



## The Requirements of Chickens for Nutritional Compounds for Growth, An advanced Nutritional outlook

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### Abstract

The science of nutrition includes the provision of balanced nutrients that meet the need of chickens (animal) to grow, maintain and continue production, and for economic reasons, these foodstuffs should be at the lowest prices, so we should provide these materials only with what the nutritional requirements need without a significant increase. However, we must provide some nutrients at higher levels in practical situations, in order to try to meet the shortage of some food components. The costs of feeding chickens represent 60-70% of the total expenses in poultry projects, so the nutritionist's goal is to obtain the highest production at the lowest possible costs while making use of feed materials whenever possible. And the nutritionist must form a relationship in which all the nutrients that the bird needs are available, whether for the production of meat, table eggs or hatching eggs. In this review, we will review the basics of feeding poultry birds, the most commonly used feed materials, the nutritional needs of each bird according to its type, age, production status, how to form leeches and models of leeches that can be used, as well as diseases caused by a lack of various nutrients.

**Key words:** needs, birds, nutrition, growth, review

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## **Introduction**

Poultry meat and eggs are popular protein foods around the world, as they are relatively inexpensive, and they are white meat with high nutritional value, easy to digest, loved by many people due to their good taste [1]. Due to the development that has taken place in the poultry industry, where it has become raised on a large and intensive commercial scale, poultry products have become multiple types and forms to suit the wishes of consumers [2]. Since food costs account for 60-70% of the final poultry product, whether meat or eggs, so it was necessary to pay attention to nutrition and take modern methods to reduce the cost of feed. And to set the metering or nutritional needs of each bird without increase or decrease to obtain the highest rate of production performance with the lowest possible food costs [3]. In this review, we will review the basics of feeding poultry birds, the most commonly used feed materials, the nutritional needs of each bird according to its type, age, production status, how to form leeches and models of leeches that can be used, as well as diseases caused by a lack of various nutrients.

## **Principles of feeding chickens**

The science of nutrition includes providing balanced nutrients that meet the need of chickens to grow, maintain and continue production. And for economic reasons, these foodstuffs should be at the lowest prices, so we should provide these materials only with what the nutritional requirements need without a significant increase [4]. However, we must provide some nutrients at higher levels in practical situations, in order to try to meet the shortage of some food components. In poultry, these food determinants are usually energy and some essential amino acids such as methionine and lysine [5]. When installing the chicken coop, the following nutrients should be taken into account: - Proteins, fats, vitamins, salts, water, in addition to energy. These components are classified into cereals, animal proteins, vegetable proteins, vegetable fats, animal fats and salts needed by chickens in large quantities in addition to the combination of vitamins [6]. Each of these components by itself provides a

specific quality and quantity of nutrients for the suspension [7]. The balance of these components for the production of the composition of the gooseberry depends on the skill of the nutritionist. For the production of ration, the nutritionist must know the needs of chickens and their composition.

## **The foundations of poultry feeding**

The costs of feeding chickens represent 60-70% of the total expenses in poultry projects, so the nutritionist's goal is to obtain the highest production at the lowest possible costs while making use of feed materials whenever possible. The nutritionist must form a relationship in which all the nutrients that the bird needs are available, whether for the production of meat, table eggs or hatching eggs [8]. There are more than 40 chemical elements or compounds, most of which must be present in poultry feed for optimal growth of the bird. As mentioned earlier, these materials can be divided into six main groups, namely: (1) proteins, (2) carbohydrates, (3) fats, (4) vitamins, (5) minerals, (6) water [9]. Carbohydrates and fats are mainly a source of energy that the body needs to maintain its temperature and to accomplish the vital activities and chemical reactions by which the bird builds body tissues and gets rid of waste. Most of the nutrients are essential in poultry nutrition, a balanced gooseberry is one that contains healthy proportions of energy, proteins (source of amino acids), fats (source of fatty acids), minerals and vitamins [10]. Therefore, the main factor for the success of any poultry farming project (meat, eggs, mothers) is to provide balanced nutritional relationships containing all the nutrients so that the poultry can reach record growth and production rates [7]. Either an unbalanced ration causes a delay in the growth of the bird or leads to the occurrence of food deficiency diseases. In poultry feeding systems, scientifically fixed amounts of the bird's nutrient needs have been prepared and estimated on the basis of obtaining high productivity and good quality of meat and eggs [11].

### **Chicken needs nutritional compounds for growth**

Balanced poultry feed should contain:

#### **Protein**

The word protein is derived from the Greek word Proteios, which means first, and the bird needs proteins for growth, building body tissues and compensating for damaged ones to produce eggs and meat, and enters into the composition of blood, muscles, skin, feathers and beak. The bird's protein needs vary depending on age [12]. In the first period of life, it needs a high percentage of protein to build body tissues, therefore, the protein content in the ration should not be less than 20% in the first four weeks of life, while covering the needs of essential amino acids (methionine - lysine) [13]. The percentage of protein in the ration can be reduced by an average of 2% every four weeks until the rate reaches 15%, so the percentage of protein in the ration is fixed until the bird reaches adulthood and the beginning of egg laying, so the percentage of protein in the ration increases to about 17 % [14]. The protein consists of basic building blocks known as amino acids linked together by peptide bonds, of which 24-26 amino acids are known, and not all of them are of the same importance for poultry, as it has been proven that birds are able to form some amino acids from other amino acids [15]. The protein consists of basic building blocks known as amino acids linked together by peptide bonds, of which 24-26 amino acids are known, and not all of them are of the same importance for poultry, as it has been proven that birds are able to form some amino acids from other amino acids [16]. Amino acids in terms of their importance are divided into three main groups:

**(A) Unnecessary amino acids:** A bird can build it inside its body. Among them are Anine - hydroxyproline - serine - aspartic acid [17].

