Growth and health of recently transported dairy heifers fed a novel antibody to interleukin-10

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ADSA 2019-T15

DEPARTMENT OF DAIRY SCIENCE
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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; zurnii; or auburnesis*). There are a number of coccidia control medications that are effective; however evaluation of alternative measures is needed for producers that cannot use or elect to not use preventative medications. Eimeria species have the unique capability to induce production of interleukin-10 (IL-10) in the intestines which down-regulates immune response and allows *Eimeria* to proliferate when preventative medication is not used. An antibody to IL-10 has been shown to help improve growth of chickens infected with *Eimeria*, but no data are available in dairy heifers.

OBJECTIVES

To evaluate the use of aIL-10 in newly relocated dairy heifers and determine its effect on disease incidence (coccidia prevalence and respiratory disease), feed intake, growth, and feed efficiency

MATERIALS & METHODS

- 160 recently transported Holstein heifers (13.7±0.8 wk old and 125.9±13.0 kg BW)
- Heifers were transported (~240 km) in groups of 8 or 16 at approximately 3 mos of age (1 mo. after weaning) with 8 heifers randomly assigned to a pen on arrival
- Every 4 pens of heifers were considered a block (5 blocks with 20 pens total) with each pen randomly assigned one of four treatments and remained on study for 70 d.
- Treatments:
  - Positive Control (ION): Sodium monensin provided at 160 mg/head/d
  - Negative Control (NEG): No medicated feed provided
  - Egg Control (EC): Fed egg yolks from sham immunized chickens for first 14 days
  - Anti IL-10 (aIL-10): Fed egg yolks from chickens immunized against IL-10 (1100 µg aIL-10/head/d) for the first 14 days after arrival
- Diets: All heifers fed 3.2 kg grower feed/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, a TMR was only offered.
- Measurements:
  - Weights at wk 0, 2, 4, 8, and 10 of study
  - Body measurements at wk 0 and 10 of study
  - Daily health scoring (respiratory and digestive) using Univ. of WI Vet School system (McGuirk, 2008) for first 14 days. All health treatments were recorded.
  - Fecal samples taken at wk 0, 2, 4, and 8 and analyzed for *Eimeria* concentration (eggs/g) using FLOTAC technique (Cringoli et al., 2010)
  - Serum samples taken at wk 0, 2, 4, and 8 analyzed for IgG and IgA concentration
- Statistics: Analyzed as a randomized complete block design with pen as the experimental unit. Chi-square analysis was used to analyze fecal coccidia data.

RESULTS

Table 1. Diet ingredient and nutrient composition

	TMR					
Item	TMR	Haylage	HMC	SBM	Grass hay	Grower
Ingredient, % of DM						
Haylage	68.0	-	-	-	-	-
HMC	24.9	-	-	-	-	-
SBM	7.1	-	-	-	-	-
DM, %	54.9	38.5	67.0	90.2	90.1	88.5
CP, %	15.8	18.1	6.88	47.7	10.8	18.8
NDF, %	28.7	44.0	9.04	8.37	58.9	13.0
NDFd, %	52.6	52.5	—	—	60.4	52.8
Starch, %	25.3	—	76.2	—	—	45.3
Ash, %	8.00	12.3	2.00	8.67	12.5	6.66

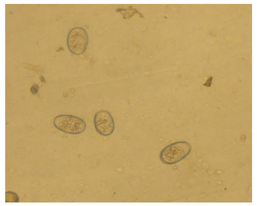
Table 2. Heifer growth, intake, and efficiency

