قسم : طب الحيوان وأمراض الدواجن .
كلية : الطب البيطرى ـ جامعة أسيوط .
رئيس القسم : أ .د . / ابراهيم سكر .

دراسات عن تفشي مرض الميكروب القولوني بين العجول حديثة الولادة ـ الفريزيان في الوادى الجديد ـ مصر

١ـ بعض التغيرات الكيميائية والمحاليل المعادله في مصل الدم

نور الدين حسان ، على السباعي ، أحمد عامر

اشتمل هذا البحث على عدد ٢ مجموعة من العجول حديثة الولادة .

المجموعة الأولى : وهي عبارة عن أربعة عجول ـ لوحظت عليها علامات حادة للجفاف .

المجموعة الثانية : كانت تسعة عجول عليها علامات مرضيه متوسطة .

أحتفظ في هذا البحث بعدد سبعة عجول سليمه صحيا ـ كمجموعة مقارنة . وكل هذه المجموعات تتبع محطات التربية بالوادى الجديد .

لوحظ أن زلال السيرم انخفض بدرجة ملحوظة في المجموعة التي تعاني من حدة الجفاف في حين المجموعة الأقل درجة في الجفاف كان نقص البروتين معتدلا . كما أن سكر الدم انخفض في المجموعتين . لقد كان الكريتتين وبولوينا الدم مرتفعة في المجموعة ذى الجفاف متوسط الدرجة في حين كان عالى جدا في الحالات الحادة المصحوبة بدرجة عاليه من الجفاف .

كذلك لوحظ ارتفاع في نسبة المحاليل المتعادلة في الحالات الحادة في حين أنه انخفضت نسبة المحاليل المتعادلة في الحالات الاقل شدة .

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STUDIES ON AN OUTBREAK OF COLIBACILLOSIS AMONG NEWLY HOLSTEIN FRIESIAN CALVES IN THE NEW VALLEY, EGYPT II. SOME SERUM BIOCHEMICAL AND ELECTROLYTE CHANGES

(With 3 Tables & 2 Figs.)

By
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SUMMARY

This investigation consisted of two groups of calves showing diarrhoeal syndrome, severely dehydrated (Four animals), moderately dehydrated (Nine animals). Seven apparently healthy animals served as control. This investigation was carried out on an colibacillosis outbreak in the new born calves from birth up to twelve weeks of age in a Governmental farm at the New Valley governorate.

Slight hypoproteinemia was observed in the moderately dehydrated calves, while hyperproteinaemia were detected in the severely dehydrated calves. Hypoglycaemia were evident in both classes of calves. It is suggested that this may have been a contributory in their mortality.

A slight increase in serum creatinine and urea nitrogen in the moderately dehydrated calves and an accompanied severe rise was detected in the severely dehydrated conditions.

Slight hypoelectrolytaemia and hyperelectrolytaemia were observed in the moderately and severely dehydrated calves respectively. It is were found upon serotyping.

INTRODUCTION

Diarrhoea in young calves has been recognised as a serious condition leading to severe losses for more than 2000 years (WATT, 1965). Of noteworthy to mehtion that the incidence of diarrhoea appears to be increasing (OTTSEN, 1959), possibly the increase due to the increasing concentration of livestock.

With the discovery of bacteria and in particularly the activity of coliform organisms in calves affected with diarrhoea, successive generations of veterinarians and associated workers have gathered an impressive indicatment against bacteria in general and coliform in particular (WATT, 1965). RADSTITS (1965) stated that bacteria belonging family Enterobacteriaceae of which E.coli is the most important factor in the pathogenesis of diarrhoea in claves under 10 days of age.

Clinical symptoms that were prominent among calves with acute colibacillosis were studied by a lot of workers (SMITH, 1962); PENHALE, 1965; WATT, 1965 and MOTTELIB, 1972.

Of special interest to report here that variable levels in the haematological picture were detected in buffalo calves affected with diarrhoea due to many different causative agents in the studies of MOTTELIB (1972) and COLE (1975).

Haematocrit values in healthy calves, diarrhoeic calves surviving and diarrhoeic dying calves were studied by FISHER and MARTINEZ (1975) proved to be a reliable guide in the prognosis of calf diarrhoea.

