ЧАСТНАЯ ЗООТЕХНИЯ, КОРМЛЕНИЕ, ТЕХНОЛОГИИ ПРИГОТОВЛЕНИЯ КОРМОВ И ПРОИЗВОДСТВА ПРОДУКЦИИ ЖИВОТНОВОДСТВА

PRIVATE ANIMAL HUSBANDRY, FEEDING, TECHNOLOGIES OF FEED PREPARATION AND PRODUCTION OF LIVESTOCK PRODUCTS

УДК: 636.084
https://doi.org/10.23947/2949-4826-2025-24-4-74-89

Original Empirical Research

Basic Principles and Practical Instructions for Proper Feeding of Donkeys

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Abstract

This paper presents the nutritional requirements of donkeys, with a special focus on the needs for water, energy, proteins, minerals and vitamins. Donkeys, as working animals originating from arid regions, have specific physiological adaptations that affect their nutritional needs. The aim of this paper is to review and present scientifically based information on nutritional requirements, nutrients and recommendations for feeding donkeys based on current research in the world. The paper shows the needs for water, energy, proteins, minerals and vitamins, as well as methods of assessing food digestibility and availability. Special attention is paid to the variations in needs depending on the physiological state (growth, pregnancy, lactation), the intensity of work and the quality of available food. The importance of food digestibility and correctness of meal that meets all nutritional needs are also presented. The need for an adequate balance between rough and concentrated feed, as well as the potential danger of inadequate supplementation, are emphasized. Based on the available literature and field observations, practical instructions are given for proper feeding of donkeys in different breeding conditions, with the aim of preserving their working capacity, health and longevity.

Keywords: donkey, non-ruminant diet, condition, nutritional requirements

For Citation. Matejević N, Urošević M. Basic Principles and Practical Instructions for Proper Feeding of Donkeys. *Russian Journal of Veterinary Pathology*. 2025;24(4):74–89. https://doi.org/10.23947/2949-4826-2025-24-4-74-89

Оригинальное эмпирическое исследование

Основные принципы и практические рекомендации по правильному кормлению ослов

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Аннотация

В статье рассматриваются пищевые потребности ослов, особое внимание уделяется их потребностям в воде, энергии, белках, минералах и витаминах. Организм ослов, которые являются рабочими животными родом из засушливых регионов, прошел ряд физиологических адаптаций, влияющих на их пищевые потребности. Цель статьи — провести обзор и представить научно обоснованную информацию о пищевых потребностях, питательных веществах и рекомендациях по кормлению ослов, основываясь на современных мировых исследованиях. В статье показаны потребности в воде, энергии, белках, минералах и витаминах, а также методы оценки усвоения и наличия корма. Особое внимание уделяется изменениям потребностей в зависимости от физиологического состояния (взросление, беременность, лактация), интенсивности работы и качества имеющегося корма. Также обоснована важность усвоения корма и правильного питания, отвечающего всем пищевым потребностям. Подчеркнута необходимость оптимального баланса между грубым и концентрированным кормом, а также потенциальная опас-

ность неоптимально подобранных добавок. На основе имеющейся литературы и полевых наблюдений даны практические указания по правильному кормлению ослов в различных условиях разведения с целью сохранения их работоспособности, здоровья и долголетия.

Ключевые слова: осел, нежвачный рацион, состояние, пищевые потребности

Для цитирования. Матеевич Н., Урошевич М. Основные принципы и практические рекомендации по правильному кормлению ослов. *Ветеринарная патология.* 2025;24(4):74–89. https://doi.org/10.23947/2949-4826-2025-24-4-74-89

Introduction. A donkey is a herbivore, and there are many assumptions that working donkeys can do their work successfully on grazing alone and that they do not need any additional feeding. However, nutritional requirements of donkeys can vary throughout the year, depending on whether they are working hard or are pregnant or nursing their foals. Grazing quality varies throughout the year, as grasses develop from young easily digestible plants to mature plants after flowering, when plants contain more fiber and are less digestible [1]. In order to conclude whether a donkey is well fed, it is necessary to know its nutritional requirements, and then determine the best way to meet these requirements from the available feed.

Many scientific papers focus on measuring and discovering the nutritional needs of horses in the context of their participation in various competitions. In the scientific literature the requirements of horses for energy, protein, minerals and vitamins have been determined [2]. The average nutritional composition of food that is usually given to horses is available in food composition tables. However, there is significantly less information in the literature about the needs of donkeys.

Donkeys and horses are non-ruminant herbivores, and digest the fibrous part of food in the cecum and colon unlike cattle, which are herbivorous ruminants and digest the fibrous part of food in the rumen [3]. Fiber digestion products are less available to non-ruminant herbivores than to ruminant herbivores. To circumvent this and ensure better resorption, the nutritional strategy for non-ruminant herbivores has to imply more frequent intake of food to ensure daily needs [1]. Because of their size, donkeys eat more roughage per unit of body mass than cattle, but less dry matter is digested [4].

