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THE INFLUENCE OF SEASONS ON BLOOD CONSTITUENTS OF DROMEDARY CAMEL (CAMELUS DROMEDARIUS)

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ABSTRACT: *This study was carried out in White Nile State, Sudan for a period of one year, and was designed to investigate the effect of seasons on the blood constituents of dromadery camel (Camelus dromedarius). One hundred and four Samples different sex and age were collected in July (Rainy Season), September (Rainy hot summer), October (Dry wet winter) and April (Dry hot summer). The effect of season on some blood hematology, metabolites, enzymes and minerals profile was studied. The results showed higher significant level were: Monocytes, total protein and Glutamic-Oxaloacetic Transaminase (GPT) during rainy season, while MCV, MCH, lymphocytes, Eosinophils and Basophils in rainy hot summer, whereas within dry wet winter were: glucose, albumin and k, even in dry hot summer were: MCHC, total white blood cells, neutrophils, uric acid, creatinine, Serum Glutamic-Oxaloacetic Transaminase (GOT) and Ca. The results also indicate that the fluctuations of seasons were observed in red blood cells, hematocrit (PCV) and E.S.R as lower level. Therefore, it could be valuable to provide that the dromedary camels adapted to tropical conditions.*

ORIGINAL ARTICLE

Key words: *Dromedary, Camels, Seasons, Blood Constituents*

INTRODUCTION

Investigation of blood constituents can provide valuable benefit and indication about the general health of animals. Observation of a deviation of certain blood parameters from their normal limits could be an indication for diagnosis or differential diagnosis of a diseased condition (Dessouky, 1992). It has been increasingly realized that more fundamental knowledge of hemogram, blood metabolites and hormones in the dromedary contributes greatly to the understanding of the physiology of this species. Many of the researches that had conducted are incomplete or lack references to fluctuations in the parameters studied caused by environmental conditions or time of sampling during the day. It was thus considered that a useful contribution in physiological knowledge could be made by studying the diurnal variations of blood None sterilized Fatty Acids (NEFA), corticoids, glucose, urea, total proteins, insulin, cholesterol, Glutamic-Oxaloacetic Transaminase (GOT), gamma-GT, Glutamic-Oxaloacetic Transaminase (GPT) (Jimale et al., 1990) and other hematological and serum biochemical values in grazing dromedaries (Dessouky, 1992; Al-Bashan, 2011). Comparison of blood values under different management systems seems to be important as these values reflect the well-being of the animal and are used extensively as diagnostic tests. Serum Glutamic-Oxaloacetic Transaminase (GOT) content is low, but after extensive destruction of cardiac, hepatic, or skeletal tissues, this enzyme is librated into the blood at high levels (Harper, 1971). The estimation of serum GOT is widely used as diagnostic tool for liver injuries, myocardial infarctions, and skeletal muscle sympathies (Ogita and Markert, 1989).

Galyean et al. (1981) found that serum GOT concentration was higher in fasted and transported steers than in untreated controls. Moreover, Schaefer et al. (1990) and Schmidt et al. (1970) reported that blood from stress susceptible pigs had greater concentration of GOT than did blood from stress resistant pigs. Ewan et al. (1968) found elevated serum GOT content in lambs with white muscle disease, a nutritional muscular dystrophy caused by a diet deficient in selenium and (or) vitamin E.

Babeker (2007) reported that increase in GOT lead to increase significantly the Glutamic-Oxaloacetic Transaminase (GPT) in Sudanese sheep.

The camel has provided life in a place uninhabited by most animals (Ouajd and Kamel, 2009). This species is able to survive in hot a temperature that is normally lethal to others species. It can walk 5-7 days with little or no food and water and can lose a quarter of its body weight without impairing its normal functions. All the functions of this species are seen to be adapted to desert environment which is characterized by little water and poor food

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(Wilson, 1988; Ouajd and Kamel, 2009). The one humped camel is an essential source of food and milk in many parts of the world and especially in developing countries in Africa and Asia. The dromedary plays also economic, social and ecological roles (Warden, 1992; Ouajd and Kamel, 2009). The camel possesses unique features which make it superior to other domesticated animals make in the hot and arid desert ecosystem. This reinforced by the ability of camel to traverse considerable distance with much less effort than other species, moving from one patch of short-live vegetation to another.