**(B) Essential amino acids:** They cannot be built by the bird inside its body and must be available in poultry feed in the prescribed proportions, including arginine - histidine - leucin - leucine - isoleucine - methonin - phenylalanine - tryptophan - valine - threonine [18].

**(C) Unnecessary amino acids under special conditions:** Such as Cysteine - Proline - glycine - tyrosine - glutamic acid. For example, poultry needs the amino acid cysteine when the content of methionine in the ration is less than the limits that cover the needs of the bird, and when methionine is available in the ration, it makes it unnecessary to meet all the needs of cysteine, as the increase in methionine turns into Cysteine inside the bird's body, and in poultry there are 6 amino acids that should be given special importance, namely methionine-lysine-arginine-tryptophan-threonine - Valine, because the amounts of these acids in the ration are limited, and most other amino acids are present in sufficient quantities in the ration, or the bird can produce them in its body by converting some other amino acids [19]. For sulfuric amino acids (methionine - Cysteine), about 50% of the bird's needs are added in the form of the amino acid methionine. Proteins from the practical point of view are divided into two parts:

**(A) Proteins from plant sources:** Sources rich in vegetable protein make up 60-70% of the total protein in poultry feed, and therefore they affect the overall nutritional value of feed protein and its most important sources. Leguminous seeds and acacias. Such as earning soybeans - earning cotton-earning sesame - earning sunflower-earning peanuts - earning flax - earning shalgam-corn gluten [20].

Usually, these proteins are deficient in one or more of the necessary amino acids, so it is difficult for poultry to rely on these species in its diet only without adding the necessary amino acids that are deficient in them. Recently, it has been noted that most breeders and nutritionists are turning to the use of vegetable relations (corn - soy), which are not included in the composition of animal protein, to be supplemented with deficient amino acids (methionine-lysine) and the production of meat and eggs based on plant relations [21].

**(B) proteins from animal sources:** Its sources are fishmeal, meat, meat and bones, dried yogurt, dried sorting yogurt. animal protein is distinguished from vegetable protein by the high percentage of necessary amino acids and

their presence in balanced proportions that suit the needs of the bird's body [22].

### **Carbohydrates**

Nutritionally they are divided into:

**(A) Dissolved carbohydrate or nitrogen-free extract:** It includes various sugars and starch, which are substances that dissolve due to the digestive juice of the bird, which is absorbed in its digestive tract, and dissolved carbohydrates are the main source of supplying the bird with its need for thermal energy, and if they exceed the needs of birds, they are stored in the form of glycogen in the liver and muscles, and more than that is stored in the form of fat, and stored in the places of fat deposition in the body, in addition to providing egg yolks with the fat necessary for its formation [23].

**(B) Crude fiber:** It consists of cellulose, hemicellulose, pentosan, lignin and pectin, and these fibers cannot be absorbed in the intestines of chicks, and a small percentage of them is absorbed in the intestines of adult birds, and its main importance in poultry nutrition is reduced to being considered a substance that gives texture and structure to the hanger and gives the bird a sense of satiety as a result of filling the digestive canal with food, and a small part of these fibers and the absorption of other nutrients, provided that the percentage of raw fiber in the brood of adult birds does not exceed 4 - 5% and its increase may cause poor digestion and reduce the benefit of the rest of the components of the ration, it is worth noting that waterfowl (ducks and geese) can tolerate an increase in fiber in their food relatively than chickens [24].

### **Fat**

It is considered the main source of energy in the body, where a unit of weight of it gives thermal energy equivalent to 2.25 times the amount of thermal energy resulting from a similar weight of carbohydrates, hence the importance of using fats in case of desire to form high-energy relationships, such as the production of broiler, and the addition of fats to poultry improves the taste and consistency of the ration in addition to it provides the bird with fat-soluble vitamins (A, K3, E, D3) [25]. Some fatty acids have a special physiological

importance: linoleic acid and is important for normal growth. (A high level of linoleic acid is required to increase the size of eggs, but some research suggests that when the increase is more than 2.5%, there is no modification in the size of eggs) as well as oleic acid. And the arachidonic. Fat is added in the range of 3-6%. An increase in the percentage of fat in the ration limits its susceptibility to oxidation and rancidity, so an antioxidant should be added. When using fats to prevent the oxidation of fatty acids [26].

