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Clinical and Laboratory Studies on Some Camel Affections

CLINICAL STUDIES OF SELECTED RUMINAL AND BLOOD CONSTITUENTS IN DROMEDARY CAMELS SUFFERED FROM VARIOUS DISEASES

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CLINICAL AND LABORATORY STUDIES ON SOME CAMEL AFFECTIONS

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INTRODUCTION

It is quite natural that species of animals such as cattle, horses and sheep which have proved suitable for use in the major live-stock have received much more attention in programs designated to improve their productivity. The camel has been for along time a neglected species of domestic animals, concentrated efforts as well as intensive investigation on their disease problems yet has to be boostered for the greater potentials that can be manifested in the meat, milk and hide production. Beside the significant tolerance to water shortage in desert areas which constitute the majority of Egyptian land. The total population of camels in the world in 2002 was about 19.321 millions with 15.130 millions in Africa; most of them are in Kenya, Ethiopia and Somalia (FAO, 2003). The distribution of camels among the Arab countries was varied and can be categorized as following:

1- First category: Includes those countries where camels represent up over (200/0) of total national animal population as Somalia, Sudan, Mauritania, United Arab Emirates and Saltanat of Oman

2- Second category: Include countries where camels represent 10-20 % of total national animal population as Saudi Arabia, Tunisia and Libya.

3- The third category: Include countries where camels represent less than 10% of the total national animal population like Yamane and Egypt in which the total number of camels was 77 thousands (Wardeh, 1992).

Camels as productive animals are considered one of the primary fundamental constituents of animal population. Healthiness of this part of animal populations required healthy respiratory, urinary, skin, reproductive and musculoskeletal systems with especial attention to digestive system because camel to be productive animal needs healthy alimentary tract. The

prevention of the diseases rather than treatment becomes the main aim in the veterinary medicine. Therefore, the ruminal and blood constituents were found to be one of the most important diagnostic and prognostic measures for health and disease conditions. But unfortunately these constituents were not yet fully studied in camels especially the rumen parameters Farid, et al. (1979) and Higgins (1986).

The plan of the present work was designed to fulfill the following points:-

1- Study the general clinical picture of dromedary camels in health and some disease conditions.

2- Record the effect of various disease conditions upon ruminal protozoa.

3- Study the effect of camel disease conditions up on organic and inorganic ruminal contents.

4- Determination of complete blood picture associated with different disease conditions among camels.

5- Biochemical analysis of blood in different disease conditions among camels.

6- Find the relation between the estimated blood and ruminal constituents in both healthy and diseased camels.

REVIEW OF LITERATURE

I- General clinical examination of apparently healthy and diseased camels

Esmat and Salah (1980) found that the rumen motility of the male and female camels was ranged from 3- 5/2 min.

Higgins (1983) indicated that the average values of rectal temperature and respiratory rate in adult healthy camels were 37.2 °c and 8/min, respectively.

Mohamed (1984) recorded that the mean values of rectal body temperature, pulse rate and respiratory rate of male camels in Upper Egypt (Nagh hammady) belonged to Guena province during Summer season were 37.46 ± 0.893 °c, 58.82 ± 3.1/min and 13 ± 2.7/min, respectively. He added that the normal conjunctival mucous membrane was rosy red in both summer and winter season.

Higgens (1985) recorded pulse of camel at the middle coccygeal artery in the mid line of ventral aspect of the tail near the root and found that the pulse rate in Arabian camels was ranged between 30 - 45 / min. in early morning and 35- 50/min. at evening.

Higgins and Kock (1985) indicated that there was a direct relationship between the body temperature and environmental temperature. The temperature was lower in early morning ranging between 36.0 & 36.5 °c, rising throughout the day to 39°c in the evening, also they found that camels sweet freely only when body temperature exceeds 40.5 °c.

Higgins (1986) clarified that the fluctuation of camel body temperature can exceed 6 °c in 24 hours and camel doesn't sweet freely until its body temperature exceeds 40.5 °c. He mentioned also that camel body

temperature in early morning averages were 36 - 36.5 °c rising steady throughout the day to about 39 °c in evening.

Rothare (1986) mentioned that the rectal body temperature, pulse and respiratory rates of clinically healthy camels in early morning were ranged from 36.5 - 38.2 °c, 32- 38/min and 7-12/min, respectively. Also he found that the mucous membrane of apparently healthy camels was pink in color.

Mohamed, et al. (1987) said that the mean value of body temperature in both male and female camel was 37.49 ± 0.714 °c and 37.015 ± 0.85 °c, respectively during summer season, while during winter season it was 37.48 ± 0.727 °c and 37.26 ± 0.95 °c, respectively.

Abd El-Samee (1990) mentioned that the mean values of rectal body temperature, pulse and respiratory rates in apparently healthy camels were 36.6 ± 0.068 °c, 44.9 ± 0.413/min and 9.1 ± 0.177/min, respectively. Also he stated that the normal coloration of conjunctival mucous membrane was purple.

Baraka (1995) reported that the rectal body temperature, pulse rate, respiratory rate and rumen motility in apparently healthy male and female camels in different season were ranged from 36.18 ± 1.04 to 37.7 ± 0.05 °c, 25.1 ± 0.67 to 41.85 ± 1.7 min, 10.00 ± 0.47 to 13.86 ± 0.84/min and 2.37 ± 0.43 to 2.88 ± 0.36/2 minutes, respectively. While in camels suffering from simple indigestion, ruminal acidosis and frothy bloat the obtained values of body temperature, pulse and respiratory rates were (37.13 ± 0.62 °c, 39.00 ± 1.69/min & 12.0 ± 6.93/min); (38.50 ± 0.29 °c, 38.6 ± 2.88/min & 12.60 ± 0.54/min) and (38.6 ± 0.05 °c, 45.00 ± 1.25/min & 18.0 ± 0.94/min), respectively.

Mohamed (1996) recorded that the mean values of rectal body temperature, pulse rate, respiratory rate and rumen motility in clinically healthy camels

were 37.32 ± 0.11 °c, 33.24 ± 0.71/min, 11.20 ± 0.32/min and 2.08 ± 0.1/2 minutes, respectively. While those suffered from simple indigestion, rumen acidosis and ruminal tympany the obtained values were (38.81 ± 0.06 °c, 34.42 ± 0.61/min, 10.51 ± 0.221/min & 1.94 ± 0.09/2 min) ; (37.10 ± 0.13 °c, 37.31 ± 4.45/ min, 12.18 ± 0.29/min & 0.81 ± O. 15/2 min) and (38.25 ± 0.10 °c ,43.75 ± 0.81 /min, 17.50 ± 0.82/min & .00 ± 0.00/2 min), respectively.

Baraka, et al. (2000) found that the mean values of rectal body temperature, pulse rate, respiratory rate and rumen motility in camels suffering from simple indigestion, ruminal acidosis, frothy bloat and trypanosomiasis were (37.13 ± 0.62 °c , 39.00 ± 1.69/min, 12.00 ± 6.93/min & 1.33 ± 0.27/2 min) ; (38.50 ± 0.19 °c, 38.60 ± 2.88 / min, 12.60 ± 0.5/min & 0.66 ± 0.54/2 min) ; (38.60 ± 0.05 °c , 45.00 ± 1.25 / min, 18.00 ± 0.94/min & 0.00 ± 0.00/2 min) and (37.64 ± 0.42 °c, 28.80 ± 2.99/min, 11.60 ± 1.08/min & 1.25 ± 0.22/2 min), respectively. He added that the camel's mucous membranes affected by trypanosomiasis was anemic due to destruction of the blood cells. Abd El Rahman, et al (2003) found that the mean values of rectal body temperature, pulse and respiratory rates in both male and female healthy camels were (36.8 ± 0.10 °c and 36.7 ± 0.10 °C), (32.00 ± 2.00 and 34.00 ± 1.00/min) and (10.00 ± 1.0 and 12.00 ± 1.0/min), respectively.

II- The ruminal constituents of apparently healthy and diseased camels

1- Physical examination of the rumen juice

Abd EI-All, et al. (1990) indicated that color of rumen juice of normal camels was varying between yellowish to yellowish green and the odor was aromatic with viscid in consistency. The color of rumen juice of camels

suffering from indigestion was green to olive green, the odor was varying Baraka (1995) reported that the color of the rumen juice was found to be varied depending up on the type of the ration in both normal and diseased dromedary camels lived in Faculty of Veterinary Medicine, Cairo University. It was light to dark grey green in camels fed on barseem or/and light to dark gray brown in camels fed on chopped wheat straw or millet. The color of the rumen juice in case of rumen acidosis was relatively whitish. The odor of the rumen juice in normal dromedary camels, camels suffered from simple indigestion and rumen acidosis was aromatic, undistinguished or putrefied and sour to putrefied, respectively. The consistency of rumen juice in normal dromedary camels, camels suffered from simple indigestion, rumen acidosis and frothy bloat was slimy, slimy to watery, viscid and in foamy, respectively.

Baraka, et al. (2000) found that the color of the ruminal fluid in camels suffering from rumen acidosis was whitish probably due to over feeding with grain. The odor of the ruminal fluid of camels affected by simple indigestion, and rumen acidosis was putrid and sour to putrid, respectively. In case of camels suffering from frothy bloat, trypanosomiasis and contagious skin necrosis the odor was aromatic. The consistency of the ruminal fluid in camels suffering from ruminal acidosis and frothy bloat was viscid and foamy, respectively. In case of camels suffered from simple indigestion, trypanosomiasis and contagious skin necrosis was slimy.

2- Ruminal pH value

Nassar (1971) said that the pH of rumen of normal dromedary camels ranged between 6.4 & 7.0 with a mean value of 6.60.

Maloiy and Clemens (1980) mentioned that the mean value of pH in the rumen and reticulum of camels was 6.67 ± 0.80.

Abd EI All, et al (1986) examined the ruminal juice pH of healthy camels and camels suffering from indigestion. They recorded that the mean values were 7.4 ± 0.80 and 5.5 ± 1.30, respectively.

Abd EI- Gawad (1993) found that the mean value of pH of clinically healthy camels was 7.36 ± 0.34.

Baraka (1995) reported that the mean value of ruminal pH in clinically healthy camels was 6.83 ± 0.07, while those suffering from simple indigestion, ruminal acidosis and frothy bloat the mean values were 6.68 ± 0.05, 5.43 ± 0.12 and 6.42 ± 0.11, respectively.

Mohamed (1996) reported that the mean value of ruminal pH of healthy dromedary camels was 6.76 ± 0.04 with range of 6.38 - 7.39. While camels suffering from simple indigestion, ruminal acidosis, frothy bloat and parasitic diarrhea showed pH mean values of 6.68 ± 0.05, 5.43 ± 0.12, 6.42 ± 0.11 and 6.53 ± 0.15, respectively.

Rouissi and Guesmi (1998 and 1999) indicated that the pH of ruminal juice of apparently healthy camels was 6.7. In addition they recorded rumen pH in two groups of camels; the first was fed on hay only while the second group on equal amount of hay & concentrate, the obtained values was 6.8 and 6.5, respectively.

Baraka, et at. (2000) examined ruminal juice of 81 dromedary camels and found that the mean value of pH in clinically healthy camels was 6.83 ± 0.07, while those suffering from simple indigestion, ruminal acidosis, frothy bloat and trypanosomiasis the mean values were 6.74 ± O.01, 5.38 ± O.16, 6.03 ± 0.08 and 6.61 ± 0.18, respectively.

3- Ruminal protozoal activity

Abd El All, et al. (1990) described the ruminal protozoal activity in camels as motile and very crowded protozoa (+++) in clinically healthy camels. While it varied from motile and crowded (++) to sluggish motility and low number (+) during indigestion.

Baraka (1995) reported that the microscopical examination of ruminal protozoa of dromedary camels fed on chopped wheat straw, barseem and hay revealed highly motile and very crowded microscopical field (+++). In simple indigestion and frothy bloat the examined ruminal protozoan films revealed motile and crowded protozoa (++) while in rumen acidosis, the number and activity were decreased and the examined samples showed low number and sluggish motility or complete absence of such protozoa (+/0). He also reported that the protozoal activity and number were not affected by camels suffered from trypanosomiasis and contagious skin necrosis. Mohamed (1996) clarified that the ruminal protozoal activity score in clinically healthy camels was highly motile and very crowded protozoa (+++) while those suffering from simple indigestion, rumen acidosis and frothy bloat were (+1++), (0 I +) and (+1++), respectively. Baraka, et aI. (2000) reported that the ruminal protozoa disappeared partially or completely and their activity varied between (0) and (+) in the group of camels suffered from ruminal acidosis.

4- Ruminal protozoal counting

Ghosal, et al. (1981) examined the fore stomach of four dromedary camels in India and found that the geometric mean value of total ciliate protozoa was 19.1 X 10 /ml with the actual value ranging from 8.8 up to 40.0 X 10 /ml.

Bhatia, et al. (1986) reported that the mean value of total ciliate protozoa in camels located in India was 11.0 X 10 / ml with the actual values ranging from 5.5 up to 17.2 X 10 /ml.

Imai and GUI Rung (1990) examined the fore stomach of four camels in Inner-Mongolia and they found that the mean value of total ciliate protozoa was 21.1 ± 10 / ml.

Kayouli, et al. (1991) calculated the mean value of total ciliate protozoa in the fore stomach of camels located in Tunisia. The recorded value was 33.1 X 10 / ml strained rumen liquor.

Bhatia and Ghosal (1992) found that the total protozoal counting in camels made at zero and one hour of feeding were 10.7 ± 0.9 and 9.0 ± 0.4 X 10 /ml in strained rumen liquor.

Mohamed (1996) indicated that the mean value of total protozoal count was 837.17± 215 X10 with the actual values ranging from 519.4 up to 1004.5 X 10 /ml stained ruminal fluid in clinically healthy camels.

Selim, et al (1996b) reported that the geometric mean value of total rumen protozoal count was 19 X10 and the actual values ranged from 11 - 33 X 10 / ml. Rouissi and Guesmi (1999) found that total rumen protozoal count was 2.7 X 10 /mi and 3.3 X 105 in camels fed on hay and hay plus concentrate, respectively.

Selim, et al. (1999) reported that the mean value of total protozoal count in the first stomach compartment of 11 dromedary camels located in Libya was 58 X 10 /ml with rang of 28 to 75 x 10 /ml.

Kubesy and Dehority (2002) revealed that the geometric mean value of total ciliate protozoa was 13.9 X 10 / ml strained rumen liquor with the actual values ranging from 4.94 up to 109.4 X 10 /ml in clinically healthy camels.

Baraka and Dehority (2003) found that the general mean value of total

protozoal count was 21.94 X 10 1ml of strained rumen liquor in normal dromedary camels.

5- Ruminal protozoal identification

Nassar (1971) stated that species of Entodinium simplex, Diplodinium cameli, Diplodinium dentatum, Ophryoscolex ecaudatus hamatus and Caloscolx were identified in rumen content of dromedary camels.

Norman (1985) reported that Buetschlia nana, Buetschlia omnivora, Epidinium caudatum and Epidinium hamatum were detected in the rumen contents of camel.

Sakr (1988) observed that Bubtschlia parva, Buetschlia omnivora, Dasytricha ruminatum, Entodinium bursa, Entodinium simplex, Entodinium amphicanthus ovum rajae and Diplodinium cameli as ruminal protozoa in the rumen of camelus dromedarus.

Soichi and Rung (1990) mentioned that Hsiungia triciliata, Polymorphilla bovis, Dasytrica ruminatum, Entodinium eXlgum, Entodinium nanellum, Entodinium dubaradia, Entodinium longinucleatum, Entodinium Okoppensis forma cameli, Entodinium ovum rajae, Diplodinium cameli, Diplodinium anisacanthum, Eudiplodinium bovis, Epidinium ecaudatum, Epidinium forma caudatum, Epidinum ecaudatumic forma bicaudatum and caloscolex camelinus were detected in the forestomach of the bacterian camels.

Baraka (1995) clarified different types of ciliate protozoa of the forestomach of camels. They were Buetschlia parva, Butschlia neglectum, Buetschlia omlnlvora, Dasytricha ruminantum, Entodinium simplex, Entodinium amphicanthus, Epidinium okoppensis forma cameli, Epidinium ecaudatum forma hamatum, Epidinium ecaudatum forma ecaudatum, Epidinium

ecaudatum forma quadricaudatum, Diplodinium cameli, Diplodinium dentatum, Diplodinium anacanthum and Caloscolex camelius.

Mohamed (1996) stated that Buetschlia parva, Buetschlia neglectum, Entodinium amphicanthus ovum raJae, Entodinium okoppensis forma cameli, Epidinium ecaudatum, Epidinium ecaudatum forma quadricaudatum, Diplodinium cameli, Diplodinium dentatum, Diplodinium anacanthum were protozoa in rumen of dromedary camels.

Selim, et al. (1996a) examined the rumen juice of eleven dromedary camels (One humped) in Egypt and reported that eight genera containing 24 species with 11 forms was identified of them, one species was concluded to be new, then described as Dasytricha kabaniin Spp. But Entodinium nanellum and Epidinium ecaudatum forma caudatum were found in all examined camels. They found also that ciliate composition in Egyptian camels was similar to that in the Bactrian camels. However, more Entodinium species were detected from Egyptian camels than from Bactrian camels.

Rouissi and Guesmi (1999) examined rumen juice of four dromedaries and found that the percentage of protozoa in camels fed on hay only were Entodinium 59.6%, Epidinium 22.0%, Eudinium 10.1% and Buetschalia 8.9 %, while camels fed on hay plus concentrates the percentages were 62.9 % in % Entodinium, 17.5 in Epidinium, 10.0 %, Eudiplodinium and 9.6 % Buetschlia.

Selim, et al. (1999) reported that six genera including 13 species and 7 formae were identified in eleven dromedary camels kept in Libya. Three species, Hsiungia triciliata, Charonina ventriculi and Caloscolex camelinus were detected only.

Kubesy and Dehority (2002) examined the fore stomach of 20 camels in Egypt and revealed that Epidinium ecaudatum forma ecaudatum and forma

causatum were present in all animals followed by Hsiungia triciliata In 19 camels, Diplodinium cameli in 17 camels, Polymorphilla bovis in 15 camels, Entodinium ovum rajae and Diplodinium anacanthum forma anacanthum in 13 camels with lowest incidence for both Entodinium tsunodai and Entodinium ekendrae in one camel only. They also found that Entodinium biconcavum, Entodinium bimastus, Entodinium ekendrae, Entodinium parvum, Entodinium tsunodai and Ostracodinium trivesticulatum were new host records for the camels.

Baraka and Dehority (2003) investigated 79 Egyptian camels under the influence of (season, sex and age) and found that the percentages of Entodinium spp. In different seasons (winter, spring, summer, autumn) were 48.76%, 54.44%, 35.16% and 36.400/0, respectively. While Diplodinium spp. percentages were 34.540/0, 24.720/0, 41.11% and 52.28%, respectively. Also, they added that the summer season was respectively. Also, they added that the summer season was the season in which all protozoal species and most forms were identified.

6- Ruminal ammonia nitrogen level:-

Farid, et al. (1979) indicated that the ruminal ammonia nitrogen concentration in camels at 0, 2 and 6 hours after feeding were 7.94,4.27 and 2.79 mg/dl, respectively. In water depraved camels the corresponding values were (9.83 - 11.58), (5.67 - 7.88) and (4.41 - 6.30), respectively.

Abd El Gawad (1993) mentioned that the mean value of ammonia nitrogen concentration in the ruminal fluid of normal camels was 32.658 ± 1.4 mg /dl. Baraka (1995) compared between clinically healthy and diseased camels and found that the mean value of ammonia nitrogen concentration in the rumen juice of clinically healthy camels was 3.36 ± 0.13 mg / dl. Camels suffering

from simple indigestion, ruminal acidosis and frothy bloat, the mean values were 3.97 ± 0.11 mg /dl, 3.93 ± 0.12 mg /dl and 3.11 ± 0.05 mg / dl, respectively.

Mohamed (1996) found that the mean value of ammonia nitrogen concentration of clinically healthy camels was 3.64 mg/dl. Rouissi and Guesmi (1998 and 1999) indicated that the ammonia nitrogen concentration in rumen juice of camels was 81.8 mmol/ L. They also mentioned that the ammonia nitrogen concentration in rumen juice of camels fed hay and hay plus concentrate was 23.5 and 104.0 mg/L, respectively.

Baraka, et al. (2000) reported that the mean value of ammonia nitrogen concentration in the ruminal fluid of clinically healthy camels was 2.40 ± 0.09 mmol/ L. Camels suffering from simple indigestion, ruminal acidosis, frothy bloat, trypanosomiasis and contagious skin necrosis, the mean value was 2.63 ± 0.16, 2.38 ± 0.20, 1.91 ± 0.01, 3.21 ± 0.35 and 3.11 ± 0.27 mmol/L, respectively.

7- Ruminal total volatile fatty acids level

Farid et al. (1979) mentioned that the level of total volatile fatty acids of camels at 0, 2.8, and 4 hours after feeding was 11.41, 9.17 and 10.50 mEq/100 ml, respectively.

Maloiy and Clemens (1980) found that the level of total volatile fatty acids in the rumen and reticulum of camels was 47.2 ± 4.60 mmol/L. Bhatia and Ghosal (1992) revealed that the mean value of total volatile fatty acids of healthy dromedary camels was 82.2 ± 3.5 mmol/L.

Abd EI Gawad (1993) found that the mean value of total volatile fatty acids in the rumen juice of camels was 33.42 ± 6.23 mEq/L.

Baraka (1995) mentioned that the mean value of fatty acids in the ruminal fluid of clinically healthy camels was 5.12 ± 0.26 mEq/L. While in camels suffering from simple indigestion, ruminal acidosis and frothy bloat the obtained values were 5.45 ± 0.18 mEq/L, 8.11 ± 0.27 mEq/L and 5.53 ± 2.47 mEq/L, respectively.

Mohamed (1996) found that the mean value of total volatile fatty acids in clinically healthy dromedary camels was 5.18 ± 0.26 mEq/L.

Rouissi and Guesmi (1998 and 1999) mentioned that the level of total volatile fatty acids in the rumen juice of normal camels was 81.8 mmol/L. While these levels in camels fed on hay and hay plus concentrate the recorded values was 78.6 and 86.9 mmol/L, respectively.