Camel physiology and special features are therefore not only of a scientific interest, but are the basic substance for people who live in marginal dry land areas. The dromedary camels adapted themselves to ecosystem of dry and arid zones where they are subjected to harsh conditions in addition to the severe fluctuations in the nutritional status, which in turn affect their general performance (Warden, 2004). The protein content of plant species consumed by camels would satisfy most of the protein requirements of camels to perform their various physiological functions (Warden and Farid, 1990).

The concentration of blood metabolites are sensitive to seasonal changes in nutrient supply. Therefore, they could be used as indicators of nutrientional status (Pamba–Gollah et al., 2000). In Sudanese camels the concentrations of plasma glucose and serum urea, creatinine, phosphorus (P) and calcium.

Blood urea concentration was increased in camels, steers and sheep during fasting (Wensvoort et al., 2004). In camels, serum triglycerides concentration has been reported to be affected by a diet (Wasfi, et al., 1987).

Amin et al. (2007) found that the red blood cells count, lymphocytes and basophiles percentages increased significantly during the dry season, while the MCV, MCH and neutrophils percentage increased significantly during the green season.

The pasture quality and quantity are influenced by the seasonal changes in rainfall (Lebon, 1965; Schwartz and Dioli, 1992), which in turn could influence the nutritional status and consequently the in rainfall (Lebon, 1965; Schwartz and Dioli, 1992), which in turn could influence the nutritional status and consequently the blood constituents of camels and comparison of blood values under different management systems seems to be important as these values reflect the well-being of the animal and are used extensively as diagnostic tests. Therefore it was our intention to study the seasonal changes in the some blood hematology, metabolic, enzymes and minerals profile of free ranging camels and to investigate if these could be used as indicators in the evaluation of pasture quality and the predication of metabolic diseases.

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MATERIALS AND METHODS

Survey background

This study was carried out in North White Nile State, Sudan (Latitudes 13^0 and 29^0 North, Longitudes 20^0 and 32^0 East). It was conducted all the year during four seasons starting from 20 June 2009 until 19 June 2010. The seasons described by (Haroon, 2002); Rainy season (from 12 June to 18 October), Rainy hot summer season (from 10 October to 17 November), Dry wet winter season (from 18 November to 15 February) and Dry hot summer season (from 17 February to 20 June). Blood samples were collected from apparently healthy camels of different sex and age. The camel herds were naturally ranging and had no feed supplementation except the provision of common salt (NaCl), where approximately l pound of salt was added to 20 L of water during the dry hot summer. The camels have had access to water every 5 - 9 days during the dry season, while water was available ad labium during the others seasons.

Climatic measurements

The daily maximum and minimum ambient temperature (T_a) rainfall and relative humidity (RH) readings were obtained from Eldweem Meteorological Unit in White Nile State. The mean monthly values of ambient temperature, rainfall and relative humidity during the survey period were then computed.

Blood analysis

Samples of blood were collected from camels by jugular vein puncture. Seven milliliter blood samples were collected from each camel using 10 mL plastic disposable syringes. Tow milliliter of the blood sample were immediately transferred to capped and heparinzed tubes (Medical Disposable Industrial Complex MDIC). These samples were used for the hematological analyses and the determination of plasma glucose concentration. The rest of the samples were allowed to clot for 2h at room temperature, the sera were then separated by centrifugation at 3000 rpm for 15 min and stored frozen at -20C for further analysis. Erythrocytic indices were determined according to the methods described in Schalm's Veterinary Hematology (Jain, 1986). The packed cell volume of erythrocytes was determined by the micro-haematocrit method using a special centrifuge. Haemoglobin concentration was determined by the cyano-methaemoglobin method as described by Van Kampen and Zijlstra

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(1961). Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC) and Mean Corpuscular Volume (MCV) calculated from the following formula (Simon et al, 2001):

MCV fl (femtoliter) = {Hematocrit % × 10} / {RBCs count (in million /uL)}

MCH pg (picogram) = { Hemoglobin (in gm/dL) × 10} / {RBCs count (in million /uL)}

MCHC (g/dL) ={ Hemoglobin (in gm/dL) × 100} / {Hematocrit (in %)}

Differential leukocyte count (DLC) was determined microscopically from a count of 100 leukocytes in thin May-Giemsa stained blood smears (Kelly, 1984). Serum total protein was determined by the Biuret reagent method according to King and Wooton (1965), serum albumin concentration was determined according to the method described by Bartholomew and Delany (1966). Plasma glucose level was determined by the enzymatic colorimetric method using a kit (Plasmatec Laboratory at Products Ltd Germany). The concentration of serum urea was determined by the colorimetric method according to Harold (1988). Serum creatinine concentration was determined by a colorimetric method as described by Henry (1974). Glutamic-Oxaloacetic Transaminase (GOT) and Glutamic-Pyruvic Transaminase (GPT) were determined according to Reitmann-Frankel method (1957). Serum Phosphorus concentration was determined by the colorimetric methods as described by Varley (1967). Serum calcium concentration was measured by the colorimetric method as described by Trinder (1964).

