CLINICAL STUDIES OF SELECTED RUMINAL AND BLOOD CONSTITUENTS IN DROMEDARY CAMELS AFFECTED BY VARIOUS DISEASES

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Abstract

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Selected ruminal and blood constituents were investigated in a group of 81 dromedary camels affected by various diseases including simple indigestion (SI, n = 38), ruminal acidosis (RA, n = 19), frothy bloat (FB, n = 3), trypanosomiasis (TR, n = 11), caseous lymphadenitis (CL, n = 6), contagious skin necrosis (CSN, n = 4) and in healthy camels (NC, n = 38). Body temperature was taken, pulse and respiratory rate were measured, and mucous membranes and ruminal motility were examined in each animal. Samples of ruminal fluid were examined for physical characteristics (pH, colour, consistency), protozoan activity and biochemical constituents including ammonia nitrogen (2.63 ± 0.16, 2.38 ± 0.20, 1.91 ± 0.01, 3.21 ± 0.35, 3.19 ± 0.11, 3.11 ± 0.27, and 2.40 ± 0.09 mmol/L for the groups SI, RA, FB, TR, CL, CSN, and NC, respectively), total VFA, total proteins, calcium, inorganic phosphorus, sodium (113.49 ± 8.16, 71.49 ± 9.19, 52.50 ± 8.25, 107.4 ± 10.27, 122.48 ± 8.7, 119.88 ± 5.01, and 109.83 ± 5.62 mmol/L for the groups SI, RA, FB, TR, CL, CSN, and NC, respectively), blood samples were tested for total erythrocyte count, haemoglobin concentration, packed cell volume, mean cellular volume (15.96 ± 1.53, 23.15 ± 3.18, 22.68 ± 3.91, 14.78 ± 0.86, 20.4 ± 2.98, 20.03 ± 0.34 and 19.75 ± 0.88 fl. for the groups SI, RA, FB, TR, CL, CSN, and NC, respectively), mean cell haemoglobin, mean cell haemoglobin concentration, and total and differential leukocyte counts.

Blood serum samples were tested for concentrations of total proteins, calcium, inorganic phosphorus, sodium, potassium (5.58 ± 0.5, 4.46 ± 0.41, 1.03 ± 0.13, 4.26 ± 0.33, 5.56 ± 0.38, 5.05 ± 0.34 and 5.47 ± 0.37 mmol/L for the groups SI, RA, FB, TR, CL, CSN, and NC, respectively), and chlorides. Compared with normal camels, significant changes were found in the group RA for ruminal pH and concentraion of VFA, calcium and sodium ($p < 0.001$), ruminal ammonia, blood haemoglobin and serum chloride concentrations ($p < 0.01$), and blood serum sodium and potassium concentrations ($p < 0.05$); in the group of FB for ruminal pH and ammonia, urea, inorganic phosphorus, and sodium concentrations, blood haemoglobin, BUN, and blood serum sodium concentrations ($p < 0.001$); in the group SI for ruminal urea, mean cell volume ($p < 0.001$) and haemoglobin concentration ($p < 0.01$); in the group TR for ruminal inorganic phosphorus ($p < 0.001$), ruminal urea and blood serum chlorides ($p < 0.01$), and ruminal urea, calcium, and potassium concentrations, erythrocyte count, and blood serum sodium and potassium concentrations ($p < 0.05$); in the group CL for ruminal ammonia, calcium, BUN and blood serum chloride ($p < 0.001$), ruminal urea and blood serum potassium and inorganic phosphorus concentrations, erythrocyte count and PCV ($p < 0.01$); in the group CSN for ruminal inorganic phosphorus and blood serum chloride concentrations, erythrocyte count, PCV ($p < 0.05$). The results should be considered in diagnosis and treatment of camel diseases.

Dromedary camel, haematology, biochemistry, rumen, simple indigestion, ruminal acidosis, frothy bloat, trypanosomiasis, caseous lymphadinitis, contagious skin necrosis.