Many disease conditions of which digestive disturbances are of great importance, induce severe changes in plasma proteins which may reflect the status of the animal body (CORNELIUS and KANEKO 1963). TENNANT et al. (1968) found an increase in the total serum proteins in calves with enteritis caused by E.coli.

WATT (1967) reported that plasma sodium and potassium levels varied considerably from no change in calves with milk cases of diarrhoea to marked changes in calves with terminal cases. In some individuals, plasma sodium and potassium increased and in others they fell, but in the majority of calves the sodium values fell and the potassium values rose. The marked hyponatraemia stated by TENNANT et al. (1972) was observed in older ages, while the lowest serum values being in six and severe days old. Variations in plasma chloride level as stated by WATT (1967) tended to mirror those of sodium insofar as an individual having an increased sodium level also had an increased chloride level, but alterations were rarely proportional. The behaviour of chlorides in serum and plasma of diarrhoeaic calves tend to decrease as stated by DALTON (1965) and MOTTELIB (1972). Of particular interest to report here that serum concentrations were related directly to sodium levels (TENNANT, et al. 1972).

In a previous study (AMER, HASSAAN, EL-SEBAIE, BAYOUMI and IBRAHIM, 1983) an outbreak of colibacillosis among Holstein Friesian home-bred calves was diagnosed. Clinical, haemotological, aetiological and pathological alterations following such cases were fully described.

Studies reported here were designed to throw some light on the blood chemistry alterations accompanying neonatal calf diarrhoea. Special atention was focused on electrolyte dislurbances that occur in the clinical cases of an outbreak with the hope that such informations would contribute to improved therapy.

MATERIAL and METHODS

ANIMALS:

Full details on the unhealthy diarrhoeic claves as well as apparently healthy ones were previously stated by AMER et al. (1983).

BLOOD SAMPLES:

Blood samples were obtained using jugular vein section. Serum was separated and immediately frozen till arrival to the laboratory were chemical analysis were performed.

Total serum proteins, glucose, creatinine and urea nitrogen were estimated using test kits supplied by Boehringer Mannheim (W. Germany).

Total serum sodium (Na) and potassium (K) were analysed on a EEL Flame photometer.

Chloride concentration (Cl) was measured using a chloride-meter (Corning model 925).

RESULTS

Our obtained results for the biochemical examination of the blood of apparently bealthy and the two groups of sick calves (severely) and moderately dehydrated), are shown in tables (1), (2), (3) and Fig. (1) and (2).

Varying degrees were observed for the total serum proteins in calves suffering diarrhoeal outbreak particularly the moderately dehydrated ones, while a slight increase in the total serum proteins were detected in the severely dehydrated calves (Tables 1,2,3 and Fig. 1) that marked hypoglycaemia in both classes of calves showing the coli infection (4.68±0.38 - 2.58±0.29 m mol/L. & (4.68±0.38 - 2.97±0.41 m mol/L.) for the severely and moderately dehydrated conditions respectively were observed.

Slight increase in the concentration of blood urea nitrogen were found in the moderately dehydrated calves (24.64±2.25 - 34.25±3.68 m mol/L.) while a high levels of BUN were detected in the severaly dehydrated conditions (24.64±2.25 - 54.95±12.40 m mol/L.), Tables (1), (2) & (3) and Fig. (1).

Our results in tables (1), (2) & (3) and Fig. (1) showed a marked rise for the serum creatinine values in both classes of calves in particularly the severely dehydrated ones as it reached up to (207.51±20.19 u mol/L.) from the accepted physiological limits (77.75±11.18 u. mol/L.).

Increased levels of both serum Na and Cl were recorded in the severely dehydrated calves (137.28±1.6 - 146.75±1.5 u mol/L.), (100.85±2.54 - 129.5±5.8 m mol/L.) respectively (Tables 1, 2 & 3) and Fig. (2), also hyperkalaemia was observed 14.35±0.89 - 6.1±0.3 m mol/L.). Hypo to normal serum Na values with correlated levels in serum Cl were detected for the moderately dehydrated calves (Tables 1 & 3 and Fig. 2). No detectable changes in serum K were observed in the moderately dehydrated calves.

