Rearing pigs with play opportunities: Effects on disease resilience in pigs inoculated with PRRSV

K. Steinerová[1], J. C. Harding[1], S. E. Parker[1], H. L. Wilson[2], A. N. Finatto[1], and Y. M. Seddon[1,3]

Karolína Steinerová

Yolande Seddon

APPLICATION FOR PRODUCERS

Rearing pigs in an environment with opportunities to play improves resilience against common production challenges and results in better growth performance. Play can be stimulated with intermittent provision of various novel enrichment such as cardboard, paper or burlap, and extra space.

SUMMARY

Positive emotions can reduce disease susceptibility during infectious challenges in humans, and emerging evidence suggests similar effects in farm animals. Because play behaviour may support a positive emotional state in pigs, this study investigated whether rearing pigs with regular intermittent play opportunities enhances disease resilience when challenged with porcine reproductive and respiratory syndrome virus (PRRSV). Litters were assigned to either play (PLY; n=5 litters) or control (CON; n=4 litters) treatments at birth. In PLY, play was promoted with extra space and enrichment items for three hours daily from five days of age (doa). At weaning (25±2 doa), 28 pigs (14/treatment) were selected for a disease challenge. The pigs were transported to a disease containment facility and at 43±2 doa (day 0 post-inoculation, DPI) inoculated with PRRSV. Play opportunities for PLY continued every other day until euthanasia of all pigs at 65±2 doa (22 DPI).

Results suggest that PLY pigs developed increased resilience to PRRSV compared to CON. Play pigs continued to play during infection, demonstrating less sickness behaviour and emphasizing the rewarding properties of play. This study demonstrates that rearing pigs in an environment supporting positive experiences through provision of play opportunities can enhance resilience against common modern production challenges, underscoring the value of positive welfare in intensive pig farming.

Inoculated PLY pigs with PRRSV during a play opportunity.

INTRODUCTION

Positive emotions have been associated with improved health in humans, and emerging evidence suggests similar effects in farm animals. Emotions and immunity work in synergy, and there are indications that a positive affective state has a beneficial effect on disease resilience. Resilience, defined as the ability of the animal to minimize the impact of environmental, social and disease challenges and quickly return to pre-challenge status, is imperative to sustain efficient pig production. An environment promoting positive experiences and the satisfaction of pigs' behavioural needs may improve pig resilience against common stressful challenges such as disease, transport, and injury. In pigs, positive emotions could be facilitated by offering opportunities to engage in a rewarding activity promoted by a stimulus-rich environment. Our previous study reported that play can be promoted and sustained in pigs beyond the period of its natural expression (2-6 weeks) in a commercial setting regardless of extra space, as long as pigs were provided with a rotation of novel enrichment, making it an attainable approach for promoting positive experiences on conventional farms. However, how play opportunities influence resilience during a disease challenge is unknown. The objective of the current experiment was to identify whether rearing pigs with play opportunities improved their disease resilience when challenged with PRRSV.

1 Department of Large Animal Clinical Science, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, SK, S7N 5B4
2 Vaccine and Infectious Disease Organization, International Vaccine Centre, University of Saskatchewan, 120 Veterinary Road, Saskatoon, SK, S7N 5E3
3 Prairie Swine Centre Inc, PO Box 21057, 2105 – 8th Street East, Saskatoon, SK S7H 5N9

