SPRAY-DRIED EGG PROTEIN IN
DIETS FOR EARLY-WEANED STARTER PIGS

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Summary

A total of 197 weanling pigs (initially
11.7 lb and 18 d of age) was used in a 28
d growth trial to determine the influence of
spray-dried egg protein as a protein substi-
tute for either soybean meal or spray-dried
porcine plasma on starter pig performance.
Pigs were blocked by weight with six
replications per treatment and seven to eight
pigs per pen. Dietary treatments were
based on level of egg protein (3 or 6%)
added to a phase I high nutrient dense diet
and the method of substitution (egg protein
replacing either soybean meal or porcine
plasma). A sixth treatment served as an
initial test of an egg protein blend. Treat-
ments were as follows: 1) Control, 2 and 3)
3% or 6% egg protein substituted for soy-
bean meal, 4 and 5) 3% or 6% egg protein
substituted for spray-dried porcine plasma,
and 6) 4% egg protein blend substituted for
spray-dried porcine plasma. The control
diet contained 7.5% porcine plasma, 1.75%
spray-dried blood meal, and 20% dried
whey. The egg products were substituted
for the soybean meal or the porcine plasma
on an equal lysine basis, maintaining the
lysine level of all diets at 1.5%. Total
added fat was maintained at 5% All pigs
were fed a common diet from d 14 to 28
postweaning. During phase I, average daily
gain (ADG) indicated that spray-dried egg
protein was a suitable substitute for up to
3% porcine plasma or up to 6% soybean
meal. However, pigs consuming the diet
substituting 6% egg protein for porcine
plasma had poorer ADG. Feed efficiency
became poorer as spray-dried egg protein
was substituted for 6% soybean meal or 3
to 6% porcine plasma. This indicates that
the fat in spray-dried egg protein may be
less available than soybean oil. Pigs fed
the diet containing the 4% egg protein
blend had poorer ADG and F/G than pigs
fed the control diet. This indicates that 4%
egg protein blend cannot effectively replace
porcine plasma. These data suggest that
spray-dried egg protein can replace at least
6% soybean meal and up to 3% porcine
plasma in the phase I diet without reducing
ADG; however, further research must be
conducted to determine the digestibility of
fat in the egg protein product.

Introduction

Recent research at Kansas State Uni-
versity has evaluated several protein sources
in diets for early-weaned pigs. These
proteins sources include spray-dried porcine
plasma, spray-dried blood meal, dried skim
milk, and various soy protein concentrates.
Spray-dried egg protein has an excellent
amino acid profile; however, few data are
available evaluating the use of egg protein
in starter pig diets. If egg protein proves to
be a suitable protein source for the young

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and animals in this experiment.
pig, it could be substituted for porcine plasma to decrease the cost of the diet while improving performance. Therefore, the objective of this experiment was to determine the influence of egg protein substituted for either soybean meal (SBM) or porcine plasma on starter pig performance.

**Procedures**

A total of 197 pigs (initially 18 d and 11.7 lb) was used in this 28-d growth trial. Pigs were blocked by weight and allotted to one of the six dietary treatments for a total of eight to 10 pigs/pen and six pens/treatment. Dietary treatments were based on level of egg protein (3 or 6%) added to the phase I diet and the method of substitution (egg protein replacing either soybean meal or porcine plasma). A sixth treatment served as an initial test of an egg protein blend. Treatments were as follows: 1) Control, 2 and 3) 3% or 6% egg protein substituted for soybean meal, 4 and 5) 3% or 6% egg protein substituted for spray-dried porcine plasma, and 6) 4% egg protein blend for spray-dried porcine plasma.

The trial was divided into two phases. Experimental diets were fed only during phase I (d 0 to 14 postweaning). All experimental diets were formulated to 1.5% lysine, .9% calcium, .8% phosphorus, and at least .36% methionine. The control diet was a high nutrient density diet containing 7.5% spray-dried porcine plasma, 1.75% spray-dried blood meal, and 20% dried whey. Spray-dried egg protein (3 or 6%) replaced either soybean meal (treatments 2 and 3) or porcine plasma (treatments 4 and 5) on an equal lysine basis. Experimental diet 6 was formulated by replacing porcine plasma in the control diet with 4% egg protein blend on an equal lysine basis. Total fat additions were maintained at 5% with soybean oil or the egg protein products serving as the added fat sources. Experimental diets fed during phase I were pelleted. A common corn-soybean meal-based diet containing 2.5% spray-dried blood meal and 10% dried whey was fed to all pigs during phase II (d 14 to 28 postweaning). This diet was formulated to 1.25% lysine, .9% calcium, and .8% phosphorus and fed in a meal form.

