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Chemoprophylactic Trials Against Neonatal Calf Diarrhoea and the Study of Relevant Haematological and Serological Parameters

Syed Muzaffar Hussain Bukhari
Government Islamia Degree College, Sangla Hill, Pakistan

Abstract: The project was designed to study the effects of various chemoprophylactic agents like, colimune ora (group A), cosumix plus (group B), streptomagma (group C), N.M.K. powder (group D) and bio-vet (group E) on neonatal calf diarrhoea with reference to haematological, serological and bacteriological parameters. For the said project 30 calves were selected through systematic random sampling technique. Culture of fecal samples were done just after birth, then after 36 h and then after 28 days. None of the animals manifested any clinical sign like diarrhoea which showed that all the therapeutic agents worked well prophylactically against neonatal calf diarrhoea but only one out of five calves in group A died 48 h after its birth. Postmortem report revealed that there was a lot of fluid accumulation in gastrointestinal tract. None of the organisms was isolated from the culture untill 48 h after birth.

Key words: Neonatal calf diarrhoea, drug efficacy, passive immunity

Introduction

Diarrhoea in neonates is one of the most common disease complexes, which the large animal clinician faced in their practice (Radostits *et al.*, 1994).

The effectiveness of treatment and control of heard epidemics of diarrhoea in calves is frustrating and causes heavy economic losses. It is characterized by profuse watery diarrhoea, progressive dehydration, acidosis and finally death within few days (Kaske, 1994).

Field and laboratory investigation revealed that etiology of calf diarrhoea, usually involves the interplay between enteropathogenic bacteria, viruses and other pathogens (Fejes *et al.*, 1990)

Common pathological lesions are dehydration, emaciation and a fluid filled intestinal tract with no other gross lesions (Kaske, 1994).

Treatment of diarrhoea largely determines the alteration of diet, electrolyte and fluid replacement therapy and immunoglobulin therapy along with supportive therapy (Radostits *et al.*, 1994).

The aim of the present study was to:

1) Help the clinicians as well as livestock owners so that they could easily handle their animals if a professional help is not available.
2) Evaluate the effectiveness of chemoprophylactic effect of various drugs like colimune ora, cosumix plus, streptomagma, N.M.K. powder and bio-vet against neonatal calf diarrhoea.
3) Evaluate the haematological parameters i.e., effect of treatment of diarrhoea upon packed cell volume, total erythrocyte count, total leukocyte count and differential leukocyte count.
4) Evaluate the serological parameters i.e., effect of treatment on total serum protein, serum albumin and serum globulin.
5) Evaluate the electrolyte parameters i.e., effect of treatment on sodium and potassium.
6) Check the microbial status of neonates before and after treatment.
7) Evaluate the effect of treatment on general health status of the neonates

Materials and Methods

The project was done at Animal Nutrition Centre, Rakh Dera Chahl, Lahore, from 26-11-1998 to 24-02-1999. A total of 30 new born calves were selected through systematic random sampling technique, which were divided into six different groups marked as A, B, C, D, E and F; consisting of five neonates each, which were medicated by a single therapeutic agent like, colimune ora, cosumix plus, streptomagma, N.M.K. powder and bio-vet respectively. The last group F was the non-medicated control group (Table 1).

Supportive therapy: Supportive therapy was given to prevent dehydration and acidosis, including: dextrose i.e., normal saline/percentage of dehydration and sodium bi-carbonate/quality of acidosis.

General management: Separation of calves from their dams as well as from each other was done. Clean and proper environment was provided to the calves.

Haematology: In this zone of testing four different tests were done i.e., packed cell volume (PVC) through Haematocrit, total erythrocyte count (TEC), total leukocyte count (TLC) through Haemocytometer and differential leukocyte count (DLC) through Slide method (Mohiuddin, 1994).

Serology: In this battery of testing six tests were done i.e., total serum protein, serum albumin, serum globulin, serum albumin-globulin ratio through Biuret method (Doumas, 1981 a,b) and the concentration of sodium and potassium through flame photometer (Coles, 1994).

Microbiology: Microbiology of fecal samples was done for the detection of *Salmonella* and *E. coli* species. The cultures of fecal samples were grown at MacConkey's bile salt agar, while staining of smears was done through Gram's stain. For the confirmation of the presence of *Salmonella* or *Escherichia coli* spp. biochemical tests likewise indole, H_2S production test, urease, catalase and methyl red were done for this purpose.

