Prevalence of tail lesions in Swiss finishing pigs

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Prävalenz von Schwanzläsionen bei Schweizer Mastschweinen

Schwanzbeissen und Schwanzläsionen sind ein bekanntes Problem in der modernen Schweinehaltung. 2008 wurde das Kupieren des Schwanzes zur Verhinderung von Schwanzbeissen bei Schweinen in der Schweiz verboten. Seitdem werden Schweine mit intakten Schwänzen gemästet. Ziel dieser Studie war es, die aktuelle Prävalenz von Schwanzläsionen bei Mastschweinen in Schweizer Schlachthöfen zu untersuchen und die Schlachthofdaten mit bestandsspezifischen Daten bezüglich potenzieller Risikofaktoren zu vergleichen. Die Datenerhebung wurde in sich wiederholenden Zyklen von je zwei Wochen in vier Schlachthöfen in allen vier Jahreszeiten durchgeführt. Unter anderem wurden Geschlecht, Schwanzlänge und Zustand der Schwanzspitze bei geschlachteten Schweinen bewertet. Während insgesamt 32 Wochen wurden 195 704 Schweine aus 6112 Posten aus 2510 Herden untersucht. Bezüglich der Schwanzlänge wurden 63,2 % der in die statistische Analyse einbezogenen Tiere mit einem intakten Schwanz geschlachtet (niedrigster Tail Length Score [TLS]), wohingegen 36,8 % einen teilweisen oder vollständigen Verlust des Schwanzes aufwiesen. Der Zustand der Schwanzspitze (Tail Tip Condition Score [TTCS]) wurde in 63,0 % als intakt, in 23,7 % als abgeheilte Läsion, in 1,3 % als akute Läsion und in 12,0 % aller Fälle als chronische Läsion beurteilt. Männliche Tiere zeigten signifikant höhere Werte für TLS und TTCS als weibliche ($P \leq 0,05$). Die TLS-Werte waren im Winter signifikant höher als im Frühjahr und Sommer ($P < 0,001$). Die TTCS-Werte waren im Herbst deutlich höher als im Frühjahr und Sommer. Die TLS- und TTCS-Werte unterschieden sich signifikant ($P < 0,001$) zwischen den vier Schlachthöfen. Zwischen den Werten von TLS und TTCS und betriebsspezifischen Daten wurden nur wenige signifikante Korrelationen nachgewiesen. Zusammenfassend lässt sich sagen, dass die Erfassung von Schwanzläsionen in Schlachthöfen eine genaue, aber arbeitsintensive Methode darstellt, um die Prävalenz von Schwanzläsionen in einer grossen Population von Mastschweinen exakt zu untersuchen. Darüber hinaus

Abstract

Tail biting and lesions are common problems in modern pig production. In 2008 tail docking to prevent tail biting was banned in Switzerland. Since then pigs have been raised with intact tails. This study aimed to assess the current prevalence of tail lesions at Swiss abattoirs and comparing abattoir data with farm-specific data regarding potential risk factors for tail lesions. Data collection was performed in repetitive cycles of two weeks at four abattoirs during all consecutive seasons of one year. Gender, tail length and the tail tip condition were evaluated among other parameters. During 32 weeks in total, 195 704 pigs from 6112 batches from 2510 herds were evaluated. Overall, 63,2 % of the animals included in the analysis were slaughtered with a complete tail (lowest tail length score [TLS]), whereas 36,8 % showed a partial or total loss of the tail. The condition of the tail tip (tail tip condition score [TTCS]) was judged as being intact in 63,0 %, as a healed lesion in 23,7 %, an acute lesion in 1,3 % and a chronic lesion in 12,0 % of all cases. Male animals had significantly higher values for TLS and TTCS than female animals ($P \leq 0,05$). TLS values were significantly higher in winter than in spring and summer ($P < 0,001$). TTCS values were significantly higher in fall than in spring and summer. TLS and TTCS values differed significantly ($P < 0,001$) between the four abattoirs. Only few significant correlations were found between values of TLS and TTCS and farm-specific data. Recording tail lesions at abattoirs is an accurate method to investigate the prevalence of tail lesions in fattening pigs. However, to monitor animal welfare on herd level, this method is very labor intensive. Moreover, data on tail lesions collected at the abattoir cannot replace veterinary on-farm examination for risk factor identification.

Keywords: Switzerland, Abattoir, Tail Length Score, Tail Tip Conditions Score, Season, Pig

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können die im Schlachthof erhobenen Daten zu Schwanzläsionen die Bestandsbesuche zur Erfassung herdenspezifischer Risikofaktoren durch Tierärzte nicht ersetzen.

Schlüsselwörter: Schweiz, Schlachthof, Tail Lesion Score, Tail Tip Conditions Score, Jahreszeit, Schwein

Introduction

Tail lesions in growing and finishing pigs are a widespread problem in modern pig production and affect animal welfare, animal health, food safety and farms' economic situation. An injury of a pig's tail is usually caused by tail biting or trauma. The influence of mycotoxins resulting in inflammation of tail tissue (swine inflammation and necrosis syndrome) and tail lesions is still under discussion.[28] Piglets including newborns of sows exposed to high levels of the mycotoxin deoxynivalenol showed reddened areas at the tail base.[40] Tail biting can be provoked by housing conditions associated with reduced animal welfare, and it reduces animal welfare itself. Pigs with tail lesions tend to have more arthritis, vertebral osteomyelitis, abscesses and lung findings than pigs without tail lesions.[3,23] Consequently, carcasses from pigs with tail lesions are more often partially confiscated or trimmed than carcasses from pigs with intact tails.[7,23]

