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Review Article

NUTRITIONAL AND BIOCHEMICAL ASPECTS OF POULTRY FEED - A REVIEW

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ABSTRACT

In poultry production, feed represents the major cost factor and it also determines the rate of the growth of chicks and also their nutritional status. The poultry feed contains plant protein sources, cereal grains, fats, animal by-products, vitamin and mineral supplements, antibiotics and feed additives. They are usually assembled on a least cost basis taking into consideration their nutritive properties as well. The present review describes the various essential growth promoters and novel feed supplements. Natural medicinal products are also ideal feed additives and are gaining their popularity nowadays. Poultry feed must be formulated such that it must provide all the nutrients necessary for growth and also disease resistant constituents like probiotics, Natural Growth Factors (NGFs) and Anti- Microbial Peptides (AMPs) which are naturally available with less side effects.

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INTRODUCTION

The consumption of chicken is increasing rapidly throughout the world because of its nutritional qualities and easy availability for people all over the world with affordable prices (Scheuermann *et al.*, 2003). Broiler chicks benefit from immediate access to feed. Although the main focus of providing nutrition is on provision of energy, chicks would benefit from a more balanced diet which includes carbohydrates, proteins and lipids. While formulating poultry diets, importance is given to protein, as it is the critical constituent of muscles and other main nutrients including carbohydrates, water, fats, vitamins and minerals are provided. After absorption into the body all these nutrients are taken up by cells and are used for energy production or as building blocks of tissues (Kleyn and Chrystal, 2008). The digestive and immune systems of the chicken will be still immature when it emerges from the egg and the feed provided during this critical period determines the nutritional status of the grown chicken (Ravindran, 2003). The feed is formulated to meet the energy and trace minerals, vitamins and protein requirements. The mixture of ingredients present in most of the poultry feed includes cereals, cereal by-products, vitamins, fats, plant products, animal by-products and feed additives (Ravindran, 2013). Generally plant products are undefined and are poorly balanced when compared with animal products as they are rich

in proteins and other nutrients. The feed is generally assembled on a least- cost basis (Kleyn and Chrystal, 2008).

Main Ingredients of Poultry Feed

The largest component of poultry diet includes energy sources, followed by protein sources. The main plant products used include maize (corn), which is the most common energy source with other cereals such as sorghum, soyabean meal, sunflower meal and peas being used as protein sources. The main animal products used in poultry feed are fish meal and meat meal. The critical minerals required include calcium, sodium, phosphorous etc which are supplemented through limestone, bone meal and from salts. The miscellaneous ingredients include vitamins and non-nutritive feed additives like antibiotics, enzymes etc (Ensminger *et al.*, 1990).

Energy Sources in Poultry Feed

Cells require a constant supply of energy to generate and maintain the biological processes that keeps them alive. This energy is derived from the chemical bond energy in food molecules, which thereby serve as fuel for cells (Alberts *et al.*, 2002). The energy sources used in poultry feed usually consists of carbohydrates. The main energy source used in poultry feed is maize which consists of a large amount of starch that can be hydrolysed into glucose, which is a readily available form of

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energy for all the living cells. The second most commonly used energy source is sorghum. Wheat and sorghum are widely used in most parts of the world (Ravindran, 2002).

Protein Products in Poultry Feed

Proteins are the most versatile macromolecules in living systems and serve crucial functions in essentially all biological processes. They serve as catalysts, they transport and store other molecules such as oxygen, they provide mechanical support and immune protection, they generate movement, they transmit nerve impulses, and they control growth and differentiation. Proteins also serve as building blocks of cells and hence play an important role in the growth of muscle mass in the chicks (Berg *et al.*, 2002).

Plant Protein Sources

The plant protein source traditionally used in poultry feed is soyabean meal. It contains 40 to 48 percent crude protein and it has a good balance of essential amino acids. The major antinutrients found in plant protein sources include toxic amino acids, saponins, cyanogenic glycosides, tannins, phytic acid, goitrogens, lectins, protease inhibitors, gossypol and amylase inhibitors. The presence of antinutrients in plant protein sources for livestock feeding is a major constraint that reduces their full utilization. Hence plant products have to be properly formulated and the concentration and the nature of the antinutrients have to be determined before adding them to the poultry feed (Akande *et al.*, 2010).