Although camels are an important source of milk, meat and wool and are widely used in transportation and for other working purposes, their potential has not yet been fully exploited (El-Gayoum 1986). Due to their physiological attributes, camels are the most suitable

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species of domestic mammals to be used under extremely arid conditions (Yagil 1985; Wilson 1989; George 1992; Wernery 1992).

Published data on camels are widely scattered and often difficult to retrieve and the current knowledge of physiology and pathology shows considerable gaps (Wilson 1984). The changes in ruminal and blood constituents in diseased camels have not been comprehensively studied. The objective of our investigations was to complete the current knowledge with results of clinical and haematological examinations and results of biochemical analysis of ruminal contents and blood of diseased camels and to compare them with the corresponding data obtained from normal animals.

Materials and Methods

The set under study included 81 camels suffering from simple indigestion (SR, n = 38), ruminal acidosis (RA, n = 19), frothy bloat (FB, n = 3), trypanosomiasis (TR, n = 11), caseous lymphadenitis (CL, n = 6), contagious skin necrosis (CSN, n = 4) and normal camels (NC, n = 38). In all the animals body temperature was taken and respiratory rates were measured, rumen motility and visible mucous membranes were examined and superficial lymph nodes were palpated.

Samples of ruminal fluid (50 ml) were collected using a rubber stomach tube and a suitable mouth gag. The samples were examined for physical characteristics including colour, consistency, odour, and pH; larger particles were removed by filtering through a sieve and the filtrate was divided into three portions. The first part (2 ml) was used for the determination of ammonia nitrogen concentration by the Conway (1957) method, the second part (2 ml) for the determination of total volatile fatty acid concentration using the method described by Eidie (1967), and the rest was centrifuged at 3000 rpm for 10 minutes. The supernatant was used for the determination of total protein, urea, calcium, inorganic phosphorus, and chloride concentrations.

Blood samples were collected by jugular venipuncture. One 10 ml sample, intended for the determination of haemoglobin concentration, erythrocyte count, total and differential leukocyte counts, and preparation of smears stained for blood parasites, was collected into heparinised test tube. Another 10 ml sample, intended for the determination of total protein, urea nitrogen, calcium, inorganic phosphorus and chloride concentrations, was collected into a plain test tube and centrifuged to separate blood serum.

All the biochemical analyses were carried out using the test kits produced by Bio-merieux and the results were read at appropriate wavelength using the Pye-Unicum spectrophotometer. The concentration of sodium and potassium were determined by Flame photometry using the technique described by Willerd et al. (1965). The diseases were diagnosed on the basis of history and results of clinical and laboratory examination of ruminal fluid, trypanosomiasis on the basis of microscopical findings in stained blood smears, and caseous lymphadenitis and contagious skin necrosis on the basis of findings in lymph nodes and skin lesions, respectively. Means and standard errors were calculated using the STATGRAPHICS (STSC Inc. and Statistical Graphics Corp.) sofware.

Results and Discussion

Clinical examination of the group TR revealed intermittent increase in body temperature, particularly in early morning, which coincided with the presence of the parasites in peripheral blood (Table 1). Similar observations were reported by Galloway (1974) and El-Magawry (1983). No significant changes in body temperature were observed in the groups SI, RA, FB, CL, and CSN.

Table 1
Temperature, pulse and breath rates, an ruminal motility in diseased camels (MV ± SEM)*

Disease	Temperature (°C)	Pulse (/min.)	Breath (/min.)	Ruminal motility (/2 min.)
Simple indigestion	37.13 ± 0.62	39.00 ± 1.69	12.00 ± 6.93	1.33 ± 0.27
Ruminal acidosis	38.50 ± 0.19	38.60 ± 2.88	12.60 ± 0.54	0.66 ± 0.54
Frothy bloat	38.60 ± 0.05	45.00 ± 1.25	18.00 ± 0.94	0.00 ± 0.00
Trypanosomiasis	37.64 ± 0.42	28.80 ± 2.99	11.60 ± 1.08	1.00 ± 0.44
Caseous lymphadenitis	36.40 ± 0.51	28.00 ± 1.58	10.75 ± 0.50	1.50 ± 0.25
Contagious skin necrosis	36.45 ± 0.38	38.50 ± 0.60	12.00 ± 0.35	1.25 ± 0.22

*MV = mean SEM = standard error of the mean.