### **Mineral salts**

It is the inorganic part of the feed and is divided into macro - and microelements based on the quantities required in the leeches. The needs are estimated as a percentage of the leeches and added in small quantities based on mg / kg of the ration or ppm [27]. mineral salts represent about 3-4% of the bird's weight. mineral salts are required to form the skeleton and egg shell and maintain the osmotic balance inside the body [28]. they also enter into the formation of hemoglobin and the formation of some enzymes, as well as energy-carrying compounds. It is necessary to provide some mineral elements for poultry feeding, mainly such as calcium and phosphorus, and most of the calcium is used in the appendages of developing chicks in the formation of bones, while it is used in the appendages of laying birds in the formation of the egg shell [29]. The needs of birds for calcium and phosphorus vary according to the age of the bird and the productive state. Chicks from one day to 8 weeks old need 1% calcium and .45% phosphorus is available and from the age of 8 - 20 weeks you need to .9% calcium and .4 % phosphorus is available, while laying hens need 3.3-3.7% calcium and .35 - .4 % is phosphorus, since a hen needs 4 - 4.5 grams of calcium to produce one egg. There is another group of mineral elements that birds need at simple or minimal levels, such as manganese, iodine, iron, copper, zinc, magnesium, sodium, potassium, sulfur, chlorine and cobalt [30].

Sodium and chloride are important for poultry and the needs are covered by adding table salt to the feeders in a proportion of .3 - .5 %, so that the sodium content in the leeches is

from .18 -.22% and chloride of .2 - .35 %, taking into account that the percentage is not increased, as high levels lead to increased water consumption and increased glaucoma humidity [31]. It should take into account the electrolyte balance between sodium, potassium and chloride because of its importance in the growth and development of bones, the quality of the egg shell and the increased utilization of amino acids and trace mineral elements are important, as iron enters into the composition of blood hemoglobin and iodine in thyroxine, copper, manganese, selenium and zinc are important for enzymes [32].

### **Vitamins**

Vitamins are found in small proportions in raw or natural feed materials, and they are considered necessary for metabolic processes, and the lack of vitamins at the prescribed levels in poultry relations causes a decrease in production and pathological symptoms, and poultry need vitamins in their relationship because they cannot create them in their bodies [18]. Vitamins are divided into:

**(A) Fat-soluble vitamins:** (A-D-E-K3).

**(B) Water-soluble vitamins:** vitamin B group-vitamin C.

(Ascorbic acid) vitamin C is created by poultry, and accordingly it is not considered a required nutrient, but there is some research supporting the addition of vitamin C to poultry under conditions of heat stress, and the needs of most vitamins are estimated in milligrams / kilogram of feed, with the exception of vitamin A, D3, E, which is estimated in international units International Unit (IU) [33].

### **Food additives:**

They are divided into:

**(A) Nutritive additives:** Animal fats - vegetable oils-include industrially prepared amino acids (methionine - lysine), mineral elements and vitamins [34].

**(B) Non-nutritive additives:** The main reason for adding non-food additives in poultry feed is to protect the components of the ration from spoilage and oxidation, and some additives are used with the intention of increasing production, raising manufacturing efficiency or improving production and taste [35]. Non-food additives are divided into the

following sections: 1- The materials that bind the components of the ration together.

Non-food additives are divided into the following sections [36]: 1- Materials that bind the components of the ration together.

2. Flavoring substances: which improves the taste of food and makes birds accept food.

3-antifungals and mycotoxins: antifungals are added either in solid or liquid form to limit the growth of fungi. Types of antifungals include [37]:

(a) Organic acids individually or combined with each other (propionic acid - sorbic acid - acetic acid).

(b) Salts of organic acids (sodium propionate-potassium sorbate).

(c) Copper sulfate inorganic binders (natural minerals) are also used to bind mycotoxins and prevent them from being absorbed in the intestines of birds, including xylote - bentonite - calcium salts - anhydrous Moonstone.

(d) Anti-coccidiosis: Coccidiotics are used to reduce the growth of coccidiosis, and from the coccidiotics used, for example - (salucid - monencin-salinomycin) and must be withdrawn from the leeches at least a week before slaughter.

(e) Antioxidants: which is used to protect many unsaturated fatty acids and fat-soluble vitamins from oxidation damage, for example, Santoquin(e.g.Q) Butyted Hydroxy Anisol (B.H.A)-Butyted Hdroyx Toluene (B.H.T) isoxyquin is added at the rate of 200 g / t active substance to reduce the speed of rancidity of fat.

(f) Enzymes: enzymes are used in poultry feed to improve nutritional value, especially with feed materials that contain some growth-inhibiting substances, and recently the enzyme phytase. Phytase has been used with plant feed, as 80% of the phosphorus contained in feed materials of plant origin, such as cereals and oil oxides, form a chemical bond in the form of phytate, and this molecule is difficult to digest by poultry due to the lack of in areas where poultry production is concentrated and causes pollution to the environment, in addition, the ability of the phytate molecule to form a complex in the stomach with Cations (iron-zinc - magnesium-calcium ) and amino acids, which

reduce their digestion and absorption, so phytates are one of the hindering substances that cause a lack of utilization of nutrients [38].

(g) Sources of carotenoids: it is added to increase the pigment under the skin and fat of meat and young chickens in the production of table eggs [39].

