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Comparison of Gleptosil with iron Dextran for anemia prevention in young pigs

Abstract

Gleptosil, a commercial iron product, was compared with iron dextran for the prevention of iron deficiency anemia in young pigs. Using 26 litters, pigs (within each litter) were randomly allotted to one of the three treatments: 1) control (no iron), 2) iron dextran (200 mg) and 3) Gleptosil (2OO mg). Blood was collected at 0, 10, 21 and 50 days post-treatment for red blood cell count (RBC), hematocrit (HCT), hemoglobin (HGB) concentration, serum iron concentration and serum iron-binding capacity (IBC). At 21 days, 30 pigs (one pig/treatment from each of 10 litters) were killed to determine mg non-heme iron (NHFe) in liver and spleen, bile IBC and concentrations of bile and fecal iron. There were no differences (P<.05) between iron sources in 3- or 8-week body weight or in any of the blood or tissue characteristics. In contrast, control pigs gained less (P<.05) weight and had lower (P<.05) RBC, HGB, HCT, serum iron, and liver and spleen NHFe than those that received iron dextran or Gleptosil. Serum IBC was greater (P<.05) for the control than for iron-treated pigs. These results demonstrate that the iron from iron dextran and Gleptosil can be used with similar efficiency for anemia prevention in young pigs.; Swine Day, Manhattan, KS, November 11, 1982

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Comparison of Gleptosil with Iron Dextran for Anemia Prevention in Young Pigs[1]

D.S. Pollmann, J.E. Smith, J.S. Stevenson, D.A. Schoneweis and R.H. Hines

Summary

Gleptosil, a commercial iron product, was compared with iron dextran for the prevention of iron deficiency anemia in young pigs. Using 26 litters, pigs (within each litter) were randomly allotted to one of the three treatments: 1) control (no iron), 2) iron dextran (200 mg) and 3) Gleptosil (200 mg). Blood was collected at 0, 10, 21 and 50 days post-treatment for red blood cell count (RBC), hematocrit (HCT), hemoglobin (HGB) concentration, serum iron concentration and serum iron-binding capacity (IBC). At 21 days, 30 pigs (one pig/treatment from each of 10 litters) were killed to determine mg non-heme iron (NHFe) in liver and spleen, bile IBC and concentrations of bile and fecal iron. There were no differences ($P<.05$) between iron sources in 3- or 8-week body weight or in any of the blood or tissue characteristics. In contrast, control pigs gained less ($P<.05$) weight and had lower ($P<.05$) RBC, HGB, HCT, serum iron, and liver and spleen NHFe than those that received iron dextran or Gleptosil. Serum IBC was greater ($P<.05$) for the control than for iron-treated pigs. These results demonstrate that the iron from iron dextran and Gleptosil can be used with similar efficiency for anemia prevention in young pigs.

Introduction

Value of supplemental iron for anemia prevention in young pigs has been recognized for many years. Researchers have demonstrated that 200 mg iron from a single intramuscular injection of either iron dextran or Gleptosil is necessary to maintain hemoglobin levels above 9 g/dl while realizing maximum growth rate of nursing pigs. It has been postulated that Gleptosil, a macromolecular complex (gleptoferron) of beta-ferric oxyhydroxide and dextran glucoheptonic acid, is superior to iron dextran in anemia prevention for young pigs. Therefore, this study was conducted to compare the effects of Gleptosil and iron dextran on anemia prevention in young pigs.

Experimental Procedure

Twenty-six litters from crossbred sows were used to compare Gleptosil[2] (sterile aqueous colloidal solution of beta-ferric oxyhydroxide and dextran glucoheptonic acid) with iron dextran[3] for prevention of iron deficiency anemia in young pigs. Pigs within each litter were allotted randomly to one of the three