Cattle consume dry matter equivalent to 2% of their body weight per day, donkeys consume roughage equivalent to 2–2.5% of their body weight, while horses consume in the range of 2.5–3% of their body weight [1]. Compared to a horse, a donkey is better at digesting rough, bulky feed and can digest a greater proportion of dry matter than a horse, if they eat the same feed. This difference is hardly noticeable with highly digestible coarse forages (alfalfa), but, digestibility can be as much as 3–4% better with less digestible forages (barley straw, corn cob).

The reasons why donkeys are better than horses and ponies at digesting poor-quality rough feed are not yet known. According to some researches, the main reason is the different relationships of microorganisms in the cecum and colon, where cellulose is better digested [1]. According to other research, the reason is that the digestive tract of a donkey is longer in relation to the total body mass than that of a horse. Donkeys have a lower food requirement per unit of body mass compared to a horse, some reports state that it is up to 25% lower than that in horses [5].

Comparative studies on the energy and protein requirements of donkeys and horses have shown no differences [5]. Therefore, in the absence of other evidence, it is possible to say that at least part of the reason why donkeys do better than horses on the same feed is their greater ability to digest roughage.

The aim of this paper is to review and present scientifically based information on nutritional requirements, nutrients and recommendations for feeding donkeys based on current research in the world. The paper shows the needs for water, energy, proteins, minerals and vitamins, as well as methods of assessing food digestibility and availability.

Materials and Methods. This study applied a literature review to find existing scientifically based information on nutritional requirements, nutrients and recommendations for feeding donkeys. For the purposes of the work, the Serbian scientific literature database, Google Scholar, CABI, RG (Research Gate) platform and RISC (РИНЦ) – Russian Index of Science Citation database were reviewed. In the available literature, any significant amount of research on the nutritional needs of donkeys as well as on nutrients suitable for feeding donkeys has not been found. The researched literature goes back to 1948, when the book by the Russian author I.S.Popov "Feeding domestic animals" [6] was translated into Serbian and used as a university textbook. Serbian scientific literature about nutrition of domestic animals refers to a donkey as a horse, without detailed explanations. The same is true for literary sources in other languages. By reviewing the RG platform database, it was determined that there was no reserch dealing with the nutrition of donkeys. The large international organization CABI (nonprofit intergovernmental development and information organisation), which has a base with thousands of units, does not have studies on the nutrition of donkeys. A search in the RISC database did not yield with any adequate text on donkey nutrition. Just few research papers dealing with donkey nutrition from the aspect of physiological features and energy requirements were published.

Nutritional requirements of donkeys. The nutrients that all animals, including donkeys, need are: water, energy, proteins, minerals and vitamins.

Water. Many working equines suffer from various degree dehydration, because they do not get enough water during the working day. Donkeys evolved in a desert environment, which means that they typically require less water per unit of body mass than most other large mammals, except for the camel [1]. The amount of water a donkey needs depends on the food it eats, the work it does, its physiological state and the temperature of the environment in which it lives and works. The more dry matter an animal eats, the more water it needs.

For every kilogram of dry matter it eats, in cold conditions and without work, a donkey needs 1.1 liters of water [5]. When working, a donkey spends a lot of energy on muscle contractions. The by-product of this process is heat. A donkey loses extra heat to maintain its body temperature during work, sweating and, in extreme conditions, panting to cool itself. These processes use up water in the body. Therefore, a working donkey needs 5–6 times more water than a non-working donkey [1].

During lactation, a donkey needs almost double the amount of water compared to a non-lactating donkey. If the air temperature rises above 30°C, and at the same time the relative humidity increases, there is no significant increase in the need for water. In the event that at such air temperature the relative humidity is low, the need for water increases 3-4 times [5].

In the case of low air temperatures and high relative air humidity, the need for water does not increase, but if at the same low air temperatures, relative air humidity decreases, there appears thirst and need for increased consumption of drinking water.

A wild donkey, in its homeland (Nubia, Somalia), does not drink water every day [7]. Only donkeys with foals and pregnant donkeys go to the watering holes every day, and the other categories usually go every second day. In that case, they can drink up to 25 liters of water.

It is considered, in general, that donkeys need, daily, an amount of water that corresponds to 10% of their body weight.

Energy. Energy requirements are usually described as the amount of digestible energy a donkey needs. This means the amount of energy it needs in a digestible form. All food contains energy, but the amount a donkey can digest depends on the nature of the food. For example, it can digest about 85% of the energy present in the corn kernel, but only 35% of the energy present in the corn husk [1]. This is because corn husks have much more fiber than corn kernels, so less energy is available for digestion and more is excreted in the feces. This solves the problem of different forages having different digestibility. Donkey that weighs 150 kg needs around 20 MJ of the digestible energy per day for maintenance [5]. In their research, Smith and Wood [14] showed the daily food requirements in dry matter for a daily food consumption of 1.5% of body weight. According to them, a 150 kg donkey has a daily digestible energy requirement of 12–14 MJ per day, based on a daily consumption of 2.3 kg of dry matter. The required energy density of food is 5.5–6.5MJ/kg of dry food matter. A 200 kg donkey needs digestible energy of 16–19 MJ per day, where the daily consumption is 3 kg of dry matter. The required energy density of food is also 5.5–6.5MJ/kg of dry matter of food. Donkeys with a body weight of 250 kg have daily digestible energy needs of 20–24 MJ per day, based on the consumption of 3.8 kg of dry matter. The required energy density of food for this body weight of a donkey is identical to the previous two, 5.5–6.5MJ/kg. This does not mean much unless it can be related to the actual amounts of food needed to meet the requirements. All animals use energy to contract muscles, therefore, when a donkey is working, its need for energy will increase [1]:

Energy requirements for work = energy expenditure for walking + energy expenditure for carrying loads + energy expenditure for pulling loads + energy expenditure for moving uphill, against the force of gravity.

The greatest energy used in work is that used in walking. The additional energy used for carrying or pulling a load or moving uphill, in addition to that used for walking, is relatively small. A donkey uses more energy per meter when traveled on rough ground than on firm flat ground, and it will travel at a slower speed and travel less during the day. If it is pulling or carrying heavy loads that require more additional energy, it will move at a slower speed than if it is lightly loaded and again will travel less during the workday. This means that the additional energy required for work can be accurately estimated by determining the distance traveled during work, rather than worrying about the type of work, workload or terrain. An average-sized donkey (150 kg) will need about 60% extra energy when walking 10 km, 100% extra energy when walking 20 km and about 140% extra energy walking 30 km working, either pulling a cart over a road with a hard surface or carrying a load on its back [1].

If distances are difficult to estimate, hours spent working can be used to estimate energy needs. A donkey that works 4 hours a day will usually need about 50% more energy than if it doesn't work. Working for 6 hours a day can mean doubling the energy needs, and working for 8 hours a day, means an increase in energy needs of up to 2.5 times compared to what is needed for maintenance on a non-working day [1]. This also takes into account some short periods of rest during the working day, i.e. it is assumed that the donkey does not spend the whole time in motion during the working day.

Donkeys in the last three months of pregnancy need about 10% more energy every day than when they are not pregnant, while during lactation in the first three months they need about 120% more energy than when they are not lactating and working [5]. The amount required will decrease by about 50% of energy relative to resting require-

ments in later periods of lactation as milk production decreases. Many growing donkeys have energy needs similar to that of adult donkeys, but because they are small they have a lower food intake. Therefore, their energy needs should be provided in a more concentrated form than that available in roughage.

Energy is available to a donkey in several different forms. Energy is obtained through food from carbohydrates, fats and proteins. It is also available from glycogen stored in the body, in the muscles and liver or fat in adipose tissue throughout the body. Getting energy from protein is unprofitable and expensive. Many working donkeys are lean and therefore have little body reserves. The main source of energy from food for working animals is carbohydrates and fats [8]. Carbohydrates are available in two forms: (a) *simple carbohydrates*, that are broken down to glucose which is absorbed from the small intestine into the bloodstream and (b) *complex carbohydrates* found in fibrous plant material, which are fermented by microorganisms in the large intestine to produce volatile fatty acids which are absorbed through the intestinal wall into the bloodstream [8].

Concentrated food contains carbohydrates, mostly in simple form, while rough food is rich in fiber, complex carbohydrates. Concentrated feed provides a donkey with a more readily available form of energy, which can be easily digested and absorbed in the small intestine. A donkey that eats mainly complex carbohydrates in roughage relies mainly on microorganisms in the large intestine to produce energy-yielding substrates in a usable form. Donkeys cannot be fed only concentrates. They must have enough fiber in the food to stimulate muscle contractions in the digestive tract and to dilute simple carbohydrates that are more easily fermented. This reduces the chance of colic or other digestive problems, which can occur when ungulates are fed high levels of concentrate. If the daily energy requirement of a working donkey is doubled then in theory on a working day the donkey will have to eat at least twice as much as it needs for maintenance, or lose weight. A working donkey on roughage of poor to moderate quality does not increase its voluntary food intake in response to work. In some cases, feed intake may even be reduced because a working donkey has less time to feed.

Therefore, in order to meet additional energy needs during the working day, a donkey should be given a higher quality meal. This is one with more digestible energy than that found in most roughages, such as crop residues and hay, which are commonly available for working donkeys. Failure to improve the energy concentration of a working donkey's ration will result in the donkey losing body mass during work [5]. Some weight loss may be acceptable in a working donkey that only does seasonal work. It is possible to gain weight in the off-season, but weight loss is not acceptable in a donkey that works every day of the year, or one that starts working in a lean state.

Proteins. Protein requirements for adult donkeys are relatively low [9]. They are, for the most part, necessary to meet the protein needs of the microorganisms in the large intestine, and they are vital for the breakdown of dietary fiber. Work does not significantly increase donkeys' protein needs. Any increase in protein requirements in work, usually due to tissue recovery after injury, is likely to be met by the protein contained in the supplementary feed provided to meet the additional energy needs of the working donkey.