Tail biting is defined as manipulation of one pig's tail through another pig's mouth. On the motivational level, this behavior can be divided into three categories. First, in «two-staged tail biting», an increased motivation of exploratory behavior resulting in manipulation of the tails in pen mates. Such manipulation can lead to tail lesions.[29,36] Second, so-called «sudden-forceful tail biting» is performed mainly in competition for resources, such as food or water.[14] Third, «obsessive tail biting» is characterized by learned and maintained bite attacks of one individual animal, often performed by runts.[1]

Impacts that can lead to tail biting are multifactorial and can trigger a tail biting outbreak alone or in combination. Inadequate food composition,[18] inadequate provision of food or water,[15] no or inadequate manipulable objects or substrates,[8] general health problems,[25] gender and unbalanced gender composition in a pen,[20] genotype,[41] large groups and high stocking density,[24] unstable group composition, inadequate environmental climate and season[2,21] can be risk factors on herd level and promote tail biting.

Preventing tail biting is challenging because of its unpredictable occurrence. Even if the risk factors that can lead to a higher incidence of tail biting are known, the specific triggering factor, which led to an outbreak, is usually hard to identify. The provision of manipulable objects and substrates and the reduction of the stocking density are recommended to lower the risk of tail biting.[11,22,27] The removal of the bitten and the biting pig as an acute intervention is advised.[11]

Tail docking is practiced to prevent tail biting, although it cannot prevent tail biting totally.[17] In this zootechnical procedure, a part of the tail is removed within the first days of life. This procedure was established to improve animal welfare threatened through tail biting. On the other hand, tail docking is a procedure that decreases animal welfare because tail docking causes stress and pain in piglets.[26] In addition, an animal welfare measurement instrument is lost with tail docking because the tails' state can be used as a highly sensitive but unspecific indicator of wellbeing in pigs.[29]

The EU Council Directive 2008/120/EC bans routine tail docking in pigs in the European Union. In case there are severe injuries on tails or ears, tail docking can exceptionally be allowed if other measures concerning environmental conditions and stocking densities have failed to prevent tail biting. Permission can then be granted, allowing tail docking in piglets younger than seven days of age without anesthesia by a veterinarian or another competent person. This exception permit led to the situation that in European countries, including Norway and Switzerland, approximately 90 % of fattened pigs were tail docked at the end of the 20th and the beginning of the 21st century.[13] Since 2001 tail docking in pigs was only permitted under general anesthesia and was prohibited in Switzerland in 2008, when the revised Swiss animal protection ordinance[31] became effective. The reported incidence of tail lesions in Switzerland varied in previous studies from 0,7 % in 2015[35] and 39,7 % in 2016,[16]

In contrast to routine procedures in other countries (e.g., Sweden), the tail state of individual pigs is usually not assessed at Swiss abattoirs. In the few cases where it is recorded, the assessment does not follow any nationwide consistent format. Deviations of individual pigs' tail health states are currently recorded as antemortem findings or as partial confiscation at meat inspection.[5] Some slaughterhouses have implemented an internal system to detect batches with a high occurrence of tail lesions (personal communication).

The aims of this study were (1) to investigate the prevalence of tail lesions at four Swiss abattoirs, (2) to analyze data on tail length and tail tip condition for patterns and factors associated with tail lesions, (3) to compare tail lesion data at herd level collected at the four abattoirs with corresponding data recorded by the Pig Health Service of SUISAG and (4) to search for risk factors associated with tail lesions by merging data on tail lesions collected at the abattoirs with farm-specific data recorded by the Pig Health Service.

Materials and Methods

General information

The observational part of this study was conducted at four major Swiss abattoirs collectively slaughtering more than 50% of the Swiss pig production, thereby warranting representativeness of the study data. These slaughterhouses were supra-regionally supplied with Swiss finishing pigs ranging from about 90 to 120 kg in bodyweight. Data were collected in repetitive cycles of two weeks at each site during the four consecutive seasons of a year. Thus, data were collected in each slaughterhouse for eight weeks of production (four times two weeks in a row) and overall for 32 weeks in this study. Distributing the cycles throughout the year aimed to detect potential seasonal effects.

Data collection

All finishing pigs were delivered to the respective abattoir on the day of slaughter. The processes and procedures until examination of the tail were fairly identical at each of the study sites: After unloading and origin marking, the animals had a varying lairage time. All animals had free access to water offered through drinking nipples. The pigs were stunned by CO_2 exposure (minimum 100 seconds on minimum 84% CO_2), then hung on one hindlimb and exsanguinated. Subsequently, the tail of each individual pig was judged by the first author. The assessment immediately after bleeding but before the first washing and further processing of the carcasses excluded the possibility of tissue damage(s) by mechanical procedures during the slaughter process.

An electronic data collection form was developed with Microsoft® Access (Microsoft® 365 MSO [16,0.13231,20110] 32-Bit, Microsoft Corporation, Redmond, USA) for on-site digital data assessment. Data, such as origin marking of the animal, gender, length of the tail, condition of the tail tip, and swelling were recorded by the author, whereas date and time of slaughter (i.e., the data entry) were captured automatically. Data were exported daily into an Excel spreadsheet (Microsoft® Excel for Microsoft® 365 MSO [16,0.13231,20110] 32-Bit, Microsoft Corporation, Redmond, USA). At the end of data collection, all slaughterhouse data were merged in one single spreadsheet.