Soybeans are the excellent sources of protein and energy for poultry. The high protein content, with its well-balanced and highly digestible amino acids, makes soyabean meal a valuable protein poultry feeding (Kocher *et al.*, 2002). Soyabean meal has a high concentration of anti nutritive factors, which decrease its nutritive value and limits its usage in poultry feed, especially at the starter phase. Since the old animals are more resistant to anti- nutritional constituents that affects digestion than younger animals, only good quality ingredients with very low levels of antinutrients should be used in starter diets to achieve good health and weight (Dersjant-Li, 2002).

Animal Protein Sources

The animal sources generally include parts of slaughtered animals which do not directly contribute to the human nutrition. Protein supplements of animal origin are usually obtained from rendering operations, meat packing, poultry processing, milk and dairy processing, fish and fish processing (Denton *et al.*, 2005). Fish meal is a good source of high quality protein and also provides abundant amount of minerals, vitamins, growth factors and essential fatty acids. Meat meal contains relatively high levels of protein, calcium and available phosphorus. Meat meals are generally derived from bones and associated tissues like tendons, ligaments, skeletal muscles, gastrointestinal tract, liver and lungs (Ravindran, 2013).

Lipids in Poultry Feed

Many different grades of fat have been used as feed ingredients by the poultry industry. Feed fats provide one essential nutrient (linoleic acid) and dietary ME. With corn-and-soybean meal-based diets, there is nearly always an excess of linoleic acid when fat is added to meet energy requirements (Pesti *et al.*, 2002).

Non Nutritive Products in Poultry Feed

Besides proteins poultry feed must also contain vitamins, minerals and antibiotics. The vitamins are required for proper growth of the chicks as they play an important role in the metabolism as cofactors and transporters. Mineral requirements include calcium that plays a crucial role in bone growth, phosphorous and sodium. Antibiotics have become important additives in poultry feed as they increase the growth rate and efficiency of feed utilization by influencing the bacterial population of the digestive tract (NRC, 1994).

Problems in Commercial Chicken Meat

The poultry industry suffers greater economic loss than any other livestock industries because of the greater susceptibility of their species to microorganisms and aflatoxins than any other species. The standard plate counts and coliform count studies performed on fresh chicken meat from commercial markets showed that they had higher counts of *Staphylococcus* species and *E.coli* (Sengupta *et al.*, 2011). Furthermore, transmission of multidrug-resistant *E.coli* strains in poultry farm is a major concern (Hussain *et al.*, 2017). Besides microbial contamination, mycotoxin contamination of various feeds continues to be a serious quality and safety problem worldwide. Considerable global attention is being focused on mycotoxin contamination of feed because of its adverse effects on animal health (Jayabarathi *et al.*, 2010).

Naturally Available Compounds in Poultry Feed

There is a link between risk of zoonotic disease and growth promoting antibiotic usage in livestock and poultry. Alternatives to the use of growth promoting antibiotics must be found to promote growth or production. The use of probiotics has many potential benefits and includes modified host metabolism, immuno-stimulation, anti-inflammatory reactions, exclusion and killing of pathogens in the intestinal tract, reduced bacterial contamination on processed broiler carcasses and enhanced nutrient absorption (Edens, 2003). Many alternative substances obtained from nature and belonging to the groups of prebiotics, probiotics, organic acids, enzymes, silicates, herbs and spices etc., have been vigorously tested and evaluated for their potential to replace Alternative growth promoters (AGPs) in poultry diets. (Panda *et al.*, 2006, Khan *et al.*, 2012). Alternative substances referred as Natural Growth Promoters (NGPs) are mainly utilised for providing beneficial role for improving health of poultry against various infectious diseases and also in improving the intestinal morphology and nutrient absorption which may also encourage the scientists to include these compounds in the diet to improve gut health, promote the growth and overall performance of birds. Antimicrobial peptides AMPs, (antibacterial, antifungal and antiviral) have been demonstrated to improve growth performance, promote nutrient digestibility and gut health, positively alter intestinal microbiota and enhance immune function in pigs and broilers. These peptides have a strong potential for application as feed additives in swine and poultry production (Shuai Wang *et al.*, 2016)

CONCLUSION

Quality of poultry feed plays the most important role in poultry farming. Good quality feed and resistant strain of hens can lead to greater production and more profit for the poultry farmers.

Poultry feed must be formulated such that they have high nutritional value, resistant to microorganisms, less side effects and are better absorbed from the gastrointestinal tract and helps in development and growth of chicks. This might be useful to increase poultry production and protect the health of birds in a better way from traditional methods towards modern perspectives and also promote the usage of herbs amongst poultry producers. Effective planning to make use of local feed resources and to minimize the dependence on imported resources would seem to be desirable in future poultry feed production.

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