Pulse and respiratory rates were increased in the groups RA and FB. No similar findings were reported in available literature.

Mucous membranes of the camels of the group TR were anaemic due to destruction of blood cells. The limbs of the infected animals were markedly oedematous as a result of renal failure. A similar clinical pattern was described also by El-Magawry (1983). The camels suffering from other diseases were free of such signs.

Ruminal motility was markedly suppressed in the groups RA and FB, the suppression reflecting ruminal atony and distension of the ruminal wall, respectively. A less marked suppression was found in the groups SI and TR, but not in any other of the groups. Similar findings were reported by Bradford (1990) for cattle.

Ruminal fluid was whitish in the group RA probably due to overfeeding with grain. In the remaining groups, the colour of the ruminal fluid depended on the composition of the ration (Table 2). The odour of the ruminal fluid was inexpressive or putrid in the group SI and sour to putrid in the group RA due to excessive fermentation of carbohydrates. In the remaining groups, the odour was aromatic. The consistence of the ruminal fluid was viscid in the group RA and foamy in the group FB. As mentioned by Blood and Radostits (1989) and Bradford (1990), the characteristics of the ruminal fluid remain unaltered unless ruminal atony develops. Ruminal protozoa disappeared partially or completely and their activity varied between 0 and + in the group RA. This observation corresponds to the findings of Dirksen (1983) and Bradford (1990) in cattle. No such effects were seen in the other groups except for SI.

Table 2
Ruminal fluid colour, constistency and protozoan activity in diseased camels

Disease	Colour	Odour	Consistency	Protozoan activity
Simple indigestion	Variable, depending on ration	Undistinguished	Slimy to watery	(++)
Ruminal acidosis	Whitish	Sour to putrid	Viscid	(+/0)
Frothy bloat	Variable, depending on ration	Aromatic	Foamy	(++)
Trypanosomiasis	Variable, depending on ration	Aromatic	Slimy	(+++)
Caseous lymphadenitis	Variable, depending on ration	Aromatic	Slimy	(+++)
Contagious skin necrosis	Variable, depending on ration	Aromatic	Slimy	(+++)

pH of the ruminal fluid decreased significantly in the groups RA, FB ($p < 0.001$) and CSN ($p < 0.01$). Changes of pH in the other groups can be explained as a result of ruminal atony affecting the rate of fermentation and/or hydrolysis and thereby the production of acid or alkaline intermediates (Hungate 1966; Bradford 1990).

The concentration of ruminal ammonia nitrogen increased in the groups SI ($p < 0.01$), TR ($p < 0.05$), CL ($p < 0.001$), and CSN ($p < 0.05$) and decreased in the groups RA and FB ($p < 0.001$ for both). These controversial changes can be attributed to the fact that the feeding time was unknown. A decrease of the ruminal ammonia nitrogen concentration associated with simple indigestion or ruminal acidosis and a decrease associated with frothy bloat was also observed by Kubesy (1987) in sheep.

The concentration of ruminal VFAs increased significantly in the group RA ($p < 0.001$) and insignificantly in all the other groups excepting CSN. Worth mentioning is the inverse proportionality between the concentration of VFAs and pH in the normal and diseased camels.

Considerable fluctuations in the ruminal total protein concentration can be explained in terms of findings of Abd El-Hafez et al. (1978) who reported direct proportionality between the content of protein in the ration and the concentration of total ruminal proteins.

