Paromomycin Sulfate as a Metaphylactic Treatment for Cryptosporidiosis Control in Newborn Dairy Calves

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Abstract

This field trial aimed to mitigate cryptosporidiosis in newborn female Holstein calves and reduce weight loss consequences under various raising systems. The study involved 120 calves from three dairy facilities in Mexico, assigned to treatments including Control, Halofuginone lactate (HL), Nitazoxanide (N), and Paromomycin Sulfate (PS). Calves were raised in individual crates and monitored for passive immunity, diarrhea, and Cryptosporidium oocysts. Statistical analyses showed PS was effective, resulting in significantly lower oocyst shedding and scours. PS-treated calves had a consistent weight gain advantage at 60, 90, and 120 days compared to other treatments. The combination of passive immunity, milk feeding plans, clinical follow-up, biosecurity measures, and timely treatment contributed to controlling cryptosporidiosis in these calves.

Introduction

Cryptosporidiosis in neonate dairy calves is a common occurrence in the World. Prevalence depends on the sampling time and diagnostic method, nonetheless it goes from 20 to 100%. Cryptosporidiosis is aggravated with FPT, malnourishing, changes in milk regime and biosecurity.
The objective of the field trials was to mitigate cryptosporidiosis in newborn female Holstein calves before its clinical presentation during the second week of life, aiming to reduce weight loss consequences under various raising systems.

Methods

A total of 120 newborn female calves were included in the studies from three different dairy private facilities. The study sites were Study 1 (S1) in northern México, Study 2 (S2) in central México, and Study 3 (S3) in western México. Calves were raised in individual crates and randomly selected at birth to one of the assigned treatments. S1 enrolled 20F in elevated crates with Control and 20F with PS; S2 enrolled 21F in Control, 14F in N, and 23F in N. And S3 enrolled 30F in HL, and 28F in PS. N was used from day 2 of life with 7d of treatment and HL was used on days 2 and 5 as indicated on the label. Personnel involved in the trials had previous training to detect loss of appetite as the first attitude change in calves where paromomycin sulfate treatment was given with or without scouring. Passive immunity was determined with Brix at 48 hours of age. A daily scoring system to record diarrhea was used for the first 60 days of life. Feces were collected at 7 and 14 days of age, and diagnosed with a morphological analysis with acid-fast staining in commercial and research laboratories.

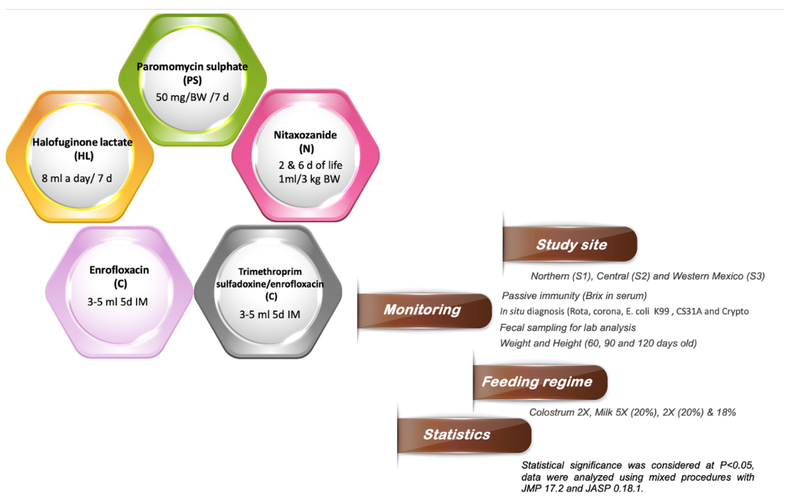
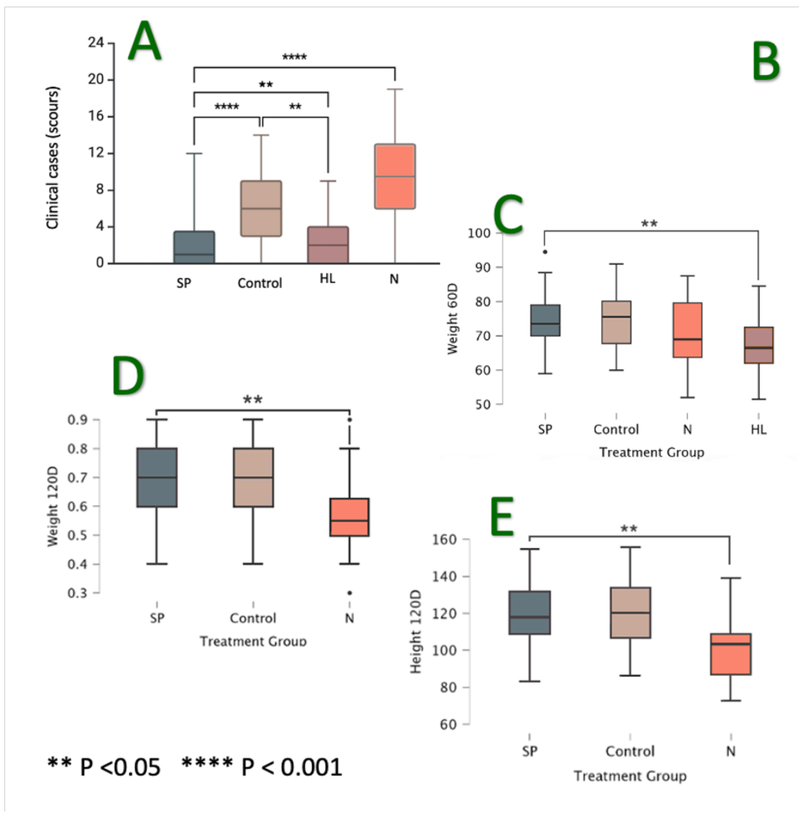


