



pork industry handbook

COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

Vitamins for Swine

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Vitamins are one of the classes of nutrients required for normal metabolic functions in the animal body. They are required in much smaller amounts than most other nutrients because they are not used as an energy source or a structural component. Some vitamins can be produced within the pig's body in sufficient quantities to meet the pig's need. Others are present in adequate amounts in feedstuffs commonly used in swine diets. However, several vitamins should be added to swine diets to obtain optimal performance. Attention to vitamin needs is more critical today than previously because of the use of simpler diets containing fewer ingredients and the trend toward confinement rearing which has reduced the use of pasture. Young, lush green grass or legumes are good sources of many vitamins.

Vitamins Needed

Those vitamins that should be added to swine diets can be divided into two groups.

- Fat soluble vitamins

Vitamin A	Vitamin E
Vitamin D	Vitamin K
- Water soluble vitamins (known as B complex vitamins)

Riboflavin or B ₂	Vitamin B ₁₂
Pantothenic acid	Choline
Niacin	

Several other vitamins function in the pig's body. These include biotin, pyridoxine (B₆), folacin (folic acid), thiamine, and vitamin C (ascorbic acid). There is only very questionable evidence that pigs fed practical diets will benefit from the inclusion of supplements containing these vitamins. Therefore, it is not recommended that they be routinely added to swine diets.

Vitamin A. The vitamin A needs of swine can be met by either vitamin A or carotene. Vitamin A does not occur in plant products, but the plant pigment, carotene, can be converted to vitamin A in the intestinal wall of the pig. Good natural sources of carotene are green pastures and green leafy alfalfa hay or meal. Yellow corn contains carotene but is not a dependable source because much may be destroyed in storage. Therefore, in formulating swine diets, the

carotene content of corn is disregarded. Other cereal grains are low or devoid of carotene.

Deficiency symptoms in growing pigs are uncoordinated movement, weakness of the back, paralysis, night blindness, and total blindness. Sows may fail to come into estrus, have a poor conception rate, resorb their fetuses, and have weak pigs at birth or pigs born dead with various deformities. Sterility may occur in boars.

Vitamin D. Swine that have daily access to sunlight produce their own vitamin D. However, fortification of diets with vitamin D is necessary when pigs are fed in confinement. Also, most feedstuffs are practically devoid of vitamin D except for sun-cured hays. Both vitamin D₂, the form found in plant products, and D₃, the animal product form, have the same value for swine.

Vitamin D is needed for efficient absorption and metabolism of calcium and phosphorus and, therefore, is required for normal calcification of bones. A deficiency in young pigs results in rickets, stiffness and lameness, enlargement of the joints, and general unthriftiness. In mature animals, fractures of the bones are common. Excessive levels of vitamin D in the feed or as an injectable have been shown to be harmful. Therefore, it is important to prevent excessive intakes.

Vitamin E. A decline in use of pasture for pigs and an increase in artificial drying of grains have resulted in a lowering of vitamin E intake and an increase in the occurrence of deficiency symptoms. Grains low in selenium increase the need for vitamin E as the dietary level of one of these nutrients affects the requirement for the other.

Signs of vitamin E deficiency in the growing pig are sudden death, jaundice, edema, white muscles, and liver necrosis. Pregnant sows may have a higher level of embryonic death, and pigs nursing sows deficient in vitamin E may show muscular incoordination.

Vitamin K. Although vitamin K occurs in many natural feedstuffs and is also synthesized by intestinal microflora of the pig, a deficiency in practical diets has been demonstrated. The deficiency is frequently associated with moldy feeds: Its characteristics are hemorrhaging (both internal

and external) and prolonged blood clotting time but may also include blood-tinged urine, lameness, and listlessness. Vitamin K can be supplied by using 2.5% dehydrated alfalfa meal or by one of the synthetic vitamin K compounds (menadione) at the level suggested in Table 1.

Riboflavin (B₂). Cereal grains and plant byproducts such as soybean meal are relatively poor sources of this B vitamin. It functions in the body as a constituent of several enzyme systems. Therefore, a deficiency of riboflavin results in a wide variety of symptoms. In growing pigs, a deficiency may cause loss of appetite, stiffness, dermatitis, and lowered growth rate. Poor conception and reproduction have been noted in sows fed riboflavin-deficient diets. Pigs may be born prematurely, dead, or too weak to survive.

Pantothenic Acid. Corn and soybean meal diets will be deficient in pantothenic acid, another vitamin of the B complex. A deficiency may result in lowered fertility, reduced growth rate, diarrhea, and an uncoordinated, wobbly or high-stepping gait (called goosestepping). Many of these symptoms are similar to those observed from other deficiencies and indicate that, in practical feeding situations, it is difficult to determine which vitamin may be lacking. In fact, in many cases, it is a combination of vitamin deficiencies that causes the problems that may be observed.

