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Feed Protein Impacts on Digestion and Wool Productionin Angora Rabbits

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Abstract

This research article is about the Feed Protein Impacts on Digestion and Wool Production in Angora Rabbits. This research article focused on the amino acid nutrition in angora rabbits and the results of that study shows that about 20 amino acids are used by animals in the synthesis of their proteins. The number of essential amino acids varies somewhat among species. Specific requirement figures are desirable for use in ration formulation. They can be used to predict protein levels in food and water supply systems. The materials and method section contains the experiment on angora rabbits, 32 in number and one year old were divided randomly into 4 groups. Diets were formulated using groundnut cake (GNC), soya flakes and sunflower cake (SFC) to provide protein. Then this paper discusses the analysis of protein requirements and growth lactation in angora rabbits. The study concludes that the protein quality of soya flakes is better for wool production followed by groundnut cake. Sunflower cake alone or in combination decreased wool production, which may be checked by supplementing energy and amino acids.

Keywords: Protein impacts, wool production, Angora Rabbits

Introduction

Angora rabbits are mainly raised for their wool which is known for its quality. Angora rabbits are of many types. The difference is mainly in wool produced and the percentage of guard hair in the wool. Among the various types, German Angora is the best and annually yields 1000 to 1200 gm of wool under ideal management practices. Rabbits can be adopted to any set of circumstances right from a kitchen garden to a large intensive commercial enterprise. The wool produced by rabbits are preferred for manufacturing of high value woolens which have got very good export potential.

Protein is commonly regarded by livestock producers as the most important component of feed, with a high-protein feed being viewed as superior to a lower protein one. While this is not entirely correct, it is true that there is usually a good relationship between protein content and nutritive value. Also, one nutrient is not really more important than another; it is necessary to supply all nutrients in adequate quantities. On a quantitative basis, energy sources are needed in larger quantity than protein. Nevertheless, there is no question that provision of adequate quantity and quality of dietary protein is of major concern. All proteins contain nitrogen because they are made up of amino acids, which contain nitrogen. On the average, proteins contain 16% nitrogen. The protein content of feeds is determined by digesting the feed with acid, and analyzing for the amount of nitrogen (as ammonia) present. This assumes, fairly accurately, that all the nitrogen in the feed is associated with protein. By definition, the crude protein (CP) content of a feed is 6.25 times the nitrogen (N). The factor of 6.25 arises from the fact that protein avenges 16% N: 16 g of N are derived from 100 g of protein; therefore, I g of N is derived from 100/16 = 6.25 g. Thus, each gram of N measured corresponds to 6.25 g of protein.

Amino Acid in Rabbit Nutrition

About 20 amino acids are used by animals in the synthesis of their proteins. Those amino acids that cannot be synthesized by animals, and thus are required in the diet (or synthesized by gut microflora), are called essential amino acids, while those that can be synthesized are referred to as nonessential amino acids. These terms refer to the need for them to be provided in the diet; metabolically, they are all essential. While the number of essential amino acids varies somewhat among species, in general the following are considered the dietary essential amino acids of most animals.

Arginine Lysine Histidine Methionine isoleucine Phenylalanine Leucine Threonine Tryptophan Valine Adamson and Fisher (1971) demonstrated that these amino acids are nutritionally essential for the rabbit, and that dietary glycine is required for maximum growth rate. These requirements were demonstrated by feeding a purified diet with the protein provided by a mixture of amino acids. The effect of deletion of each of the amino acids was assessed by measuring growth rate. Weight loss occurred with each deletion of an essential amino acid, while the control group showed a normal weight gain. When glycine was omitted from the amino acid mixture, growth rate was about half of that of the control group. Thus, rabbits require the same amino acids in the diet as do most other nonruminant animals. The specific requirements for amino acids for growth and productive functions (lactation, Angora wool production, Rex fur production) have not been well studied. Specific requirement figures are desirable for use in ration formulation. Adamson and Fisher (1973) reported requirements for growth, using a purified diet containing crystalline amino acids. Their study was the primary basis for the NRC requirement figures, while the French rabbit nutritionist. F. Lebas, has provided estimates based on European work and practical experience (Table 1.1).

