

## **Effects of exogenous porcine somatotropin and transportation on physiological parameters in weaned pigs.**

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### **Summary**

An experiment was performed to examine effects of exogenous porcine somatotropin (pST) on physiological measures of health and well-being in weaned pigs with or without subsequent transport. We hypothesized that pST may counteract stress-related decreases in health and well-being in recently weaned and transported pigs. On d 17 of life, unweaned pigs were weighed and assigned to treatment groups (n=8/group) as follows: NPNT (injection contains vehicle only (no pST), no transport), YPNT (injection contains pST, no transport), NPYT (injection contains vehicle only, transport at weaning), and YPYT (injection contains S, transport at weaning). Upon allocation, all pigs received daily intramuscular injections containing pST (0.5 mg/kg) or vehicle for 5 d. On d 21, a blood sample was drawn immediately prior to injection (0800 h). At 1200 h on d 21, pigs were weighed and blood was collected. Pigs in the NT groups were then weaned into mixed nursery pens while pigs in the YT groups were mixed and transported by truck for 3 h before being brought back to the nursery. All weaned pigs were fed a standard nursery diet. Blood samples and body weights were taken on d 22, 29 and 37. Transport resulted in lower body weights ( $P < 0.05$ ) at all time points post-weaning, and weight gain within the 14-d window postweaning tended to be less in YT pigs ( $P = 0.05$ ). Transport increased circulating neutrophil numbers and overall white cell counts ( $P < 0.05$ ). A pST\*time interaction was observed ( $P < 0.05$ ) such that pST caused a sharp increase in circulating neutrophils 4 h after injection; however, neutrophil count returned to control levels within 24 h. Elevated concentrations of circulating cortisol were noted in all groups on d 22 (the morning after weaning ( $P < 0.0001$ )). These data suggest that treatment with pST altered immune

and hormonal profiles in weanling pigs but was not effective in preventing the weight loss observed in transported pigs.

### **Introduction**

Recently weaned pigs suffer growth setbacks due to maternal separation, new housing, social displacement, dietary change, and transportation. Diet change and social mixing increase fecal shedding of enterotoxigenic *E. coli*, and a transport time of only 30 mins can be sufficient to cause acidosis, which may in turn increase intestinal permeability, potentially increasing susceptibility to bacterial infection (Jones et al., 2001; Nabuurs et al., 2001). Acute shipping stress results in weight loss and altered immune function including mitogen-induced lymphocyte proliferation and natural killer cell cytotoxicity (Hicks et al., 1998). A reduction in corticosteroid-binding globulin (CBG) can result in an increase in the free cortisol index, and can be used as an indirect measure of biologically active cortisol, especially within one week subsequent to the elimination of the stressor (Siiteri et al., 1982; Bright, 1995). During weaning, pigs consume inadequate feed; this decreases plasma levels of CBG while increasing plasma cortisol and urinary cortisol (Le Dividich and Seve, 2000; Heo et al., 2003).

Somatotropin reduces levels of  $\text{TNF}\alpha$ , an immune response marker, and reduces phagocytosis in piglets; it may also be involved in the regulation of T cell apoptosis (Balteskard et al., 1997; Sartin et al., 2000; Jeay et al., 2002). Stress and exposure to previously unknown pigs increase the risk of disease in newly weaned and transported pigs; somatotropin treatment has the potential to ameliorate such challenging situations.

### **Objectives**

We performed a preliminary experiment to assess physiological measures of health and well-being in weaned pigs with or without subsequent transport, and to examine the effects of exogenous porcine somatotropin (pST) on those measures.

We hypothesized that S may help prevent stress-related decreases in health and well-being in recently weaned and transported pigs.

### **Materials and Methods**

On d 17 of life, unweaned pigs were weighed and assigned to treatment groups (n = 8 per group) as follows:

NPNT	injection contained vehicle only, no transport
YPNT	injection contained pST, no transport
NPYT	injection contained vehicle only, transport at weaning
YPYT	injection contained pST, transport at weaning

Upon allocation, all pigs received daily intramuscular injections containing recombinant porcine somatotropin (0.5 mg/kg; kindly provided by Monsanto) or vehicle for 5 d.

On d 21, a blood sample was drawn immediately prior to injection (0800 h). At 1200 h on d 21, pigs were weighed and blood was collected. Pigs in the NT groups were then weaned into mixed nursery pens while pigs in the YT groups were mixed and transported by truck for 3 h before being brought back to the nursery. Two nursery pens were used such that each pen contained 4 animals from each treatment group (16 pigs per pen). All weaned pigs were fed a standard nursery diet. Blood samples and body weights were taken on d 22, 29 and 37.