Statistics: Statistics of the results was done through complete randomized technique to find the difference among treatments (Steel and Torrie, 1982).

Results and Discussion

One of the calves died during whole of the project out of 30 neonates (3.33%). Died neonate was of the group treated with colimun ora. In the group mortality rate was 20%. This fact is against the observations of Akhtar *et al.* (1993) who said that administration of antiserum worked well against neonatal calf diarrhoea. The only reason for this is area and climatic difference.

Packed cell volume (Table 4) significantly decreased both within a time period (49.87) and between therapeutic agents (31.67). These results goes against the observations of the Sodhi *et al.* (1998) who reported that PVC decreased non-significantly and Khan *et al.* (1996) who reported that PCV increased significantly. Results are between these two findings so these are appreciable.

Total erythrocyte count (Table 5) showed non-significant results both for a time period (0.56) and therapeutic agent's (1.378). These observations are in accordance with the observations of Sodhi *et al.* (1998), who reported that a non-significant difference exists for TEC.

Table 1: Therapeutic regime of chemoprophylactic drugs and its dose rate and route of administration

Groups	Drugs	Dose rates	Route of administration	Manufactured By
A	Colimune ora	10 ml/calf within 12 h	Orally	AZM Pharmaceuticals Karachi
B	Cosumix plus	10 gm/50Kg body weight	Orally	Ciba Geigy Ltd. Karachi2
C	Streptomagma	25gm/calf	Orally	Wyeth-Lederle Division. Cynamid (Pak) Ltd, Lahore
D	NMK powder	1gm/8kg body weight	Orally	Self Prepared
E	Bio vet	10 ml/day	Orally	Nature Farming Research & Development Foundation Faisalabad
F	Non-medicated control group			

Table 2: Effect of various therapeutic agents over haematology of neonatal calves

	Perinatal					Neonatal									
	0-24 h					24-36 h					36 h - 28 Days				
Groups	PCV %	TEC M/mm^3	TLC T/ mm^3	Neutr-phils %	Lympho-cytes %	PCV %	TEC M/mm^3	TLC T/ mm^3	Neutr-phils %	Lympho-cytes %	PCV %	TEC M/mm^3	TLC T/ mm^3	Neutr-phils %	Lympho-cytes %
A	34	5.4	7.4	32	52	28	6.9	8.2	30	50	34	6.0	7.0	32	51
	36	6.0	8.0	33	51	30	5.2	7.5	27	51	35	7.1	5.4	32	50
	31	5.9	7.6	30	53	28	5.1	7.0	32	51	-	-	-	-	-
	27	5.4	5.4	31	52	30	5.0	7.2	32	52	35	6.0	7.3	30	50
	30	5.3	6.9	31	53	34	5.4	7.5	34	50	34	5.9	7.2	34	52
B	22	4.2	5.8	33	53	30	5.7	5.5	34	50	36	6.2	7.0	27	50
	36	6.7	8.0	33	53	36	6.8	7.3	34	52	37	6.3	7.4	30	52
	34	5.6	4.8	34	50	35	5.7	8.3	34	52	32	5.8	7.9	34	52
	30	5.6	7.6	33	51	32	6.0	7.5	32	52	33	6.2	7.0	30	53
	29	5.1	7.0	32	55	28	5.3	6.9	28	55	27	5.2	6.0	30	52
C	29	6.0	7.3	32	54	30	6.2	7.2	29	55	32	6.4	7.4	31	52
	31	6.1	7.2	32	55	32	5.7	7.3	30	54	32	5.7	7.3	33	50
	28	5.4	7.0	30	52	34	5.4	7.4	30	51	33	5.4	7.4	30	52
	32	5.8	7.8	31	53	30	5.2	5.9	31	53	31	5.9	7.3	34	52
	36	6.4	8.2	32	53	36	6.4	8.2	30	52	34	6.0	8.0	28	55
D	27	5.3	6.7	31	54	27	5.3	6.8	30	52	28	5.2	7.0	31	53
	25	4.9	5.8	31	52	25	4.9	5.8	31	53	29	5.6	6.1	32	51
	21	4.8	4.9	31	52	22	4.9	6.0	30	53	30	5.3	6.0	32	51
	36	6.5	8.1	30	55	36	6.6	8.2	35	50	34	5.9	7.4	30	52
	30	5.0	4.4	29	55	32	5.7	7.2	30	52	34	6.0	8.0	34	50
E	32	6.4	6.0	33	59	33	6.4	6.1	31	53	33	5.9	7.0	34	50
	30	6.1	5.6	36	54	36	5.4	6.6	30	53	35	5.7	7.1	34	52
	18	6.2	4.4	39	50	26	5.0	7.2	30	52	30	5.8	7.3	34	52
	29	5.3	7.1	35	54	30	5.2	7.4	30	50	29	6.0	6.9	35	50
	33	5.6	7.8	35	51	36	6.1	8.2	31	53	34	6.7	7.2	28	55
F	36	6.9	8.0	32	54	36	6.7	7.2	30	52	34	5.6	6.9	30	53
	33	6.7	7.1	31	54	30	5.4	7.0	31	52	33	5.4	7.0	30	52
	26	4.4	3.9	31	52	24	5.1	4.8	32	52	29	5.9	7.1	31	53
	20	3.4	6.7	29	55	18	3.2	4.5	33	56	21	6.1	7.1	34	50
	24	4.7	6.9	29	56	33	5.6	7.1	30	52	34	6.3	7.3	30	50

