Sprayed Dried Eggs as a Source of Immune Globulins for SEW Pigs

B. G. Harmon, M. Latour, and S. Norberg
Department of Animal Sciences

Introduction

Successful segregated early weaning (SEW) programs are dependent on excellent sanitation, rigid biosecurity and use of dense, highly nutritive diets that include ingredients containing a rich source of immune globulin (IgG). Pigs that are of SEW age only have the immune protection originating from gamma globulin obtained from colostrum during the neonatal period.

A constant supply of an external source of immune globulin to bathe the gastro-intestinal tract in these young pigs enhances feed intake, reduces diarrhea and improves performance. Spray dried porcine plasma protein has been the primary feed ingredient used in SEW diets to provide immune globulin.

More recently, spray dried eggs (SDE) have been used as an alternative to plasma protein (Harmon, Latour, and Durst, 2000). Egg yolk is a rich source of immune globulins (IgY in yolk). Akita and Nakai (1992) reported the IgY in yolk to be about 10 mg/mL of egg yolk.

- Each egg contains about 16 g of yolk
- Assume egg yolk has a density of approximately 1 g/mL
- Therefore, 10 mg of IgY/mL of yolk x 16 mL IgY per yolk and per egg = 160 mg/yolk or per egg
- Contents of an egg (minus shell) weigh about 55 g, which contains about 24.5% solids, or 13.475 g of solids per egg
- Therefore, the concentration of IgY in dried eggs is about 11,870 ppm IgY (160mg IgY/13.475 g = .01187 mg IgY/mg of dried egg or 11,870 mg/kg (ppm)
- In summary, spray dried eggs contains about 12,000 ppm IgY

Rose et al. (1974) at Cambridge University have reported the immune globulin fraction in different chicken and egg components.

Sample	IgY or IgG mg/mL
Hen Serum	6
Egg Yolk	25
Egg White	<.003

Using calculations as demonstrated above, the Rose et al. data showed a concentration of lgY in yolk and ultimately in dried eggs of 30,000 ppm.

The research by Rose et al, is noteworthy in that the immune globulin in yolk is more than 4 times as concentrated as it is in serum or plasma. By either reference SDE is a rich source of immune globulin.

Sprayed dried eggs are an excellent source of nutrients, earning the reputation as the world's most complete food.

Protein, %	48.00
Lysine, %	3.72
Methionine/Cystine, %	2.79
Threonine, %	2.23
Tryptophan, %	0.74
Fat, %	28.00
Metabolizable energy, kcal/lb	2285.70
Phosphorus, %	0.80

Sprayed dried eggs used in these studies is made from unfertilized eggs that are stored at 34° F and processed within 4 days of laying. The product is pasteurized before drying for 8 minutes at 143° F.

Material and Methods

Pigs were weaned at 14 to 18 days and transported to the Purdue University segregated early weaning unit at the Animal Science Research and Education Center. Pigs were purchased from high health herds. Segregated early weaning biosecurity procedures were maintained in a minimal traffic environment.

In two trials, 168 pigs in trial 1 and 70 pigs in trial 2, averaging 16 days of age, were blocked by weight and randomly allotted to treatments. The diets used in these trials are shown in tables 1 and 2. Diets contained either 0 or 5.0% spray dried eggs. Diets were formulated to constant lysine and metabolizable energy levels. Differences in performance should be attributable to immune globulin differences in the diets.

Results

Growth performance for pigs in trials 1 and 2 are shown in tables 3 and 4, respectively. In each trial the pigs receiving spray dried eggs consumed more feed and gained significantly more weight during the 10-d post-weaning period (19 and 13 % respectively in trials 1 and 2).

Feed efficiency values, as feed per unit of gain, were numerically in favor of the pigs receiving spray dried eggs, but were not significantly improved. Typically pigs receiving spray dried eggs or plasma protein will have greater feed consumption in the first diets post weaning.

Implications

These trials demonstrate that spray dried eggs can provide an excellent alternative to porcine plasma protein as a source of immune globulins in phase 1 diets for SEW pigs.

