

Effects of second iron injection before weaning on growth performance, hematological parameters, and fecal score of pigs fed nursery diets with different dietary iron levels under natural disease challenge

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Iron(III) Dextran



Introduction

An iron injection to newborn piglets is a common practice in swine production as newborn piglets are susceptible to iron deficiency anemia.

A secondary iron injection before weaning may be needed for piglets having a longer suckling period as hemoglobin level could be declined from d 21 of age after the first injection.

After weaning, high level of dietary iron in nursery diets could lead to the proliferation of pathogenic bacteria resulting in postweaning diarrhea.

Objectives

To demonstrate effects of secondary iron injection before weaning in combination with dietary iron levels in the nursery diets on growth performance, hematological parameters, and fecal score of pigs under natural disease challenge.

Materials and Methods

A total of 70 piglets from 7 litters at d 2-3 of age

- Weaning at approximately 27-30 days of age
- 4 weeks of nursery period

Treatments

- **All pigs received 200 mg iron-dextran injection at d 2-3 of age**
 1. Negative control (NC): No additional iron supplementation (Basal diet: 100 mg/kg iron)
 2. NC+IRON: Secondary iron-dextran injection (200 mg) at d 5 after first injection + NC diets
 3. Positive control (PC): Additional iron supplementation (100 mg/kg of nursery diets)
 4. PC+IRON: Secondary iron-dextran injection (200 mg) at d 5 after first injection + PC diets
- A common iron-dextran product (UNIFERON[®] 200, Pharmacosmos, Inc.) for both injections
- Corn-soybean meal-based diets with 100 ppm iron
- Piglets were naturally challenged with *E.coli* and rotavirus after weaning

Table 1: Complete blood count analysis and liver and serum iron content at day 24 of experiment (weaning)

	1 inj.	2 inj.	SEM	P-value
Red blood cell, M/ μ l	5.72	6.18	0.18	0.08
Hemoglobin, g/dL	9.72	11.74	0.42	0.01
Hematocrit, %	34.13	40.21	1.28	0.01
MCV, fl	59.64	66.4	1.76	0.03
MCH, pg	17.05	19.42	0.74	0.04
MCHC, g/dL	28.53	29.19	0.48	0.38
Platelet, K/ μ l	479.06	303.45	56.66	0.06
Liver Fe, ppm DM	372.78	1424.03	250.26	0.08
Serum Fe, ppm	1.65	2.27	0.3	0.16

Results

Second iron injection increased liver iron content at weaning ($P=0.08$), serum iron ($P<0.05$), hemoglobin, and hematocrit levels until d 13 postweaning with no effect at d 27 postweaning. The second iron injection increased body weight at d 27 postweaning ($P=0.05$), overall ADG ($P=0.08$) and ADFI ($P<0.05$). Additionally, it significantly improved the fecal score throughout the nursery phase ($P<0.05$).

The pigs fed the PC diets had greater hemoglobin and hematocrit levels ($P<0.05$) at d 27 postweaning and lower fecal score ($P=0.09$; tendency) in d 13-27 postweaning than the NC diets. The ANCOM showed a higher abundance of the bacterial taxon Lactobacillales in the 2-injection group than the 1-injection group at weaning.

Table 2: Growth performance and fecal score in nursery period

	Suckling		Nursery		SEM	P-value		
	1 inj.	2 inj.	0 ppm	100 ppm		Suc	Nur	S*N
Body weight, kg								
day 0 postweaning	9.71	9.91	9.77	9.84	0.67	0.15	0.57	0.97
day 13 postweaning	11.04	11.81	11.52	11.33	0.52	0.16	0.71	0.71
day 27 postweaning	18.82	20.78	20.01	19.59	0.81	0.05	0.62	0.33
ADG, kg/day								
day 0-13 postweaning	0.103	0.147	0.135	0.115	0.04	0.21	0.55	0.65
day 13-27 postweaning	0.555	0.641	0.607	0.59	0.04	0.07	0.68	0.26
day 0-27 postweaning	0.337	0.403	0.379	0.361	0.03	0.08	0.58	0.34
ADFI, kg/day								
day 0-13 postweaning	0.289	0.346	0.329	0.306	0.02	0.02	0.26	0.83
day 13-27 postweaning	0.921	1.035	0.998	0.958	0.04	0.03	0.36	0.18
day 0-27 postweaning	0.617	0.704	0.676	0.644	0.03	0.01	0.26	0.24
G:F								
day 0-13 postweaning	0.343	0.416	0.398	0.362	0.11	0.47	0.72	0.88
day 13-27 postweaning	0.604	0.619	0.610	0.614	0.04	0.69	0.91	0.88
day 0-27 postweaning	0.546	0.572	0.561	0.577	0.05	0.55	0.94	0.75
Fecal score (1=normal, 4=severe diarrhea)								
day 0-13 postweaning	2.40	2.24	2.31	2.33	0.12	0.22	0.85	0.55
day 13-27 postweaning	2.12	1.69	2.03	1.78	0.12	0.01	0.09	0.94
day 0-27 postweaning	2.26	1.96	2.17	2.05	0.11	0.03	0.32	0.78

Table 3: Complete blood count analysis in nursery period

	Suckling		Nursery		SEM	P-value		
	1 inj.	2 inj.	0 ppm	100 ppm		Suc	Nur	S*N
Hemoglobin, g/dL								
day 6 postweaning	10.49	12.95	11.86	11.58	0.54	0.01	0.62	0.69
day 13 postweaning	9.92	11.45	10.51	10.86	0.41	0.01	0.41	0.78
day 27 postweaning	10.61	10.85	10.40	11.06	0.23	0.31	0.01	0.17
Hematocrit, %								
day 6 postweaning	37.71	44.05	41.18	40.58	1.68	0.01	0.73	0.6
day 13 postweaning	32.29	35.90	33.39	34.8	1.13	0.01	0.23	0.78
day 27 postweaning	34.6	35.04	33.77	35.88	0.74	0.52	0.01	0.42
Platelet, K/μl								
day 6 postweaning	529.03	323.9	404.6	448.33	96.6	0.06	0.66	0.34
day 13 postweaning	694.14	477.83	516.05	655.92	61.5	0.01	0.03	0.08
day 27 postweaning	406.83	384.5	411.5	379.83	32.0	0.43	0.27	0.32

Conclusion

The second iron injection to pigs improved postweaning hematological parameters and impacted the fecal microbiome. Additionally, the second iron injection improved growth performance with treated pigs weighing an additional 1.96kg at the end of the nursery phase ($P=0.05$), consuming 0.087 kg/day more during the nursery phase ($P<0.05$), and improving ADG ($P=0.08$). The pigs that received a second injection also had significantly improved fecal scores ($P<0.05$).

The 100 ppm of dietary iron supplementation increased hematological parameters and reduced fecal score in the late nursery period.