Growing animals, as well as pregnant and lactating donkeys, require more protein in their feed than other categories of donkeys [10]. The needs of pregnant donkeys for proteins increase in the last 3 months of pregnancy, which is the period when the growth and development of the fetus is the greatest. This is the time when the developing fetus takes up more space in the abdominal cavity, reducing the donkey's capacity to eat bulky food. In order to meet the additional energy and protein needs during this period, it is necessary to increase the amount of concentrate in the meal and reduce bulky food.

Proteins are made up of long chains of amino acids. There are 25 important amino acids, 10 of which are essential in nutrition [2]. Essential amino acids are necessary because the donkey or the microorganisms in the cecum and colon cannot synthesize them in sufficient quantities to meet daily needs. There is no system for digesting microbial proteins in the large intestine, therefore the donkey really depends on the protein it eats to provide amino acids.

Plants can synthesize all the amino acids that donkey needs. A young growing donkey has high lysine requirements. This is the amino acid most likely to be deficient and inhibit growth if a young donkey is fed only roughage. Amino acids that are ingested in excess cannot be stored, but are instead metabolized to provide energy or converted into the body fat and glycogen reserves. Based on this, it is very expensive and unprofitable to feed donkeys with large amounts of protein. This situation rarely occurs with the working donkey living in tropis, because good sources of dietary protein are generally expensive and therefore used sparingly by most owners who can afford them.

The amount of protein in feed is usually expressed as the amount or percentage of protein in the dry matter of the feed. This is actually the nitrogen in the dry matter of food multiplied by 6.25 [8]. This is based on the fact that most proteins contain 16% nitrogen, i.e. 100/16 = 6.25 units of protein for each unit of nitrogen. It is easy to measure the nitrogen content in food, it is much more difficult to measure the amino acid content as well as the amount of protein in it. Foods with similar nitrogen content may have the same crude protein content, but the proportion of essential amino acids and thus the quality of the food may be different. The higher the proportion of essential amino acids, the better the quality of the protein. In ruminants, a large part of the protein in the diet is broken down in the rumen into

simple nitrogenous compounds and is used by microorganisms for growth and production of microbial proteins. Therefore, part of the additional nitrogen that promotes the growth of microbes and thus helps the fermentation of complex carbohydrates can be provided in the diet as urea. In donkeys, this can have fatal consequences, as the urea would be absorbed directly into the bloodstream through the stomach wall, before reaching the microorganisms in the large intestine, where it could be of use. This means that providing urea can cause toxicity, which can lead to a fatal outcome. Therefore, all the protein needs of a donkey and the nitrogen needs of the microorganisms in its large intestine must be provided from the protein in the food. Donkey feed should never be supplemented with urea or ruminant concentrate which containing urea.

The highest quality proteins, those that contain the highest proportion of essential amino acids in the protein, are proteins of animal origin such as fish meal. The greatest of plant proteins is soy. Legumes are roughage that contain the highest amount of protein. As grasses and cereal plants mature, the protein content of the stems and leaves decreases, and so does the protein content in roughage made of them. Hay protein quality declines as the crop is harvested later in the growing season. Ripe straw and corn husks contain very small amounts of protein. The same as with energy in food, it is important to know how much protein in food is available to the donkey, i.e. how much can be digested in the intestines and how much is excreted in the feces.

Minerals, vitamins. Minerals are inorganic elements, which have a number of functions in metabolic processes and activities in the body. The most abundant minerals are calcium, phosphorus and magnesium (important for the structure of the body and skeleton), sodium, potassium and chlorine (important for acid-base balance and fluid regulation), sulfur (necessary in metabolic processes). Trace minerals (required in small amounts in the donkey's body) are iron, manganese, zinc, copper, iodine, selenium and cobalt. All of them can be obtained from food. Calcium, phosphorus and magnesium requirements are greatest in growing animals. A working animal needs to maintain fluid balance by replacing sodium lost through sweat. It is therefore important to ensure that the working donkey is given a handful of salt in its food every day, or that it is given rock salt or lick blocks while it is resting.

Fig. 1. After the return of the herd and the donkey from grazing, in Anatolia (TR) the donkey licks the salt rock to take in minerals and vitamins

Vitamins are organic substances necessary for the proper functioning of physiological processes. They are needed in very small quantities. There are two types of vitamins. Fat-soluble vitamins are A, D3, E and K, and water-soluble vitamins are vitamin C and B vitamins. Vitamins B and K2 are synthesized by microorganisms in the large intestine, so it is less important to get them through the diet, and vitamin C can be produced by the donkey in sufficient quantities to meet the needs. Fresh green leafy vegetables and grass are good sources of vitamins, therefore they should be regularly included in small amounts in the diet. When donkeys do not have access to fresh green plant material, mineral and vitamin supplements that are widely available can be added to rations.

