Eimeria management for recently transported Holstein heifers using essential oils, anti IL-10 or monensin

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BACKGROUND

Dairy heifers can have health challenges during stress events including transportation to a new environment. Coccidiosis is a significant disease caused by *Eimeria* species (*bovis; zuernii; or auburnensis*). Preventative measures in addition to coccidiostats or coccidiocides for suppressing *Eimeria* pathology in dairy heifers could be valuable tools. Polyphenolic compounds in essential oils (cinnamaldehyde, thymol, oregano oil) have variable results in lowering *Eimeria* fecal egg counts (FECs). *Eimeria* induce immunotolerance from their host through interleukin-10 (IL-10) cytokine recruitment. Ionophores, such as monensin, are the common approach to feed additive management of coccidiosis.

OBJECTIVES

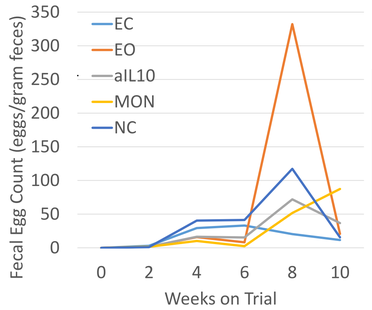
To evaluate the use of aIL-10, essential oils and monensin in newly relocated dairy heifers and determine their effects on fecal egg counts for 3 common *Eimeria* species.

MATERIALS & METHODS

- 160 recently transported Holstein heifers (12-14 wk old and 119-132 kg BW)
- Heifers were transported ~240 km in groups of 8 or 16 at approximately 3 mos of age (1 mo. after weaning)
- Heifers were grouped 8 per pen with 4 blocks of 5 treatment pens, for 70 days
- Heifers were randomly assigned to one of 5 treatments at arrival
- Pen bedding was mixed and replenished weekly along the length of the barn, distributing *Eimeria* to all pens
- Daily health scoring (respiratory and digestive) using Univ. of WI Vet School system (McGuirk, 2008) for first 14 days. All health treatments were recorded.
- Calves with significant scouring were treated with Corid. Pen FEC averages did not include Corid-treated heifers.
- 5 treatments on the fecal egg shedding (FEC) of *E. auburnensis*, *E. bovis* and *E. zuernii*. Treatments:
  - Positive Control (MON): 160 mg/head/d of sodium monensin
  - Anti IL-10 (aIL-10): fed egg yolks containing 1100 µg/head/d of antibody to a peptide of IL-10 during wk 3-4 on the study
  - Essential oils (EO): proprietary blend of cinnamaldehyde, thymol, oregano oil
  - Egg control (EC): fed egg yolks without antibodies to IL-10, equal volume to aIL-10, during wk 3-4 on the study
  - Negative Control (NC): No medicated feed provided
- Diets:
  - All heifers fed 3.2 kg grower diet/d (2 feedings/d)
  - Grower was reduced to 2 kg/d at 6 wk, then to 0.6 kg/d at wk 7 to transition to a TMR.
  - Free-choice grass hay was provided daily when fed grower
  - At wk 8, only a TMR was offered
- Sampling:
  - Rectal fecal samples taken at wk 0, 2, 4, 6, 8, and 10 and analyzed for *Eimeria* count by species (eggs/g) using FLOTAC technique (Cringoli et al., 2010)
  - FEC averaged by pen before analysis
- Statistics: Analyzed as a randomized complete block design with pen as the experimental unit. Effects were analyzed with a mixed model ANOVA in SAS with repeated measures and ranked for normality. Chi-square analysis was used to analyze FEC data.

