarmed A*, 46(8):473-81).

Abokouider, S. N., N. Dabbag and F. Schenkel, (2001). Studies on camels blood parameters in relation to season in Syria. *6th Annual conference on animal production under Arid condition. Alain, United Arab Emirates*.

Aichouni A., Belhadia M., Kebir N. and Aggad H. (2013). Season influence on serum organic parameters of dromedarius (*Camelus dromaderius*) in Algeria. *Biochemistry and Biotechnology Research*, **1**(1): 8-12.

Aichouni, A., Jeblawi R., Dellal A., Hammou H., Aggad, H. (2010). Breed variation in blood constituents of the one-humped camel (*Camelus dromedarius*) in Algeria. *Journal of Camelid Science*, **3**: 19-25.

AL-Busadah, K. A. (2007). Some Biochemical and Haematological Indices in Different Breeds of Camels in Saudi Arabia. *Scientific Journal of King Faisal University (Basic and Applied Sciences)* **8**(1): 131-142.

AL-Sultan, S. I. (2003). Studies of some normal biochemical parameters of Mijaheem Breed of camel Camelus dromedarius in Saudi Arabia. *Journal of Animal and Veterinary Advances*, **2**(12):646-647.

Amin, A. S. A., Khalid A.Abdoun and Abdalla M. Abdelatif (2007): Seasonal Variationin blood constituents of one humped camel (*Camelus dromedarius*), *Pakestan Journal of Biochemical Sciences,* **10**(8):1250-1256.