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[1]Financial support for authors' research has come partially from Continental
[2]Animal Health, Division of Burns-Biotec., Omaha, NE.
[3]Continental Animal Health, Division of Burns-Biotec., Omaha, NE.
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treatments: 1) control (no iron), 2) Fe dextran (200 mg iron) or 3) Gleptosil (200 mg iron). Pigs were bled before treatments (day 0) to establish a baseline within 24 hours postpartum. Iron injections were given intramuscular using a 20-gauge needle. Littler size was equalized within 3 days postpartum. Blood was collected with sterile blood collection tubes with no additive from pigs by puncture of anterior vena cava at 10, 21 and 50 days postpartum. An aliquot was transferred before coagulation into a vacutainer containing an anticoagulant EDTA. Red blood cell count (RBC), hemoglobin (HGB and hematocrit (HCT) were determined using a Coulter[4] counter. Serum was harvested after centrifugation and transferred via polyethylene pipet into polypropylene micro test tubes and frozen for later determination of serum Fe and IBC.

Iron and total IBC in serum, and bile and iron in feces, were determined with coulometric techniques. Non-heme iron in the liver and spleen was measured and total non-heme iron (mg) content of liver and spleen was calculated (µg/g of tissue).

No creep feed was offered before 21 days of age, but baby pigs had access to sow feed. Sows were housed in an environmentally regulated building with a total slatted floor under the farrowing crates, covered with plastic-coated woven wire. Pigs were weaned at approximately 21 days of age and moved into a nursery with galvanized woven-wire floor and were offered a starter feed (Table 1).

At 21 days of age, 30 pigs (one pig from each treatment from 10 litters) were killed by electrocution to determine iron concentration in the liver, spleen, bile and feces. Spleen and liver were weighed on a top loading balance to the nearest 0.1 g and frozen for later analyses. Using a sterile 3-ml draw vacutainer tube (no additive), bile was collected for iron analysis.

Results and Discussion

Treatment effects on mortality rate and growth are shown in Table 2. Mortality rate was not different among treatments. These results are similiar to the earlier findings of English researchers, who observed a 2.6% reduction in mortality rate when Gleptosil (2,890 piglets from 288 litters) was compared with parenteral iron product (6,633 piglets from 631 litters) in field trials.

Iron-treated pigs were heavier ($P<.01$) at 3 and 8 weeks than control pigs. Pigs that did not receive the iron injection were 3.6 lbs lighter at 8 weeks of age. Several studies have demonstrated that supplemental iron will increase weight gain in the nursing pig. Contrary to English researchers, no differences were observed between iron sources on weight at 3 or 8 weeks.

As expected, at day 0, no differences were observed among the three treatments. At 10 and 21 days, there were no differences between iron sources for RBC, but control pigs had lower ($P<.01$) RBC than iron-treated pigs.

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[4]Coulter Counter, Model S Sr, Coulter Electronics, Inc., Hialeah, FL, 33010.

However, by 50 days, no differences in RBC counts were present among treatments. Overall, RBC counts were higher ($P<.01$) for the iron-treated than control pigs during suckle period. Iron dextran-treated pigs tended to have higher ($P<.08$) HGB levels at 50 days than Gleptosil-treated pigs. Iron dextran-treated pigs had higher ($P<.05$) HGB levels at 50 days than the control group but not the Gleptosil group.

The HCT levels were higher ($P<.01$) for the iron-treated group than for the control pigs. Iron dextran-treated pigs had higher ($P<.06$) HCT levels at 10 days than did the Gleptosil-treated pigs. At 50 days, iron-treated pigs were not different from the controls.

At birth all treatment groups had low serum iron and total IBC (quantitative ability of transferrin to bind iron). During the suckling period (0 to 21 days), pigs in the control group developed anemia typical of iron deficient pigs. Serum iron declined ($P<.05$) at day 10 and serum total IBC increased ($P<.05$). In iron-treated groups, serum iron and total IBC increased ($P<.05$) during the suckling period compared with controls, but did not differ from each other. At 50 days, the control serum iron had increased ($P<.05$) and total IBC had decreased so that differences between treatments no longer existed.

There were no differences in liver weight and liver as percentage of the body weight (table 4) of pigs slaughtered at 3 weeks of age (average weight 10.3 lbs). Liver non-heme iron (mg) levels were higher ($P<.05$) for the iron-treated pigs than for the control pigs. There were no differences observed between the iron sources in liver non-heme iron levels.

