



Vitamin Deficiencies

AG 240

Vitamin A

∞ Importance

- Maintenance
- Growth
- Reproduction
- Thus if no Vitamin A, animal will stop growing and die

Vitamin A

♂ **Animals stores Vitamin A in liver**

- **Especially when grazing green grass because they can convert carotene to vitamin A**



Vitamin A

Ω Conversion rates vary with specie

- Rats/Poultry: 1 mg beta carotene = 1667 IU
- Cattle, sheep, horse: 1 mg beta carotene = 400 IU
- Swine: 1 mg beta carotene = 200-500 IU
- Cat's can't convert beta carotene to Vit A

Vitamin A deficiency

∞ **Most deficiencies occur in late winter when no green grass is available**

- **Feeding corn stalks**



Vitamin A deficiency

• **Most deficiencies occur in late winter when no green grass is available**

- **Feeding corn stalks**

• **Eye problems**

- **Epithelial tissues of the eye affected**
- **Watery eyes**
- **Night blindness**

Vitamin A deficiency

⌘ **Rough hair coat, swollen legs in cattle**



Photo courtesy of Irlbeck (CSU)

Vitamin A deficiency

∞ **Incoordination followed by
posterior paralysis in growing
pigs**



Photo courtesy of Irlbeck (CSU)

Vitamin A deficiency

⌚ **Reduced egg production and hatchability**

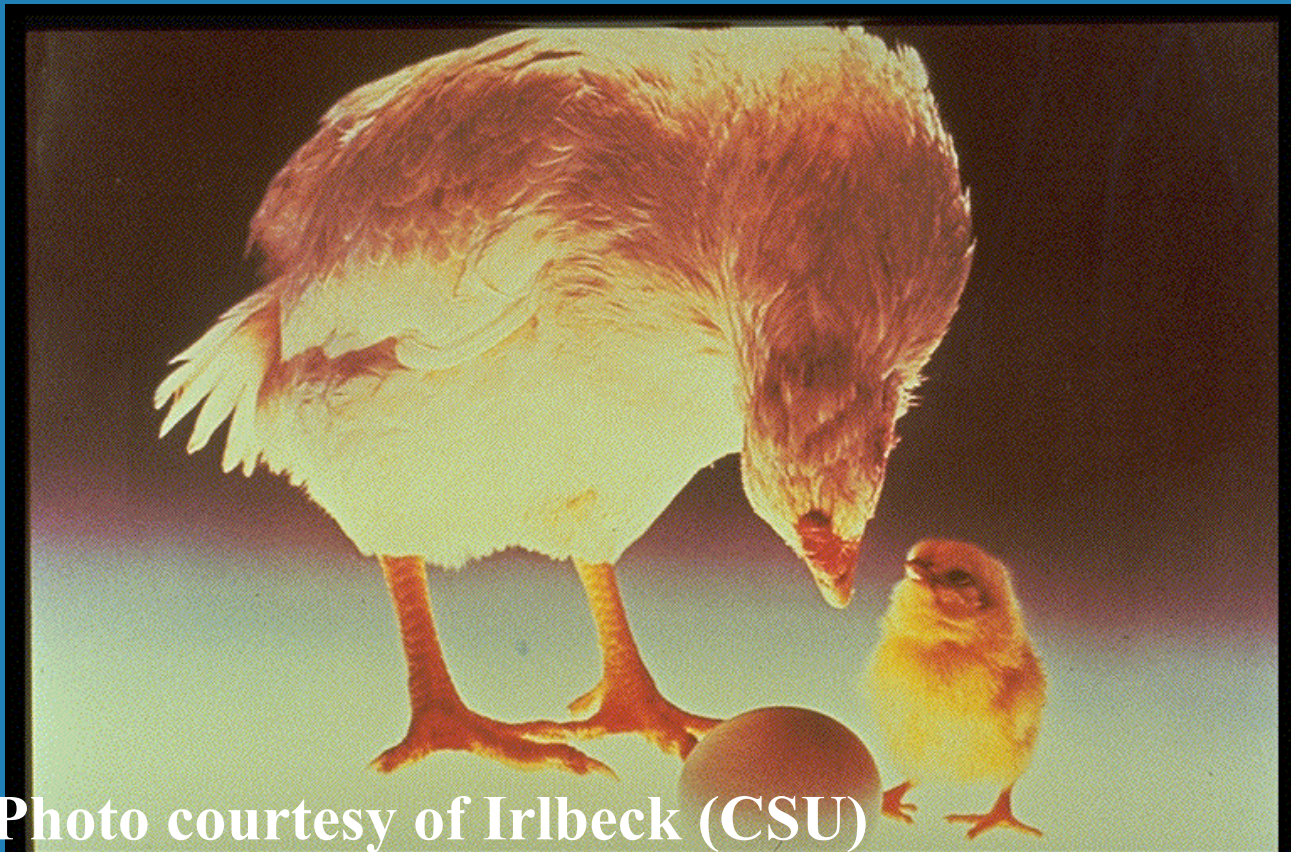


Photo courtesy of Irlbeck (CSU)

