Feeds and Feeding of Commercial Poultry

AgScience Poultry Science Curriculum
Section 5
Introduction

Nutrition is one of the most important aspects of poultry production
Comprises 60-70% of production cost (CHECK)
Grow more rapidly
Mature at earlier ages
  More sensitive to environmental changes

Proper nutrition and productivity are inextricably bound
  Optimizing growth
  Growth and productivity will be sacrificed without proper nutrition
    Deficiencies or Toxicities

Poultry must be provided with the following major nutrient groups:
  Proteins
  Energy
  Minerals
  Vitamins

WATER – Most important nutrient! Birds will die very quickly without water.
Nutritional needs of poultry

Feeding behaviors of poultry:
- Birds consume many small meals throughout the day
- Feed almost always present in the gastrointestinal (G.I) tract
- Feed needs to be present at all times!
- Eat to meet nutritional needs

Newly hatched birds can survive on residual yolk
- Critical that get on feed as soon as possible
- Residual yolk is used to stimulate digestive and absorptive function of G.I. tract
Poultry are **monogastric** – having only one stomach
Digestive System

To Head

To Vent

Direction of food passage

Esophagus

Crop

Proventriculus

Ventriculus (Gizzard)

Ceca

Large Intestine

Small intestine

Meckel’s Diverticulum
Nutrient Groups

Dietary Energy

40-50% of feed costs (CHECK)
Derived from carbohydrate sources in the feed
Remember – Birds eat to meet nutritional needs
Low energy diet = high consumption
High energy diet = low consumption

Dietary Energy Sources:

Cereal grains including:
- Corn
- Milo

Simple Carbohydrates – Majority of energy from these sources

Animal fats
Vegetable oils
Animal by-product meals

Dietary Lipid

Soybeans – although not an ideal source
Dietary Protein

Chains of Amino acids – Building blocks of proteins

Essential amino acids – Cannot be metabolized in the body, must be in feedstuffs

Non-essential amino acids – can be metabolized in the body

Used in the body for formation of lean tissue, enzymes, hormones, and body metabolites

Young animals use for building
Old animals use for maintaining

Dietary Sources:

Oilseed byproducts from edible or functional oil production including:

Soybean oil, peanut oil and canola oil

40-60% protein in most cases

Others can be used if available and cost effective

Animal protein by-product meals

Can include feather meal, blood meal, fish meal, meat and bone meal

Product quality is extremely variable

Comprise <5% of diet
Amino acid requirements are dependent on a variety of factors:
- Age
- Size of bird
- Genetics of bird
- Dietary energy level

High energy diets require higher dietary amino acid density.

Limiting amino acid:
- Growth will only reach the point of the limiting nutrient in the diet

Common poultry diets are limiting in the amino acid lysine and the sulfur amino acids (methionine and cysteine)
- Corn is relatively deficient in lysine
- Soy bean meal is relatively deficient in methionine and cysteine
Amino acid digestibility:
  Digestibility – amount of amino acid absorbed from the diet that does not end up in excreta
  How much of fed amino acid will actually be absorbed by the bird

Nutrient digestibility (%) = \frac{\text{Nutrient intake} - \text{Nutrient in feces}}{\text{Nutrient intake}} \times 100

Amino acid digestibility cont’d:
  Ingredient A contains 1.5% lysine with a digestibility of 90%. Ingredient B contains 2.0% lysine with a digestibility of 50%. Which ingredient is contributing more to the dietary lysine?
Nutrient Groups

Dietary Fats:
- Triacylglycerides composed of glycerol and 3 fatty acid chains
- Source of energy for the body – 2.25 times more than carbohydrates
- Source of essential fatty acids
- Carriers of fat-soluble vitamins

Dietary Sources:
- Tallow
- Vegetable oils
- Poultry fat
Nutrient Groups

Dietary Vitamins:
- Organic compounds needed by the body in very small amounts
- Requirements in poultry are relatively high compared to other animals
- Few are synthesized in G.I. tract
- Fat soluble vs. Water soluble

Fat soluble vitamins:
- A – vision, reproduction, bone development
- D – Ca absorption
- E – Antioxidant, protects cells from oxidative damage
- K – Blood clotting

Water soluble vitamins:
- ascorbic acid (C), niacin, biotin, choline, etc.