Statistical analysis

The data obtained from the blood samples collected from the camels during the seasons have been subjected to standard methods of statistical analysis was performed using windows based SPSS (Version 10.0, 1999). The analysis of variance (ANOVA) test was used to evaluate the effects of season on blood constituents of the camels.

RESULTS

Climatic data

The prevalent maximum and minimum ambient temperature (T_a), rain fall and relative humidity (RH) during the survey period in the Rainy season (from 12 June to 18 October), Rainy hot summer (from 10 October to 17 November), Dry wet winter (from 18 November to 15 February) and Dry hot summer (from 17 February to 20 June) are shown in Figure 1. The highest mean value of maximum and minimum ambient temperature (43.0°C, 27.5°C) was recorded in May and July during the dry hot summer, respectively, and the maximum mean value of rainfall (116.1mm) and humidity (55%) was recorded in July during the rainy season. The lowest mean value of maximum and minimum ambient temperature (33.0°C, 19.4°C) was recorded in January during the dry weight winter, respectively, and the minimum mean value of rainfall (0.0mm) and humidity (19%) was recorded in April during the dry hot summer.

Seasonal variation in blood constituents of camel Erythrocytes indices

Except for Hemoglobin (Hb), all parameters presented in table (1) showed significant variation due to seasonal effect. R.B.Cs count and the Packed Cell Volume (PCV) was significantly ($p<0.05$) lower during Rainy hot summer and Dry hot summer, respectively. Erythrocyte Sedimentation Rate (E.S.R) increased significantly during Dry hot summer a level slightly higher than that of Rainy hot summer or Rainy season which turndown significantly within Dry weight winter.

Mean Corpuscular Volume (MCV) and Mean Corpuscular Hemoglobin (MCH) demonstrated significant differentiation to seasons of year, increased significantly during Rainy hot summer season and decreased significantly in Dry hot summer. Mean Corpuscular Hemoglobin Concentration (MCHC) showed higher and lower significant in Dry wet winter.

Differential leukocytes count

When compared examined differential leukocytes in the course of seasons of the year, showed highest significant value were: Total W.B.Cs count during Dry hot summer, Lymphocytes and Basophils rations in Rainy hot summer and Monocytes in Rainy season. While the significant lower value were: Neutrophils (%) and Eosinophils (%), during Rainy hot summer and Dry hot summer, respectively (Table 1).

Blood metabolites

Blood metabolites during different seasons is presented in Table 3. Serum glucose was found to be significant ($P<0.05$) higher (80.40 ± 5.04) in Dry weight winter, then showed a significant low level (36.45 ± 6.14) during Rainy season. Uric acid and Creatinine showed the same significance for increased values during Dry hot summer as compared to other environmental and physiological conditions. Total protein a level shows a peak of (9.33 ± 0.15) during Rainy hot summer a slightly higher than Rainy season, which significant increased as compared with total protein concentration during Dry wet winter and Dry hot summer.

On other hand albumin concentration showed a significant variations within seasons and recorded higher value (3.82 ± 0.33)g/dl during Dry wet winter than other seasons.

Concentration of serum enzymes in camels: Glutamic Oxaloacetic Transaminase (GOT) in Dry wet winter was significantly ($P<0.05$) lower as compared to other seasons of the year, this increase continued to reach the peak of

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(3.03 ± 0.57) during Dry hot summer, Glutamic-Pyruvic Transaminase (GPT) also showed significant increase to reach level (16.95 ± 1.61). During Rainy season it goes down with significant decline to reach (2.50 ± 0.20) in Dry hot summer (Table 4).

Concentration of serum minerals in camels: Serum inorganic calcium (Ca+2) during Dry hot summer was significantly higher with other periods. Potassium (K+) concentration augmented significantly during Dry wet winter to reach level (7.19 ± 2.60) and decrease significantly in Rainy season to attain (2.04 ± 0.15) (Table 5).

