

Basic nutrient requirements for poultry in the feed

Healthy poultry require a sufficient amount of protein and carbohydrates, along with the necessary vitamins, dietary minerals, and an adequate supply of water. The science of nutrition involves providing a balance of nutrients that best meets the bird needs for growth, maintenance, egg production, etc. For economic reasons, this supply of nutrients should be at least cost, and must supply only enough for requirements, without there being any major excesses. It is very difficult and very expensive to supply all nutrients at the exact nutrient needs - rather we have to oversupply some nutrients in practical situations, in an attempt to meet the limiting nutrients. In poultry diets these limiting nutrients are usually energy and some of the essential amino acids, such as methionine and lysine. In formulating diets the following nutrients are considered: Energy, Protein, Fat, Vitamins, Minerals and Water

With the exception of water, these nutrients are provided by the ingredients that make up the diet. Ingredients are classified as: Cereals, Animal Proteins, Vegetables Proteins, Vegetable Fats, Animal Fats, Micro Minerals, Macro Minerals, and Vitamin Premixes Each of these separate types of ingredient provides a specific quantity and quality of nutrients to the diet. Balancing these ingredients to produce the diet formulation (recipe) relies on the skill of the nutritionist. In order to produce a diet, the nutritionist must know the **bird's needs** and the **composition of the ingredients**.

Formulation = Balance needs vs ingredients vs costs.

The following nutrients are considered both for the birds needs and for the composition of the various ingredients:

Carbohydrates

Organic compounds composed mainly of C, H and O.

They classified to:

- A- Hydrolyzed CHOs (Sugars and Starch), they hydrolyze easily and easy to digest and absorb by the intestine.
- B- Un- hydrolyzed CHOs (Crude fiber) such as cellulose and hemicellulose, in which poultry cannot digest and absorb by the intestine.

Biological function of CHOs:

The main biological function of CHOs is the **production of energy** for maintenance requirements (maintain the body heat, respiration, absorption, heart muscle movements, metabolism, birds movements and production requirements such as growth and egg lying).

Lipids

Organic compounds composed mainly of C, H and O and some contain phosphorus.

They are classified to:

- A- Simple lipids such as fats, oils and waxes.
- B- Complex lipids such as phospholipids.
- C- Derived lipids such as fatty acids

Biological functions of lipids:

- A. Considered as rich in **energy** (2.5 folds of CHO)
- B. Considered as a source of **essential fatty acids** (such as **Linolenic acid**) in which it is essential nutrient in poultry nutrition.

Source of lipids

- **Animal fats** – they are physically hard, inexpensive but young birds are unable to digest animal fat.
- **Vegetable oils** - liquid, expensive and birds are able to simply digest it.

However the inclusion of oils in the feed prevents dustiness of mash feed, but high levels of oils in the pelleted feeds affect negatively on pellet quality and increase fragility.

The Protein

Organic compounds mainly composed of C, H, O and the nitrogen. And some contain phosphorus and sulfur. Crude protein usually measured simply by (nitrogen x 6.25).

Biological functions of proteins:

1. **Building** of body tissues and **replace** the damaged cells.
2. Involve in many **metabolic reactions** as Enzymes and Hormones.
3. Inter as a part of the **production** (meat and eggs)

The basic components of proteins are Amino acids. They are classified to:

- A. Essential AAs in which the body cannot produce it (10 AAs)
- B. Essential AAs under specific conditions (5 AAs)
- C. Unessential AAs in which the bird can produce in the body (7-8 AAs).

Proteins are classified due to their sources to:

Plant proteins (originated from the plants) supplied by ingredients such as: Soybean meal, Canola meal etc. Usually they are poor in one or more essential AAs. All contain toxins that must be destroyed by heat treatment

Animal proteins (from animal byproducts), they contain all essential AAs to the bird. Therefore they are called complete biological value. They are generally of better amino acid content, but are expensive supplied by ingredients such as Meat meal, Poultry by-product meal, Fish meal etc.

Vitamins

They are organic compounds which the body requires very trace amount. The body of the chicken cannot synthesize most of the vitamins and is not able to reserve in the body and supplied as synthetics.

Vitamins classify into two groups:

1. Fat soluble vitamins such as A, D3, E and K
2. Water soluble vitamins such as B complex (B1, B2, B3, B6 and B12), Choline, Niacin, folic acid and ascorbic acid.

