Prevention and treatment of tail biting in weaned piglets

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Abstract

The aims of this study were to evaluate four preventive measures and two curative treatments of tail biting. The preventive measures were: chain, rubber hose, straw rack (5 g/pig/day) and the provision of straw on the floor twice daily by hand (2 × 10 g/pig/day). The two curative treatments, which were applied following the onset of tail biting in a pen were: straw twice daily (as in the fourth preventive measure) and the removal of the biter. In total, 960 undocked weaned piglets (10 piglets per pen) were observed during 5 weeks. Tail lesions (none, bite marks and wounds) were recorded daily. The incidence of pens with wounded pig tails was significantly lower when straw was provided twice daily (8% of pens) compared to the chain (58% of pens) and rubber hose (54% of pens) treatment, but did not differ significantly from the straw rack treatment (29% of pens). Tails with bite marks were significantly less common in pens with twice daily straw (16% of pens) compared to chain (88% of pens), rubber hose (79% of pens) and straw rack (75% of pens). No significant difference was found between the curative treatments. Both treatments showed a reduced incidence of red fresh blood on the tails at days 1–9 following curative treatment, compared to day 0. However, neither curative treatment eliminated tail biting entirely. In conclusion, this study indicates that tail biting is best prevented with a small amount of straw, provided twice daily, and to a lesser extent with a straw rack, compared to providing a chain or a rubber hose. Once tail biting has

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occurred, providing a small amount of straw twice daily and removing the biter appears to be equally effective.

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1. Introduction

In most countries the tails of young pigs are docked to prevent tail biting later in life (McGlone et al., 1990). Tail docking is not only painful for the animals, it also conceals the presence of a more chronic animal welfare problem, namely behavioural deprivation and boredom.

Several studies suggest that environmental enrichment, especially the provision of straw, reduces the chance of tail biting (Van Putten, 1969) and tail biting behaviour (e.g. Bøe, 1993; Petersen et al., 1995). However, most pig husbandry systems in Western Europe cannot be equipped with large amounts of straw, because this would block their slurry-based manure systems. Other enrichment devices were developed for these systems, such as the provision of iron chains, rubber hoses, car tyres and wooden beams. Such ‘toys’ may provide some occupation and reduce general penmate-directed behaviours (Sambraus and Kuchenhoff, 1992), but the degree depends on the provided materials. Van de Weerd et al. (2003) investigated 74 different enrichment objects during 5 days in order to find the characteristics that the favoured objects had in common. They found that the main characteristics for intense use were, among other things, ingestibility, chew ability and destructability. Zonderland et al. (2003) suggested that a combination of flexibility and destructability might be relevant material characteristics to attract the pigs’ attention. This may help to reduce tail biting as tail biting has been suggested to be redirected exploration behaviour (Van Putten, 1980). However, research comparing the effects of different enrichment treatments on the prevention of tail biting is limited, mainly because tail biting outbreaks may be difficult to predict and hard to initiate (Van Putten, 1969; Ewbank, 1973). Therefore, research on tail biting prevention used mainly indirect parameters like tail in mouth behaviour (Schrøder-Petersen et al., 2004), epidemiological risk factor surveys (e.g. Moinard et al., 2003) or tail damage surveys in abattoirs (e.g. Hunter et al., 1999). Since tail biting was regularly observed among the weaned piglets at the Pig Research Unit of the Animal Sciences Group in Lelystad, the Unit offered a unique opportunity to study tail biting directly.

In addition to preventing tail biting, a need exists for more scientific information on curative treatments once tail biting has started, to limit the negative consequences of a tail biting outbreak. Several recommendations have been made once the first signs of tail biting are present, such as providing pigs with lots of straw, extra fresh air, an extra meal or to darken the room (Van Putten, 1968). Schrøder-Petersen and Simonsen (2001) suggested isolation of the tail biter, provided that such an individual can be identified. Arey (1991) advised coating of bitten tails in substances with an aversive taste such as wood tar, or isolation of the wounded animals when coating of the tail did not help. However, such recommendations have never been studied. Therefore, in this experiment the effects of two curative treatments (removing biter and twice daily straw provision), were tested in pens subjected to four different preventive measures against tail biting (suspended chain, suspended rubber hose, straw rack and twice daily straw provision). Regarding the straw treatments, it was tried to
combine partly slatted floors with the provision of small amounts of long straw without blocking the slurry-based manure system.