Image 1. Paromomycin sulphate (PS) compared to tradicional antibiotics for scouring, halofuginone lactate and nitazoxanide. The image describes the monitpring samplind

Results

During the second week of age, quantification of Cryptosporidium oocysts post-treatment revealed a significantly lower oocyst count in the Paromomycin Sulfate (PS) group compared to the Control and Nitazoxanide (N) groups in the S2 cohort (P<0.05). In the first week of treatment, PS led to a decrease in scours across all three sites, and this effect continued into the consecutive week in S1 (P<0.05) and S2 (P<0.0001), although no follow-up was recorded for S3 (P<0.05). Additionally, S2 experienced significantly fewer pneumonia cases with PS treatment (P<0.05).
There were consistent increments in weight and height for S1 and S2 when treated with PS. Regarding S2, calves treated timely for diarrhea showed no significant difference compared to PS treated calves, while calves treated with N prophylactically did not prevent weight loss and had less height at 120 days of age (P<0.05).
In the comparison of different milk feeding schemes and treatments, S1 calves fed a higher milk plane supplemented with PS showed a 13.6 kg weight difference with the control group. In S2, the weight difference was 16.8 kg when comparing the control and PS groups to the N treatment. The smallest weight difference was in S3 at 6.9 kg. Passive immunity was also a probable contributing factor to the weight increment, with S1 and S2 registering Brix values of 9.9 and 9.5 respectively, while S3 had a lower Brix value of 7.3.



Site	Study group	Sampling days	*Cryptosporidium* spp.	Treatment effectiveness	Hu´s MCB Test p Value
North	Control	7	30%		0.870
	SP		40%		
	Control	14	35%	+5%	0.068
	SP		***20%***	-50%	

Site	Study group	Sampling days	*Cryptosporidium* spp.	Treatment effectiveness	Hu´s MCB Test p Value
Center	Control	7	85.7%		*0.049
	N		78.6%		
	SP		73.9%		
	Control	14	100 %**	+24.5%	*0.016 **0.000 Tukey
	N		85.7 %*	+7.1%	
	SP		***56.2 %***	***-23.9%***	

Site	Study group	Sampling days	*Cryptosporidium* spp.	Treatment effectiveness	Hu´s MCB Test p Value
West	HL*	7	0%		*0.003
	SP		21.4%		
	HL	14	33%	+33%	**0.008
	SP		***14%***	-34.6%	

Image 2. Results from clinical cases comparing all treatments where SP and HL to N (p<0.001) and Control (p<0.05) (A); Morphological diagnosis in laboratory of samples collected at 7 and 14 day old calves, with the prevalence comparison and treatment efficiency where SP demonstrates efficiency in controling *Cryptosporidium* spp. in contrast with C in the Center and West (p<0.05) and N (p>0.001) (B); Weight comparison outcomes between treatments over 60 and 120 days of age (C and D) in N (p<0.05) and N (p<0.05) in the center and West in comparison with HL (p<0.05). Height comparison outcomes between treatments at 120 days of age (E) with N (p<0.05). Statistical analysis were performed in JMP 18, JASP 0.19.1 and BioRender.

Conclusion

In conclusion, paromomycin sulfate (PS) was effective during the peak of cryptosporidiosis, resulting in 34-50% less oocyst shedding, thereby allowing for local immunity with fewer clinical signs, no appetite loss, and fewer pneumonia cases. Weight gain was consistently higher in the PS study group at 60, 90, and 120 days of age, compared to other prophylactic treatments for controlling Cryptosporidium spp. The combination of good passive immunity, higher milk feeding planes, and close clinical follow-up, along with biosecurity measures and timely treatment, collectively contributed to the effective control of cryptosporidiosis in newborn calves.

References upon request

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