The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK

Animal Welfare 2007, 16: 165-168
ISSN 0962-7286

How to deal with complex data of skin lesions in weaner pigs

J Baumgartner

Institute of Animal Husbandry and Welfare, University of Veterinary Medicine Veterinaerplatz 1, A-1210 Vienna, Austria;
email: johannes.baumgartner@vu-wien.ac.at

Abstract

Skin lesions of pigs can be used as an indicator of their ability to adapt to the social and physical environment. A total of 315 weaner pigs were assigned to one of three treatments: groups of nine piglets from one litter (9s), mixed groups of nine piglets from three litters (9m) or mixed groups of 36 piglets from four litters (36m). The ear, neck/shoulder, rump, back, hindquarter, tail and belly of piglets were inspected for scratches, abrasions and signs of inflammation on days 0, 5 and 28 post mixing. Due to the large number of body regions, different types of injuries and data from three inspections, the results of explorative data analysis were very heterogeneous. Data preparation focusing on scratches and combination of corresponding regions using factor analysis resulted in a data set which was useful for further statistical procedure. Factor analysis identified corpus, ear and tail as factors. Using the Wilcoxon test different inspections within a treatment were compared. Differences between treatments were analysed using Kruskal-Wallis and Mann-Whitney U tests. Mixed groups (9m, 36m) showed an increase of 'many scratches' on ear and corpus from day 0 to day 5 and a decrease on ear from day 5 to day 28. 'Many scratches' on corpus were more frequent in mixed groups than in single litter groups. This study suggests that skin lesion score can be used to analyse treatment effects on the aggression of pigs. However, it has to be focused on a precise hypothesis and should be based on behavioural observations.

Keywords: *animal welfare, factor analysis, pig, post-mixing aggression, skin lesion, weaner*

Introduction

The integument of an individual is the organ that has the most intensive contact with its social and physical environment (Ekesbo 1984; Gloor 1984). Post-mixing aggression in commercially housed weaner pigs often results in the accumulation of superficial skin lesions. The number of skin lesions offers a rapid means of assessing the aggressiveness of a large number of pigs (Turner *et al* 2005) and can therefore be used to compare the treatment effects on aggression. Skin lesions differ in quantity, quality, location, severity and in the healing process. Collecting data of this level of complexity has the tendency to give rise to very heterogeneous results and data preparation for statistical analyses is necessary. Taking skin lesion data of weaner pigs kept in single litter groups and in mixed groups as an example, this paper tries to offer a procedure on how best to deal with this problem. Mixing of unfamiliar pigs meant an increased number of fights between group members leading to a higher prevalence of skin lesions.

Materials and methods

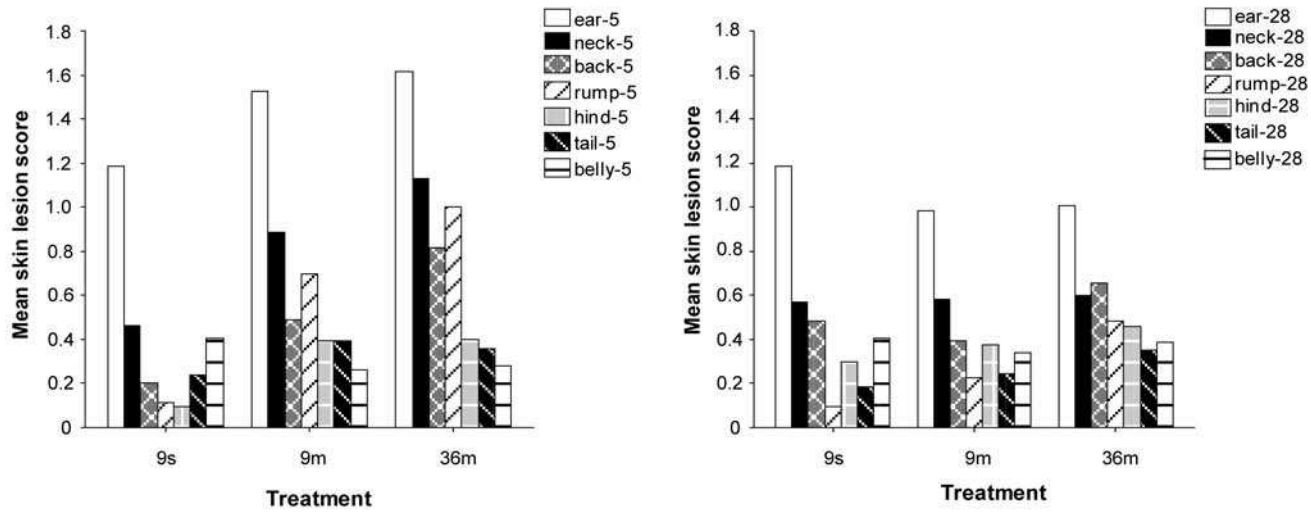
A total of 324 female and castrated male pigs (Large White × Pietrain), born and raised in farrowing crates, were weaned at five weeks of age (35.87 ± 3.01 days) at 10.24 ± 1.96 kg. After weaning pigs were assigned to one of three treatments: groups of nine piglets from one litter (9s), mixed groups of nine piglets from three litters (9m) or mixed groups of 36 piglets from four litters (36m). Treatments were replicated six times. Pigs were housed in pens with partially slatted floors and a space allowance of 0.41 m^2 per pig. Feed, water and straw for manipulation were provided *ad libitum* on one single space feeder, one nipple drinker and one straw rack respectively for nine animals.