2. Animals, materials and methods

2.1. Animals

In total 960 experimental animals (523 male and 437 female) crossbred weaned piglets were used. They were allocated to 96 groups of 10 animals with mixed sex. At the start of the experiment, the average age was 27.9 days (±2.8 S.D.) and live-weight was 8.1 kg (±1.4 S.D.). At the end of the 5-week experimental period, the animals were weighing on average 27.5 kg (±4.0 S.D.). Contrary to common practice, the piglets’ tails were not docked, their teeth were not clipped, and the males were not castrated. Animals were individually marked on their backs, using three colours of spray (red, blue and green).

2.2. Housing and husbandry

The experiment was conducted in two rooms at the High Health Pig Research Unit of the Animal Sciences Group in Lelystad between August and November. In each experimental room, the environmental temperature was automatically regulated by forced ventilation, and was set at 28 °C when the piglets entered. This temperature was gradually lowered to 26 °C after 5 days, to 23 °C after 21 days and then to 22 °C after 28 days until the end of the experiment (35 days). The room was illuminated by fluorescent light from 07:00 till 19:00 h with an average light intensity of 50 lux.

Each room contained 18 identical part-slatted pens (Fig. 1) measuring 2.95 m × 1.42 m (0.4 m²/piglet). In each pen, the front 0.35 m and the rear 1.10 m of the floor had metal slats and the remaining area was a solid sloped concrete floor with floor heating. The pen walls were constructed from solid plastic panels in the front and sides, and vertical metal bars adjacent to the slatted area in the rear of the pen. Each pen contained a two-space dry-feeder. Piglets were fed ad libitum. A water bowl drinker was available next to the feeder.

Fig. 1. Layout of the experimental rooms.
2.3. Treatments

The following four treatments to prevent tail biting and two curative treatments were tested.

2.3.1. Preventive measures

(1) Chain: a 0.5 m metal chain with 20 mm links was suspended from the pen partition fixed to a horizontal metal pipe above the slatted area in the back of the pen. The distance between the chain, pen partition and back wall were 0.2 and 0.9 m, respectively. The chain hung at piglets’ eye level.

(2) Rubber hose: two rubber hose tubes (length 0.4 m and diameter 30 mm) were tied in a cross shape and suspended on a chain. The rubber hoses were soft enough to be chewed on, but strong enough to prevent the weaned piglets from destroying it. The position of the rubber hose in the pen was similar to the chain in the previous treatment.

(3) Straw rack: the straw rack was a converted double space dry-feeder added with three metal chains and a horizontally placed 25 mm thick round plastic bar (Fig. 2). A metal rack with openings of 50 mm × 50 mm replaced the sloped front panel. Straw was ad libitum available from the straw rack; the racks were checked daily and refilled with long straw when half empty. The piglets used on average 5 g of straw per pig per day.

(4) Twice daily provision of straw: twice daily approximately 100 g of long straw was provided by hand on the solid floor (i.e. a total of 20 g/animal/day). This was enough to provide the pigs with straw 24 h per day. A hardwood barrier was placed between the solid sloped floor and the slats in the back of the pen. The slats in the front of the pen were covered with a metal plate in order to prevent large amounts of straw from disappearing into the manure system and leading to blockage. When a part of the solid floor became soiled, straw and manure were removed manually.

2.3.2. Curative treatments

Tail damage of individual piglets was scored daily using a protocol (see Section 2.4). An outbreak of tail biting was defined as an instance where at least one piglet was observed with a fresh tail wound and at least one other piglet was observed simultaneously with either a fresh tail wound or with bite marks. For tail biting pens one of the following two curative treatments was applied.
(a) Twice daily provision of straw: similar as the fourth preventive measure.
(b) Removal of biter: removal of one or two biters.

For ethical reasons all pens where an outbreak occurred were treated. No curative treatment was required for pens receiving twice daily straw, because no outbreaks of tail biting were observed in these pens. Alternately, one of the two curative treatments was carried out after an outbreak of tail biting had been observed in a pen. For the identification of the biters (piglets excessively biting a pen mate’s tail) the animals were observed through a monitor connected to the camera above the pens for a maximum of $2 \times 30$ min. When one or two biters were identified, they were removed. When no biter could be identified or when three or more biters were identified, for ethical reasons, the curative treatment for this pen became ‘twice daily straw provision’. These pens were left out of the statistical analysis. In order to balance the number of pens per curative treatment, the next pen with a tail biting outbreak would receive the curative treatment ‘removal of the biter’.