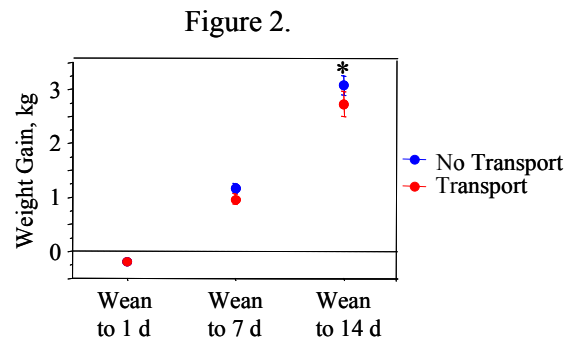
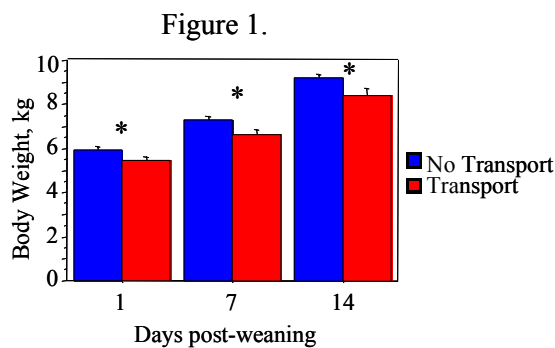
Circulating plasma concentrations of cortisol were measured by radioimmunoassay. White cell blood counts were provided through a commercial laboratory service (Antech, Nashville, TN).

Variables were analyzed with mixed model analysis of variance, using a model for a randomized block design with factorial treatments. Individual pigs served as the experimental units, represented by block by treatment interactions. Repeated measures over time were incorporated, and changes over time were tested. Initial measurements on body weight were used as covariates to address remaining variation within blocks and to further investigate biological responses. If no effect was found for any one endpoint, the model was simplified and the data re-analyzed. Least squares means were compared using Fisher's Protected Least Significant Difference. A significance level of  $P < 0.05$  were used for all testing.

All procedures were performed with the approval of the UT Institutional Animal Care and Use Committee.

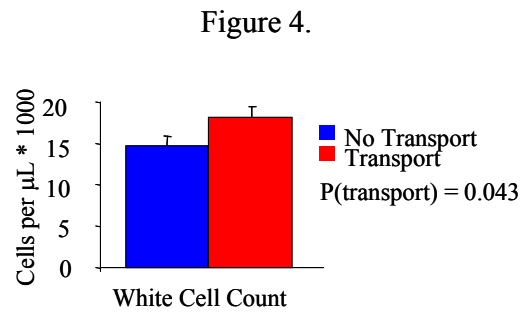
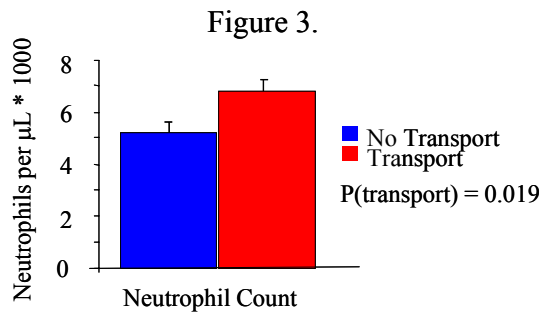
## Results

Transport resulted in lower body weights (Figure 1;  $P < 0.05$ ) at all time points post-weaning, and weight gain within the 14-d window postweaning tended to be less in transported pigs (Figure 2;  $P = 0.05$ ).



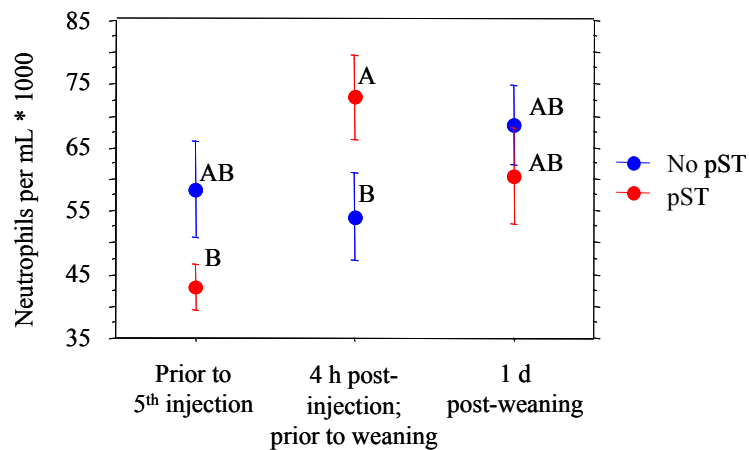
Treatment with pST did not affect body weights or weight gain pre- or post-weaning.