Measurement of food digestibility. Food digestibility is assessed by measuring the degree to which dry matter, organic matter, proteins or fiber components of food are digested [8]. Dry matter digestibility can be determined by measuring the amount of dry matter eaten during a certain period (usually not less than 7 days) and the amount of dry matter excreted in the feces at the same time [1]. This means confining donkeys to individual stalls for a period and weighing the food they eat and the feces they excrete. Samples of daily feed intake and collected feces are dried to constant weight (until all water is gone) to determine the dry matter content of each. From these values, the total dry matter that is eaten and the total excreted are calculated. The digestibility of dry matter in food expressed as a percentage could be calculated with the following formula [1]:

$$\text{Digestibility of feed } (\%) = \frac{\text{Weight of dry matter in the food } - \text{ weight of dry matter in the feces x } 100}{\text{Weight of dry matter in the food}}$$

This method does not require any sophisticated laboratory, just food and excrement drying agents and a precision scale. Drying is usually started in the sun and finished in an oven at around 60°C for one day. The digestibility of any of the other nutrients such as organic matter (dry matter content — ash), protein or fiber (neutral detergent fiber and acid detergent fiber) can be determined by measuring the total dry matter present in the food and feces and substituting the value in the above formula. A feed laboratory with protein, fiber and ash determination facilities is required to determine these feed components. There are feed composition tables that can be studied to see average values for the digestibility of many nutrients. However, less information is available for ungulates than for ruminants.

Availability of food. Most donkeys are fed roughage throughout their lives, with grazing on natural grasslands, roadsides, bushes and undergrowth if kept in rural areas. Many working donkeys are found in urban and suburban areas of the world where there are few opportunities for grazing and people feed their animals exclusively on purchased feed. In these situations, the amount of daily earning often dictates the quality of feed given to the donkey. However, unless the roughage is of the highest quality (fresh legumes or legume hay), a working, pregnant, lactating or growing animal must receive supplemental nutrition in addition to roughage to maintain condition and health and be productive.

Roughage. Quality roughage varies from good (fresh and canned legumes) to bad (husk and straw from sorghum, millet and rice production). It is important to be able to distinguish good roughage from bad food. The condition of the roughage is very significant. It should be free of dust and mold, bad odor and any garbage (unsightly and poisonous weeds, plastic, wire and other garbage). The next step is to evaluate the type of roughage in terms of nutritional value. In terms of digestible protein, it's relatively easy: legume roughage is usually high in protein, grasses and hay are medium to low in protein, and crop residue and straw are low in protein. The younger the grass, the higher the protein content. As all plants mature, digestible protein content declines as plants become more fibrous. Similarly, as the amount of fiber (complex carbohydrates) increases, the content of digestible energy in roughage incresses as well. Tropical grasses grow and reach maturity (seed) faster than temperate grasses. They are more cellulosic than temperate grasses and can be very low in protein when mature. Temperate grasses have a higher protein content than tropical grasses.

Pearson [1] presents a simple scoring system for determining the energy value of roughage for ruminants based on appearance, which provides a guidelines for analysing grass and pasture, legumes, hay and crop residues. The higher the number of points, the better the nutritional value of the roughage (Table 1). It is a useful system for evaluating roughage when feeding a donkey. It is based on:

a) General appearance — is the roughage free of mold, dust, garbage? Does it smell nice and sweet?

b) Leaf to stem ratio — is it very fibrous with lots of stems or is it young and leafy?

c) Color — is it young, green and freshly cut or old, yellow dry and late cut?

Each of the three characteristics should be rated from 1 to 5 according to the descriptions in Table 1, and then added up. These results should be used to interpret the data in Table 3 and Table 4.

Table 1

Scoring system for evaluation of the quality of roughage in relation to digestible energy content

Characteristics	Score				
	1	2	3	4	5
General Appearance	Very poor	Poor	Moderate	Good	Very Good
Leaf to Stem Ratio (age of plant)	Mainly stems	Stems > Leaf	Leaf = Stem	Leaf > Stems	Very leafy
Colour	Yellow	Yellow > Green	Green > Yellow	Green	Very Green

Source: [1]

According to Pearson [1], roughage with a score below 6 has low energy value, while that with a score over 12 has a high level of digestible energy and thus is good for feeding working, lactating or growing donkeys. Freshly cut green grass with lots of leaves would get a score of 12 – 13, while chopped barley straw with few leaves left might get less than 6, and stalks with few leaves might get 3.

Energy-rich concentrates. Cereal grains are a good source of energy, but they need to be crushed, rolled or ground so that the carbohydrates and proteins in the grain can be best digested [8]. Oats can be given raw, but crushing improves digestion. The barley grain is in a hard shell, so grinding is required to break the shell. Sorghum and wheat grain are small, so it is best to grind or roll them before feeding, otherwise they can pass through the digestive tract undigested. Corn kernels can be given in any form, but as it is hard, it is best to grind it, especially for animals with weak teeth.