Pigs were housed in an environmentally controlled nursery in 5 x 7 ft pens. They were allowed ad libitum access to feed and water. Pigs were weighed and feed disappearance were measured on d 7, 14, 21 and 28 after weaning to determine ADG, ADFI, and F/G.

Data were analyzed as a randomized complete block design. General linear model procedures were used with initial weight serving as the blocking factor. Single degree of freedom contrasts were used to separate treatment means.

**Results and Discussion**

During phase I (d 0 to 14 postweaning), pigs fed diets containing 3% egg for plasma or 3 or 6% for SBM had similar ADG. However, pigs consuming the diets substituting 6% spray-dried egg protein for porcine plasma and 4% egg protein blend for porcine plasma had poorer ADG (P<.06 and P<.03, respectively). Additionally, feed efficiency was depressed as spray-dried egg protein was substituted for 6% soybean meal (P<.05) or 3 (P<.07) and 6% (P<.01) porcine plasma. Substituting 4% egg protein blend for spray-dried porcine plasma resulted in a 5% poorer F/G when compared to the positive control. These data indicate that the fat in spray-dried egg protein and egg protein blend may be less available than soybean oil.

During phase II (d 14 to 28 postweaning) and the overall trial, pigs fed the diet substituting 6% spray-dried porcine plasma with spray-dried egg protein had the poorest ADG (P<.01) and ADFI (P<.01). Over the entire trial, replacing 6% spray-dried porcine plasma with spray-dried egg protein resulted in poorer F/G (P<.05) compared with pigs fed the other experimental treatments. Pigs fed all other treatments had similar growth performance. These data
imply that replacing 6% spray-dried porcine plasma with spray-dried egg protein depresses performance during both phases (I and II) of production.

In conclusion, decreasing the amount of spray-dried porcine plasma in the phase I diet from 7.5 to 4.5% by replacement with spray-dried egg protein results in a $40/ton reduction in diet cost. Therefore, diet cost can be reduced in phase I and similar average daily gains acquired by replacing 3% spray-dried porcine plasma with spray-dried egg protein. However, these results warrant further investigation addressing the availability of fat in the spray-dried egg protein product.

Table 1. Composition of Diets d 0 to 14 Postweaning

<table>
<thead>
<tr>
<th>Ingredient, %</th>
<th>Control</th>
<th>3% Egg</th>
<th>6% Egg</th>
<th>3% Egg</th>
<th>6% Egg</th>
<th>4% EPB</th>
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<tbody>
<tr>
<td>Corn</td>
<td>45.54</td>
<td>46.92</td>
<td>48.31</td>
<td>45.34</td>
<td>45.13</td>
<td>46.78</td>
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<td>Soybean meal (48% CP)</td>
<td>15.96</td>
<td>12.67</td>
<td>9.39</td>
<td>15.96</td>
<td>15.96</td>
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<tr>
<td>Porcine plasma</td>
<td>7.50</td>
<td>7.50</td>
<td>7.50</td>
<td>5.88</td>
<td>4.27</td>
<td>2.88</td>
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<tr>
<td>Egg protein</td>
<td>--</td>
<td>3.00</td>
<td>6.00</td>
<td>3.00</td>
<td>6.00</td>
<td>--</td>
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<tr>
<td>Egg protein blend (EPB)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>4.00</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>5.00</td>
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<td>2.93</td>
<td>3.97</td>
<td>2.93</td>
<td>4.20</td>
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<td>Dried whey</td>
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<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
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<td>Spray-dried blood meal</td>
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<td>Monocalcium phosphate</td>
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<td>1.89</td>
<td>1.86</td>
<td>1.82</td>
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<tr>
<td>Monosodium phosphate</td>
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<td>--</td>
<td>--</td>
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<td>.67</td>
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<tr>
<td>Limestone</td>
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<td>.67</td>
<td>.66</td>
<td>.67</td>
<td>.66</td>
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<td>Antibiotic</td>
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<td>Copper sulfate</td>
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<td>.08</td>
<td>.08</td>
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<td>L-lysine</td>
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<td>.10</td>
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<td>.10</td>
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<td>DL-methionine</td>
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<td>.05</td>
<td>.02</td>
<td>.03</td>
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<td>Vitamin premix</td>
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<td>.25</td>
<td>.25</td>
<td>.25</td>
<td>.25</td>
<td>.25</td>
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<tr>
<td>Trace mineral premix</td>
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<td>.15</td>
<td>.15</td>
<td>.15</td>
<td>.15</td>
<td>.15</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
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</tbody>
</table>