Transport increased circulating neutrophil numbers (Figure 3;  $P = 0.019$ ) and overall white cell counts (Figure 4;  $P = 0.043$ ) 24 h post-weaning.

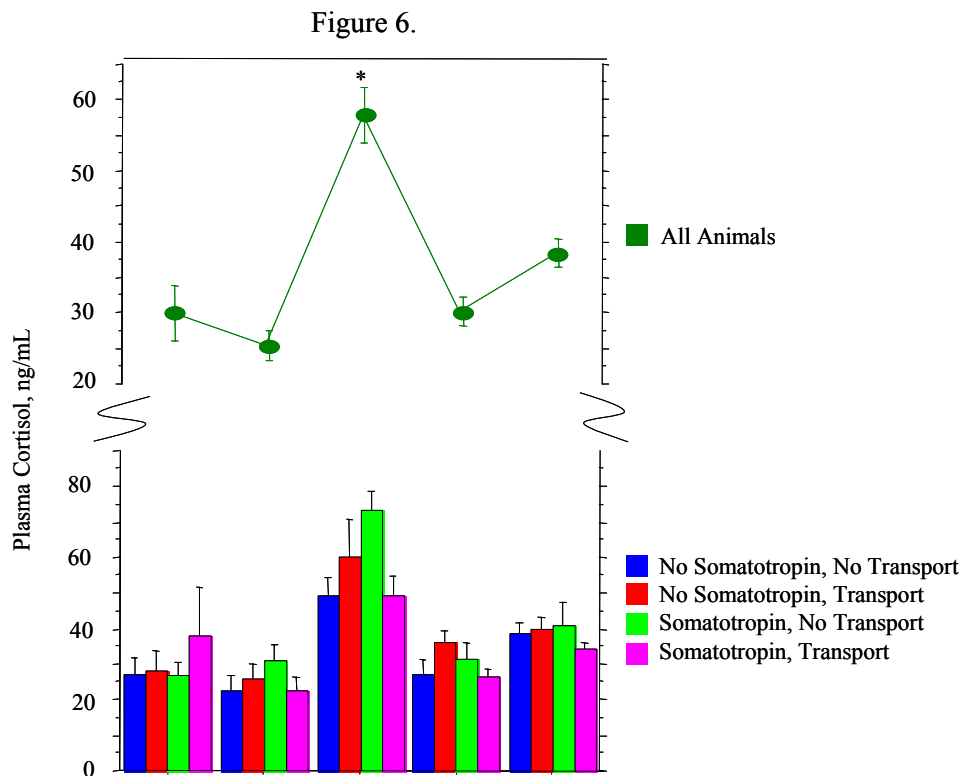


A pST\*time interaction was observed ( $P = 0.017$ ; Figure 5) such that pST caused a sharp increase in circulating neutrophils 4 h after injection; however, neutrophil count returned to control levels within 24 h.

Figure 5.



Elevated concentrations of circulating cortisol were noted in all groups 1 d post-weaning (Figure 6;  $P < 0.0001$ ).



### Conclusions

Although no effects of somatotropin treatment were seen on body weight and weight gain, the increased neutrophil counts may indicate a positive effect of somatotropin on immune function.

To expand on this investigation, plasma concentrations of CBG will be measured, and the free cortisol index will be calculated using the ratio of plasma total cortisol to pCBG concentrations. We anticipate that treatment with pST will increase CBG production in early

weaned pigs and therefore decrease the amount of biologically active cortisol and its associated negative effects seen in weaning and transport.

### **Implications**

This research addresses concerns regarding the transport of recently weaned pigs in commercial swine operations. Through this work we intend to develop management schemes or treatments that will reduce the harmful effects of weaning and transport, and improve the well-being of weaned pigs. Such strategies should provide producers with additional ways to manage production challenges and enhance consumer confidence and acceptance of pork products.

### **References**

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