#### **Water**

Water makes up about 60-80% of the bird's weight and it also accounts for about 75% of the egg's weight, so its importance is clear in that it is an essential component for animal cells and tissues and for all vital processes that take place inside the body, and the chicken drinks twice the amount it consumes of feed at moderate temperature and clean pure water must be provided taking into account the standard specifications of water suitable for drinking poultry [40]. The following is an explanation of the maximum permissible proportions in drinking water:

- Dissolved solids 1000 ppm at most.
- Iron salts are 50 ppm at most.
- Nitrates are 40-50 ppm at most.
- Sulfur (sulfate) is 250 ppm at most.
- Sodium chloride is 500 ppm at most.
- The total alkaline material is 400 ppm at most.
- Ionic concentration is 7.6-8 PH.
- Bacteria. E. Coli is not present (zero).

#### **The most important feed materials commonly used in poultry feed**

Feed materials are divided into:

(A) **Energy source feed materials:** such as cereals, grain industry residues, fats and oils [41].

##### **I. Cereals and their products**

It is considered an essential source of carbohydrates and the main component of dry matter, which is starch.

- Dry matter ratio 80 - 90 %
- The protein content is 8 - 12 %.
- The percentage of raw fiber is 2-4 %.
- Fat content is 1.5 - 6 %.
- Deficient in amino acids (methionine-lysine).
- Poor in calcium less than 0.15 %.
- Its high phosphorus content is 0.3-0.5%, but part of it is in the form of phytates phytates,

which is the image that the bird does not benefit from.

- Deficient in vitamin D, Low content of riboflavin and a good source of thiamine and vitamin E.

- The essential fatty acids in cereals are oleic and linoleic [42].

#### **One of the most important cereals used in poultry feed:**

**The corn:** A main component in poultry feed, the percentage of which reaches 75 % in feed, contains 7.7-9% crude protein, the energy represented by 3350 kcal, Fat is about 3.1%, fiber 2 %, with vitamin A prefixes beta-carotene, which is converted into vitamin A in the body, and recently strains of corn have been derived with a high content of fat (6-7%), lysine and protein due to the large size of the corn embryo [43].

**Barley:** Its use is limited in poultry feed because it contains some of the many sugars that are difficult to digest, such as beta-glucan. The average percentage of protein in it from 9-12% and fiber is about 6% deficient in amino acids, especially lysine, which is considered the specific amino acid. It is added in leeches by no more than 25% and it is preferable to serve it to adult birds after it is well crushed [44].

Some studies have shown that barley can be used in poultry feed by 75-100% instead of corn with the use of some commercial enzymes such as B - glucanase to get rid of beta - glucan difficult to digest for poultry with the addition of amino acids, taking into account the economic aspects when used in poultry feed [45].

**Wheat:** The protein content ranges from 8-12% and the fiber content is 3-4%. it is used in human nutrition. wheat fraction may be used in poultry nutrition. it can replace corn and be used up to 25%. if it is used more, some enzymes must be added that increase its digestion [46].

**Bran:** The percentage of raw protein is 12.5 - 15%, fiber is 8.5-12%, and the energy represented is relatively low (1300 kcal) and can be added in adult birds up to 10%, ducks and geese up to 25% [47].

**Sorghum:** The protein content ranges from 8.3 - 11% and the energy used in chicks differs more in sorghum grains with a brown crust cover than without a cover, and it is noted the presence of tannin in them, which is a toxic substance that reduces growth, and there are species containing small percentages of this substance that can be replaced from part or all of the corn in poultry feed [48].

**Rice:** It is mainly used as the main food for humans, however, during the bleaching process, there may be quantities of rice left that are less than suitable for human consumption, and it can be used to feed poultry as well as break rice, and rice is considered one of the highest energy sources after corn and can replace part of corn in the range of 25-35 % [49].

**Rice bran:** It is the product of rice grains, and it contains a high percentage of oils up to 14%, Therefore it spoils quickly as a result of the rancidity of these oils, so it is preferable to use it immediately after production and not stored, and oils can be extracted from it and stored for a long time, and the extracted universe contains 10% raw fiber and 12% protein. It can be used in adult chickens and adult chickens by no more than 10% and increases in ducks, geese and turkeys up to 35%. it is noted that the percentage of phosphorus is not available in it, and the utilization of phosphorus can be improved by adding the enzyme phytase [50].

**(B) Feed materials that are a source of protein:** such as vegetable supplements - animal protein sources - and yeast in addition to minerals and vitamins.

## II. Sources of vegetable protein [51]:

Sources rich in vegetable protein make up 60-70% of the total protein in poultry feed, and there are many factors that affect the nutritional value of vegetable proteins, including:

1. The availability of the necessary amino acids in them.
2. The presence of non-nutritional factors that reduce growth.
3. The impact of manufacturing processes.

The most important plant proteins are:

## Earning soybeans:

One of the most important vegetable proteins used in poultry feed because it contains most of the amino acids needed by poultry in balanced proportions, and it is not recommended to use raw soybean seeds in poultry feed because they contain a growth - inhibiting factor that stops the work of the trypsin enzyme, so it acts as a stop for the digestion of some amino acids, especially methionine and cysteine, and works not to benefit from them - whole soybeans contain 35% crude protein and 16-21% oil [52].