Vitamin A Toxicity

Of all the vitamins, Vitamin A is the most likely to present toxicity problems

- **Monogastrics**
 - 4-10 times the requirements
- **Ruminants**
 - 30 times the requirements

Symptoms

- **Skeletal malformations; reduced growth; reproductive failure**

Vitamin A Sources

∞ **Green plants contain carotene**

- **Alfalfa hay is high in Vitamin A**
 - But does leach out so 2-year old hay is low

∞ **Mineral mixes**

∞ **Vitamin A injections**

∞ **Vitamin A and carotene are susceptible to destruction by oxidation**

Vitamin D Importance

- ∞ **Bone formation**
- ∞ **Growth**
- ∞ **CHO metabolism**
- ∞ **Absorption of calcium and P from the small intestine**

Vitamin D Deficiency- Rickets



Photo courtesy of Irlbeck (CSU)

Vitamin D Deficiency

- ⌚ **Soft egg shells**
- ⌚ **Reduced growth and leg weakness**



Photo courtesy of Irlbeck (CSU)



Vitamin E Importance

∞ Strong antioxidant

- Along with Se it prevents the breakdown of cell membranes by free radicals

∞ Immune system

- Primarily in monogastrics

∞ Muscle structure

∞ Reproduction

Vitamin E Deficiency



Photo courtesy of Irlbeck (CSU)

⌚ **Nutritional muscular dystrophy**

⌚ **Related to Selenium**

- **White muscle disease in calves and lambs**
- **Vit E (and Se) can prevent and correct WMD**

Vitamin E Deficiency

- ∩ **Liver necrosis in swine**
- ∩ **Brain degeneration in poultry**
- ∩ **Retained placentas**
- ∩ **Low fertility**

Vitamin E Toxicity

⌚ **Relatively nontoxic**

⌚ **Utilization dependent upon adequate Se**

⌚ **Research is looking at feeding high dietary levels of Vit E to improve meat quality**

- **More Vitamin E in tissue**
- **Longer shelf life because of decreased oxidation**

Vitamin K Importance

∞ Blood clotting

- If feeding sweet clover , need Vitamin K
- Warfarin
 - Rat poison that produces internal bleeding

∞ Activation of prothrombin (plasma protein) to create calcium binding sites



Vitamin K

∞ Deficiency

- Spontaneous hemorrhages
- Increased blood clotting time

∞ Toxicity

- Relatively non toxic

Vitamin K Sources

- ⌚ **Synthesized in rumen**
- ⌚ **Swine and poultry need Vitamin K**
 - **Coccidiosis increases K requirement**
- ⌚ **Green forage, well cured hays; fish meal**

Thiamine - B1

- ∞ **Conversion of pyruvate to acetate**
- ∞ **CHO Metabolism**

Thiamine - B1

⌚ Usually not deficient unless thiaminases
are present in digestive tract to destroy
thiamine



Sources of Thiaminases

∞ Ferns

- **Bracken fern poisoning causes thiamine deficiency in horses**

∞ Bacteria

- **Clostridium sporogenes are high in gut of animals on high concentrate diets**

Symptoms of Thiamine Deficiency

⌚ Polioencephalomalacia (PEM)

- Induced thiamine deficiency
- Rubbing head on post
- Wasting away appearance

“Applied Animal Nutrition” by Cheeke

This case was caused by Bracken Fern poisoning



Symptoms of Thiamine Deficiency

- ∩ Scours
- ∩ Weight loss
- ∩ Head retraction



Photo courtesy of Irlbeck (CSU)

Prevention of PEM

∞ Primarily in Feedlots

- Add 1 mg thiamine per head per day
- Feeding ionophores may help prevent PEM

∞ Avoid Ferns

Riboflavin - B2

∞ Importance

- CHO and protein metabolism
- Most likely to be deficient in swine and poultry
 - Grains and plant proteins are low in B2

∞ Synthesized in rumen

B2 Deficiency Symptoms

- ⌚ **Curled toe paralysis in chicks**
- ⌚ **Reduced egg production and hatchability**



Photo courtesy of Irlbeck (CSU)