Baraka, et al. (2000) found that the mean value of total volatile fatty acids in rumen juice of clinically healthy camels was 5.12 ± 0.26 mEq/L, while those suffering from simple indigestion, ruminal acidosis, frothy bloat, trypanosomiasis and contagious skin necrosis the obtained values were 5.31 ± 0.34, 7.81 ± 0.78, 5.50±0.17, 5.68 ± 0.72 and 4.91 ± 0.37 mEq/L, respectively.

8- Ruminal biochemical assay

(A) Ruminal total protein, albumin, urea calcium, inorganic phosphorus, sodium, potassium and chloride.

Visek (1972) reported that the ruminal urea level depends on the rate of detoxification of ammonia into urea by the liver.

Bartley, et al (1976) found that the ruminal urea level depends largely on the rate of production and absorption of ruminal ammonia nitrogen concentration.

Abd EI Hafez, et al (1978) indicated that there was a direct relationship between the content of protein in ration and the concentration of total ruminal proteins.

Maloiy and Clemens (1980) reported that the levels of sodium, potassium and chloride in the rumen juice of camels were 89.0 ± 0.08 mEq/L, 37.0 ± 15.5 mEq/L and 12.0 ±2 mEq/L, respectively.

Abd EI All, et al. (1986) mentioned that the levels of total protein, sodium, potassium and chloride in the ruminal fluid of normal dromedary camels were 2.9 ± 1.4 gm 0/0, 87.3 ± 26.2 mmol/L, 10.7 ± 7.03 mmol/L and 13.8 ± 4.3 mmol/L, respectively.

Baraka (1995) reported that the levels of ruminal total protein, urea, calcium, inorganic phosphorus, sodium, potassium and chloride In dromedary camels (fed on chopped wheat, straw, barseem, millet and hay) were ranged between (0.30 ± 0.07 and 2.08 ± 1.02 gm j dl), (0.22 ± 0.02 and 1.3 ± 0.09 mmol/L), (1.89 ± 0.61 and 12.45 ±1.16 mg /dl), (2.08 ± 0.33 and 8.44 ± 3.36 mg /dl), (94.21 ± 8.99 and 178.50 ± 12.46 mmol/L), (12.82 ± 3.88 and 64 ± 6.63 mmol/L) and (12.02 ± 0.73 and 44.71 ± 18.05 mmol/L), respectively.

Baraka, et al. (2000) revealed that the levels of ruminal total protein, urea, calcium, inorganic phosphorus, sodium, potassium and chloride in healthy dromedary camels were 9.2 ± 0.60 g/L, 0.84 ± 0.07 mmol/L, 1.58 ± 0.16 mmol/L, 1.28 ± 0.12 mmol/L, 109.83 ± 5.85 mmol/L, 25.75 ± 2.35 mmol/L and 31.47 ± 0.32 mmol/L, respectively. While camels suffering from simple indigestion and ruminal acidosis the obtained values were (8.10 ± 0.70 g/l, 0.53 ± 0.06 mmol/L, 1.79 ± 0.32 mmol/L, 1.24 ± 0.12 mmol/L, 113.49 ± 8.16 mmol/L, 25.93 ± 3.07 mmol/L and 40.30 ± 3.86 mmol/L) and (9.60 ± 0.70 g/l, 1.68±0.35 mmol/L, 4.09 ± 0.39 mmol/L, 1.53 ± 0.21 mmol /L, 71.49 ± 9.19 mmol/L, 39.10 ± 5.4 /mmol/L and 33.07 ± 4.58 mmol/L),

respectively. In addition camels suffered from frothy bloat and trypanosomiasis were (6.10 ±1.40 g/l, 1.36 ± 0.05 mmol/L, 1.10 ± 0.50 mmol/L, 1.35 ±0.04 mmol/L, 25.50 ± 8.25 mmol/L, 28.7 ± 7.59 mmol/L and 36.04 ± 3.28 mmol/L) and (8.50 ± 3.0 g/l, 1.28 ± 0.12 mmol/L, 3.13 ± 0.57 mmol /L, 2.02 ± 0.10 mmol/L,107.40±10.57 mmol/L, 35.55± 4.13 mmol/L and 43.70 ± 3.03 mmol/L), respectively.

(B) Ruminal lactic acid and carbonic acid

Secrist, et al (1995) investigated that the mean values of L- lactate and D-lactate mg/dl pre-feeding, 4hand 12 h post- feeding in steers fed on fine particles were 4.17 & 0.58 mg/dl, 24.08 & 17.08 mg/dl and 4.67 & 1.50 mg/dl, respectively. Montano, et al (1999) found that the ruminal D-lactate and L-lactate mg/dl in steers fed high concentration after one hour of glucose challenge were 60.1 and 40.57 mg/dl respectively. Ho-Hong, et al (2004) indicated that the major gas produced in the rumen of bovine is carbon dioxide (65.5 mol %).

||| - The blood constituents of clinically healthy and diseased dromedary camels.

A-The blood cellular constituents

1- Hematological picture of clinically healthy camels

Barakat and Abd EI-Fattah. (1970) indicated that the mean values of erythrocytic count, Hb. concentration and total leucocytic count in clinically healthy camels were 7.78 ± O.19 million/cmm., 13.05 ± 0.12 gm% and 15.03 0.34 thousands/cmm, respectively. While the differential leucocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes)

were 26.82 ± 0.75, 3.4 ± 0.23, 1.00 ±0.10, 66.57 ± 0.82 and 2.75 ± 0.13 0/0, respectively.

Tartour (1971) reported that the mean values of RBCs, Hb, PCV %, WBCs count and differential leukocytic count (neutrophil, eosinophil, basophil, lymphocyte and monocyte) of clinically healthy male camels were 8.4 ± 1.05 million/cmm., 13.2 ± 2.5 gm%, 33.8 ± 7.6%, 17.38 ± 6.52 thousand/cmm., 41.6 % ± 8.3 ,5.7 ± 2.40/0, 0-1%,48 ± 13.60/0 and 3-9 %, respectively.

Bokore (1974) recorded that the total erythrocytic count, packed cell volume and total leucocytic count in the blood of normal camels were 5.6 million/cmm, 29.7% and 13.2 thousand/cmm, respectively. Vagi, et al (1974) indicated that the controversial changes could be attributed to the discrepancy in RBCs count and size, Hb content and PCV % and consequently the erythrocytic indices with a concomitant state of dehydration and dehydration.

EI-Magawry (1980) revealed that the average total erythrocytic count, hemoglobin, packed cell volume, total and differential leukocytic count (neutrophil, eosinophil, basophil, lymphocyte and monocyte) of apparently normal camels were 8.178 million/Cmm, 11.875 gm%, 24 - 30%, 12.10 ± 0.040 thousand/cmm and (57.575 %, 8.125 %, 0.15 %, 34.825 %, 975 %), respectively.

Raisinghani and Lodha (1980) reported that the RBCs count, hemoglobin concentration, packed cell volume, total leukocytic count and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of normal camels were 9.98 million/cmm, 10.2 gm% , 29.60/0, 18.8 thousand/cmm and (46%, 2.2%, 0.17, 50.6, 1.1%), respectively.

Musa and Mukhtar (1982) revealed that the mean values of total erthrocytic count, hemoglobin concentration, packed cell volume, leucocytic count and differential leucocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of normal camels were 6.1 ± 1.5 million/cmm, 11.6± 2.5 gm%, 25.9 ± 4.4%, 12.6 ± 5.2 thousand/cmm and (55.1±5.2 1.5 ± 6.8 ,0 - 1%, 47.64±1.42 4.5 ±1.6), respectively.

Laila and Mourad (1984) stated that the mean values of total erthrocytic count, hemoglobin value, packed cell volume, total and differential leucocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of clinically healthy camels were 6.72 ± 1.28 million/cmm, 10.5±19.1 gm%, 27 ± 3.6%, 12.7± 0.18 gm%, 27 ± 3.6%, 12.7 ± 0.18 thousand/cmm., and (43.4±13.8, 4.4±13.8, 4.4±1.6, 0.7±0.7, 50.3±14.1, 1.3±1.30/0), respectively.

Omran, et al (1984) reported that mean values of RBCs count, Hb%, packed cell volume, leucocytic count and differentiated leucocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of normal camels were 8.60 ± 2.9 million/cmm., 11.92 ± 0.29 gm %, 28.60 ± 0.27%, 10.53 ± 0.42 thousand/cmm and (55.40 ± 0.92, 6.70 ± 0.67, 0.4 ± 0.16,33.8 ± 0.82 and 3.70 ± 0.47 %), respectively.

EI-Magawry, et al. (1986) mentioned that the mean values of total erythrocytic count, Hb gm/dl and packed cell volume% of apparently healthy camels were 8.85 ± 0.13 million/Cmm, 12.05 ± 0.13 gm% and 28.48 ± 0.144%, respectively.

Manaa (1990) found that the mean values of RBCs, Hb, PCV %, MCV, MCHC, WBCs and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in adult male camels were 8.592 ± 0.18 % million/cmm., 13.13 ± 0.28 gm/dl, 28.61 ± 0.18 ,33.56 ± 46.42 ±

0.570/0, 16.42±0.52 thousand/cmm and 0.35(fI), (41.32 ± 0.28, 6.14 ± 0.13, 0.47 ± 0.12, 48.39 ± 0.62, 2.86 ± 0.22%), respectively.

Anas (1992) reported that the mean values of RBCs, Hb, PCV%, MCV, MCH , MCHC, WBCs and differential count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of healthy camels were 7.96 ± 0.20 million/cmm., 13.34 ± 0.17 gm/dl, 26.1 ± 0.450/0, 33.38 ± 0.83(fl), 17.25 ± 0.42 (Pg), 52.31 ± 0.13%, 19.04 ± 0.26 thousand/cmm and (36.66 ± 1.7, 5.63 ± 0.04,0.61 ± 0.1, 51.79 ± 1.84,4.49 ± 6.22%), respectively.

Baraka (1995) indicated that the mean values of total RBCs count, Hb , PCV %, MCV, MCH, MCHC, WBCs and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes)of clinically healthy dromedary camels fed on chopped wheat straw, barseem, millet and hay were 17.22 ± 0.41 million/cmm., 13.47 ± 0.38 gm/ell, 31.69 ± 1.110/0,19.75 ± 0.88(fl), 12.27 ± 0.26(Pg), 63.98 ± 5.510/0, 5.63 ± 0.32 thousand/cmm and (31.15 ± 2.22, 2.23 ± 0.38, 2.06 ± 0.33, 57.32 ± 0.78, 5.33 ± 0.660/0), respectively.

Partani, et al (1995) found that the mean values of hematological picture: RBCs count, Hb, PCV %, MCV, MCH, MCHC, WBCs, and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in camels free from gastrointestinal nematode were 7.71 ± 0.45 million/cmm., 12.77 ± 0.58 gm/dl, 31.22 ± 2.69%, 35.15 ± 1.67(fl), 16.76 ± 0.50(Pg), 43.10 ± 2.79%, 10.15 ± 0.82 thousand/cmm., and (31.50 ± 3.25,3.67 ± 0.56,0.17 ± 0.17, 64.17 ± 3.31,0.50 ± 0.00%), respectively.

Mohamed (1996) mentioned that the mean values of RBCs count, Hb PCV%, MCV, MCH, MCHC, WBCs count and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes)of clinically healthy camels were 12.36 ± 0.42 million/cmm., 12.28 ± 0.43

gm/dl, 32.48 ± 0.62%, 26.12 ± 0.48(fl), 11.06 ± 0.17(Pg), 41.95 ± 0.790/0, 10.87 ± 0.49 thousand/cmm and (35.72 ± 0.22%, % 0.16 ± 0.07%, 57.12 ± 1.99, 4.04 ± 0.34%), respectively.

Sayed (1998) recorded that the mean values of RBCs count, Hb, PCV%, MCV, MCH, MCHC and WBCs count of clinically healthy camels in the New Vally and Assiut Governorate were (8.2 ± 1.7 million/cmm., 12.27 ± 18.9 gm%, 31.4% ± 4.1, 39.3 ± 7% (fl), 15.3 ± 3.6(Pg), 38.7 ± 6.6, 7.7 ± 1.9 thousand/cmm.) and (8.4 ± 1.7 million/cmm., 13.78 ± 17%, , 30 ± 4%, 35.47 ± 7.98(fl), 16.8 ± 2.4(Pg), 46.2 ± 5.1 gm%, 8.2 ± 2.2 thousand/cmm.), respectively.

Sayed, et al. (1998) said that the mean values of RBCs count, Hb, PCV %, MCV, MCH,MCHC, WBCs and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of clinically healthy camels were 11.01 ± 1.73 million/cmm., 143.95 ± 16.60 gm/L, 27.20 ± 1.62%, 25.38 ± 4.15(fl), 12.99 ± 3.13(Pg), 52.89 ± 6.180/0, 9.43 ± 3.05 thousand/cmm. And (50.90 ± 2.92, 6.50 ± 2.36, 0.10 0 ± 0.32, 30.30 ± 4.85, 6.70 ± 2.35/0)' respectively.

Hassan and Magda (2000) found that the mean values of RBCs count, Hb gm/dl, PCV%, MCV(fl), MCH(Pg), MCHC%, WBCs count, and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of normal camels were 12.38 ± 0.44 million/cmm., 13.30 ± 0.45 gm/dl, 32.50 ± 0.65%, 26.26 ± 0.50(fl), 10.74 ± 0.19(Pg), 40.90 ± 0.81%, 10.90 ± 0.52 thousand/cmm and (35.75 ± 2.08, 3.15 ±0.25, 0.19 ± 0.10, 57.15± 2.15, 3.76 ± 0.57%), respectively.

Abd El Rahman, et al. (2003) mentioned that total leucocytic and differential count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) of clinically male and female healthy camels were (12.07± 0.22 & 11.87 ± 0.18

thousand/cmm.), and (6.76 ± 0.10 and 6.71 ± 0.10 %), (0.42 ± 0.05 and 0.37 ± 0.05) , (0.120 ± 0.01 & 0.120 ± 0.01), (3.35 ± 0.10 and 3.30 ± 0.10) and (1.42 ± 0.06 & 1.37 ± 0.04 %) , respectively.

2- Hematological picture of camels affected by various diseases

El Magawary (1983) reported that the mean values of RBCs count, Hb, PCV%, WBCs count and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in camels suffering from impaction were 8.24 ± 0.07 million/cmm., 12.35 ± 0.09 gm%, 34.9 ± 12.350/0, 12.18 ± 0.14 thousand/cmm and (57 ± 0.25, 8.1 ± 0.1, 0.2 ± 0.06, 32.90 ± 0.23, 1.6 ± 0.06%), respectively. While in camels suffering from dietetic diarrhea (sudden change in ration) the mean values were 8.14 ± 0.01 million/cmm., 11.92 ± 0.01 gm%, 34.04 ± 0.02%, 11.98 ± 0.02 thousand/cmm and (57.23 ± 0.03,8.25 ± 0.01,32.21 ± 0.03, 1.67 ± 0.01%), respectively. Omran, et al. (1984) found that the mean values of RBCs count, Hb gm%, PCY%, MCY (fl), MCH (Pg), MCHC%, WBCs, and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in camels suffering from gastrointestinal nematodes were 8.6 ± 0.29, 11.92 ± 0.29, 28.6 ± 0.27,34.71 ± 0.96, 13.88 ± 0.80,41.68 ± 0.80, 10.83 ± 0.42 and (55.40 ± 0.92, 6.70 ± 0.67, 0.40 ± 0.16, 33.8 ± 0.82, 3.7 ± 0.47), respectively. Partani, et al. (1995) mentioned that the mean values of RBCs count, Hb gm%, PCY%, MCY(fl), MCH(Pg), MCHC%, WBCs, and differential leukocytic count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) In camels affected by gastrointestinal nematode were 4.58 ± 0.43 million/cmm., 8.02 ± 0.76 gm%, 15.48 ± 1.36%, 32.14 ± 0.52(fl), 17.42 ± 0.25(Pg), 51.03 ± 0.610/0,7.19 ±

0.49 thousand/cmm., and (40.15 ± 3.40,7.55 ± 0.76,0 .15 ± 0.11, 49.85 ± 2.93, 2.30 ± 0.34%), respectively.

Mohamed (1996) found that the mean values of blood picture (RBCs million/cumm, Hb gm/dl, PCY % and WBCs thousand/cumm.) in camels suffering from simple indigestion, rumen acidosis, frothy bloat and parasitic diarrhea were (13.63 ± 0.42, 15.09 ± 0.38, 35.40 ± 0.60 & 11.70 ± 0.47); (14.33 ± 0.70, 15.36 ± 0.60, 35.18 ± 1.06 & 11.27 ± 0.46); (12.61 ± 0.82, 15.58 ± 0.70, 31.25 ± 1.02 & 11.40 ± 0.39) and (9.79 ± 0.40, 12.25 ± 0.56, 27.54 ± 1.18 & 14.08 ± 0.49), respectively.

Sayed (1998) found that the mean values of blood picture (RBCs million/cumm, Hb gm/l, PCV % and WBCs thousand/cumm.) In emaciated camels suffering from trypanosomiasis and mange were (5.3 ± 0.90, 82.2 ± 15.6, 22.1 ± 3.5 & 14.6 ± 3.5) and (7.4 ± 1.6, 87 ± 10.8, 31.8 ± 4.6 & 15.6 ± 3.4), respectively.

Sayed, et al (1998) investigated 76 dromedary camels of both sex, 4-8 years old in daraw city, Assiut Governorate, Egypt and they classified the diarrheic camels according to the severity of clinical signs into two groups Group 1 (mild to moderate diarrhea) and Group 2 (severe diarrhea) and found that the mean values of blood picture: RBCs count, Hb gm/L, \PCV%, MCV(fl), MCH (Pg), MCHC g%, WBCs, count and differential count (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in group (1) were 8.27 ± 1.62 million/cmm., 84.20 ± 11.26 gm/L, 29.54 ± 4.75%, 36.00 ± 4.26(fl), 10.52 ± 1.10(Pg), 29.12 ± 2.12 g%, 15.65 ± 3.43 thousand/cmm., and (42.69 ± 12.57, 10.15 ± 6.11, 0.23 ± 0.44, 38.69 ± 14.40, 3.85 ± 2.19%), respectively. While in the group (2) the mean values were 8.61 ± 0.88 million/cmm, 86.00 ± 11.21 gm/l, 30.00 ± 4.72 ,35.20 ± 7.37(fl), 10.14 ± 1.89(Pg), 29.03 ± 4.07 g%, 17.95 ± 7.09 thousand/cmm and

(48.53 ± 12.72,9.47 ± 7.34,0.20 ± 0.42,35.53 ± 12.09,3.27 ± 3.24%), respectively.

Baraka, et al. (2000) found that the mean values of cellular blood constituents (RBCs million/cumm, Hb gm/l, PCY % and WBCs thousand/cumm.) in camels suffering from simple indigestion, ruminal acidosis, frothy bloat and trypanosomiasis were (17.54 ± 0.76,216.1 ± 16.9,29.65 ± 1.71 & 6.13 ± 0.64); (14.87 ± 1.52, 176.9 ± 14.4, 29.89 ± 2.52 & 6.08 ± 0.53); (14.04 ± 2.66, 165.5 ± 8.70, 29.50 ± 2.12 & 6.45 ± 0.61) and (13.80 ± 1.38, 149.4 ± 3.00,25.09 ± 1.44 & 6.09 ± 6.02), respectively. Haroun, et al (2000) mentioned that the mean values of hematological indices: RBCs, Hb gm/dL, PCY%, MCY (Fm), MCH (Pg), MCHC g%, WBCs count, and (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in camels experimentally infected with trypanosoma evansi inoculated intravenously with 6X10 tryp. (After 2 weeks of infection) were 6.90 million/cmm., 12.00 gm/dl, 24.00 35.00(Fm), 50.00(Pg), 50.00 g%, 19.60 thousand/cmm., and (10.30, 24.00, x, 8.43, 0.67), respectively.

Hassan and Magda (2000) examined 30 camels at the six villages at Abes-Alexandria, Egypt. They found that the mean values of RBCs count, Hb, PCV%, MCY, MCH, MCHC, WBCs count, and (neutrophils, eosinophils, basophils, lymphocytes and monocytes) in debilitating camels with chronic intestinal parasitic infestation were 9.20 ± 0.34 million/cmm., 10.77 ± 0.35 gm/dl, 26.50 ± 0.95%, 28.80 ± 0.05(Fm), 11.70 ± 0.19(Pg), 40.64 ± 0.80 g%, 14.11 ± 0.52 thousand/cmm and (35.38 ± 1.38, 8.80 ± 0.58, 0.24 ± 0.09, 52.33 ± 1.80, 3.25 ± 0.70%), respectively.

B- The blood biochemical constituents of clinically healthy and diseased camels.

1- Blood serum total protein, albumin, globulin and A/G ratio

Barakat and Abd EI Fattah (1970) reported that the mean blood serum total protein in clinically healthy camels was ranging between 5.47 and 7.85 gm/dl with mean value of 6.42 ± 0.004 gm/dl.

Botros, et al. (1970) recorded that the mean value of blood serum total protein of adult healthy camels was 6.2 ± 0.7 gm/dl.

Barakat and Abd El Fattah (1971) mentioned that the blood serum total protein of male and female camels during green season was 6.63 ± 0.07 and 6.47 ± 0.09 gm/dl, respectively. While the level in dry season was 6.43 ± 0.8 and 6.17 ± 0.07 gm/dl, respectively. Zein El Abdin, et al. (1975) indicated that the mean value of blood serum total protein of camels was 6.82 ± 0.32 gm/dl, while the mean values of serum albumin, globulins and A/G ratio were 3.70 ± 0.04, 3.12 ± 0.031 gm/dl and 1.47 ± 0.0238; respectively. Abd EI-Gadir, et al. (1979) mentioned that the normal values of blood serum total protein, albumin, globulin and A/G ratio of healthy camels were 6.21 ± 0.12,3.7 ±0.41, 3.80 ± 0.081 gm/dl and 1.147 ± 0.007, respectively.

Buccil, et al. (1979) postulated that the mean value of blood serum total protein of adult normal camels was 7.00 ± 0.8 gm/dl. Wahbi, et al. (1979) pointed out that the blood serum total protein, albumin and globulins in clinically healthy camels were ranged between (6.3 - 8.7), (3.4 - 4.0) and (2.8 - 4.4) gm/dl, respectively.