When small amounts of raw soybean seeds are added to the chicks ' brood, the following occurs:

- Lack of intestinal activity in chicks.
- Lack of growth.
- Lack of Representative energy.
- Increased size of the pancreas.
- Increased bile acids.

- Single-stomach animals (simple) are affected by the use of soybeans, unlike ruminant animals, where they are able to use non-heat-treated soybeans.

- Trypsin inhibitors that reduce the nutritional value of the protein can be eliminated with appropriate heat treatment (so that the activity of the urease enzyme does not exceed 0.02-0.2% and the heating temperature and duration vary depending on the extraction methods, namely:

- Solvent extraction.
- Hydraulic pressure and compression.
- Solvent extraction and pressing.

There are two types of soybeans used on a commercial scale in poultry feed, one of which contains 44% of raw protein, 2230 kcal energy represented by KG, 7.3% of raw fiber, and the other is a high-extraction soybean without peel containing 48.5% of raw protein, 2440 kcal energy represented by KG and about 3.9% raw fiber [[53]. Both types are used in poultry feeding and give good results and the main factor determined in choosing one of them is the economic factor, in addition, full fat soybeans can be used in one of the following ways: (roasting - infrared radiation - heating with a rushing air stream wet or dry extrusion) where it is used in poultry feed without the

need to use fats and full fat soybean seeds treated by one of the previous methods contain 36 - 38% raw protein and energy represented by 3500 -3750 kcal / kg [54].

#### **Earning a cotton seed:**

The use of cotton gain in poultry feed determines the content of gossypol (gossypol).03- .2 %), which is toxic to single-stomach animals, where the growth of chicks is affected if the percentage of free gossypol exceeds 0.4 - 0.6%, and egg production is affected if its percentage exceeds 0.3 % In addition to a deficiency in some essential amino acids (methionine-lysine- Threonine ), and when given to poultry at a level higher than 5-10% in the ration, it has a bad effect on the quality of the egg and the color of the yolk is olive green and the Whites are pink, and it is usually recommended not to exceed the percentage of gossypol 0.2 % and the addition of ferrous salts reduces the toxic effect of gossypol, fortunately, the squeezing process reduces the efficiency of raw gossypol, and the gain of peeled cotton can be used as a source of protein in the ration, as it contains 42% protein and is used by no more than 5% in chicks or white currants with coverage of deficient amino acids in the ration [55].

#### **Earning a sunflower seed:**

Its content is low in the amino acids' lysine and tryptophan, and the protein content reaches 40% in some peeled fruits, and its high fiber content is noted, and recent studies have shown that it can be added up to 20% from blackberries, and it can be partially or completely replaced by soy without a negative impact on the performance of poultry, while adjusting the total protein and energy represented in the leeches [56].

#### **Earning peanuts:**

The seeds contain 25-35% crude protein and about 35-60% fatty substances. The outer shell is high in fiber - peanuts contain Trypsin inhibitor activity, especially in the shell, heat treatment did not improve the nutritional value, contains lectin goiter and some saponins-like compounds. The problem in gaining peanuts is the rapid growth of fungi on it and produces toxins (aflatoxins), most importantly B1, and aflatoxins should not exceed 20 ppb and the

concentration of B1 of them should not exceed 10 ppb. The percentage of crude protein is not less than 45% in earning peeled peanuts, and it can be used up to 15% and contains a high percentage of amino acids, especially arginine - glycine and a low percentage of methionine - lysine - tryptophan - and sulfuric amino acids [57].

#### **Earning a sesame seed:**

It contains most of the essential amino acids at levels sufficient for the growth of chicks and chicken eggs, especially methionine, the missing amino acid is lysine, and sesame has a high content of Phytic acid and contains an anti-pyrodexin agent, as well as contains about 40% of raw protein and can be used up to 25%, it is rich in mineral salts, especially calcium and phosphorus, but not available at 100 % [58].

#### **Earning flaxseed:**

It contains a low level of methionine-lysine and flax gain is not considered a suitable food for poultry, as it was found that chicks fed on leeches contain 5% flax gain delayed their growth, it also caused the death of turkey chicks at a level of 10% and it can be given to poultry within no more than 3% and it was possible to overcome the harmful effect by treating gain by autoclave heating and by increasing the percentage of vitamin B6 in the ration (the percentage of protein in the gain of unpeeled flax seeds is about 34 %) [59].

#### **Earning a rapeseed:**

It may contain glycosides and erucic acid, which are toxic substances that reduce the growth of birds. Rapeseed gain contains about 3% Tannic acid and the protein percentage ranges from 35-40%. it can be added to poultry feed by 5-10%. modern strains of rapeseed have been produced that contain a very low percentage of glucosides and erucic acid Erucic acid and can be used in poultry feed up to 15% of the ration [60].

#### **Earn unpeeled safflower:**

Unpeeled safflower seeds contain 16-20% protein, 29-31% fiber and are low in lysine, methionine, so its value is low in poultry feed, but peeling gives a gain containing 44% protein, 9% fiber and 1.5% oil. when adding lysine and methionine, soybean gain or fish



powder to unpeeled safflower gain, it can be used up to the level of 10% [61].

