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HAEMATOLOGICAL PROFILE OF THE ONE-HUMPED CAMEL SUBJECTED TO PACKING (LOAD-CARRYING) IN THE HARMATTAN SEASON IN THE SEMI-ARID REGION OF NIGERIA

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ABSTRACT

The study was conducted to determine the effects of packing on some haematological responses in the one-humped camel (*Camelus dromedarius*) during the harmattan season in the semi-arid zone of Nigeria. The study was conducted using 8 experimental camels which were packed with bags of grains of 200 kg, while 4 camels served as the control group only trekked but were not packed. Ambient temperature (AT) and relative humidity (RH) of the experimental site were recorded three days prior to the experiment and on the experimental day at 06.00 h, 12.00 h and 15.00 h. Some haematological parameters were determined in all the camels. The mean AT and RH values ranged between 22-36.50 °C and 26-36 %, respectively. The erythrocyte count, TP and PCV values were significantly higher ($P < 0.05$) in experimental camels than control camels after the experiment. The changes recorded in some of the parameters demonstrated that compensatory mechanisms were adopted by the camels to reduce the adverse effects of stress of packing. It is therefore recommended that a potent antioxidant should be administered to camels before subjecting them to packing to ameliorate the effects of stress of packing.

Keywords: Camel, haematological profile, harmattan season, Nigeria

INTRODUCTION

The One-humped camel is capable of thriving, reproducing and producing in harsh climatic conditions compared with other animals in the same habitat (Mohammed, 2000). Camels are comparatively cheaper means of transportation than the conventional motorized form of transportation to small farmers and nomad (Khan *et al*., 2003) and can survive in hot temperatures that are lethal to other species. They can walk 5-7 days with little or no food and can lose a quarter of their body weights, without impairment in normal functions (Ouajd and Kamel, 2009). Understanding of the physiological status of animals is necessary for efficient control and management (Barnett and Hemsworth, 1990; AL-Haidary, 2006) and it has been postulated that the camel's ability to accomplish great feats of endurance in extreme conditions is due to its ability to employ unique physiological mechanisms (Khan *et al*., 2003). The camel's blood plays a principal role in adaptive mechanisms. Leucocytes are in large proportion neutrophils (approximately 50 %) whereas in other ruminants' blood, lymphocytes are dominant (Ouajd and Kamel, 2009). The erythrocytes are ovoid, small, and relatively thin and present a great transferring surface. The erythrocytes continue to circulate in situations of increased blood viscosity and have the capacity to change volume depending on the state of animal hydration (Mohammed and Hussein, 1999). Haemoglobin concentration varies in range of 13-16 g/100ml, which is relatively higher compared to other domestic animals. It is recognized that the camel's haemoglobin has higher affinity for oxygen (Bogin, 2000; Ouajd and Kamel, 2009). Several factors such as blood pH, electrolytes concentration of plasma and environmental conditions such as ambient temperature and relative humidity play important role in determining the homeostasis of blood of animals (Minka and Ayo, 2007; Ayo *et al*., 2008; Peshin *et al*., 2010). This study is aimed at investigating some physiological and haematological changes that occur when camels are subjected to packing (load-carrying).

MATERIALS AND METHODS

Animals

A total of 12 apparently healthy male dromedary camels were used for the study. They were dewormed and screened for haemoparasitic diseases and only healthy camels served as subjects. They were divided into two

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groups. Group I consisted of eight camels which constituted the experimental group and group II comprised of four camels which served as the control. The camels were raised under semi-intensive system and their feed was supplemented with hay. Water was provided ad libitum. The experiment was carried out in Kasuwar-Daji (12°36′ N, 6°35′ E), Zamfara State, located in the Sahel Savannah zone of Nigeria.

Live weight measurement

The weight of each camel was determined approximately using a weight measuring tape (The Kruse Company, Denmark). The live weights were calculated using the formula of Khan *et al.* (2003). (Live weight, (kg) = Shoulder height (m) × Thoracic girth (m) × Hump girth (m) × 50).

