Understanding the Nutritional Needs of 4-H Broilers

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Several counties in Florida offer 4-H youth the opportunity to raise and exhibit broilers. The 4-H broiler project, also known as a pen of meat birds project, is an opportunity for youth to purchase, care for, raise, exhibit, and sometimes process chickens for meat production. Most of these projects involve raising broiler chicks of the popular Cornish/Rock cross. These birds grow incredibly fast and are the birds commonly found on broiler operations all over the country. Since these birds have been bred through careful selection to produce heavily muscled carcasses in a very short period of time, youth must understand how to properly feed these birds in order to have a successful project.

Understanding Nutrients

Animals need nutrients to live, grow, and reproduce. Understanding classes of nutrients, and what benefits these nutrients provide the living organism, can help 4-H members better provide for the nutrient requirements of their project animals. There are six main nutrient categories: water, carbohydrates, proteins, fats/lipids, minerals, and vitamins. The following is further information on each of these categories:

Water

All animals need access to clean, fresh water daily and broilers are no different. Water is considered the most important nutrient. Many body tissues are made up primarily of water, and many chemical reactions in the body occur in water. Broilers should have access to fresh, clean water at all times. Make sure every bird can access a water fount whenever they choose to drink.

Carbohydrates

Carbohydrates provide most of the energy for animals. This includes energy to live, move, and grow, in fact energy for every life function. In poultry rations, cereal grains typically supply most of the concentrated carbohydrates. Corn, wheat, sorghum, barley, and rye are examples of cereal grains. For broilers, these grains are usually ground. Metabolizable Energy (ME) in broiler diets is measured in kilocalories per kilogram (kcal/kg).

Growth Phase	*Age Range*	*ME (kcal/kg)*
Starter	0–10 days	3000–3010
Grower	11–24 days	3050–3175
Finisher	25+ days	3100–3225

Table 1 – Metabolizable Energy needs in broiler feeds by growth phase.

Proper energy levels must be matched with protein and amino acid content to ensure optimal performance.

Protein

Proteins are composed of amino acids, and these are the building blocks of muscle. Broiler chickens are very heavily muscled and deposit a lot of muscle in a hurry as they are extremely fast-growing animals. That's why broiler diets are high in protein. Protein sources for poultry feed include plant sources and animal sources. Soybean meals are the most common source of protein in poultry feeds. In feed, protein is measured by percent crude protein. Crude protein percentages in broiler diets are often higher than standard chick starter/grower rations and are often over 20% crude protein.

Amino acids make up proteins. There are 22 amino acids that chickens need to have in their diet to grow, form muscles and other bodily tissues. Some of these amino acids can be synthesized by the body if all the necessary components are present, and these are referred to as non-essential amino acids. This doesn't mean that these amino acids are not important to bodily functions, it just means the body can synthesize them when needed. Essential amino acids are those amino acids the body can't synthesize. This means they need to be present in the poultry diet in adequate amounts.

Essential Amino Acids for Broilers and their Role

1. Lysine
    - Supports muscle growth and tissue repair and often used as a reference point in ideal amino acid ratios.
2. Methionine
    - Important for feather development and antioxidant function and often supplemented as DL-methionine.
3. Threonine
    - Maintains gut health and supports protein synthesis.
4. Tryptophan
    - Influences growth and behavior; precursor to serotonin.
5. Valine
    - Supports muscle metabolism and energy production.
6. Isoleucine
    - Works with valine and leucine for muscle development.
7. Leucine
    - Stimulates protein synthesis and muscle growth.
8. Arginine
    - Essential for young birds; supports immune function and growth.
9. Histidine
    - Important for enzyme function and hemoglobin production.
10. Phenylalanine
    - Precursor to tyrosine; involved in neurotransmitter synthesis.

These amino acids must be present in the correct ratios and quantities depending on the bird's age, breed, and production goals. Feed formulations often use ideal amino acid ratios (IAAR) based on lysine to ensure balance. Read your feed label to ensure the feed has the optimum concentration of nutrients. The following chart helps conceptualize both the crude protein and essential amino acid needs of broilers at various ages.

Percent Recommended	*Starters 0-14 Days*	*Growers 15-28 Days*	*Finishers 29 Days-Harvest*
Crude Protein (CP) %	22-23	20	18
Lysine %	1.36	1.19	1.06
Methionine %	0.62	0.5	0.46
Threonine %	0.84	0.77	0.71
Tryptophan %	0.2	0.18	0.16
Arginine %	1.47	1.28	1.14
Valine %	1.03	0.94	0.87
Isoleucine %	0.91	0.82	0.75
Leucine %	1.6	1.45	1.3
Histidine %	0.44	0.4	0.36
Phenylalanine %	0.83	0.75	0.68

Table 2 – The Crude Protein and Essential Amino Acid percentages needed in broiler feed by growth phase.

