

Diseases of Malnutrition in Poultry

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Nutrition

- It is a process of furnishing cells inside the animal with that portion of external environment for optimum functioning of metabolic and chemical reactions (M. Scott)
- It involves procurement, ingestion, digestion and absorption. Failure in any of these steps will result in malnutrition
- Nutrients: essential for normal growth, work, development, livability, and reproduction
- Nutrients should be in the diets in proper concentration and balance

Functions of Nutrients

- **Proteins:** involved in structural parts, homeostasis, osmotic pressure, clotting mechanism and transport oxygen, vitamins, etc.
- **Carbohydrates** are the primary source of metabolizable energy. Chickens lack lactase
- **Fats** are source of energy, linoleic acid and arachidonic acid
 - constituents of cell organelles, membranes, adipose tissue and precursors of prostaglandins
- **Vitamins** are a heterogeneous group of fat-soluble and water-soluble compounds. All vitamins, except C, are essential
- **Essential inorganic elements** include Ca, P, Mn, Cu, Fe, Zn, Selenium, Na, Cl, K, Mg, water and oxygen
 - Some are components of bone and soft tissues
 - They are essential for maintenance of osmotic pressure, acid-base balance, muscle and nerve stimuli and activation of enzymes
 - Functions of specific inorganic elements
 - *Calcium* (Ca) is essential for bone and egg shell formation, for clotting and cellular metabolism and processes
 - *Phosphorus* (P) is necessary for bone formation, components of compounds and cells, metabolism and acid-base balance
 - *Manganese* (Mn) is essential for bone and egg shell formation and activator of enzymes
 - *Copper* (Cu): necessary for hemoglobin and collagen, is a component of enzymes (super oxide dismutase, cytochrome oxidase)
 - *Iron* (Fe) is part of hemoglobin, cytochromes, component of enzymes (catalase, peroxidase, etc.)
 - *Zinc* (Zn): activates enzymes, component of carbonic anhydrase
 - *Selenium* (Se) is a cofactor of glutathione peroxidase
 - *Sodium* (Na) and *chloride* (Cl) are involved in membrane potentials, hydrogen ion concentration, cellular transport processes
 - Chloride is a major anion, helps in ionic balance
 - *Potassium* (K) is a major cation, necessary for membrane potential, cellular fluid balance and biochemical reactions and heart activity

- *Magnesium* (Mg) necessary for bone formation, activates enzymes and involved in carbohydrate metabolism
- *Water* is the medium upon which body chemistry functions
- *Oxygen* releases energy from food stuffs

Malnutrition

- Can be due to absolute or marginal deficiency of nutrients
- Marginal deficiency is probably more common
- Effects of Malnutrition:
 - Can manifest as generalized or a specific disease resulting in increased morbidity, mortality and secondary infections
 - Suppresses immune system
 - Decrease in reproductive performance
 - Decreased weight gain, egg production and egg shell quality
 - Result in feather problems and decreased response to therapeutic agents

Factors that Influence Malnutrition

- Diet composition (deficiency or absence of nutrients)
- Human errors:
 - omission of ingredient(s)
 - equipment failure
 - improper mixing and storage
 - miscomputation in feed formulations
 - feeding to wrong species, sex or age
- Insufficient feed intake (anorexia, starvation)
- Poor nutritive value and poor shelf life
- Maldigestion and malabsorption
- Nutrient and mineral interactions

Diagnoses of Diseases caused by Malnutrition

- History, clinical signs, gross and microscopic lesions
- Analysis of feed
- Analysis of liver for heavy metals, vitamins and others
- Serum for analysis of Ca and P, trace minerals and others
- Feeding trials
- Peroxide (rancidity) level in the feed
- Response to treatment

