The Requirements of Protein and Amino Acids in Rabbit Nutrition and Production

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Abstract

This paper reviews the nutritional requirements of protein and amino acids in rabbit production. Protein plays a very significant role in the animal body and, therefore, must be appropriately provided for in the diet. All living cells have protein as one of its principal constituents. Protein has an essential association with living processes. They are important components of animal tissue (muscles, cell tissue) hormones and enzymes. The dietary protein requirements are 16% for maximum growth and 18% for lactation. The crude protein levels of 12%, 18%, 16% and 17% have been recommended for maintenance, pregnancy, growth and lactation respectively. Crude protein of 18 to 22% has been reported to be optimum for production of tropical rabbits. For hair or fur producing rabbits, the minimum of 17% crude was reported to be adequate. A crude protein of 15 to 16 percent is considered adequate for fattening rabbits. The optimum requirement of crude protein for breeding does seem to be roughly 17 to 18 percent. Basically, proteins are vital to animals and must be appropriately provided in the diet as required.

Keywords: *Crude protein, rabbits, amino acids, cecotrophy*

1. Introduction

Proteins are organic compounds that contain carbon, hydrogen, oxygen, and nitrogen and sometimes iron, phosphorus, and sulphur. They are needed to grow new tissues and to repair old tissues in an animal. Three to five percent of the body's proteins are rebuilt on a daily basis. The most common nutrient deficiency is that of proteins [1].

According to [2] who metaphorically defined proteins as compounds that are associated with motion, the basic quality of animal life. He also stated that on one hand, plant life is more concerned with sugars and carbohydrates. While, on the other hand, animal life is more concerned with proteins. (However, all life contains both proteins and carbohydrates).

Proteins are highly complex nitrogenous organic compounds occurring naturally in all living organism and forming an essential part of animal food requirements. Proteins are important for gestation, lactation, growth and weight gain. Young animals require diets higher in proteins than older ones. Higher dietary levels of proteins are needed by animals in gestation or lactation stages [1]. Correct protein nutrition is of paramount importance not only for animal performance, but also to minimize nitrogen excretion and reduce pollution [3]. The symptoms of protein deficiency include: slow growth rate, anorexia, decreased feed efficiency, lower milk yield and low birth weight.

2. Discussion

2.1 The significant role of protein

All cells synthesize proteins for part or all their life cycle. Proteins are involved in practically every function performed by a cell and without protein synthesis life could not exist [4, 5]. Protein is a critical component of animal tissue (muscles, cell tissue) hormones and enzymes [6]. Protein plays a distinctive role in the animal body ranging from bodybuilding (growth), repair of body tissues and protection of body surface for defence against invading organism.

Proteins are very important for many cellular functions, some of which are listed here:

(i) Protein plays an important role in the sustenance of neural reaction of the body (homeostasis).
(ii) They are the chief structural unit of protoplasm.
(iii) For the synthesis of enzymes, which catalyze all of metabolic reactions.
(iv) Production of antibodies which are complex defensive proteins of the immune system.
(v) Proteins play an important role in the transport of water, inorganic ions, organic compounds and oxygen.
(vi) Proteins in diet serve as primary source of amino acids, the blocks of cellular proteins [4, 5 and 7]. The nuclear DNA (deoxyribonucleic acid) controls the synthesis of all proteins regardless of their functions. Thus, proteins are vital to animals and must be appropriately provided in the diet [5]. The protein requirements of rabbit in different stages or production type in shown in Table 1.

Table 1: Crude protein requirements for rabbits

Rabbit stage (production type)	Crude protein requirement (%)	Authors (Source)
Fur (hair) producing		
	17	[5]
Lactating	18	[8]
	17	[9]
Growing (young) rabbits	16	[8]
	16	[9]
	15	[11]
Gestation (pregnancy)	18	[9]
Breeding	17-18	[12]
Maintenance	12	[9]
Fattening	15-16	[12]

2.2 Dietary Protein Requirements of Rabbits

Proteins are necessary to supply the elements to build or rebuild rabbit bodies. Rabbits require dietary sources of protein, however, consumption of the cecotropes does provide a source of microbial protein. Dietary protein quality is particularly important for rapidly growing weanling rabbits, which may not have well developed cecal fermentation. The dietary protein requirements are 16% for maximum growth and 18% for lactation [8]. [9] recommended crude protein levels of 12%, 18%, 16% and 17% for maintenance, pregnancy, growth and lactation respectively (Table 1).

[10] carried out an experiment with diets containing 10 to 22% crude protein and he reported that 18 to 22% was optimum for production of tropical rabbits whereas [11] stated that a 15% crude protein was adequate for rabbits in the tropics. The variation in the recommendation of the protein requirements of rabbits by these workers may be partly due to the type of breed of rabbit used in their experiments, duration of the feeding trials, the protein quality of the diets used and the geographical locations where the experiments were carried out. The optimum requirement of crude protein for breeding does seem to be roughly 17 to 18 percent (Table 1). An increase of protein content to 21 percent leads to higher milk production but slightly reduces the number of young rabbits weaned in a given period [12]. The protein requirement for lactating does is higher than those for growing rabbits due to the protein demands during lactation. There is a high secretion of protein and energy in the milk during lactation. This secretion is directly proportional to milk production. The producer should take into account that protein levels below 18 percent without the proper level of energy have a negative effect on milk production and, therefore, on the rate of gain of the suckling rabbits [5]. Lactating rabbit does that are also concurrently pregnant, need higher crude protein levels in their diets in order to prevent negative protein balance, i.e. protein being withdrawn from their body reserves [13].