Biagi and Salutini (1983) clarified that the mean value of blood serum total protein of normal adult camels was 6.24 ± 0.83 gm/dl. El Atrash (1983) found that the mean values of blood serum total protein, albumin and globulins in clinically healthy camels were 6.2 ± 0.24, 3.06 ± 0.12 and 3.14 ± 0.24 gm/dl, respectively.

EI-Magawary (1983) mentioned that the mean values of blood serum total protein, albumin, globulin and A/G ratio in adult male camels were 7.31 ± 0.02 gm/dl, 3.80 ± 0.012 gm/dl, 3.49 ± 0.13 gm/dl and 1.099 ± 0.79, respectively. While in pregnant and non pregnant female camels the mean values were 6.499 ± 0.12 gm/dl, 3.265 ± 0.14 gm/dl, 3.233 ± 0.48 gm/dl and 1.007 ± 0.412 and (6.974 ± 0.026 gm/dl, 3.672 ± 0.14 gm/dl and 1.112 ± 0.21), respectively.

EI-Amrousi, et al. (1984) indicated that the mean value of blood serum total protein of mature healthy she camels in Saudi Arabia was 6.48 ± O.17 gm / dl.

Higgins and Kock (1985) determined the blood serum total protein, albumin and globulins in adult dromedary camels and found to be ranged between (6.3 - 8.7 gm /dl), (3.0 ±4.4 gm/dl) and (2.8 ± 4.4 gm/dl), respectively.

Abd El All, et al. (1986) estimated the mean values of blood serum total protein in healthy camels and those suffering from indigestion and the obtained values were 12.3 ± 1.4 gm/dl and 10.1 ± 1.1 gm/dl, respectively. EI-Amrousi, et al. (1986) reported that the mean value of blood serum total protein in clinically healthy camels was 8.79 ± 1.22 gm/dl. Karram, et al. (1986) showed that normal blood serum total protein in male and female camels were 11.4 ± 1.2 and 13.2 ± 1.7 gm/dl, respectively.

Laila, et al. (1986) mentioned that the mean values of blood serum total protein, albumin, globulins and A/G ratio in clinically healthy camels were 9.7 ± 0.8 gm/dl, 6.3 ± 0.4 gm/dl, 3.4 ± 0.6 gm/dl and 1.85± 0.6, respectively. Abd El-Samee (1987) clarified that blood serum total protein level of normal dromedary camels was ranging between 5.45 - 9.73 gm/dl with a mean value of7.295 ± 0.092 gm/dl, while in camels suffering from trypanosomiasis it was 8.19 ± 0.345 gm/dl.

Radwan, et al. (1987) stated that the mean values of blood serum total protein, albumin in normal camels were 6.90 ± 0.8 gm/dl and 3.70 ± 0.5 gm/dl, respectively.

Shehata and Zaghloul (1988) indicated that the mean values of blood serum total protein in healthy female camels in summer and winter were 7.2± 0.2 and 6.5 ± 0.2 gm/dl, respectively.

Abd El Samee (1990) recorded that the mean values of serum total protein, albumin and globulin in clinically healthy camels were 6.771 ± 0.252, 3.430 ± 0.134 and 3.343 ± 0.119 gm/dl, respectively.

Manaa (1990) mentioned that in male, non pregnant females, pregnant females and young camels the blood serum total protein levels were 7.67 ± 0.16, 7.19 ± 0.23, 6.67 ± 0.24 and 6.97 ± 0.28 gm/dl, respectively. While in camels suffering from trypnosomiasis the level was 6.6 ± 0.18 gm/dl. Anas (1992) reported that the mean values of blood serum total protein, albumin, globulins and A/G ratio in clinically healthy camels were 7.78 ± 0.22, 4.34 ± 0.11, 3.51 ± 0.15 gm/dl and 1.36 ± 0.06, respectively.

Nasser (1992) investigated that the normal blood serum total protein in suckling camels, 6-8 months old, 10 – 12 months old, pregnant non lactating she camels and non pregnant she camels were 6.4 ± 0.29 gm/dl , 6.66 ± 0.16gm/dl, 7.28 ± 0.12 gm/dl, 7.5±0.17 gm/dl and 8.1± 0.17 gm/dl; respectively.

Agag, et al. (1993) mentioned that the blood serum total protein level in clinically healthy camels and camels suffering from trypanosomiasis was 7.84 ± .28 gm/dl and 6.75 ± 0.15 gm/dl, respectively.

Baraka (1995) indicated that the mean values of blood serum total protein in clinically healthy camels was 8.05 ± 0.34 gm/dl, while in camels suffering from simple indigestion, rumen acidosis and frothy bloat the reported values

were 8.80 ± 0.243, 7.361 ± 0.425 and 8.014 ± 0.046 gm/dl, respectively. Mohamed (1996) mentioned that the mean values of blood serum total protein, albumin, globulins and A/G ratio in clinically healthy camels were (7.70 ± 0.36 gm/dl, 4.07 ± 0.27 gm/dl, 3.62 ± 0.23 gm/dl and 1.24 ± 0.06), respectively. While in camels suffering from simple indigestion, rumen acidosis and frothy bloat the respective mean levels were (8.32 ± 0.23 gm/dl, 4.49 ± 0.16 gm/dl, 3.82 ± 0.14 gm/dl, 1.32 ± 0.06), (7.10 ± 0.26 gm/dl, 3.96 ± 0.14 gm/dl, 3.14 ± .18 gm/dl, 1.30 ± 0.07) and (6.96 ± .15 gm/dl, 3.75 ± 0.15 gm/dl, 3.20 ± 0.14 gm/dl and 1.18 ± 0.08).

Baraka, et al. (2000) mentioned that the mean values blood of serum total protein (g/L) in clinically healthy camels was 9.2 ± 0.60 gm/L. While those suffering from simple indigestion, ruminal acidosis, frothy bloat, trypanosomiasis and contagious skin necrosis revealed a mean value of 8.10 ± .70, 9.60 ± 0.70, 6.10 ± 1.40, 8.50 ± 3.0 and 8.30 ± 1.60 gm/L, respectively.

Nabih and Toos (2002) found that the mean values of blood serum total protein, albumin, globulin and A/G ratio in clinically healthy camels were 8.30± 0.22 g/dL, 3.23 ± 0.13 g/dL, 5.07 ± 0.40 g/dL and 0.64 ± 0.06, respectively in 60 camels at Giza province , Egypt.

Ayoub, et al (2003) found that the mean values of blood serum total protein, albumin and globulin gm/dl in pregnant and non pregnant female camels were (6.43 ± 0.04,2.70 ± 0.05 and 3.74 ± 0.04 gm/dl) and (5.95 ± 0.08, 2.49 ± 0.02 and 3.51 ± 0.06 gm/dl), respectively.

Iqbal and Rashid (2003) indicated that the mean values of serum total protein, albumin and A/G ratio in clinically adult camels were 56.8 ± 1.50, 30.6 ± 0.80 g/L and 1.2 ± 0.00, respectively.

Saleh and EI-Sokkary (2003) found that the mean value of blood serum total protein level in juvenile and mature camels was 6.307±0.487 g/dL and 7.377 ± 0.551 g/dl, respectively. While albumin level was 3.263 ± 0.317 and 3.537 ± 0.335 g/dL, respectively.

Raghib, et at. (2004) found that the mean values of blood serum protein, albumin and albumin j globulin ratio were 71.91 ± 1.28 g/L, 40.38 ± 0.97 g/L and 31.53 ± 0.71, respectively in 30 adult dromedary camels at Ahram distraet, Giza province, Egypt.

2- Blood serum urea level:

Emanuel (1979) indicated that the blood plasma urea level of camels was ranged between 8.89 and 22 mg/dl.

Farid, et al. (1979) mentioned that the blood urea nitrogen concentration of camels watered intermittently were at zero time, at 2nd hour, at 4 hour, at 8 hour and at 12 hour were 2.05 - 7.12 mg/dl, 3.49 - 6.12 mg/dl, 78.94 -11.29 mg/dl, 5.56 - 12.72 mg/dl and 4.71 - 8.89 mg/dl, respectively.

Salah EI-Din, et al. (1979) clarified that the blood plasma urea level of camels was ranging between 15.7 & 48.5 mg/dl with a mean value of31.48 ± 8.92 mg/dl.

Abd EI-Samee (1987) reported that the blood serum urea level of clinically healthy male and female camels were 3.41 ± 0.11 and 3.54 ± 0.02 mg/dl, respectively. While in camels suffering from trypanosomiasis. The mean value was 3.10 ± 2.52 mg/dl.

Agag, et al (1993) mentioned that the serum urea level in camels suffering from trypanosomiasis was 44.52 ± 1.82 mmol/L.

Baraka (1995) mentioned that the plasma urea level of dromedary camels was ranging between 2.11 ± 0.69 and 6.89 ± 0.89 mmol/L.

Sayed, et al. (1998) indicated that the mean value of blood serum urea level of healthy camels and camels suffering from severe diarrhea was 5.43 ± 2.18 mmol/L and 5.62 ± 3.00 mmol/L, respectively.

Baraka, et al (2000) clarified that the mean value of blood urea nitrogen of clinically health camels was 3.95 ± 0.36 mmol/L. While in camels suffering from simple indigestion, ruminal acidosis, frothy bloat, trypanosomiasis and contagious skin necrosis the recorded values were 4.09 ± 0.49, 3.97 ± 0.49,2.31 ± 0.00, 4:11 ± 0.03 and 2.80 ± 0.98 mmol/L, respectively.

Ayoub, et al (2003) found that the mean value of blood urea level in both pregnant and non pregnant female camels were 15.48 ± 1.45 and 7.85 ± 1.45 mg%, respectively.

3- Blood serum calcium and inorganic phosphorus in clinically healthy and diseased camels

Custer, et al. (1977) reported that the blood serum calcium level of healthy male camels was 10.20 ± 1.00 mg/dl.

Parasad (1977) found that the decrease of blood serum calcium level in some disease conditions was due to the possible concomitant decrease In both intake and/or absorption of calcium which caused either by anorexia or gastrointestinal atony that usually associated with primary indigestion or reflexly induced by other disease conditions.

Wahbi, et al. (1979) mentioned that the blood serum calcium level in camels was ranged from 6.3 to 11.0 with a mean value of9.2 ± 0.99 mg/dl.

Musa and Mukhtar (1982) indicated that the mean values of blood serum calcium and inorganic phosphorus in clinically healthy camels were 19.5 ± 1.8 mg/dl and 5.72 ± 0.43 mg/dl, respectively.

EI-Magawry (1983) recorded that the mean values of blood serum calcium and inorganic phosphorus in adult male, adult non pregnant female and pregnant female camels were (11.69 ± 0.068 and 7.19 ± 0.212 mg/dl, (10.62 ± 0.045 and 6.88 ± 0.089 mg/dl) and (10.27 ± 0.12 and 6.88 ± 0.089 mg/dl), respectively. Also he added that there was significant reduction in blood serum calcium levels as well as highly significant decrease in serum inorganic phosphorus in camels suffering from parasitic enteritis with mean values of 11.31 ± 0.012 and 5.91 ± 0.011 mg/dl, respectively.

Higgins (1986) found that the mean values of blood serum calcium and inorganic phosphorus in normal camels were 11.88± 0.19 and 7.06 ± 0.21 mg/dl, respectively.

Abd EI Samee (1987) indicated that the mean values of blood serum calcium and inorganic phosphorus in clinically healthy camels were 11.26 ± 0.277 and 5.85 ± 0.117 mg/dl, respectively.

Mohamed (1996) found that the mean values of blood serum calcium and inorganic phosphorus in clinically healthy camels were 9.55 ± 0.28 & 6.78 ± 0.28 mg/dl, respectively. While in camels suffering from simple indigestion, rumen acidosis and frothy bloat, the mean values of the same parameters were (9.22 ± 0.26 & 6.72± 0.20), (9.29 ± 0.36 & 6.65± 0.30) and (9.22± 0.09 & 6.69 ± .19 mg j dl), respectively.

Sayed (1998) mentioned that the mean values of blood serum calcium & inorganic phosphorus of clinically healthy camels were 2.97 ± 0.71 and 1.99 ± 0.34 mmol/L, respectively.

Baraka, et al (2000) indicated that the mean values of blood serum calcium and inorganic phosphorus in clinically healthy camels were 2.67 ± 0.04 and 2.43 ± 0.11 mmol/L, respectively. Camels suffering from simple indigestion, rumen acidosis, frothy bloat and trypanosomiasis revealed a mean values of

(2.77 ± 0.12 & 2.60 ± 0.24 mmol/L), (2.64 ± 0.17 & 2.33 ± 0.22 mmol/L), (2.43 ± 0.17 & 3.08 ± 0.05 mmol/L) and (2.59 ± .16 & 2.45 ± 0.38 mmol/L), respectively.

Hassan and Magda (2000) found that the mean values of blood serum calcium and inorganic phosphorus in clinically healthy camels were 9.90 ± 0.55 and 6.95 ± 0.18 mg/dl, respectively. In debilitating camels with chronic intestinal parasitic infestation the mean values of the same parameters were 8.59 ± 0.53 and 5.38 ± 0.38 mg/dl, respectively.

Nabih and Toos (2002) reported that the mean values of blood serum calcium and in organic phosphorus in normal camels were 11.35 ± 0.38 mg/dL and 8.38 ± 0.30 mg/dL, respectively. The authors added also the ratio between calcium and inorganic phosphorus was 1.33 ± 0.03.

4-Blood serum sodium, potassium and chloride in healthy and diseased camels

Soliman and Shaker (1967) mentioned that the mean value of blood serum chloride in adult she camels was 604.0 ± 4.35 mg /dl. Barakat and Abd El Fattah (1970) reported that the mean values of blood serum sodium, potassium and chloride were 48.16 ± 2.057 mEq/L, 4.707 ± 0.1 mEq/L and 101.43 ± 0.52mgjdl, respectively in clinically healthy camels.

Barakat and Abd El Fattah (1971) found that the mean values of blood serum sodium and potassium in normal camels were 150 ± 1.2 mmol/L and 5.7 ± 0.11 mmol/L. Also, they added that the mean values of blood serum chloride for both male and female camels in green and dry seasons were (92.03 ± 0.63 & 107.18 ± 0.77 mmol/L) and (101.12 ± 0.63 & 05.39 ± 0.52 mmol/L), respectively.

Fawzia, et al. (1979) found that the minimum blood serum chloride content of normal camels was 148 mEq/L and minimum was 120 mEq/L with average values of 128.1 mEq/L.

EI Magawary (1980) reported that the serum sodium, potassium and chloride of normal camels were 135.95 ± 0.07 mEq /L , 5.675 ± 0.0215 mEq/L and 129.10 ± 0.071 mEq/L, respectively.

Maloiy and Clemens (1980) clarified that the serum sodium, potassium and chloride levels of apparently normal camels were 163 mEq/L, 31 mEq/L and mEq/L, respectively.

Musa and Muckhtar (1982) mentioned that the mean values of serum sodium and potassium of clinically healthy camels were 170.8 ± 12.7 and 2.6 ± 2.2 mEq/L, respectively. EI-Magawary (1983) recorded that the mean value of serum sodium of male and female non pregnant camels were 136.09 ± 0.089 and 136.89 ± 0.084 mmol/L, respectively.

EI Amrousi, et al. (1984) found hat the mean values of serum sodium and potassium of apparently normal camels was 146.06 ± 2.03 and 4.39 ± 0.13 mmol/L, respectively.

Abd EI-All, et al. (1986) stated that the mean values of serum sodium, potassium of apparently normal camels were 113.6 ± 5.5 mmol/L & 5.2 ± 0.09 mmol/L, respectively. While in camels suffering from indigestion the mean values of serum sodium, potassium and chloride were 104.0 ± 4.4 mmol/L, 4.9 ± 0.1 mmol/L and 123.1 ± 7.5 mmol/L, respectively.

Abd El Samee (1990) indicated that the mean values of blood serum sodium, potassium and chloride in apparently healthy camels were 136.5 ± 2.99, 3.544 ± 0.082 and 130.36 ± 2.738 mEq/L, respectively.

Hafez (1994a) examined 37 Egyptian camels in Assiut Governorate and concluded that the .mean values of serum sodium, potassium and chloride in

adult male, young male, pregnant female and non pregnant female camels were (137.3 ± 0.54,6.12 ± 0.08 & 131.9 ± 0.86 mmol/L), (136.9 ± 0.57,5.9 ± 0.18 & 131.4 ± 0.7 mmol/L), (136.9 ± 0.89, 6.0 ± 0.40 & 133.0 ± 0.68 mmol/L) and (137.9 ± 0.9,6.03 ± 0.18 & 132.3 ± 0.75 mmol/L), respectively.

Hafez (1994b) investigated 30 one humped camels in Assiut governorate and found that the mean values of serum sodium, potassium and chloride in clinically healthy camels were (135.2 ± 0.38, 6.0 ± 0.07 and 110.2 ± 0.10 mmol/L), respectively. While in mangy camels, the same parameters were 113.2 ± 0.58, 5.8 ± 0.04 and 87.2 ± 0.71 mmol/L, respectively. Baraka (1995) indicated that the mean values of serum sodium, potassium and chloride were (159.04 ± 5.43, 5.79 ± 0.37 and 67.67 ± 7.71 mmol/L), respectively, in clinically healthy camels. While In those suffering from simple indigestion, rumen acidosis and frothy bloat the same parameters were (157 ± 6.21, 5.582 ± 0.49 and 58.80 ± 7.04 mmol/L), (142.333 ± 6.197, 4.455 ± 0.40 and 93.60 ± 4.65 mmol/L) and (110.5 ± 0.70, 1.025 ± 0.12 and 82.96 ± 5.41 mmol/L), respectively.

Mohamed (1996) mentioned that the mean values of serum sodium, potassium and chloride in apparently normal camels were 144.25 ± 5.14, 5.42 ± 0.14 and 130.25 ± 2.57 mmol/L), respectively. While in those suffering from simple indigestion, rumen acidosis and frothy bloat were (141.57 ± 4.09, 5.22 ± 0.13 and 24.27 ± 2.25 mmol/L), (129.93 ± 5.50, 4.81± 0.16 & 124.90 ± 2.49mmoljL) and (121.30 ± 1.34, 3.55 ± 0.31 & 127.27 ± 2.53 mmol/L), respectively.

Sayed, et al. (1998) found that the mean values of blood serum sodium, potassium and chloride in clinically healthy camels were (150.10 ± 10.89, 4.69 ± 0.62 & 118.00 ± 3.33 mmol/L), respectively. While in those suffering

from mild to moderate diarrhea and Severe diarrhea were (141.26 ± 5.51, 5.46 ± 0.87 & 81.27 ± 6.66 mmol/L) and (145.39 ± 5.39, 5.85 ± 0.85 & 85.08 ± 7.96 mmol/L), respectively.

Baraka, et al. (2000) reported that the mean values of serum sodium, potassium and chloride in normal camels were (159.05 ± 5.13, 5.47 ± 0.37 & 67.67 ± 7.71 mmol/L), respectively, while in camels suffering from simple indigestion, rumen acidosis, frothy bloat and trypanosomiasis. The same parameters were 157.0 ± 6.21, 5.58 ± 0.50 & 85.8 ± 7.07 mmol/L), (142.33 ± 6.19,4.46 ± 0.41 & 93.60 ± 4.64 mmol/L), (110.5 ± 0.71, 1.03 ± 0.13 & 82.96 ± 5.4 mmol/L) and (145.73 ± 8.95,4.62 ± 0.33& 92.66 ±3.14 mmol/L), respectively.

Hassan and Magda (2000) mentioned that the mean values of serum sodium, potassium and chloride in clinically healthy dromedary camels were (145.26 ± 6.14, 5.62 ± 0.34 and 134.29 ± 3.60 mmol/L), respectively. While in debilitating camels with chronic intestinal parasitic infestation the mean values of the same parameters were (127.93 ± 2.74, 4.78 ± 0.33 and 120.93 ± 3.39 mmol/L), respectively.

(5) Blood Serum lactic acid

Flores (1999) found that the reference values of blood lactic acid vary from laboratory to another but can be found within the following ranges: 4.5-19.8 mg/dl (Venous blood) and 4.5-14.4 mg/dl (Arterial blood). Montano, et al (1999) found that the blood plasma 0- lactate and L-Iactate mg/dl in steers fed high concentrate finishing diets were 1.26 and 7.96 mg/dl, respectively. Minniti, et al (2001) mentioned that the blood lactate value was ranged from 1.5-2.5 mmol/L. Omole; et al (2001) found that the mean value of 0 and L-

lactic acid in blood of healthy neonatal calves was 1.7±1.2 mmol/L while in calves suffering from diarrhea was 8.9±5.1 mmol/L.

(5) Blood serum carbonic acid

Schalm, et al (1975) found that the mean value of pC02 was 38 mmHg in venous blood of clinically healthy sheep. Lukomski (1977) mentioned that the mean value of pC02 venous blood of healthy sheep was 30-45 mmHg. Kaneko (1983) reported that the mean value of pC02 in healthy sheep was 38 mmHg. Hejlasz and Nicpon (1983) said that the mean value of pC02 in venous blood of sheep was 36.1 mmHg. Nicpon (1983) reported that the mean value of pC02 in venous blood of healthy sheep was 37.6 mmHg. Omole, et al (2001) indicated that the mean value of pC02 in blood serum of clinically healthy· neonatal calves was 57.8±4.3 mmol/L while in calves suffering from diarrhea was 46.5±12.3 mmol/L.

MATERIALS AND METHODS

This study was carried out to investigate the clinical and laboratory finding on some diseased and clinically healthy camels during the summer and winter seasons in three different areas. Sengalf village, EI Bagour city "Menoufia Governorate", private flock in Hagag village, Kafr EI Dawar "Beheira Governorate" and Bastian slaughter house "Giza Governorate", Egypt.