**Corn gluten:**

After separating the starch from the corn grains, corn gluten remains, which is a protein-rich substance, where the percentage of raw protein ranges from 40-64% and its content is low in lysine-arginine-tryptophan, but it is rich in methionine and can be used in proportions of up to 10% of the ration, and it contains a high energy content of about 3720 KK / kg, and is used in relation to meat poultry, which contains a high protein and energy content [62].

**Palm kernel powder:**

Relatively low in protein content-the first specific amino acid is methionine and the ratio of calcium to phosphorus is excellent than the rest of the oily grain residues-it is mixed with other foods to be more palatable and has a fiber content of about 15 %. Date kernels can be used in bird feeders up to 15-20 % [63].

**Beans:**

It follows legumes and uses Bean fraction in poultry nutrition, the protein content is 26-30%, it is a good source of phosphorus and energy, the fat content is 1.5%, it is poor in calcium, low in cysteine and methionine and contains a high percentage of lysine and can be used up to 25 %.

Some other non-traditional energy sources in poultry food [64]. The benefits and restrictions related to each feed item are also described. While species-specific aspects and issues in terms of applications are briefly investigated, also feeding strategies such inclusion levels in poultry diets are reviewed (Table 2).

**Table 1.** Recommended inclusion rate (%) in diets broiler chickens.

Item	Broiler Chickens
Faba beans	20–40
Field peas	15–36
Chickpeas	12–15%
Copra meal	25
Palm-kernel meal	30–40
Poultry meal	10–16
Feather meal	6
Blood meal	7.5
Insect meal	10–15
Cassava root	10–50% replacement

	of corn
Bakery meal	25
Triticale	40–60
Molasses	24
Sugar beet pulp	3
Rice bran	10–20
Oat hulls	3
Palm oil	-

**The potato:**

It is considered one of the tuber crops, which is rich in starch and poor in protein, calcium and phosphorus, so it contains on the basis of dry matter 5.8% of raw protein, 7% of raw fat and 6.6% raw fiber, and when presented to poultry, it must be ground or boiled in water before feeding [65].

**Cassava or tapioca:**

Cassava powder contains about 3% of raw protein, 89% of raw fat, 4.9% of raw fiber, 2-3% of ash and 88-90% of dissolved carbohydrates and cassava powder can be used as a substitute for yellow corn in poultry feed, preferably mixed with corn, and cassava powder contains about 3% of raw protein, 89% of raw fat, 4.9% of raw fiber, 2-3% of ash, and 88-90% of dissolved carbohydrates it can replace 20% of yellow corn (12% of blackberries) during the fattening period for meat chicks [66].

**Potatoes:**

It is considered one of the tubers, and the protein content of the dry matter is about 10%, and about half of this value is nitrogenous compounds of these compounds, alkaline solandin, which is very toxic to animals and causes them infectious disorders, and this toxic effect can be overcome by treating potatoes with hot water, boiling it in water or exposing it to heat - its content is low in fiber - and this makes it a suitable food for poultry, which is considered poor in mineral matter except potassium [67].

**(III) Sources of animal proteins**

They are used in a small proportion to supplement the shortage of essential amino acids in vegetable protein concentrates, in addition, they contribute amount of minerals and vitamins such as vitamin B - complex, and

may be used in limited quantities due to their high prices, and when used in large quantities, they are uneconomical [68].

**(a) Fishmeal**

It is a product of manufacturing, drying and grinding whole fish or parts of it of various types, noting its exposure to appropriate temperatures so as not to affect its nutritional value, and fish powders contain 55-72% crude protein and fat percentage of 5-10%. there are types of fish powders [69]. The most important of which are: **White fish powder:** You get it by drying and grinding for Whitefish or whitefish offal. Its properties: it has a high content of lysine - methionine - tryptophan and contains a high percentage of mineral salts, where it contains 8% of calcium and 3.5% of phosphorus and contains a percentage of micro - mineral elements (manganese - iron - iodine) and is a good source of B vitamins (B12 - riboflavin-choline) [70]. **Herring fish powder:** It contains about 70% raw protein, it is recommended to add them in specific proportions of 2-5% in order to increase their prices, and it is also recommended not to add them at the end of the fattening period or in egg production relations due to the transfer of the smell of fish in the carcass and eggs [71].

**(b) Shrimp powder**

The percentage of protein in shrimp powder depends on the shrimp meat as well as on its freedom from impurities, and it contains a percentage varying between 30-40% of raw protein and can be added to the leeches by 5 % [72].

**(c) Meat powder**

It is the result of drying and grinding of the animal carcass or parts of the carcass, except for hooves, horns, hair, internal viscera, meat powder without bones contains raw protein ranging from 60-65%, while meat and bone powder contains 45-60% raw protein and is used in poultry feed by 4-10%, meat and bone powder is a good source of calcium, phosphorus, riboflavin, choline, vitamin B12, a good source of lysine and poor in methionine and tryptophan, and the percentage of fat in meat powders ranges from 5 % - 20 %, and due to the appearance of some diseases that may be transmitted to the animal and then to humans,

such as salmonella and others, it is recommended to limit its use in animal and poultry feed [73].