Amino acid	Percentage requirement in diet: Growth NRC[a]	Growth Lebas[b]	Lactation[b]	Does and litters fed one diet[b]
Methionine + cystine	0.6	0.5	0.6	0.55
Lysine	0.65	0.6	0.75	0.7
Arginine	0.6	0.9	0.8	0.9
Histidine	0.3	0.35	0.43	0.4
Leucine	1.1	1.05	1.25	1.2
Isoleucine	0.6	0.6	0.7	0.65
Phenylalanine + tyrosine	1.1	1.2	1.4	1.25
Threonine	0.6	0.55	0.7	0.6
Tryptophan	0.2	0.18	0.22	0.2
Valine	0.7	0.7	0.85	0.8
Glycine[c]	—	—	—	—

Table 1.1

Rabbits and their essential amino acid requirements

Material and Method

German X British X Russian strain adult angora rabbits, 32 in number and one year old were divided randomly into 4 groups (Ti T‹) of 8 with an equal sex ratio. Diets were formulated (table 1.3) by using either groundnut cake (GNC), soya flakes (SF). sunflower cake (SFC) alone or in combination as a source of feed protein. About 98o CP was supplied through each cake in their respective test diet. In combination Wz) the same amount of protein was supplied through a mixture of three sources. The level of fiber in the diets was adjusted by using rice phak. Rice phak is a combination of rice polish, rice bran and rice husk (Bhatt et al., 1999b).

Feed ingredient	T_1	T_2	T_3	T_4
Maize	21	21	22	21
Barley	20	20	22	20
Rice phak	26	26	29	18
Groundnut cake (CP 41%)	22	9	-	-
Sunflower cake (CP 30%)	-	4	-	30
Soyaflakes (CP 56%)	-	9	16	-
Fish meal	4	4	4	4
Molasses	5	5	5	5
Mineral mixture	1	1	1	1
Salt	1	1	1	1
Total	100	100	100	100
Cost of diet (Rs. per kg)	6.09	5.78	5.98	5.39

Table 1.3.
Physical composition of experimental diets

The animals were offered the test diets in the morning and green forage (combination of white clover, tall fescue and rye grass) in the afternoon. Intake of dry matter through feed and grass were recorded once per fortnight. Rabbits were shorn for wool at intervals of three months. Wool yield and body weight of rabbits was recorded. Samples for analysis of wool attributes (staple length, fibre diameter, guard hair) were collected from the dorsal side of each rabbit and were analyzed using Ermascope (Errna India, Chandigarh). The experiment continued for 9 months and the data from three consecutive shearing was recorded. At the end of feeding trial a metabolic rial was conducted io assess the digestibility of nutrients. Feed, green forage, faeces and urine samples were analyzed for proximate principles and calcium (AOAC, 1990), phosphorus (Gupta ei al., 1992) and fibre fractions (Goering and Van Soest, 1984). Biological value and net protein utilization of the different iesi diets was calculated by method of Mc Donald et al. (1995) as:

$$\frac{[\text{ Nitrogen Intake - (Faecal Nitrogen - Metabolic Faecal Nitrogen) - (Urinary Nitrogen - Endogenous Urinary Nitrogen)}]}{[\text{Nitrogen Intake - (Faecal Nitrogen - Metabolic Paecal Nitrogen)}]}$$

Analysis of Protein Requirements for Growth and Lactation

Animals have no specific requirement for protein; rather, they require the amino acids from which body proteins are synthesized. For practical purposes, however, it is useful to express a crude protein requirement based on good-quality dietary protein. Numerous studies have been conducted for the determination of optimal dietary protein levels for growth and lactation. Since it is not a common practice in the rabbit industry to use separate grower and lactation diets, a protein level that is adequate for both functions is usually needed. Spreadbury (1978) and Omole (1982) have studied dietary protein requirements under temperate and tropical conditions, respectively. Their results are shown in Fig. 1.1. A level of 18% crude protein was optimal under tropical conditions, while about 16% protein was the optimal level in a temperate climate

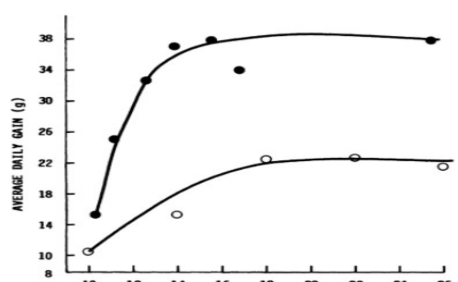


Fig 1.1.