Materials

I- Animals

A total number of 119 adult male and female dromedary Egyptian camels (Camelus dromedaries) of about 4 -10 years old and 300-500 Kg body weight were used in this study. The animals were classified into 7 groups according to full case history, clinical manifestation and laboratory examination shown as in the following table: -

Group	Number of animals	Case history and clinical signs	Health status
Group 1	**31**	Apparently healthy and showed no clinical signs of the disease	**Healthy**
Group 2	**21**	Anorexia, slight increase in pulse and respiratory rates and decrease in ruminal motility.	**Simple indigestion**
Group 3	**14**	Complete anorexia, abdominal pain, slight increase in respiratory and pulse rates and absence of ruminal movement. (Ruminal stasis)	**Acute ruminal impaction**
Group 4	**7**	In appetence, history of vomiting, marked increase in respiratory and pulse rates as well as marked distention of the left side of abdomen	**Ruminal tympany**
Group 5	**20**	Profuse diarrhea and partial loss of appetite	**Parasitic diarrhea**
Group 6	**6**	Anemia, emaciation, recurrent fever, disappearance of the hump, atrophy of the thigh muscles and edema of the limb	**Trypanos -omiasis**
Group 7	**20**	Sever itching, emaciation, anorexia and thicking of the affected part of the skin.	**Mange**

2- Samples

A) Ruminal samples

50 ml of ruminal juice was obtained in early morning before feeding by clean, dry stomach tube. The samples were received in dry clean container then immediately examined for physical characteristics as color, odor, consistency and pH. Large particles in ruminal juice samples were removed by filtering through a sieve. The filtrate was divided into five portions as follows: The first one was used immediately for evaluation of protozoal activity. The second was used for protozoal counting and identification. The third was used for estimation of ruminal ammonia nitrogen concentration. The fourth was used for estimation of total volatile fatty acids. The fifth was centrifuged at 3000 rpm for 10 minutes and the supernatant fluid was used for the determination of ruminal total proteins, albumin, urea, calcium, inorganic phosphorus, sodium, potassium, chloride, lactic acid and carbonic acid.

B) Blood samples

Two blood samples were taken from jugular vein of examined camels using sterile syringe. The first one was received in dry clean labeled test tube contain heparin as anticoagulant for recording complete haemogram (RBCs, Hb, PCV%, total leukocytic and differential leucocytic count as well as blood parasites by geimsa stained blood films. The second one was received in dry clean centrifuge tube and kept in sloping position without agitation till coagulation; the clotted samples were centrifuged at 3000 rpm for 10 minutes for separation of a clear non-hemolysed serum for determination of total protein, albumin, urea, calcium, inorganic phosphorus, sodium, potassium, chloride, lactic acid and carbonic acid.

C) Skin scraping

Samples were collected from infected camels for detection of mite (Sarcoptic scapiei var cameli).

D) Fecal samples

Rectal fecal samples were collected from all examined camels in plastic containers then filtrated and examined in the same day of collection.

II. Methods

(A) Complete clinical examination including body temperature, Pulse, respiratory rates, mucous membrane and rumen motility were recorded in early morning before feeding.

(B) The ruminal fluid samples were obtained by using lubricant stomach tube and mouth gag (photo 1 & 2) Photo (1): Lubrication of rubber stomach tube before using

Photo (1): Lubrication of rubber stomach tube before using

Photo (2): Introduction of stomach tube through mouth gag

(1) Determination of pH degree: using PH-meter according to Nassar, (1971).

(2) Evaluation of protozoal activity: According to the method previously described by EI-Saifi, (1969). The examination was carried out by adding one drop of fresh ruminal juice sample then covered by cover slide and examined directly under microscope by high power (XI00) and the activity was evaluated as following:

(+++) Highly motile and crowded.

(++) Motile and crowded.

(+) Low motile and low number.

(0) No or sporadic a live infusaria.

(3) Counting and Identification of the rumen ciliate protozoa: according to the method described by Mohamed and Serum (1999).

(4)Estimation of ruminal ammonia nitrogen concentration: according to Conway, (1957).

(6) Estimation of ruminal total volatile fatty acids: was determined by steam distillation of the distillate according to Eadie, et al (1967)

(7) Blood serum and ruminal biochemical assays:

Estimation of blood serum ruminal total proteins was done using test kits supplied by (Randox co. U.K.) according to Henry, et al. (1974).

Estimation of blood serum and ruminal albumin using test kits supplied by (Randox co. U.K.) according to Doumas, et al. (1971).

Estimation of blood serum and ruminal globulin mathematically by the differences between serum total protein and albumin according to Coles (1986).

Estimation of blood serum and ruminal urea level by using test kits supplied by (Randox co. U.K.) according to the method described by Fawcett and Scott (1960)

Determination of blood serum and ruminal calcium using test kits supplied by (Randox co. U.K.) according to Gitelman (1967).

Estimation of blood serum and ruminal inorganic phosphorus using test kits supplied by (Randox co. U.K.) according to Zollinger, et al. (1965).

Determination of blood serum and ruminal sodium and potassium using test kits supplied by (Randox co. U.K.) according to Oser (1965).

Determination of blood serum and ruminal chloride using test kits supplied by (Randox co. U.K.) according to Fried (1972).

Determination of blood serum and ruminal lactic acid colorimetrically according to the method described by Taylor (1996).

Estimation of blood serum and ruminal carbonic acid by titrimetric method according to Vogel (1975)

(C) Blood samples examination:

Hematological examination

(1) Determination of red blood cells, Hb, packed cell volume, mean corpuscular volume (MCV}, mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC), total leukocytic and differential leukocytic count according to Coles (1986).

(D) Fecal samples examination

Fecal samples were collected individually in clean plastic bags for examination of gastrointestinal parasites by direct fecal smear, concentration method (Sedimentation Flotation Technique) according to Coles (1986). The detected parasitic eggs were diagnosed according to Lapage (1956).

(E) Skin scraping

Skin scraping were collected from the edges of skin lesions and examined microscopically after adding sodium hydroxide 100/0 for detection of mite (Sarcoptic scapiei var cameli) according to Coles (1986)

(E) Statistical analysis

The data were statistically analyzed according to SAS (1987).

RESULTS

According to full case history, clinical examination and laboratory examination. The examined camels were divided into 7 groups: Group 1 (31 animals) were apparently healthy (photo 4), Group 2 (21 animals) were suffering from simple indigestion, Group 3 (14 animals) were suffering from acute ruminal impaction, Group 4 (7 animals) were suffering from ruminal tympany (photo 4), Group 5 (20 animals) were suffering from parasitic diarrhea (photo 5), Group 6 (6 animals) were suffering from trypanosomiasis (photo 6 and 10) and Group 7 (20 animals) were suffering from mange (photo 7 & 8). General clinical examination of both healthy and diseased dromedary camels was shown in table (1), fig (1 & 2) and photos (9 & 10). Ruminal juice examination included: Physical examination of rumen juice as shown in table (2). Ruminal pH, protozoal activity and count were shown in table (3), and fig (3 & 4). Protozoal identification were shown in photos (11, 12,13, 14,15,16,17,18, 19,20,21,22,23 & 24). Ruminal ammonia and total volatile fatty acids were shown in table (4) and fig (5 & 6). Ruminal biochemical analysis of both healthy and diseased camels was represented in table (5, 6 & 7) and fig (7, 8, 9, 10, 11, 12, 13 & 14). Blood analysis of apparently healthy and diseased dromedary camels include: Blood cellular constituents were represented in table (8 & 9) and fig (15, 16, 17 & 18). Blood biochemical assays were reported in table (10, 11 & 12) and fig (19, 20, 21,22,23,24, 25 & 26). Microscopical examination of blood film reveals trypanosoma evansi of infested camel as shown in photo (25). Parasitological examination of fecal samples revealed characteristic eggs of many species of gastrointestinal nematodes as shown in photos (26, 27, 28

and Emiria oocyste photo 29). Skin examination revealed Sarcoptic scapiei var cameli as shown in photo (30).

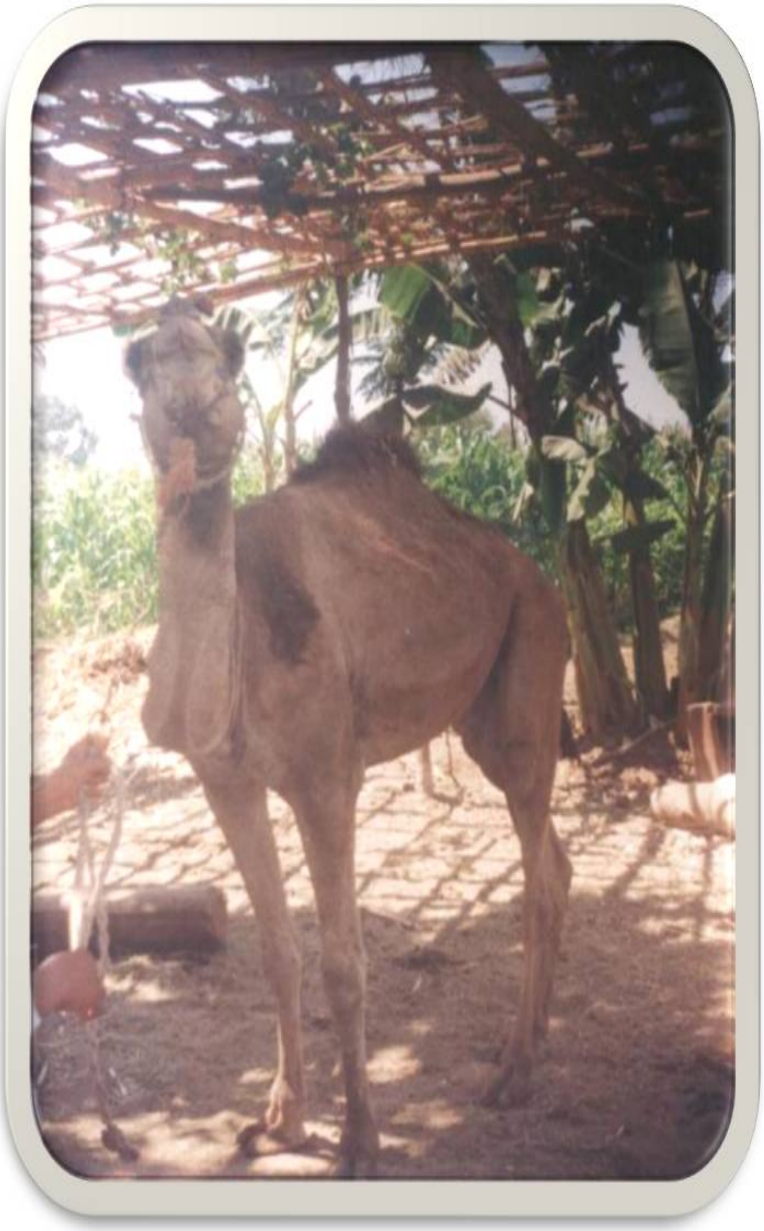


Photo (3): Apparently healthy dromedary camel (Showed healthy signs)

Photo (4): Camel suffering from tympany (Distention of the left flank region)

Photo (5): Camel suffering from diarrhea

Photo (6): Camel suffering from trypanosomiasis (Edema in the legs)

Photo (7): Mange (Neck region)

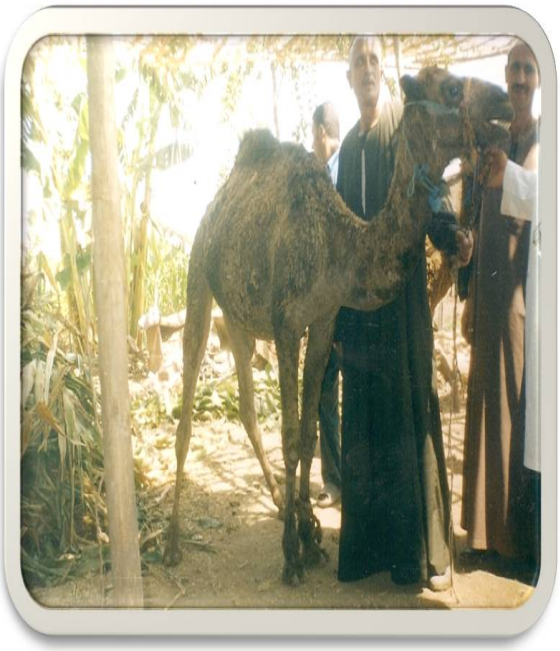


Photo (8) Mange (All over the body)

I) Results of general clinical examination of apparently healthy and diseased dromedary camels.

Table (1): General clinical examination of apparently healthy and diseased dromedary camels. (Temperature Pulse, Respiratory rates, ruminal motility and mucous membranes). (MV± S.E).

Parameter Animal group	Temperature	Pulse/min.	Respiratory rate/min.	Ruminal motility/2min	M.Ms (Color)
Group (l) N=31	37.14±0.1	39.45±1.35	12.12±O.57	3.03±0.15	Rosy
Group (2) N=21	37.32±0.12	43.22±1.62	12.68±O.62	1.68±0.13 **	Rosy
Group (3) N= 14	38.46±0.15 **	44.00±2.14	15.50±1.64	0.00±0.00 **	Congested
Group (4) N=7	37.24±31	48.20±3.07 **	19.20±1.93 *	0.20±0.20 **	Rosy
Group (5) N= 20	36.54±0.15*	34.90±2.91	12.10±1.21	2.80±O.20	Rosy
Group(6) N= 6	39.42±0.31**	35.25±3.83	13.25±1.75	3.25±0.25	Anemic
Group (7) N=20	37.90±O.13	37.95±1.25	13.33±O.62	2.95±O.10	Rosy

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

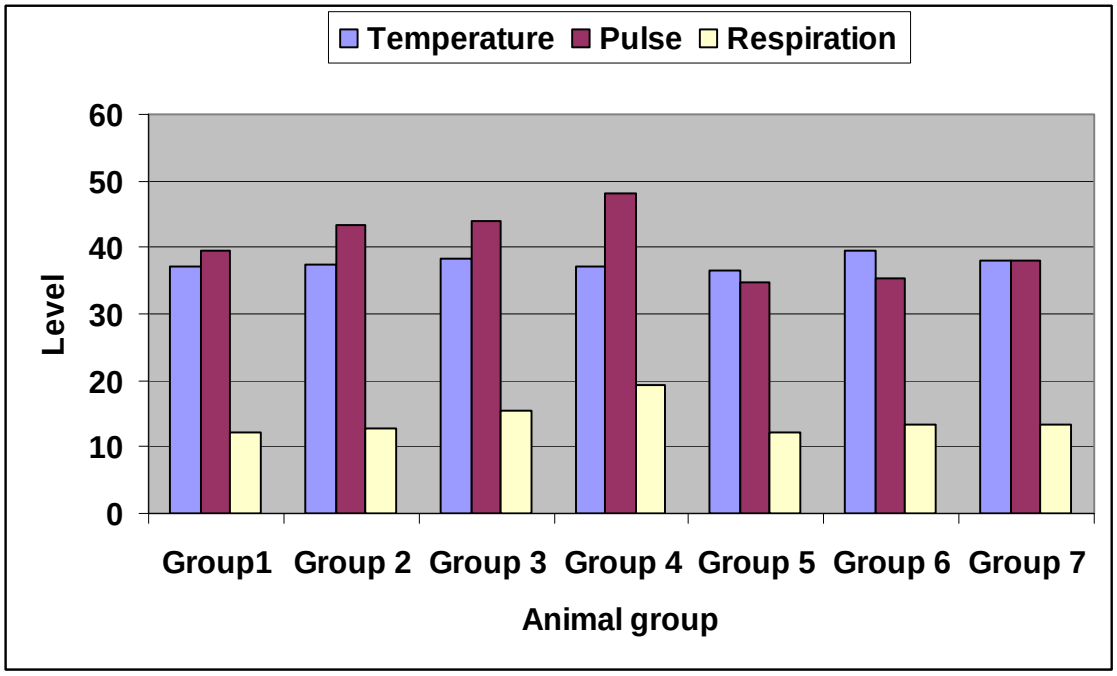


Fig. (1): General clinical examination of apparently healthy and diseased dromedary camels. (Temperature, pulse and respiratory rates)

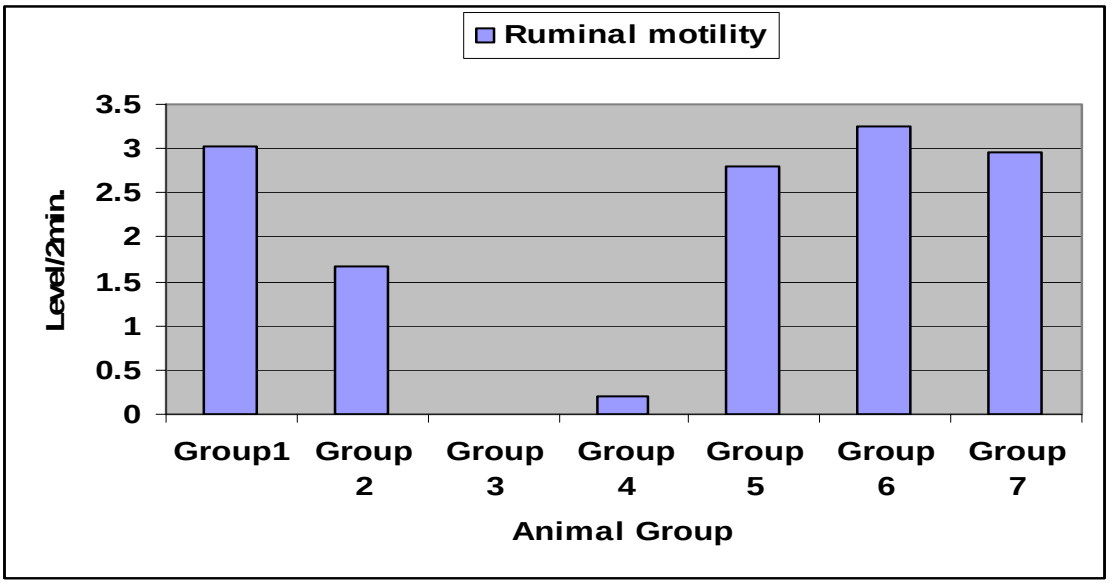


Fig. (2): General clinical examination of apparently healthy and diseased dromedary camels (Rumen motility)

Photo (9): Normal conjunctival mucous membrane (Rosy red in color)

Photo (10): Anemic mucous membrane of the eye (trypanosomiasis)

(2) Ruminal PH, protozoal activity and protozoal count

Table (3): Ruminal juice examination. PH, protozoal activity and protozoal count. (MV + SE)

Animal Group Parameter	Group (1) N=31	Group (2) N=31	Group (3) N=31	Group (4) N=31	Group (5) N=31	Group (6) N=31	Group (7) N=31
PH	6.71 ±0.08	6.59 ±0.12	5.66± 0.12 **	6.38 ±0.11	6.90 ±0.12	7.04 ±0.21	6.68 ±0.15
P.A	++/+++	+/++	0/+ *	++/+++	++/+++	+++	++/+++
P.C	26.64 ±1.81	12.36 ±1.21 **	8.33 ±1.66 **	9.00 ±1.87 **	22.50± 4.66	23.75 ± 8.5	16.71± 2.21

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).
Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

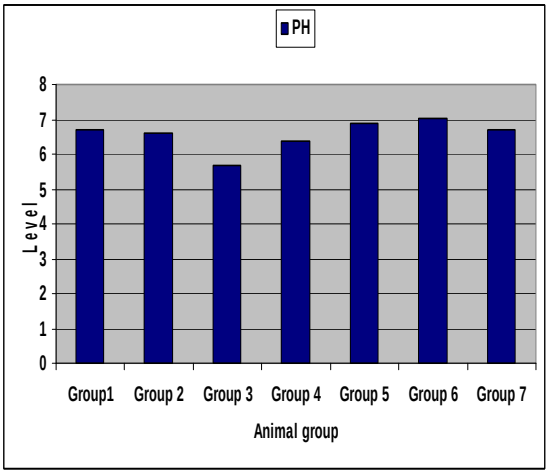


Fig. (3): Ruminal PH

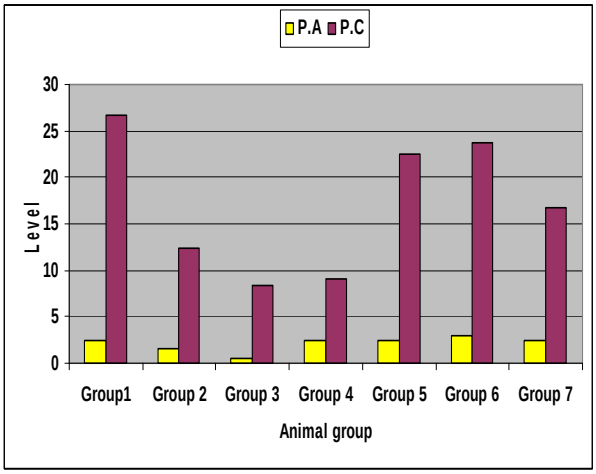


Fig. (4) Ruminal protozoal activity and count

(3) Identification of protozoa in the rumen of apparently healthy and diseased camels:

1- GENUS: BUETISCHLIA

1.1 Buetschlia neglectum spp. (Photo 11)

The body is ovoid with a truncated anterior end and a rounded posterior end, the body is covered by cilia Increase in length at the apical and/or sub apical cytosome. The cytoplasm was granular. The macronucleus is cylindrical. The contractile vacuole was oval and anterior to the macronucleus in one side of the organism**.**

2- GENUS: DIPLODINIUM

2.1 Diplodinium cameli spp. (Photo 12)

The body was large ovoid in shape covered by thick cuticle extends interiorly forming an apical process. A heavy long macronucleus. The cytoplasm was coarsely granular. Two contractile vacuoles were present at one side of the body.

2.2 Diplodinium anisacanthum spp.

The body is nearly square, the left surface is convex and the right surface is flattened or concave. Operculum is relatively small. The posterior end was tapered giving it some what conical appearance. The macronucleus is heavy large rod-shaped. This species has 7 formae with caudal spines varies from zero to six as follow: 2.2.1- D. anisacanthum forma anacanthum. (Photo 13) with no caudal spine.

2.2.2- D. anisacanthum forma monacanthum. (Photo 14)

With one caudal spine

2.2.3- D. anisacanthum forma diacanthum. (Photo 15)

With two caudal spines

2.2.4- D. anisacanthum forma triacanthum. (Photo 16)

With three caudal spines

2.2.5- D. anisacanthum forma tetracanthum. (Photo 17)

With four caudal spines

2.2.6- D. anisacanthum forma pentacanthum. (Photo 18)

With five caudal spines

2.2.7- D. anisacanthum forma anisacanthum. (Photo 19)

With six caudal spines

2.3 Eudiplodinium maggii spp. (Photo 20)

The body is ovoid to triangular. Operculum IS small. There is one slender skeletal plate. The macronucleus is characteristic in shape, it resembles a 7in shape. There are two contractile vacuoles at the left side of the macronucleus.