**(d) Blood powder**

It is made by passing a stream of steam through the blood until the temperature reaches 100 M to ensure the sterilization process, then it is dried by steam heating, then it is ground and contains 80% raw protein and its high content of lysine and low of isoleucine, glycine and methionine and is used in poultry feed at a low percentage of 2-3 %. Also, blood powder is prone to contamination with salmonella and other pathogens so it is advisable not to use it [74].

**(e) Poultry slaughterhouse waste powder**

The products of slaughterhouses include: feathers-legs-blood-viscera-heads, if it is possible to manufacture these residues in a proper way and make them in a more digestible and useful form, they will be economical when used in relationships, and it has been possible to classify these residues into:

**Poultry offal powder:** It includes heads-legs-intestines, which is an excellent source of protein and contains 50-60% of raw protein and 5-15% fat, and it must be extracted so as not to cause rancidity and is considered poor in threonine and tryptophan, while lysine and methionine are found in approximately equal proportion to the needs of poultry, and can be used in the range of 1-5% of the ration [75].

**Feather powder:** Since feathers contain creatinine protein, which cannot be digested, so it must be treated with steam under pressure, and the processed feather powder contains a crude protein content of at least 80% and is added No more than 5% with one of the other animal protein sources and contains a high percentage of cysteine [76].

**Residues of the spawning process:** It includes a mixture of eggshells, unfertilized eggs (slate), non - hatched eggs (caps) and deformed chicks after cooking, drying and grinding after removing part of the fat or without removing it, and it contains a protein content in the range of 48-49%. studies have shown that the best percentage of adding to the waste of hatching Laboratories from an economic point of view is in the range of 6% in relation to meat chicks

[77]. **Avian feces:** It is known that avian feces may contain some undigested feed materials, some epithelial cells, some secretions, intestinal microbes, special substances for urine and its components. feces contain about 30% crude protein and is a source of calcium, phosphorus and potassium. the best feces resulting from batteries may contain sawdust in the case of breeding on land, as well as algae may grow on it and can be added to poultry feed by 5%. Although there are opinions that birds do not benefit from poultry feces, as it contains undigested food compounds.

#### **(f) Dairy products**

The main protein in milk is casein and contains about 78 % of total nitrogen, and milk protein is of excellent quality, but it has a slight deficiency in its content of sulfuric amino acids, calcium and phosphorus must be added, as its content is low in ash and milk is low in magnesium and has a significant lack of iron and is a good source of vitamin A [79]. **(1)**

**Yogurt sorting:** It is the one that remains after separating the cream from the milk after drying, and its content is low in fat (less than 1%) and it has few fat-soluble vitamins, and it is used as a source of protein in the relations of single-stomach animals and contains about 35% of protein [80]. **(2) whey:** It is produced from the cheese industry and is poor in energy, where it is -270 kcal / kg and poor in fat-soluble vitamins, calcium and phosphorus, and the good quality of it contains 14% of raw protein and can be used within 5% of the ration [81].

#### **(g) Other types of residues**

**1. Rumen residues:** These residues are collected from slaughterhouses immediately after slaughter, then dried and grinded. dry Rumen residues contain approximately 9-10% of raw protein and 28-30% of fiber. they can be used with 10% of meat and egg chicks ' attachments. transactions have been carried out to improve the nutritional value by autoclave treatment or the addition of sulfuric acid with the addition of molasses or the addition of some commercial enzymes. It can also be used as a brush for poultry and then used to feed ruminant animals, as some studies have shown that rabbits can be fed on the contents of dried

Rumen instead of threshing by up to 25% in case of a high price or shortage in the market [82].

**2. Apricot kernels: (without the wooden casing):** It is rich in protein as it contains 28% of raw protein, 1% of fiber, 41% of raw fat, 28% of excess carbohydrates and 2% of ash, and it also contains a toxic substance (amygdalin). some studies have shown that the use of apricot kernels in feeding rabbits is a good source of protein, but it needs future studies to improve manufacturing processes and invent new methods [83].

**3. Azolla:** It is a small fern plant that lives floating on the surface of the water and is not alone, as it is associated with a type of algae that does a kind of symbiotic living with Azolla, and it works to stabilize atmospheric nitrogen, therefore it contains a high protein content ranging from 25-30% of its dry weight, Azolla can be used in poultry feed by up to 20%, and some studies have shown its use by up to 45% with a normal growth rate such as a comparison group, and ducks can feed on it, whether it is green or after drying and slightly moistened with water [84].

**4. Restaurant waste:** Large amounts of waste lags behind in restaurants and hotels and before being used in poultry feeders, it must be processed, where it is dried and grinded, and we find that these waste differ in nutritional value, so it must be analyzed before being added to poultry feeders, and it can be used in its fresh form in small poultry farms or for birds raised at home, provided that it is served and mixed with crushed corn and soybeans with the addition of sources of calcium, phosphorus and vitamins, and it should not be stored because if stored for a day or more, it leads to fermentation and bacterial and fungal growths and becomes invalid for feeding birds [85]. The absence of contamination of feed materials with harmful substances is taken into account and Table (2) shows the maximum limits of contamination with harmful substances of feed and raw materials [86].