The ruminal urea concentration significantly decreased in the groups SI ($p < 0.001$), CL, and CSN ($p < 0.01$ for both) and increased significantly in the groups RA ($p < 0.05$), TB

Table 3
Ruminal constituents in camels suffering from simple indigestion, ruminal acidonis, frothy bloat, trypanosomiasis, caseous lymphadenitis, or contagious skin necrosis (MV ± SEM)

Parameter	Simple indigestion	Ruminal acidosis	Frothy bloat	Trypano-somiasis	Caseous lymphadenitis	Contagious skin necrosis	Control
pH	6.74 ± 0.01	5.38 ± 0.16a	6.03 ± 0.08	6.61 ± 0.18	7.23 ± 0.11	7.60 ± 0.25[b]	6.83 ± 0.07
Ammonia N (mmol/L)	2.63 ± 0.16	2.38 ± 0.20	1.91 ± 0.01	3.21 ± 0.35[c]	3.19 ± 0.11[a]	3.11 ± 0.27[c]	2.40 ± 0.09
TVFAs* (mEq/L)	5.31 ± 0.34	7.81 ± 0.78[a]	5.50 ± 0.17	56.83 ± 0.72	5.50 ± 0.74	4.91 ± 0.37	5.12 ± 0.26
Total protein (g/L)	8.10 ± 0.70	9.60 ± 0.70	6.10 ± 1.40	8.50 ± 3.0	8.80 ± 1.60	8.30 ± 1.60	9.2 ± 0.60
Urea (mmol/L)	0.53 ± 0.06	1.68 ± 0.35[c]	1.36 ± 0.05[a]	1.28 ± 0.12[b]	0.53 ± 0.07[b]	0.50 ± 0.08[b]	0.84 ± 0.07
Calcium (mmol/L)	1.79 ± 0.32	4.09 ± 0.39[a]	1.10 ± 0.50	3.13 ± 0.57[c]	0.93 ± 0.16[a]	1.79 ± 0.87	1.58 ± 0.16
In. phos.** (mmol/L)	1.24 ± 0.12	1.53 ± 0.21	1.35 ± 0.04[a]	2.02 ± 0.10[a]	2.17 ± 0.13	1.10 ± 0.06[a]	1.28 ± 0.12
Sodium (mmol/L)	113.49 ± 8.16	71.49 ± 9.19[a]	25.50 ± 8.25[a]	107.40 ± 10.27	122.48 ± 8.70	119.88 ± 5.1	109.83 ± 5.65
Potassium (mmol/L)	25.93 ± 3.07	39.10 ± 5.41	28.7 ± 7.59	35.55 ± 4.13[c]	30.60 ± 1.08[b]	22.15 ± 2.91[c]	25.75 ± 2.35
Chloride (mmol/L)	40.30 ± 3.86	33.07 ± 4.58	36.04 ± 3.28	43.70 ± 3.03	40.93 ± 3.37	38.81 ± 3.01	31.47 ± 0.32

*TVFAs = total volatile fatty acids **In. phos. = inorganic phosphorus a: $p < 0.001$ b: $p < 0.01$ c: $p < 0.05$

($p < 0.001$), and TR ($p < 0.01$). The ruminal urea concentration depends on the rate of production and absorption of ammonia nitrogen (Bartley et al. 1976), as well as on the rate of detoxification of ammonia into urea in the liver (Visek 1972).

The ruminal calcium concentration increased in the groups RA ($p < 0.001$) and TR ($p < 0.05$) and decreased in the group CL ($p < 0.001$). An insignificant increase was observed in the remaining groups. The concentration of inorganic phosphorus increased significantly ($p < 0.001$) in the groups TR, FB, and CSN. The concentration of ruminal sodium increased significantly in the groups RA and FB ($p < 0.001$). The concentration of ruminal potassium increased significantly in the groups RA and TR ($p < 0.05$). The concentration of ruminal chlorides significantly increased in the groups CL ($p < 0.01$) and CSN ($p < 0.05$). Similar findings were reported also by Abd El-All et al. (1986) and Mohamed (1992). The possible explanation of these interrupted values of ruminal macro-elements and electrolytes is that the changes of sodium and potassium levels were attributed to the levels of them in the saliva; and in the ration (Hungate 1966).

