The effects of stress on feed intake, growth and plasma insulin like growth factor I (IGF-I) in growing pigs

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Stress factors have been shown to reduce growth rate and efficiency of feed use and tend to increase carcase fatness in pigs (1). IGF-I is an anabolic hormone and circulating IGF-I levels have been shown to reflect lean tissue growth and growth rate in pigs (2). As a consequence, the evaluation of circulating levels of IGF-I, in conjunction with measures of growth and feed intake, is assessed in this study as a possible metabolic indicator of the influence of stress on growth and feed intake in pigs.

The study was originally designed to examine the binary (on/off) activation of regulated genes (not reported here) in growing pigs. Pigs were maintained at 2 stocking densities and exposed to combinations of 2 groupings and 2 temperatures during weeks 4 and 7 of an 8-week study. During the two weeks preceding weeks 4 and 7, pigs were subjected to thermoneutral temperatures and the same stocking rates as in weeks 4 and 7. Ninety-six male hybrid (mainly Large White × Landrace) pigs were allocated at 34.5 ± 0.36 kg liveweight (mean ± SEM) to one of eight treatment combinations (2 × 2 × 2 factorial) including 2 stocking densities (low 2 m^2 /pig, high 1 m^2/pig), 2 ambient temperatures (thermoneutral [22˚C] or high temperature [30˚C]) and grouping (1 pig, 6 pigs), in a sequence of two phases (cross-over design). Due to the size of this study, this paper reports only on the effect of grouping and high temperature, pooling the two stocking densities, on growth, feed intake and plasma IGF-I during week 7. Liveweight gain (growth) and feed intake were measured at intervals of one week. Blood samples were collected by venipuncture from all pigs at the end of weeks 1, 3, 4, 6, 7 and 8. Plasma IGF-I was measured by ELISA. The effects of the treatments on growth, feed intake and plasma IGF-I concentrations were analysed using linear mixed models for all the data.

The heat treatment significantly reduced feed intake ($P<0.01$) during week 7. Grouping alone and the combination of grouping plus heat significantly ($P<0.001$) decreased growth, feed intake and plasma IGF-I concentration. The effects of grouping were more pronounced than the effects of heat on growth and IGF-I, and these treatment effects were not additive.

	Group[1]	Heat[1]	Group + heat [1]	Control[1]
Growth (kg/week)	3.4 ± 0.4 ^{b***}	5.8 ± 0.3 ^{a}	2.6 ± 0.3 ^{b***}	5.9 ± 0.3 ^{a}
Feed Intake (kg/week)	15.5 ± 1.4 ^{b***}	16.7 ± 0.5 ^{b**}	13.0 ± 0.9 ^{b***}	20.0 ± 0.9 ^{a}
IGF-I (ng/mL)	269 ± 11 ^{b***}	338 ± 14 ^{a}	242 ± 10 ^{b***}	348 ± 15 ^{a}

[1] mean ± SEM. $^{a, b}$ Means with different superscripts within rows differ significantly, ** $P < 0.01$, ***$P < 0.001$.

In summary, the plasma IGF-I levels tended to reflect growth and not necessarily feed intake. The decrease in circulating IGF-I levels most likely reflected a decrease in somatic tissue (liver, muscle and adipose) IGF-I production, since nutrient substrate is most likely repartitioned to maintain normal metabolism in key essential tissues such as the brain, heart, lungs and related viscera when the stressors were imposed. Alternatively, the decrease in plasma IGF-I could be indicative of a decrease in IGF-I clearance from tissues in an attempt to maintain metabolic homeostasis in response to the grouping and the combination of grouping and heat stress. We speculate that plasma IGF1 status may reflect the metabolic status of pigs subjected to stressors.

References

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