Iron Deficiency in Outdoor Pig Production

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Summary
It has been claimed that outdoor-reared suckling piglets do not need iron supplementation. According to practical experience, outdoor-reared and non-iron-supplemented piglets show a lower performance in comparison with their iron-supplemented counterparts. The purpose of the present study was to determine the effect of iron supplementation on outdoor-reared suckling piglets. In a large Hungarian outdoor pig production unit, 4691 piglets were assigned to one of two treatment groups. Piglets in group 1 (n = 2344): received no iron supplementation, whereas piglets in group 2 (n = 2347) were intramuscularly injected in the neck on day 3 post-partum with 1.5 ml of Ferriphor\textsuperscript{®} 10% solution (TAD Pharmaceutical GmbH, Bremerhaven, Germany). Animal weights, morbidity, haemoglobin concentration and mortality were recorded and analysed. At weaning the iron-injected piglets were significantly (P < 0.05) heavier. The iron-supplemented piglets also revealed significantly (P < 0.01) less pre-weaning morbidity and mortality and higher (P < 0.01) blood haemoglobin concentration compared with the non-injected ones. This study suggests that in order to prevent pre-weaning losses and support piglet health and weight performance, iron supplementation should be administered to piglets in outdoor pig production units.

Introduction
Piglets are born with low iron stores and under indoor production systems they are unable to supplement their iron stores in order to meet their physiological needs (Egeli and Farmstadt, 1999). Rapidly growing suckling piglets have a physiological need for iron that exceeds the amount they can ingest under contemporary production conditions (Kay et al., 1980). Thus, treating piglets may prove beneficial by correcting their haematological status as soon as possible (Dewey et al., 1995). A parenteral form of iron is commonly administered on day 3–6 post-partum to the piglets in Hungary (Bilkei, 1987).

It has been suggested that outdoor-reared piglets in Hungary do not need iron supplementation (Bilkei, 1995, 1996). Despite these statements we have diagnosed iron-deficiency-caused hypochromic, microcytic anaemia in a large outdoor production unit that is a client of our consulting office. The purpose of this study was to determine whether outdoor-reared piglets have better weaning weights, health and blood haemoglobin status when iron injections were administered on day 3 of their lives.

Materials and Methods
The trial was conducted in a nucleus herd of 1200 sows, in Alföld in Hungary between April and September 2001. The animals were crosses of pure-bred Large White and Landrace sows, mated to Duroc boars. The sows and their litters were housed in individual farrowing huts, in large individual paddocks of 80–100 m\textsuperscript{2}, separated by electric fences.

A total of 4691 piglets were assigned to one of two treatment groups: group (G) 1 (n = 2344 piglets from 251 litters): received no extra iron supplementation. In G2 (n = 2347 piglets from 250 litters): the piglets were injected intramuscularly in the neck with 1.5 ml of Ferriphor\textsuperscript{®} 10% solution (TAD Pharmaceutical GmbH, Bremerhaven, Germany) at day 3 post-partum.

Cross-fostering was used to equalize litter size at birth, but no further cross-fostering occurred between the second day of life until weaning on days 34.7 ± 1.8 in G1 and 34.6 ± 1.7 in G2. Within 24 h of birth, the individual piglets were weighed with an electric scale and their weights were rounded up to the next 50-g value. The piglets were processed (teeth clipping, tail docking, ear marks were placed into the right ear with coloured ear tags (Allflex\textsuperscript{®}, Chicago, IL, USA) for individual identification.

Piglet birth weight, number of piglets born alive, piglet weaning weight, morbidity (reduced feed intake, rough hair, wrinkled skin, diarrhoea, fever, joint swellings or signs of respiratory illness), treatments and mortality were recorded on a daily basis. All pre-weaning losses were subjected to post-mortem examination. One randomly selected pig in each litter was subjected to routine examination to determine haemoglobin concentration (g/100 ml, photometrically at 546 nm) at weaning (G1: n = 251, G2: n = 250).