2.4. Observations

The following observations were performed.

2.4.1. Tail damage scores

During the entire experimental period (5 weeks) each piglet’s tail was scored daily using two tail parameters (Table 1):

(a) Tail damage (3 classes).
(b) Blood freshness (4 classes).

To standardize the application of the observed parameters, a leaflet with photos for each score was used by each of the five different observers, who collected data 7 days per week. Before the experiment started it was checked how different observers scored the tail damage and blood freshness. This information was used to improve the experimental protocol. During tail damage scoring, the observer stood in the middle of the pen checking each individual’s tail while surrounded by the piglets.

<table>
<thead>
<tr>
<th>Description</th>
<th>Tail damage</th>
<th>Blood freshness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 No</td>
<td>No tail damage visible</td>
<td>No blood visible</td>
</tr>
<tr>
<td>2 Bite marks</td>
<td>Small damages/bite marks are visible. These individual bite marks have the size of a pinhead</td>
<td>Old dried black blood in the form of a scab</td>
</tr>
<tr>
<td>3 Wound</td>
<td>Clearly visible wound</td>
<td>Sticky dark red blood, mainly a half day to day old</td>
</tr>
<tr>
<td>Blood freshness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 No</td>
<td>No blood visible</td>
<td></td>
</tr>
<tr>
<td>2 Dried</td>
<td>Old dried black blood in the form of a scab</td>
<td></td>
</tr>
<tr>
<td>3 Sticky</td>
<td>Sticky dark red blood, mainly a half day to day old</td>
<td></td>
</tr>
<tr>
<td>4 Fresh</td>
<td>Fresh bleeding wound</td>
<td></td>
</tr>
</tbody>
</table>
2.5. Experimental design

Of the 18 pens in each of the two experimental rooms, only 16 were used in this experiment, the 2 pens against the outer walls were left out the experiment. The pens were grouped into four blocks of four pens (Fig. 1). Within each block, the four preventive measures were assigned randomly. The experiment was carried out in three consecutive batches (with 3 weeks between batches).

2.6. Statistical procedures

2.6.1. Preventive measures

The occurrence of tail biting was expressed as a binary variable at the level of individual pens, in the following two ways: (1) no tail damage versus tail damage (either bite marks or wound) and (2) no serious tail damage (either no tail damage or bite marks) versus tail wound. A pen was labelled ‘bite marks’ when during the observation period at least one pig was observed with bite marks. Similarly, a pens was labelled ‘tail wound’ when at least one piglet was observed with a tail wound. The effect of preventive measures on these binary variables was analysed using logistic regression analysis with the treatment effect on logit scale (\(\text{Logit}(p) = \text{Log}(p/(1-p))\)) and a binomial distribution.

\[
\text{Log}(p/(1-p)) = \text{Logit}(p) = \mu + \text{batch} + \text{room} + \text{block} + \text{preventive measure}
\]

\[
\text{Var}(Y) = p(1-p)
\]

With \(Y\) as the 0–1 variable and \(p\) the chance at a ‘bite marks’ pen or a ‘tail wound’ pen. Differences between classes of preventive measures were tested pair wise using Fisher’s LSD test (\(P = 0.05\); GenStat, 2002).

2.6.2. Curative treatment

The effect of the curative treatment was derived from the blood freshness parameter. During a healing process wounds with fresh blood (score 4) were anticipated to dry up (dark red blood; score 3), form a scab (black dried blood; score 2) and eventually recover (no blood, score 1). The percentage of pigs exhibiting wounds with fresh blood was used as a parameter for the effectiveness of the curative treatments. For each pen where a curative treatment was applied (either removing the biter or provision of straw twice daily) the percentage of pigs exhibiting wounds with fresh blood was calculated on each day over a period of 10 successive days following treatment. The effect of the curative treatment was analysed using non-parametric tests. Due to the limited number of pens with a curative treatment (\(n = 20\)), the possible interaction between the effects of preventive and curative treatments on the percentage of pigs with fresh blood on the tail could not be analysed.

