Tail-biting causes considerable economic losses in pig production (Chambers et al., 1995) and has a negative effect on the welfare of the animals (Van Dijk et al., 1984). Tail-biting has been attributed to physical, environmental, nutritional and feeding management, group size, overcrowding, gender, genetic makeup, length of tail, and lack of more suitable objects to occupy the animals (Bilkei, 1994). There are no known published findings on tail-biting in outdoor production.

The present study was performed between January and March 2004 in five identical, neighbouring Croatian outdoor production units of 150 sows each, in the same geographic area. The units received medical and management advice from the same veterinary consulting group. Pretrial abattoir surveys revealed gross pathological lung lesions typical for enzootic pneumonia and Haemophilus parasuis infections. The seroprevalence of antibody to Mycoplasma hyopneumoniae using a Tween 20 Elisa (Bayer) was 0.436–0.710 mean optical density (OD).

The units comprised large paddocks (200 m² for a group of 25–30 weaned pigs from six weeks of age until slaughter at 95–120 kg, n = 458 [241 barrows, 217 gilts]) laid out within a large circle with a small handling and access area at the centre. High investment insulated growing-finishing huts of 20 m² with plastic curtains were designed to house each group. The huts were built with solid floors. The paddocks had no running water so water was given ad libitum twice a day in troughs. Deep straw bedding was renewed by adding 40–50 kg clean dry straw per hut weekly. The pigs were fed with the same commercial meal type diet (Table 1). Pigs were slaughtered at the same age. Animals were individually weighed at weaning and at slaughter.

A cross-sectional study was performed to determine the prevalence and severity of bitten tails and the association of bitten tails with gender. Individual tail-biting scoring (Table 2, modified after Kritas and Morrison, 2004) and treatment of bitten tails were performed.
weekly at the same time in each group. Pigs with bitten tails were treated with Oxytetracyline Spray (Stricker AG) in cases of TS 2 to 3 and with Terramycin LA (Pfizer) injections, and Oxytetracyline Spray in cases of TS4. Chi-square analysis was performed to test the association between tail-biting and gender.

The grade of the lesion was recorded per group by calculating “tail biting score” (TB). Individual pigs were scored for the severity of lesions associated with tail-biting on a score from 0 to 4 as described in Table 2. An overall TB for each group was obtained by summing the products of each score \( N_i \times \text{number of pigs at each score} \) and dividing the sum by the total number of pigs in the group thus:

\[
\frac{N_1 + 2N_2 + 3N_3 + 4N_4}{\text{total number of pigs in group}}
\]

Multiple regression analysis (using a group as the unit) was conducted to investigate the association of prevalence of bitten tails and TB, with animal density (space allowance; number of pigs in a group, and the barrow/gilt ratio within each pasture).

A case-control study was then performed in order to determine the association of severity of lesions with body weights and carcass condemnation at slaughter. Bitten tails along with the root of the tail and surrounding tissues were removed (according to visible pathological changes), the amount of tissue that was condemned (weights were rounded up to 20 g) and recorded. The pigs were weighted individually at slaughter and those weights were rounded up to 1 kg. The matched control comprised the non-bitten pig in the same group.

All measurements and scoring were performed by the same veterinarian. A “main effects ANOVA” was performed to determine the association between body weights and carcass condemnation as dependant variable and TB as independent variable, while controlling the pasture and gender effects. Duncan’s multiple range test was used to compare mean body weights among different scoring of TB. The level of significance was set at \( P < 0.05 \).


The average group-prevalence of bitten tail between for different units were 14.1 ± 2.1% to 20.1 ± 3.0%
The size of a group of pigs might affect the incidence of tail-biting due to hierarchy establishments. A restless group of pigs with an unstable hierarchy would induce social stress and discomfort (Bilkei, 1994). According to Gonyou (1998), social discomfort can be observed to a greater degree in medium sized groups than in larger groups. Bilkei (1994) suggested that lower group size and larger space allowance per pig would reduce tail-biting behaviour. Gonyou (1998) found that reduction in space allowance is far more important in the establishment of a social hierarchy than group size. Moinard et al. (2003) found that at a higher stocking density (>110 kg/m²) the incidence of tail-biting increased by factor of 2.7. However, in another study (Kritas and Morrison, 2004) neither group size nor space allowance affected the prevalence and severity of tail-biting lesions.

Tail-biting seems to result from the pigs' natural tendency to root and chew on objects in their environment (Van Putten, 1969). As outdoor-kept pigs have less social discomfort, more space allowance and more objects to chew on, it seems reasonable to presume that outdoor pigs would not express tail-biting behaviour (Bilkei, 1994). The fact that in the present study outdoor pigs did suffer from tail-biting indicates that factors other than social distress and stocking density may have induced the problem in these animals. Genetics, respiratory problems, possible dietary inadequacies, and general rooting in muddy pastures might all have contributed to the triggering of tail-biting behaviour (Bilkei, 1994). We therefore conclude that raising pigs outdoors does not prevent tail-biting in pigs.

### Table 3

Average slaughter weights (after removal of condemned tissues) and partial carcass condemnation of tail-bitten pigs in growing-finishing outdoor kept animals

<table>
<thead>
<tr>
<th>Score</th>
<th>Pigs, n = 1454</th>
<th>Average weights, kg ± SE</th>
<th>Carcass (tail and tail root) condemnation, kg ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1223</td>
<td>116.9 ± 3.2          a</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>43</td>
<td>114.9 ± 3.3          a</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>102.1 ± 2.7          b</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>101</td>
<td>101.5 ± 3.6          b</td>
<td>1.3 ± 0.2c</td>
</tr>
<tr>
<td>4</td>
<td>42</td>
<td>96.9 ± 3.3           b</td>
<td>1.9 ± 0.3c</td>
</tr>
</tbody>
</table>

\(^{a,b} P < 0.05; \ ^{ac} P < 0.001.\)