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ACUTE ENTERITIS IN NOENATE FRIESIAN CALVES IN SOHAG GOVERNORATE WITH SPECIAL REFERENCE TO ETIOLOGY, CLINICOBIOCHEMICAL ASPECTS AND THERAPY.

(With 4 Tables)

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الالتهابات المعوية الحادة في العجول الفريزيان حديثة الولادة بمحافظة سوهاج مع إشارة خاصة للأسباب والتغيرات الإكلينيكية والبيوكيمائية والعلاج

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في قطيع من الأبقار الفريزيان الحلابة ، ظهرت حالات إسهال حادة و نفوق في بعض العجول الرضيعة خلال الفترة من يناير -إبريل ١٩٩٨. شملت الدراسة عدد ٣٨ عجل حديث الولادة تراوحت أعمارهم من ٥-٢٥ يوم منها ٣٠ حالة مصابة بالإسهال الحاد و ٨ حالات سليمة أخذت للمقارنة. استهدفت الدراسة معرفة الأسباب البكتيرية و الطفيلية للإسهال وكذلك التعرف على التغيرات الإكلينيكية والدموية المصاحبة لها ثم العلاج. أظهر الفحص الإكلينيكي درجات متفاوتة من الإسهالات المائية الصفراء المائلة للاخضرار في معظم الحالات، مخاطي مدمم فى قليل منها ، مع الهزال ، والجفاف متوسط و شديد الحدة، وقد نفق عدد ٣ عجول قبل العلاج و اثنان بعد العلاج . أخذت مسحات من المستقيم و عينات من البراز للفحص البكتيري و الطفيلى و كذلك تم فحص الخلوي و الكيميائي للدم . وطبقا للصورة الإكلينيكية و المعملية تم تشخيص الحالات على أنها إصابة حادة مزدوجة من البكتريا و الأوليات المعوية . وكانت نتائج الفحص كالآتي: إصابة بكتيرية (٤٠ %) مثل بكتريا القولون العصوي (ايشريشيا كولاى) إما بمفردها أو يصاحبها ميكروبات أخرى منها أجناس البروتيس الكلبسيلا، السيدومونس، الكامبيلوباكتر والسالمونيلا؛ إصابة مزدوجة بكتيرية وطفيلية (الكربتوسبوريديا والآيميريا) في ٣٣.٥ % من الحالات ؛ إصابة طفيلية فقط (الكربتوسبوريديا و الآيميريا) في من الحالات و لم يتم التعرف على أي ميكروبات في ١٦,٥ ينات التي تم فحصها في ١٠ % من الحالات. تم عمل مزارع و اختبارات الحساسية للميكروبات المسببة للمرض. أظهر الفحص الدموي رضوخ في المؤشرات المعملية للجفاف مثل زيادة تركيز الدم متمثلا في زيادة حجم كرات الدم المصمت ، نقص الشوارد مثل الصوديوم وزيادة معنوية في مؤشرات وظائف الكلى مثل البولييا و الكرياتينين و التى عكست نقص معدلات الترشيح الكلوي للدم. تم علاج العجول المصابة مبدئيا باستخدام

ملطفات و مبطنات الأمعاء - وبعد عمل اختبار الحساسية البكتيرية تم الحقن العضلي لعقار الانروفلوكساسين بواقع ٥ مجم / كجم من وزن الحيوان لمدة ٤-٥ أيام ، مع الاستمرار في إعطاء العجول لكميات اللبن العادية و استخدام محاليل الارواء عن طريق الفم والتي تحتوى على الشوارد و الجليكوز بين الوجبات و قد استجابت العجول للعلاج بشكل جيد و سريع بينما كان هناك عدد ٥ عجول في حالة رقود وفقد تمام للرغبة في الرضاعة و جفاف شديد و قد عولجت هذه العجول بنظام التنقيط الوريدي بمحاليل الارواء و التي تحتوى على بيكربونات الصوديوم و كلوريد الصوديوم و الجليكوز. مما تقدم يمكن القول أن الإصابة المزدوجة بالبكتريا المعوية و الأوليات يمكنها أن تسبب التهابات معوية حادة و نفوقا في العجول الرضيعة و أنه بالتدخل المبكر بالمحاليل التعويضية و المضادات البكتيرية المناسبة واستمرار التغذية على الألبان يمكن السيطرة عليها .