Fats/Lipids

Fats (also called lipids) are a concentrated source of energy made up of fatty acids. They are a denser form of energy. They are often included in broiler diets to increase the density of energy. Fats can also help improve feed efficiency. Fats are also essential for the absorption of fat-soluble vitamins A, D, E, and K.

Like essential amino acids, some fatty acids are essential. Linoleic acid and other omega-6 fatty acids are essential fatty acids that help maintain skin health, growth, and reproductive health. Poultry nutritionists also recognize that fats often taste good and help improve a poultry feed's palatability. This means the feed will taste better to the birds and they will be more likely to consume the feed. Fats can also help improve the texture of a feed and help reduce the dust in a poultry feed. In cooler climates, fats/lipids can also help birds maintain proper body temperature.

Common sources of fats/lipids in poultry diets include vegetable oils such as soybean or corn oil. Animal fats are sometimes also used.

Minerals

Minerals are the inorganic elements that broilers must have in their diet. They can be classified as either macrominerals or microminerals (also known as trace minerals). Macrominerals are

needed in larger amounts, while micro- or trace minerals are needed in smaller amounts (but are just as important as macrominerals). Minerals matter because if an animal is deficient in a mineral it can lead to things such as poor growth, weak bones, a weak immune system, and metabolic disorders. Too much of a particular mineral can lead to a mineral toxicity which can also be harmful to the animal or interfere with the body's absorption of other nutrients. Here is a list of the macrominerals and microminerals broilers need:

Macrominerals

1. **Calcium (Ca)**
    - Crucial for bone formation and eggshell quality (in layers).
    - Works with phosphorus for skeletal development.
2. **Phosphorus (P)**
    - Supports bone growth and energy metabolism.
    - Often supplemented as **phytase** to improve absorption.
3. **Sodium (Na)**
    - Regulates fluid balance and nerve function.
    - Often added as salt (NaCl).
4. **Potassium (K)**
    - Helps with muscle function and acid-base balance.
5. **Magnesium (Mg)**
    - Involved in enzyme activation and bone health.

Microminerals (Trace Minerals)

1. **Zinc (Zn)**
    - Supports immune function, skin health, and enzyme activity.
2. **Iron (Fe)**
    - Essential for oxygen transport and red blood cell production.
3. **Copper (Cu)**
    - Important for cardiovascular health and enzyme systems.
4. **Manganese (Mn)**
    - Needed for bone formation and reproductive health.

5. **Selenium (Se)**
    - Works with vitamin E as an antioxidant; supports immunity.
6. **Iodine (I)**
    - Regulates thyroid function and metabolism.

Vitamins

Vitamins, or 'vital amines' are classified by how they are absorbed by the body. Some are able to dissolve in water and are known as water soluble vitamins. Others are able to dissolve in fat and are know as fat soluble vitamins. While vitamin requirements are low, they have important roles in regulating a lot of bodily functions. Vitamins can promote rapid growth and feed efficiency, help prevent disease, support immune system strength, aid in bone development and energy metabolism.

Fat-Soluble Vitamins

These are stored in body fat and require dietary fat for absorption:

- **Vitamin A** – Supports vision, immune function, and skin health.
- **Vitamin D** – Regulates calcium and phosphorus for bone development.
- **Vitamin E** – Acts as an antioxidant and supports immune health.
- **Vitamin K** – Essential for blood clotting and bone metabolism.

Water-Soluble Vitamins

These are not stored in the body and must be consumed regularly:

- **Vitamin B1 (Thiamine)** – Aids in energy metabolism.
- **Vitamin B2 (Riboflavin)** – Supports growth and enzyme function.
- **Vitamin B3 (Niacin)** – Important for energy production and skin health.
- **Vitamin B5 (Pantothenic Acid)** – Involved in hormone and energy metabolism.
- **Vitamin B6 (Pyridoxine)** – Supports protein metabolism and nervous system health.
- **Vitamin B12 (Cobalamin)** – Essential for red blood cell formation and nerve function.
- **Folic Acid** – Crucial for DNA synthesis and cell division.
- **Biotin** – Supports skin, feathering, and metabolism.
- **Choline** – Important for liver function and fat metabolism.

Summary

Some people have PhDs in poultry nutrition and spend their life's work analyzing feedstuffs and balancing diets. These are some in-depth scientific concepts we have shared in this summary. This information might seem difficult to comprehend. We aren't trying to scare you off from a broiler project. We also don't expect you to mix your own feed at home. That's why feed companies employ poultry nutritionists. We simply present this information so that you will know what you are looking at and looking for when you read the label on a bag of feed you are purchasing for your broilers. This is also an educational project, so we want you to learn as much as you can about the various aspects of poultry. In addition, if you do find this sort of thing interesting, there are several career options in poultry and livestock nutrition, and one of the reasons for participating in 4-H projects is to learn about career opportunities in areas in which you already have an interest. It is hoped you found this publication helpful and have learned some of the nutritional needs of your broilers, and what feedstuff can provide those nutrients.