DISCUSSION

The variable pictures in the affected calves with enteritis due to colibacillosis are interesting and depends entirely on the effect of these pathogenes on the internal organs in particular liver, kidney and heart. A slight hypoproteinaemia was observed in some moderately dehydrated calves (Animals No. 2, 5 & 9) tables 1, 2, 3 and Fig. (1). These values are in close agreement with those reported by MOTTELIB (1972) who attributed the hypoproteinaemia in enteric buffalo calves mainly to the destructive effect of bacteria/or bacterial toxins on the liver cells proding impaired synthesis of serum albumin. In a previous study by AMER et al. (1983) a characteristic typical form of hepatitis was observed. Moreover, they recorded severe intestinal ulcerations and haemorrhages in the affected calves, that will contribute to the loss of serum proteins via the damaged intestinal tract. Nevertheless, the detected increase in total serum porteins in the severely dehydrated calves (Tables 1, 2 & 3 and Fig. 1) might be due mainly to the excessive loss of body fluids and concentration of blood constituents. AMER et al. (1983) confirmed these results reporting high levels of haematocrit (40.00±1.63%) and typical clinical signs of severe dehydration.

Hypoglycaemia was evident in both classes of calves showing the moderate and severe dehydrated conditions (Tables 1, 2 & 3 and Fig. 1). Our results are in close agreement with those reported by MOTTELIB (1972) who reported hypoglycaemia in Escherichia coli enteritis in buffalo calves attributed such a decrease to the alterations in tissue metabolism caused by decreased blood flow and oxygenation associated with shock. Another explanation given by MADISON (1964) that ketone bodies were elevated in cases of gastroenteritis. They were of the opinion that blood ketones in such, cases would depress blood glucose. It is of interest to indicate that because of the daily fluctuating values measured in healthy calves, these figures are not helpful in providing a prognostic guide in individual cases, but they do suggest that an energy deficiency may be an important predisposing factor in mortality from diarrhoea. AMER et al. (1983) in a previous study observed severe

moribund condition, incoordination and recumbency that indicate a state of energy deficiency. Also they reported marked changes in the liver of the necropsied calves, that might play a role in such cases.

The data for blood serum creatinine and urea nitrogen given in tables (1, 2 & 3 and Fig. 1) showed slight and severe rise in these levels in both severely and moderately dehydrated conditions. Of particular interest to state here that our results are in consistent with those reported by a lot of workers (TENNANT and OTHERS, 1972 and BARBER et al. 1975), that indicated renal insufficiency in diarrhoeic calves. The calves that showed acute collapse did show increased urea levels prior to death (54.95±12.9 m mol/L.) indicating on assosiation between uraemia and death from diarrhoea. These findings indicate that were calves are suffering from colibacillosis, measurements of blood serum creatinine and urea nitrogen is a guide to prognosis with a dividing line between those likely to recover and those likely to die at about 55 m mol/L. onwards. The macro and microscopic alterations of the died calves kindeys in a previous study by AMER et al. (1983) would confirm our results.

The results given in this investigation (Tables 1, 2 & 3 and Fig. 1) showed varying degrees for the total serum Na, K and Cl in both classes of calves, from no change and hypoelectrolytaemia in the moderately dehydrated cases to the hyperelectrolytaemia in the severely dehydrated ones. The slight hyponatraemia and hypochloraemia in our resuls are in agreement with those of DALTON (1965) and FISHER (1965) who reported a fall in Na and Cl levels with prolonged diarrhoea. Also in consistent with those of MOTTELIB (1972) in buffalo calves who explained this phenomena in the view of BLAXTER and WOOD (1953) that there might be loss of these anions and cations in the faeces. The hypernatraemia and slight hyperchloraemia observed in this study (Table and Fig. 2) are in close agreement with those of McSHERRY and GRINYER (1954) in their studies on the distrubances in acid-base balance and electrolyte in calf diarrhoea. It might be due to the disproportionate loss of nonionic water in the severely dehydrated conditions. Another explanation given ELKINTON, WINKLER and DANOWSKI (1947) that more water loss than Na lost from the circulation in these calves, this combined with the fact that the calf would excrete k rather than Na for urine formation during a period of fluid depletion (MUDGE, FOULXS and GILMAN, 1950), that would result in an apparent hypernatreamia when in fact the total body store of Na must have been depleted. The hyerkalemia was a characteristic finding (Tables 1, 2 & 3 and Fig. 2) in the severely dehydrated conditions. The high indidence of hyperkalaemia was similar to that observed by ROY, SHILLAM, HAWKINS, LANG and INGRAM (1959), MOTTELIB (1972), TENNANT, et al. (1972) and BARBER et al. (1975). Several factors must have been important in the development of hyperkalaemia. It has been suggested that increased tubular resorption of k may occur in response to acidosis (FISHER, 1965). If renal functions were normal, this might play a role, but increased BUN values suggest significant compromise in renal function. Another more likely reason for hyperkalaemia related to renal function that has been suggested also by FISHER (1965) is decreased tubular excretion of k, the result of reduced renal blood flow. Movement of k from intracellular to exaracellular fluid also must have contributed to increased serum k concentration. Dehydration of tissues may also cause loss of k from the intracellular fluid. There is an evidence by BLAXTER and WOOD (1958) that energy requirements during the course of acute enteric infections must be supplied by breakdown of tissues. The k released during tissue catabolism would be an additional factor contributing to increased serum k concentration. It appears that hyperkalaemia might be a cause of death in calves suffering severe dehydration. This question has been investigated extensive by FISHER (1965) and FISHER and MC EWAN (1967) where bradycardia and cardiac arrhythmias have noted, in some but not all hyperkalaemic calves. The intracellular k concentration of the myocardium in dehydrated calves was significantly less than normal (FISHER and MC EWAN 1967). The low

