

Rabbit Nutrition

- Rabbits are strict herbivores, which means they only eat vegetable materials, and they require a high-fiber diet for proper digestion.
- A controlled amount of high-quality grass hay pellets with fresh grass hay, vegetables, and fruits is an optimal diet for a pet rabbit.
- Water is the most important nutrient for rabbits and should be fresh and readily available.

Rabbits make great pets: they are easy to keep; can be litterbox trained like cats; and can live a long, healthy life, providing many hours of enjoyment. The average life span of a domestic rabbit is 6 to 10 years. If kept outdoors, rabbits need to live in a secure location safe from predators. If rabbits are kept indoors, the house must be “bunny proofed” to remove items that rabbits could chew and destroy or that could be harmful, such as electrical cords. Rabbits need to be kept in a clean, climate-controlled environment with fresh water and good nutrition. Pet rabbits typically live longer than rabbits for commercial use, so the goals for feeding pet rabbits differ from those for production rabbits.

Rabbits belong to the order Lagomorpha, which has two families (Leporidae and Ochotonidae) that comprise 12 genera. The modern rabbit is *Oryctolagus cuniculus*, a descendant of the European wild rabbit.

Male rabbits are bucks, females are does, and babies are kits. Rabbits raised for meat are called fryers. Sexual maturity begins between 4 and 7 months, depending on the adult size of the rabbit: small breeds mature quicker than large breeds. On average, does have a 31-day gestation. When kits are weaned at 28 days, they should be able to eat solid food on their own.

Pet rabbits have become increasingly popular. In the United Kingdom, pet rabbits are the third most popular pet after cats and dogs. Historically, rabbits have been used primarily for research and production of meat, wool, and fur.

Rabbits are strict herbivores, which means they only eat vegetable materials. Rabbits require a high-fiber diet for proper digestion and to prevent enteritis. Most

commercial diets are designed for rabbits to reach market weight quickly; therefore, these diets are high in protein and calories. However, many feed companies have realized the need for pet rabbit diets with reduced amounts of protein and calories to help pet rabbits live long, healthy lives.

Rabbits are strict herbivores, which means they only eat vegetable materials, and they require a high-fiber diet for proper digestion.

Feed Regulations

Rabbit feed is regulated by the Food and Drug Administration (FDA) Center for Veterinary Medicine. The FDA works with state and local agencies as well as the Association of American Feed Control Officials (AAFCO) to ensure that ingredients and their definitions are consistent and that labeling is correct. In addition, some states enforce labeling requirements based on AAFCO recommendations. AAFCO is a nongovernment advisory organization with representative officials from every US state, but it has no regulatory ability. The FDA requires sanitary conditions during feed production to ensure a pure and wholesome product that does not contain harmful substances. The FDA also requires animal feed to be truthfully labeled. These requirements are the same as those for human food.

Animal feed does not have to be approved by the FDA before shipping. However, if a food company violates the law, the FDA has the authority to take action. The FDA recommends that rabbit feed companies follow the Model Regulations recommended by AAFCO. The FDA works cooperatively with state and local partners and with AAFCO to ensure uniform feed ingredient definitions and proper labeling. Rabbit feed companies should have veterinarians and nutritionists working to develop diets for pet rabbits.

Digestion

Rabbit kits nurse only one time a day, and does stay with them only a few minutes a day. It has been postulated that once-daily nursing protects kits from predators. Does produce a very thick milk curd. After nursing, kits have fully distended stomachs full of thick milk curd, which slowly moves into the digestive tract.

Rabbits have continuously growing teeth. Unlike rodents, rabbits have two pairs of upper incisors; the second pair is commonly called *peg teeth*. Rabbits are born with some permanent and some deciduous teeth and have all their permanent teeth by 3 to 5 weeks of age. Rabbits break down fiber by relying on the microflora of the hindgut. Rabbits selectively excrete fiber through their stool and re-ingest cecal contents in the form of cecotrophs. Rabbits cannot vomit because of a well-developed cardiac sphincter. A rabbit's stomach is used for storage and should never be empty. Twenty-four hours after eating a meal, a rabbit's stomach is usually still half full. If a rabbit has an empty stomach, a medical problem could exist.

