

Fat-soluble vitamin needs for nursing and weaned pigs

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Introduction

Fat-soluble vitamin deficiencies in rapidly growing pigs continue to be of concern. Vitamin A (retinol), vitamin D (cholecalciferol) and vitamin E (alpha-tocopherol) are the fat-soluble vitamins of prime interest for the nursing and weaned pig. Due to minimal placental transfer, the primary source of vitamins A and E for the newborn pig is colostrum and milk. For vitamin D, the sources are placental transfer, minimal colostrum/milk transfer and with access to sunlight, synthesis from 7-dehydrocholesterol.¹ For the weaned pig, the only source of vitamin A and E is feedstuffs and supplements; while vitamin D can either be synthesized in the body with access to sunlight or feedstuffs and supplements. Sub-clinical nutritional deficiencies of these vitamins often go undetected unless or until those deficiencies impact morbidity and/or mortality of newborn and weaned pigs.

Role of the gestating and lactating sow

Supplementation of the gestating sow's diet is the primary method to transfer fat-soluble vitamins to fetal and nursing pigs due to levels accumulated in colostrum and milk to a lesser extent. Of the three fat-soluble vitamins, Vitamin D appears to be transferred to fetuses in relationship to supplementation of the gestating sow more so than vitamins A and E.² For vitamins A and E, there is limited placental transfer and at newborn pigs depend upon sow's colostrum and milk to provide needs for these vitamins.^{3,4,5} Nursing pigs born to sows with access to grass in addition to feed, had higher vitamin E status when compared to pigs born to confined sows without access to grass, primarily due to the higher levels of vitamin E in colostrum and milk.⁶ Pigs nursing sows fed adequate vitamin A and E appear to have adequate status at weaning.⁵ Recently, vitamin D deficiencies are being reported in various Midwest facilities.^{7,8}

Fat-soluble vitamin status in newborn and weaned pigs

Serum retinol averaged 10 $\eta\text{g/mL}$ (ppb) in newborn pigs.⁹ Serum vitamin E (alpha-tocopherol) status for newborns ranged from 0.1-0.2 $\mu\text{g/mL}$ and 21-day-weaned pigs have 3.0-5.0 $\mu\text{g/mL}$ (ppm).^{10,11} Weaned pig status drops to below 2.0 $\mu\text{g/mL}$ within one week without supplementation of a biologically available source of vitamin E.¹² For vitamin D, serum 25-OH cholecalciferol is an indication of vitamin D status. Newborns should have 5-15 $\eta\text{g/mL}$ (ppb), and weaned pigs should have 25-30 $\eta\text{g/mL}$ (ppb).¹³

Various state diagnostic laboratories offer serum analysis for vitamins A, E and D. If deficiencies are suspected, serum or plasma samples can be submitted to determine pigs' status before initiating a supplementation program.

Importance of bioavailability of fat-soluble vitamin supplements

For newborn pigs, either oral dosing or injectable fat-soluble vitamins can be utilized, provided the products utilized have been shown to be bioavailable. Injectable fat-soluble vitamins are utilized much more efficiently than an oral dose. When vitamin E was administered either orally or via injection to weaned pigs, 21 day-tissue levels were approximately 70% higher (4.8 vs 2.8 $\mu\text{g/g}$) in those pigs injected compared to those given an oral gavage of the same product.¹⁴

For weaned pigs, either feed-grade vitamins, water-supplemented or injectable fat-soluble vitamins can be utilized as long as they are bioavailable sources. Weaned pigs fed nursery diets supplemented with vitamin E acetate were unable to maintain the serum vitamin E status at weaning. Even when supplemented at levels up to 200 I.U. vitamin E/kg (182,000 I.U./ton), pigs serum alpha-tocopherol levels declined dramatically within one week post-weaning.¹²

A combination of vitamin E and vitamin D (EMCELLE E-D₃ LIQUID) was administered to weaned pigs via the drinking water. The average initial serum alpha-tocopherol and 25-OH D₃ levels in ten pigs were 2.6 µg/mL and 13.2 ng/mL, respectively. After ten days of supplementation, serum alpha-tocopherol and 25-OH D₃ levels increased to 4.7 µg/mL (+80.7%) and 37.9 ng/mL (+187.1%), respectively.⁷ The levels after supplementation were considered adequate for weaned pigs.

Before recommending any product to producers, one should demand bioavailability data from manufacturers of either oral or injectable products.

Products for newborn and weaned pigs

Depending upon the swine operation, methods of fat-soluble vitamin supplementation may vary by location. Following are various oral and injectable products available from Stuart Products, Inc:

Newborn Pigs

Single oral dose- EMCELLE NEWBORN E-A-D (Each mL provides 500 I.U. vitamin E, 50,000 I.U. vitamin A and 50,000 I.U. vitamin D). Dose: 1 mL.

Injectable- VITAL E-NEWBORN (Each mL provides 500 I.U. vitamin E, 20,000 I.U. vitamin A and 50,000 vitamin D). Injection amount: 0.25-0.50 mL

Nursery Pigs

Drinking water- EMCELLE E-D₃ LIQUID (Each mL provides 500 I.U. vitamin E and 30,000 I.U. vitamin D) or EMCELLE TOCOPHEROL (Each mL provides 500 I.U. vitamin E)

Injectable- VITAL E-500 (500 I.U. vitamin E per mL) Injection amount: 1-2 mL, or

VITAL E-A+D (Each mL provides 300 I.U. vitamin E, 100,000 I.U. vitamin A and 10,000 I.U. vitamin D) Injection amount: 1-2 mL.

Summary

Fat-soluble vitamin needs for newborn and weaned pigs have dramatically transformed due to changes in housing, feed ingredients and practices, and improved genetics. Before utilizing any oral or injectable product, get assurance from suppliers that the products are bioavailable by requesting data showing efficacy.¹⁵

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