Measurement of thermal environmental conditions

The dry-and wet-bulb thermometer (Brannan, England) was used to measure relative humidity and dry-bulb and wet-bulb temperature of the experimental site at 06.00 h, 12.00 h and at 15.00 h. The relative humidity was calculated using the instructions of the manufacturer.

Collection of blood samples

Ten ml of blood was collected from each camel before the commencement of the experiment and at the end of the experiment. The samples were collected into vacuum containers containing the anticoagulant, ethylene diamine tetraacetic acid (EDTA). The blood samples were then transported to the Physiology Research Laboratory of the Department of Veterinary Physiology and Pharmacology, Ahmadu Bello University, Zaria in a Coleman box for analyses. They were analysed for the following parameters: PCV, total and differential leucocyte count, erythrocyte count, haemoglobin concentration and total protein.

Analyses of haematological parameters

Blood samples containing EDTA were aspirated into plain capillary tubes and centrifuged at 750 × g for 15 minutes. Thereafter, PCV of each sample was read using haematocrit graphic reader (Kelly, 1984). The haemoglobin concentration of each sample was determined using cyanmethaemoglobin method (Kelly, 1984). The total protein of the samples was measured using the hand refractometer as described by Benjamin (1985). Total and differential leucocyte counts were also determined using a standard Haematology Analyzer (Abbott Laboratories, Abbott Park, Illinois, U.S.A.). Erythrocyte counts were determined using a haemocytometer as described by Schalm *et al*. (1975).

Statistical analysis

Data obtained from the study were expressed as mean ± standard error of the mean (mean ± SEM) and analyzed using the Student's *t*-test to compare the differences in the mean values between the control and experimental camels. Values of $P < 0.05$ were considered significant.

RESULTS AND DISCUSSION

Table 1 shows the estimated body weights of the camels used in the experiment. The average weight of the camels was approximately 400 kg.

Table 1. Body weights of camels

Camel no.	1	2	3	4	5	6	7	8	9	10	11	12
Body weight (kg)	413	397	402	403	395	403	389	398	417	404	399	406

Table 2 shows the ambient temperature recorded three days prior to the experiment and on day of experiment. The minimum ambient temperature at 06.00 h was 22°C while 24°C was the maximum value at the same time. At 12.00 h the minimum value was 35°C while the maximum value was 36.5°C. At 15.00 h, the minimum and maximum values were 36 and 36.5°C respectively. Table 2 shows the result of relative humidity of the site. The minimum and maximum relative humidity values at 06.00 h were 26 and 27 % respectively with a mean value of 26.67 ± 0.3 %. The values then increased to 32 and 37 % respectively with a mean value of 34.7 ± 1.3 % at 12.00 h and 15.00 h.

Table 2. Dry-Bulb Temperature recorded three days prior to experiment and on day of experiment

Hour of the day	Minimum Temperature (◦C)	Maximum Temperature (◦C)	Mean + SEM (◦C)
06.00	22.00	24.00	22 ± 0.7
12.00	35.00	36.50	35.5 ± 0.3
15.00	36	36.50	36.2 ± 0.2

Table 3. Relative Humidity recorded three days prior to experiment and on day of experiment

Hour of the day	Minimum Relative humidity (%)	Minimum Relative humidity (%)	Mean ± SEM (%)
06.00	26	27	26.67 ± 0.3
12.00	32	37	34.7 ± 1.3
15.00	32	37	34.6 ± 1.3

Table 4 shows the haematological parameters of camels in experimental group. Packed cell volume increased significantly from 27.75 ± 0.21 % before packing to 31.75 ± 0.84 % after packing. There was also a significant increase in total protein from 71.63 ± 0.31 g/l before experiment to 78.88 ± 0.97 g/l after the experiment. Total leucocyte counts also increased significantly from16.66 ± 0.18 to 19.66 ± 0.87 10^9/l.