The small intestine of rabbits is the shortest of any species, making up only 12% of the total gastrointestinal (GI) volume. The small intestine is the site of nutrient absorption, carbohydrate and fat digestion, fat emulsification, and acid neutralization.

The cecum is the largest organ in the abdominal cavity of rabbits. The cecum is coiled and thin walled, holding 40% to 60% of the ingesta. After moving into the cecum, fiber is digested and fermented. The GI transit time of fiber in rabbits is approximately 4 to 5 hours.

In cecotrophy, which is commonly known as *coprophagy*, rabbits eat their own feces. Cecotrophy is required for rabbits to obtain certain nutrients—mostly B vitamins. Rabbits have two types of bowel movements: a normal hard pellet and a soft bowel movement that rabbits usually eat directly from their anus. The soft stool is in a grapelike cluster of small pellets surrounded by a gelatinous membrane.

Nutrient Requirements

Like all species, rabbits have nutrient requirements that can be met by consuming certain ingredients. A rabbit's basic nutrients are protein, carbohydrate, fat, vitamins, minerals, and water, which is the most important.

Protein

The crude protein requirement for rabbits is 12% to 18% dry matter (DM). The protein requirements of rabbits vary with life stage. Gestation and lactation require 18% DM protein, growth requires 15% to 16% DM protein, and maintenance requires 13% DM protein. Pet rabbits need 12% to 16% protein; higher levels may be excessive and may be detrimental to long-term health.

Carbohydrate and Fiber

Carbohydrate is a major source of energy for rabbits. Most of the carbohydrate requirement for rabbits is in the form of fiber. A diet too high in grain or fermentable fiber, such as oats and corn, can cause enteritis. High levels of nondigestible fiber, such as timothy grass hay and alfalfa hay, may help prevent enteritis and obesity. Nondigestible fiber is not fermented in the cecum, whereas digestible fiber is fermented by passing through the cecum. Nondigestible fiber is important for dental health because it helps wear rabbits' teeth. Nondigestible fiber also helps

A controlled amount of high-quality grass hay pellets with fresh grass hay, vegetables, and fruits is an optimal diet for a pet rabbit.

stimulate gut motility. Fermentable fiber helps rabbits digest cecotrophs as well as prevents colonization of the cecum by pathogenic bacteria, helping to prevent bacterial overgrowth and decreasing the likelihood of enteritis.

Volatile fatty acids (i.e., propionate, butyrate, acetate) are produced by bacteria in the cecum, absorbed into the bloodstream, and used as energy. To produce volatile fatty acids, rabbits require crude fiber of at least 12% to 16% DM, depending on life stage: 12% DM for lactation, 14% DM for gestation, and 15% to 16% DM for growth and maintenance. Pet rabbits need higher levels of fiber to help prevent obesity and hair chewing and to maintain GI health. A desirable amount of fiber for pet rabbits is 18% to 25% DM. Low-fiber diets can decrease GI motility,

possibly leading to retention of food and hair and to formation of hairballs (trichobezoars). Rabbits cannot vomit hairballs like some animals can; therefore, blockages can be life-threatening.

Fat

Rabbits use fat for energy and to absorb fat-soluble vitamins. Most foods contain 2% to 5% DM fat, which rabbits can get from a vegetable diet. Rabbits do not need fat added to their feed. Fat can increase palatability, but an excess amount can increase the risk of obesity, hepatic lipidosis, and atherosclerosis in the aorta.

Vitamins

The water-soluble vitamins comprise the vitamin B complex and vitamin C. The fat-soluble vitamins are A, D, E, and K. B vitamins are synthesized by bacteria in the cecum and colon and are absorbed by eating cecotrophs. Obesity can prevent a rabbit from reaching its anus to eat its cecotrophs, resulting in a vitamin deficiency. Pelleted feed is usually fortified with vitamins and minerals. To prevent destruction of vitamins A and E due to oxidization, rabbit feed should be fed within 90 days of milling.