Diseases of Malnutrition

Nutrient deficiency	Name of the disease	Figures
Vitamin A	Xerophthalmia	1-15
Vitamin D3 Calcium/phosphorus	Rickets/osteomalacia	16-31
Vitamin E	Encephalomalacia	32-39
Vitamin E/Selenium	Exudative diathesis/ muscular dystrophy	40-43
Vitamin B1 (Thiamin)	Polyneuritis	44
Vitamin B2 (Riboflavin)	Curled-toe paralysis	45-47
Vitamin B6 (Pyridoxine)	Nervous	
Choline/Manganese	Slipped tendon	42-50
Pantothenic acid/Biotin	Perosis, dermatitis	51
Niacin, Folic acid	Perosis and others	52
Iodine	Goiter	53-55
Others: Zinc, Copper, Salt, Methionine, Vitamins K and B12		56

Xerophthalmia (Vitamin A deficiency) is rare in commercial poultry but seen in backyard poultry occasionally.

- *Clinical signs:* drooling of mucus from the mouth, corneal opacity, conjunctivitis, ruffled feathers, decreased weight gain and egg production.
- *Gross lesions:* nodules in upper Gastro Intestinal (GI) tract, exudate in conjunctiva, respiratory tract, bursa of Fabricius, nephrosis, opaque dry cornea, hyperkeratosis of plantar surfaces



Figure 1: Eye - Vitamin A deficiency. Conjunctivitis in a chicken



Figure 2: Eye - Vitamin A deficiency. Corneal opacity in a golden pheasant

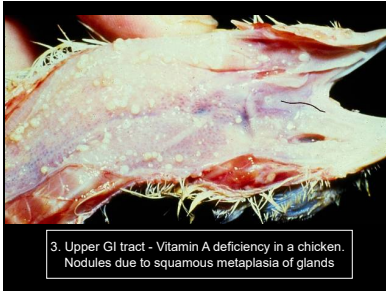


Figure 3: Upper GI tract - Vitamin A deficiency in chickens. Nodules due to squamous metaplasia of glands



Figure 4: Upper GI tract - Vitamin A deficiency in chickens. Impaction of esophageal glands



Figure 5: Vitamin A deficiency, turkey. Exudate in the nasolacrimal duct



Figure 6: Vitamin A deficiency, turkey. Exudate in upper GI tract.



Figure 7: Vitamin A deficiency, turkey. Exudate in the tracheal lumen

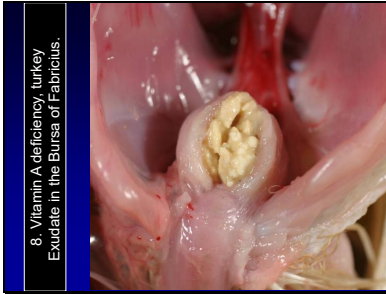


Figure 8: Vitamin A deficiency, turkey. Exudate in the bursa of Fabricius

- *Microscopic lesions*: hallmark lesion is “squamous metaplasia” of the epithelium and hyperkeratosis. Squamous metaplasia may or may not have keratin formation and exudation of the mucosal and submucosal glands. Most commonly affected organs are:
 - Proximal esophagus and conjunctiva are more consistently affected than others
 - Cornea, salivary glands in tongue and choana, pharynx, proventriculus, kidneys
 - Lacrimal gland, salt gland, gland of harder, sinuses, turbinates, larynx, trachea, bronchi, parabronchi
 - Bursa of Fabricius, feather follicles



Figure 9: Vitamin A deficiency, Chicken esophagus. Squamous metaplasia, esophageal glands



Figure 10: Vitamin A deficiency. Squamous metaplasia. Chicken trachea

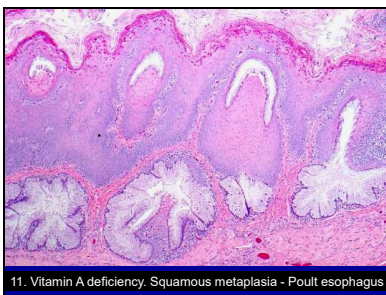


Figure 11: Vitamin A deficiency. Squamous metaplasia. Poult esophagus

1. Eye - Vitamin A deficiency
Conjunctivitis in a chicken



2. Eye - Vitamin A deficiency
Corneal opacity
in a golden pheasant