SUMMARY

An acute attack of enteritis and deaths among the neonate calves had occurred in a herd of 250 dairy cows, during the period of January - April, 1998. A total of 38 neonate calves aged 5-25 days were involved in this investigation (30 with diarrhea and 8 was clinically healthy). The study aimed to achieve an etiological diagnosis, clinicobiochemical changes and trials for treatment. Moderate to severe greenish yellow diarrhea, tenesmus, depression and mild to moderate dehydration were the main signs. Rectal swabs and fecal samples were taken for bacterial and parasitic examinations respectively. On the basis of clinical and laboratory findings, the condition was diagnosed as concurrent acute bacterial and protozoal enteritis. The recognized etiological agents were mostly bacteria (40 %) such as *E. Coli* either alone or in association with *proteus spp.*, *Klebsiella* spp. /or *Pseudomonus*, /or *Cambylobacter spp.*, and /or *Salmonella*; Bacteria and Protozoa *(Cryptosporidia and Eimeria bovis)* in 33.5 % of cases; Protozoa only (16.5 %) as *Cryptosporidia and Eimeria bovis.* No enteropathogens were identified in 10 % of cases. Hemoconcentration, hyponatremia, and increased blood urea and serum creatinine were the main biochemical changes in enteric calves. It could be concluded that concurrent infection of bacteria, *Cryptosporida* and *Eimeria* spp. may cause severe enteritis and case fatalities among suckling calves. Immediate application of intestinal protectant, Enrofloxacin with oral rehydration by electrolyte - glucose solutions for calves that have a suckling affinity as well as continuos drip infusion containing alkalizing agents, electrolytes and source of energy for severely apathetic calves proved a good rapid recovery.

***Key words**: Enteritis - Calves, Dehydration, E. coli , Cryptosporidia.*

INTRODUCTION

Acute enteritis of neonate calves contribute to a high economic losses through the disease hazards itself and its subsequent treatment costs. Acute enteric infection of neonate calves are mainly infectious: Bacterial such as *E. Coli, Salmonella, Campylobacter, Clostridium;* Viral such as *Rota-, Corona-, Adeno-, Parvo-, Breda- Calcivirus, Bovine virus diarrhea)* and enteroparasites such as *Cryptosporidia, Eimeria* and helminths (Danner, 1983; Hess, 1987; Radostits et al., 1994 and Sadiek and Schlerka, 1996). Improper colostral intake, with the stresses of unsuitable housing and climatic changes may predispose the neonate calves to catch the infection (Janke, 1989 and Radostits et al., 1994).

Coccidian protozoa of the genus Cryptosporidium were isolated from several cases of neonatal diarrhea, especially in calves (Aurich et al., 1990). Under stress situations or in association with other enteropathogens such as rotavirus, corona virus or E. Coli, cryptosporidia contribute to high morbidity and mortality in neonatal animals (Aurich et al., 1990).

The pathophysiology of diarrhea varies according to the causative agents. In E. Coli infections, diarrhea occurs through the effects of enterotoxins on the epithelium of the intestinal rypts esulting n stimulation of chloride and by turn water secretions (hypersecretory diarrhea) with minor, if any structural changes in intestinal mucosa. The Sodium- transport system of glucose and amino acids is not influenced by enterotoxins of E. Coli (Kaske, 1993). On the other hand, *Cryptosporidia* develop in the brush border of the intestine, especially jejunum and ilium (Chermette and Boufassa-Ouzrot, 1988), where the parasite cause an atrophy of the intestinal villi with consequent malabsorption and hypersecretion (Moore, 1989; Aurich, et al., 1990; Kaske, 1993 and Castrucci et al., 1994). The chemical mediators such as histamine, serotonin and prostaglandin secreted in the inflamed intestine, affect the intestinal glandular lining leading to disturbed intestinal peristalsis (Kaske, 1993 and Castrucci et al., 1994). During the course of enteritis, either due to hypersecretion or malabsorption, disturbances of fluid, electrolyte and energy balance occurs, resulting in dehydration and metabolic acidosis (Naylor, 1989 and Glawischnig et al., 1990).