In order to retrace the actual origin of the individual animals, the origin marking of each pig was recorded and later merged with the individual herd identifier that is provided by the Swiss animal movement database (TVD-number).[32] A tail length score (TLS) for better comparison of tail lengths of different breeds and weight classes and a tail tip condition score (TTCS) were used for visual grading (Figure 1, based on and adapted from Keeling et al. 2012[19] and von Gunten 2016[16]).

Statistical analysis

The statistical analysis of all data was performed using NCSS 2019 (NCSS 2019 Statistical Software 2019; NCSS LLC, Kaysville, Utah, htpps://www.ncss.com/software/ncss). TLS and TTCS as categorial variables were subjected to Kruskal–Wallis test analysis of variance, or Z-test including Bonferroni correction if data were not normally distributed and more than two variables were assessed. TLS and TTCS were installed as dependent variables,

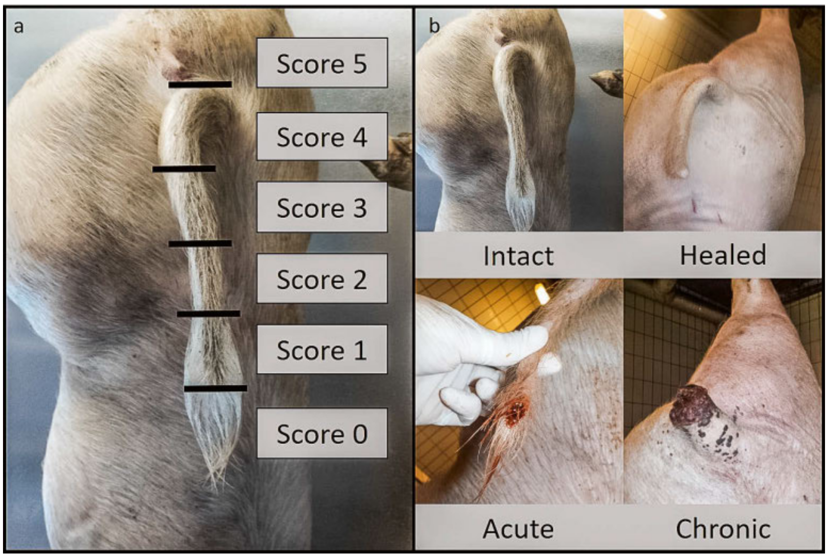

Figure 1: Scheme of (a) the tail length score (TLS) and (b) the tail tip condition score (TTCS) in Swiss finishing pigs. TLS: 100% of tail is remaining, endplate is present: Score 0; 75–99% of tail remaining: Score 1; 50–74% of tail remaining: Score 2; 25–49% of tail remaining: Score 3; 1–24% of tail remaining: Score 4; 0% of tail remaining, base of tail is convex: Score 5. TTCS: Interpretation of the condition of the distal 2 cm of the tail (tail tip); intact tail: no signs of injury, endplate is complete; healed lesion: part of tail tip is missing, complete cure through re-epithelization or scar tissue; acute lesion: part of tail tip is missing, tissue damage with no signs of proliferation of granulation tissue and/or re-epithelization, bleeding or not bleeding; chronic lesion: part of tail tip is missing, tissue damage with signs of proliferation, re-epithelization or necrosis, bleeding or not bleeding.

whereas «abattoir,» «season» and «animals per batch» were used as independent variables in the univariable and multivariable analyses. Abattoirs were anonymized (A to D). Examinations took place in August and September (fall), November and December (winter), February and March (spring), and May and June (summer). Batches were grouped in quartiles according to the number of animals per batch (Quartile 1: 1 to 29 animals; Quartile 2: 30 to 46 animals; Quartile 3: 47 to 70 animals; Quartile 4: more than 70 animals) to investigate the effects of batch size on tail lesions.

A two-sample Mann–Whitney *U* test or Wilcoxon rank-sum test for difference in «location» was used to analyze the influence of gender on the TLS and the TTCS. Correlation between «swelling» and TTCS was tested using a chi-squared test.