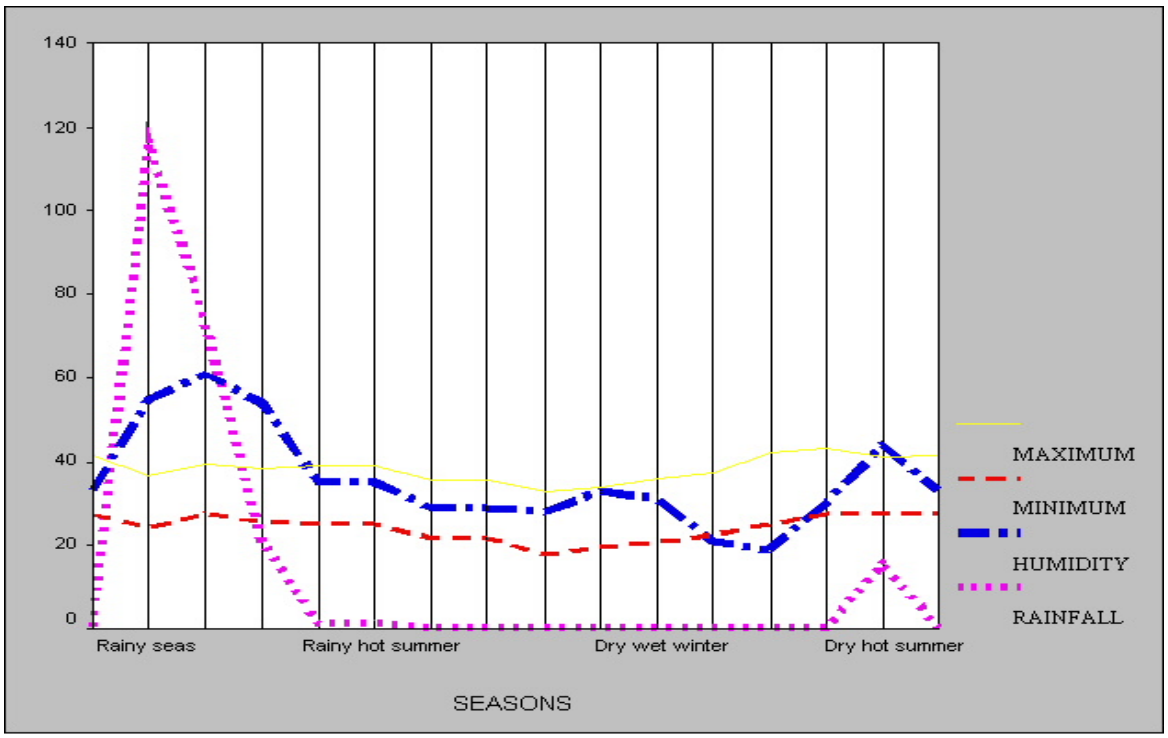

Figure 1 - Meteorological data during the study period at north of White Nile State (El dweem city)

Table 1 - Seasonal variation in the erythrocytes indices of camels (values are mean ± SE)

Parameter	Rainy Season (July) No.=27	Rainy hot summer (September) No.=27	Dry wet winter (October) No.=20	Dry hot summer (April) No.=30
R.B.Cs. (×10⁶ µL⁻¹)	2.96 ± 0.22^{a}	2.25 ± 0.08^{b}	3.29 ± 0.98^{a}	2.92 ± 0.09^{a}
PCV (%)	23.42 ± 1.8^{a}	22.59 ± 1.39^{a}	23.70 ± 1.36^{a}	10.90 ± 0.79^{b}
E.S.R (mm/hour)	2.79 ± 0.31^{a}	2.88 ± 0.25^{a}	2.10 ± 0.34^{ab}	3.03 ± 0.29^{ac}
Hemoglobin (g/dl)	7.98 ± 0.87^{a}	8.59 ± 0.34^{a}	7.47 ± 0.33^{a}	8.27 ±0.54^{a}
MCV (fl)	89.43 ± 9.62^{ab}	103.87 ± 7.88^{a}	72.31 ± 3.86^{b}	39.99 ± 3.16^{c}
MCH (pg)	32.45 ± 4.08^{ab}	38.52 ± 1.07^{a}	23.11 ± 1.27^{b}	28.34 ± 1.74^{b}
MCHC (g/dl)	33.41 ± 5.28^{a}	43.52 ± 3.95^{ab}	33.57 ± 2.46^{a}	47.60 ± 5.21^{b}

$^{a, b, c, d}$ Means with different superscripts in the same raw are significantly different at (P <0.05). No.: Number of camels in season.