Table 4
Cellular blood constituents in camels suffering from simple indigestion, ruminal acidonis, frothy bloat, trypanosomiasis, caseous lymphadenitis, or contagious skin necrosis (MV ± SEM)

Parameter	Simple indigestion	Ruminal acidosis	Frothy bloat	Trypano-somiasis	Caseous lymphadenitis	Contagious skin necrosis	Control
RBCs (10^{12}/L)	17.54 ± 0.76	14.87 ± 1.52	14.04 ± 2.66	13.80 ± 1.38[c]	13.40 ± 1.17[b]	14.80 ± 0.44[b]	17.22 ± 0.41
Haemoglobin (g/L)	216.1 ± 16.9[b]	176,9 ± 14.4[b]	165.5 ± 8.70[a]	149.4 ± 3.00	109.5 ± 7.9	124.8 ± 5.50	134.7 ± 3.8
PCV (L/L)	29.65 ± 1.71	29.89 ± 2.52	29.50 ± 2.12	25.09 ± 2.61	25.75 ± 1.44[b]	29.75 ± 1.08[c]	31.69 ± 1.11
MCV (fl)	15.96 ± 1.53[a]	23.15 ± 3.18	22.68 ± 3.19	14.78 ± 0.86	20.46 ± 2.89	20.03 ± 0.34	19.75 ± 0.88
MCH (pg)	12.65 ± 0.75	14.15 ± 1.69	18.85 ± 4.49	11.32 ± 1.41	9.65 ± 1.38	8.39 ± 0.24	12.27 ± 0.25
MCHC (%)	90.13 ± 13.26	59.72 ± 10.75	79.69 ± 2.56	69.62 ± 9.38	55.24 ± 10.03	42.03 ± 1.83[a]	63.98 ± 5.51
WBCs (10^9/L)	6.13 ± 0.64	6.08 ± 0.53	6.45 ± 0.61	6.09 ± 6.02	6.63 ± 0.99	5.49 ± 0.79	5.63 ± 0.32
Neutrophils (%)	29.65 ± 4.14	43.00 ± 7.18	27.33 ± 3.07	33.82 ± 5.79	31.17 ± 6.22	28.00 ± 3.48	31.15 ± 2.22
Eosinophils (%)	2.71 ± 0.69	1.11 ± 0.51	1.00 ± 0.00	1.82 ± 0.67	3.67 ± 1.31	0.75 ± 0.65	2.23 ± 0.38
Basophils (%)	1.65 ± 0.44	0.77 ± 0.38	0.67 ± 0.27	1.36 ± 0.49	1.50 ± 0.51	1.00 ± 0.50	2.06 ± 0.35
Monocytes (%)	58.65 ± 4.25	49.11 ± 6.76	67.00 ± 3.77	55.36 ± 5.14	56.33 ± 4.64	64.75 ± 5.05	57.32 ± 0.78
Lymphocytes (%)	6.76 ± 0.93	5.33 ± 1.18	4.00 ± 0.94	7.55 ± 1.21	7.33 ± 1.39	5.50 ± 1.75	5.33 ± 0.50

a: $p < 0.001$ b: $p < 0.01$ c: $p < 0.05$

As regards the blood cells (Table 4), a significant increase in haemoglobin concentration ($p < 0.01$) and a significant decrease in mean corpuscular volume ($p < 0.05$) were observed in the group SI, a significant increase in haemoglobin concentration in the groups RA ($p < 0.01$) and FB ($p < 0.001$), a significant decrease in total erythrocyte count in the group TR ($p < 0.05$), a significant decrease in total erythrocyte count and packed cell volume in the group CL ($p < 0.01$), and a significant decrease in total erythrocyte count, mean corpuscular volume ($p < 0.001$ for both), and packed cell volume ($p < 0.05$) in the group CSN. The possible explanation of these controversial results of cellular blood constituents and indexes could be attribute to the discrepancy in RBCs count and size, Hb content and PCV% and consequently the erythrocytic indexes with a concomitant status of dehydration or rehydration as reported by Yagil et al. (1974).

Similar results for dromedary camels affected by trypanosomiasis were published by Karram et al. (1991). On the other hand, Abd El-Samee (1987) and Manaa (1990) reported for such camels an increase in relative counts of eosinophils, lymphocytes, and monocytes, and a decrease in relative counts of neutrophils and basophils. No data on differential leukocyte counts in camels affected by the other diseases involved in our study were found in available literature.