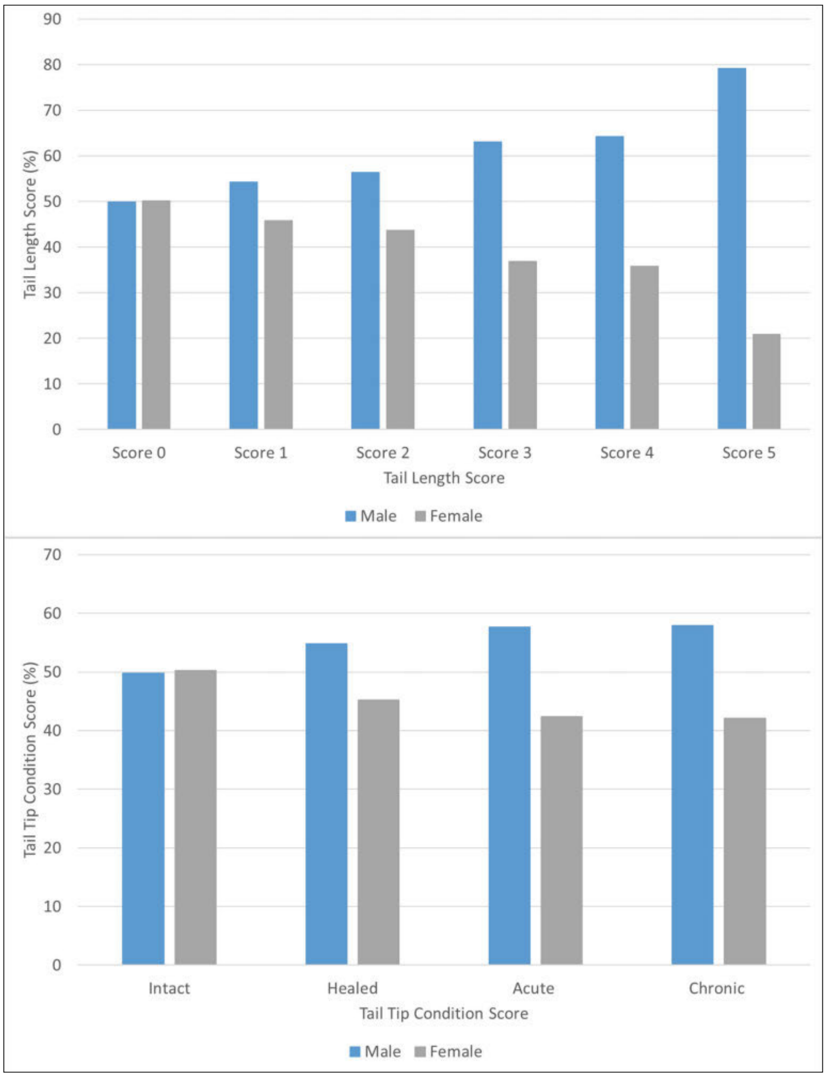

Figure 2: Proportion of male and female finishing pigs in regards to (a) tail length score (TLS) and (b) tail tip condition score (TTCS).

To compare the data from the abattoir with data provided by the Pig Health Service, the two herd-level databases were merged and anonymized by an independent organization based on the individual TVD-number for each herd in both databases. During routine or event-related visits, the Pig Health Service uses a form that captures farm-specific information. This data was captured by the staff of the Pig Health Service and contract veterinarians maximally six months before we began the abattoir investigation.

For further analysis and the comparison of abattoir data with data from the Pig Health Service, data from individual pigs were summarized on herd level. The herd-level parameters contained the counts of animals in each given score concerning the TLS and the TTCS in each season and the total number of animals examined from this herd. Subsequently, the herds were allocated to one of two groups: Group I was composed of herds with less than 15 % of animals with acute or chronic lesions per batch and Group II of herds with 15 % or more pigs with acute or chronic lesions per batch. We defined a proportion of at least 15 % acute or chronic tail lesions as limit value. Differences in percentages between the seasons were tested using Cochran's *Q* test. For tail health state evaluation on farm level, the findings at the abattoir were compared with the assessment of the latest visit by the Pig Health Service with regard to cannibalism in the fattening pigs. To compare the grouping based on abattoir data (Group I: less than 15 % acute or chronic lesions; Group II: at least 15 % acute or chronic lesions) with the grouping of the Pig Health Service (no problem with cannibalism in fattening pigs, problem with cannibalism in fattening pigs under control, and problem with cannibalism in fattening pigs not under control), a chi-squared test was used. Whether farm-specific factors recorded by the Pig Health Service had a significant impact on the grouping (Group I, Group II) was tested with a chi-squared test. Parameters showing a significant difference in the grouping ($P < 0,05$) were tested in a Spearman rank correlation analysis.

Results

Data collection at the abattoir

From 29 July 2019 until 26 June 2020, 195,704 slaughtered pigs from 6,112 batches were examined. Overall, 181,850 complete datasets were available for further analysis, whereas 13,854 datasets had to be excluded because of missing values.

Prevalence of tail lesions based on the abattoir data

Tail length score (TLS) was rated as complete (0) in 63,2 %, as 1 in 23,7 %, as 2 in 8,1 % and 3 in 3,1 % of the examined animals. Less than one quarter (TLS of 4) of the tail was present in 1,8 %. Forty-eight pigs were evaluated with a total loss of the tail (TLS of 5). The condition of the tail tip indicated 63,0 % intact tails and 37,0 % non-intact tails (23,7 % healed lesions, 1,3 % acute lesions and 12,0 % chronic lesions).

Gender

The values of the TLS and the TTCS in male pigs (TLS mean: 0,66, SD: 0,95; TTCS mean: 0,68, SD: 1,02) were significantly higher (*P* < 0,05) than those in female pigs (TLS mean: 0,50, SD: 0,84; TTCS: mean: 0,56, SD: 0,95). Gender proportions in relation to TLS and TTCS are shown in Figure 2.

Season

Tails examined in winter showed the highest values of TLS of all seasons, and were significantly higher than in spring and summer (*P* < 0,001). Tails evaluated in summer had a significantly lower TLS (*P* < 0,001) than in fall, winter and spring (Figure 3a). In fall, the tails showed the highest TTCS and were significantly higher than in spring and summer (*P* < 0,001). In summer, the TTCS were significantly lower (*P* < 0,001) than in fall, winter and spring (Figure 3b).

Abattoir

The TLS at Abattoir B were significantly higher than at the other three abattoirs (*P* < 0,001). Abattoir C had the lowest TLS, which were significantly lower than at Abattoirs B and D (*P* < 0,001) (Figure 3c). TTCS was highest at Abattoir B, which was significantly higher than at Abattoirs A, C and D (*P* < 0,001). Tails at Abattoir D showed the lowest TTCS, which were significantly lower than those recorded at Abattoirs A, B and C (*P* < 0,001) (Figure 3d).

