Vitamin D Status from Sun Exposure in Swine in Laramie

B.C. Ingold1, S.R. Fensterseifer2, K.C. Myers2, E. Larson-Meyer1, and B. Alexander2

Vitamin D insufficiency increases risk for both chronic diseases and acute illness. Altitude, season, time of day, and latitude are all known factors affecting the amount of vitamin D synthesized by the skin when exposed to sunlight. Since pigs are commonly raised indoors with limited exposure to natural sunlight, the majority of circulating vitamin D in the pig is of dietary source, risking vitamin D insufficiency. Low vitamin D status in all mammals leads to bone disease and may also increase risk of infectious illness and suboptimal health. Even though dietary supplementation is utilized in modern swine operations, bone disorders still occur (Dittmer and Thompson, 2011), suggesting optimal supplementation of diets is not always achieved.

Confined animal practices serve practical management purposes, but in an era when the consumer is demanding natural products and is adverse to animal practices that are perceived to be abusive, confined practices, in general, are being scrutinized. This is a favorable time to explore the benefits of limited sunlight exposure in swine operations. Expected benefits to the exposed pigs include enhanced immunity (Konowalchuk et al., 2013) and increased storage of vitamin D in animal tissues. Although animal tissues are not generally regarded as vitamin D rich (Heaney et al., 2009), exposure to sunlight would be expected to increase vitamin D synthesis and storage, increasing the health value of those pork products.

Objectives
Objectives of this study were to determine the capacity of white pigs to synthesize vitamin D during the spring equinox and summer solstice at altitude in a northern latitude and further determine the vitamin D value of pork products obtained from sun-exposed pigs.

Materials and Methods
Ten primarily white, Landrace-cross pigs (69.2±9.4 lb) were exposed to sunlight for one hour each day during solar noon (when the sun is directly overhead) for a two-week period surrounding the spring equinox in March 2014 and the summer solstice in June. Control pigs (n=10) were kept indoors as per conventional production practice. Total UV radiation was measured, and UVB was calculated during the exposure periods (the study is taking place at the Laramie Research and Extension Center, elevation ~7,200 feet). Pigs were weighed weekly with blood samples collected prior to and following sun exposure to determine concentrations of vitamin D and a marker of inflammation (TNFα). All pigs were fed conventional grower diets containing 750 IU of vitamin D3/lb of feed. Following the summer solstice exposure period, slaughter-weight pigs were sent to the slaughterhouse. Loin samples were collected to determine muscle vitamin D content.

Results and Discussion
Average UVB radiation was not different between spring and summer; however, peak inten-
University of UVB was greater ($p=0.006$) in the summer than spring. Sun-exposure caused a slight pinking of the skin during exposure periods, but exposed pigs did not demonstrate any sign of pain or discomfort.

During the spring equinox, exposure to sunlight increased ($p<0.001$) serum concentrations of total vitamin D by 177% with control pigs experiencing a 26% dietary-induced increase. All values fall within the reported range of growing pigs (Arnold et al., 2015). Following two months of indoor confinement, all pigs had similar serum concentrations of vitamin D. Exposure to sunlight during the summer solstice again increased ($p<0.001$) serum concentrations of vitamin D by 31% for sun-exposed pigs. Weight gain was unaffected by sun exposure. Total vitamin D content of loin tissue was improved (141%; $p<0.001$) by sun exposure.

Exposing pigs to sunlight is a cost effective way to improve the vitamin D status in swine and improve the nutritional value of their products. Although differences were not noted in measures of inflammation, the improved vitamin D status may improve health outcomes if pigs were exposed to pathogens.

**Contact:** Brenda Alexander at balex@uwyo.edu or 307-766-6278, or Enette Larson-Meyer at enette@uwyo.edu or 307-766-4378.

**Keywords:** swine, sun-exposure, vitamin D

**PARP:** not applicable

**Literature Cited**