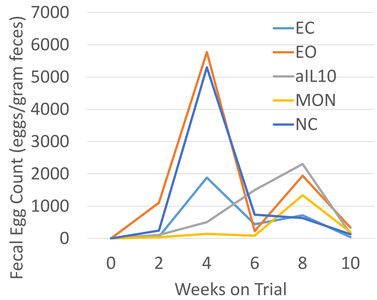
RESULTS

***Eimeria auburnensis* fecal egg count by week and treatment with SE**



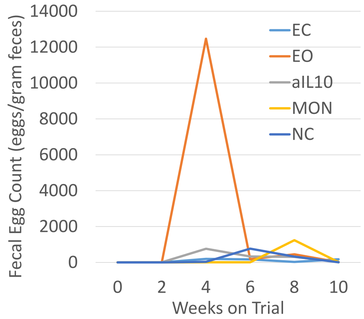
	Control Egg		Essential Oil		aIL10		Monensin		Negative Control	
Week	FEC	SE	FEC	SE	FEC	SE	FEC	SE	FEC	SE
0	0	0	0	0	0	0	0	0	0	0
2	3	195	2	195	2	195	2	195	1	196
4	29	3200	16	3200	16	2950	10	2990	41	3110
6	33	280	8	284	15	265	2	258	41	276
8	20	508	332	527	72	485	52	463	117	485
10	12	71	21	70	37	65	88	63	16	66

***Eimeria bovis* fecal egg count by week and treatment with SE**



	Control Egg		Essential Oil		aIL10		Monensin		Negative Control	
Week	FEC	SE	FEC	SE	FEC	SE	FEC	SE	FEC	SE
0	0	0	0	0	0	0	0	0	0	0
2	54	195	1108	195	110	195	39	195	241	196
4	1885	3203	5769	3203	504	2953	143	2991	5298	3113
6	441	280	229	284	1500	265	86	258	736	276
8	719	508	1942	527	2306	485	1339	463	633	485
10	42	71	337	70	141	65	194	63	131	66

***Eimeria zuernii* fecal egg count by week and treatment with SE**



	Control Egg		Essential Oil		aIL10		Monensin		Negative Control	
Week	FEC	SE	FEC	SE	FEC	SE	FEC	SE	FEC	SE
0	0	0	0	0	0	0	0	0	0	0
2	4	195	5	195	6	195	3	195	3	196
4	195	3203	12471	3203	759	2953	9	2991	34	3113
6	173	280	185	284	331	265	8	258	771	276
8	30	508	452	527	313	485	1240	463	321	485
10	174	71	14	70	36	65	17	63	5	66

SUMMARY

- Eggs were not present at wk 0, with greater prevalence at wk 4 and 6 for all treatments except MON ($P < 0.05$), and no differences among treatments in positive prevalence by wk 8 and 10 ($P > 0.10$)
- At wk 4 and 8, FEC increased for all species, consistent with the life cycle of *Eimeria*
- There was evidence of reduced monensin efficacy or excessive environmental *Eimeria* load for the 3 *Eimeria* species with lack of significant difference ($P > 0.10$) between NC and MON treatments for:
  - wks 2 and 4 for *E. auburnensis*
  - wks 6, 8 and 10 in *E. bovis*
  - wks 2 and 4 for *E. zuernii*
- aIL-10 and EO fecal counts were not different ($P > 0.05$) than MON counts at many time points:
  - EO fecal counts were significantly different than MON counts ($P < 0.05$) only in wks 4 and 6 for *E. zuernii*, and wks 2 and 4 for *E. bovis*
  - aIL-10 fecal counts were different ($P < 0.05$) than MON counts only in wks 4 and 6 for *E. zuernii*, and wk 6 for *E. bovis*
- EO fecal counts increased significantly above the other treatments and the NC in wk 8 for *E. auburnensis* and wk 4 for *E. zuernii*
- This essential oil mix appeared to favor fecal shedding of *E. auburnensis* and *E. zuernii* in different weeks but wasn't significantly different than NC; just more variable

CONCLUSIONS

- Potential monensin resistance after extended exposure (6-8 wk) to high environmental loads among 3 species of *Eimeria*
- Similar fecal counts between monensin treated heifers and those treated with essential oils or aIL-10.

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REFERENCES

- McGuirk, S.M. 2008. Disease management of dairy calves and heifers. Vet. Clin. North Am. - Food Anim. Pract. 24:139–153. doi:10.1016/j.cvfa.2007.10.003.
- Cringoli, G., L. Rinaldi, M.P. Maurelli, and J. Utzinger. 2010. FLOTAC: New multivalent techniques for qualitative and quantitative copromicroscopic diagnosis of parasites in animals and humans. Nat. Protoc. 5:503–515. doi:10.1038/nprot.2009.235.