Inspite of the wide complex causes of diarrhea in calves, many metabolic fatal consequences are encountered. Variable degrees of fluid loss, electrolyte imbalance, energy dificit and acidosis were reported

(Bywater, 1982; Hess, 1987 and Kaske, 1993). Loss of intestinal fluid and eventually plasma loss results in dehydration. Loss of intestinal electrolytes and eventually blood and tissue electrolytes such as sodium, potassium, chloride and bicarbonate ions in feces in association with decreased renal perfusion rate results in retention of H^+ ion and metabolic acidosis (Groutides and Michael, 1990 and Radostits et al., 1994).

Rehydration and correction of acid-base and electrolyte imbalances are considered the most important and successful treatment of diarrhea in calves (Groutides and Michell, 1990; Rossow et al., 1994; Hartmann, 1995 and Sadiek and Schlerka, 1996). Based on the actual deficit, daily requirement of maintenance fluid and daily continuos fluid loss, the required fluid volume for a 50 kg severely dehydrated calves is about 10-12 litre (Geishauser, 1991 and Hartmann, 1995).

Oral rehydration is the simplest and cheapest method specially when the calf is still standing and have a suckling affinity (Phillips, 1985; Naylor et al., 1990 and Rossow et al., 1994). The use of oral rehydration therapy with glucose-electrolyte solutions after Dirksen (1992) is considered an advanced step in veterinary practice.

Continuous iv. drip infusion is known as the only therapeutic measurement for severely dehydrated calves which needs a large volume of fluid, specially those lost their suckling affinity and are in a recumbent position (Groutides and Michell, 1990; Geishauser, 1991; Rossow et al., 1994 and Hartmann, 1995 and Sadiek and Schlerka, 1996). The study aimed to achieve an etiological diagnosis especially bacterial and parasitic causes. Unfortunately, and due to lack of facilities, no attempts were made for diagnosis of enteric viral infection, especially Rota and/or Corona viruses, that were known to be almostly involved in etiology of enteritis in neonates. The study aimed also to recognize the clinicobiochemical changes associating neonate enteritis and trials for treatment were also achieved.

MATERIALS and METHODS

1-Materials:

Disease history:

In a Friesian dairy herd, belonging to El-Diabaat-Sohag Governorate, frequent attack of enteritis and deaths of neonate calves had occurred during the period of January-April, 1998. A total of 38 neonate Friesian calves, 5-25 days old were investigated (30 neonate calves of

both sexes with diarrhea, while 8 healthy ones were kept as control). On the first visit of the farm, 2 calves were found dead with a history of svere diarrhea and dehydration, 20 calves were showing variable signs of diarrhea. On the second visit (2 months later), another 10 neonate calves were showing a similar signs of acute enteritis and one calf was found dead. Neonate calves were housed in straw bedded separate boxes away from their dams just after birth. They fed colsotrum for the first 3 days after birth, then changed to whole natural milk 2 times daily until weaning. Careful clinical examination of enteric calves were carried out according to Radostits et al., (1994). Special attention was paid to the indices of dehydration and electrolytes imbalance such as general body condition, suckling affinity, skin elasticity, condition of eye ball, ability to stand and characters of feces.

II- Samples and Adopted Methods:

1 - Fecal samples:

A- Fecal swabs were taken aseptically from the rectum of all diarrheic calves for isolation and identification of bacteria. Isolation and identification of enterobacteraiece, as well as bacterial culture and sensitivity tests were carried out according to the methods adopted in Carter (1984).

B- Another fecal samples were examined for parasitological examination (especially for protozoa) according to Coles, (1986). Suspected samples of *Cryptosporidiosis were* examined by modified Ziehl-Neelsen staining methods (Henriksen and Prohlen, 1981).

2- Blood samples:

A- EDTA Blood: Red blood cells (RBCs T/l), Hb (gm/l), and Total leucocytic count (G/L) were estimated by full automated Abott Cell Dyne-1700 blood counter. Packed Cell volume (PCV %) was carried out by microhematocrit capillary tubes according to Coles, (1986). MCV (fl), MCH (pg) and MCHC (g/dl) were mathematically calculated according to Coles, (1986). Plasma lactate was measured colorometrically by means of test kits supplied by Boehringer Mannheim Diagnostica - Germany.

