Evaluating Housing Stress in Gestating Gilts Using Immunological Measures

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Introduction

Although gestation stalls have provided a reduction in building and labor costs to producers, they remain a controversial system of swine production in terms of animal welfare. Gestation stalls physically limit the sow to standing, sitting, and lying. Several studies have suggested that repetitive abnormal behaviors, termed stereotypic and considered an indicator of poor welfare, can be induced in animals by restrictive housing (Randrup et al., 1988). Due to the natural hierarchal social structure of swine, aggression often occurs in group settings. In addition, group housing can result in competition for resources. Although housing sows individually minimizes social conflict and competition, stalled sows may experience unresolved conflicts with adjacently housed animals. This may lead to frustrated states in sows. For these reasons, welfare evaluation in different housing systems remains necessary for the gestating sow.

In this study, we approached swine welfare evaluation by comparing immunological differences between gilts housed in individual stalls with gilts housed in groups of four. We included plasma haptoglobin and α_1- acid glycoprotein parameters, which are thought to be indicators of environmental stress, with a hematology analysis.

Materials and Methods

Forty-eight Landrace x Yorkshire gilts were utilized at the Purdue University Swine Research Farm. Eight groups of four gilts were compared as individual experimental units to 16 individually stalled gilts. Groups of four were allocated a space of 12 ft. 11 in. x 8 ft. with four separate feeding stalls, while individual stalls measured 7 ft. 3 in. x 2 ft. Gilts were housed in the same gestation room to maintain a high degree of control and reduce environmental effects. Additionally, both treatments were managed identically and according to standard practices regarding health care and feeding to maintain control.

Blood samples were obtained via jugular puncture on days 35, 63, and 91 of gestation. Immune values reported here do not include the seven gilts that returned to estrus. Hematocrit (%), granulocyte and lymphocyte numbers ($x10^9$/L), and fibrinogen concentrations (g/dL) were determined using IDEXX, Vettest autoanalyzer. Plasma haptoglobin (Hp) and α_1- acid glycoprotein (AGP) concentrations (ug/ml) were determined by radial immunodiffusion using a kit (Saikin Kagaku Institute, Sedai, Japan) specific for porcine Hp and AGP. Data were analyzed as a repeated measures design using Mixed Models in SAS (SAS, 1982).

Results and Discussion

There were no significant differences in hematocrit, lymphocyte, or AGP concentrations (Table 1). Normal AGP levels suggest little sign of inflammation, however, several researchers propose AGP is not a pronounced marker of inflammation in swine as it is in most species. Lampreave et al. (1994) and Eckersall et al. (1996) demonstrated that AGP did not respond to turpentine injections in pigs. Nevertheless, AGP has been previously reported as an acute phase protein in pigs responding to infectious diseases (Eckersall et al., 1996). Fibrinogen and

granulocytes also did not have a treatment effect, but had a time effect in both housing treatments ($P < .0002$, $P < .0003$).

In humans and some non-human animals, Hp is one of the acute-phase reactants, which increases in sera after inflammatory stimuli, and is thus used as an indicator of inflammation (Morimatsu et al., 1992). Haptoglobin evaluation revealed a time effect, with Hp concentrations gradually increasing in both environments over time ($P < .002$). This might be expected in a gestating state, as Hp often increases before calving in cattle (Alsemgeest et al., 1993).

Our data show a trend toward higher serum concentration of Hp in gilts housed in stalls compared to gilts housed in groups ($P < .06$). We initially expected to find higher levels of haptoglobin in grouped gilts, as their lesion scores indicated more cases of skin trauma and inflammation (see Harris et al., Swine Research Report 2001), predominantly due to dominance aggression. Our results suggest stalled gilts may have had internal areas of inflammation that were not detected in this study. Movement restriction in stalls may have caused inflammation in joints, shoulders, and legs, which was not visible to inspectors and caused haptoglobin to elevate.

Conclusions and Applications

Haptoglobin increased over the period of gestation for both treatments. Individually stalled gilts revealed a trend towards higher levels of Hp than did group housed gilts. The reason for this is unclear. Granulocytes and fibrinogen increased significantly over the gestation period as well, which may be explained by the stress in both types of housing and/or the demands of pregnancy. Although other immunological measures should be further researched to better assess the welfare of gestating sows, we did not find substantial evidence of immunological differences in gilts housed in these two particular systems. This implies that gilts have similar welfare status regarding immunity in either system. Other aspects of swine health and behavior should continue to be investigated to evaluate the overall well-being of the gestating sow in different housing systems.

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Table 1. Blood parameters for gilts housed in groups of 4 or individual stalls

Variable	Time	Stalls n*	Stalls mean	Groups n**	Groups mean	Level of sign.
Hematocrit	1	16	40.4	8	41.5	> .10
(%PCV)	2	13	40.3	8	40.9	> .10
	3	14	38.7	8	40.6	> .10
Granulocyte	1	16	9.29	8	9.20	> .10
($x10^9$/L)	2	13	8.80	8	8.79	> .10
	3	14	10.7	8	11.3	<. 003 Time
Lymphocytes	1	16	6.08	8	6.16	> .10
($x10^9$/L)	2	13	5.81	8	5.66	> .10
	3	14	5.70	8	5.19	> .10
Fibrinogen	1	16	0.32	8	0.32	> .10
(g/dL)	2	13	0.26	8	0.30	> .10
	3	14	0.38	8	0.40	<. 002 Time
α_1-acid Glycoprotein	1	16	467	8	379	> .10
(ug/ml)	2	13	406	8	435	> .10
	3	14	460	8	426	> .10
Haptoglobin	1	16	1433	8	1308	<. 06 Trt.
(ug/ml)	2	13	1617	8	1297	<. 06 Trt.
	3	14	1824	8	1724	<. 002 Time

*value indicates number of individuals tested
**value indicates number of groups of four tested