Animals per batch

Tails from pigs in batches of Quartile 4 had the highest TLS (Table 1), which were significantly higher than in Quartile 1 and Quartile 2 (*P* < 0,001). TLS in Quartile 1 was significantly lower than in Quartiles 2, 3 and 4 (*P* < 0,001).

Recurrent origins

Figure 4 shows the proportion of pigs with acute or chronic tail lesions of 116 herds for which data were available for each season. Overall, 47 herds were found having less than 15 % acute or chronic lesions (Group I) in every season and six herds were found having at least 15 % acute or chronic tail lesions (Group II) in each

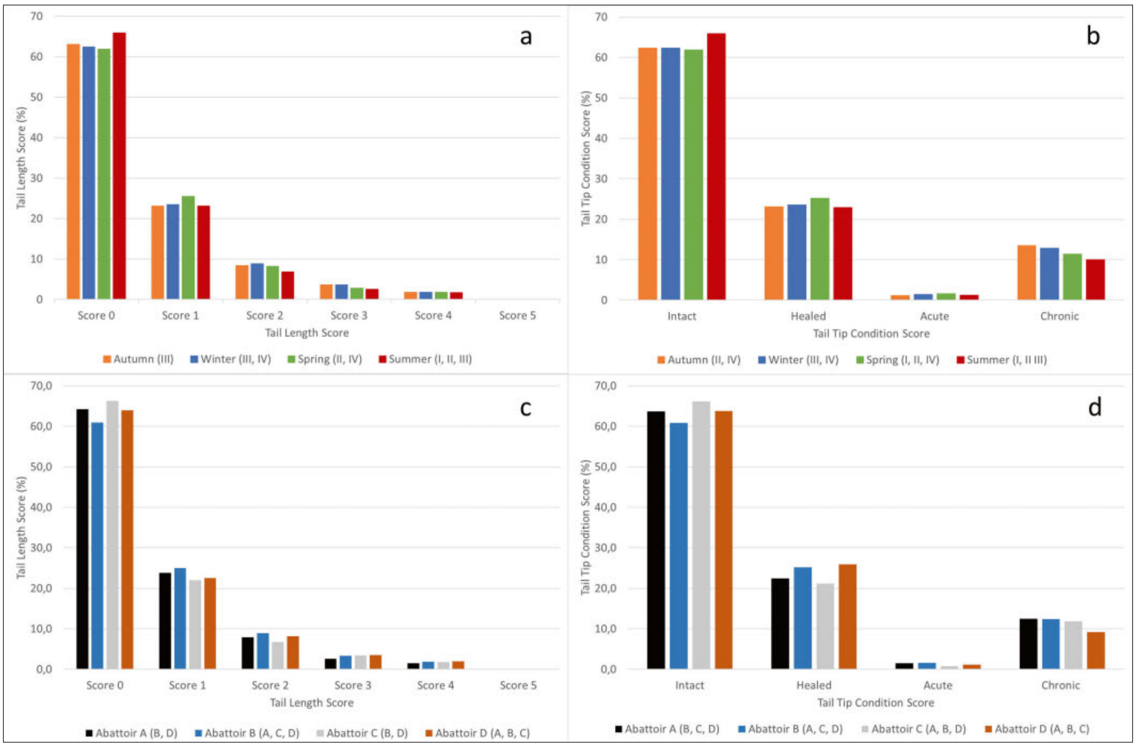

Figure 3: Distribution of values for the tail length score (TLS) and the tail tip condition score (TTCS) in Swiss finishing pigs for the four seasons and the four abattoirs. Latin numbers in brackets indicate significantly different distributions in TLS ($P < 0.001$) and TTCS ($P < 0.05$) between seasons: fall = I, winter = II, spring = III, summer = IV (Figure 3a and b). Capital letters in brackets indicate significantly different distributions in TLS ($P < 0.001$) and TTCS ($P < 0.05$) between abattoirs: Abattoir A = A, Abattoir B = B, Abattoir C = C, Abattoir D = D (Figure 3c and d).

season. The proportions of pigs with acute or chronic lesions were significantly different between fall and winter and between winter and summer.

Swelling

A significant positive correlation ($P < 0,05$) was found between TTCS of 3 (chronic lesions) and the occurrence of swelling.

Comparison of the abattoir data with the Pig Health Service data

During our period of data collection and maximum six months before, the Pig Health Service evaluated 1'843 herds of the delivered batches. The Pig Health Service classified 1,373 herds with «no problem,» 57 with «problems under control» and five with «problems not under control» regarding cannibalism in finishing pigs. Four hundred and eight herds had no classification. Among the 1,373 herds that had been classified with «no problem,» 1,117 herds had a prevalence of less than 15% (Group I) and 256 herds a prevalence of at least 15% (Group II) acute or chronic tail lesions in the abattoir. 57 herds were classified with «problem under control» (43 herds in Group I, 14 herds in Group II) whereas five herds were classified with «problem not under control» (three herds in Group I, two herds in Group II) and 408 herds were not classified (324 herds in Group I, 84 herds in Group II). There was no significant correlation ($P > 0,05$) between the abattoir classification of batches (Group I vs. Group II) and the classification of the farm of origin in the database of the Pig Health Service.