3- GENUS: ENTODINIUM

3.1- Entodinium simplex spp. (Photo 21)

The body is ovoid. Anterior end of the body is slightly flattened. Posterior end of the body is round. The macronucleus is rod-shaped and its length is about one third of the body length.

3.2- Entodinium nanellum spp. (Photo 22)

The body is relatively elongated .Anterior end of the body is relatively flattened. Posterior part of the body becomes slender. The macronucleus is rod-shaped and its length is about one-third of the body length.

3.3- Entodinium longinucleatum forma longinucleatum (Photo 23)

The body is ovoid and its anterior part is flattened. The macronucleus is long and located anteriorly to the posterior end of the body along the right surface.

3.4 Entodinium rostratum (Photo 24)

The body is a symmetrical. There is a heavy spine at the posterior end. The macronucleus is rod-shaped, and the same thickness at any part.

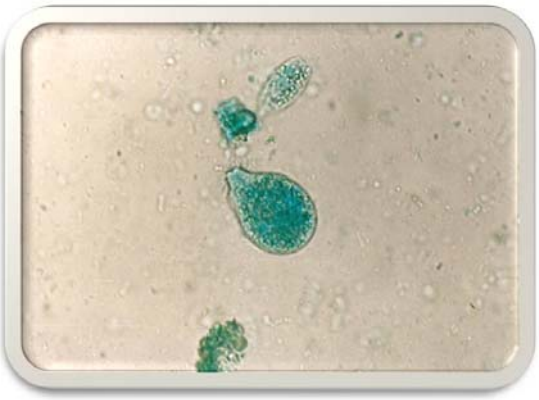


Photo (11): Buetschlia neglectum spp.

Photo (12): Diplodinium cameli spp.

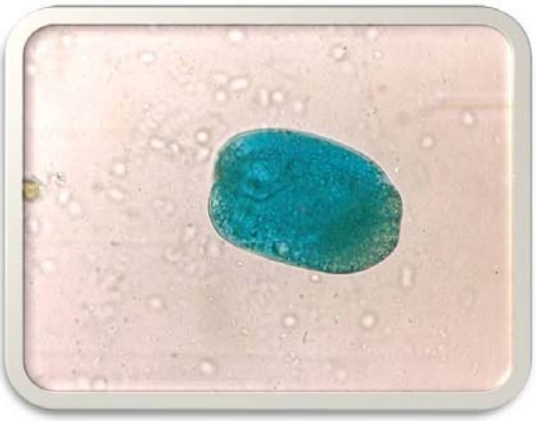


Photo (13): Diplodinium anisacanthum forma anacanthum spp.

Photo (14): Diplodinium anisacanthum forma monacanthum spp.

Photo (15): Diplodinium anisacanthum forma diacanthum spp. (X40)

Photo (16): Diplodinium anisacanthum forma triacanthum spp. (X40)

Photo (17): Diplodinium anisacanthum forma tetracanthum spp. (X40)

Photo (18): Diplodinium anisacanthum forma pentacanthum spp. (X40)

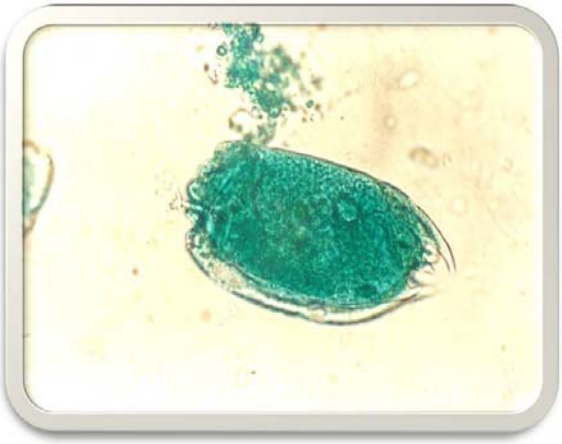


Photo (19): Diplodinium anisacanthum forma anisacanthum spp. (X40)

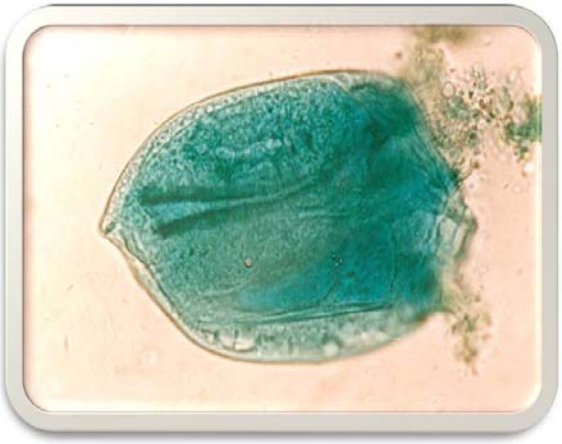


Photo (20): Eudeplodinium maggii spp.

Photo (21): Entodinium simplex spp.

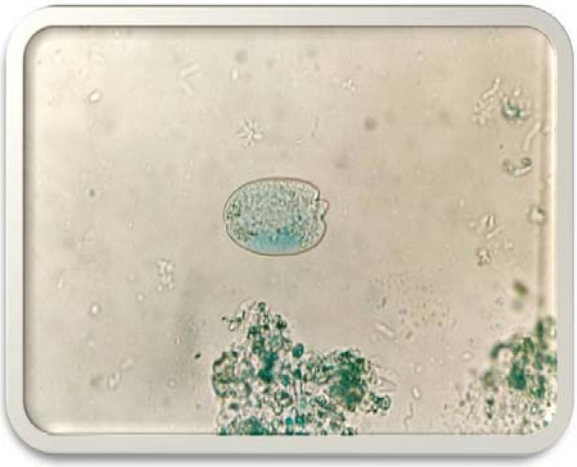


Photo (22): Entodinium nanellum spp.

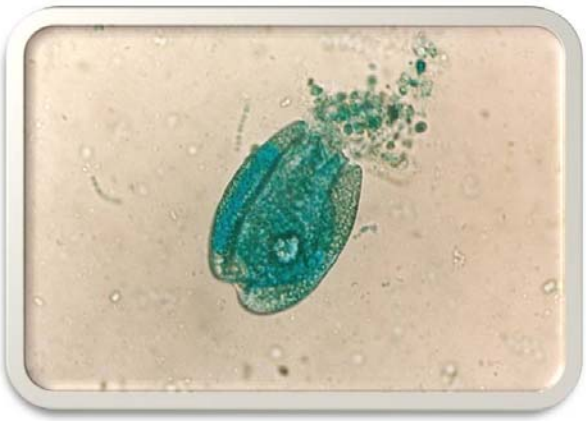


Photo (23): Entodinium longinucleatum forma longinucleatum spp. (X40)

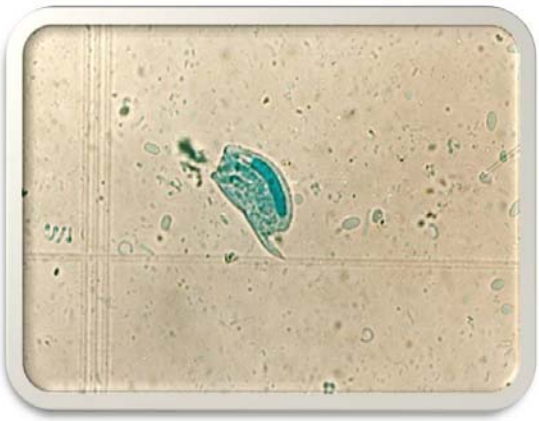


Photo (24): Entodinium rostratum spp

(4) Ruminal ammonia and total volatile fatty acids (TVFA)

Table (4): Ruminal ammonia nitrogen concentration and total volatile fatty acids (TVFA) in apparently healthy and diseased dromedary camels. (M.E. + SE)

Animal group Parameter	Group (1) N=31	Group (2) N=31	Group (3) N=31	Group (4) N=31	Group (5) N=31	Group (6) N=31	Group (7) N=31
Ammonia mg/L	36.17± 1.53	44.06± 1.03 **	43.91± 2.02 *	33.60± 3.45	37.66± 2.52	48.65± 2.38 **	46.80± 1.53 **
T.V.F.A mEq/L	5.47± 0.09	5.76± 0.15	8.42± 0.38 **	5.73± 0.12	5.68± 0.18	5.68± 0.10	5.54± 0.12

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

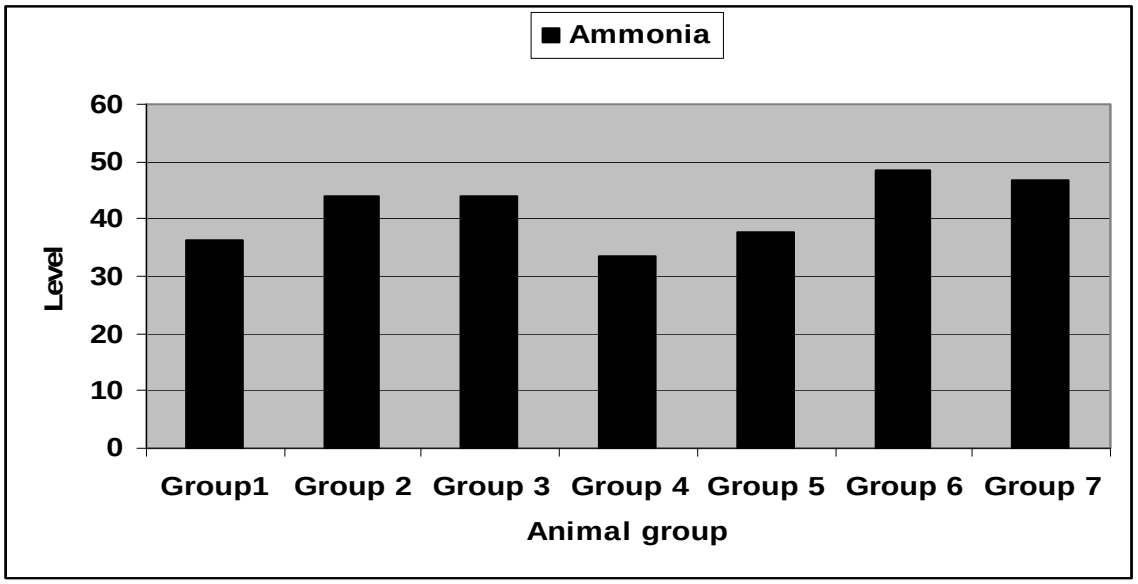


Fig. (5): Ruminal ammonia nitrogen concentration (mg/L)

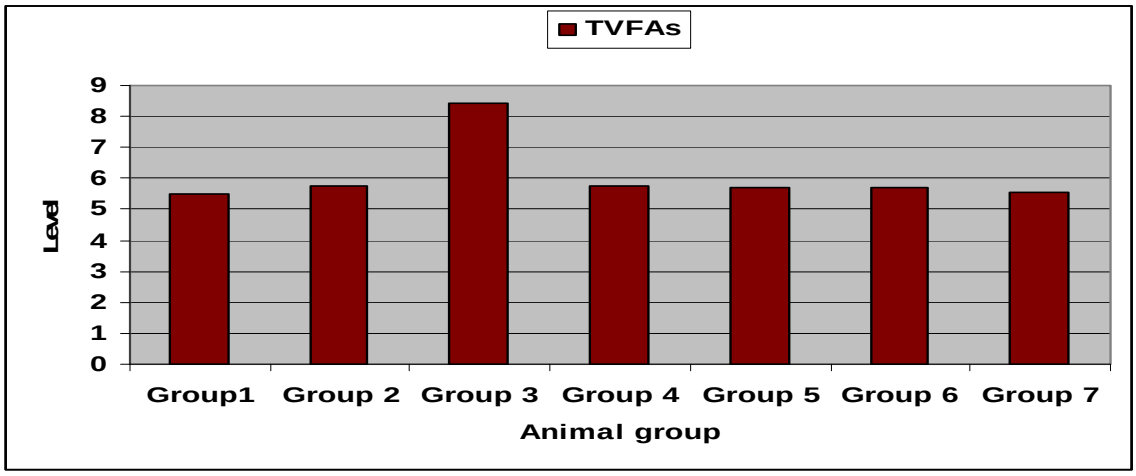


Fig. (6): Ruminal total volatile fatty acids (mEq/L)

(5) Ruminal Urea, total protein, albumin, globulin and AIG ratio

Table (5): Urea, total protein, albumin, globulin and A/G ratio in rumen juice of apparently healthy and diseased dromedary camels (MV ± SE)

Animal group Parameter	Group (1) N=31	Group (2) N=31	Group (3) N=31	Group (4) N=31	Group (5) N=31	Group (6) N=31	Group (7) N=31
Urea (mmol/L)	0.98 ±0.06	0.53 ±0.06 **	1.83 ±0.30 *	1.47 ±0.18	0.92 ±0.15	1.45 ±0.29	0.54 ±0.60
Total protein gm/dl	8.51 ±0.17	7.43 ±0.23	9.64 ±0.30	6.44 ±0.24 **	9.65 ±0.57	8.98 ±0.81	8.72 ±0.26
Albumin gm/dl	3.97 ±0.26	3.70 ±0.17	5.35 ±0.49 **	2.95 ±0.32	4.27 ±0.40	4.58 ±0.79	4.53 ±0.25
Globulin gm/dl	4.53 ±0.31	3.72 ±0.21	4.28 ±0.66	3.48 ±0.23	5.37 ±0.55	4.39 ±0.13	4.19 ±0.27
A/G ratio	1.21 ±0.18	1.11 ±0.12	1.59 ±0.47	0.88 ±0.14	0.87 ±0.11	1.41 ±0.47	1.26 ±0.16

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

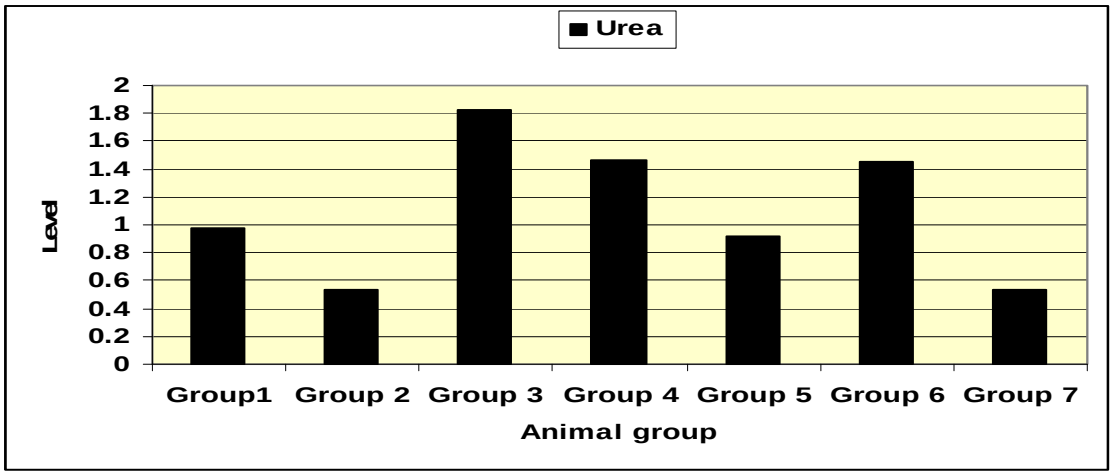


Fig. (19): Biochemical blood serum urea level mg/dl.

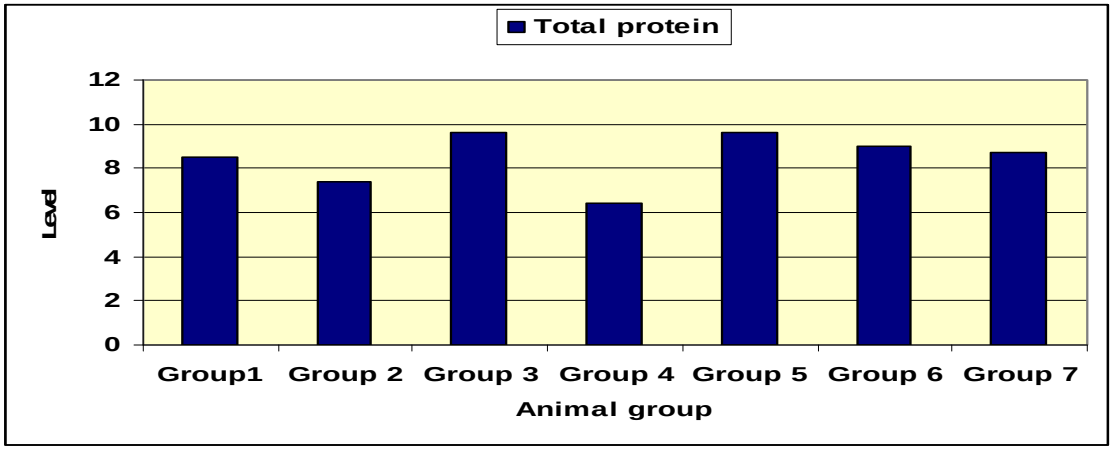


Fig. (20): Biochemical blood serum total protein gm/dl.

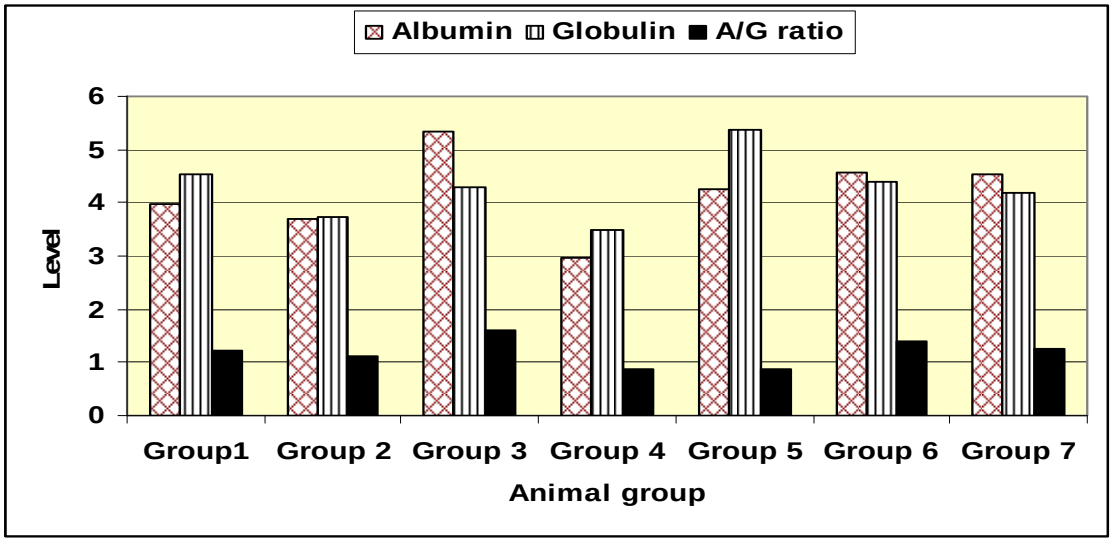


Fig. (9): Ruminal albumin, globulin (gm/dl) and A/G ratio

(6) Ruminal calcium, inorganic phosphorus, sodium, potassium and chloride:-

Table (6): Ruminal calcium, inorganic phosphorus, Sodium, potassium and chloride in apparently healthy and diseased dromedary camels. (MV±S E)

Animal group **Parameter**	**Group (1)** **N=31**	**Group (2)** **N=21**	**Group (3)** **N=14**	**Group (4)** **N=7**	**Group (5)** **N=20**	**Group (6)** **N=6**	**Group (7)** **N=31**
Calcium mmol/L	1.81 ±0.09	1.74 ±0.03	4.24 ±0.21 **	1.44 ±0.16	1.42 ±0.32	3.88 ±0.23 **	1.76 ±0.14
Inorganic Phosphorus mmol/L	1.49 ± 0.10	1.47 ±0.09	1.66 ±0.34	2.17 ±0.28	1.25 ±0.14	2.55 ±0.27 **	2.13 ±0.12 **
Sodium mmol/L	113.70 ±2.03	120.63 ±2.57	86.66± 5.64 **	47.40 ±8.16 **	102.10 ±4.56	110.75 ± 4.15	125 ± 2.98
Potassium mmol/L	25.09 ±1.04	25.56 ±1.22	34.80± 4.25	28.96 ±1.85	27.81 ±1.63	36.93 ±3.50 *	22.49± 1.13
Chloride mmol/L	35.80± 1.79	43.29 ±1.95 *	31.33± 3.30	36.85± 1.77	31.09± 2.38	45.61 ±2.74 *	42.21± 1.78

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

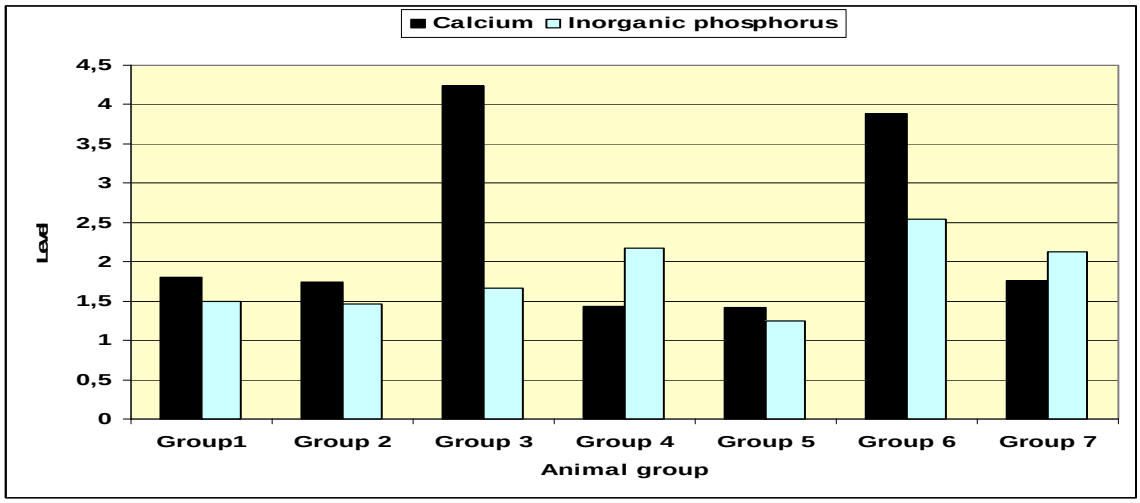


Fig. (10): Ruminal calcium and inorganic phosphorus (mmol/L)