Since diets were formulated to equal lysine and metabolizable energy, both of which are present in excellent quantities in spray-dried eggs, the improved performance could be attributed to the high level of IgY contained in spray dried eggs.

References

Akita, E. M. and S. Nakai. 1992. Immunoglobulins from egg yolk; isolation and purification. J. Food Sci 57; 629-634.

Harmon, B. G., M. A. Latour and J. Durst, 2000. Spray dried eggs as an ingredient in diets for SEW pigs. Purdue Swine Day pp 6-9.

Norberg, S. E., J. B Durst, M. A. Latour, and B. G. Harmon, 2001. Spray dried eggs as an ingredient in diets for SEW pigs. J. Anim Sci 79; suppl 2. 219.

Norberg, S. E., H. Dong, M. A. Latour, and L. Adeola, 2002. Energy and Amino Acid utilization in spray dried egg determined with ducks. Southern Poultry Science Society, 2002.

Rose, M. E., E. Orlans and M. Buttress, 1974. Immunoglobulin classes in the hen's egg; their segregation in yolk and white. Euro. J. Immunology, 4:521-523.

Table 1. Diet Composition for trial 1

Spray dried eggs, %	**0**	**5**
Ingredients, %		
Corn	35.44	38.10
Soybean Meal, 48% CP	29.85	23.30
Dried Whey	15.00	15.00
Meat and Bone Meal	5.00	5.00
Fish Meal	5.00	5.00
Spray Dried Eggs	0.00	5.00
Animal Fat	5.51	4.51
Di-calcium Phosphate	1.34	1.33
Limestone	0.54	0.51
Salt	0.20	0.20
Lysine-HCl	0.33	0.34
Methionine	0.08	0.20
Mecadox	0.25	0.25
Swine Vit Px	0.30	0.30
Swine Tr Min Px	0.15	0.15
Zinc Oxide	0.20	0.20
Sodium Selenite Px	0.05	0.05
Calculated Composition		
Lysine, %	1.62	1.62
Methionine/Cystine, %	0.82	0.82
Metabolizable energy, kcal/lb	1497.00	1497.00
Threonine, %	0.92	0.92
Tryptophan, %	0.27	0.27

Table 2. Diet composition for trial 2

Spray dried eggs, %	0	5
Ingredients, %		
Corn	50.08	47.34
Soybean Meal, 48% CP	16.51	23.08
Dried Whey	15.00	15.00
Poultry Byproduct Meal	5.00	5.00
Fish Meal	4.00	4.00
Spray Dried Eggs	0.00	5.00
Animal Fat	1.48	2.52
Di Calcium Phosphate	1.29	1.41
Limestone	0.07	0.03
Salt	0.20	0.20
Lysine-HCl	0.41	0.41
Methionine	0.02	0.06
Mecadox	0.25	0.25
Swine Vit Px	0.30	0.30
Swine Tr Min Px	0.15	0.15
Zinc Oxide	0.20	0.20
Sodium Selemete Px	0.05	0.05
Calculated Composition		
Lysine, %	1.62	1.62
Methionine/Cystine, %	0.82	0.82
Metabolizable energy, kcal/lb	1519.00	1519.00
Threonine, %	0.92	0.92
Tryptophan, %	0.26	0.27

Table 3. Effect of spray dried eggs on nursery pig growth performance, trial 1

Spray Dried Eggs, %	0	5
Daily Gain, lb/d	0.449	0.535
Daily Feed Intake, lb/d	0.449	0.520
Feed/Gain	1.00	0.97

Pigs were raised in segregated early weaning environment; first diet after weaning at 16 days of age.
10 day study, 84 pigs per treatment.

Table 4. Effect of spray dried eggs on nursery pig growth performance, trial 2

Spray Dried Eggs, %	0	5
Daily Gain, lb/d	0.399	0.449
Daily Feed Intake, lb/d	0.557	0.579
Feed/Gain	1.40	1.29

Pigs were raised in segregated early weaning environment; first diet after weaning at 16 days of age.
10 day study, 35 pigs per treatment.