Table 2 - Seasonal variation in the differential leucocytes count of camels (values are mean ± SE)

Parameter	Rainy Season (July) No.=27	Rainy hot summer (September) No.=27	Dry wet winter (October) No.=20	Dry hot summer (April) No.=30
Total W.B.Cs (×10³/ µL)	7.25 ± 0.31^{a}	7.99 ± 0.17^{a}	6.54 ± 0.30^{a}	9.11 ± 0.36^{b}
Lymphocytes (%)	40.07 ± 0.99^{a}	47.10 ± 2.06^{b}	41.60 ± 0.92^{a}	40.24 ± 1.03^{a}
Monocytes (%)	12.20 ± 0.46^{a}	10.30 ± 0.60^{b}	10.53 ± 0.39^{b}	10.35 ± 0.66^{b}
Neutrophils (%)	40.40 ± 0.92^{a}	32.90 ± 1.25^{b}	36.67 ± 0.61^{a}	43.82 ± 0.78^{c}
Eosinophils (%)	6.27 ± 0.32^{a}	8.60 ± 0.54^{b}	8.40 ± 0.31^{bc}	4.65 ± 0.37^{d}
Basophils (%)	1.13 ± 0.19^{a}	2.30 ± 0.15^{b}	0.93 ± 0.15^{a}	1.12 ± 0.17^{a}

$^{a, b, c, d}$ Means with different superscripts in the same raw are significantly different at (P<0.05). No.: Number of camels in season.

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Table 3 - Seasonal variation in the concentration of blood metabolites in camels (values are mean ± SE)

Parameter	Rainy Season (July) No.=27	Rainy hot summer (September) No.=27	Dry wet winter (October) No.=20	Dry hot summer (April) No.=30
Glucose (mg/dl)	36.45 ± 6.14^{a}	59.20 ± 4.11^{bd}	80.40 ± 5.04^{c}	58.24 ± 5.95^{d}
Total protein	9.14 ± 0.78^{a}	9.33 ± 0.15^{a}	6.35 ± 0.12^{b}	2.16 ± 0.12^{c}
Albumin (g/dl)	2.08 ± 0.21^{a}	3.30 ± 0.60^{b}	3.82 ± 0.33^{c}	1.78 ± 0.06^{d}
Uric acid (mg/dl)	0.24 ± 0.07^{a}	0.34 ± 0.03^{a}	0.34 ± 0.05^{a}	2.99 ± 0.08^{b}
Creatinine (mg/dl)	0.97 ± 0.10^{a}	0.97 ± 0.06^{a}	0.96 ± 0.05^{a}	1.45 ± 0.13^{b}

$^{a, b, c, d}$ Means with different superscripts in the same raw are significantly different at (P <0.05). No.: Number of camels in season.

Table 4 - Seasonal variation in the concentration of serum enzymes in camels (values are mean ± SE)

Parameter	Rainy Season (July) No.=27	Rainy hot summer (September) No.=27	Dry wet winter (October) No.=20	Dry hot summer (April) No.=30
GOT (U/L)	2.79 ± 4.02^{a}	2.88 ± 1.35^{bd}	2.10 ± 2.19^{c}	3.03 ± 0.57^{d}
GPT (U/L)	16.95 ± 1.61^{a}	3.31 ± 2.31^{b}	10.60 ± 1.41^{a}	2.50 ± 0.20^{b}

$^{a, b, c, d}$ Means with different superscripts in the same raw are significantly different at (P <0.05). No.: Number of camels in season.

Table 5 - Seasonal variation in the concentration of serum minerals in camels (values are mean ± SE)

Parameter	Rainy Season (July) No.=27	Rainy hot summer (September) No.=27	Dry wet winter (October) No.=20	Dry hot summer (April) No.=30
Calcium (Ca^{+2}) (mg/l)	8.40 ± 0.20^{a}	8.17 ± 0.23^{a}	8.52 ± 0.34^{a}	18.61 ± 0.65^{b}
Potassium (K^{+}) (mEq/l)	2.04 ± 0.15^{a}	2.25 ± 0.08^{a}	7.19 ± 2.60^{b}	4.70 ± 0.16^{ab}

$^{a, b, c, d}$ Means with different superscripts in the same raw are significantly different at (P <0.05). No.: Number of camels in season.