Analysis of risk factors based on the Pig Health Service data

Eighty-nine of the recorded parameters from the Pig Health Service's latest farm visit were investigated with regard to potential risk factors for tail lesions. Significant positive correlations were found between batches with a proportion of at least 15% acute or chronic lesions at the abattoir and the parameters «runts among weaners» ($P = 0,02$), «cannibalism in pre-fattening» ($P = 0,01$) and «skin alteration in pre-fattening» ($P = 0,01$). Each parameter had been rated as «no problem,» «problem under control» or «problem not under control.» The parameters «cannibalism in pre-fattening» and «skin alteration in pre-fattening» were strongly correlated to each other ($P < 0,05$). No other significant associations between the abattoir database and the Pig Health Service database were detected.

Discussion

This observational study evaluated 181,850 tails of Swiss finishing pigs during 32 weeks of one year, this corresponds to 7,4% of all pigs slaughtered during this period in Switzerland (approx. 2,5 million in 2019).[30] Therefore, results from this study can be extrapolated to the target population, i.e., the whole Swiss pig population, and validity is considered very high. Any examination by a single person, as it was done here, always can introduce a bias into study results. However, the examiner was

Table 1: Influence of the number of delivered finishing pigs per batch (assigned to four quartiles, see methods) on the values of the tail length score (TLS) and the tail tip condition score (TTCS), with counts and percentages of TLS and TTCS divided in quartiles. Superscripted letters indicate significantly different median values with P < 0.001 between quartiles for TLS: Quartile 1 = 1, Quartile 2 = 2, Quartile 3 = 3, Quartile 4 = 4; and for TTCS: Quartile 1 = I, Quartile 2 = II, Quartile 3 = III, Quartile 4 = IV.

Tail Length Score										
	Quartil 1 ^{2,3,4}		Quartil 2 ^{1,3,4}		Quartil 3 ^{1,2}		Quartil 4 ^{1,2}		Total	
	n	%	n	%	n	%	n	%	n	%
Score 0	30'150	66,6	28'650	64,2	27'720	61,5	28'463	60,8	114'983	63,2
Score 1	9'786	21,6	10'426	23,4	11'146	24,7	11'818	25,3	43'176	23,7
Score 2	3'216	7,1	3'480	7,8	3'957	8,8	4'055	8,7	14'708	8,1
Score 3	1'256	2,8	1'356	3,0	1'497	3,3	1'618	3,5	5'727	3,1
Score 4	884	2,0	723	1,6	773	1,7	828	1,8	3'208	1,8
Score 5	7	0,0	12,0	0,0	14	0,0	15	0,0	48	0,0
Total	45'299	100,0	44'647	100,0	45'107	100,0	46'797	100,0	181'850	100,0
Tail Tip Condition Score										
	Quartil 1 ^{II,III,IV}		Quartil 2 ^{I,III,IV}		Quartil 3 ^{I,II}		Quartil 4 ^{I,II}		Total	
	n	%	n	%	n	%	n	%	n	%
Intact	30'091	66,4	28'573	64,0	27'599	61,2	28'374	60,6	114'637	63,0
Healed	9'651	21,3	10'055	22,5	11'143	24,7	12'170	26,0	43'019	23,7
Acute	519	1,1	627	1,4	674	1,5	631	1,3	2'451	1,3
Chronic	5'038	11,1	5'392	12,1	5'691	12,6	5'622	12,0	21'743	12,0
Total	45'299	100,0	44'647	100,0	45'107	100,0	46'797	100,0	181'850	100,0

trained at the beginning of the study by experts, using constantly a grading scheme inspired by already validated, established and used schemes in other studies.[16,34]

The findings of this study are similar to those of recent studies from 2016[16] and 2020[34] that determined the prevalence of non-intact tails in Swiss pigs as reaching 39,7 % and 36,6 %, respectively. These values differ significantly from those of older Swiss reports, where 2,8 % to 21,9 % non-intact tails were found in 2005[6] and 0,7 % in 2008/2009,[35] Apart from this increase in prevalence, today's level of tail lesions in Swiss pigs is similar to those in other European countries. In 2020 a proportion of 50,8 % of non-intact tails were reported after scalding in a Finnish slaughterhouse.[39] Another study in two Swedish slaughterhouses recorded a prevalence of non-intact tails between 7,0 % and 7,2 % by using a scoring system comparable to the one used in the present study in 2003,[19] These findings in Swiss, Finnish and Swedish studies together with the present study highlight the high variance in prevalence of tail lesions in countries that have banned tail docking. However, data from different countries are difficult to compare because of varying sample sizes, number of assessed abattoirs, short data capture slots, and different scoring and judging systems applied by different examiners.

Our finding that male animals experienced more often and more severe lesions than female animals is in line with observations on undocked pigs at a Swedish abattoir.[19] In countries where tail docking is performed, male animals are also more often affected by tail lesions than female animals.[33] It is hypothesized that female pigs upon reaching sexual maturity are more active and express more anogenitally directed foraging behavior toward male pigs than male pigs do.[36] Contradicting is the finding for both genders that pigs in single-gender groups suffer more from tail biting than pigs in mixed groups.[17] The complexity of behavior and the current state of knowledge require further research to identify the optimal gender balance regarding tail biting in groups of fattening pigs.

