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# Dietary Selenium and Vitamin E combine to reverse the effects of heat stress on intestinal barrier integrity in growing pigs

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A predicted increase in the prevalence of heat events will heighten the challenge of managing hyperthermia in summer. Intestinal barrier integrity is often compromised during heat stress (HS) by oxidative damage due to blood flow being redirected away from splanchnic to peripheral tissue to dissipate heat (Pearce *et al*. 2012). Therefore, this experiment was conducted to test whether supraphysiological dietary supplementation of antioxidants (selenium yeast (Se) and Vitamin E (VE)) can maintain gut barrier integrity in heat stressed pigs.

Forty-eight female growing pigs (22.4 ± 0.9 kg) were randomly assigned to four diets containing either 0.2 ppm Se and 17 IU VE/kg (Diet A, NRC 2012 recommended), 0.3 ppm Se and 50 IU VE/kg (Diet B), 0.5 ppm Se and 100 IU VE/kg (Diet C), or 1.0 ppm Se and 200 IU VE/kg (Diet D). After two weeks of supplementation, six pigs from each dietary group were allocated into climatic chambers set at thermoneutral (TN) conditions (20° C) or cyclic (HS) (35° C, 9am-5pm followed 28° C overnight) for two days. On the third day, pigs were euthanized and fresh jejunum and ileum samples were mounted into Ussing chamber for quantifying electrical trans-epithelial resistance (TER) and FITC-dextran (4k Da) apparent permeability (APP) of mucosa. A linear mixed model was used to analyze the effects of dietary treatment, thermal exposure, and intestinal site on TER and APP in Genstat 16th edition. Location of cages was used as a random effect.

Table. Effects of Se and VE combination in mitigating HS induced changes in small intestinal integrity

| Parameters | TN | | | | HS | | | | SED | *P*-values | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Diet A | Diet B | Diet C | Diet D | Diet A | Diet B | Diet C | Diet D | | T[a] | D[b] | T*D |
| Rectal Temperature (°C) | 38.3 | 38.2 | 38.3 | 38.3 | 39.5 | 39.7 | 39.6 | 39.6 | 0.15 | 0.01 | 0.83 | 0.78 |
| Intestinal weight (g/kg)[c] | 39.6 | 41.4 | 40.4 | 40.1 | 37.6 | 37.3 | 37.3 | 40.5 | 2.8 | 0.11 | 0.82 | 0.69 |
| TER ($\Omega/cm^2$)[d] | 105 | 119 | 117 | 135 | 73 | 86 | 107 | 112 | 17 | 0.03 | 0.02 | 0.75 |
| APP (ng/mL/min/$cm^2$)[d] | 221 | 193 | 150 | 138 | 370 | 278 | 212 | 188 | 60 | 0.03 | 0.02 | 0.69 |

[a] Temperature; [b] Diet; [c] small intestinal weight to live body weight; [d] data were expressed as the pooled value from jejunum and ileum;

Heat stress increased (P=0.01) rectal temperature but had no significant effect on small intestinal atrophy as small intestinal weight were not affected (P=0.11). HS reduced (P=0.03) TER and increased (P=0.03) APP. Conversely, TER was increased (P=0.02) and APP was decreased (P=0.02) with increasing dose of antioxidants. Interestingly, under HS condition, the pigs fed on Diet C and D had higher (P<0.05) TER and lower (P<0.05) APP than the pigs fed Diet A, and maintained at similar levels to the control diet under TN condition.

In conclusion, these data demonstrate that short-term supplementation with supraphysiological levels of Se (0.5-1.0 ppm) and VE (100-200IU/kg) prior to, and during, HS improves intestinal integrity in pigs thereby preventing leaky gut.

Pearce, S. *et al.* (2012). *Journal of Animal Science* **90**, 257-259.