*All diets were formulated to contain 1.5% lysine, .9% calcium, .8% phosphorus and at least .365% methionine and .52% sodium.

*b 3% egg = 3% egg substituted for SBM.

*c 6% egg = 6% egg substituted for SBM.

*d 3% egg = 3% egg substituted for spray-dried porcine plasma.

* e 6% egg = 6% egg substituted for spray-dried porcine plasma.

*f 4% EPB = 4% egg protein blend substituted for spray-dried porcine plasma.

*Provided 150 g of apramycin per ton of feed.
Table 2. Influence of Spray-Dried Egg Products on Starter Pig Performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>3% Egg&lt;sup&gt;f&lt;/sup&gt;</th>
<th>6% Egg&lt;sup&gt;g&lt;/sup&gt;</th>
<th>3% Egg&lt;sup&gt;h&lt;/sup&gt;</th>
<th>6% Egg&lt;sup&gt;i&lt;/sup&gt;</th>
<th>4% EPB&lt;sup&gt;j&lt;/sup&gt;</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG, lb</td>
<td>.59&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.55&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.55&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.48&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.51&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.0</td>
</tr>
<tr>
<td>ADFI, lb</td>
<td>.672</td>
<td>.66</td>
<td>.69</td>
<td>.69</td>
<td>.65</td>
<td>.62</td>
<td>9.5</td>
</tr>
<tr>
<td>F/G</td>
<td>1.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.25&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.25&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.37&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1.22&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>7.1</td>
</tr>
</tbody>
</table>

D 0 to 14

| ADG, lb    | 1.050<sup>b</sup> | 1.00<sup>b</sup> | 1.00<sup>b</sup> | 1.05<sup>b</sup> | .93<sup>c</sup> | 1.03<sup>b</sup> | 7.9  |
| ADFI, lb   | 1.660<sup>b</sup> | 1.605<sup>b</sup> | 1.54<sup>b</sup> | 1.62<sup>b</sup> | 1.43<sup>c</sup> | 1.60<sup>b</sup> | 7.4  |
| F/G        | 1.58    | 1.61                | 1.55                | 1.54                | 1.57                | 1.55                | 6.1  |

D 14 to 28

| ADG, lb    | .819<sup>b</sup> | .784<sup>b</sup> | .77<sup>b</sup> | .80<sup>b</sup> | .70<sup>c</sup> | .77<sup>b</sup> | 7.7  |
| ADFI, lb   | 1.166<sup>b</sup> | 1.131<sup>b</sup> | 1.12<sup>b</sup> | 1.15<sup>b</sup> | 1.04<sup>c</sup> | 1.11<sup>b</sup> | 7.3  |
| F/G        | 1.43<sup>b</sup> | 1.45<sup>b,c</sup> | 1.44<sup>b</sup> | 1.44<sup>b</sup> | 1.50<sup>c</sup> | 1.44<sup>b</sup> | 4.6  |

<sup>a</sup>One hundred and ninety seven weanling pigs were used (initially 11.7 lbs and 21 d of age), 7 to 8 pigs/pen with 6 pens per treatment. All diets were formulated to contain 1.5% lysine, .9% calcium, .8% phosphorus and at least .365% methionine and .52% sodium.

<sup>b,c,d,e</sup>Means within the same row without a common superscript differ (P<.05).

<sup>f</sup>3% egg = 3% egg substituted for SBM.

<sup>g</sup>6% egg = 6% egg substituted for SBM.

<sup>h</sup>3% egg = 3% egg substituted for spray-dried porcine plasma.

<sup>i</sup>6% egg = 6% egg substituted for spray-dried porcine plasma.

<sup>j</sup>4% EPB = 4% egg protein blend substituted for spray-dried porcine plasma.