PCV = Packed cell volume, TEC = Total erythrocyte count, TLC = Total leukocyte count

Total leukocyte count (Table 6) showed a non-significant increase both for a time period (1.548) and therapeutic agents (1.328). These observations match with the previous observations of Donovan *et al.* (1998) who reported that Leukopenia is observed in neonates with diarrhoea.

Significant neutrophilia (Table 7) was observed in the neonates with all aspects of time frame and therapeutic agents (9.984 and 7.511) convincing the results of Khan *et al.* (1996) who reported that neutrophilia is observed in the neonates opposing the observations of Donovan *et al.* (1998) who depicted that neutropenia is observed in the diarrhoeic neonates. While lymphocytes (Table 8) showed a significant increase in their value with the introduction of therapeutic agents and with the time period zero hour to 28 days (5.798. 21.378) opposing the observations of the Blood *et al.* (1994), Khan *et al.* (1996) and Donovan *et al.* (1998) who reported that lymphocytopenia is observed in diarrhoeic calves. The only reason for this difference is that during this time calves were consuming precautionary medication which cause the increase in lymphocytes population.

Total serum protein showed a great variability (Table 9).

Therapeutic agents when introduced initially increase the serum protein significantly but as the time passes the value tends towards a non-significant change (1.076, 0.348). The observations are against the observations of Blood *et al.* (1998), Adam (1998) and Donovan *et al.* (1998) who justified that total serum protein decreased from its original value. It is due to the reason that calves were under medication and observation right from the birth.

Serum albumin (Table 10) increased significantly when we introduced the therapeutic agents (2.974) but as the time goes there we find a non-significant difference it is against the results of Adam (1998) as he depicted that serum albumin decreased in diarrhoeic neonates. It is due to the fact that calves were under medication and observation right from the birth.

Serum globulin concentration (Table 11) showed a significant difference both after the administration of therapeutic agent (1.805) and time period (1.831). It is in accordance with Adam (1998) where he admitted that serum globulin decreased along with total serum protein and serum albumin.

Serum electrolytes i.e., sodium and potassium showed alternative results. Sodium (Table 12) decreased significantly both after drug administration (24.604) and time period (37.011) while potassium (Table 13) decreased non-significantly both after drug administration (0.224) and time period (1.416). These results matches the results of Donovan *et al.* (1998) who described that serum sodium and potassium decreased considerably from their values in diarrhoeic calves.

None of the bacteria was found in the fecal culture obtained from neonates of each group. This result matches the results of Fecteau *et al.* (1997) who described that normal healthy calves did not show any bacteria.