B2 Deficiency Symptoms

⌘ **Skin lesions, reduced growth, high neonatal mortality in pigs**

- **Hairless dead piglets**

⌘ **Moon blindness in horses**

- **Horses more susceptible when fed poor quality hay**



Niacin

∞ Importance

- Energy metabolism (along with Riboflavin)
- Enhances protein synthesis

∞ Also known as Nicotinic Acid

Niacin Deficiency

⌚ **Cereal grains (esp Corn) are low in niacin**

⌚ **Humans - Pellegra**

- **Fiery red tongue**
- **3 D's - diarrhea, dermatitis, dementia**

Niacin Deficiency

♂ Swine

- Poor growth
- Dermatitis, diarrhea, intestinal lesions



♂ Littermates where the smaller pig did not receive nicotinic acid in its ration

Niacin Deficiency

⌚ Poultry

- Dermatitis (poor feathering), leg problems



Photo courtesy of Irlbeck (CSU)

⌚ Dogs - black tongue

Notes on Niacin

⌚ **Not available from grains for swine**

- **Must be synthesized from surplus tryptophan in body tissue**
 - **Raw soybeans contains a tryptophan inhibitor**

⌚ **Used in dairy rations during post-partum period**

- **Research indicates it may prevent ketosis in dairy cattle**
- **12 g / cow per day**

Pyradoxine - B6

∞ Importance

- Protein metabolism
- Red blood cell formation

∞ Deficiency

- Seldom deficient except when feeding linseed meal

B6 Deficiency Symptoms

Ω **Convulsions, dermatitis, impaired reproductions**

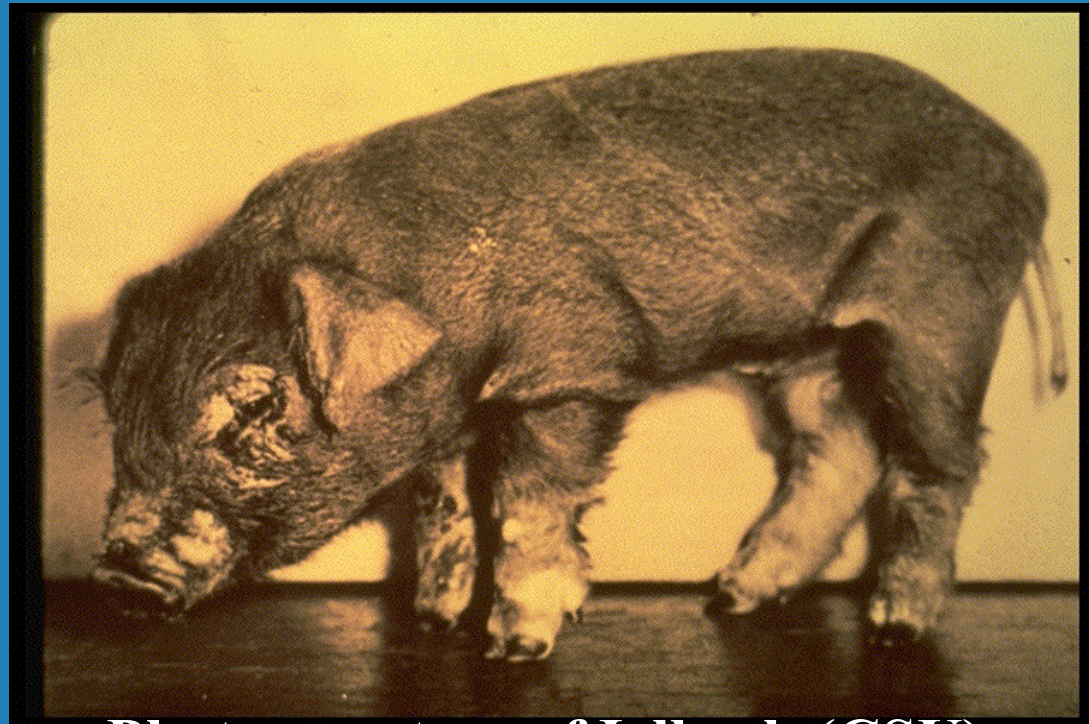


Photo courtesy of Irlbeck (CSU)



Pantothenic Acid

∞ Importance

- **Metabolic role in forming Vit A**

∞ Sources

- **High in barley wheat and SBM**
- **Low in corn and sorghum**
- **Commonly deficient for swine or poultry**

Pantothenic Acid Deficiency

- ⌚ **Reduced growth, dermatitis, neurological defects**
- ⌚ **Loss or graying of hair**