315 out of 324 pigs were inspected for skin lesions by one observer immediately before being transferred to the experimental pens (day 0), five days later (day 5) and at the end of the trial (day 28). The pigs' bodies were divided into seven regions: ear, neck/shoulder, rump, back, hindquarter, tail and belly. Each region was inspected and classified into the following categories: 0) without lesion, 1) few scratches, 2) many (> 3) scratches, 3) abrasions and 4) signs of inflammation. A scratch is defined as a thin, superficial cut in the skin, an abrasion is a superficial scraping away of skin area (diameter > 5 mm) and an inflammation is characterised by pain, redness, swelling and occasional loss of function. The highest category of both body sides was recorded.

Due to the large number of body regions, different severity and quality of injuries and data from three inspections, explorative data analyses with mean values resulted in a huge number of heterogeneous results (Figure 1). This was

https://doi.org/10.1017/S0962728600031249 Published online by Cambridge University Press

Figure 1



Skin lesions of weaner pigs kept in groups of nine piglets from one litter (9s), mixed groups of nine piglets from three litters (9m) or mixed groups of 36 piglets from four litters (36m) at day 5 (left graph) and day 28 (right graph) after weaning. Different bars show different regions of the body. Mean skin lesion score from 6 replicates.

Table 1 Rotated component matrix of aggregated data from 18 trials for 'many scratches' on different body regions at day 28. (Figures calculated by using the factor analysis. The component loadings show the correlation coefficients between variables and factors. Variables with a high correlation within a component are clustered together to a new variable).

	Component		
	1 – corpus	2 – ear	3 – tail
Ear-28_ms	-0.122	0.947	0.036
Neck-28_ms	0.610	0.293	-0.620
Back-28_ms	0.631	0.327	-0.154
Rump-28_ms	0.931	0.040	0.092
Hind-28_ms	0.633	-0.154	-0.242
Tail-28_ms	0.138	0.051	0.920
Belly-28_ms	0.956	0.071	0.204

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations.

not conducive to a comparison of inspection days within a treatment and different treatments, respectively.

Therefore in a second step of data preparation, scratches (category 1 and 2), which are caused by bites in the majority of cases were separated from abrasions and inflammations (category 3 and 4), which were ignored for further analysis because of their different aetiology. Then we focused on the question of whether there were 'many scratches' (category 2) on a body region of a pig or not. To exclude injuries occurring prior to the experimental period, the results from the second inspection were corrected taking into account the initial situation (day 5 minus day 0). Factor analysis was used to reduce the large number of variables (regions) to a smaller number of factors for modelling purposes. Based on aggregated data from 18 trials about 'many scratches' on different body regions at day 28, three factors could be identified (Table 1). Factor 1 loaded the regions neck/shoulder, rump, back, hindquarter and belly, which were combined to the region 'corpus' for further analyses. Factor 2 separated ear only and factor 3 loaded tail. These three factors accounted for 82% of the variance among the intercorrelations of the seven issue variables of the total variance.

Using reduced number of variables ('many scratches' on corpus, ear and tail) statistical analyses were carried out. The Wilcoxon test was used to compare the different inspections (days 0, 5 and 28) within a treatment. Kruskal-Wallis and Mann-Whitney *U* tests were used for comparison of different treatments.