Biochemical analyses of whole blood samples (Table 5) showed an increase in the total protein concentration in the groups SI. TR, and CL, and a decrease in all the remaining groups. The increase observed in the group TR can be attributed on the one hand to an increase in the γ-globulin concentration in response to the parasitic antigens (Moustafa et al. 1991) and on the other had to a release of haemoglobin from destructed erythrocytes (Jatker and Purohit 1971).

Table 5
Biochemical blood constituents in camels suffering from simple indigestion, ruminal acidonis, frothy bloat, trypanosomiasis, caseous lymphadenitis, or contagious skin necrosis (MV ± SEM)

Parameter	Simple indigestion	Ruminal acidosis	Frothy bloat	Trypano-somiasis	Caseous lymphadenitis	Contagious skin necrosis	Control
Total protein (g/L)	8.81 ± 0.24	7.36 ± 0.43	8.01 ± 0.05	8.36 ± 0.49	10.22 ± 1.28	7.92 ± 0.43	8,05 ± 0.34
BUN (mmol/L)	4.09 ± 0.49	3.97 ± 0.49	2.31 ± 0.00[a]	4.11 ± 0.03	1.23 ± 0.22[a]	2.80 ± 0.98	3.95 ± 0.36
Calcium (mmol/L)	2.77 ± 0.12	2.64 ± 0.17	2.43 ± 0.17	2.59 ± 0.16	2.50 ± 0.13	2.64 ± 0.37	2.67 ± 0.04
In. phos. (mmol/L)	2.60 ± 0.24	2.33 ± 0.22	3.08 ± 0.05	2.45 ± 0.38	0.58 ± 0.19[b]	2.36 ± 0.51	2.43 ± 0.11
Sodium (mmol/L)	157.0 ± 6.21	142.33 ± 6.19[c]	110.5 ± 0.71[a]	145.73 ± 8.95[c]	166.69 ± 6.59	175.5 ± 6.19	159.05 ± 5.43
Potassium (mmol/L)	5.58 ± 0.50	4.46 ± 0.41[c]	1.03 ± 0.13	4.62 ± 0.33[c]	5.56 ± 0.38	5.05 ± 0.34	5.47 ± 0.37
Chloride (mmol/L)	85.8 ± 7.05	93.60 ± 4.64[b]	82.96 ± 5.41	92.66 ± 3.14[b]	99.83 ± 1.03[a]	112.99 ± 2.29[a]	67.67 ± 7.71

a: $p < 0.001$ b: $p < 0.01$ c: $p < 0.05$

The blood serum urea concentration decreased significantly in the groups FB and CL ($p < 0.001$) and insignificantly in the group CSN, and increased insignificantly in the groups SI, RA, and TR.

The changes in the blood serum concentration of calcium can be attributed to a decrease in both intake and absorption of this electrolyte due to anorexia, or gastrointestinal atony usually associated with primary indigestion and other diseases (Parsad 1977; Blood and Radostits 1989).

The concentration of blood serum inorganic phosphorus decreased significantly in the group CL and insignificantly in the group CSN, and increased insignificantly in the other groups. The variations in the blood serum concentrations of inorganic phosphorus can be explained by differences in the dietary intake of calcium, magnesium, and vitamin D (Parsad 1977; McDwell et al. 1983; Church 1988). The blood serum sodium and potassium concentrations were significantly lower in the groups FB ($p < 0.001$), RA and TR