DISCUSSION

This study has been conducted to investigate the effect of season on blood constituents of camels (Camelus dromedarius) kept under tropical conditions in White Nile State, Sudan. The results obtained would be useful for establishment of normal hematological indices, normal serum metabolites, enzymes and mineral profile for camels. The period of the year in the current study, described by (Haroon, 2002), classified into: Rainy season (from 12 June to 18 October), Rainy hot summer season (from 10 October to 17 November), Dry wet winter season (from 18 November to 15 February) and Dry hot summer season (from 17 February to 20 June). The meteorological data shown in Figure 1 indicated that in the study period, the camels have been exposed to marked seasonal changes in ambient temperature (T_a), relative humidity (RH) and rainfall.

In the present study, the seasonal variation in blood constituents showed a marked effect on the total red blood cells count (Table 1). The observed decrease in RBC count during the Rainy hot summer could be due to the half-life and survival time of red blood cells during dehydration, similar of that results obtained by (Amin et al., 2007) which is common decline during green season. The RBC count obtained in the present study is slightly lower than that reported for Sudanese adult camels (Abdelgadir et al., 1984; Amin et al., 2007). However, it is within the reference ranges reported by Christiansen et al. (2007). The observed decreased in the PCV during Dry hot summer season (Table 1) could be due to ambient temperature and state of hydration as mentioned by (Bernard et al, 2000).

These results are not agreement with those obtained by (Amin et al., 2007) who reported no difference in the PCV with dry and green season. The PCV count obtained in the present study is within the range that reported for Sudanese adult camels (Abdelgadir et al., 1984; Amin et al., 2007). The observed increased in the E.S.R during Dry hot summer season (Table 1) could be due to dehydrate, asphyxia excitement leads to release of erythrocytes from the spleen (Dukes, 1993), thus, increased the E.S.R in that season. The results obtained in the present study of the E.S.R within the physiological normal for this species (Jain, 1986; Kuleta et al., 1993; Winnicka, 1997). The observed increase in the MCV and MCH during the Rainy hot summer season and the decrease in dry hot summer (Table I) could be due to hypotonic and hypertonic of RBCs to absorb water and hemolyze before their RBCs membrane can accommodate the change (Shimizu et al., 1979; Ogawa et al., 1989); in commonplace the MCHC observed high in Dry hot summer and low in Rainy season could be attributed to the concomitant increase or decrease in Hb concentration and PCV levels. Similarly, Amin et al. (2007) reported an increasing level of MCV and MCH during green seasons in dromedary camels but no discrepancy in MCHC. The mean values of MCV, MCH and MCHC reported in the current study are high of the previous report (Abdelgadir et al., 1 984; Amin et al., 2007).

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However, it is within the normal rang reported by (Christiansen et al., 2007). The observed of Hb in current study show no significance between seasons, the same findings were previously reported by (Amin et al., 2007) who revealed that no difference was detected between dry season (10.67 mg/dl) and green season (10.73 mg/dl) of hemoglobin. consecutively during Rainy hot summer and Rainy season, levels are highly than that of the other seasons of the year as compared with preceding mentioned parameters, these observed changeability could be due to the dromedary camels adapted themselves to ecosystem of dry and arid zones where they are subjected to harsh conditions in addition to the severe fluctuations in the nutritional status, which in turn affect their general performance (Warden, 2004). The pasture quality and quantity are influenced by the seasonal changes in rainfall (Lebon, 1965; Schwartz and Dioli, 1992), which in turn could influence the nutritional status and consequently the blood constituents of camels. The White blood cells (W.B.Cs.) and neutrophils ratio, Lymphocyte, Eosinophils, Basophils and Monocytes reported in the current study are similar of the previous reported (Amin et al., 2007; Alharbi, 2012). However, it is within the normal rang reported by (Christiansen et al., 2007).

Total protein and glucose contents in (Table 3) were in range of other results reported by (Amin et al., 2007; Patodkar et al., 2010; Alharbi, 2012), Similar of that findings were previously reported by (Amin et al., 2007), who showing difference was detected between dry and green season in serum content of total protein, the results showed that glucose levels were significantly higher during Dry wet winter reach the peak level of (80.40 ± 5.04) mg/dl, these results are in agreement with those obtained by (Alharbi, 2012), who reported the higher values during winter season in comparison to the other period of the year, While, (Amin et al., 2007) noted that glucose levels raised during the green season. It was believed that this may be attributed to seasonal effect with relation to nutritional effect for difference of roughs while grazing during different seasons.