B- Whole blood without anticoagulant: for determination of blood serum electrolytes (Na, K mmol/l) by means of Flame photometry Corning 400. Blood serum chloride (Cl mmol/l) by means of test-kits supplied by ETC-France. Blood serum calcium (Ca mmol/l), Inorganic phosphorus (P mmol/l), Magnesium (Mg mmol/l), serum total proteins (gm/l), glucose (mmol/l), Blood urea

(mmol/l) and serum creatinine (µmol/l) were determined colorometrically by means of test kits supplied by Biomereux.-Bainse-France.

III- Therapeutic trials.

1- Symptomatic treatment was initiated with antidiarrheal mixture containing Kaolin and pectin as an intestinal protectants.

2- Oral electrolyte and glucose solution was initiated for enteric calves those have a suckling affinity. Oral rehydration with glucose and elctrolytes solution were given between meals at morning and evening, the dose was 80 gm powder dissolved in 2 liter warm water for 5 successive days.

3- Five calves (during both visits) were severely apathetic and received parentral rehydration with fluids containing an alkalizing agent as that described by Sadiek and Schlerka (1996). They received 100 ml 8,4 % NaHco3 (84 gm /l), 500 ml 4,5 % NaCl, 250 ml 30 % glucose solution. These amounts were completed into a 5 L distilled water. Each calf received about 4-5 liter in the first 12 hours through i.v drip infusion in a speed of about 240 drop /minute. Nearly an equal amount was given for the next 12 hours with the same composition.

4- Enrofloxacin (Noroxin)® was the antibiotic of choices (Culture & sensitivity) for the most bacterial isolates of *E. coli, Salmonella spp., Klebsieella spp.; Proteus spp. and Campylobacter spp.* It was given intramuscularly in a dose of 5.0 mg/kg body weight for 5 successive days. No specific drugs was given against *cryptosporidia*. Enrofloxacin is a synthetic antibacterial chemotherapeutic agent which belong to the second generation of quinolones (fluoroquinolones). It has a wide antibacterial spectrum against gram negative, gram positive bacteria and mycoplasma. Its bactericidal effect achieved by inhibition of protein synthesis of bacterial cell through blocking of the bacterial DNA gyrase, leading to a reduction in supercoiling and serious disruption of the spatial arrangement of bacterial DNA (Brander, 1991).

5- A concomitant milk feeding and oral rehydration were parallely given.

V- Statistical analysis: Means, S.D., ANOVA of the obtained data were carried out by means of software computer statistical program (SPSSWIN, 1995)

RESULTS

1- Clinical findings:

On the first visit to the farm, 2 calves were found dead with signs of diarrhea and severe dehydration (Table 1). The other 20 neonate calves were suffering from variable degrees of enteritis, depression and early signs of dehydration. Three calves were apathetic and recumbent. Feces was watery, greenish yellow, tinged with mucous and blood in 9 calves. Straining and tenesmus were noted in some cases. Internal body temperature, arterial pulse rate, respiratory rate were variably elevated. Partial to complete loss of suckling affinity, inability to stand for long time and loss of weight were mostly seen (Table, 2). On the second visit to the farm, 10 calves showed signs of acute enteritis and dehydration, that were mostly similar to the first one (Tables, 1 &2) and one calf was found dead.

2- Microbiological findings:

The results of bacterial and protozoal examinations were illustrated in Tables 3.

3- Hematological and biochemical findings:

The results of blood picture, blood serum electrolytes, serum protein, blood glucose, plasma lactate, blood urea and serum creatinine were tabulated in Table 4.

4- Results of therapeutic trials:

1- Symptomatic treatment with intestinal protectants and oral fluids showed little improvement. Oral rehydration with glucose and elctrolytes solution were given between meals at morning and evening, the dose was 80 gm powder dissolved in 2 liter warm water. 5 calves, were severely apathetic and received parentral rehydration with fluids containing NaHCo3 (8.4 %).

2- On the base of the results of bacterial culture and sensitivity tests, Enrofloxacin was the antibiotic of choices for the most bacterial isolates of *E. coli, Salmonella spp., Klebsiella spp.; Proteus spp. and Campylobacter spp.* It was given intramuscularly in a dose of 5.0 mg/kg body weight for 5 successive days.