Dietary Crude protein levels effect on average daily grains of fryers under temperature and tropical conditions

The difference in performance observed in the two studies, with a maximum average daily gain of 35-40 g for temperate conditions and 20-25 g for tropical areas, is typical. in a study conducted in Spain (de Blas et al., 1981), the optimal crude protein level for growth was 16% (Fig. 1.2). In this study, three crude fiber levels (7, I I, 15%) were used. With lower protein levels, gain was reduced to a greater extent with the low-fiber diets. This reflects a greater feed intake on the high-fiber lower energy diet, resulting in a greater daily protein intake at the same dietary protein level. Because feed intake varies with the DE content of a diet, it is desirable to express the CP requirement as the milligrams CP per kilocalorie DE. The optimal protein/energy ratio is about 55 (Fig. 1.3). de Blas et al. (1984) have provided estimates of the amount of crude protein required per day by fryers for different rates of gain (Table 1.2).

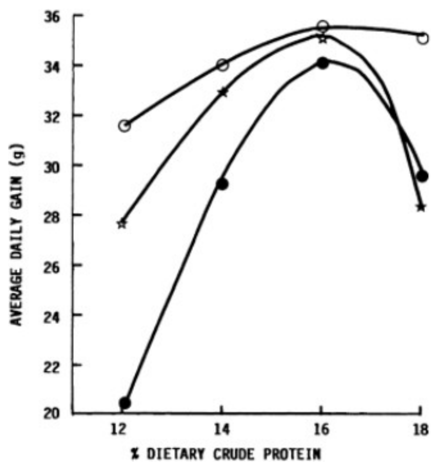
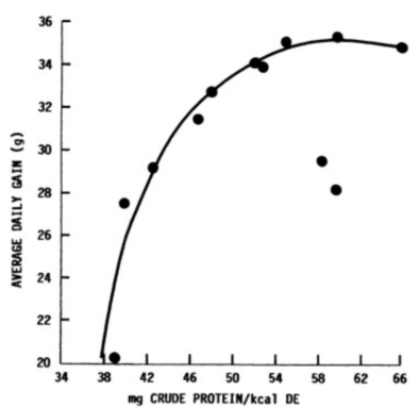


Fig 1.3.

Fryer rabbits' growth rates fed diets with varying protein to digestible energy



Market weight (kg)	Average daily gain (g)			
	30	35	40	45
2.00	9.93	10.66	11.40	12.13
2.25	11.18	11.80	12.43	13.06
2.50	11.46	12.03	12.60	13.17

Table 1.2

Digestible CP rates for fryer rabbits for various rates of grain and slaughter weight

The optimal level of dietary crude protein for lactating does appears to be somewhat higher than for growth of fryers. Sanchez etal. (1985) recommended a level of 19% crude protein for maximum production of both lactating does and growing fryers, but differences between 17.5% and 19% protein were slight. Under tropical conditions. Omole (1982) found that 18% protein gave maximum liner size and weaning weight (Fig. 1.5). Partridge and Allan (1982) measured milk production of does fed diets with 13.5, 17.5, and 21.0% crude protein, with litter size adjusted to eight kits per doe. The total 28-day milk yields were 3.89, 4.82, and 5.27 kg for does fed the 13.5, 17.5, and 21.0% protein levels, respectively, indicating that at least 21% protein is required for maximum lactational performance. In a subsequent study, Partridge et al. (1983) observed that does fed a high-energy diet with 19% crude protein were in positive nitrogen balance, indicating that their dietary protein status was adequate.

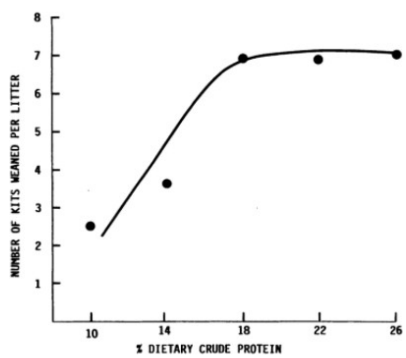


Fig 1.4.