Createnine and uric acid levels found in the present work (Table 3) increased significantly during Dry hot summer, were in range as compared to other levels reported by (Amin et al. 2007; Albahrawy et al., 2011); which the Createnine was high in green season and late sprig than the other period of the year, and as a result the uric acid in green season. The observed increase in the concentration of serum Createnine and urea during Dry hot summer season (Table 3) could be attributed to the availability and quality of forage during the green season. Payne (1990) reported a higher level of crude proteins of pasture plants in wet summer. Higher dietary protein in the racing season was reported to increase Blood Urea Nitrogen (BUN) of camels (Salman and Afzal, 2004). Further more, the idling and ruminating times were reported to be higher during growing season compared to the dry season (Kassilly, 2002). It has also been reported that the level of serum urea is related to the forage intake and consequently the energy and crude protein concentration (firings et al., 1991).

Albumin concentrations in the current study show significance variation all the way through the year (table 3), recorded minimum value of (1.78 ± 0.06)g/dl during Dry hot summer and maximum value of (3.82 ± 0.33)g/dl within Dry wet winter, were in range as compared to other levels reported by (Amin et al. 2007; Christiansen et al., 2007), these revolutionize results could be due to dehydration and poor diet as mentioned (Pagana and Pagana, 2002; Fischbach et al., 2004) who explained that High albumin levels may be caused by severe dehydration, Low albumin levels may be caused by a poor diet (malnutrition).

In the present study demonstrate seasonal variation in the concentrations of serum enzymes GOT and GPT in the dromedary camels, The experimental increase in the concentrations of serum GOT and GPT during the Dry hot summer and Rainy season, respectively (Table 4), may be attributed to the availability of plants, Galyean et al. (1981) found that serum GOT concentration was higher in fasted and transported steers than in untreated controls. Moreover, Schaefer et al. (1990) and Schmidt et al. (1970) reported that blood from stress susceptible pigs had greater concentration of GOT than did blood from stress resistant pigs.

The results of the present study showed seasonal variation in the concentrations of serum Ca and k in the dromedary camels, The observed marked increase in the concentrations of serum Ca and k during the Dry hot summer season and Dry weight winter, respectively (Table 5), may be attributed to the availability of plants rich us minerals (ash content) during the wet season (Kuria et al., 2004; Amin et at, 2007). The mean serum Ca and k concentrations reported in this study are within the range of previous reported (Mohamed and Hussein, 1999; Amin et al. 2007).

CONCLUSION

The results obtained in the current study signify that the nutritional status through the period of the year could persuade considerable changes in the physiological responses of the dromedary camel, the higher significant level were Monocytes, total protein and GPT during rainy season; MCV, MCH, lymphocytes, Eosinophils and Basophils in rainy hot summer and within Dry wet winter were: glucose, albumin and k, while in dry hot summer were: MCHC, WBCs, neutrophils, uric acid, creatinine, GOT and Ca. The results also indicate that the fluctuations of seasons were observed in RBCs PCV and E.S.R as lower level. Therefore, it could be beneficial to provide concentrate feed to camels kept under the tropical conditions.

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mineral indices in dromedaries (Camelus. dromedarius), blood samples were collected. from 40 clinically healthy animals, reared under. semi-extensive conditions in the Djelfa valleyÂ season Influence on blood parameters. of Algerian dromedaries â€˜Camelus. dromedarius). Revue, Med. Vet., 162Â Breed variation in blood constituents of the one-humped camel (Camelus dromedaries) in Algeria. Article. Full-text available. some biochemical constituents of camel blood in Saudi Arabia. J.Â Blood constituents were determined with an automatic hematological analyzer and muscle pH was measured by a portable pH meter. Drip loss was calculated from the difference in muscle weight before and after storage and cooking loss was determined as the difference in weight sample before and after cooking.Â Thirty healthy dromedary camels (Camelus dromedarius) were used to measure plasma triiodothyronine (T3), thyroxine (T4) and thyroid-stimulating hormone (TSH) concentrations. The microparticular enzymatic immunoassay method (MEIA) was used for the T3 and TSH determination and the T4 was measured using the fluorescent polarisation immunoassay method (FPIA).