Supplemental effects of By-O-reg on growth efficiency and health status of growing-finishing pigs

Sung Woo Kim

Department of Animal Science, North Carolina State University, Raleigh NC 27695
Introduction

- Acidifiers
- Clay minerals
- Enzymes
- Essential oils
- Nutraceuticals such as Cu, Zn
- Plant extracts
- Prebiotics
- Probiotics

Thacker, 2013; Vondruskova et al., 2010
**Introduction: Plant extracts in pig nutrition**

<table>
<thead>
<tr>
<th>Plant</th>
<th>The effect observed</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oregano, cinnamon, Mexican pepper</td>
<td>Decreased ileum total microbial mass, Increase lactobacilli ratio</td>
<td>Kim et al. (2006); Manzanilla et al. (2004)</td>
</tr>
<tr>
<td>Sangovit (alkaloids of Macleaya cordata)</td>
<td>Increase weight gain, G:F by growing pigs</td>
<td>Borovan (2004)</td>
</tr>
<tr>
<td>Cinnamon, thyme, oregano</td>
<td>Inhibited pathogenic E. coli in piglet intestine</td>
<td>Namkung et al. (2004)</td>
</tr>
<tr>
<td>Clove, oregano</td>
<td>Growth performance of pigs close to pig fed antibacterials</td>
<td>Costa et al. (2007)</td>
</tr>
<tr>
<td>Specific blend of herbal extracts</td>
<td>Increase ADG, improve FCR in finishing pigs</td>
<td>Liu et al. (2008)</td>
</tr>
<tr>
<td>Aged garlic extract, Allicin</td>
<td>Improve body weight, morphological properties of intestinal villi and non-specific defense mechanism of pigs</td>
<td>Zanchi et al. (2008); Kim et al. (2005)</td>
</tr>
</tbody>
</table>
Introduction: Our experience

- To determine the effects of dietary supplementation of phytobiotics (oregano, cinnamon bark, anise, citrus) on growth efficiency of nursery pigs
- This phytobiotic product had unique and strong aroma.
- 0.1% dietary inclusion caused aroma in the entire barn.
- Results have been published in a journal showing limited benefits.
Phytobiotics and Organic Acids As Potential Alternatives to the Use of Antibiotics in Nursery Pig Diets

S. K. Kommera, R. D. Mateo, F. J. Neher and S. W. Kim
Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX 79409, USA

ABSTRACT: Two experiments were conducted to determine the effect of phytobiotics and organic acids on growth performance of nursery pigs as an alternative to antibiotics. Phytobiotics refer bioactive compounds from plant materials including essential oils and herbal extracts. In Exp. 1, 144 pigs, weaned at 23.4±0.3 d age, were allotted to three dietary treatments. Treatment diets were: 1) NC (no antibiotics and no phytobiotics); 2) PC (NC+carbadox, 50 mg/kg); and 3) PB (NC+phytobiotics; 0.1% PEP1000-1®). Each treatment had six replicates with eight pigs per pen. Pigs were fed the experimental diets for 5 wks in 3 phases (phase 1 for 2 wk; phase 2 for 2 wk; phase 3 for 1 wk). In Exp. 2, 192 pigs, weaned at 19.2±0.3 d age, were allotted to three dietary treatments: 1) NC; 2) PC; and 3) PBO (NC+phytobiotics; 0.2% or 0.1% PEP1000-1® and organic acids; 0.4% or 0.2% Biotronic® for the phase 1 and 2, respectively) with eight replicates per treatment and eight pigs per pen. Pigs were fed the assigned diets for 5 wks in 2 phases (phase 1 for 2 wk; phase 2 for 3 wk). Body weights were measured at the beginning of the experiment and at the end of each week in both Exp. 1 and 2. Feed
Introduction: Our experience
Introduction: By-O-reg
Introduction: By-O-reg