($p < 0.05$ for both). The concentration of chlorides was significantly higher in the groups CL, CSN ($p < 0.001$), RA, and TR ($p < 0.05$) and insignificantly higher in the groups SI and FB. Only scarce data on blood serum concentrations of sodium, potassium, and chlorides in camels affected by any of the diseases investigated within this study were found in the available literature. Thus, insignificant changes of electrolyte concentrations in camels suffering from simple indigestion were reported by Abd El-All et al. (1986), Abd El-Samee (1987) and Manaa (1990) found insignificant changes in camels affected by trypanosomiasis. It has been well established that serum electrolyte concentrations are influenced by the amount of secreted saliva, the rate of sodium and potassium secretion and/or sequestration in the abomasum, and the rate of renal excretion and absorption as affected by acid-base imbalance (Melvin, 1970; Blood and Radostits 1989). This may explain the rather unusual behaviour of the individual electrolyte concentrations. Our investigations showed significant changes of **a)** ruminal pH, and concentrations of ruminal VFA, calcium, sodium ($p < 0.001$ for all), ammonia, haemoglobin, blood serum chlorides ($p < 0.01$ for all), and blood serum sodium and potassium ($p < 0.001$ for both) in the group RA; **b)** ruminal pH, concentrations of ammonia, urea, inorganic phosphorus and sodium, haemoglobin, BUN and blood serum sodium ($p < 0.001$ for all) in the group FB; **c)** ruminal urea concentration, MCV ($p < 0.001$ for both), and haemoglobin concentration ($p < 0.01$) in the group SI; **d)** the concentrations of ruminal inorganic phosphorus ($p < 0.001$), ruminal urea, blood serum chlorides ($p < 0.01$ for both), ruminal ammonia, calcium, and potassium, erythrocyte count, and blood serum concentrations of sodium and potassium ($p < 0.05$) in the group TR; **e)** the concentrations of ruminal ammonia, calcium, BUN, serum chlorides ($p < 0.001$ for all), ruminal urea, blood serum potassium, and inorganic phosphorus, and erythrocyte count and PCV in the group CL; **f)** the concentrations of ruminal inorganic phosphorus and blood serum chlorides, erythrocyte count, MCHC ($p < 0.001$ for all), ruminal pH and urea concentration ($p < 0.01$ for both), ruminal ammonia and potassium concentrations, and PCV ($p < 0.05$ for all).

Conclusions

Our previous results and published data indicate that more detailed investigations of ruminal and blood constituents in diseased camels are needed. In our study, camels suffering from ruminal acidosis showed significant decreases of ruminal pH and ruminal sodium concentration ($p < 0.001$), significant increases of VFA ($p < 0.001$), ruminal ammonia and blood serum chloride, and haemoglobin concentrations ($p < 0.01$ for all), and significant decreases of blood serum sodium and potassium concentrations ($p < 0.05$ for both). Characteristic for frothy bloat were significant decreases of ruminal pH and ruminal ammonia and sodium concentrations, BUN, blood serum sodium concentration ($p < 0.001$ for all), and significant increases of ruminal ammonia and inorganic phosphorus and blood haemoglobin concentrations ($p < 0.001$ for all). The camels suffering from simple indigestion showed significant decreases of ruminal urea concentration and MCV ($p < 0.001$) and a significant increase in blood haemoglobin concentration ($p < 0.01$). Trypanosomiasis was characterised by significant increases of inorganic phosphorus ($p < 0.001$) ruminal ammonia, blood serum chloride ($p < 0.01$ for both), and ruminal ammonia, calcium, and potassium concentrations ($p < 0.05$ for all), and significant decreases of erythrocyte count and blood serum sodium and potassium concentrations ($p < 0.05$ for both). Characteristic for caseous lymphadenitis were significant increases of ruminal ammonia, serum chloride ($p < 0.001$), and serum potassium ($p < 0.01$) concentrations, and significant decreases of ruminal calcium and BUN concentrations ($p < 0.001$), ruminal urea and blood serum inorganic phosphorus concentrations, erythrocyte count, and PCV ($P < 0.01$). The camels affected by contagious skin necrosis showed significant increases of

blood serum chloride concentration ($p < 0.001$), ruminal pH, and ruminal ammonia concentration ($p < 0.05$ for both), and significant decreases of ruminal inorganic phosphorus concentration, erythrocyte count, MCHC ($p < 0.001$ for all), ruminal urea ($p < 0.01$), and ruminal potassium concentrations, and PCV ($p < 0.05$ for both).