High or low temperature and a rapid change in weather are often suspected to increase the occurrence of tail lesions.[10] We found only few studies that investigated the occurrence of tail lesions during a period of one year or longer and considered (changes in) climatic conditions during this time. In abattoir data from England and Wales, a trend was seen that tail biting increased when temperature decreased.[21] Our findings correspond with such reports concerning the TLS, which was highest in winter. However, results of the TTCS, which was highest in August and September, did not match these reports. An explanation could be the onset of tail lesions in this season, leading to shorter tails in the winter months November and December. For an investigation of a possibly recurrent higher prevalence of shorter tails in winter, the evaluation period must be longer than one year. Another point is that the prevalence of tail lesions on the base of the collected data cannot be tracked back to the time when tail lesions first appeared (e.g., nursery vs. fattening period), and analyses of the potential influences of daily weather in terms of humidity, temperature fluctuations or other extreme weather were not part of this study.

The four abattoirs, which were supplied supra-regionally, differed in the distribution of values for TLS and TTCS. Such abattoir-specific differences were also observed in another study.[21] It is not unlikely that instructions and regulations enacted and controlled in a federal system lead to variably strict controls and sanctions regarding tail health issues. Another factor could be the selling of animals with severe wounds to small local slaughterhouses before the animals reach the standard market weight. Finally, the purchasing and animal welfare policy pursued by the company buying and slaughtering pigs might influence the occurrence of affected pigs in big slaughterhouses (personal communication). We found a positive correlation between the number of animals per batch and the median of the TLS over all four quartiles representing different batch sizes and the median of the TTCS over the first three quartiles. One could assume that batches with more animals were more likely to be fattened in bigger groups linked to more stress, or they were mixed from different pens for transportation, which could also lead to more stress and in consequence to the occurrence of tail biting. Another point could be that with increasing number of fattening pigs the animal observation is done with less staff and less intensity. Thus, our finding underlines the necessi-

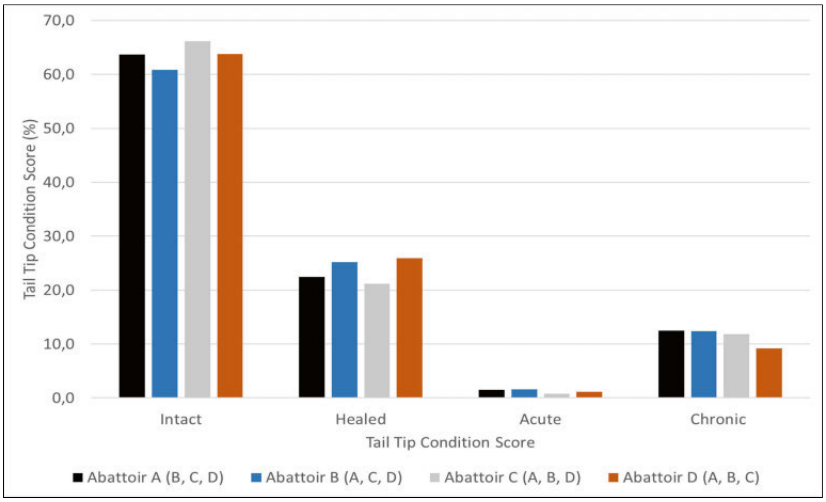

Figure 4: Proportion of acute or chronic lesions in herds of Swiss finishing pigs that were evaluated during four seasons.

ty to investigate the influence of limited space on the occurrence of tail lesions during raising and transport.[12] A swelling of the tail was seen most often in tails with chronic tail lesions. Chronic inflammation in human wounds often occurs when physiological wound healing is disturbed. One factor is bacterial infection with *Streptococcus* or *Staphylococcus* species, which can form polymicrobial microfilms and interfere with an adequate wound healing.[42] This mechanism is conceivable in farm conditions and would explain the finding.

The advantage of scoring tails at the abattoir is the frequent, accurate and quantitative evaluation of the tail health thereby indicating the animal welfare status on herd level.[37] The disadvantage of retrospectively assessing the animal health and welfare status instead of using data from «on-farm visits» is outweighed by the finding that significantly more herds with acute or chronic tail health problems were detected at the abattoir than during on-farm examination and documentation based on the Pig Health Service database. The comparison of the abattoir data with the Pig Health Service data revealed only few correlations, which allows the conclusion that scoring tail lesions at the abattoir as an objective parameter should accomplish or even replace the qualitative scoring of this parameter on-farm for detecting problems with tail lesions on herd level during the often «one-and-only» annual farm visit. It remains unclear if tail health during farm visits was impacted by too many different parameters or if the data quality of farm-visit records was not suitable for such analysis. Finally, the lack of correlations between the two databases indicates that the abattoir scoring of tails could be used as a tool to monitor the tail health state of herds. However, for specific risk factor analysis and targeted prevention plans, on-farm visits by specialized veterinarians remain indispensable.

Conclusions

Routine scoring of tail lesions at abattoirs is an objective but laborious method to investigate the prevalence of tail lesions on population and herd level. Such data can serve for continuous animal welfare monitoring, thereby enabling an early detection and intervention on farm level. With the ongoing development of artificial intelligence and improved automated data collection,[4,9] all available data should be compiled and analyzed to improve the monitoring of pig welfare parameters on-farm and in the slaughterhouse.

Declarations

Authors' contributions

HN and UG generated and analyzed the abattoir database and the Swiss Pig Health Service database. HN, XS and BW were major contributors in organizing the project and HN in writing the manuscript. All authors read, commented and approved the manuscript. All authors gave consent to publish the study in the current form.

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Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

The datasets and databases generated and analyzed during the current study are not publicly available owing to data protection of the farmers but are available from the corresponding author upon request. The used Microsoft® Access form is available from the corresponding author upon request.