First, to examine the possible interaction between curative treatment and time (i.e. day following treatment), differences in percentage of piglets with fresh bleeding tails per pen between successive days were calculated. These differences were analysed with a Mann–Whitney U-test, comparing the two curative treatments. Here, a non-significant Mann–Whitney U-test result indicates that the percentage of pigs with fresh blood shows similar time-courses for both curative treatments. Since all Mann–Whitney-tests were non-significant (\(P > 0.05\) for all tests, results not shown), differences between days in the percentage of pigs with bleeding tail wounds were analysed across curative treatments, using Wilcoxon matched pairs signed rank
tests. Each successive day following treatment was compared with the day prior to the application of the curative treatment (i.e. day 0).

3. Results

In this experiment, no tail biting was observed in 34 of the 96 pens. Piglets with a maximum of bite marks (but no wounds) were observed in 27 different pens (63 piglets with bite marks and 207 without tail damage). Piglets with tail wounds were observed in 35 different pens (156 piglets with tail wounds, 107 piglets with bite marks and 87 piglets without tail damage).

Average daily weight gain of the pigs during the weaning period was 539 g/day and feed conversion ratio was 1.45.

3.1. Development of tail biting

Fig. 3 shows the overall development of the percentages of piglets with bite marks or wounds on their tail for, respectively, tail biting pens (20 pens) and non-tail biting pens (76 pens).

For both tail biting and non-tail biting pens, the number of piglets with bite marks increases after day 5, especially in tail biting pens. After day 28 the number of animals with bite marks decreased, mainly because these bite marks developed into tail wounds. The number of piglets with tail wounds is logically higher in tail biting pens. Although 15 non-tail biting pens contained piglets with tail wounds at one point, these pens did not meet our criterion to start a curative treatment (i.e. there was not at least one piglet with a fresh tail wound and another piglet with a fresh tail wound or bite marks present at the same time).

The number of animals with fresh, sticky or dried blood seems to follow a pattern similar to the pattern of the tail wounds (Fig. 4). The tail biting pens contain a small, but persistent proportion of piglets with fresh blood (1–2%), indicating that each day tails of new piglets get wounded. The total number of piglets with blood on their tail appeared to decrease in the last observation week for both tail biting and non-tail biting pens. This decrease may indicate a small recovery of the tail damage at the end of the observation period, but this cannot be ascribed to the curative treatments, because a similar pattern is shown in the pens without curative treatment (the non-tail biting pens).

Fig. 3. Development of the number of piglets (%) with bite marks or wounds on their tail for tail biting pens (left: 20 pens) and non-tail biting pens (right: 76 pens).
3.2. Preventive measures

During the experiment, the chains and rubber hoses were not damaged and lasted throughout the 5-week experimental period. Twice daily straw provisions lead in a few occasions to manure blockages of the small manure channel of the pen, but this blockage could be removed easily. In almost half of the pens with twice daily straw, the solid floor was soiled. Therefore, soiled straw was regularly removed, and the removed straw replenished. These pens had a higher straw usage compared to non-soiled pens.

Fig. 5 shows the predicted means of the percentage of pens with one or more animals with bite marks and tail wounds, respectively. Different characters in a row indicate a significant difference ($P < 0.05$).

3.3. Curative treatments

Curative treatment was applied in 20 pens (21% of all pens). In 10 pens biters were identified (9 pens with one biter and 1 pen with two biters) and removed. In one pen the biter could not be identified and in one pen there were more than two biters identified. These two pens were
provided with twice daily straw, but left out of the statistical analysis. The remaining 8 pens with twice daily straw were included in the analysis. In total 11 biters were identified of which 5 males and 6 females with an average start weight of 7.4 kg (±1.4 S.D.) compared to 7.7 kg (±1.0 S.D.) of the pen average ($P > 0.05$), which the pigs were removed from.

Curative treatments were applied most often in pens with a chain (10), followed by the rubber hose (7) and straw rack (3) (Table 2). Pens with twice daily straw did not need a curative treatment. Curative treatments were administered mainly at the end of the experimental period (median 24 days, range 8–31 days). The amount of tail biting did not escalate further after administering one of the two curative treatments and no extra piglets had to be removed (see also Fig. 3).