Spleen weight and spleen as percentage of body weight were not different among treatments. Spleen non-heme iron (mg) levels were higher ($P<.05$) for iron-treated pigs compared to controls. Non-heme iron concentrations were higher in the liver than in the spleen.

Iron in the bile and bile IBC were not affected by treatment (Table 5). Fecal iron concentrations also were not affected by treatment. Bile iron and IBC and fecal iron appear to be less sensitive indicators of iron deficiency in young pigs than blood or tissue parameters.

These results demonstrate that iron dextran and Gleptosil are effective hematinics for anemia prevention in young pigs. Furthermore, the data indicate that the iron from the two hematinics is utilized for hemoglobin synthesis and iron storage in the suckling pig with similar efficacy.

Table 1. Composition of Starter Diet

Ingredient	%
Sorghum grain	52.50
Soybean meal, solvent	25.00
Whey, dried	20.00
Dicalcium phosphate	1.15
Limestone	.80
Salt	.10
L-lysine	.10
Vitamin-trace mineral mix	.35

Table 2. Comparison of Gleptosil with Iron Dextran on Mortality and Growth

Item	Treatment Control	Iron Dextran	Gleptosil
No. pigs	46	87	84
No. died	5	10	6
Mortality, %	10.9	11.5	7.1
Avg. wt., lbs			
Birth	3.3	3.3	3.3
3 wk[a]	10.6	11.7	12.3
8 wk[a]	29.0	82.6	32.6

[a]Control vs iron dextran + Gleptosil (P<.01).

Table 3. Comparison of Gleptosil with Iron Dextran on Blood Characteristics

Item	Period, days	Treatment Control	Iron dextran	Gleptosil
Red blood cell count, 10[b]				
	0	5.89 (40)[a]	5.76 (65)	5.71 (73)
	10	4.86 (38)	5.93 (67)	5.74 (72)
	21	5.16 (43)	6.53 (76)	6.38 (57)
	50	6.31 (29)	6.08 (54)	5.89 (41)
Hemaglobin, g/100 ml[b]				
	0	10.9	10.7	11.1
	10	7.1	11.6	11.1
	21	7.8	11.9	12.1
	50	9.6	11.7	10.2
Hematocrit, %[bc]				
	0	34.1	33.1	33.0
	10	23.0	35.3	34.2
	21	10.2	35.3	34.4
	50	29.0	30.4	31.3
Serum Fe, µg/dl[bc]				
	0	40.2	43.8	46.6
	10	29.5	136.8	135.1
	21	47.2	155.8	144.8
	50	115.7	119.2	122.8
Serum Fe binding capacity, µg/dl[b]				
	0	151	164	150
	10	474	313	320
	21	654	382	396
	50	393	375	380

[a]Number of pigs.
[b]Iron dextran + Gleptosil vs control (P<.01)
[c] Day effect (P<.01).

Table 4. Comparison of Gleptosil with Iron Dextran on Non-Heme in Liver and Spleen[a]

Item	Treatment Control	Iron Dextran	Gleptosil
Liver			
Wt, g	111	117	112
% of body wt.	2.51	2.38	2.47
Non-heme Fe, µg/g[b]	10.6	154.8	145.4
None-heme Fe, mg	1.1	16.5	13.0
Spleen			
Wt, g	9.6	10.0	8.5
% of body wt.	.21	.19	.23
Non-heme Fe, µg/g[b]	3.5	27.6	26.2
Non-heme Fe, mg[b]	.02	.23	.23

[a]Represents 30 pigs (3 pigs from 10 litters); age, 3 weeks; average weight, 10.3 lbs.
[b]Control vs iron dextran + Gleptosil ($P<.05$).

Table 5. Comparison of Gleptosil with Iron Dextran on Bile and Fecal Iron[a]

Item	Treatment Control	Iron Dextran	Gleptosil
Bile Fe, µg/ml	121	128	102
Bile IBC, µg/ml	108	286	259
Fecal Fe, µg/g	228	286	259

[a]Represents 30 pigs (3 pigs from 10 litters); age, 3 weeks; average weight 10.3 lbs.