As far as the drug efficacy was concerned all the drugs worked well against neonatal calf diarrhoea in the said project, but critically

Table 3: Effect of various therapeutic agents over serology of neonatal calves

	Perinatal					Neonatal									
	0-24 h					24-36 h					36 h - 28 Days				
Group	Prot g%	Alb g%	Glob g%	Na^+ Meq/l	K^+ Meq/l	Prot g%	Alb g%	Glob g%	Na^+ Meq/l	K^+ Meq/l	Prot g%	Alb g%	Glob g%	Na^+ Meq/l	K^+ Meq/l
A	7.2	5.7	1.5	145	4.8	7.6	6.1	1.5	136	3.7	7.4	4.0	2.3	141	3.8
	5.6	4.2	1.4	141	3.9	7.6	6.0	1.6	139	5.5	6.6	5.0	2.5	138	6.0
	6.4	4.2	2.2	139	5.4	8.2	7.2	1.0	142	5.4	-	-	-	-	-
	5.2	3.2	2.0	140	3.4	5.6	4.0	1.6	136	4.1	7.3	6.1	2.4	138	4.1
	6.9	3.9	3.0	131	4.6	7.8	7.5	0.3	130	3.1	5.5	4.2	2.9	142	3.1
B	7.6	4.2	2.7	139	5.5	6.4	4.0	2.4	135	3.8	6.0	6.0	2.8	139	4.8
	7.2	4.9	2.2	145	4.9	7.4	4.1	3.3	145	5.6	6.3	3.9	2.9	139	3.7
	7.5	4.9	2.6	147	5.0	7.6	6.6	1.0	136	3.8	7.4	4.5	3.1	145	5.6
	7.8	4.9	2.9	144	5.4	6.4	3.9	2.4	135	3.8	6.3	6.0	3.2	142	5.1
	7.5	4.5	3.0	139	5.8	6.0	3.7	2.3	141	3.4	6.2	4.0	3.2	141	3.9
C	6.2	3.7	2.4	141	3.4	6.8	6.3	0.4	133	4.2	6.2	3.8	3.4	136	5.8
	7.2	4.0	3.2	145	5.7	7.4	4.0	3.4	139	3.7	6.9	3.9	3.3	139	4.2
	6.7	3.9	2.6	134	5.3	7.0	5.1	1.9	141	3.8	7.1	4.2	2.4	135	3.8
	6.8	3.2	3.6	139	4.9	6.7	4.4	2.3	142	4.2	6.5	5.3	2.3	133	3.7
	7.2	3.7	3.4	146	5.4	6.2	3.9	2.2	145	5.6	6.4	4.5	2.5	138	3.7
D	6.0	5.8	0.2	134	3.8	6.8	5.0	1.8	137	3.3	7.0	4.0	2.9	130	3.7
	7.2	5.4	1.7	136	3.7	7.6	5.8	1.7	139	5.5	7.0	4.9	3.1	133	4.2
	6.5	5.0	1.5	145	5.7	7.2	5.8	1.3	141	3.8	6.5	5.0	3.0	135	3.8
	6.2	5.3	0.9	139	5.1	4.8	2.5	2.3	139	5.4	6.4	5.1	2.9	139	4.2
	6.6	4.3	2.3	133	5.3	6.6	4.0	2.6	142	5.6	6.0	3.9	2.3	136	5.8
E	6.0	3.6	2.4	137	5.6	7.2	4.0	3.2	136	3.7	6.8	4.1	2.4	141	5.6
	7.8	5.2	2.6	138	5.8	7.6	5.1	2.5	139	3.7	6.9	3.9	2.2	136	3.8
	8.0	5.0	3.0	146	5.9	7.6	3.9	3.61	135	3.8	7.0	5.2	2.2	136	3.8
	7.1	3.9	3.1	137	3.7	6.8	3.2	3.6	133	4.2	6.8	4.4	2.4	145	3.8
	6.0	3.2	2.7	136	3.7	6.3	4.0	2.3	138	5.8	6.3	3.9	2.3	135	3.4
F	5.6	2.9	2.6	141	3.9	6.4	2.9	3.5	141	3.9	6.5	4.0	2.5	130	3.7
	6.6	4.3	2.3	145	3.7	6.6	4.3	2.3	142	5.0	6.7	3.9	2.8	136	5.5
	6.2	5.3	0.9	142	5.4	5.8	3.2	2.6	145	5.6	6.3	4.1	2.2	142	5.4
	5.7	4.0	1.7	141	3.8	6.2	3.7	2.5	139	3.7	6.4	3.9	2.5	139	4.1
	5.9	3.9	2.0	136	3.7	6.2	2.3	2.3	139	4.8	6.3	3.9	2.4	136	3.1