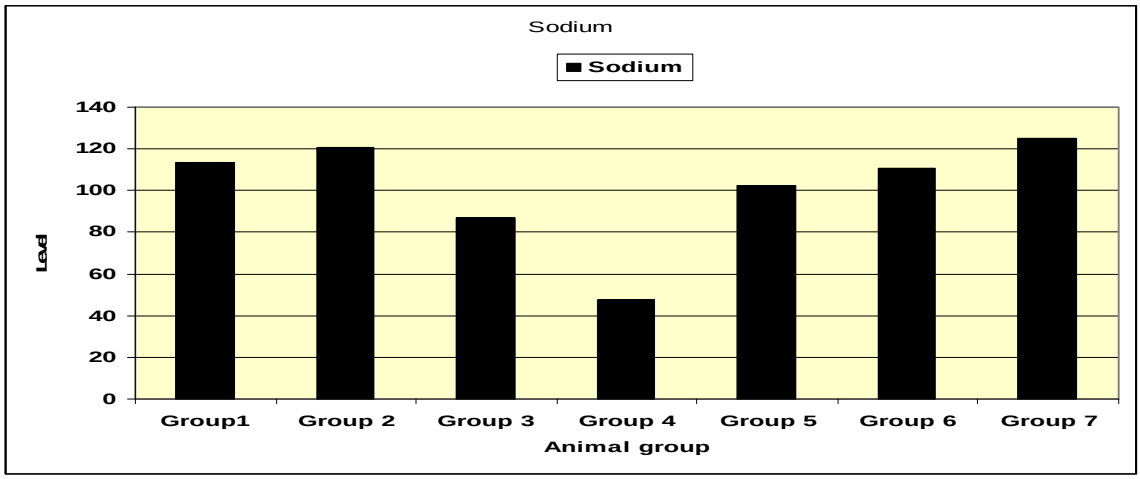


Fig. (11): Ruminal sodium level (mmoI/L)

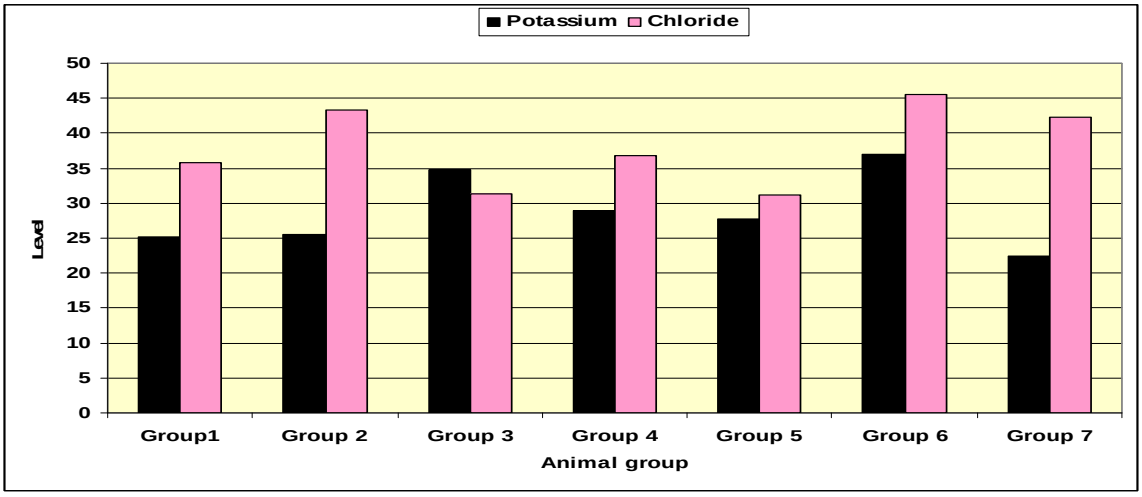


Fig. (12): Ruminal potassium and chloride level (mmol/L)

(8) Ruminal lactic and carbonic acid

Table (7): Ruminal lactic and carbonic acid in ruminal fluid of apparently healthy and diseased dromedary camels. (MV ± SE)

Animal group Parameter	Group (1) N=31	Group (2) N=21	Group (3) N=14	Group (4) N=7	Group (5) N=20	Group (6) N=6	Group (7) N=31
Lactic acid (mg/dl)	12.79 ± 0.94	17.4 ± 0.77 **	28.0 ± 1.93 **	15.3 ± 2.35	15.8 ± 1.70	13.87 2.91	13.01 ± 0.87
Carbonic acid (mmol{L)	149.19 ± 11.09	157.8 ± 18.13	197.0 ± 21.47	452.6 ± 43.79 **	160.6 ± 12.40	200.08 ± 34.05	131.33 ± 9.83

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

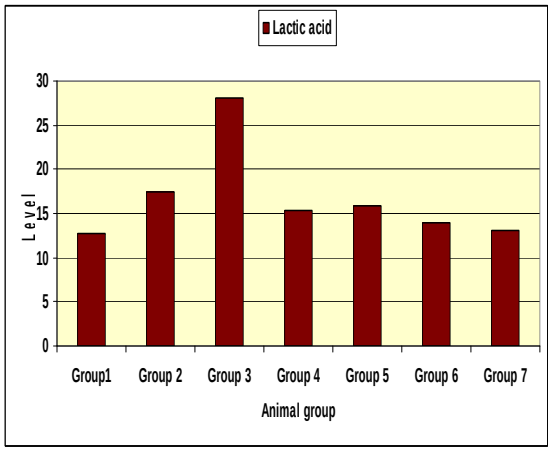


Fig. (13): Ruminal lactic acid level

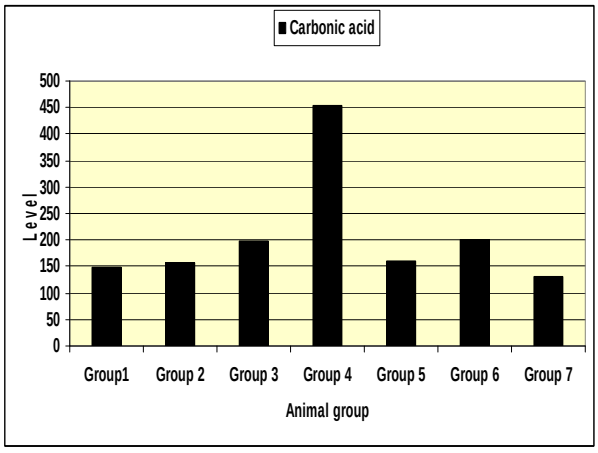


Fig. (14): Ruminal carbonic acid level

111- Blood analysis of apparently healthy and diseased dromedary camels.

A-The blood cellular constituents:-

Table (8): Cellular blood constituents in apparently healthy and diseased dromedary camels. RBCs, Hb, PCV, MCV, MCH and MCHC (MV ± SE)

Animal group Parameter	Group (1) N=31	Group (2) N=21	Group (3) N=14	Group (4) N=7	Group (5) N=20	Group (6) N=6	Group (7) N=31
RBCs million/Cumm	12.80 ±0.65	12.98 ±0.69	9.07± 1.21 *	13.60 ±1.27	10.56 ±0.81	8.00 ±1.35 *	± 9.34 0.69
Hb gm%	11.87 ±0.47	13.02 ±0.67	16.35 ±1.01 **	14.42 ±1.31	12.47 ±0.88	14.15 ±0.80	10.76±0 .39
PCV%	29.87 ±0.51	29.99 ±0.76	28.18 ±0.77	29.40 ±1.11	29.76 ±1.44	29.77 ±1.10	28.43±1 .00
MCV(fl)	25.98 ±1.57	24.25 ±1.68	33.52 ±3.80	22.35 ±2.27	29.60 ±2.68	37.69 ±7.28	29.57±2 .09
MCH(Pg)	10.37 ±0.61	10.51 ±0.74	19.97 ±3.05 *	10.88 ±1.40	12.9 ±1.40	19.58 ±3.98	12.25±1 .10
MCHC%	39.89 ±1.64	43.46 ±2.01	58.27 ±4.24 **	48.76 ±3.27	41.80 ±1.85	52.55 ±3.27	39.01 ±2.25

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

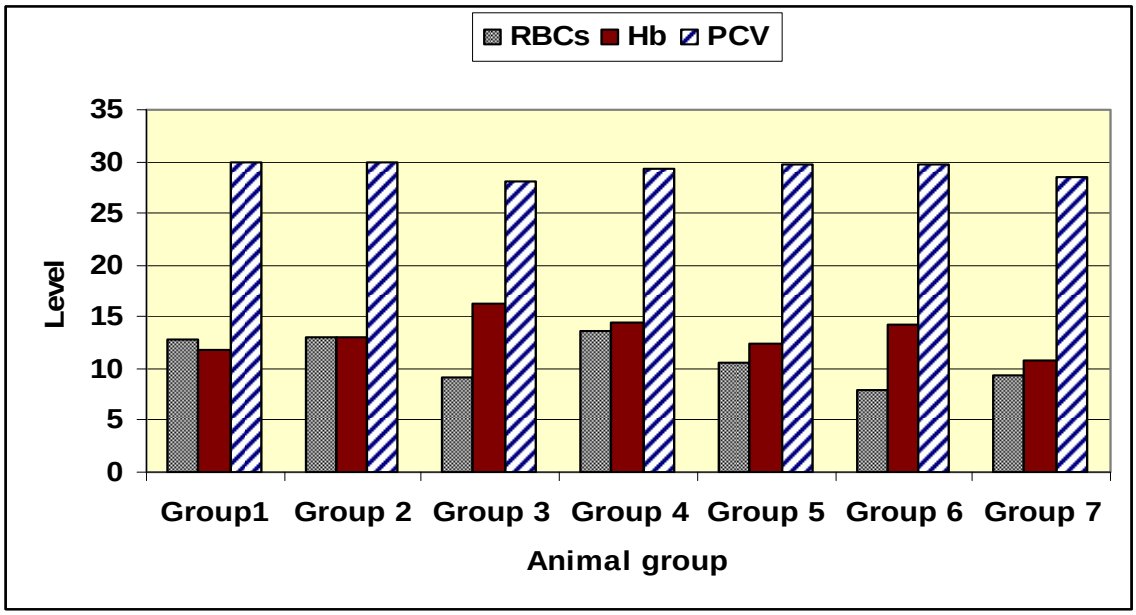


Fig. (15): Cellular blood constituent (RBCs l06jcum, Hb gm/dl and PCV %).

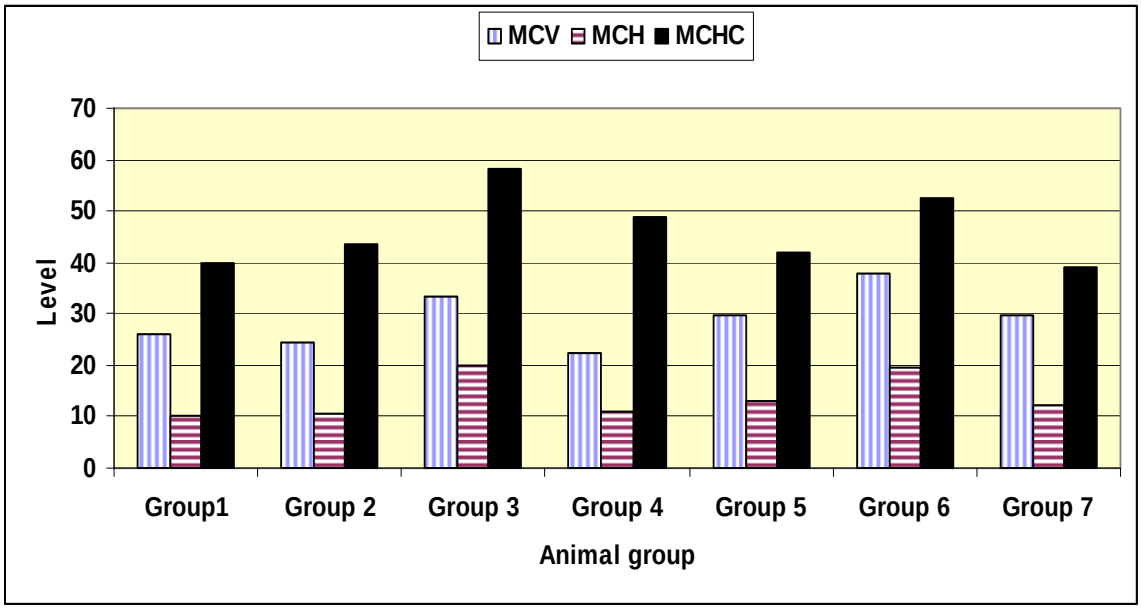


Fig. (16): Cellular blood constituents (MCV (fl), MCH (Pg) and MCHC %)

Table (9): Cellular blood constituents in apparently healthy and diseased dromedary camels. WBCs, Neutrophil, Eosinophil, Basophil, Lymphocyte and Monocyte (%). (MV±SE)

Animal group Parameter	Group (1) N=31	Group (2) N=21	Group (3) N=14	Group (4) N=7	Group (5) N=20	Group (6) N=6	Group (7) N=31
WBCs XI03/Cumm	7.58 ±OA9	9.14 ±0.74	6.71 ±0.60	6048 ±0.22	12.75± 1.52 *	6.35 ±0.29	6.11 ±0.27
Neutrophil %	30.90± 0042	31.77± 1.03	41.66± 2.06 **	28.60± 1.80	36.10± 3.78	32.00± 2.27	28.61± 0.54
Eosinophil %	2045 ±0.26	3.54 ±0.34	1.66 ±0.33	1.00 ±O.31	9040 ±1.16 **	2.00 ±OAO	3.52 ±0.66
Basophile %	1.51 ±0.17	1.36 ±0.21	1.00 ±0.36	1.00 ±OA4	0.80 ±0.24	1.25 ±0.25	1.23 ±0.21
Lymphocyte %	57A5± 0.51	57.63± 1.10	50.3±1 .64 **	65.00±1 043 **	49.7±3 .62	58.50± 1.75	60.90± 0.75
Monocyte %	7.74 ±0.36	5.68 ±OA8	5.33 ±0.95	4.00 ±1.26 *	4.00±0 .77 **	6.25±0 .85	5.38±0 .51

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

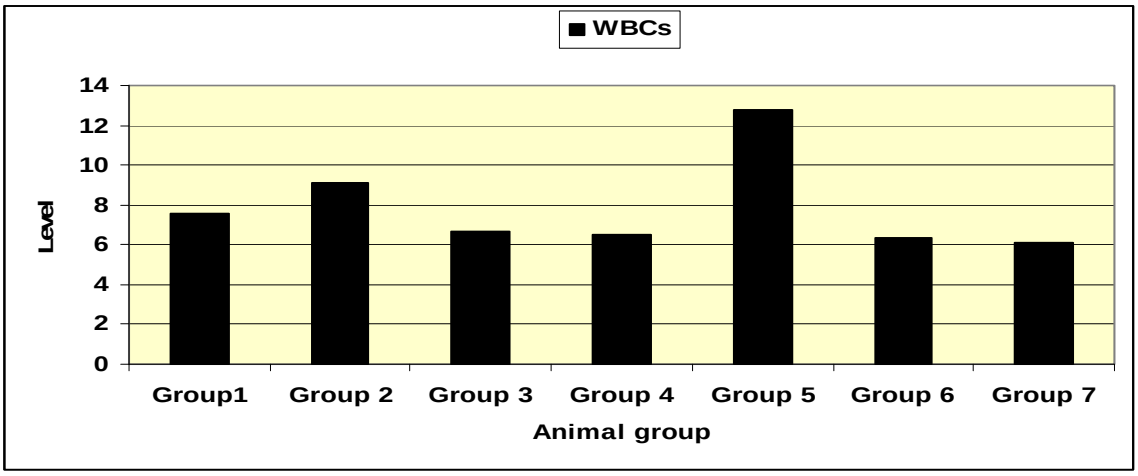


Fig. (17): Cellular blood constituents (WBCs)

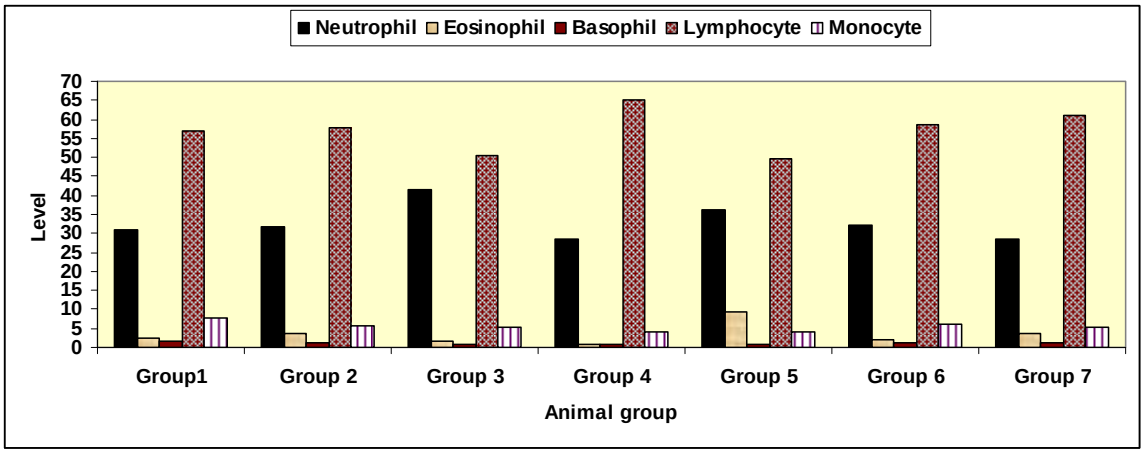


Fig. (18): Cellular blood constituents (Neutrophil, eosinophil, basophil, lymphocyte, and monocyte %).

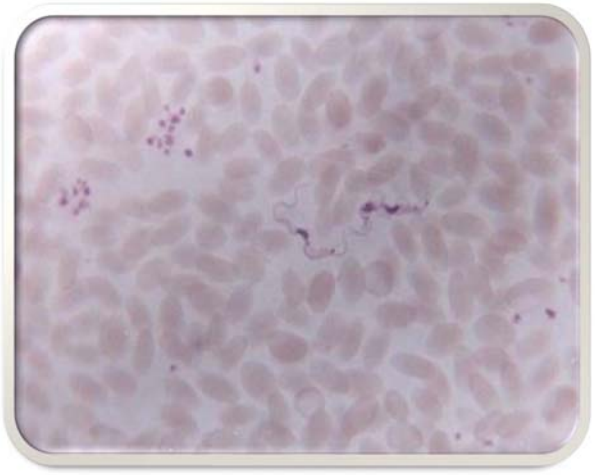


Photo (25): Trypanosoma evanci in the blood film of infected camels

(B) The blood biochemical constituents

Table (l0): Biochemical blood urea, total protein, albumin, globulins (gm %) and A/G ratio in apparently healthy and diseased dromedary camels. (M.V. + S.E.).

Animal group **Parameter**	**Group (1)** **N=31**	**Group (2)** **N=21**	**Group (3)** **N=14**	**Group (4)** **N=7**	**Group (5)** **N=20**	**Group (6)** **N=6**	**Group (7)** **N=31**
Urea mg/dl	32.43 ±2.21	41.48 ±1.84 *	41.93 ±3.75	23.18 ±4.67	32.66 ±3.26	47.62 ±3.28 **	25.38 ±1.93
Total protein gm/dl	8.34 ±0.13	10.18± 0.27 **	7.03 ±0.30 **	9.05 ±0.44	6.20 ± 0.24 **	1O.08±0 .40 **	8.15 ±0.25
Albumin gm/dl	3.58 ±0.13	4.62 ±0.19 **	3.45 ±0.26	4.31 ±0.37	3.06 ± 0.12 *	5.67 ±0.28	4.08 ±0.19
Globulin Gm/dl	4.76 ±0.18	5.55 ±0.24	3.58 ±0.33 *	4.74 ±0.55	3.14 ± 0.24 **	4.41 ±0.35	4.07 ±0.28
A/G ratio	0.78 ±0.04	0.88 ±0.06	1.03 ±0.16	0.99 ±0.17	0.94 ± 0.08	1.31 ±0.13 **	1.40 ±0.33

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

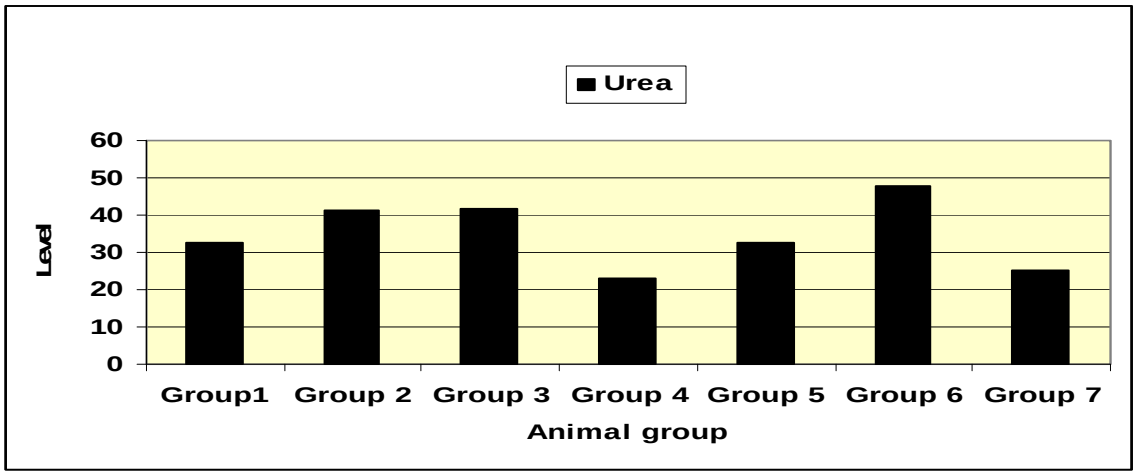


Fig. (19): Biochemical blood serum urea level mg/dl.