Table 4. Haematological parameter of camels in the experimental group. Values are means ± SEM

Parameters	Before packing (n = 8)	After packing (n = 8)
Packed cell volume (%)	27.75 ± 0.21^a	31.75 ± 0.84^b
Haemoglobin (g %)	7.44 ± 0.19	7.81 ± 0.20
Total protein (g/l)	71.63 ± 0.31^a	78.88 ± 0.97^b
Leucocytes 10^9/l	16.66 ± 0.18^a	19.66 ± 0.87^b
Erythrocyte 10^{12}/l	10.23 ± 0.28	10.45 ± 0.33
Neutrophil 10^9/l	11.04 ± 0.46	11.66 ± 0.43
Lymphocytes 10^9/l	5.84 ± 0.33	6.38 ± 0.43
Eosinophils 10^9/l	0.811 ± 0.1	1.32 ± 0.41
Monocytes 10^9/l	0.35 ± 0.1	0.21 ± 0.04
Basophils 10^9/l	0.00	0.00
Band cell10^9/l	0.50 ± 0.16	0.18 ± 0.11
Neutrophil/ Lymphocyte ratio	1.98 ± 0.8	1.89 ± 0.09

Values on the same row with different superscript letters are significantly different ($P < 0.05$), (^{ab} = $P < 0.05$)

Table 5 shows the haematological parameters of the camel in the control group. There was a significant increase in value of packed cell volume after the experiment with vales of 25.71 ± 0.13 % and 27.05 ± 1.10 % respectively. There was also a significant increase in total leucocyte counts from 16.20 ± 0.32 to 18.70 ± 0.89 10^9/l.

Table 6 shows the haematological parameters of the experimental camels and the control camels after the experiment. The packed cell volume were significantly higher in the experimental group than the control group with values of 31.75 ± 0.84 % and 26.05 ± 0.10 % respectively. The total erythrocyte count was also significantly higher in experimental group than the control group with values of $15.30 \pm 2.20 \times 10^{12}$/l and 10.45×10^{12}/l respectively.

The climatic condition in the study site was characterized by fluctuations in environmental temperatures with diurnal cycle of cold nights alternating with relatively hot daytimes, cold, dry and dusty wind without rainfall due to low relative humidity (Tables 2 and 3). The harmattan season is reported to be the most thermally stressful to animals than the other two seasons (hot dry and rainy) in savannah of Northern Nigeria (Igono *et al*., 1982, Olorunshola *et al*., 2012). The results of all haematological parameters were within the normal range for camels in both experimental and control groups (Bogin, 2000). The results of haematological parameters in experimental camels showed a significant increase in PCV after packing and trekking ($P < 0.01$), and this agreed with the

Table 5. Haematological parameters of control (n=4) camel before and after trekking. Values are means ± SEM

Parameters	Before	After
Packed cell volume (%)	25.71 ± 0.13^{a}	27.05 ± 1.10^{b}
Haemoglobin (g %)	7.33 ± 0.35	7.53 ± 0.33
Total protein (g/l)	71.63 ± 1.80	73 ± 2.20
Leucocytes 10^9/l	16.20 ± 0.32	18.70 ± 0.89
Erythrocyte 10^{12}/l	15.05 ± 2.10	15.30 ± 2.20
Neutrophil 10^9/l	10.74 ± 0.6	11.17 ± 0.32
Lymphocytes 10^9/l	6.05 ± 0.3	6.27 ± 0.30
Eosinophils 10^9/l	0.86 ± 0.10	0.70 ± 0.22
Monocytes 10^9/l	0.27 ± 0.20	0.19 ± 0.00
Basophils 10^9/l	0.00	0.00
Band cell10^9/l	0.41 ± 0.11	0.27 ± 0.17
Neutrophil/ Lymphocyte ratio	1.79 ± 0.03	1.78 ± 0.04