Concentrates with a mixture of at least two types of cereals are always of better quality than concentrates with one type. Molasses is a source of easily digestible carbohydrates that can increase the flavor of dry food while providing energy. The main problem with molasses is storage in hot weather as it can ferment and spoil, especially low quality molasses, which has the highest water content. Oil is a good source of energy and is used more and more in

feeding donkeys. Vegetable oils (soybean, rapeseed, corn, palm, sunflower) and fish oil can be used in small quantities. A cup a day in food as an additional source of energy is good for working donkeys, but it should be gradually introduced into the diet over 10–14 days. Oil is added immediately before feeding.

Protein-rich concentrates. When grains are used in conjunction with poor-quality roughage, they can provide a low-protein meal. Pregnant animals, lactating animals and growing young require protein-rich mixtures to supplement particularly poor bulk feed. Oilseed cakes, soybean cakes and cottonseed cakes are some of the best sources of protein for donkeys. Sunflower cake can also be used in food. Peanuts may contain mold derivatives — mycotoxins, to which ungulates are sensitive.

Dolichos biflorus, sometimes called “field” or “horse” vetch is another good source of protein, which is available in many tropical countries for donkeys and can be fed without cooking or processing. Beans (*Vicia fabia*) are legumes that contain approximately 25% crude protein. It can be used in its raw state, without any prior processing. Other legumes, such as those from the *Phaseolus* species (mung, navy, kidney, lima pea) need to be cooked to remove toxins before being fed to equines, and are therefore less useful. Forage legumes, such as alfalfa and Alexandrian clover, contain more protein than grasses, whether fresh or canned, and are good nutrients in donkey diets.

Other concentrated raw materials in donkey nutrition. Wheat bran provides some energy, more protein and cellulose in the diet of donkeys. It contains less calcium but has high phosphorus content. When using wheat bran in the diet, it is necessary to balance the meal well to avoid bone abnormalities due to the unbalanced ratio of calcium and phosphorus. In the case of using alfalfa together with wheat bran, this imbalance is smaller, provided the alfalfa is rich in calcium.

Food storage. Some nutrients in bulk foods, grains and protein supplements deteriorate during storage. Food should be stored in a cool place where the temperature does not fluctuate much, ideally where there is good air flow, ventilation and low humidity. Food should not be stored in direct sunlight or in humid conditions and should be stored away from rain, water, rodents, insects and birds [2].

The amount of water in food varies, a kg of fresh grass can have 80% of its weight as water, while 1 kg of grain contains only 15% of water. This means that an animal that eats 1 kg of grass will only get 200g of the other nutrients it needs, however, if it eats 1 kg of cereal grains, it will get 850g of the other nutrients it needs. When defining the amount of food in donkey’s meal, it is preferable to estimate the dry matter content of the food and to know the amonut of dry matter the donkey can consume to be able to calculate how much "fresh food" to offer.

Food intake. When planning how to feed a donkey, it must be estimated how much a donkey is able to eat every day, when it receives roughage, the amount of dry matter corresponding to 2% of its body weight per day. It is assumed here that the mostly used roughage is of moderate quality. The actual amount of dry matter a donkey eats a day depends on many factors. Some of the important ones are given in Table 2 [1].

Type of food. Young plants can be eaten faster than mature ones, but they contain less dry matter per kilogram. It takes less time to consume 1 kg of ground or pelleted food than to consume 1 kg of raw food, even if it is chopped. It takes less time to eat 1 kg of legume concentrate or hay than 1 kg of crop residues.

Fig. 2. Hay brought to the farm must be dry and stored in a dry place (Photo by: Nemecek, M.)

Fig. 3. Such bad hay must not be included in the diet (Photo by: M.Urošević)

Table 2

Factors affecting the amount of food a donkey eats a day

Food Type:
Nature of feed
Quality of feed
Management:
Time allocated for eating
Amount of food at one time
Water available
Health
Internal parasite burden
State of the teeth
Reproductive state
Environment:
Ambient temperature and humidity

Source: [1]

Time allocated for eating. In natural conditions, a donkey spends 14 – 16 hours a day feeding. It is important that donkeys kept on pasture have time to eat. Work especially shortens the feeding time of a donkey. The more work it does, the less time it has to feed, but more food is needed to meet the increased energy needs. Therefore, a working donkey needs a more concentrated feed than a non-working one. Donkeys are more susceptible to the influence of the time available for eating than cattle. Cattle increase consumption if they have worked, donkeys do not, because initial chewing is more important in food processing in donkeys than in ruminants.

Guidelines for feeding donkeys for different activities. The present guidelines define the effect of the exact amounts and proportions of available feed on the expected productivity of a donkey, its body condition. A thin donkey has little body energy reserves, while a donkey in good condition has some in reserve for a short time. Table 1 shows how to assess the nutritional value of roughage in terms of poor, moderate and good.

Maintenance Requirements. A donkey can eat enough to meet its maintenance energy requirements from a moderate-quality roughage of hay or a 3:1 mixture of straw and green forage (such as alfalfa) or from moderate-quality pasture, if the animal is allowed ad libitum access to the food source during the day. Then it will eat about 2.5 kg of dry matter per 100 kg of live weight per day. A donkey that is allowed grazing at wild will spend about 60% of the day feeding.