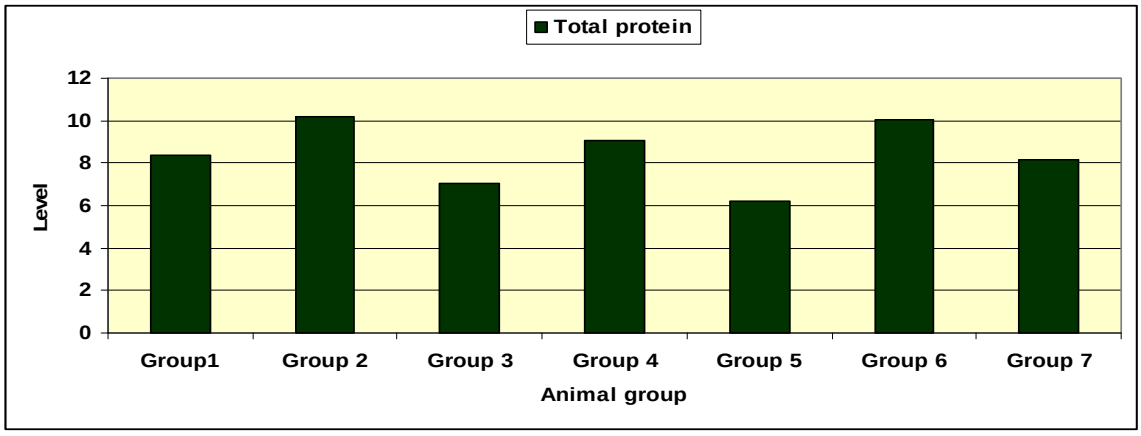


Fig. (20): Biochemical blood serum total protein gm/dl.

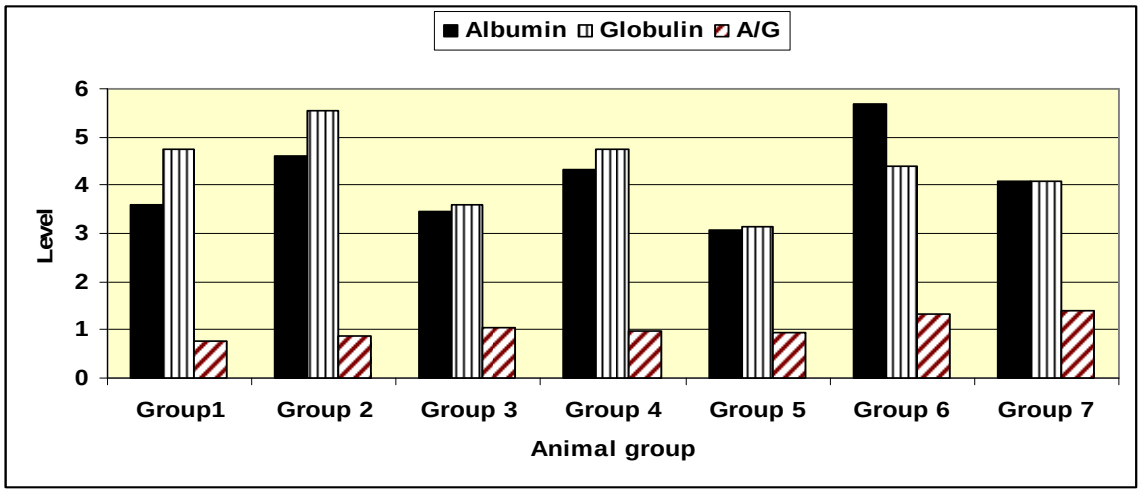


Fig. (21): Biochemical blood serum albumin, globulin and AIG ratio (gmldl).

Table 11): Biochemical blood serum calcium, inorganic Phosphorus, sodium, potassium and chloride in apparently healthy and diseased dromedary camels. Calcium and inorganic phosphorus (M.V. + S.E.)

Animal group **Parameter**	**Group (1)** **N=31**	**Group (2)** **N=21**	**Group (3)** **N=14**	**Group (4)** **N=7**	**Group (5)** **N=20**	**Group (6)** **N=6**	**Group (7)** **N=31**
Calcium mg%	10.35 ±0.21	9.3 ± 0.19	9.91 ±0.70	9.82 ±0.50	8.69 ±0.4 *	9.71 ±0.57	8.58 ±0.3 **
Inorganic ph mg%	5.07 ±0.28	5.60 ±0.29	4.52 ±0.76	6.64 ±0.23 *	4.06 ±0.37	4.52 ±0.59	4.52 ±0.22
Sodium (m.Eq/L)	146.93 ±1.89	137.59 ±1.99 *	138.50 ±4.99	108 ±4.50 **	112.60 ±5.13 **	156.25 ±3.19	128.52 ±2.84 **
Potassium (mEq/L)	4.74 ±0.15	4.99 ±0.18	3.65 ±0.27 *	2.39 ±0.28 **	2.56 ±0.21 **	3.29 ±0.38 **	4.85 ±0.19
Chloride (mEq/L)	124.09 ±2.85	134.31 ±3.36	159.83 ±4.25 **	128±6. 46	102.70 ±3.09 **	148.0 ±5.58 **	102.42 ±2.50 *

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).

Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

Fig. (22): Biochemical blood serum calcium and inorganic phosphorus levels (mg/dl).

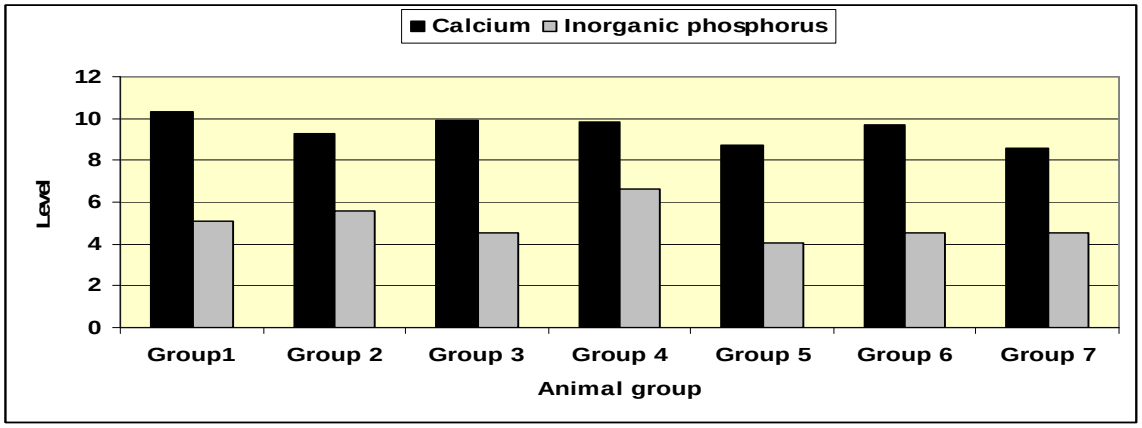
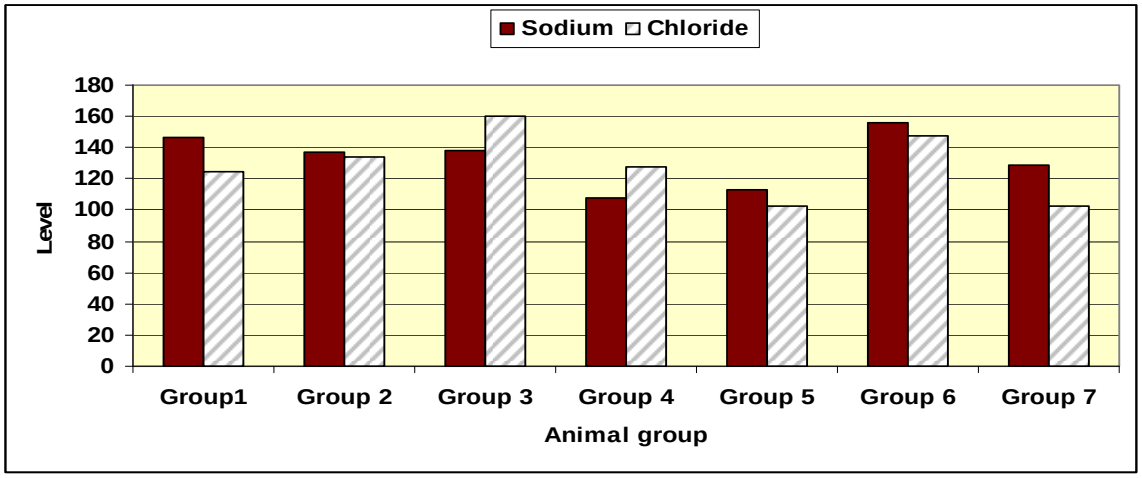


Fig. (23): Biochemical blood serum sodium and Chloride levels (mEq/L).



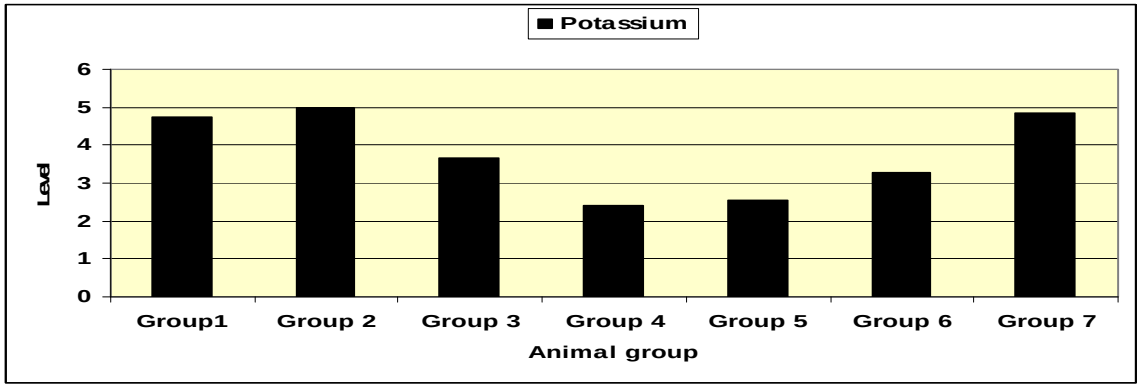


Fig. (24): Biochemical blood serum potassium level (mEq/L).

Table (12): Biochemical blood serum lactic (mg/dl) and carbonic acid (mmol/L in apparently healthy and diseased dromedary camels. (MV±SE).

Animal group Parameter	Group (1) N=31	Group (2) N=21	Group (3) N=14	Group (4) N=7	Group (5) N=20	Group (6) N=6	Group (7) N=31
Lactic acid (mg/dl)	5.58 ± 0.30	6.62 ± 0.43	9.19 ± 0.80 **	7.32 ± 0.67	6.48 ± 0.43	5.81 ± 0.63	5.79 ± 0.61
Carbonic acid (mmol/L)	94.72 ± 5.16	94.29 ± 2.23	169.9 ± 24.45 *	347.89 ± 26.44 **	124.92 ± 14.50	102.28 ± 12.83	108.25 ± 4.47

Means followed by an (*) differ significantly compared to the control group ($P < 0.01$).
Means followed by an (**) differ significantly compared to the control group ($P < 0.001$).

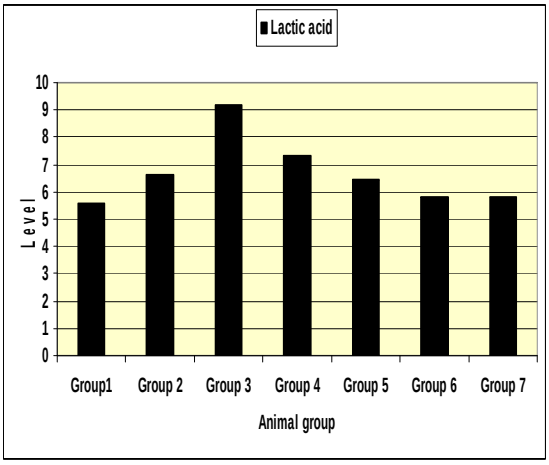


Fig. (25): Biochemical blood serum Lactic acid

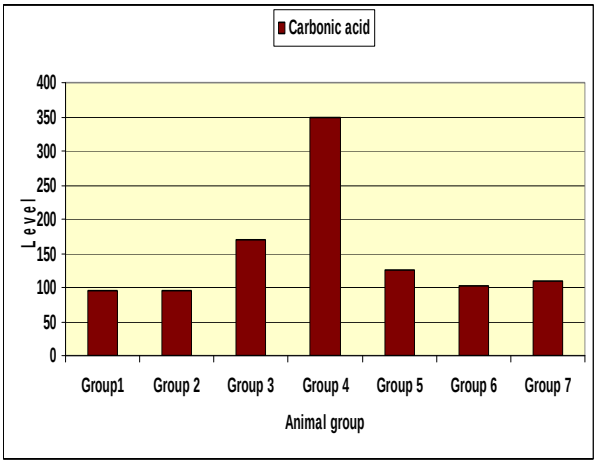


Fig. (26): Biochemical blood serum Carbonic acid

(IV) Results of faecal examination

Photo (26): Trichuris egg

Photo (27) Trychostrongylus egg

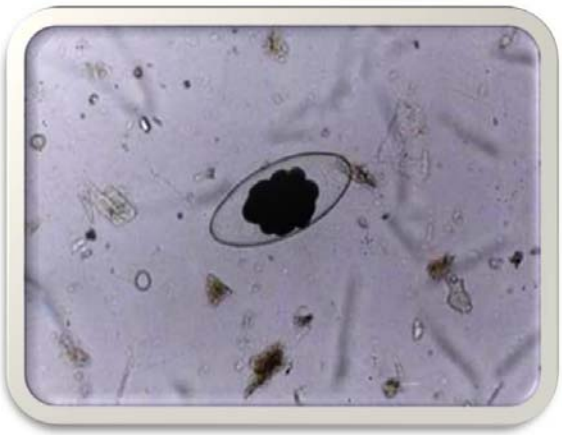
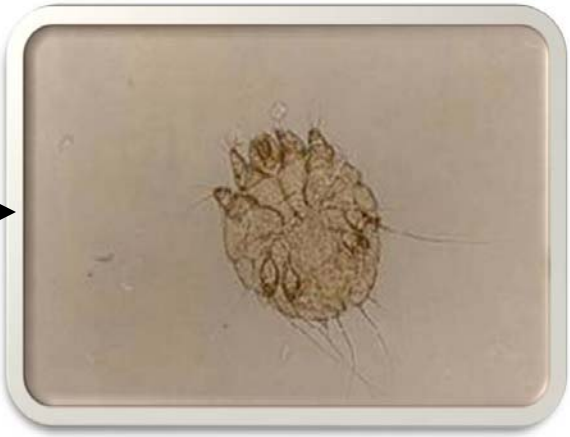


Photo (28): Nematodirus egg

Photo (29): Emiria oocyste

(V) Results of skin examination

Sarcoptic scapiei var cameli ⟶



DISCUSSION

General clinical examination of apparently healthy and diseased dromedary camels

Rectal body temperature

Although camels are considered to be hot blooded animals, the camels are well known to have a great variation in body temperature depending on many factors as seasonal variations, types of food, climatic conditions and the type of work done by the camels Higgins and Kock (1985). In the present investigation the mean value of rectal body temperature of clinically healthy (control) dromedary camels was 37.14 ± 0.10 DC, (Table 1). This result was nearly similar to that obtained by Higgins (1983), Rothore (1986), Baraka (1995), Mohamed (1996), Mohamed (1984) and Baraka, et at. (2000). The value was significantly increased in trypanosomiasis and ruminal acidosis (P<0.00l) but significantly decreased in parasitic diarrhoea (P<0.00l), while insignificant Increase was noticed in the remaining groups (Table 1). Camels suffering from trypanosomiasis revealed increase in rectal body temperature, particularly in early morning, which coincided with the presence of parasites in peripheral blood. Similar observations were reported by Baraka (1995) and Baraka, et at. (2000). Pulse rate: the mean value of pulse rate In clinically healthy dromedary camels was 39.45±1.35/min. This finding was in the range that reported by Higgins (1985), Rothare **(**1986) and Baraka, et al. (2000). On the other hand, Mohamed (1984) and Abd El Samee (1990), recorded higher value, while Mohamed (1996) recorded a relatively lower result. The present study recorded that the mean value of pulse rate was significantly increased in ruminal tympany (P<0.001), this

higher value might be due to change of pH of both rumen and blood that lead to academia. While no significant changes were detected in the remaining groups (Table 1).

Respiratory pattern

The present investigation revealed that the mean value of respiratory rate in clinically healthy dromedary camels was 12.12± *0.57/min.* this value was closed to those recorded by Baraka (1995), Mohamed (1996) and Baraka, et al. (2000). On the other hand, higher value was observed by Mohamed (1984), while Abd El Samee (1990) recorded a relatively lower value. In this investigation the mean value of respiratory rate was significantly increased in ruminal tympany ($P<0.01$), while no significant changes in the remaining groups (Table 1). This elevation in respiratory and also pulse rates in ruminal tympany was attributed to the effect of over production of gases especially carbon dioxide which stimulates the respiratory centre in medulla oblongata lead to increase of respiratory rate. This explanation was supported by those obtained by Baraka (1995), Mohamed (1996) and Baraka, et al. (2000).

Rumen motility

The present result revealed that the mean value of rumen motility in clinically healthy dromedary camels was 3.03 ± 0.15/2 min. nearly similar data was obtained by Esmat and Saleh (1980). On the other hand Baraka, et al. (2000) observed lower value. In the present study the rumen motility was significantly decreased in ruminal acidosis, ruminal tympany and simple indigestion ($P<0.00l$) (Table 1). This result was in agreement with Baraka (1995), Mohamed (1996) and Baraka, et al. (2000). The lowering of ruminal

motility might be attributed to the change in rumen pH that leads to rumen atony.

Mucous membrane of the eye

It was rosy red in colour photo (9). This finding was in agreement with those observed by Baraka (1995). In the present study a congested and pale mucous membrane was observed in ruminal acidosis and trypanosomiasis, respectively. Baraka, et al (2000) described a similar clinical pattern. This variation might be due to destruction of red blood cells.

Ruminal constituents of clinically healthy and diseased dromedary camels

Physical examination of the rumen juice

The colour was found to be varied depending on clinical state of the camel and feed intake. It was light to green in camels fed on barseem and/or light to dark grey in camels fed on wheat straw or millet, while in camels affected by ruminal acidosis the ruminal juice was whitish in colour probably due to over feeding with grain. In the remaining diseased groups, the colour of ruminal juice depended on the composition of the ration (Table 2). The same observation and attribution was also mentioned by Baraka (1995) and Baraka, et al. (2000).

The odour of the rumen juice in apparently healthy dromedary camels was found to be aromatic. In simple indigestion the odour was undistinguished or putrefied, while in Ruminal acidosis it was sour and putrefied due to excessive production of lactic acid. In the remaining groups, the odour was

aromatic (Table 2). Same observation was noticed by Baraka (1995) and Baraka, et al. (2000).

The consistency of the rumen juice in the present study was slimy in most of the samples collected from control group, slimy to watery in those of simple indigestion, while in ruminal acidosis and ruminal tympany the consistency was viscid and foamy, respectively. In trypanosomiasis, diarrhea and mange no changes were observed regarding the character of colour, odour and consistency (Table 2). Nearly same result was reported by Baraka (1995) and Baraka, et al. (2000).

Ruminal pH value of clinically healthy dromedary camels it found to be 6.71 ± 0.08 (Table 3). This finding was in agreement with those obtained by Nassar (1971), Maloiy and Clemens (1980), Baraka (1995), Mohamed (1996), Roussi & Guesmi (1998) and Baraka et al. (2000), while Abd El Gawad (1993) recorded a relative higher value of ruminal pH. The ruminal pH was significantly decreased in ruminal acidosis ($P<0.00l$) with recorded value of 5.66 ± 0.15. (Table 3), insignificantly decreased in ruminal tympany (6.38 ± 0.11). On the other hand, the ruminal pH was non significantly changed in other diseased conditions. These results were coincided with those recorded by Baraka (1995), Mohamed (1996) and Baraka, et al. (2000). Hungate (1966) explained the changes in ruminal pH associated with some digestive disturbance to concomitant atony affecting the rate of fermentation and/or hydrolysis and consequently increase or decrease acid and alkaline end products.

Ruminal protozoal activity

The microscopical examination of ruminal protozoa of clinically healthy dromedary camels revealed highly motile and very crowded (+++) and some

samples showed motile and crowded protozoa (++). In simple indigestion and ruminal tympany the field showed crowded and less motile protozoa as (+) to (++), while in rumen acidosis, the samples showed lower sporadic number with sluggish motility (0) to (+) (Table 3). The number and activity of Ruminal protozoa were not affected by trypanosomiasis, diarrhoea and mange. Similar observations were described by Abd El All, et al. (1990), Baraka (1995), Mohamed (1996) and Baraka, et al. (2000).

Ruminal protozoal count

The mean value was 26.64±1.81 X 104 /ml of rumen juice (Table 3). This result was nearly similar to those reported by Ghosal, et aI. (1981), Imai and Gui Rung (1990), Selim, et aI. (1996b), Roussi & Guesmi (1998) and Baraka & Dehority (2003). While Mohamed (1996) and Selim, et al. (1999) recorded a relatively higher value for clinically healthy camels. The protozoal count was significantly decreased in ruminal acidosis, ruminal tympany and simple indigestion ($P<0.00l$) (Table 3). The lowering number and weakness of protozoal motility in indigestion cases might be due to lowering of rumen pH.

Ruminal protozoa identification

14 protozoal species belonging to 3 genera were identified photo (12 to 25). The species were Buetischlia neglectum, Diplodinium cameli, Diplodinium anisacanthum forma anacanthum, Diplodinium anisacanthum forma mbnacanthum, Diplodinium anisacanthum forma diacanthum, Diplodinium anisacanthum forma triacanthum, Diplodinium anisacanthum forma tetracanthum, Diplodinium anisacanthum forma pentacanthum, Diplodinium anisacanthum forma anisacanthum, Eudeplodinium maggii, Entodinium

simplex, Entodinium nanellum, Entodinium longinucleatum forma longinucleatum and Entodinium rostratum. These protozoal species were previously identified in rumen content of dromedary camels by Nassar (1971), Sakr (1988), Soichi and Rung (1990), Baraka (1995) Mohamed (1996), Selim, et al (1999) and Baraka, et al (2000). Although the pathway of the break down of various food constituents by the rumen micro-organisms is differenced, the main end product is ammonia, Hungate (1966). So estimation of ammonia nitrogen concentration is one of the most important diagnostic parameter in digestive disturbance.

