Evaluation of the Phytogenic Potential (I-Rosa canina) of the Weaned Piglets Diets on Copper and Zinc Absorption and Elimination through Faeces

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Abstract. A 35 days study on 8 piglets (average initial weight 12 kg) kept in individual metabolic cages evaluated the effects of using supplementary Rosa canina in piglet diets on Cu, Zn absorption and elimination through faeces. The piglets were assigned to two groups (C and E) and received the same basal diet (corn and soybean meal) with 18.27% CP and 3300 Kcal ME. The diet for group E contained 3% supplemental Rosa canina and the premix was decreased with 10%. Both the ingesta and excreta were recorded throughout the experimental period. Average weekly samples of the ingesta and faeces were organized for each individual pig and assayed for Cu and Zn. For Cu and Zn the coefficients of apparent absorption were not significantly different, (C- 59.93% ± 7.67 and E – 61.87% ± 3.52 for Cu and C- 66.61% ± 8.42 and E – 63.36% ± 7.31 for Zn). Observing the evolution of the experimental group, one can notice the stabilization of the amounts of Cu excreted through faeces after 15 days of treatment, which stabilized implicitly the amounts of Cu absorbed by the animal organism. The results show that the 10% decrease of the dietary premix and the use of supplemental dog rose (Rosa canina) preparation, the amounts of Cu and Zn eliminated through the faeces decreased by 13.45% and 4.93%, respectively.

Keywords: Rosa canina, absorption, elimination, minerals, piglet

INTRODUCTION

Minerals represent about 5% of the total body mass of pigs. Many of them are essential for most of the basal metabolic processes taking place in the animal organism. They play an important role indigestion, protein, lipid and glucose metabolism; chromosomes, enzymes, blood, bone tissue, milk and hair structure. Minerals also are important to reproduction, growth and the immune system. To meet the nutritional requirements they are supplemented to pig diets as mineral premixes. Generally, the trace elements supplementation of pig diets is done according to the recommendations of the mineral premixes manufacturers, which are 2-3 times higher than the requirement determined by the scientific research. Minerals are usually added to the diets as oxides, phosphates, carbonates, chlorides etc. Such substances are used in piglet feeding during the weaning and post-weaning period. The EU considers that the excessive supplementation with minerals from inorganic sources is harmful both for food safety and for the environment [Nicholson et al., 2007].

The weaning period involves the shift of piglets from liquid feed (maternal milk) to a solid diet and this is a critical period for the piglets. This is the age at which these animals can develop their enzymatic equipment, their immunity and capacity of intestinal absorption. This is also the period when infectious diseases appear frequently [Acda et al, 2002], which made
antibiotics to be added, with prophylactic purpose, to piglet diets. The European legislation currently bans the use of antibiotics in farm animals’ diets. An alternative to antibiotics, with growth promoting role, was to use copper and zinc in amounts much in excess of the nutritional requirements. Thus, significant amounts of copper and zinc, heavy metals with toxic potential, according to EU directives, appear in the faeces. These minerals build up in the soil and have toxic effects on the plants, microorganisms and they turn into an environmental problem in the areas with intensive animal production (Nicholson and Chambers, 2006).

Within this context, it is useful to study the phytogenic additives as alternative to the excessive use of mineral premixes in pig diets. The Rosaceae family is reputed for a very long period for its therapeutic activity, its members being used chiefly as medicinal plants. The physiological properties of the fruits are due mainly to their high content of phenols. The phenols have a wide range of biochemical activities, such as antioxidative, antimutagenic and anticarcinogenic effects (Nakamura, 2003). The fruits contain vitamins and minerals, the whole complex bestowing them a high nutritive value (Sen, 1996). Rosa genus includes over 100 species spread in Europe, Asia and North America (Nilsson, 1997). In Romania, the species with a wide spreading is Rosa Canina (dog rose).

This paper describes the results of an experiment conducted on weaned piglets, which monitored comparatively the effects of a dog rose (Rosa Canina) supplement of copper and zinc elimination through faeces, the dietary mineral premix being reduced by 10%.

**MATERIALS AND METHODS**

The experiment used 8 growing pigs (Landrace × Large White), 15-40 kg, castrated males, half brothers, assigned to two randomized groups (control – C; experimental – E). The experiment had a duration of four weeks. The animals were housed in individual metabolic cages located in the experimental house for pigs of the Laboratory for nutrition physiology of IBNA Balotesti.

The pigs had free access to a diet of compound feeds produced by IBNA. The diets were calculated using the mathematical model for energy and protein metabolism simulation (Burlacu et al, 1983). The diets were isoproteic and isocaloric and contained corn and soybean meal as basic ingredients (Table 1). The diet for group E contained additionally 3% dog rose supplement. The diet for group E contained 0.9% premix, while the diet for group C contained 1.0% premix with 2500 ppm Cu and 10000 ppm Zn.

The dog rose fruits had been collected from central and south-eastern Oltenia; they were dried and ground and then included in the compound feed.