Niacin. Although niacin is present in adequate amounts in most cereal grains, it exists in a bound form that is largely unavailable to the pig. The protein source and content of the diet can also affect the dietary need for niacin because an excess of the amino acid tryptophan can be converted into niacin. Slow growth, diarrhea, dermatitis, loss of hair, and occasional vomiting are deficiency symptoms. Alfalfa meal and good pasture are good natural sources of riboflavin, pantothenic acid, and niacin.

Vitamin B₁₂. The cereal grains and plant products are poor sources of B₁₂, but the animal products are good sources. The requirement of this vitamin is approximately one-thousandth of the amount of the other B vitamins discussed. Signs of a deficiency are reduced growth rate and anemia. Vitamin B₁₂ is also known as cyanocobalamin.

Choline. The specific requirement for choline has not been determined. The need for choline is increased in diets low in the amino acid methionine. Recent research has

indicated that supplemental choline increased litter size when gestating sows were fed corn-soybean meal diets. Choline deficiency has been implicated by some as the cause of spraddle legs in newborn pigs. However, this has not been proved in research where sows are fed practical type diets during gestation. Apparently, there are other causes of the spraddle leg condition.

Biotin, Folic Acid (Folic Acid), Vitamin C (Ascorbic Acid), Thiamine and Pyridoxine (B₆). Although these vitamins are required by the pig, the levels required in the diet are not known. Deficiency symptoms may be produced when diets contain an antagonist or high levels of sulfa drugs. Rancidity can also cause destruction of biotin. Biotin deficiency is characterized by cracking of the feet and dermatosis of the skin. Weakness, poor growth, and anemia are deficiency signs of folic acid. It has been suggested that environmental stress increases the need for dietary ascorbic acid for normal growth. However, the amount of these vitamins present in practical diets plus that synthesized by microorganisms in the digestive tract are considered to be sufficient to meet the requirement of the pig.

Synthetic Vitamins

The chemical structure of a given vitamin is identical regardless of source. Therefore, "natural" and synthetic vitamins are of equal value to the pig. Since the natural ingredients used in practical swine diets may not contain adequate amounts of vitamins, it is recommended that a vitamin supplement be added. Synthetic vitamins are produced by many companies and are sold individually or in various combinations of vitamins or as vitamin-mineral combinations. Often these can be purchased in quantities prepackaged to be added to 1 ton of feed. The vitamin premix in Table 1 contains all the vitamins needed to be added to swine starter, gestation, or lactation diets (based on daily feed intake of 4-5 lb. during gestation and 9-12 lb. during lactation) when 5 lb. are added per ton of feed, and for growing and finishing diets by including 3 lb. per ton. Commercial complete feeds and protein supplements generally contain supplemental vitamins. Check to see if the levels are adequate. If not, add vitamins that are needed in necessary amounts. Suggested vitamin additions per ton of feed are shown in Table 2.

Mixing Instructions

The vitamin premix should be purchased from a commercial company. These suppliers have much better quality control and mixing facilities than producers do to handle the small quantities of vitamins that are required. Purchase no more than what will be used in 3-4 months (use in 3 months in hot, humid areas) and store in a dry, cool area to reduce storage losses. Mix only enough feed for 3-4 weeks as certain combinations of ingredients can increase vitamin losses over time.

Special care should be taken when mixing the vitamin premix to obtain a thorough dispersion throughout the feed. One method is to mix the vitamin premix for 1 ton of feed with about 20-50 lb. of finely ground corn or soybean meal and then add this total mixture to the mixer.

Table 1. Suggested vitamin mix.*

Ingredient	Amount/lb. of premix
Vitamin A	800,000 IU
Vitamin D	80,000 IU
Vitamin E	3,000 IU
Vitamin K (menadione)†	660 mg.
Riboflavin	1,000 mg.
Pantothenic acid	4,500 mg.
Niacin	7,000 mg.
Choline chloride‡	20,000 mg.
Vitamin B ₁₂	5 mg.

* Premix is designed to be used at a rate of 5 lb. per ton of complete feed for sows and baby pigs and 3 lb. per ton of complete feed for growing and finishing swine.

† Menadione conversion values are as follows:

1 gm. of menadione = 3 gm. of menadione sodium bisulfite complex (MSBC) or

2 gm. of menadione dimethylprimidol bisulfite (MPB) or

2.2 gm. of menadione sodium bisulfite (MSB).

‡ To meet the recommended level of choline in gestation and lactation diets, add 1.5 lb. of choline chloride (50% choline) per ton of diet.

Table 2. Suggested vitamin additions per ton of feed.*

Vitamin	Starter	Grower-finisher	Gestation-lactation
Vitamin A, IU	4,000,000	2,400,000	4,000,000
Vitamin D, IU	400,000	240,000	400,000
Vitamin E, IU	15,000	9,000	15,000
Vitamin K (menadione), gm.	3.3	2	3.3
Riboflavin, gm.	5	3	5
Pantothenic acid, gm.	22.5	13.5	22.5
Niacin, gm.	35	21	35
Choline, gm.	100	—	300
Vitamin B ₁₂ , mg.	25	15	25

* Suggested levels are at least 150% of NRC recommended requirements with the exception of choline.