

Section 5

Feeds and Feeding of Commercial Poultry

Notes

Slide 2

Nutrition is a huge component of production cost!

The knowledge of nutrient requirements for chickens is astounding. Commercial poultry strains grow rapidly and mature at earlier ages therefore proper nutrition is critical.

Furthermore, nutrition and meeting nutrient requirements of any animal is inextricably bound to productivity. By feeding the appropriate nutrients growth can be optimized and no deficiencies or toxicities will occur.

Optimizing growth – the faster an animal reaches market age the more efficient the production must be. Broilers compared to layers. Broilers use less of the feed consumed for body maintenance and more for muscle accretion.

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Poultry have unique feeding behaviors, unlike some animals they are not “meal” eaters. They graze throughout most of the day consuming small quantities often. Because of this feed is almost always present in the digestive tract. Because of these feeding behaviors feed needs to be present for the birds all of the time, and birds eat to meet nutritional needs not necessarily because of taste etc. Remember this when we discuss diet composition.

When a chick is newly hatched, if it must, it can survive on residual yolk for several days. The residual yolk can be used to stimulate the digestive system and improve absorptive function of the GI tract. However, it is critical that chicks get on feed as soon as possible because the yolk residue is better used for maternal antibodies and not nutrition.

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Poultry are monogastric animals, meaning that they have only one stomach. In the picture on the left you see the body cavity of the bird opened and the organs undisturbed. The large muscular organ, located most caudally, covered in white connective tissue is the gizzard. The large red organ above that is the liver, and above the liver lays the heart. On the right you see the

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The digestive tract begins at the bird’s mouth. Birds don’t have teeth and the beak is used primarily for receiving feed. The tongue is used for moving feed through the mouth and into the esophagus. Following the esophagus is the crop; the function of the crop is primarily feed storage after eating. Some fermentation of feedstuffs can occur here. Once feed leaves the crop it travels through the proventriculus, the gastric stomach of poultry, where digestive enzymes are secreted for incorporation into the feed. After the proventriculus is the gizzard (ventriculus), this is the grinding stomach. The gizzard is lined with a tough lining called the kolin lining which protects the tissue during grinding of feedstuffs. The gizzard is comprised of two strong opposing muscle groups which grind the feed and incorporate the digestive enzymes secreted in the proventriculus. Often you hear of grit being added to the diet to help with the grinding and digestion of feed. Grit can be sand or small stones that the bird would eat. However, commercial birds do not require grit in their diet for the feed to be fully digestible. If birds are provided forage (grasses, etc.) having some form of grit in the diet will be critical to aid in digestion.

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The first nutrient group that we will discuss will be dietary energy which is a huge portion of dietary composition and cost. Remember from the beginning of this section where we discussed that poultry eat to meet nutritional needs? Nutritional needs can be narrowed to energy needs. If you are feeding a low energy diet consumption will be high, where if you are feeding a high energy diet feed consumption will be low.

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Sufficient dietary protein is critical for any meat producing animal and poultry is no different. Proteins are made up of chains of amino acids. There are two categories of amino acids essential and nonessential. Essential amino acids cannot be metabolized in the body and must be fed for the animals to have adequate amounts. Non-essential amino acids can be metabolized in the body therefore it is not necessary that they be supplied solely in the diet. The body used protein in the composition of a variety of functions including lean tissue formation, hormones, and body metabolites.

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Amino acid requirement is dependent on several factors such as age of the bird, size of the bird, genetic strain and dietary energy level. Remember birds eat to meet nutritional needs therefore if you are feeding a high energy diet greater amino acid density in the diet is required so that birds will have adequate amino acid intake while consuming less.

Also, the limiting amino acid factor to consider when formulating diets. Animal growth will only reach the level of the most limiting amino acid. So, in any feed ingredient, in this example nutrient B, there is a limiting amino acid. Nutrient C would be the next limiting amino acid and Nutrient A is in adequate quantities in the ingredient to meet requirement. Therefore, growth level of the animals only fed this ingredient with no supplementation would only meet the growth level for the limiting amino acid.

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Poultry diets are commonly limiting in the amino acid lysine and the sulfur amino acids cysteine and methionine. The most used feed ingredients in poultry diets are corn and soybean meal. Corn is relatively deficient in lysine and soybean meal is relatively deficient in methionine and cysteine. Often crystalline amino acids supplements are added to the diet to meet nutrient requirements.

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Carbohydrates, proteins and fats all provide energy to the animal. However, dietary fats provide little of anything else besides energy. Dietary fats are composed of triacylglycerides, they have a dual role as the source of essential fatty acids as well as carriers of fat-soluble vitamins. Essential fatty acids as with essential amino acids must be consumed in the diet and cannot be produced by the body however, they are critical for many body functions.

Common sources in poultry diets for fats can include: Tallow (rendered beef or mutton fat, vegetable oils, and poultry fat)

There is a current trend toward all vegetable oil poultry diets.

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Minerals are used in the body as the inorganic constituents of bones and teeth. Minerals are also important for enzyme function, immunity and oxygen transport. Again minerals can be broken into two categories: macro minerals and micro minerals. Macro minerals are required in relatively large amounts, in poultry diets macrominerals are Calcium phosphorus and sodium. Micro minerals in contrast are required in relatively small amounts these include zinc, iron, manganese, copper, selenium, and iodine. In the diet these minerals are derived from Salt, oyster shells, limestone, and bone meal

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Vitamins are also a portion of a complete ration, although a very small portion. Vitamins are organic compounds needed by the body in very small amounts but that have a variety of important functions. Actually, vitamin requirements in poultry are relatively high compared to other animals because unlike other animals few are synthesized in the digestive tract because the digestive tract is relatively short in birds compared to other animals. Also, birds have a very high metabolic rate therefore require greater amounts of vitamin in their formulated feed comparatively.