Klinické studie vybraných bachorových a krevních parametrů u jednohrbých velbloudů postižených různými nemocemi

Vybrané bachorové a krevní parametry byly změřeny u 81 jednohrbých velbloudů s jednoduchou idigescí (SI, n = 38), ruminální acidózou (RA, n = 19), pínovou tympanií (FB, n = 3), trypanozomiázou (TR, n = 11), kaseózní lymfadenitidou (CL, n = 6), kontagiózní nekrózou kůže (CSN, n = 4) a u zdravých velbloudů (NC, n = 38).

Velbloudům byla změřena teplota, pulz a dech, u každého pokusného velblouda byly vyšetřeny sliznice a motilita bachoru. Odebrané vzorky bachorové tekutiny byly posouzeny fyzikálně (pH, barva, konzistence), zhodnoceny na základě protozoární aktivity a obsahu biochemických látek včetně amoniakálního dusíku (2.63 ± 0.16, 2.38 ± 0.20, 1.91 ± 0.01, 3.21 ± 0.35, 3.19 ± 0.11, 3.11 ± 0.27 a 2.40 ± 0.09 mmol/L u všech skupin, tj. SI, RA, FB, TR, CL, CSN a NC).

Byly změřeny celkové hodnoty VFA a proteinů, vápník, anorganický fosfor a sodík (5.58 ± 0.5, 4.46 ± 0.41, 1.03 ± 0.13, 4.26 ± 0.33, 5.56 ± 0.38, 5.05 ± 0.34 and 5.47 ± 0.37 mmol/L u skupin SI, RA, FB, TR, CL, CSN a NC, u krevních vzorků byl stanoven celkový počet erytrocytů, koncentrace hemoglobinu, celkový buněčný objem a průměrný buněčný objem (15.96 ± 1.53, 23.15 ± 3.18, 22.68 ± 3.91, 14.78 ± 0.86, 20.4 ± 2.98, 20.03 ± 0.34 and 19.75 ± 0.88 fl.) průměrná koncentrace buněčného hemoglobinu, celkový a diferenciální počet leukocytů.

U všech vzorků krve byla změřena koncentrace celkových proteinů, kalcia, anorganického fosforu, sodíku, draslíku a chloridů (5.58 ± 0.5, 4.46 ± 0.41, 1.03 ± 0.13, 4.26 ± 0.33, 5.56 ± 0.38, 5.05 ± 0.34 a 5.47 ± 0.37 mmol/L). Ve srovnání se zdravými velbloudy byly zaznamenány u skupiny RA významné změny pH bachorové tekutiny, koncentrace VFA, vápníku a sodíku ($p < 0.001$), obsahu čpavku v bachoru, krevního hemoglobinu a koncentrace chloridů v krevním séru ($p < 0.01$), koncentrace dusíku a draslíku v krevním séru ($p < 0.05$);

Ve skupině FB byly zaznamenány změny pH bachorové tekutiny, koncentrace čpavku, močoviny, anorganického fosforu a sodíku, krevního hemoglobinu, BUN a sodíku ($p < 0.001$);

Ve skupině SI byly zjištěny významné změny obsahu močoviny v bachoru, průměrného buněčného objemu ($p < 0.001$) a koncentrace hemoglobinu ($p < 0.01$); ve skupině TR byly odlišné hodnoty zaznamenány u anorganického fosforu v bachoru ($p < 0.001$), u močoviny v bachoru a u chloridů v séru ($p < 0.01$), u močoviny v bachoru, vápníku a draslíku, v počtu erytrocytů a v koncentraci sodíku a draslíku v krevním séru ($p < 0.05$); ve skupině CL byly zaznamenány odlišné hodnoty močoviny v bachoru, vápníku, BUN a u chloridů v séru ($p < 0,001$), u močoviny v bachoru, u draslíku a anorganického fosforu v séru, v počtu erytrocytů a PCV ($p < 0.01$); ve skupině CSN se změny týkaly koncentrace anorganického fosforu v bachorové tekutině, koncentrace chloridů v séru a počtu erytrocytů, PCV ($p < 0,05$).

Výsledků lze použít při stanovení diagnózy a terapie.

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