EXPERIMENTAL PROCEDURES

Nine litters (n = 127 piglets) were assigned to either play (PLY; n=5 litters) or control (CON; n=4 litters) treatments at birth. The PLY treatment was reared with regular play opportunities from five days of age, whereas the CON treatment was reared under standard production conditions (farrowing pen: 0.3 m2/pig) without play opportunities. In PLY, play was promoted daily in a session consisting of 3 hours of continuous access to extra space in a playpen (1.8 m x 1.8 m; 0.5 m2/pig total space including the farrowing pen, Figure 1a) with the same seven types of destructible and durable enrichment items. The playpens were situated behind the farrowing pen gate in the corridor and had solid flooring. The entire litter was released to the playpen by opening the back gate of the farrowing pen. At weaning (25±2 doa), 28 pigs (14/treatment) were selected for a disease challenge. Individual pig-based factors shown to influence disease outcomes and immune response, such as growth and back test assessing the pig's coping strategy (low resistance [LR], medium resistance [MR] and high resistance [HR]), were accounted for in the selection, as well as sex, sow and the frequency of play at d21. The pigs were transported to a disease containment facility and at 43±2 doa (day 0 post-inoculation, DPI) inoculated with PRRSv. Play opportunities for PLY continued every other day until euthanasia of all pigs at 65±2 doa (22 DPI).

RESULTS AND DISCUSSION

Skin lesions (Figure 1): Skin lesions indicate agonistic encounters. The treatments did not differ in skin lesion score pre- nor one-day post-weaning, perhaps due to the large size of the pens. Following transport to the disease challenge facility, the skin lesion score increased but was substantially lower in PLY pigs compared to CON. PLY pigs might have spent more time exploring the transport trailer bedded with straw, and less time manipulating other pigs. Pre-inoculation (-2 DPI), the score declined again with PLY maintaining a lower score than CON until the end of the experiment (21 DPI). At 21 DPI, PLY, but not CON, had a lower skin lesion score compared to pre-weaning (Figure 1).

Viral load and respiratory distress: PRRSV viral load did not differ between treatments and peaked in the first week post-inoculation and then gradually declined. Regarding clinical signs, PLY pigs had a lower probability of moderate and severe respiratory distress and had a shorter duration of respiratory distress than CON pigs.

Growth performance (Figure 2): PLY pigs had higher average daily gain through the infection and were more feed efficient than CON pigs. There was no effect of treatment on average daily feed intake.

"Play pigs grew better during the infection and were more feed efficient."

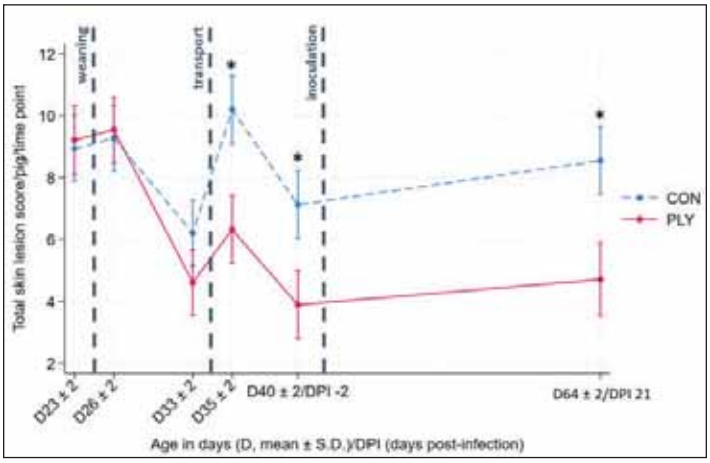

Figure 1. Total skin lesion scores in Play (PLY, solid line) and Control (CON, dashed line) treatments per pig (n = 28) at different time points: pre-weaning (age: D23 ± 2; mean ± S.D.), post-weaning (D26 ± 2), before transport (D33 ± 2), after transport (D35 ± 2), pre-inoculation (-2 DPI, DPI; D40 ± 2), and 21 DPI (D64 ± 2). Data are presented as predicted means with 95% confidence intervals.

Footnote: 'X' between two variables signifies an interaction effect. Significant differences between treatments within a day are denoted on the graph with an asterisk (*).