3- A concomitant milk feeding was continuously fed as a main meals. The amount of milk was divided for each calf 3 times daily.

4- Among of all treated cases, marked and rapid recovery were noticeable with the above-mentioned treatment trials, but only 2 calves had succumbed inspite of immediate parentral treatment, those were severely apathetic and markedly dehydrated.

DISCUSSION

Diarrhea in neonate calves is caused by a combination of many risk factors. Interaction between environments, improper colostral intake, improper nutrition and virulence of pathogens provoke the imbalance of intestinal equilibrium of the neonates resulting in diarrhea. The frequency of diarrhea is increased in winter, where calves are housed in enclosed, bad ventilated barns, that may be near to the growing and adult cattle. Some outbreaks of diarrhea occurs as a result of a single enteropathogen, but most of these are due to mixed infection (McGuirk, 1996).

Colostral immunoglobulins provide both systemic and local immunity in the gastrointestinal tract following absorption. Failure of passive transfer of colostral immunoglobulins will lead to numbers of neonatal diseases such as colisepticemia, calf scours, salmonellosis and pneumonia (Gay, 1983 and Kruse, 1983 and McGurick, 1996).

In the present work, the identified etiological agents were mostly bacteria (40 %) such as *E. Coli* either alone or in association with *proteus spp., Kliebsilla spp.,*/or *Pseudomonus spp.,* /or *Cambylobacter spp.,* and /or *Salmonella spp.* Many reports recorded these enteropathogens in acute enteritis of milk fed calves (McDonough et al., 1994; Meltzer, et al.,1996 and Sadiek and Schlerka, 1996). The association of *Campylobacter spp.* with calf diarrhea was previously reported (Morgan et al., 1986). Mixed infection with one or more of the above-mentioned bacteria and intestinal protozoa such as *Cryptosporidia* and *Eimeria bovis* were identified in 33.5 % of cases. These findings support many previous records in a similar conditions (Chermette and Boufassa-Ouzrot, 1988; Aurich et al., 1990; Corwin, 1992; McDonough et al., 1994; Celment et al., 1995), whose reported *Cryptosporidia* and *Eimeria spp.* either alone or in association with enterobacteriaceae as an etiological agents in the diarrheic neonate calves. Only intestinal protozoa (*Cryptosporidia and/ or Eimeria bovis)* was recognized in 16.5 % of cases, however 10 % of enteric calves showed no enteropathogens. Unfortunately viral examination were not available in this work, however, this can't exclude involvement of viruses in such enteric infection.

Enteritis caused by *Cryptosporidia* may be primary or secondary infection. Association of *Cryptosporidia* with *E. coli, Rota and/or Corona* viruses were previously reported (Sadiek and Schlerka, 1996). *Eimeria spp.* (Gut dwelling coccidia) is widely distributed among calves

populations with high prevalence rates of infection of several species of *Eimeria* (Corwin, 1992).

The clinical signs observed on calves in this study were in the form of watery greenish yellow diarrhea, weakness, loss of weight, wasting and dehydration. Hemorrhagic enteritis with signs of straining and rectal protrusion, marked rise of body temperature were noted in some calves specially those were positive for *Eimeria* and *Cryptosporidia* infection (Table, 3). Similar signs associated with similar circumstances were previously mentioned (Celment et al., 1995; Meltzer et al., 1996 and Sadiek and Schlerka, 1996). Some calves showed signs of respiratory manifestations, that could be attributed to primary or secondary complications to diarrhea in neonates. The occurrence of concomitant infection with Enteropathogens and cryptosporidia may be explained by many ways. Firstly, the condition occurred during the period of increased calving and climatic changes (January- April); secondly, improper colostral intake, and lastly, their dewelling were damp and near that of the growing calves. These factors may stressed the neonates resulting in lowering of their resistance, facilitating ease transfer of enteropathogenic bacteria and protozoa.