intracellular k concentration combined with elevated extracellular k is believed to interfere with depolarization and result in bradycardia and heart block. AMER et al. (1983) in previous studies on the severely affected calves recorded a clinical symptoms, necropsy and pathological findings that confirm our interpretations.

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Table 1- Blood Chemical Analysis of Apparently Healthy New born Calves .

Animals Nr.	Total protein g/L.	Glucose mmol/L	Blood urea mmol/L	Creatinine µmol/L	Sodium mmol/L	Potassium mmol/L	Chloride mmol/L
1	55.80	5.21	27.0	91.93	139	5.5	101
2	54.92	4.64	25.5	72.48	133	5.3	103
3	55.83	4.51	25.5	77.79	135	5.3	103
4	46.16	4.51	25.5	77.79	138	4.2	100
5	55.78	4.65	25.7	56.57	130	3.8	98
6	46.22	4.59	20.0	78.67	136	5.0	98
7	56.20	4.07	25.0	66.30	138	2.8	101
$\bar{X}$	52.99	4.68	24.64	77.75	137.28	4.35	100.85
S.D.	± 4.56	±0.38	± 2.25	±11.18	± 1.60	±0.89	±2.54

Table 2 – Blood Chemical Analysis of Neonatal Calves With Acute Enteric Infections (Severely Dehydrated Conditions)

Animals Nr.	Total protein g/L	Glucose mmol/L	Blood urea mmol/L	Creatinine µmol/L	Sodium mmol/L	Potassium mmol/L	Chloride mmol/L
1	78.90	2.07	68.2	198.9	148	6.60	133
2	78.90	2.32	42.4	247.52	148	5.80	128
3	70.20	2.49	46.6	167.06	145	5.80	122
4	50.75	2.39	62.6	215.[illegible]	146	6.20	135
$\bar{X}$	69.68	2.[illegible]	54.95	207.51	146.75	6.1	129.5
S.D.	±13.29	±0.29	±12.40	±20.1[illegible]	±1.5	±0.38	±5.80

Table 3 – Blood Chemical Composition of Neonatal Calves With Acute Enteric Infections (Moderately Dehydrated Conditions)

Animals Nr.	Total proteins g/L	Glucose mmol/L	Blood urea mmol/L	Creatinine µmol/l	Sodium mmol/l	Potassium mmol/L	Chloride mmol/L
1	58.80	2.56	40.6	138.78	138	4.90	103
2	45.60	2.43	38.6	114.30	138	3.80	95
3	54.40	3.03	35.5	78.6	134	4.20	90
4	60.80	2.55	32.3	88.4	132	4.50	93
5	48.60	3.04	32.6	110.5	136	4.90	87
6	60.40	3.00	28.6	114.03	136	3.80	98
7	58.80	3.56	32.3	88.40	136	3.90	101
8	58.75	3.58	35.5	90.16	138	5.20	89
9	50.75	3.04	32.3	132.6	132	3.90	100
$\bar{X}$	54.94	2.97	34.25	106.17	135.55	4.34	95.11
S.D.	±6.00	±0.41	±3.68.	±21.06	±2.40	±0.54	± 5.73

