# Sun Exposure in Growing Pigs Increases the Vitamin D Nutritional Quality of Pork

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## Introduction

Vitamin D is known for its critical role in maintaining bone health. Increasing evidence also suggests that vitamin D plays a role in the prevention of many chronic diseases. Of the 30 leading causes of death in the U.S. in 2010, 19 were linked to low vitamin D status (Baggerly, 2015). At the same time, a high prevalence of vitamin D insufficiency worldwide has been identified.

Vitamin D is unique among vitamins in that it can be obtained from diet as well as synthesized in the body from exposure to ultraviolet-B (UVB) radiation from sunlight. Compared to what is typically consumed in the diet, higher amounts of vitamin D can be synthesized from exposure to sunlight. It is estimated that a single 10- to 15-minute exposure during peak sunlight in July will produce between 10,000 and 20,000 IU (international units) of vitamin D; however, concerns of increased risk of skin cancer and skin aging keep many people out of the sun. To achieve sufficiency, these individuals must obtain vitamin D through diet and/or supplementation.

Meat, in general, is not considered a good source of vitamin D. The vitamin D content of pork may be particularly low due to traditional husbandry practices, which limit exposure to sunlight. Furthermore, the U.S. Department of Agriculture (USDA) nutrient database only evaluates pre-vitamin (D3 and D2) content of food sources. Synthesized vitamin D3 and supplemental D2 is modified in the liver to form 25(OH)D, the primary circulating form of vitamin D. Heaney et al. (2009) suggest that vitamin D content in meat products is underestimated due to failure to consider the 25(OH)D content, which is estimated to be about five times as potent as vitamin D3 in increasing serum concentration of vitamin D. Vitamin D3 is readily sequestered by adipose tissue, while 25(OH)D is distributed throughout the body and taken up by skeletal muscle tissue.

Although swine are generally raised in confinement, they, like other agricultural animals, have the capacity to synthesize vitamin D. Sun exposure, therefore, has the potential to increase the vitamin D content of pork products.

## Objectives

The objective of this experiment is to determine the effects of sunlight exposure in pigs on lean and subcutaneous fat content of vitamin D in pork products.

## Materials and Methods

This study was established in 2014 at the Laramie Research and Extension Center (LREC). Landrace-Duroc-Yorkshire-cross grower pigs aged 81 ± 16 days and weighing 69.7 ± 3.7 pounds were assigned at random to sunlight exposure or to remain in standard confinement housing. Sun-exposed pigs were exposed to sunlight for one hour at solar noon for 10 days as growers and for another 10 days just prior to slaughter. Pigs were slaughtered in July and October 2014 following sun exposure during the summer solstice and fall equinox, respectively.

## Results and Discussion

Pig growth performance, including average daily gain, did not differ among pigs regardless of sun exposure. Back fat thickness at the first and last ribs and percentage fat-free lean tissue were similar among control and sun-exposed pigs. Serum concentrations of 25(OH)D were similar among pigs prior to sun exposure, but increased ($p$<0.001) with sun exposure. Sun

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exposure increased ($p$<0.001) 25(OH)D content of muscle and subcutaneous fat tissue while vitamin D3 content only increased in the lean tissue.

Many people in the U.S. and worldwide fail to maintain adequate concentrations of vitamin D. To achieve optimal vitamin D status, additional dietary sources of vitamin D may be necessary. Strategies to fortify or naturally add vitamin D to the food supply are currently being explored. Green and colleagues (2013) suggest that a greater range of food vehicles other than dairy, margarine, and cereals may be necessary to improve the vitamin D status of populations. Increased vitamin D may also be achieved by enhancing the natural vitamin D content of foods, termed bio-addition. Altering modern agricultural practices to allow pigs exposure to sunlight may be an effective means to naturally increase the vitamin D content of pork products.

In a previous study, analysis of vitamin D content of pork cuts from conventionally raised pigs yielded a vitamin D3 and 25(OH)D content of 1.6 and 2.0 IU/3.5 oz serving in the lean loin tissue, respectively, and 5.7 and 3.5 IU/oz in the fat rind (Clausen et al., 2003). Sun-exposed pigs in the present experiment had an average D3 content of 28.5 IU/3.5 oz in the lean and 52.2 IU/ oz in the fat rind of the loin. This is a near 18-fold increase of D3 in lean tissue and a nine-fold increase in subcutaneous fat. 25(OH)D content averaged 11.2 IU/3.5 oz serving in the lean and 9.2 IU/ oz in the fat rind of the loin from sun-exposed pigs.

The USDA nutrient database reports the vitamin D3 content of a raw, lean center loin to be 14 IU/3.5 oz, but does not include the 25(OH)D content of meat products. To compare, a 3.5 oz serving of lean with one ounce of fat from a sun-exposed pig would provide approximately 100 IU of vitamin D, which is similar to the vitamin D content in an 8 oz serving of vitamin D-fortified milk. Considering that 25(OH)D is present in natural animal-based sources of vitamin D and has five times the biological activity of vitamin D3, 25(OH)D should be measured and accounted for in future vitamin D analysis of animal products.


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