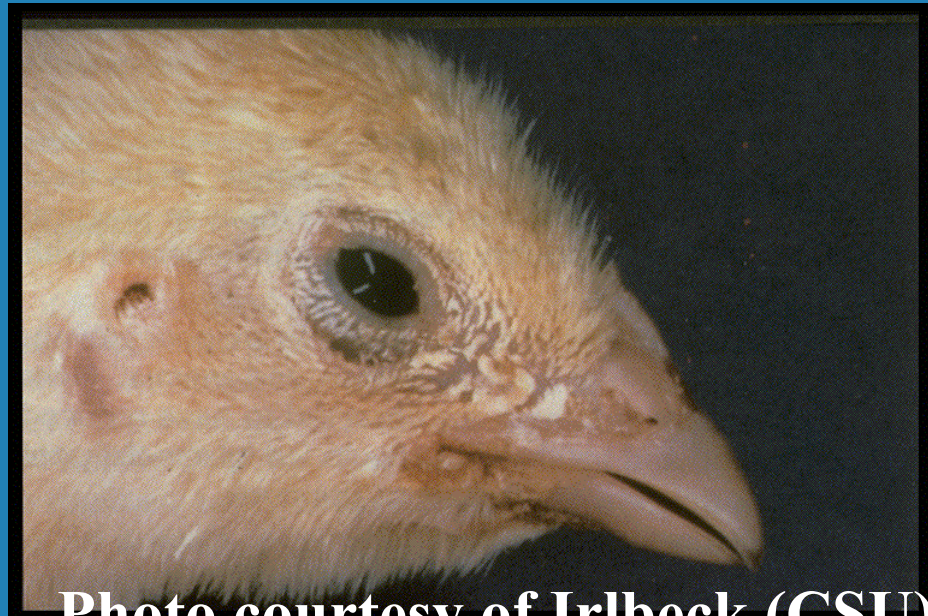


Photo courtesy of Irlbeck (CSU)

Pantothenic Acid Deficiency

♿ Goose-stepping gait in swine



Photo courtesy of Irlbeck (CSU)



Biotin

∞ Importance

- CHO and Fat metabolism

∞ Sources

- Widely available but low in wheat, barley, sorghum and oats

Biotin

⌘ Deficiency

- **Wheat based diets in poultry**
- **Raw egg whites contain avidin - a biotin antagonist**
- **Can be used to induce biotin deficiency**

Biotin

⌘ Symptoms

- **Dermatitis and cracks in feet**
- **Poor growth**
- **Loss of hair or feathers**
- **Poor reproduction**



Photo courtesy of Irlbeck (CSU)



Folic Acid Importance

- ∞ Synthesis of hemoglobin**
- ∞ Related to B12 metabolism**
- ∞ Reproductive performance in swine**
- ∞ Increase in litter size**



Folic Acid Deficiency

- ⌚ **Anemia**
- ⌚ **Poor growth**
- ⌚ **Unlikely to be deficient for livestock**

Vitamin B12

∞ Importance

- Synthesis of hemoglobin (with Folic Acid)

Vitamin B 12 Sources

∞ Synthesized by rumen

- Cobalt needed for synthesis in rumen
- New born calves need 45-60 days to have functional rumen so it can be synthesized
 - Usually get enough from mother's milk
 - Stressed/weaned calves can be helped with a Vitamin B12 shot.

∞ Essential for swine and poultry

Vitamin B12 Deficiency

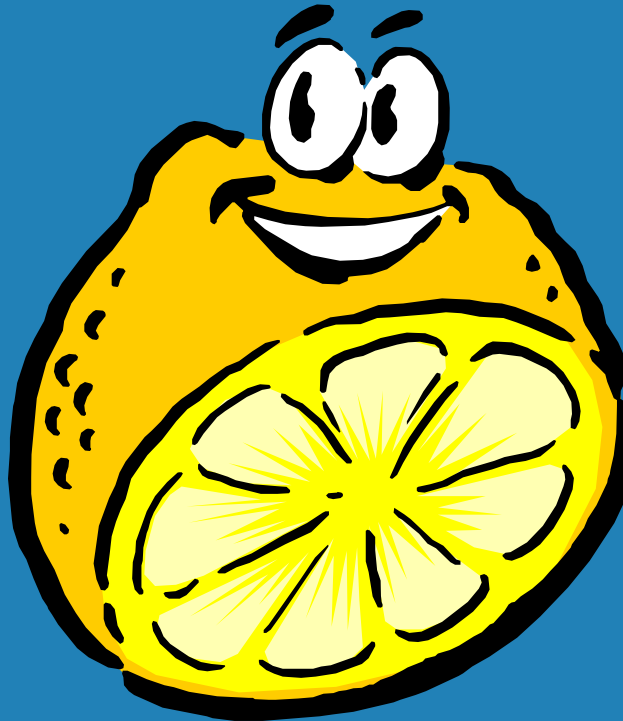
∞ Symptoms in Monogastrics

- Reduced growth
- Anemia
- In humans it is called pernicious anemia
- Poor reproduction
- Hatching problems in chicks

Vitamin C - Ascorbic Acid

∞ Importance

- Only essential for primates and guinea pigs





Vitamin C - Ascorbic Acid

∞ Deficiency Symptoms

- Usually not deficient unless animal is under great stress
- Egg shell quality
- Resistance to heat stress

∞ Sources

- Used very little in feed industry