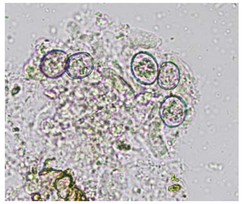
	Treatment					Trt
Item	NEG	EC	aIL-10	ION	SEM	(*P* =)
Initial BW, kg	125.2	126.1	126.7	125.4	5.02	0.96
Final BW, kg	191.3	190.8	193.0	195.3	6.90	0.64
BW gain, kg	66.1	64.7	66.3	69.9	5.14	0.21
ADG, kg/d	0.94	0.92	0.95	0.99	0.07	0.20
DMI, kg/d	4.31	4.30	4.13	4.20	0.22	0.27
Feed efficiency, kg DMI/kg gain	2.07^{ab}	2.14^{a}	1.99^{ab}	1.93^{b}	0.11	0.05
Girth gain, cm	16.4	17.0	17.0	14.9	0.75	0.72
Length gain, cm	14.0	13.6	16.4	15.7	0.58	0.18
Hip height gain, cm	12.1	12.2	13.4	15.2	0.59	0.22

Table 3. Fecal coccidia concentration

	Treatment					Trt
Item	NEG	EC	aIL-10	ION	SEM	(*P*=)
Log Coccidia						
d 0	0	0	0	0	-	-
d 11	0.95	1.17	0.67	0.17	0.21	0.75
d 25	5.28^{a}	3.69^{b}	5.16^{a}	1.35^{c}	0.21	< 0.01
d 53	4.86	5.06	5.09	4.90	0.21	1.00

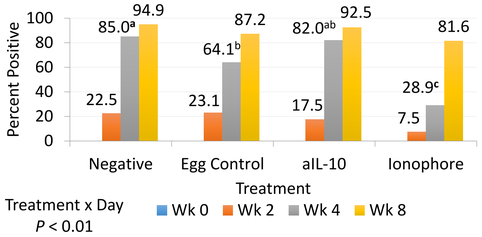
$^{a-c}$Lower case superscripts means within row with different superscripts differ (P ≤ 0.05)





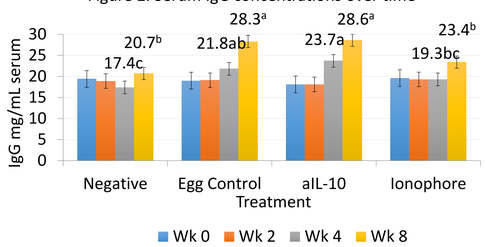
Pictures 1 and 2. *Eimeria bovis* (left) and *Eimeria zurnii* in fecal samples

Figure 1. Prevalence of fecal samples positive for coccidia



Treatment x Day
P < 0.01

Figure 2. Serum IgG concentrations over time



SUMMARY

- Fecal *Eimeria* prevalence was zero at wk 0 and increased throughout the study
- Use of anti IL-10 did not reduce prevalence of heifers with fecal samples positive for Eimeria. Sodium monensin reduced prevalence of positive fecal samples at wk 2 and 4 but was similar to other treatments at wk 8.
- Log transformed coccidia counts were lower for ION at wk 4 compared to other treatments (P < 0.01). At wk 8, all treatments had high, but similar coccidia counts.
- Overall treatment rates for clinical scours was 0% of ION, 2.5% of EC, 7.5% of NEG, and 12.5% of aIL-10 heifers.
- Body weight gain and DMI were similar across treatments (P > 0.20)
- Feed efficiency was improved for heifers fed ION compared to EC (P < 0.01) with no differences among other treatments
- Serum IgG content was increased at wk 8 for both aIL-10 and EC compared to NEG and ION (P < 0.01)
- Serum IgA (data not shown) was not affected by treatment (P=0.59), but increased at each sampling time (P <0.01)

CONCLUSIONS

- Feeding of anti IL-10 did not reduce prevalence of positive fecal Eimeria samples or the Eimeria concentration. However, the prevalence of Eimeria was very low until 4 weeks after arrival and the anti IL-10 was provided only during the first 2 weeks. Providing anti IL-10 when the infection rate is high may have improved the effectiveness of the antibody.
- Use of an ionophore reduced Eimeria prevalence and concentration until 8 weeks after arrival, but feed efficiency was similar to anti IL-10 and negative control

ACKNOWLEDGMENTS

- This project was supported by the USDA National Institute of Food and Agriculture, Hatch project 1013011.
- The authors thank the herd staff of the Marshfield ARS for animal care and assistance with sampling

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