The results of hematological examination, reflect the condition of dehydration and hemoconcentration, where the PCV, RBCs, MCV and Hb concentration (Table, 4) were significantly increased in enteric calves, that could be attributed to loss of body fluid especially blood plasma in hypersecretory diarrhea. Regarding the pathophysiology of enteritis, many authors stressed this point, declaring more or less similar findings (Coles, 1986; Naylor, et al., 1990 and Sahal et al., 1993). The Na- and Cl values (Table, 4) were significantly below that of control ones, that may be attributed to loss of electrolyte in feces (Doll, 1994). The expected increase of serum K was not evident, in contrary to the studies of Bywater (1982); Sahal et al., (1993) and Hartmann (1995), but in accordance with that of Sadiek and Schlerka (1996) where potassium ion may be not sufficiently excreted into extracellular fluid to compensate the excpected metabolic acidosis (Hartmann, 1995).

The value of serum urea & creatinine were significantly increased, indicating hypovolemia, reduced renal perfusion rate and function and the beginning of nephrobiotic changes (Sahal et al., 1993). Insignificant alterations were noted in blood serum levels of Ca, P, Mg, total proteins plasma lactate and glucose (Table, 4). The hypovolemia and dehydrating status of enteric calves may mask the expected changes in these values

(Lewis et al., 1975; Wis et al., 1975; Mair et al., 1990 and Deshpande et al., 1993).

In the present study, diarrhea was mostly secretory in nature, so oral fluid replacement was sufficient for rehydration and maintaining of intestinal and tissue equilibrium, because the mucosa still intact (Naylor et al., 1990). However the protozoan *cryptosporidia* may cause injury, mainly of jejunum and ileum (malabsorptive diarrhea), that may make oral rehydration insufficient, but early and immediate use of intestinal protectants with oral rehydration gave a good response except in 5 cases, those were not respond to oral rehydration. These 5 calves were given intravenous drip infusion with electrolyte-glucose solution containing principally NaHco3, NaCl and glucose. Bywater and Woode, (1980) and Sadiek and Schlerka, (1996) reported also a successful oral rehydration therapy in diarrheic calves caused by *Rotaviruses*, *Coronaviruses* and *Cryptosporidia*.

It could be concluded that concurrent infection with *Enterobacteriaceae, Cryptosporidia* and/ or *Eimeria* may cause acute severe enteritis and deaths among neonate calves. Intestinal protectants, enrofloxacin in association with oral electrolyte-glucose and continuos milk feeding had reduced the risk of infection and proved a good response, except those calves with sustained suckling affinity and severe dehydration, they should be parentrally rehydrated.

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Table, 1 : Data regarding total no. of healthy and enteric neonate calves as well as no. of deaths, treated and recovered calves during both visits to the herd.

	1st visit	%	2nd visit	%
Total neonate calves in the herd	37	100	28	100
Calves found dead/ total	2	5.4	1	3.57
Affected enteric calves/Total	20	54.05	10	35.71
Deaths (after therapy) / affected	2	10	0	0
Recovered (after therapy) /affected	18	90	10	100

Tab. 2: The most prominent clinical findings of acute enteritis observed in neonate calves..

Clinical/Lab. findings	Observed signs	No.
General condition	Alert, still stand	10
	Depressed and able to stand.	14
	Unable to stand	6
Suckling affinity	Present	12
	Reduced	13
	Absent	5
Character of feces	Thin watery , yellowish	15
	Greenish yellow	6
	Mucoid & Bloody	9
Skin elasticity	Normal	10
	Reduced	14
	Severely reduced.	6
Condition of eyeball	In normal position	10
	Mild sunken	15
	Severely sunken	5
Superficial skin temperature	Normal	25
	Cold extremities to very cold	5
Internal body temperature	37.5-38.5	16
	39.2 - 41.8 o C	10
	Less than 37	4
Lung auscultation	Normal vesicular sound	17
	Harsh vesicular sound	10
	Pneumonic	3
Rectal protrusion	Just straining	6
	Marked protrusion with straining, ulceration and hemorrhage	4

Table 3: The results of bacteriological and parasitological examination as well as bacterial culture and sensitivity tests of calves suffering from acute enteritis.