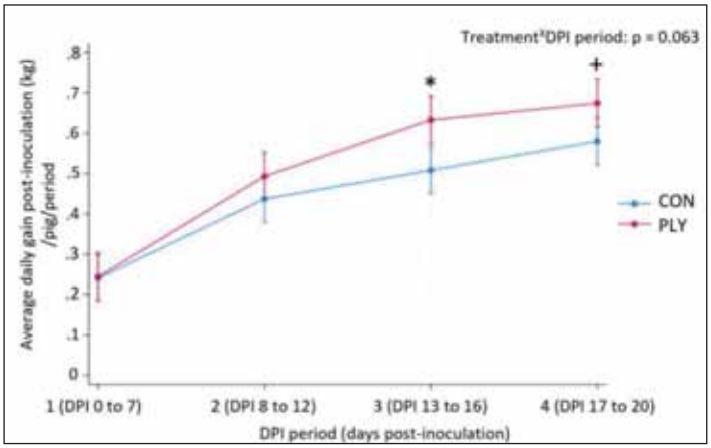

Figure 2. Average daily gain (ADG) post-inoculation (kg) per pig in Play (PLY, solid line) and Control (CON, dashed line) treatments during periods 1 (DPI 0 to 8; days post-inoculation), 2 (DPI 8 to 13), 3 (DPI 13 to 17; n = 27■ in periods 1, 2, 3), and period 4 (DPI 17 to 21; n = 26•). Data are presented as predicted means and 95% confidence intervals.

Footnote: 'X' between two variables signifies an interaction effect. Significant differences between the treatments within DPI period or DPI are denoted on the graphs with an asterisk (*). + p = 0.027 (close to the significant threshold). ■Datapoints from all DPI periods of one deceased PLY pig due to secondary bacterial infection, and •a datapoint from DPI period 4 of the CON outlier pig were excluded from this analysis.

Immune response: The pigs demonstrated a typical immune response to PRRSV, with the lowest levels of white blood cells, neutrophils, lymphocytes, and monocytes in the first week post-inoculation and a rebound in the second week until euthanasia at 22 DPI. The number of monocytes, the progenitor of macrophages that is the primary PRRSV replication site, differed between treatments. PLY pigs had fewer monocytes on 8 DPI, and by 21 DPI they returned to baseline, whereas CON had elevated monocyte counts. This can be suggesting lower inflammatory response in PLY.

Play behaviour (Figure 3): During the play opportunities, PLY pigs were more active pre-inoculation as well as during the infection compared to CON. Within the initial 10 min of a play session, PLY pigs engaged in locomotor, social and object play to some extent in all days pre- and post-inoculation. Play pigs continued to play during infection, demonstrating less sickness behaviour and emphasizing the rewarding properties of play.

IMPLICATIONS

The results indicate that the pigs reared with play opportunities were less affected by PRRSV. The ability to mitigate the detrimental effects caused by a pathogen, as seen in PLY pigs, indicates improved disease resilience. These findings underscore the value of positive experiences for farmed pigs, demonstrating their potential to enhance pigs' resilience towards coping with various challenges encountered in modern production environments, thereby improving pig health and welfare.

ACKNOWLEDGEMENTS

Funding for this project was provided by Natural Sciences and Engineering Research Council (NSERC), University of Saskatchewan, Alberta Pork, BC Pork Producers Association, Conestoga Meat Packers Ltd, Hylife Ltd, Les Eleveurs de porcs du Québec, Manitoba Pork Council, Maple Leaf Foods, Olymel S.E.C./L.P., Ontario Pork Producers Marketing Board, and PEI Hog Community. The authors would also like to acknowledge the strategic program funding provided to the Prairie Swine Centre by Sask Pork, Alberta Pork, Ontario Pork, the Manitoba Pork Council, and the Saskatchewan Agriculture Development Fund. In addition, we wish to acknowledge the support of the production and research technicians at Prairie Swine Centre that make it possible to conduct this research.

"Pigs reared with play opportunities were less affected by PRRSV, indicating improved disease resilience."