Dietary Sources:
- Pre-made vitamin mix
Nutrient Groups

Dietary Minerals:

- Inorganic constituents of bones and teeth etc.
- Important for enzyme function, immunity and oxygen transport

Macro minerals – Required in relatively large amounts
  - Ca, P, Na

Micro minerals – Required in relatively small amounts
  - Zn, Fe, Mn, Cu, Se, I

Dietary Sources:

- Salt
- Oyster shells
- Lime
- Bone meal
Non-Nutritive feed additives

Coccidiostats – commonly used to protect birds from disease causing organisms that cause coccidiosis a disease that can impair growth and cause increased mortality

Antibiotics – Some antibiotics can have growth promoting abilities because of their ability to improve gut health and nutrient absorption. Strict guidelines are in place to regulate the use of these and overall the use of antibiotics is declining

Hormones – Have never been cleared for use in poultry, therefore commercial poultry is always hormone-free
Diet Formulation

NRC 3-phase recommendations
Industry-type diet
Diet Formulation

Commercial nutritionists often use least-cost formulations for diets
Computer programs are used
Inputs required include:
- Nutrients needed and what nutrients are required
- List of all available ingredients
- Ingredient composition
  - Amount of energy, amino acids vitamins and minerals
- Ingredient cost
Computer will figure the least expensive formulation while still meeting all dietary requirements

Feed Form
- Mash
- Crumble
- Pelleted
<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Broiler Starter</th>
<th>Turkey Starter</th>
<th>Chicken Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Percentage of Complete Ration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow Corn</td>
<td>56.46</td>
<td>47.75</td>
<td>60.50</td>
</tr>
<tr>
<td>Soybean Meal (48% protein)</td>
<td>27.33</td>
<td>38.83</td>
<td>21.50</td>
</tr>
<tr>
<td>Meat and Bone meal (50% protein)</td>
<td>7.0</td>
<td>_</td>
<td>5.09</td>
</tr>
<tr>
<td>Meat meal (56% protein)</td>
<td>_</td>
<td>9.50</td>
<td>_</td>
</tr>
<tr>
<td>Bakery by-product</td>
<td>6.00</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>Animal-vegetable fat</td>
<td>1.82</td>
<td>0.31</td>
<td>3.00</td>
</tr>
<tr>
<td>D,L - Methionine</td>
<td>0.17</td>
<td>0.24</td>
<td>0.11</td>
</tr>
<tr>
<td>L-Lysine</td>
<td>_</td>
<td>0.23</td>
<td>_</td>
</tr>
<tr>
<td>Dicalcium Phosphate</td>
<td>0.13</td>
<td>1.54</td>
<td>0.49</td>
</tr>
<tr>
<td>Ground Limestone</td>
<td>0.49</td>
<td>0.81</td>
<td>8.66</td>
</tr>
<tr>
<td>Iodized Salt</td>
<td>0.10</td>
<td>0.09</td>
<td>0.20</td>
</tr>
<tr>
<td>Sodium Bicarbonate</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Vitamin/mineral premix</td>
<td>0.30</td>
<td>0.50</td>
<td>0.25</td>
</tr>
</tbody>
</table>
## Diet Formulation

<table>
<thead>
<tr>
<th>Analyzed as Fed</th>
<th>Broiler Starter</th>
<th>Turkey Starter</th>
<th>Chicken Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein %</td>
<td>22.50</td>
<td>28.00</td>
<td>18.00</td>
</tr>
<tr>
<td>Metabolizable Energy (kcal/lb)</td>
<td>1,425</td>
<td>1,280</td>
<td>1,320</td>
</tr>
<tr>
<td>Calcium %</td>
<td>0.95</td>
<td>1.45</td>
<td>3.80</td>
</tr>
<tr>
<td>Available Phosphorus %</td>
<td>0.48</td>
<td>0.83</td>
<td>0.45</td>
</tr>
<tr>
<td>Lysine %</td>
<td>1.21</td>
<td>1.80</td>
<td>0.94</td>
</tr>
<tr>
<td>Methionine +Cysteine %</td>
<td>0.92</td>
<td>1.10</td>
<td>0.71</td>
</tr>
</tbody>
</table>
## Dietary Deficiencies – Cause and Effect

<table>
<thead>
<tr>
<th>Fat-soluble Vitamin</th>
<th>Specific Role</th>
<th>Likely Deficiency Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Vision, Epithelial cell lining of body</td>
<td>Poor vision in dim light, Increased infections, Weak offspring</td>
</tr>
<tr>
<td>D</td>
<td>Aid in Ca absorption</td>
<td>Bone disorders (rickets)</td>
</tr>
<tr>
<td>E</td>
<td>Antioxidant, aids selenium</td>
<td>Encephalomalacia(^1) in chicks, white muscle disease</td>
</tr>
<tr>
<td>K</td>
<td>Needed for blood clotting</td>
<td>Increased clotting time</td>
</tr>
<tr>
<td>B-Complex vitamins</td>
<td>Coenzymes in release of energy, skin health, red-blood cell production</td>
<td>Weakness, dermatitis, poor oxygen transport, anemia, poor growth</td>
</tr>
</tbody>
</table>

\(^1\)Observed in chicks and poults less than 2 mo old, Loss of balance and falling backward. Hemorrhage and softness of cerebellum.

Malabsorption of fed nutrients as the result of a coccidial infection could cause any of above deficiencies.
In formulating poultry diets why is corn and soybean meal a good combination?

Common poultry diets are limiting in the amino acid lysine and the sulfur amino acids (methionine and cysteine).

Corn is relatively deficient in lysine.
Soybean meal is relatively deficient in methionine and cysteine. Therefore, when used in combination the deficiencies of these two ingredients are marginalized.