Ser.	Bacterial isolates	Parasite	Results of Culture & sensitivity
1.	*E. Coli*	*Cryptosporidia*	NOR ++++, GM +++
2.	*E. Coli, Pseudomonas spp.*	-	NOR +++, GM +++
3.	*E. Coli, Kliebsiella spp.*	*Eimeria spp.*	NOR ++++, CL +++
4.	*E.coli*	*Eimeria , Cryptosporidia*	NOR ++++, GM +++
5.	*Proteus spp.*	*Cryptosporidia*	CM +++, NOR +++
6.	*Salmonella typhi.*	-	CM ++++,NOR +++
7.	*E. Coli, Campylobacter spp.*	-	NOR ++++, SXT +++
8.	*E. Coli, Klebsiella spp.*	*Eimeria spp.*	NOR ++++, GM +++
9.	-	*Cryptosporidia*	-
10.	*E. coli*	-	NOR ++++, GM +++
11.	*Pseudomonus spp., E. Coli*	-	NOR +++, GM +++, SXT +++
12.	*E. Coli*	*Cryptosporidia*	NOR ++++, GM +++
13.	*E. coli*	-	NOR ++++, GM +++
14.	*E. Coli*	-	NOR ++++ GM +++
15.	-	*Eimeria, Cryptosporidia*	-
16.	-	*Cryptosporidia*	-
17.	*E. coli*	-	NOR ++++, SXT +++
18.	*E. Coli*	-	NOR ++++, SXT +++
19.	*Campylobacter spp*	*Cryptosporidium*	CM +++, NOR +++
20.	*E. Coli , Proteus spp.*	-	NOR +++, CM +++
21.	*Campylobacter spp.*	*Eimeria bovis*	NOR +++, CL +++
22.	*E. Coli, Kliebsiella spp.*	-	NOR ++++
23.	-	-	-
24.	*Salmonella , E. Coli*	-	CL ++++, NOR ++++
25.	-	-	-
26.	-	*Cryptosporidia*	-
27.	*E. Coli*	*Eimeria +Cryptosporidia*	NOR ++++, GM+++, SXT +++
28.	-	-	-
29.	-	-	-
30.	*E. Coli*	*Cryptosporidia*	NOR ++++, CL +++

*- Only drugs that gave inhibition zone more than 3 + were reported .
CM= Chloramphenicol, **GM**= Garamycin, **NOR**= Noroxin (Enrofloxacin), **SXT** (Sulph&Trimethobrim).

Tab. 4: Hematological and blood biochemical findings in healthy and diarrheic neonate calves (Mean ± standard deviation, n = Number).

	Control	Enteric calves	
Parameter	**n = 8**	**n=30**	Levels of significance
RBCs (T/l)	6.72 ± 1.28	9.11 ±1.56	↑ **
Hb (G/l)	81.0 ± 18.42	120.73 ±32.03	↑ ***
PCV (%)	23.025 ± 4.9	36.2 ±7.53	↑ ***
MCV (fl)	34 ±1.3	39.11 ±4.01	↑ **
MCH (pg)	11.92 ±1.92	14.26 ±2.16	↑ *
MCHC (g/dl)	35.25 ±5.32	36.14 ±5.48	n.s.
WBCs (T/l)	8.71 ±3.91	11.92 ±4.43	n.s
Na (mmol/l)	117.25 ±11.23	139.667 ±10.23	↑ **
K (mmol/l)	5.75 ±6.17	4.005 ±.87	n.s.
Cl- (mmol/l)	85.67 ±13.81	97.125 ±6.1	↑ *
Ca (mmol/l)	2.39 ±0.43	2.25 ±0.6	n.s.
P (mmol/l)	2.16 ±0.48	2.18 ±0.53	n.s.
Mg (mmol/l)	.56 ±0.164	.74 ±0.24	n.s
Tot. Prot. (g/l)	55.37 ±6.8	51.00 ±7.28	n.s.
Glucose (mmol/l)	5.08 ±1.54	4.036 ±1.26	n.s.
Lactat (mmol/l)	1.37 ±0.39	1.96 ±1.21	n.s
Urea (mmol/l)	2.15 ±0.33	5.72 ±3.07	↑***
CREA (µmol/l)	59.87 ±11.67	113.17 ±24.16	↑***

*Analysis of variance** = $P < 0.05$ ** = $P < 0.01$ *** = $P < 0.001$