effect of Dietary protein level of no of kits weaned per litre

Wool production in angora rabbits

Wool production in angora rabbits is about four times that of sheep on unit weight basis (Schlaut, 1985). Since wool fibre contains 93 percent protein the dietary protein is important as it is required both for tissue synthesis and wool production. Rations containing 20% crude protein (CP) with 80 % digestibility were found to be adequate for wool production (Lail et al., 1984), whereas, diets containing 17.45% CP with 11.5% digestible CP were found to be suboptimal (Negi and Goel, 1985). Later reports indicate a level of 18% CP is required in the diet for wool production (Prasad and Malhi, 1997). Peanut, mustard, linseed and cottonseed meals can be incorporated at 60% of feed protein for wool production (Singh and Negi, 1987). A diet containing Soya flakes gave better performance than groundnut cake and sunflower cake, however the biological value of nitrogen was better with combination of three protein sources (Bhatt et al., 1999a). Feed proteins vary widely in their ability to supply amino acids, and have been subject of extensive investigation for wool and meat production (Cheeke, 1987). Few reports, however, exist on comparative utilization of feed nitrogen from cheaper feed protein sources. In this experiment, diets having equal protein content from different protein sources were assessed for their wool production potential.

Relations of wool production in Angora Rabbits and Different Animals

There are many factors that affect the production of wool and the level of feed intake-to-wool production ratio of the animals in the environment. Factors such as weather, land management, land layout and vegetation and terrain are all considered when evaluating breeding characteristics of an individual rabbit and its diet. In order to improve and optimize these factors for wool production, there is research being done on how the goats behave in their natural environment and what they should eat in order to become more efficient at producing wool. So far this research has been successful in determining that male goats that are fed a high quality hay along with copious amounts of mineral blocks have more stable weights and produce higher quality wool more quickly than does a goat that is fed a diet that lacks mineral blocks and fresh grass. Another successful research project by scientists at the University of Wyoming College of Science has shown that laying hens that are given minerals and plant nutrients before breeding also produced higher quality eggs.

During the fall, an important part of the breeding process known as teething is completed and young goats will begin to show signs of teething. The teething stage is a mandatory process that all goats must go through as an important step in their development from lambs to adults. As a goat grows it will experience increasing challenges in its production and diet in order to obtain maximum production ratio of wool and consequently increase its daily weight gain.

During its development, an animal will enter into two phases: the growth phase and the postnatal stage. Growth is characterized by increased weight gain during early stages of development followed by subsequent losses and weight losses. Postnatal stage is characterized by shorter hair growth cycles, smaller incision marks and reduced body temperatures which are all typical of an adult animal stage. An important result of studying the 4th periods in sheep is that this short phase represents the critical period when a wool production is maximized.

The fiber type used to manufacture wool in Angora rabbits is known as hay. The fibers used are softer, finer and less fibrous than those found in Angora goats and sheep. As compared to Angora's wool, khaya wool can withstand high temperatures without losing its fibre structure when subjected to them. Moreover, it has a longer life span and is resistant to adverse conditions such as excessive heat and cold. On the other hand, Khaya wool cannot be manufactured on looms as it does not possess the quality of thread.

Once you know the fibre length of each wool variety and its respective production times, you can now start calculating the optimum wool interval for each animal. As long as the commercial lifespan of rabbits is roughly 28 years, the optimum wool interval for an Angora rabbit should be approximately two weeks. The optimum wool interval can be calculated by dividing the total fibers produced during the lifetime of the animal by the total number of days it spent on the matted fur. Therefore, the number of days of production and the total number of fibers produced during its lifetime are the factors that need to be considered. The calculator can also be used to determine the volume of the matted fur to be expected during different ages.

It is also necessary to determine the average temperature and relative humidity of different seasons in order for the calculation of the optimum wool harvest intervals. The rabbits will need to be placed in a temperature range that is just below their critical thermal level during different seasons. Relative humidity can also be determined by using a hygrometer to determine the moisture content of the fur. Although commercial producers often use a hygrometer with a humidity meter that measures relative humidity, a hygrometer is often used as a guide for calculating the moisture content of the fur.

Digestive System of Angora Rabbits

The digestive system of the Angora rabbit is similar to that of humans. It utilizes proteins, carbohydrates and fats as sources of energy. However, in rabbits the proteins are unable to undergo digestion and are not metabolized. Instead, these nutrients are transported through the blood to the muscles where they are used as energy. In the case of a complete lack of digestive enzymes, proteins, fats and carbohydrates are excreted from the body in feces.

If you add fresh alfalfa sprouts to the diet, it can hasten the rate of protein digestion. The addition of the berry juice also speeds up the rate of protein breakdown. The juice is rich in sugar and can be added to other feeds such as lettuce, wheat, corn, barley or rice. The juice is best added directly to the food or mixed with water.