Sow parity, individual sow number were also recorded.
Table 1. Effect of iron supplementation in outdoor-reared piglets

<table>
<thead>
<tr>
<th>Groups (G)</th>
<th>Weaning weights (kg)</th>
<th>Morbidity (%)</th>
<th>Haemoglobin (g/100 ml)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>10.95 (0.81)</td>
<td>15.9</td>
<td>5.1 (1.2), n = 251</td>
<td>16.4</td>
</tr>
<tr>
<td>G2</td>
<td>12.08 (0.79)*</td>
<td>8.9 **</td>
<td>10.1 (1.4)**, n = 250</td>
<td>9.1 **</td>
</tr>
</tbody>
</table>

Group 1 (G1; n = 2344): received no iron supplementation. Group 2 (G2: n = 2347): on day 3 post-partum the piglets were intramuscularly injected in the neck with 1.5 ml of Ferriphor® 10 %. SD in parentheses. *P < 0.05 between groups. **P < 0.01 between groups.

Data were recorded in Quatro-Pro. Descriptive statistics using a mixed model were performed by using PC/SAS (SAS, 1996). Interaction variables were created and models were built with backward elimination using a P-value set at 0.05 to drop variables. Piglets that died were eliminated from the study.

Results

Differences between groups in weaning weight, morbidity, mortality and haemoglobin concentration are presented in Table 1. Birth weights were 1.35 (0.11) kg [mean(SD)] in G1 and 1.35 (0.12) in G2.

Post-mortem examinations of dead piglets in G1 invariably showed the following gross pathologic-anatomical changes: enlarged heart and spleen, enlarged fatty liver, ascites. The iron-supplemented piglets did not reveal these changes.

Discussion

Anaemia in unweaned piglets is primarily due to iron deficiency (Bilkei, 1987). In outdoor production units erythrozoonosis (prevalent in sudden Hungary) and umbilical haemorrhage will produce anaemic piglets. The primary features that distinguish iron deficiency, erythrozoonosis and umbilical haemorrhage are the ages of the affected piglets and the presence of icterus (Bilkei, 1996). Icterus is prominent with erythrozoonosis but it is not seen in cases of iron deficiency. In the present trial the piglets revealed no signs of icterus. Umbilical haemorrhage occurs during the perinatal period and erythrozoonosis tends to be seen in pigs less than 5 days of age, whereas iron deficiency is seen in pigs at 1–2 weeks of age. In iron-deficiency anaemia there is a history (as in the present trial) of failure to administer adequate iron substitution and iron-deficiency anaemia is always associated with reduced growth and higher pre-weaning morbidity and mortality (Bilkei, 1996).

It has been suggested (Bilkei, 1995) that in outdoor production the piglets ingest enough iron from the soil and they do not need iron supplementation. The present study suggests that, at least in this particular nucleus herd there is a necessity for iron supplementation. The weaning weights of the piglets in the present study were high. It must be mentioned that if the growth capacity of the piglets were lower, the iron requirements would also be lower. High weaning weights are markedly influenced by the feeding regime and genetic potential of the piglets.

There are also other reasons why in outdoor production parenteral iron supplementation could be unfavourably regarded. It has been suggested that iron injections may cause an increased risk of piglet morbidity and bacteraemia possibly leading to polyarthritis (Holmgren, 1990). This can especially happen in outdoor production system (Bilkei, 1996). In the present study there was no negative effect of iron injection on the morbidity of the piglets; on the contrary, the iron-supplemented piglets revealed a significantly lower morbidity rate in comparison with the non-injected ones.

In an earlier study (Bilkei, 1996), iron injections were shown to improve resistance to infections. Farms with a low prevalence of disease caused by iron-dependent bacteria, such as Escherichia coli, may increase weaning weights by administering iron (Bilkei, 1996). Other authors have expressed concern (infections, toxicity, inability to use the iron given) about parenteral iron supplementation (Dewey et al., 1995). Such concerns may be based on the experiences of farms that have a high prevalence of E. coli where scouring may be initiated by iron injections (Holmgren, 1990).

The effect of increased weight gain due to iron injection seen in the present study may be specific to the weight capacity of the piglets and the soil composition there. Nevertheless these results for a large number of piglets and during the short 5-month duration of the trial suggest the necessity for iron supplementation in outdoor pig production.