Work shortens the time available for eating, so it can be assumed that a donkey will be able to eat only about 2 kg of dry matter per 100 kg of body weight per day. Therefore, a donkey needs energy in a more concentrated form than when it is not working. If fed roughage of moderate quality, a donkey needs about half of feed dry matter as energy-rich concentrates if it works 4 hours a day and 60% if it works 8 hours a day. Poor quality roughage will require more concentrate. If it works 4 hours a day, it needs about 60% of its dry matter intake as energy-rich concentrates, and if it works 8 hours a day, it needs about 70% of its dry matter intake as energy-rich concentrates [8].

Growth. The energy needs of young donkeys, after weaning in the first year of life, can be met by feeding them a 2:1 ratio mixture of concentrate and roughage. This assumes a dry matter intake of 1.5 kg per 100 kg body weight

when a donkey is small, increasing to 2 kg per day when it reaches around 100 kg live weight [1].

Pregnancy and Lactation. Pregnant donkeys consuming a 1:1 ratio mixture of moderate-quality roughage and protein-rich concentrate will eat about 2 kg of dry matter per 100 kg of body weight, which can meet their protein needs at late pregnancy.

Donkey milk is not as rich in protein as cow milk, however, protein needs increase especially in early lactation. After the foal is born, the amount of protein and easily digestible energy in the donkey's meal should be increased. A ratio of 40% of moderate quality roughage to 60% of energy- and protein-rich concentrate would provide enough nutrients for the first three months of lactation [5]. This allows the donkey to meet the lactation needs for energy and protein and gives the foal a good start in life. After 3 months, the donkey's protein and energy requirements decrease, and a 1:1 ratio mixture of moderate quality roughage and concentrate will meet the requirements [1]. After the foal is weaned, if the donkey is not working, the concentrate can be removed from the donkey's ration. When only poor roughage is available, such as leftover grain, the proportion of concentrate in the ration should be increased.

The final check of whether the amount of food is sufficient for the donkey is to monitor its body condition (table 5) and adjust the ration accordingly. If a working donkey is losing mass, it needs more energy in its meal or less work or both. It is necessary to increase the concentration of energy by improving the quality of roughage (Table 1) or to increase the proportion of concentrates in roughage [1]. If a pregnant or lactating donkey becomes thin (Table 5), a female donkey needs more energy and protein in its feed. Then the offered dry roughage is reduced and the proportion of concentrate in the roughage is increased. Lactating donkeys should be offered more green roughage, if available.

Duncan et al. [11] provided recommendations for meal composition during different physiological states.

Fig. 4. Special attention to nutrition is required during breastfeeding

Table 3

Daily rations for adult donkeys (if roughage is of poor quality)

State	Live Weight (kg)	Total Dry Matter Intake (kg)	Amount of Roughage (kg)	Amount of Concentrates (kg)	Remarks
Mature idle	100	2.5	2.25	0.25	Need to supplement poor roughage with some concentrate
	200	5	4.5	0.5	
Work 4 hr/day	100	2	0.8	1.2	Need to supplement with energy rich concentrate Much less time for feeding in the day
	200	4	1.6	2.4	
Work 8 hr/day	100	2	0.6	1.4	
	200	4	1.2	2.8	
Last 3 months of pregnancy	100	1.5	0.5	1	Need for protein rich concentrates rather than energy rich. Less space in abdomen for roughage
	200	3	1	2	
First 3 months of lactation	100	2	0.6	1.4	Need for a mixture of protein and energy rich concentrates, and increased water requirment
	200	4	1.2	2.8	
> 3 months of lactation	100	2	0.8	1.2	
	200	4	1.6	2.4	

Source: [1]

Table 4

Daily rations for adult donkeys (if roughage is of moderate quality)

State	Live Weight (kg)	Total Dry Matter Intake (kg)	Amount of Roughage (kg)	Amount of Concentrates (kg)	Remarks
Mature idle	100	2.5	2.5	0	No need to supplement
	200	5	5	0	
Work 4 hr/day	100	2	1	1	Need to supplement with energy rich concentrate Much less time for feeding in the day
	200	4	2	2	
Work 8 hr/day	100	2	0.8	1.2	
	200	4	1.6	2.4	
Last 3 months of pregnancy	100	1.5	0.75	0.75	Need for protein rich concentrates. Less space in abdomen for roughage
	200	3	1.5	1.5	
First 3 months of lactation	100	2	0.8	1.2	Need for a mixture of protein and energy rich concentrates, and increased water requirment
	200	4	1.6	2.4	
> 3 months of lactation	100	2	1	1	
	200	4	2	2	

Source: [1]

Table 5

Recommendations for the composition of meals during different physiological states