Minerals

Rabbits absorb all the calcium in their diet; the kidneys excrete excess calcium as calcium carbonate in the urine, which appears milky as a result. Excess calcium carbonate can cause crystals and uroliths to form in the kidneys, ureters, and bladder. Therefore, rabbits require a calcium level limited to 0.5% to 1% DM.

Alfalfa is a legume with a high calcium content, and grains have a high phosphorus content; therefore, a diet high in alfalfa and grains has adequate calcium and phosphorus for growing rabbit kits but excessive levels for full-grown rabbits. Deficiencies in phosphorus, calcium, or vitamin D can result in rickets, which causes a crooked, unnaturally arched back and enlarged joints in young rabbits. These deficiencies in adult rabbits may cause bone demineralization, increasing the risk of a broken back. Commercial rabbit feed is supplemented with minerals. Mineral salt blocks are available for rabbits but may not be necessary if a commercial diet is fed. Pet rabbits do

well when fed grass hay, such as timothy hay, which has a low calcium content.

Water

Water is the most important nutrient for rabbits and should be fresh and readily available. Rabbits consume approximately 10% of their body weight in water per day.

Water is the most important nutrient for rabbits and should be fresh and readily available.

Feeding

From birth until 10 days of age, rabbits typically nurse once daily; after this, they continue nursing and start eating solid food and cecotrophs. Rabbits are weaned around 4 weeks of age. Alfalfa-based pellets and alfalfa hay can be fed during the growth phase and then discontinued. Full-grown rabbits do not need the extra nutrients that growing rabbits need. Pet rabbits should be switched to an adult diet at 7 to 12 months of age.

High-quality alfalfa pellets and alfalfa hay are best to feed during pregnancy, lactation, and growth. Pet rabbits need a high-fiber (18% to 22% DM), low-protein (12% to 16% DM) diet for maintenance. Timothy grass hay pellets should be fed for maintenance because they are lower in protein, calcium, and calories than alfalfa pellets. Pelleted food that contains grains, seeds, or dried fruits is not appropriate for adult pet rabbits. Although very palatable, grains, seeds, and dried fruits can lead to obesity and medical conditions, such as diarrhea. In addition, rabbits will pick out grains, seeds, and/or dried fruits and leave the rest of the feed, leading to an unbalanced diet. Pellets should be fed as a small, measured amount of the total daily diet. Free-choice grass hay, such as timothy hay, should be fed; vegetables and a small amount of fruit should make up the rest of the diet. The House Rabbit Society lists acceptable vegetables and fruits (e.g., romaine lettuce; kale [in limited amounts]; carrot tops; mustard greens; parsley; dandelions that are not from a chemically treated yard;

Wellness Care

broccoli; small amounts of carrots, strawberries, papaya, and pineapple). Because vegetables, fruits, and grass hay lose nutrients during storage, they should be fresh when fed to pet rabbits. Pellets should be stored at or below 72°F (22.2°C) and for no more than 3 months past their milling date when they are fed.

When a new food is introduced, it should be gradually transitioned into the diet over a period of 5 to 7 days. To do this, owners should feed three-fourths of the original food and one-fourth of the new diet for 2 days, then half of the original diet and half of the new diet for 2 days, and then one-fourth of the original diet and three-fourths of the new diet for 2 days. After these 6 transition days, the new diet can be fed without the original diet. Rabbits with sensitive GI tracts may need a longer transition.

Conclusion

Recognizing and meeting their unique nutritional needs can help give pet rabbits a long, healthy life. The diet should be appropriate for the rabbit's life stage. A controlled amount of high-quality grass hay pellets with fresh grass hay, vegetables, and fruits is an optimal diet for a pet rabbit.

Learn More

- The House Rabbit Society: <http://www.rabbit.org/faq/sections/diet.html>
- FDA Center for Veterinary Medicine: <http://www.fda.gov/AnimalVeterinary/default.htm>
- Association of Animal Feed Control Officials: <http://www.aaftco.org/>