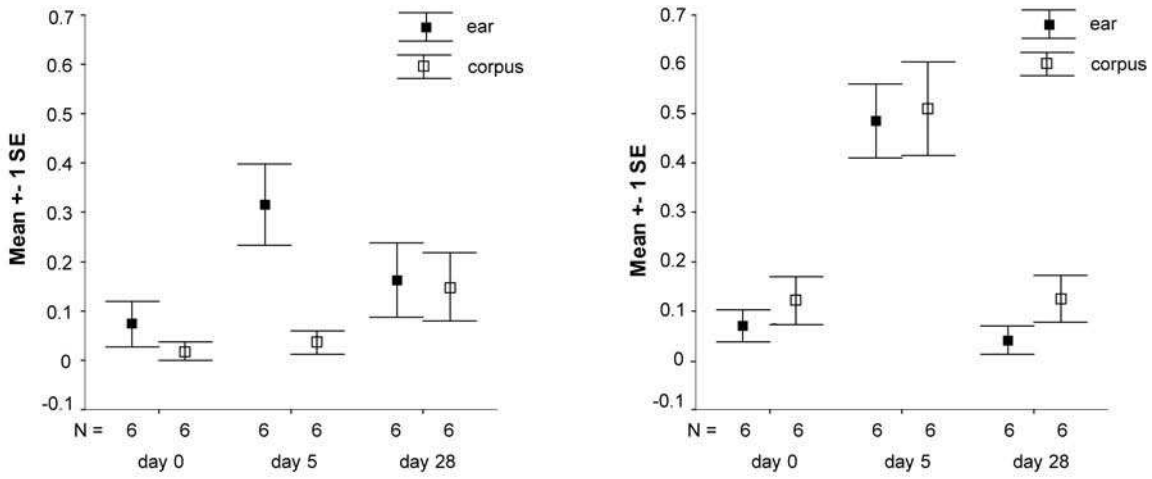
Results

When comparing different days within a treatment no difference in 'many scratches' on ear and corpus could be found in group 9s (Figure 2; left graph). Groups 36m (Figure 2; right graph) and 9m showed an increase on ear and corpus from day 0 to day 5 and a decrease on ear from day 5 to day 28 ($P < 0.05$).

At day 5 pigs with 'many scratches' on the corpus were more frequent in mixed groups (9m, 36m) than in single litter groups (Figure 3; right graph), however, no difference between treatments could be found on ear (Figure 3; left graph). At day 28 the groups did not differ in corpus and ear. Results for tail lesions showed neither differences between inspection days within treatments nor between the treatments.

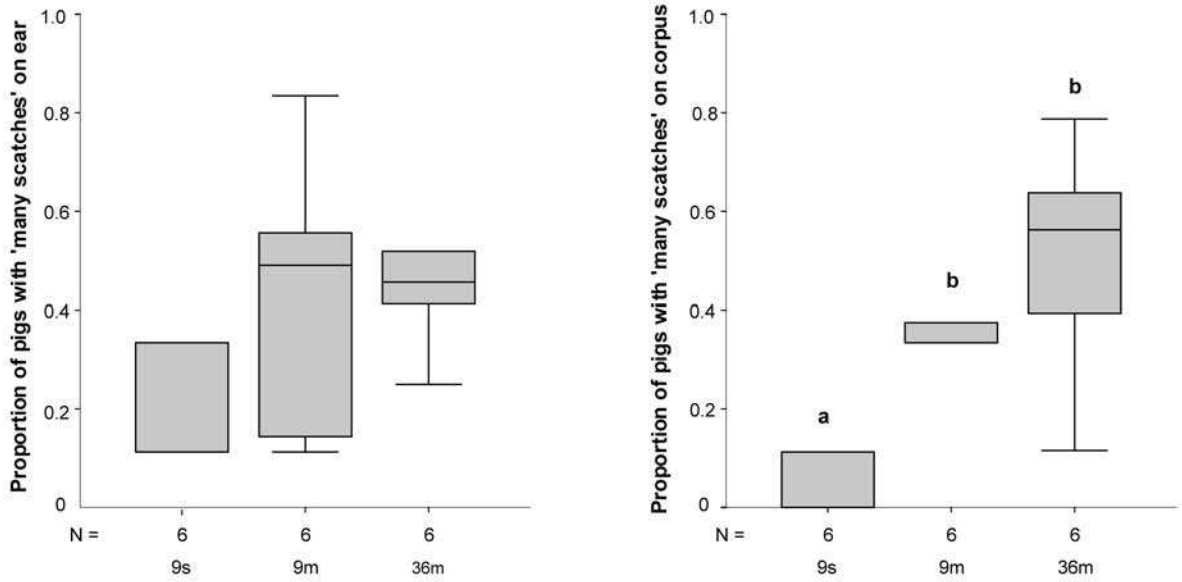
https://doi.org/10.1017/S0962728600031249 Published online by Cambridge University Press