Table 4: Analysis of variance for packed cell volume

Sources	df	Sum of squares	Mean square	F value
Replication	4	202.044	50.511	2.8238
Factor A	5	158.35	31.671	1.7706*
Factor B	2	99.756	49.878	2.7884*
AB	10	51.978	5.298	0.2906
Error	68	1216.356	27.888	

Table 5: Analysis of variance for total erythrocyte count

Sources	df	Sum of squares	Mean square	F value
Replication	4	3.451	0.863	1.7932
Factor A	5	2.844	0.569	1.825NS
Factor B	2	2.756	1.378	2.8617*
AB	10	2.393	0.239	0.4975
Error	68	32.713	0.481	

Table 6: Analysis of variance for total leukocyte count

Sources	df	Sum of squares	Mean square	F value
Replication	4	6.430	1.607	1.812
Factor A	5	7.738	1.548	1.7506NS
Factor B	2	2.656	1.328	1.5023NS
AB	10	7.373	0.737	0.8340
Error	68	60.114	0.884	

Table 7: Analysis of variance for neutrophils

Sources	df	Sum of squares	Mean square	F value
Replication	4	16.956	4.329	1.330
Factor A	5	49.922	9.984	3.1397*
Factor B	2	15.022	7.511	2.3619*
AB	10	88.311	8.831	2.7770
Error	68	216.244	3.180	

Table 8: Analysis of variance for lymphocytes

Sources	df	Sum of squares	Mean square	F value
Replication	4	14.156	3.539	1.3411
Factor A	5	28.859	5.798	2.1971*
Factor B	2	42.756	21.378	8.1011*
AB	10	8.311	0.831	0.3149
Error	68	179.444	2.639	

Table 9: Analysis of variance for total serum protein

Sources	df	Sum of squares	Mean square	F value
Replication	4	6.376	1.594	5.194
Factor A	5	5.381	1.076	3.5102*
Factor B	2	0.697	0.348	1.1364NS
AB	10	6.358	0.636	2.0737
Error	68	20.845	0.307	

Table 10: Analysis of variance for serum albumin

Sources	df	Sum of squares	Mean square	F value
Replication	4	5.873	1.468	2.2426
Factor A	5	14.872	2.974	4.5429*
Factor B	2	1.052	0.526	0.803NS
AB	10	13.664	1.365	2.08690
Error	68	44.523	0.655	

Table 11: Analysis of variance for serum globulin

Sources	df	Sum of squares	Mean square	F value
Replication	4	1.282	0.321	1.0641
Factor A	5	9.024	1.805	5.9910*
Factor B	2	3.662	1.831	6.0775*
AB	10	13.536	1.354	4.4933
Error	68	20.485	0.301	

Table 12: Analysis of variance for serum sodium

Sources	df	Sum of Squares	Mean Square	F Value
Replication	4	106.044	26.511	1.9881
Factor A	5	123.022	24.604	1.8452*
Factor B	2	74.022	37.011	2.7756*
AB	10	219.978	21.998	1.6497
Error	68	906.756	13.335	

Table 13: Analysis of variance for serum potassium

Sources	df	Sum of Squares	Mean Square	F Value
Replication	4	4.202	1.050	1.3123
Factor A	5	1.122	0.224	0.2804NS
Factor B	2	2.833	1.416	1.7694NS
AB	10	5.754	0.575	0.7188
Error	68	54.430	0.800	

cosumix plus was the best against neonatal calf diarrhoea because it is in the combination of two best groups of antibiotics against diarrhoea i.e., sulphonamides and trimethoprim. This observations correctly favoured by the results presented by Lofstedt *et al.* (1996), Radostits *et al.* (1994) and Daykin (1960) as they also described these two as the best choice for the diarrhoea control. In the light of these results we must keep in mind the following points:

- Management must be upto the mark for the prevention of diarrhoea.
- Colimune ora, cosumix plus, streptomagma, NMK powder or bio-vet must be provided to the calves just after birth as a prophylactic measure. If the calf is entrapped by neonatal calf diarrhoea. It should be treated with any of the above mentioned therapeutic agents as soon as possible.
- Proper care of the calves must be done upto 28 days of life, as it is the most cautious period of young one.
- Bio-vet must be provided as a precautionary measure against neonatal calf diarrhoea.

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