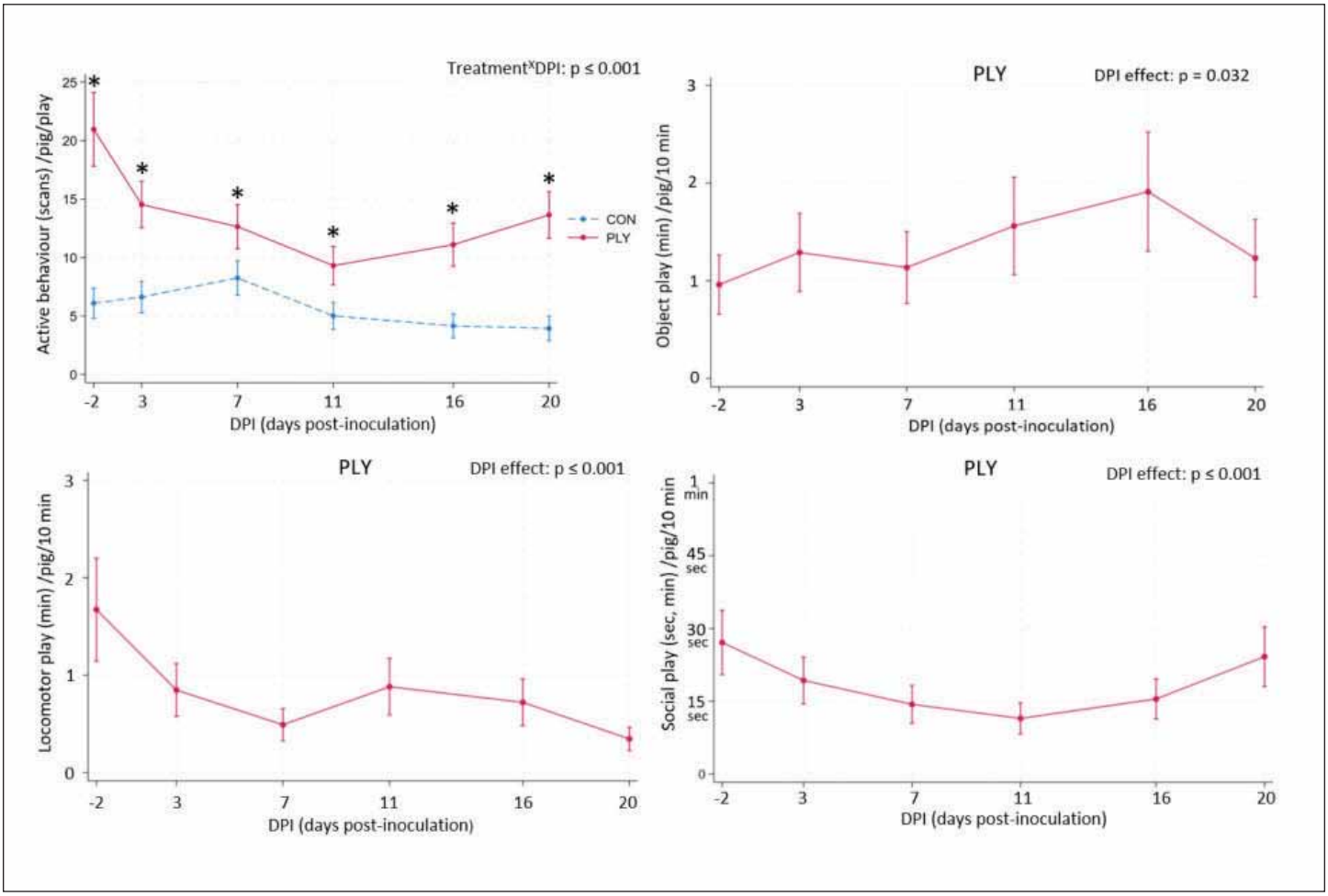

Figure 3. Active behaviour during the play sessions (a) in Play (PLY, solid line) and Control (CON, dashed line) treatments per pig (n = 28) and duration of object (min; b), locomotor (min; c) and social (sec, min; d) play in PLY (n = 14) within the initial 10 min of the play sessions on -2, 3, 7, 11, 16 and 20 days post-inoculation (DPI). Data are presented as predicted counts and 95% confidence intervals.

Footnote: 'X' between two variables signifies an interaction effect. Significant differences between the treatments within DPI (a) are denoted on the graph a with an asterisk (*).