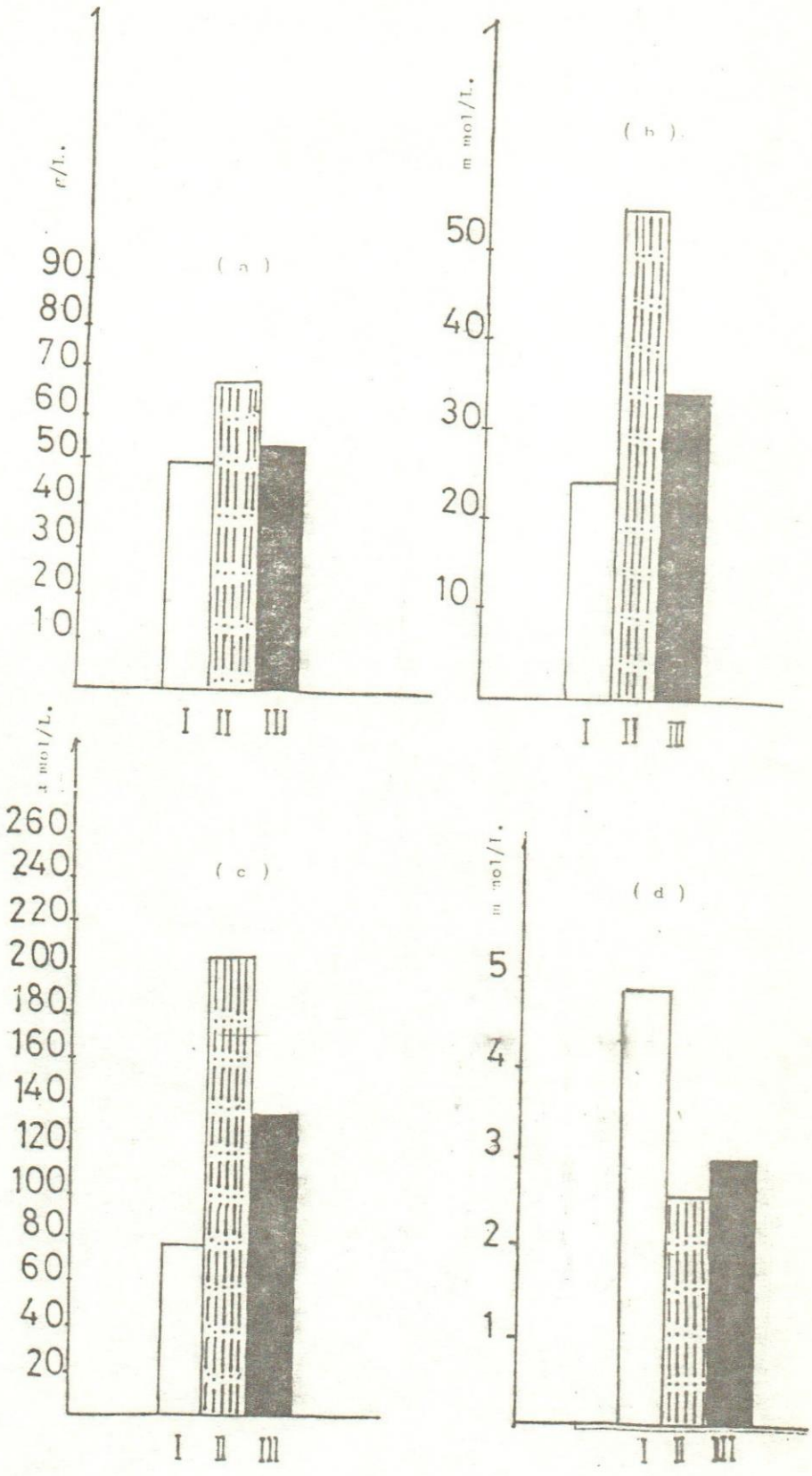
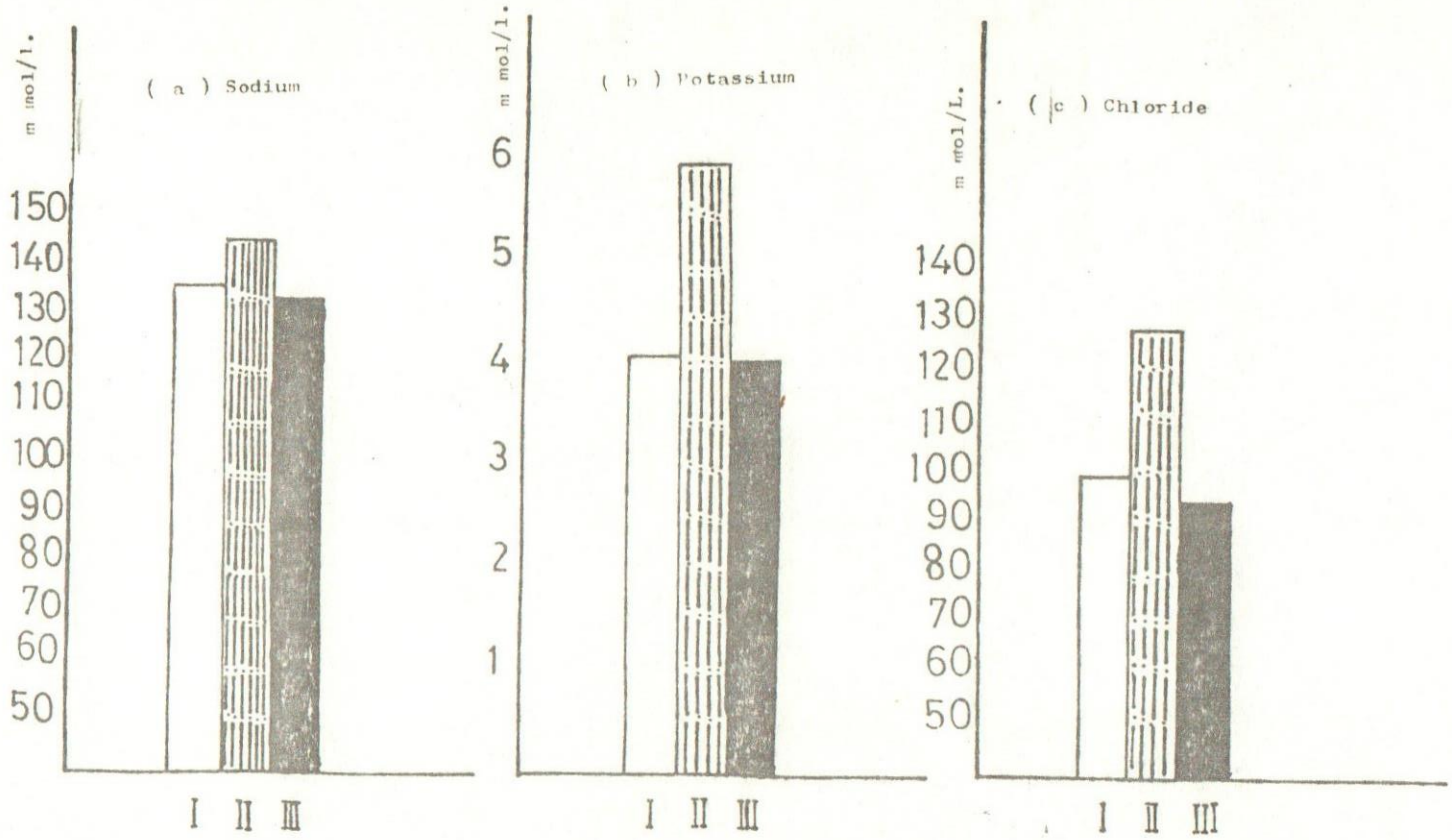


Fig. 1 - Concentrations of Total Blood Serum Proteins (a) in g/L. , Blood Urea Nitrogen (b) in m mol/L! , Serum Creatinine (c) in μ mol/L. , and Blood Serum Glucose (d) in m mol/L. White bars I , mean concentration in apparently healthy calves . Hatched bars II , mean concentration in severely dehydrated conditions . Black bars III, mean concentration in moderately dehydrated conditions .



2- Concentrations of Total Blood Serum Sodium (a) in m mol/l. , Total Serum Potassium (b) in m mol/l. and Total Serum Chloride (c) in m mol/l. White bars I, mean concentration in apparently healthy calves. Hatched bars II, mean concentration in severely dehydrated conditions . Black bars III, mean concentration in moderately dehydrated conditions .