There are many factors that influence the rate of protein breakdown in the digestive system of a rabbit. The food type, the fiber content, the water content and the presence of enzymes all affect the rate of protein digestion. Factors that control the rate of digestibility include: the presence of mucilage in the intestinal tract, the presence of bile salts in the stool and whether the food is being hydroscopic or eukaryotic.

In addition to these factors, some dietary supplements are able to stimulate the digestion of various foods including hay and alfalfa sprouts. These supplements can be added to the diet after the rabbit has been fed an initial base diet for a short period. Most commercial rabbit feeds contain indigestible fiber. In case the berry juice is unable to stimulate the digestive process, the berry juice should be administered after every meal.

Feeding hay regularly will help stimulate digestion because the stomach has to work more to digest the food as it is ingested more slowly. Feeding hay regularly also helps give fiber material of the time to break down. Rabbit food that contains fiber is called whole-food. There are several types of grains available commercially. Most domestic rabbit feeds are usually a combination of at least two main grains, although unrefined white rice is also included as a beneficial protein source.

If the rabbit is not fed any mineral and vitamin supplements, a good commercial supplement that contains acidophilus may be beneficial. This bacterium is naturally present in the intestines and plays an important role in the digestion of food. Feeding berry juice to a rabbit is also helpful. Some breeds of domestic rabbits are less susceptible to acidophilus than others.

It is not advisable to give hay and grain directly to a rabbit. Feeding fresh vegetables to a pet is an important part of its digestive process. In a normal digestive process, proteins are broken down into smaller components and are able to travel through the intestines relatively quickly. Rabbits have different digestive systems. For instance, while Angora berry juice may have some beneficial effects on the digestive system of a rabbit that is unable to consume it because of a diet that is too high in fiber, a rabbit that is fed a healthy berry juice diet will not likely suffer from digestive problems.

So, can you feed protein to your domestic rabbit? Yes, you can feed protein to your pet. Protein is a necessary part of a rabbit's diet. However, do not overfeed. Instead, choose a combination of vegetables and fruits that will complement the variety of pellets and feeds that you provide to maintain a healthy diet for your rabbit.

If you are concerned about the impact that feeding hay could have on the digestive tract of your pet, you may want to consider another type of hay. Instead of giving your pet deer or alfalfa hay, for example, choose a source of high-quality hay that will be acceptable to your pet digestive system. This type of hay would be a source of fiber. If you choose a source of fiber, always rinse off the hay and thoroughly dry any feed before giving your pet a final dose. You can also choose an alternative source of hay such as Timothy.

A common question about feeding hay is if a pet that has been accustomed to eating pellets can digest it properly. Feeding hay is a natural way to provide nutrients to your pet rabbit. As long as hay is not contaminated, it is an ideal way to ensure that your pet gets all the nutrients that it needs. Unlike pet foods, which often use chemicals to disguise the taste of processed pet foods, hay is a genuine source of protein that will not harm your rabbit. Because of this, hay is the ideal choice for those who are concerned about digesting their pet's food.

It is important to note that you should never feed your pet commercial pellets or any other type of feed. Even though they are labelled "human grade", these types of foods are typically lower in quality than other sources of protein. When choosing a source of protein for the rabbits, it is best to use the highest quality hay that is available.

Conclusion

The study concludes that Wool production in angora rabbits is about four times that of sheep on unit weight basis. Rations containing 20% crude protein with 80% digestibility were found to be adequate for wool production (Lail et al., 1984) diets containing 17.45% CP with 11.5% digestible CP were suboptimal. A level of 18% crude protein was optimal under tropical conditions, while about 16% protein was the optimal level in a temperate climate. The maximum average daily gain of 35-40 g for temperate conditions and 20-25 g for tropical areas is typical. The digestive system of the Angora rabbit is similar to that of humans. Some dietary supplements can stimulate the digestion of hay and alfalfa sprouts. The berry juice can also speed up the rate of protein breakdown in the digestive system for rabbits. It is not advisable to give hay and grain directly to a rabbit. Instead, choose a combination of vegetables and fruits that will complement the variety of pellets and feeds you provide your pet. Choose a source of high-quality hay that will be acceptable to your pet's digestive system. Results of the experiment reveal that the protein quality of soya flakes is better for wool production followed by groundnut cake. Sunflower cake alone or in combination decreased wool production, which may be checked by supplementing energy and amino acids.

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