Ethics approval

This study did not require official or institutional ethical approval. The animals were examined after stunning and bleeding.

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Prévalence des lésions de la queue chez les porcs d'engraissement en Suisse

Les morsures et les lésions de la queue sont des problèmes courants dans la production porcine moderne. En 2008, la Suisse a interdit la caudectomie pour prévenir les morsures de la queue. Depuis lors, les porcs sont engraissés avec des queues intactes. Cette étude visait à évaluer la prévalence actuelle des lésions de la queue dans les abattoirs suisses et à comparer les données de l'abattoir avec les données spécifiques à l'exploitation concernant les facteurs de risque potentiels pour des lésions de la queue. La collecte des données a été effectuée par cycles répétitifs de deux semaines dans quatre abattoirs pendant toutes les saisons d'une année. Le sexe, la longueur de la queue et l'état de l'extrémité de la queue ont été évalués parmi d'autres paramètres. Pendant 32 semaines au total, 195 704 porcs provenant de 6 112 lots de 2 510 troupeaux ont été évalués. Dans l'ensemble, 63,2 % des animaux inclus dans l'analyse ont été abattus avec une queue complète (Tail Length Score [TLS] la plus basse), tandis que 36,8 % présentaient une perte partielle ou totale de la queue. L'état de l'extrémité de la queue (Tail Tip Condition Score [TTCS]) a été jugé intact dans 63,0 % des cas, avec une lésion cicatrisée dans 23,7 % des cas, avec une lésion aiguë dans 1,3 % des cas et avec une lésion chronique dans 12,0 % des cas. Les animaux mâles présentaient des valeurs de TLS et de TTCS significativement plus élevées que les animaux femelles ($P \leq 0{,}05$). Les valeurs de TLS étaient significativement plus élevées en hiver qu'au printemps et en été ($P < 0{,}001$). Les valeurs de TTCS étaient significativement plus élevées en automne qu'au printemps et en été. Les valeurs TLS et TTCS différaient significativement ($P < 0{,}001$) entre les quatre abattoirs. Seules quelques corrélations significatives ont été trouvées entre les valeurs de TLS et TTCS et les données spécifiques à l'exploitation. L'enregistrement des lésions de la queue dans les abattoirs est une méthode précise pour étudier la prévalence de ces lésions chez les porcs d'engraissement. Cependant, pour contrôler le bien-être animal au niveau du troupeau, cette méthode demande beaucoup de travail. En outre, les données sur les lésions de la queue collectées à l'abattoir ne peuvent pas remplacer les examens vétérinaires sur l'exploitation pour l'identification des facteurs de risque.

Mots clés: Suisse, abattoir, Tail Length Score, Tail Tip Condition Score, saison, porc.

Prevalenza di lesioni alla coda nei suini da ingrasso svizzeri

La morsicatura della coda e le lesioni sono problemi comuni nella moderna produzione suina. Nel 2008 il taglio della coda per prevenire il morso della coda nei maiali è stato vietato in Svizzera. Da allora i suini vengono allevati con la coda intatta. L'obiettivo di questo studio era di valutare l'attuale prevalenza delle lesioni alla coda nei macelli svizzeri e di confrontare i dati ottenuti con quelli specifici degli allevamenti per quanto riguarda i potenziali fattori di rischio delle lesioni alla coda. La raccolta dei dati è stata eseguita in cicli ripetitivi di due settimane in quattro macelli durante tutte le stagioni consecutive di un anno. Gli altri parametri presi in considerazione sono il sesso, la lunghezza della coda e lo stato della punta della coda. Durante un totale di 32 settimane, sono stati valutati 195 704 maiali di 6 112 lotti di 2510 branchi. Il 63,2 % degli animali inclusi nell'analisi statistica sono stati macellati con una coda intatta (punteggio più basso di lunghezza della coda (Tail Length Score [TLS]), mentre il 36,8 % aveva una perdita parziale o completa della coda. Lo stato della punta della coda (Tail Tip Condition Score [TTCS]) è stato considerato come intatto nel 63,0 %, con una lesione guarita nel 23,7 %, con una lesione acuta nell'1,3 % e con una lesione cronica nel 12,0 % di tutti i casi. Nei maschi si sono rilevati valori significativamente più alti per TLS e TTCS rispetto alle femmine ($P \leq 0{,}05$). I valori di TLS erano significativamente più alti in inverno che in primavera e in estate ($P < 0{,}001$). I valori TTCS erano significativamente più alti in autunno che in primavera e in estate. I valori TLS e TTCS differivano significativamente ($P < 0{,}001$) tra i quattro macelli. Sono state rilevate poche correlazioni significative tra i valori TLS e TTCS e i dati specifici dell'azienda. La registrazione delle lesioni alla coda nei macelli risulta quindi essere un metodo accurato per valutare con precisione la prevalenza delle lesioni alla coda nei suini da ingrasso ma al contempo molto laborioso per monitorare il benessere degli animali in una grande popolazione. Inoltre, i dati sulle lesioni alla coda raccolti al macello non possono sostituire le visite alla mandria da parte dei veterinari per valutare i fattori di rischio specifici.

Parole chiave: Svizzera, macello, punteggio delle lesioni alla coda, Tail Length Score, punteggio delle condizioni della punta della coda, Tail Tip Condition Score, stagione, maiale.

Prevalence of tail lesions in Swiss finishing pigs

U. Gerster, X. Sidler, B. Wechsler, H. Nathues

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