<table>
<thead>
<tr>
<th>Items</th>
<th>C</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein (CP) - g %</td>
<td>21.36</td>
<td>21.36</td>
</tr>
<tr>
<td>Metabolisable energy (ME)-MJ/kg feed</td>
<td>12.17</td>
<td>12.22</td>
</tr>
<tr>
<td>Calcium (Ca) - g %</td>
<td>1.40</td>
<td>1.58</td>
</tr>
<tr>
<td>Phosphors (P) - g %</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Copper (Cu) – mg / Kg</td>
<td>38.51</td>
<td>36.00</td>
</tr>
<tr>
<td>Zinc (Zn) – mg / Kg</td>
<td>131.37</td>
<td>120.99</td>
</tr>
</tbody>
</table>

*Premix IBNA: Zoofort P1+2: 2500 ppm Cu, 10000 ppm Zn*
The pigs were monitored daily throughout the duration of the experiment, and their health state has been checked. The given feed was recorded on a daily basis and the piglets were weighed weekly.

Each week, for five days, the given feed, the left over feed and the excreta (faeces and urine) were recorded accurately for each individual pig and the data were used to draw out the mineral balance of the pigs. During the five days of balance, individual samples of ingesta and excreta were collected from each pig. The chemical determinations on the ingesta, faeces and urine samples, corroborated with the daily records of feed intake and with the daily amounts of faeces and urine were used to calculate the coefficients of apparent absorption of the dietary minerals, the coefficient of retention and the coefficient of utilization.

The minerals were analyzed with an atomic absorption spectrometer Thermo Electron– SOLAAR M6 Dual Zeeman fitted with deuterium lamp for background correction. Class A glassware was used for transvasation, dilution and storage; porcelain crucibles with lids were used for calcinations. Merck high purity reagents were used. Stock 1000 ppm solutions traceable to SRM from NIST were used to calibrate the device.

StatView software was used to calculate the evolution of mineral intake and excretion as well as the correlations during the balance period.

RESULTS AND DISCUSSION

The records of the intakes and gains have shown significant differences between the groups, for p < 0.05. Figure 1 shows the evolution of the feed intake and of the average daily gain throughout the experiment.

The graph above shows the positive correlation between the parameters, existing a directly proportional increase between the weight gain (g/day) and the compound feed intake (g CF/day).

As shown in Table 1, both the concentration of Zn and that of Cu were significantly lower for the experimental group, which used 0.9% of the mineral premix. The chemical composition of the dog rose showed 4.07 mg Cu/kg dog rose and 9.57 mg Zn/kg dog rose, the data being lower than those reported in the literature (Ercisli, 2007).
The coefficients of the mineral balance (absorption, retention, utilisation) were calculated from the primary experimental data and from the chemical analyses; the results showed higher values than the ones reported by the literature (Case et al., 2002; Carlson et al., 2004; Buff et al., 2005). Table 2 shows the mineral balance data. No significant differences between groups were observed.

Tab. 2

<table>
<thead>
<tr>
<th>Element</th>
<th>Coefficient</th>
<th>C</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Absorption coefficient (%)</td>
<td>59.93 ± 7.67</td>
<td>61.86 ± 3.52</td>
</tr>
<tr>
<td>Copper</td>
<td>Retention coefficient (%)</td>
<td>53.86 ± 2.63</td>
<td>58.81 ± 2.46</td>
</tr>
<tr>
<td></td>
<td>Utilization coefficient (%)</td>
<td>99.51 ± 0.50</td>
<td>99.58 ± 0.32</td>
</tr>
<tr>
<td>Zinc</td>
<td>Absorption coefficient (%)</td>
<td>66.61 ± 8.42</td>
<td>63.36 ± 7.31</td>
</tr>
<tr>
<td></td>
<td>Retention coefficient (%)</td>
<td>61.86 ± 6.90</td>
<td>61.14 ± 2.94</td>
</tr>
<tr>
<td></td>
<td>Utilization coefficient (%)</td>
<td>99.50 ± 0.23</td>
<td>99.45 ± 0.37</td>
</tr>
</tbody>
</table>

Where s= significantly different for p≤0.05

The correlation between the ingested and absorbed amounts of metal was plotted (Figs. 2 and 3) using the balance data, these data being relevant for the evaluation of the intestinal absorption.
A very good correlation between the considered parameters was observed, the plots being characterised by the following correlation coefficients: for copper – R = 0.9026 (C) and R = 0.9423 (E); for zinc – R = 0.9315 (C) and R = 0.9663 (E).

The balance data were used to determine the Cu and Zn eliminated through faeces during the experiment, as shown in figures 5 and 6.

Figure 5 shows in the experimental group, after 15 days of treatment, an almost constant amount of Cu in the faeces (plateau plot). The data for the control group show a constant increase of the amount of Cu in the faeces throughout the experiment.

As Zn is concerned, an inflexion point can be noticed after 21 days of experiment, after that moment the amount of eliminated zinc having very close values, while in the control group the values increased constantly.

Table 3 shows the average amounts of Cu and Zn eliminated through faeces for the overall experimental period.
The results show that the 10% decrease of the dietary premix and the use of supplemental dog rose preparation, the amounts of Cu and Zn eliminated through the faeces decreased by 13.45% and 4.93%, respectively.

CONCLUSIONS

The absorption, retention and utilization coefficients for Cu and Zn didn’t differ significantly between the groups (p< 0.05).

A very good correlation was noticed for both groups between the amounts of ingested and absorbed metals.

The 10% reduction of the dietary premix and the use of 3% supplemental dog rose preparation, decreased by 13.45% and 4.93%, respectively, the amounts of Cu and Zn eliminated through the faeces; no significant differences in animal performance was noticed between the two groups.

REFERENCES


85