Figure 2



Proportion of pigs with 'many scratches' on ear and corpus at day 0, 5 and 28 in single litter groups (9s; left graph) and in mixed groups of 36 pigs (36m; right graph).

Figure 3



Proportion of pigs with 'many scratches' on ear (left graph) and on corpus (right graph) at day 5 in single litter groups (9s) and in mixed groups (9m, 36m). Different letters show a significant difference between groups (Mann-Whitney *U* test, $P < 0.05$). The data are presented as a box and whisker plot: the box contains the middle 50% of the data, the line within the box indicating the median. The top and the bottom of each box represent the 75 and 25% quartile, respectively. The whiskers represent the minimum and maximum data values.

Discussion and conclusion

Skin lesions can be qualified and quantified in many different ways. Dividing the body into a variety of small regions and recording different kinds of lesions can lead to confusing results that are difficult to analyse and interpret. Reducing the number of variables by focusing on scratches and combining regions by using the factor analysis resulted in a data set useful for further statistical analysis. Factor analysis identified the regions ear, tail and corpus as key components. This outcome is in complete accordance with methods used in other studies, ie Turner *et al* (2005) who divided the body into front, middle and rear.

A comparison of different inspections within a treatment followed our hypothesis: only pigs in mixed groups showed an increase in skin lesions immediately after weaning as a result of frequent fighting between unfamiliar pigs for social rank as described by Rushen and Pajor (1987). Mixed groups differed from single litter groups only in the variable

https://doi.org/10.1017/S0962728600031249 Published online by Cambridge University Press

'many scratches' on corpus but not on the ear. These results can be explained by the fact that the pigs in all treatments were fed in the same manner ie one single-space feeder for nine piglets. Limited feeding space allowance resulted in an increased level of aggression at the feeding place in all treatments and a high number of bites targeting the ear of the feeding pigs.

This work suggests that skin lesion scores can be used to analyse treatment effects on the aggression of pigs. However, the precision of measurement in terms of localisation, frequency and severity of injuries has to be focused on a precise hypothesis and should be based on a preliminary study including behavioural observations. From our results we conclude that lesions on ears, tail and the rest of the body may have different behavioural contexts and therefore should be measured separately.

Animal welfare implications

Mixing of unfamiliar pigs, a practice common in commercial pig production, results in fighting and compromises welfare. Skin lesions can be used for on-farm welfare assessment but special emphasis should be given to the methodology of data collection and analysis.

Acknowledgements

The author would like to thank Daniela Lexer, Alexander Ploner, Herbert Strnad and Franz Posseth for their invaluable assistance. This project was partly funded through the Jubilaeumsfond OENB (research grant no. 7844).

References

Ekesbo I 1984 Methods for evaluation of environmental influences on animal health. *Wiener Tierärztliche Monatsschrift 71:* 186-190

Gloor P 1984 Verletzungen und Veränderungen am Integument des Schweines als Indikatoren für die Tiergerechtheit eines Stallsystems. In: *Aktuelle Arbeiten zur artgemäßen Tierhaltung 1983. KTBL-Schrift 299* pp 94-105. KTBL: Darmstadt, Germany. [Title translation: Skin lesions of pigs as an indicator for animal welfare]

Rushen J and Pajor E 1987 Offence and defence in fights between young pigs (*Sus scrofa*). *Aggressive Behaviour 13:* 329-346

Turner SP, Farnworth MJ, White IMS, Brotherstone S, Mendl M, Knap P, Penny P and Lawrence AB 2005 The accumulation of skin lesions and their use as a predictor of individual aggressiveness in pigs. *Applied Animal Behaviour Science 96:* 245-259

https://doi.org/10.1017/S0962728600031249 Published online by Cambridge University Press