**Table (2):** Maximum limits of contamination by harmful substances of feed and raw materials

Contamination with harmful substances	Maximum limits / ppm
Fluorine	250
Free gossypol	100
Lead	10
Mercury	0.01
Nitrate (sodium nitrate)	15 parts per million
Arsenic	2 parts per million
Polychlorinated phenol	Completely free from this harmful substance

**(h) Sources of fats:**

Animal fat or artificial fats (hydrogenated vegetable oils) are used in fattening feed at a rate of 3-5% and are used in feed factories that make currants in the form of cubes, where it works to hold the currants together and an antioxidant such as centaquine must be added to reduce the speed of their rancidity. Poultry fat, extruded soybean seeds (whole fat), sunflower seeds, rapeseed (shallots) can be used, and it is noted not to store leeches containing a high fat content for more than one or two weeks at most to prevent the occurrence of rancidity or corruption of fats and vitamins dissolved in them. It should be noted that there is a difficulty in mixing fat in the ration due to the lumpiness of the feed and its consistency and not distributed regularly, so it must be in liquid form [87].

**(i) Natural sources of vitamins:**

**1-Beer factory waste:**

It is also rich in vitamins such as vitamin B complex and is added up to 10% to the BlackBerry, as well as dry Brewer's yeast, it contains about 50% of protein, which is a high source of vitamin B complex, and dry Brewer's yeast contains about 50% of protein, which is a high source of vitamin B complex, and the BlackBerry can be added by 2-3 % for its bitter taste and to increase the concentration of nucleic acids in them [88].

**2. Black honey (molasses):**

It is one of the residues of the sugar industry and contains 50% sugar, which is rich in mineral salts and contains 3-4% potassium, and

is used in the manufacture of poultry feed when making cubes, and it may be added to the ration by 1 – 3 % in order to encourage birds to consume feed to change its taste, it contains niacin, pantothenic acid and choline [89].

**(j) Sources of mineral salts**

Among the most important minerals that poultry needs in its relationship are calcium - phosphorus - sodium - manganese - zinc - copper - selenium - cobalt - iron-iodine [90].

One of the most important sources of calcium and phosphorus in poultry feed:

**1. Bone powder:** It contains 85-90% calcium phosphate, 1-2% magnesium phosphate, 25-30% calcium and 10-15% phosphorus and is a good source of calcium and phosphorus.

**2. Shell powder:** It contains a high percentage of calcium, about 38%, and the need for it increases in the nutrition of egg-producing chickens.

**3. Limestone powder:** The cheapest available sources of calcium and contains about 37 % calcium.

**4. Dicalcium Phosphate:** It is made by chemical treatment using phosphoric acid with calcium carbonate and the resulting contains 21-24% calcium and 18-19% phosphorus.

**5- Fluorine - free phosphoric rocks:**

It contains about 20-22% calcium, 15-16% phosphorus.

**Salt (sodium chloride)**

Most plant sources used in poultry feed have a low sodium and chloride content, therefore sodium and chloride should be added in the form of table salt at a level of 0.3 - 0.5% of the ration so that the sodium content in the ration is about 0.18% and the chloride content in the ration is not more than 0.22 % [91].

**Conclusion**

It concluded from the review of studies and researches that the nutritional composition of feed materials is the content of the ration of nutrients or the chemical composition of the feed materials and therefore the final product, which is the feed. The ration is composed of nutrients of protein, energy, fiber, vitamins and minerals and knowledge of these nutrients has an important role in the synthesis of feed in accordance with the required specifications.

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## متطلبات الدجاج للمركبات الغذائية للنمو، نظرة تغذوية متقدمة

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### الخلاصة

يشمل علم التغذية توفير العناصر الغذائية المتوازنة التي تلبي حاجة الدجاج (الحيوان) إلى النمو والمحافظة ومواصلة الإنتاج، ولأسباب اقتصادية، يجب أن تكون هذه المواد الغذائية بأقل الأسعار، لذلك يجب أن توفر هذه المواد فقط بما تحتاجه المتطلبات الغذائية دون زيادة كبيرة. ومع ذلك، يجب علينا توفير بعض العناصر الغذائية بمستويات أعلى في المواقع العملية، من أجل محاولة سد النقص في بعض المكونات الغذائية تمثل تكاليف تغذية الدجاج 60-70٪ من إجمالي النفقات في مشاريع الدواجن، لذلك هدف أخصائي التغذية هو الحصول على أعلى إنتاج بأقل التكاليف الممكنة مع الاستفادة من مواد الأعلاف كلما أمكن ذلك. ويجب على اختصاصي التغذية تكوين علاقة تتوفر فيها جميع العناصر الغذائية التي يحتاجها الطائر، سواء لإنتاج اللحم أو بيض المائدة أو بيض التفريخ. في هذا الاستعراض، سنراجع أساسيات تغذية طيور الدواجن، ومواد العلف الأكثر استخداماً، والاحتياجات الغذائية لكل طائر وفقاً لنوعه وعمره وحالة إنتاجه، وكيفية تكوين العلق ونماذج العلق التي يمكن استخدامها، وكذلك الأمراض الناجمة عن نقص العناصر الغذائية المختلفة.

**الكلمات المفتاحية:** إحتياجات، طيور، تغذية، نمو، مراجعة