Beta-1,3-glucan and FOS

Cassia

Oregano

Vitamin C
Introduction: By-O-reg

Beta-1,3-glucan and FOS
Oregano
Cassia
Vitamin C
Encapsulation
Hypothesis

- Phytobiotics and herbal extracts may have impact on gut health and growth performance of pigs. However, correct inclusion level is critical to the success due to potential negative impacts on feed intake. Encapsulation of phytobiotics would mask negative impacts on feed intake and successfully deliver benefits to the gut.
Objective

• To determine the effects of a long term supplementation of encapsulated herbal extracts (By-O-reg, Advanced Ag Products, Hudson, SD) on growth efficiency and health status of growing-finishing pigs
Materials and Methods

• By-O-reg as a source of herbal additives (Advanced Ag Products, Hudson, SD)

• 120 growing pigs (Smithfield Premium Genetics) at 25 kg BW for 6 wk feeding (phase 4 and 5)

• 4 treatments (10 pens/trt and 3 pigs/pen) based on a 2 x 2 factorial arrangement:
  • 1\textsuperscript{st} factor: AGP (0 or 0.05% Tylan 40)
  • 2\textsuperscript{nd} factor: Herbal additive (0 or 0.05% By-O-reg)

• Randomized complete block design
  • Blocks: initial BW and sex
Materials and Methods

- Blood sampling to obtain plasma at the end
  - A pro-inflammatory cytokine, TNF-α, as an indicator of systemic inflammation
  - Protein carbonyl as an indicator of systemic oxidative stress
  - IgG as an indicator of systemic humoral immunity
### Materials and Methods

**Composition of the experimental diets, %**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>P4</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>70.1</td>
<td>76.5</td>
</tr>
<tr>
<td>Dehulled SBM</td>
<td>25.0</td>
<td>20.0</td>
</tr>
<tr>
<td>L-Lys HCl</td>
<td>0.24</td>
<td>0.23</td>
</tr>
<tr>
<td>L-Thr</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>DL-Met</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Poultry fat</td>
<td>2.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Composition</th>
<th>P4</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME, Mcal/kg</td>
<td>3.40</td>
<td>3.35</td>
</tr>
<tr>
<td>SID Lys, %</td>
<td>0.98</td>
<td>0.85</td>
</tr>
<tr>
<td>SID Met+Cys, %</td>
<td>0.55</td>
<td>0.48</td>
</tr>
<tr>
<td>SID Trp, %</td>
<td>0.59</td>
<td>0.52</td>
</tr>
<tr>
<td>SID Thr, %</td>
<td>0.18</td>
<td>0.16</td>
</tr>
<tr>
<td>Calcium, %</td>
<td>0.66</td>
<td>0.59</td>
</tr>
<tr>
<td>STTD P, %</td>
<td>0.31</td>
<td>0.27</td>
</tr>
<tr>
<td>Analyzed:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP, %</td>
<td>17.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Fat, %</td>
<td>4.8</td>
<td>3.5</td>
</tr>
</tbody>
</table>
• Statistical analysis:
  – Proc MIXED (SAS ver. 9.3)
    • Factors, and sex block: fixed effects
    • Initial BW block (5): random effect
  – AGP, herbal additive, and interaction effects
    • $P < 0.05$: significance
    • $0.05 \leq P < 0.10$: tendency
Results: final BW

- AGP: $P = 0.636$
- Herbal additive: $P = 0.703$
- Interaction: $P = 0.006$

Bar chart showing body weight in kg for different AGP levels:
- 0% AGP: 72.04 kg, 74.50 kg
- 0.05% AGP: 74.57 kg, 72.67 kg

Legend:
- Red: 0.00% By-O-reg
- Black: 0.05% By-O-reg
Results: ADG (wk 1 to 6)

AGP: \( P = 0.619 \)
Herbal additive: \( P = 0.789 \)
Interaction: \( P = 0.004 \)