Ruminal ammonia nitrogen concentration:

In the present study of clinically healthy camels the mean value was 36.17 ± 1.53 mg/L (Table 4). Similar findings were reported by Fatid, et al. (1979), Baraka (1995) and Mohamed (1996), while Abd El Gawad (1993) and Roussi & Guesmi (1999) recorded a higher value. The ruminal ammonia nitrogen concentration was significantly increased in trypanosomiasis, mange, simple indigestion ($P<0.001$) and ruminal acidosis ($P<0.0l$) (Table 4). On the other hand the increase of ruminal ammonia nitrogen concentration In trypanosomiasis & mange might be attributed to be concomitant increase of the ruminal pH value with an increase of ionized no absorbable ammonia nitrogen as explained by Kubesy (1987) in sheep, a relatively similar observations were recorded by Baraka (1995) who stated that the ammonia nitrogen concentration was significantly increased in ruminal acidosis & significantly decreased in ruminal tympany.

Ruminal total volatile fatty acids

The mean value was 5.49 ±0.09 mEq/L. This result was in agreement with those obtained by Baraka (1995), Mohamed (1996) and Baraka, et al. (2000). However Abd El Gawad (1993) recorded a higher value. The ruminal total volatile fatty acids were significantly increased (P<0.00l) in ruminal acidosis. Parallel observations were recorded by Baraka (1995), Mohamed (1996) and Baraka, et al. (2000). It is interesting to report that a negative relationship observed between the level of total volatile fatty acids and pH values in both normal and diseased camels. Similar finding was recorded by Baraka (1995). Ruminal total protein level: the mean value In clinically healthy dromedary camels was 8.51 ± 0.17gm/dl. This finding was in agreement with recorded by Baraka (1995) and Baraka et al. (2000), while Abd EI All et al. (1986) recorded a relatively higher value for clinically healthy camels.

Ruminal total protein levels

Were significantly decreased in ruminal tympany (P<0.001), insignificantly increased in ruminal acidosis and diarrhoea (P> 0.001) (Table 5). Consulting the literatures, Abd EI All, et al. (1986) found a significant increase in ruminal total protein in case of indigestion in camels. However the results obtained by Abd EI Hafez, et al. (1978) explained the fluctuating values of ruminal total protein, he found a positive relation between the protein level in the ration and ruminal total protein level. Ruminal albumin level: the mean value was 3.97 ± 0.26 gm/dl. This finding was in agreement with that reported by Baraka (1995) and Baraka, et al. (2000). The Ruminal albumin level was significantly increased in ruminal acidosis (P<0.00l).

Ruminal urea level

The mean value in clinically healthy dromedary camels was 0.98±0.06 mmol/L. Similar finding was reported by Baraka (1995) and Baraka, et al. (2000). The urea level was significantly increased in ruminal acidosis (P<0.0l), while significantly decreased in simple indigestion (P<0.00l). (Table 5). It is well known that the ruminal urea level depends largely on the rate of production and absorption of ruminal nitrogen Bartley, et al (1976), as well as the rate of detoxification of ammonia into urea by the liver Visek (1972) and this may explain the controversial results of ruminal urea level in both normal and diseased conditions.

Ruminal calcium and inorganic phosphorus

The mean values of both elements in clinically healthy camels were 1.81 ± 0.09 and 1.49± 0.10 mmol/L, respectively. Similar values were recorded by Baraka, et al. (2000). The ruminal calcium level was significantly increased in ruminal acidosis and trypanosomiasis (P<0.00l). No significant changes were observed in the other disease conditions (Table 6). The ruminal inorganic phosphorus level was significantly increased in trypanosomiasis (P<0.05), ruminal tympany and mange (P<0.00l), but no significant changes in the remaining diseases. Parallel observations were obtained by Baraka, et al. (2000) who recorded that the ruminal inorganic phosphorus was increased significantly in trypanosomiasis, ruminal tympany and contagious skin necrosis. The higher level of both calcium and inorganic phosphorus in different diseased condition might be due to stagnant GIT that lead to decrease absorption of these elements.

Ruminal Sodium, potassium & Chloride

The mean values in clinically healthy dromedary camels were 113.70 ± 2.08,

25.09 ± 1.04 and 35.80 ± 1.79 mmol/L, respectively. Similar findings were observed by Baraka, et al. (2000), while a little decrease was obtained by Abd EI All, et al. (1986). The ruminal sodium level was significantly decreased in ruminal acidosis and ruminal tympany (P<0.00l) but insignificant Increase in mange and simple indigestion. The ruminal potassium level was significantly increased in trypanosomiasis (P<0.0l). The ruminal chloride level was significantly increased in trypanosomiasis and simple indigestion (P< 0.01), while non significant changes in the remaining diseases (Table 6). The possible explanation of these interrupted values of ruminal electrolytes is that the changes of sodium and potassium level were attributed to the levels of them in the saliva and in the ration Hungate (1966). However further studies still needed to distinguish the relationship between the level of such elements in ruminal content, saliva and ration fed to the animal.

Ruminal lactic acid

The mean value in clinically healthy dromedary camels was 12.79 ± 0.94 mg/dl. A little decrease was obtained by Secrist, et al (1995), while higher value was obtained by Montano, et al (1999). The ruminal lactic acid was significantly increased in ruminal acidosis and simple indigestion (P<0.001). (Table 7). The higher level of lactic acid might be attributed to high grains intake lead to increase of acetic acid in rumen.

Ruminal carbonic acid

The mean value in clinically healthy dromedary camels was 149.19 mmol/L. (Table 7). The ruminal carbonic acid was significantly increased in ruminal tympany (P<0.00I). That observation was might be due to the over

production of gases especially carbon dioxide which present in dissolved form (carbonic acid).

Blood constituents of clinically healthy and diseased dromedary camels

Erythrocytic count, Hb and PCV%

The mean values in clinically healthy camels were 12.80 ± 0.65 X 10 /cumm, 11.87 ± 0.47 gm/dl and 29.87 ± 0.51 respectively. (Table 8 and Fig. 15). Nearly similar results were recorded by Omran, et al. (1984), Mohamed (1996), Hassan and Magda (2000) and a relatively lower results were recorded by Musa and Mukhtar (1982), Laila and Mourad (1984) and Anas (1992). While a relatively higher results were obtained by Baraka (1995) and Baraka, et al. (2000). The erthrocytic count was significantly decreased in trypanosomiasis, ruminal acidosis (P<0.0I), insignificantly decreased in mange and diarrhoea (P>0.0I). (Table 8). The haemoglobin was significantly increased in ruminal acidosis (P<0.00I), while the packed cell volume had non significant changes in all groups (Table 8).

Erythrocytic indices

The mean values of MVC, MCH and MCHC in clinically healthy dromedary camels were 25.98 ± 1.57 fl, 10.37 ± 0.61 Pg and 39.89 ± 1.64 %, respectively (Table 8). These results were in agreement with those previously obtained by Manaa (1990), Mohamed (1996) and Hassan & Magda (2000), however higher results were detected by Anas (1992), Baraka (1995) and Sayed (1998). MCV showed non significant changes in the all diseased condition. MCH was significantly increased in ruminal

acidosis (P<0.05) and trypanosomiasis (P<0.05). MCHC was significantly increased in ruminal acidosis (P<0.0l) (Table 8).

Total and differential leucocytic count

It was an important point to know that there was a great variation in both total and differential leucocytic count among the different available literatures. In the present study the total leucocytic count and differential leucocytic count (neutrophils, eosinophils, basophiles, lymphocytes and monocytes) of clinically healthy dromedary camels were 7.58±0.49 X 3 10 cumm, and (30.90 ± 0.42%, 2.45 ± 0.26%, 1.51 ± 0.17%, 57.45 ± 0.51% and 7.74 ± 0.360/0), (Table 12 and Fig.15), respectively. Nearly similar results were obtained by Mohamed (1996), Sayed (1998), Sayed, et al. (1998) and Hassan and Magda (2000). While lower values were recorded by Baraka (1995) and higher values were recorded by Barakat and Abd El Fattah (1970), Tartour (1971), Bokore (1974), El Magawry (1980), Raisinghani and Lodha (1980), Manna (1990), Anas (1992) and Abd EI-Rahman, et al. (2003). The total leucocytic count was significantly increased in parasitic diarrhoea (P< 0.01), in significant increase in simple indigestion and no significant changes in the remaining diseased groups (Table 9). The neutrophil percentage and eosinophil percentage were significantly increased in ruminal acidosis and diarrhoea (P<0.001), respectively. The basophiles % was not significantly changed in all diseased conditions except insignificantly decreased in parasitic diarrhoea (P>0.05). The lymphocyte percentage was significantly increased in ruminal tympany (P<0.00I) and significantly decreased in ruminal acidosis (P<0.00I). The monocytes percentage was significantly decreased in diarrhoea (P<0.00I) and ruminal tympany (P<001). Similar results were reported by El Magawary (1983),

Omran, et al. (1984), Partani, et al. (1995), Mohamed (1996) and Sayed (1998). Similar results for dromedary camels affected by trypanosomiasis were published by Baraka (1995) and Baraka, et al. (2000). Total and differential leucocytic count in trypanosomiasis showed insignificant change compared with control group. This observation might be due to the parasites has no cellular immunity effect because it is extra cellular parasites.

Blood biochemical constituents

Serum total protein, albumin, globulins and A/G ratio

The mean values of blood serum total protein, albumin, globulins and A/G ratio in clinically healthy dromedary camels were 8.34 ± 0.20 gm/dl, 3.58 ± 0.13 gm/dl, 4.76 ± 0.18 gm/dl and 0.78 ± 0.04, respectively. (Table 9). Nearly similar results were obtained by Buccil, et at. (1979), Wahbi, et al (1979), Higgins (1985), EI Amrousi, et al. (1986), Agag, et al (1993), Baraka (1995), Mohamed (1996), Baraka, et at. (2000) and Nabih and Toos (2002). A relatively lower values were recorded by Barakat and Abd EI Fattah (1970), Botros, et at. (1970), EI Amrousi, et al (1984) and Saleh and Sokkary (2003), while higher results were recorded by Abd EI All, et al (1986), Karram, et at. (1986). The serum total protein was significantly lower in parasitic diarrhoea and ruminal! acidosis ($P< 0.001$). While significantly higher in simple indigestion and trypanosomiasis ($P<0.00l$). The observed elevate levels of serum total protein in the camel group trypanosomiasis could be attributed to the concomitant elevation of gamma globulin as stimulated by the parasite antigens. Same findings previously reported by Mustafa et at. (1991). The serum albumin level was significantly decreased In parasitic diarrhoea ($P< 0.01$), while significantly increased in

simple indigestion (P<0.00l). The serum globulins was significantly decreased in parasitic diarrhoea (P<0.00l) and ruminal acidosis (P<0.0l). A/G ratio was significantly increased in Trypanosomiasis (P<0.00l). (Table9). Nearly similar results concerning parasitic diarrhoea were obtained by EI Magawary (1983) who proved that there was significant decrease in total protein, albumin in parasitic infestation. Also, Manaa (1990), Partani, et at. (1995) and Mohamed (1996) indicated that there were hypoprotenaemia associated with hypoalbuminaemia in the parasitic infested camels. Such decrease in the serum protein, albumin in cases of diarrhoea might be due to direct loss of protein into the gut through the lesions produced by gastrointestinal parasites. The serum total protein is controlled by the activity of the liver in synthesis of plasma proteins, the nephropathological changes, the crude protein level in the ration, the protein losing enteropathy as well as the efficiency of the rumen microorganisms in fixation of ruminal ammonia nitrogen Hungate (1966).

Serum urea nitrogen level

The mean value in clinically healthy camels was 32.43 ± 2.21 mg /dl (Table 10). Similar findings were recorded by Salah EI Din, et al. (1979) & Azawi, et al. (1990); however lower values were obtained by Emanuel (1979), Abd EI Samee (1987), Baraka (1995) and Baraka, et al. (2000). Higher values were obtained by Agag, et al (1993). The serum urea level was significantly increased in trypanosomiasis (P<0.00I) and simple indigestion (P<0.0l. (Table 10). Similar findings concerning trypnosomiasis was recorded by Abd EI samee (1987), Agag, et al (1993), Baraka (1995) and Baraka, et al. (2000). It is well known that the serum urea nitrogen level depends largely on the capacity of the liver for detoxification of ammonia Visek (1972).

Serum calcium and inorganic phosphorus levels

The mean values of these elements in clinically healthy dromedary camels were 10.35 ± 0.21 and 5.07 ± 0.28 mg/dl, respectively. These findings were parallel to those results obtained by Soliman and Shaker (1967), Custer et at. (1977), Wahbi, et al. (1979), EI Magawary (1983), AI-Ani, et at. (1992) and Mohamed (1996). Higher values were reported by Musa and Mukhtar (1982) and Baraka (1995) in phosphorus only. The serum calcium level was significantly decreased in camels suffering from mange ($P<0.001$) and parasitic diarrhoea ($P<0.0l$) (Table 11). The serum inorganic phosphorus level was significantly increased in cases of ruminal tympany ($P < 0.01$) while no significant changes were observed in the remaining groups, EI Magawary (1983), Manaa (1990) and Mohamed

(1996) reported similar decrease of serum calcium and inorganic phosphorus in both dietetic and parasitic camel's diarrhoea. Also Hassan and Magda (2000) recorded similar decrease of serum calcium and inorganic phosphorus in chronic debilitating intestinal parasitic infested camels. Baraka (1995) noticed similar decrease of serum calcium and inorganic phosphorus in cases of ruminal acidosis and frothy tympany and he recorded an increase of the same parameters in simple indigestion. Hafez (1994a) found similar decrease of serum calcium and inorganic phosphorus in camels suffering from mange. The present decrease of serum calcium level in the previously mentioned diseased conditions could be attributed to the possible concomitant decrease of both intake and/or absorption of calcium which caused either by anorexia or gastrointestinal atony usually associated with primary indigestion or reflexly induced by other disease conditions Parasad (1977) and Blood & Radostitis (2000). It was previously explained that the serum .inorganic phosphorus was regulated by multiple factors

including the phosphorus intake and absorption, the dietary level of calcium, magnesium and Vito D as mentioned by Parasad (1977), MCD Well, et al. (1983). This might explain the fluctuating levels of serum inorganic phosphorus in the encountered diseased conditions.

Serum electrolyte levels (Sodium, Potassium and Chloride)

The mean value of serum sodium level in clinically healthy dromedary camels was 146.93±1.89 mEq/L. This finding was in agreement with those recorded by EI Amrousi, et al. (1984), Mohamed (1996) and Hassan and Magda (2000), but higher level was reported by Maloiy and Clemens (1980), Musa and Mukhtar (1982), Baraka (1995)· and Baraka, et al. (2000), while lower level was obtained by El Magawary (1980 & 1983), Abd El All, et al (1986) and Abd El Samee (1990). In the present study the serum sodium level was significantly decreased in cases of ruminal tympany, diarrhoea, mange (P<0.00I) and simple indigestion (P<0.0l). The mean value of serum potassium level of (Table11) dromedary healthy camels was 4.74 ± 0.15 mEq/l. This finding was agreeable with those obtained by Barakat and Abd El Fatah (1970), Zein EI Abdin, et ale (1975), El Amrousi, et al (1984). A relatively higher value of potassium levels were recorded by Maloiy and Clemens (1980), Hafez (1994a), Baraka (1995), Mohamed (1996), while lower levels were obtained by Musa and Mukhtar (1982) and Abd El Samee (1990). The serum potassium level was found to be significantly decreased in cases of ruminal tympany, parasitic diarrhoea, trypanosomiasis (P<0.00I) and ruminal acidosis (Table 11 and Fig. 24). The mean value of serum chloride of clinically healthy dromedary camels was 124.09 ± 2.86 mEq/L. Similar results were recorded by Fawzia, et al. (1979) & El Magawary (1980); however higher values were obtained by Abd El Samee (1990),

Harez (1994a), Mohamed (1996) and Hassan and Magda (2000). The serum chloride level was significantly decreased in cases of parasitic diarrhoea, Trypanosomiasis (P<0.00I) and mange (P<0.0I) while significantly increased in cases of ruminal acidosis (P<0.00I). Similar results were recorded by Baraka (1995) and Baraka et al. (2000). It is interesting to mention that the level of serum sodium, potassium and chloride in the present encountered diseased conditions were went parallel with the ruminal level of these electrolytes in such diseases. The only exceptions were the level of sodium in trypanosomiasis and the level of potassium in ruminal acidosis, ruminal tympany and trypanosomiasis (Table 11). The ruminal electrolytes level represented the dietary level of such elements as determined by Hungate (1966) affecting the serum electrolyte levels and this could explain the present direct relationship. It was well established that the serum electrolyte levels were influenced by the level of electrolytes in salivary secretion, the rate of chloride and potassium secretion and/or sequestration in the abomasums, the excretion and reabsorption by the kidney as affected by the state of acid base imbalance Blood and Radostitis (2000).

Serum lactic acid

The mean value in clinically healthy camels was 5.58 mg/dl. (Table 12). A relatively higher value was recorded by Omole, et al (2001). The serum lactic acid was significantly increased in ruminal acidosis (P<0.00l), while no significant changes were observed in the remaining groups. This higher level might be due to academia that might associated with acute impaction due to withdrawal of alkaline radical from blood as a compensatory mechanism to ruminal acidosis.

Serum carbonic acid

The mean value in clinically healthy camels was 94.72 mmol/L. The blood serum carbonic acid was significantly increased in camels suffering from ruminal tympany (P<0.00l) and ruminal acidosis (P<0.0l), (Table 12). This higher level might be due to retention of C02 during this diseased condition that associated with disturbance in respiratory pattern and acid- base imbalance

SUMMARY AND CONCLUSION

The present study was carried out to investigate the clinical and laboratory findings of clinically healthy dromedary camels as well as in some disease conditions. 119 adult dromedary camels of 4-10 years old and 300-S00Kg. body weight were used in this investigation. The animals were divided into 7 groups, the 1 group was apparently healthy (31 animals) served as control group and other 88 diseased animals. The recorded diseased group include simple indigestion, acute ruminal impaction, ruminal tympany, parasitic diarrhoea, trypanosomiasis and mange. General clinical examination include temperature, pulse, respiratory rates, rumen motility and conjunctival mucous

The results were summarized as follow:-

1) Camels suffered from simple indigestion

General clinical examination revealed that the rumen motility was significantly decreased. Ruminal juice analysis showed that the odour of the ruminal fluid was undistinguished or putrefied. The ruminal protozoal activity and count were significantly decreased, respectively. Ruminal

ammonia nitrogen level and ruminal lactic acid were significantly increased, while ruminal urea level was significantly decreased. Blood analysis revealed significant increase in blood serum total protein, blood serum albumin and blood serum urea.

2) Camels suffered from acute ruminal impaction

General clinical examination showed that the temperature was significantly increased, while the rumen motility was significantly decreased. Ruminal juice analysis revealed that the color, odor and consistency of the ruminal juice were whitish, sour to putrefied and viscid, respectively. The ruminal pH, protozoal activity and protozoal count were significantly decreased. The ruminal ammonia nitrogen concentration, ruminal total volatile fatty acids, ruminal albumin level, ruminal urea level, ruminal calcium level, ruminal potassium level and ruminal lactic acid were significantly increased, while ruminal sodium level was significantly decreased. Blood analysis revealed that the total erthrocytic count, the lymphocyte percentage, blood serum total protein, blood serum globulins and blood serum potassium level were decreased, while hemoglobin content, MCH, MCHC, blood serum chloride level, blood serum lactic acid and blood serum carbonic acid were increased.

3) Camels suffered from ruminal tympany

General clinical examination showed that respiratory rate and pulse rates were decreased. Ruminal juice examination revealed that the consistency of ruminal fluid was foamy. The ruminal

protozoal activity and count were decreased. The ruminal total protein and ruminal sodium levels were decreased, while the inorganic phosphorus, potassium and carbonic acid levels were increased. Blood examination revealed that the lymphocyte percentage, inorganic phosphorus and blood serum carbonic acid were increased, while the monocytes percentage, blood serum sodium and blood serum potassium were decreased.

4) Camels suffered from parasitic diarrhea

Fecal examination revealed that four types of gastrointestinal parasites were found in the feces of diarrheic camels. These parasites were Trichuris, Trychostrongylus, nematodirus and Emiria oocyste. General clinical examination showed that the temperature was significantly decreased. Blood examination revealed that total leucocytic count and eosinophils percentage were' increased, while lymphocyte percentage, serum total protein, serum globulins, serum calcium and serum sodium were decreased.

5) Camels suffered from trypanosomiasis

Blood film .revealed trypanosoma evanci in between red blood cells of infected camels. Also cytological examination revealed significant reduction in total erthrocytic count and serum chloride, while significant increased in serum total protein, *AI* G ratio and serum urea nitrogen. General clinical examination showed that the temperature was significantly increased, while conjunctival mucous membrane was anemic. Ruminal analysis

revealed marked' increase in ammonia nitrogen concentration, ruminal calcium, potassium and chloride.

6) Camels suffered from mange

Skin examination showed that Sarcoptic scapiei var cameli was present in the skin of infected camels. Ruminal juice examination revealed that ruminal ammonia nitrogen concentration and ruminal calcium were increased. Blood examination showed that blood serum chloride was significantly decreased.

From the previous results, it could be concluded that there was marked changes in both ruminal and blood constituents in camels suffered from various diseases which affect on the productivity of these animals. Therefore we recommended the following:-

1- Estimation of lactic and carbonic acid has a great value for accurate differential diagnosis of various form of indigestion.

2- The main cause of parasitic diarrhea arnong camels in the present study were Trichuris egg, Trychostrongylus egg, nematodirus egg and Emiria oocyste.

3- The only blood parasite that detected in examined blood film was trypanosome evanci.

4- The skin lesions of examined camels were due to Sarcoptic scapiei var carneli.

5- Further studies were required on both healthy and diseased camels to give more information about this animal which considered an important source of fur and meat besides their racing, military and police services.

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Camels as productive animals are considered one of the primary fundamental constituents of animal population. Healthiness of this part of animal populations required healthy respiratory, urinary, skin, reproductive and musculoskeletal systems with especial attention to digestive system because camel to be productive animal needs healthy alimentary tract. The prevention of the diseases rather than treatment becomes the main aim in the veterinary medicine. Therefore, general clinical examination (temperature, pulse, respiration, mucous membranes and lymphnodes), ruminal and blood constituents were found to be the most important diagnostic and prognostic measures for health and disease conditions.

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