There was no effect of treatment (twice daily straw or removing biter) on the number of piglets with fresh blood on their tail. Fig. 6 shows the percentage piglets per pen with fresh blood on their tail after curative treatment had been implemented.

Compared to day 0, significantly fewer pigs had fresh blood on their tails on days 1–9 after curative treatment had started (day 10 showed a trend). However, curative treatment did not reduce the number of piglets with fresh blood to the level observed in pens without curative treatment (on average 0.1% of the piglets per pen).

<table>
<thead>
<tr>
<th>Preventive treatment</th>
<th>Total number of pens</th>
<th>Curative treatment</th>
<th>Number of pens</th>
<th>Observation day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain</td>
<td>24</td>
<td>Removing biter(s)</td>
<td>5</td>
<td>21, 22, 26, 29, 29</td>
</tr>
<tr>
<td>Straw</td>
<td>5</td>
<td></td>
<td></td>
<td>13&lt;sup&gt;a&lt;/sup&gt;, 26, 27, 29, 31</td>
</tr>
<tr>
<td>Rubber hose</td>
<td>24</td>
<td>Removing biter(s)</td>
<td>3</td>
<td>19, 20, 24</td>
</tr>
<tr>
<td>Straw</td>
<td>4</td>
<td></td>
<td>12, 20, 21&lt;sup&gt;a&lt;/sup&gt;, 30</td>
<td></td>
</tr>
<tr>
<td>Straw rack</td>
<td>24</td>
<td>Removing biter(s)</td>
<td>2</td>
<td>8, 23</td>
</tr>
<tr>
<td>Straw</td>
<td>1</td>
<td></td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Straw</td>
<td>24</td>
<td>Removing biter(s)</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Straw</td>
<td>0</td>
<td></td>
<td>0</td>
<td>–</td>
</tr>
</tbody>
</table>

<sup>a</sup> Excluded from the analysis (no biter identified or more than three biters).

Fig. 6. Percentage of pigs per pen with freshly bleeding tail wounds in pens where a curative treatment was provided. Significance level indicates a difference between day1–10 compared to day0 <sup>***</sup>$P < 0.001$, <sup>**</sup>$P < 0.01$, <sup>*</sup>$P < 0.05$ and <sup>#</sup>$P < 0.1$. 

4. Discussion

The aim of this study was to quantify the relative merits of four preventive and two curative treatments intended to reduce tail biting. The tail biting problem in the weaned piglets at the Pig Research Unit in Lelystad enabled us to conduct this study without inducing tail biting experimentally. In addition, a curative treatment was applied to limit the discomfort of the piglets. As a consequence, tail biting did not escalate during the experiment and no additional piglets had to be removed once curative treatments had been provided.

The tail damage scoring protocol (Bracke, 2007) was a useful tool to systematically assess tail damage in the individual pig. We had to use several observers in order to score all tails every day. Although this is not ideal, since the observations of the different observers were proportionally divided over the treatments, treatment effects could be estimated correctly.

4.1. Development of tail biting

Fraser (1987) distinguished two stages of tail biting. Stage 1 is the pre-injury stage, before any visual wound is present on the tail. This stage may be followed by Stage 2, the injury stage, where the tail is wounded and bleeding. Effective management of tail biting could benefit from (early) diagnosis of the pre-injury stage. Most often, however, tail biting is not diagnosed and treated until a wound is present (Schrøder-Petersen and Simonsen, 2001). In the present study, tails with bite marks could be considered to represent tail biting in the pre-injury Stage 1. Bleeding tail wounds in this study corresponded to the injury Stage 2. The blood released in the injury stage may act as an extra incentive for tail biting, resulting in the escalation of tail biting into cannibalism (Schrøder-Petersen and Simonsen, 2001). This research provided a detailed overview of the development of tail biting and such escalation of tail biting did not occur during the current experiment. Transition from Stage 1 to Stage 2 was observed in 16% of the piglets and averaged 7.5 days, but there was a large variation (S.D. 5.4 days) and in 2% of the cases transition was within 1 day. Therefore, it is important to take sufficient measures, preferably before the first animals have tail wounds with fresh blood (Van Putten, 1968). This implies a need for predictors indicating an outbreak of tail biting and further research is necessary to find suitable indicators of a tail bite outbreak.