Protein nutrition is of special concern in fur and hair producing rabbits because the final product (pelt and hair) is high in nitrogen-containing compounds and in sulphur-containing amino acids. The levels of dietary protein should, therefore, be high, with a minimum of 17 percent crude protein (Table 1) and a minimum of 0.6 percent of sulphur-containing amino acids (methionine and cystine) [5]. Protein digestibility is influenced by age in the growing rabbit [6]. Decreases following weaning to reach a steady level about the 9th week of age, and gradually decreasing from 5 weeks of age [13].

Excess dietary protein is not desirable because of the effects on air quality. Rabbits are normally raised in confined buildings with a fairly high stocking density. Compared to swine and poultry, they have high water requirement and excrete large quantities of urine, promoting high humidity. This in conjunction with high atmospheric ammonia is very undesirable in a rabbit building. The ammonia dissolves in the water vapour, and when inhaled by the animals, damages the cilia and mucous membranes in the nasal passages. This disruption allows the bacterium *Pastueralla multocida* to invade, causing respiratory disease (snuffles). The

nitrogen from excess protein and amino acids excreted in the urine as urea is converted to ammonia by bacterial action. In addition, the excretion of large amounts of urea in the urine increases water excretion, further intensifying air quality problems. Ammonia levels in rabbit buildings are controlled by not feeding excess protein and by providing good ventilation [8].

2.3 Amino Acid Requirements of Rabbits

Proteins are made up of amino acids. Researchers have found that growing rabbits need feeds that contain certain amounts of 10 of the 21 amino acids that made up the proteins. These are called the basic or essential amino acids with two additional amino acids which can partially replace two of the essential amino acids this is the full list for rabbits: arginine, histidine, leucine, isoleucine, lysine, phenylalanine plus tyrosine, methionine plus cystine, threonine, tryptophan and valine [12].

Studies on the quantities required have been virtually confined to arginine, lysine and the sulphur amino acids (methionine and cystine) expressed as a percentage of the ration. The lysine requirements for growing rabbits is 0.6 and for sulphur amino acids, 0.7 percent. The lysine intake of breeding does should be considerably higher under intensive milk production to feed 9 to 12 young. The arginine intake should be at least 0.8 percent and a little more for growing rabbits. The toxicity thresholds of lysine and arginine are well above the recommended intake levels. For the sulphur amino acids, however, there is a slim margin between the amount the rabbit needs and an excess dose that would reduce its performance [12].

The recommended amounts of other essential amino acids have been estimated simply on the basis of regular satisfactory diets. Where these essential amino acids are supplied by protein in the diet, 15 to 16 percent crude proteins should be adequate for fattening rabbits (Table 1). Rabbits will always eat more of a balanced feed containing essential amino acids than the same feed without amino acids [12].

[14] stated that the protein requirement of rabbit of 12 to 17% with 0.65% lysine and methionine 0.60% can easily be met by combining common protein sources. Cereal grains contain low levels of methionine and lysine, and, therefore, are the most limiting in rabbit diets. Diets deficient in methionine and lysine will negatively influence growth rate and reproduction [6].

2.4 Microbial Protein from Cecotrophy

The consumption of the soft faeces (cecotropes) by the rabbit directly upon being expelled from the anus is called cecotrophy. To do this, the rabbit twists itself around, sucks in the soft faeces as they emerge from the anus then, swallows without chewing them. The practice of cecotrophy has certain nutritional value in that it provides appreciable amount of microbial protein, B-complex vitamins and energy (from volatile fatty acid production) [8, 12].

According to [14], the quantity and quality of protein are not critical in rabbits as in poultry because rabbit practice cecotrophy. Rabbits can adapt to low and poor protein situations, but production will not be optimum. However, with good quality protein, optimum production can be achieved. When rabbits are on diets of low protein quality, the microbial protein in the cecotropes can significantly improve the absorbed amino acid balance whereas swine and poultry fed diets containing low quality proteins will have markedly reduced growth. In rabbits, the effect of low dietary protein quality is much less because of the amino acids derived from the microbial protein [8]. When rabbits are on high protein diets, cecotropes are not consumed, but on low protein diets, they are avidly consumed. Thus, cecotrophy seems to be physiologically regulated by the metabolic need for amino acids [8]. The adult rabbit (probably) obtains 10 - 20 percent of its total protein intake from cecotrophy as good quality bacterial protein. Restricting cecotrophy can reduce protein digestibility by as much as 20% [6].

Rabbits increase their amino acid intake from the consumption of their cecotrophs or soft faeces [6]. Part of the amino acids produced in the caecum by microorganisms are absorbed directly by the caecum wall, and after cecotrophy, the rest are absorbed by the small intestine. The contribution of microbial protein to young rabbits (4 - 8 weeks of age) is very small, and steps should be taken to supply good quality protein to growing animals [5].

3. Conclusion

Protein plays a vital role in the animal body ranging from body building (growth), repair of body tissues, protection of body surface to defence against invading pathogenic organisms. The right quantity of protein nutrition is of paramount importance not only for the animal for health and productivity, but also to reduce bad air quality and environmental pollution.

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