- **0.00% By-O-reg**
- **0.05% By-O-reg**

<table>
<thead>
<tr>
<th>AGP</th>
<th>ADG, kg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% AGP</td>
<td>1.129</td>
</tr>
<tr>
<td>0.05% AGP</td>
<td>1.194</td>
</tr>
<tr>
<td>0.00% By-O-reg</td>
<td>1.198</td>
</tr>
<tr>
<td>0.05% By-O-reg</td>
<td>1.143</td>
</tr>
</tbody>
</table>
Results: ADFI (wk 1 to 6)

AGP: $P = 0.261$
Herbal additive: $P = 0.246$
Interaction: $P = 0.026$

- 0% AGP
  - 0.00% By-O-reg: 2.486 kg/d
  - 0.05% By-O-reg: 2.534 kg/d

- 0.05% AGP
  - 0.00% By-O-reg: 2.535 kg/d
  - 0.05% By-O-reg: 2.390 kg/d
Results: G:F (wk 1 to 6)

AGP: \( P = 0.014 \)
Herbal additive: \( P = 0.023 \)
Interaction: \( P = 0.278 \)

![Bar chart showing G:F for different AGP and herbal additive levels.](chart.png)

- **0% AGP**
  - 0.00% By-O-reg: 0.455
  - 0.05% By-O-reg: 0.473

- **0.05% AGP**
  - 0.00% By-O-reg: 0.474
  - 0.05% By-O-reg: 0.481
Results: changes of $P$ value

$P$ value

- ADG (interaction)
- ADFI (interaction)
- G:F (By-O-reg)

Weeks:
- Wk 1
- Wk 2
- Wk 3
- Wk 4
- Wk 5
- Wk 6
Results: serum TNF-α

AGP: $P = 0.659$
Herbal additive: $P = 0.171$
Interaction: $P = 0.190$

<table>
<thead>
<tr>
<th>AGP</th>
<th>0% By-o-reg</th>
<th>0.05% By-o-reg</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% AGP</td>
<td>72.33</td>
<td>75.45</td>
</tr>
<tr>
<td>0.05% AGP</td>
<td>81.89</td>
<td>75.67</td>
</tr>
</tbody>
</table>
Results: serum IgG

AGP: $P = 0.341$
Herbal additive: $P = 0.011$
Interaction: $P = 0.370$

<table>
<thead>
<tr>
<th>AGP</th>
<th>0% AGP</th>
<th>0.05% AGP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00% By-O-reg</td>
<td>10.42</td>
<td>10.37</td>
</tr>
<tr>
<td>0.05% By-O-reg</td>
<td>9.33</td>
<td>8.18</td>
</tr>
</tbody>
</table>
Results: serum protein carbonyls

AGP: $P = 0.341$

Herbal additive: $P = 0.001$

Interaction: $P = 0.827$

Plasma PC, nmo/mg P

0% AGP

- 0.00% By-o-reg: 5.21
- 0.05% By-o-reg: 3.88

0.05% AGP

- 0.00% By-o-reg: 5.45
- 0.05% By-o-reg: 4.26
Conclusions

- When By-O-reg was provided to healthy growing pigs, it increased final BW, ADG when pigs were fed non-medicated feed.
- Benefits disappeared with medication.
- By-O-reg can enhance feed efficiency regardless of feed medication.
- By-O-reg reduced oxidative stress and immune responses, benefiting overall health and growth.
- Benefits of By-O-reg were shown from week 4.
Further questions

- Based on this study, By-O-reg benefited growth and health of pigs fed non-medicated feed.
- Supplemental level may need to be reduced when used with AGP.
- By-O-reg may enhance loin drip loss.
- Benefits of By-O-reg would be from enhanced gut health.
- Benefits of By-O-reg could be enhanced under challenge condition: heat stress, toxin, disease, oxidative stress, etc.
Acknowledgement
Thank you!

Any questions?

Kim Lab