The biological function of vitamins:

3. Involved in several **metabolic actions**
4. Essential for the **maintenance of the regular growth**

Availability of vitamins is reduced by Storage, Time, Temperature, Humidity

Minerals

The minerals are classified to:

- A. Major or macro minerals are defined as those inorganic elements required by the bird as a percentage of the diet such as calcium, phosphorus, sodium, potassium, magnesium and chloride.
- B. Trace or micro minerals (represented in part per million or less) such as zinc, copper, cobalt, manganese and ferrous (Iron), Iodine and Selenium

Biological functions of minerals:

- 1- Involved as **building structure of the bones** and eggshell
- 2- Essential for **nervous and muscle** functions
- 3- Essential in the **digestion** and the **metabolism**
- 4- **Regulate the osmotic pressure**

Calcium and phosphorus are required for the skeleton. Sodium, potassium, and chloride help maintain the osmotic and pH relationships in the body. Excretion of excess or indigestible minerals, such as phosphorus, copper, and zinc, can have a negative effect on the environment.

The Water

Water is considered as most important nutrient essential for metabolic functions in the body such as digestion absorption metabolism and regulation of body temperature, also it is part of the meat (55%) and the egg (65%). It must be regarded as an essential nutrient, although it is not possible to state precise requirements. **The amount needed depends on:**

1. Environmental temperature and relative humidity
2. The composition of the diet
3. Rate of growth or egg production
4. Efficiency of kidney reabsorption of water in individual birds.

It has been generally assumed that birds drink approximately twice as much water as the amount of feed consumed on a weight basis, but water intake actually varies greatly.

Sources of water for poultry:

1. Drinking water
2. The water content of the feed
3. Metabolized water

A safe water supply is essential for healthy livestock and poultry. Contaminated water can affect growth, reproduction, and productivity of animals as well as safety of animal products for human consumption.

Energy

The most expensive nutrient in a diet, but is difficult to measure and there is no guarantee with the feed. Energy is important because it governs feed intake.

- high energy ---> low feed intake
- low energy ---> high feed intake

Sources of energy - everything in the diet other than minerals.

Units - Calorie, or Kilocalorie (Kcal/kg feed) and Megajoule (MJ/kg feed)

Metabolizable energy = Energy intake as feed minus energy appearing in urine and feces. Therefore can only measure with a chicken trial, therefore expensive (\$1,000/assay).

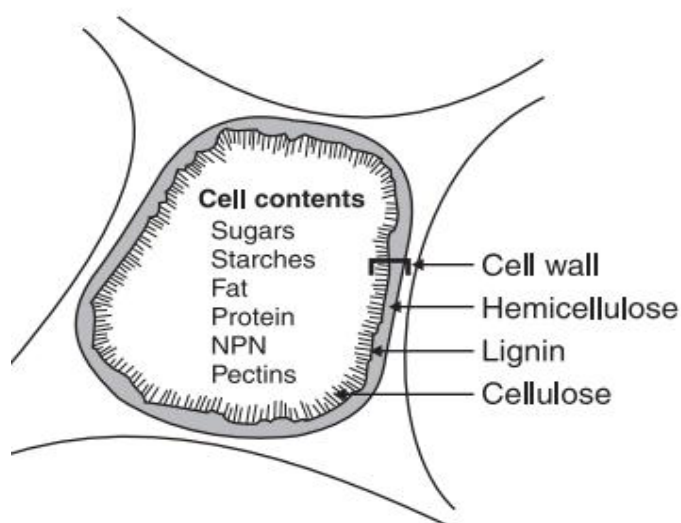
If the supplemented energy in the feed exceeded the requirements of the bird it will store in the body as fat deposit for use later.

Feed additives

They are additives with no feeding value, but indirectly affect positively on the growth of the bird. Feed additives are essential for maintenance and adequate production. (such as **organic acids**, **Enzymes**, **Probiotics**, **Prebiotics**, **Herbs** (phytogenic), **Essential Oils**, **Immune-stimulants** and **Antioxidant**, **Anticoccidiosis** etc.)

Antibiotics removal has led to poultry performance problems, feed conversion increases and a rise in the incidence of certain animal diseases, such as (subclinical) necrotic enteritis. Such a situation has compelled the researchers to explore the utility of other non-therapeutic alternatives like **organic**

acids, enzymes, probiotics, prebiotics, herbs (phytogenic), essential oils, immune-stimulants and antioxidant as feed additives in poultry production.



1. Diagram of a plant cell showing cell wall structure.