4.2. Preventive measures

Previously Day et al. (2002) found that a small quantity of straw (92 g/pig/day) could reduce damaging behaviour like tail biting. The present study has shown that even smaller amounts (20 g/pig/day) can substantially reduce tail biting, not only tail wounds, but also much smaller bite marks. This amount of straw is much less than what has been used in most other studies, e.g. Fraser et al. (1991; 1000 g/pig/day), Bøe (1992; 192 g/pig/day), Day et al. (2001; 100 g/pig/day) and Van Putten (1980; 100 g/pig/day). Previously Fraser et al. (1991) showed that providing 63 g of straw per pig per day in a straw rack can reduce biting in growing pigs. The current experiment suggests a significant reduction in tail wound with as little as 5 g/pig/day in a rack compared to providing a metal chain (Fig. 5). We used lower amounts of straw in order to diminish the chance of blockage of the manure channel (even though we did not completely succeed in this). Nevertheless, providing the piglets with on average 20 g of straw per pig per day (in two portions) was effective in reducing (but did not completely eliminate) bite marks and tail wounds. Since the straw rack (5 g/pig/day; refilled once or twice per week) was considerably less effective than providing straw twice daily,
perhaps the frequency of straw provision (twice daily) and the way it is provided (loose on the floor) were important in addition to the actual amount provided. Every time straw was provided on the floor, the piglets became very active and started manipulating the straw immediately, which was also reported by Fraser et al. (1991). Furthermore, straw has some nutritional value that will reinforce chewing behaviour (Day et al., 1996) and keep pigs occupied for a longer period.

Pens with a chain or rubber hose did not differ in their effectiveness to prevent bite marks or tail wounds. This is surprising since Grandin and Curtis (1984) found that piglets manipulated a rubber hose more compared to a metal chain and in addition, Van de Weerd et al. (2003) found that chew ability of the rubber hose (compared to lack of chew ability of the chain) resulted in maintained interest. Apparently, in the present study, the difference between chain and hose did not result in a difference in prevention of clinical tail damage. Both, the rubber hose and chain were much less effective in preventing tail biting than the provision of straw twice daily. This is consistent with the outcome of a review conducted by Bracke et al. (2005), who failed to find studies using simple metal objects, rubber or plastic toys reporting significant reductions of tail biting behaviour. Beattie et al. (1995) also stated that a toy alone was not sufficient to reduce harmful social behaviour such as tail biting and that toys only stimulate behaviour when ‘novel’. According to Scott et al. (2006), no form of enrichment reliably provides the same level of occupation as seen with straw and further study is necessary to find reasons for differences in occupation time between straw and enrichment objects.

4.3. Curative treatments

We did not include a control treatment without any curative treatment in case of a tail biting outbreak, because this was ethically not acceptable. As a consequence, we cannot conclude that the reduction in fresh blood after curative treatment was actually due to the curative treatments administered. This is likely, however, as it has been found previously that once tails are covered with blood, the situation is likely to escalate and the level of tail biting will increase, rather than decrease (Van Putten, 1968; Fraser, 1987; McIntyre et al., 2001).

Bitters removed from a pen with a tail biting outbreak have to be put in another pen. Special pens (sickbay) are usually available to isolate an occasional biter, but with larger outbreaks involving a large number of biters the animals may have to be regrouped. In our experiment, we regrouped several biters into the same pen more than once, but this did not lead to tail biting outbreaks in those pens.

Both curative treatments fully reduced the tail biting outbreak, but reduced the blood score only temporarily. This suggests that in case of removing the biter(s): not all biters were identified at the moment of removal; or that other piglets developed tail biting after removal. Leaving piglets with damaged tails in the pens might be an incentive for the other pigs to start tail biting resulting in an increased blood score a few days after the start of the curative treatment. Therefore, as suggested by Van den Berg (1982), removal of the biter may benefit from simultaneous removal of all wounded pigs from a pen as an effective curative treatment. Removal of biter and wounded pigs supplemented with straw provision would possibly be an even more effective curative treatment.

5. Conclusions and implications

Daily twice provision of a small amount of long straw (2 × 10 g/pig/day) considerably reduced the occurrence bite marks and tail wounds in weaned piglets compared to the provision
of a chain or rubber hose, while a straw rack showed an intermediate effect. Once tail biting had started, both removing the biter and daily twice straw provision, reduced tail biting temporarily, but not permanently.

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References