Table 6. Haematological parameters of experimental (n = 8) and control camel (n = 4) after packing. Values are means ± SEM

Parameters	Experiment	Control
Packed cell volume (%)	31.75 ± 0.84^{a}	26.05 ± 0.10^{c}
Haemoglobin (g %)	7.81 ± 0.20	7.53 ± 0.33
Total protein (g/l)	78.88 ± 1.90	73.00 ± 2.20
Leucocytes 10^9/l	19.66 ± 0.63	17.50 ± 0.61
Erythrocyte 10^{12}/l	15.30 ± 2.20^{a}	10.13 ± 0.12^{c}
Neutrophils 10^9/l	11.66 ± 0.83^{a}	7.17 ± 0.12^{b}
Lymphocytes 10^9/l	6.38 ± 0.43	6.27 ± 0.30
Eosinophils 10^9/l	1.32 ± 0.41	0.70 ± 0.22
Monocytes 10^9/l	0.21 ± 0.04	0.19 ± 0.0
Basophils 10^9/l	0.00	0.00
Band cell10^9/l	0.18 ± 0.11	0.27 ± 0.17
Neutrophil / Lymphocyte ratio	1.89 ± 0.09	1.78 ± 0.04

Values on the same row with different superscript letters are significantly different (^{ab} = $P < 0.05$, ^{ac} = $P < 0.01$)

findings of Tarrant *et al*. (1992) and Earley *et al*. (2006) that stress due to transportation increases PCV in calves and steer, respectively. The increase in PCV and Hb may be due to release of erythrocytes from storage organs such as the liver and spleen (Schimidt-Nilsen, 1997; Tanvguchi *et al*., 2004) in response to stressful conditions of load-carrying and trekking, which increased supply of nutrients and oxygen to the tissue. The total protein of experimental camels increased significantly after packing and trekking ($P < 0.05$). This may be attributed to an increased activity of albumin which is a principal plasma protein required for the maintenance of plasma hydration to prevent extracellular dehydration during stressful conditions (Ouajd and Kamel, 2009), and as a result of generation of reactive oxygen species due to stress of packing. Albumin is an endogenous antioxidant that increases to combat oxidative stress during stressful situations because it has a thiol group, which protects vital targets such as erythrocytes from copper ion-induced Fenton reaction and inhibits iron-dependent free radical production (Argawal and Prabukaran, 2005; Roche *et al*., 2008). Similar increase in total protein have been reported in calves (Earley *et al*., 2006) transported by road and in sheep (Kumar *et al*., 2003).

Total leucocyte counts increased significantly ($P < 0.05$) after the experiment in both control and experimental camels. Leucocytosis observed in this present study may be due to response to the stressful conditions of trekking and packing. This finding agreed with the findings of Zapata *et al*. (2004), who reported leucocytosis following stress of road transportation in captive-reared guanacos (*Lima guanicoes*). The neutrophil counts, recorded in experimental camels after packing was significantly higher ($P < 0.05$) than the values obtained in

the control camels the experiment, which may be due to stress of packing and trekking. Values of lymphocytes, monocytes, eosinophils, basophils, and band cells after the experiment were not significantly different ($P > 0.05$) from those obtained prior to packing in both experimental and control camels. The results however, contradict those of Zapata *et al*. (2004) who recorded a decrease in lymphocyte count following transport of guanacos by road. Neutrophil/lymphocyte ratio did not change significantly after packing and this also contradicts the result obtained by Zapata *et al*. (2004) in captured guanacos (*Lima guanicoes*) and that of Kock *et al*. (1999) in rhinoceros, where neutrophil/lymphocyte ratio was significantly higher after subjecting the animals to stress of road transportation.

The changes recorded in some of the parameters demonstrated that compensatory mechanisms were adopted by the camels to reduce the adverse effects of stress of packing. It is therefore recommended that a potent antioxidant should be administered to camels before subjecting them to packing to ameliorate the effects of stress of packing.

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