Vitamins are broken into two categories: fat soluble and water soluble

Fat soluble are most active in regulating body functions such as vision, blood clotting, tissue maintenance, bone development. Fat soluble vitamins include A which is used for..., D which is used for..., E which is used for... and K which is used for...

Water soluble – body metabolic regulation. Water soluble vitamins include ascorbic acid...

In the diet, typically a pre-made vitamin pre-mix is used

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Non-nutritive feed additives are a common topic of discussion and often confusion for consumers. Coccidiostats are a non-nutritive feed additive that is often added to poultry diets to protect birds against a protozoal pathogen that causes the disease coccidiosis. Coccidiosis is often a chronic disease not necessarily resulting in bird death however, growth can be significantly impaired and in some cases mortality can occur primarily from increased susceptibility to secondary infections.

Antibiotics are a common area of misconception among consumers!! It has been found that some antibiotics can have growth promoting abilities. This is because the antibiotic effectively improves gut health and therefore nutrient absorption. Antibiotics that have been used in the past for improving gut health are not relevant in human medicine and are never used. However, increasingly strict guidelines are being put into place to regulate the use of antibiotics. This in combination with increasing public concern has caused the overall use of antibiotics in poultry to decrease.

If you get a question about antibiotic resistance... Make the point that when we go to the dr we most often get an antibiotic. Human doctors typically prescribe antibiotics regardless of whether the illness is caused by a bacteria or a virus. If the illness is caused by a virus antibiotics are completely ineffective and should not be administered. If you do take an antibiotic and it is not needed (like with a viral disease) you are increasing antibiotic resistance in your own body because you are killing susceptible healthy micro flora and not effecting the disease causing agent in your body at all.

The hormone question... Hormones have never ever been cleared for use in poultry. Commercial poultry is ALWAYS HORMONE FREE.

If you still have questions... how are hormones administered? An implant in the ear... an injection...

Hormones cannot be fed because they will be broken down and metabolized as any other feed ingredient. Therefore there is no practical way to administer hormones on the scale of the commercial industry.

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Nutrient requirements decrease as bird's age. Represented in this graph by the red line are the nutrient requirements of a commercial broiler. Birds require greater nutrient density in the diet at d 1 than they require at 56 d.

The blue lines represent nutrient requirements of the commercial broiler recommended by the NRC. The NRC feeding regimen is 3 phases: 0-3, 3-6 and 6-8 weeks of age. Notice that as the bird's nutrient requirements decrease linearly over time there are periods when the NRC regimen is over-feeding nutrients.

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Commercial poultry diets also come in several forms. Mash, crumble and pelleted. Pelleted is vastly preferred because consumption is much easier and intake is increased with a pelleted diet. During the brooding period crumbled diets are often used to make it easier for the chicks to eat. Both are preferred to a mash type diet. In this picture is a mash diet.

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Here is a picture of a control panel at the University of Arkansas Poultry Science feed mill. From the previous slide you see the large hopper filled with bulk ingredients outside the feed mill. In these are primarily corn and soybean meal, other bulk ingredients will be kept in bins like this also (milo for example). On this control panel you see the ingredient number coordinates with the bin and the appropriate amount of ingredient for the diet being mixed is sent into the mixer using this control panel.

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Diet table Excerpt from Animal Science and Industry 3rd edition pg 414

Here is an example of a commercial diet: a broiler starter diet, turkey starter diet and a layer diet. For commercial broiler and turkey production the starter diet will be the most nutrient dense diet fed. First notice not the use of bakery by-product. This product is typically used for energy in poultry diets dependent on availability of other ingredients. Also, notice the use of crystalline AAs to supplement the diet. The amount of energy in the diet is different for all three diets... laying hens require higher energy for egg production. Soybean meal in this diet is the primary source of AA (protein) however it is supplemented with Meat and Bone, and Meat meal in the different diets. Notice the different levels of protein in diets, what does this tell you about nutrition demand?

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Diet table Excerpt from Animal Science and Industry 3rd edition pg 414

Note the differences in analyzed values for the same poultry diets in the previous slide. Chicken layer diets require much less protein than a broiler or turkey starting because of the nutritional need of these birds for accruing muscle. Also appreciate the balance between metabolizable energy and protein content in the diet. The turkey ration for example has less energy and higher protein content compared to the broiler diet. What do you remember about this? For the layer diet the Ca % is significantly greater than the other diets. What does this indicate about nutritional need? Remember Egg production section... Where does this calcium go? Not directly into the egg. Replaces Ca in the medullary bones.

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Table excerpt from Animal Science and Industry Seventh edition pg 78

Dietary deficiencies can cause clinical signs and disease in poultry. Would this be a direct or pre-disposing cause of disease? Would this be infectious or non-infectious disease? In this table are some dietary deficiencies that would cause disease in poultry. Deficient in Vit A... Vit D... E... K... B-Complex vitamins...

Also, note that if a flock is affected by a coccidial infection, nutrient absorption in the gut can be hindered and any of the above deficiencies could potentially be observed.