	Adult donkey fed on fibrous forages			
Period of year	Body weight	MJ, DE/day	Daily DMI needs	Recommended diet
summer	goal weight 180 kg	14.4	2.4 kg	2.1 kg barley straw (5 MJ DE/kg DM) + limited grazing or + 0.5 kg moderate hay (8 MJ DE/kg DM)
	goal weight 180 kg	13	2.4 kg	2.2 kg barley straw (5 MJ DE/kg DM) + very limited grazing or + 0.2 kg moderate hay (8 MJ DE/kg DM) + forage balancer
	180 kg donkey with dental disease	14.4–15	2.4 kg	2.4 kg short chop hay replacer (7.3 MJ DE/kg DM assuming 85% DM) e.g. forage balancer
winter	donkey goal weight 180 kg	17.1	3.1 kg	3 kg barley straw (5 MJ DE/kg DM) + 0.4 kg moderate hay (8 MJ DE/kg DM)
	donkey goal weight 180 kg	15.5	3.1 kg	3.1 kg barley straw (5 MJ DE/kg DM) + very limited grazing or + forage balancer
	180 kg donkey with dental disease	17.1–18	3.1 kg	2.9 kg short chop hay replacer (7.3 MJ DE/kg DM assuming 85% DM) e.g. forage balancer
	Female donkey in last 3 months of pregnancy			
	Body weight	MJ, DE/day	Daily DMI needs	Recommended diet
summer	180 kg – 9 months of pregnancy	16.7	2–2.4 kg	1.1 kg barley straw (5 MJ DE/kg DM) + grazing and high protein balancer or + 1.3 kg moderate hay (8.5 MJ DE/kg DM) and high protein balancer
	180 kg – 10 months of pregnancy	17.4	2–2.4 kg	0.4 kg barley straw (5 MJ DE/kg DM) + 1.8 kg moderate hay (8.5 MJ DE/kg DM) + high protein balancer
	180 kg – 11 months of pregnancy	18.6	2–2.4 kg	2.2 kg moderate hay (8.5 MJ DE/kg DM) + high protein balancer + grazing if hay is not managed supplement with high fibre cubes, alfalfa chop or unmolassed sugar beet
winter	180 kg – 9 months of pregnancy	19.8	2.5–3.1 kg	1 kg barley straw (5 MJ DE/kg DM) + 1.7 kg moderate hay (8.5 MJ DE/kg DM) + high protein balancer
	180 kg – 10 months of pregnancy	20.7	2.5–3.1 kg	2.2 kg moderate hay (5 MJ DE/kg DM) + 0.4 kg barley straw (8.5 MJ DE/kg DM) + high protein balancer
	180 kg – 11 months of pregnancy	22.1	2.5–3 kg	2.5 kg moderate hay (5 MJ DE/kg DM) + 200 g alfalfa chop (9 MJ DE/kg DM) + high protein balancer

Source: [11]

Table 6

Recommendations for the composition of meals during lactation

	Body weight	MJ, DE/day	Daily DMI needs	Recommended diet
summer	180 kg, 1st month	27.5	2.4–3 kg	2.4 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.3 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 2nd month	27.3	2.4–3 kg	2.6 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.2 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 3rd month	26.5	2.4–3 kg	2.6 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.15 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 4th month	25.5	2.4–3 kg	2.6 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.1 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 5th month	24.5	2.4–3 kg	2.5 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.1 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 6th month	23.6	2.4–3 kg	2.4 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer
winter	180 kg, 1st month	30.2	2.7–3.1 kg	3 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.3 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 2nd month	30	2.7–3.1 kg	3 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.2 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 3rd month	29.2	2.7–3.1 kg	3 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.15 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 4th month	28.2	2.7–3.1 kg	3 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.1 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 5th month	27.2	2.7–3.1 kg	2.8 kg good hay (9 MJ DE/kg DM) + grazing and high protein balancer or 0.1 kg alfalfa oil chop (11.2 MJ DE/kg DM) + high protein balancer
	180 kg, 6th month	26.3	2.4–3 kg	2.6 kg good hay (9 MJ DE/kg DM) grazing + high protein balancer

Source: [11]

Estimation of donkey body mass. The body mass of an adult donkey can be approximately determined by measuring the height of the withers. It is calculated based on the assumption that every 1 cm of withers height corresponds to 1.34 kg of mass (1.12–1.44) [12]. In addition, Hafner [13] states that donkeys whose height at the withers is up to 110 cm can weigh a maximum of 205 kg. This gives a reasonable prediction of animal mass, but it is not always so easy to detect the relative changes in mass that occur from week to week in an animal.

Stimulation of the body condition of the donkey. The easiest method to assess whether a donkey is getting enough food is to evaluate its condition based on various scoring systems. Different donkey scoring systems are used in temperate and tropical countries to assess the animal's weight changes over time [10]. The scoring system shown in Table 7 provides guidelines for assessing the donkey's condition as objectively as possible. After assessing which condition category the donkey fits into, i.e. whether the donkey is thin (1 – 3), moderately fat (4 – 6) or fat (7 – 9), using the guidelines from the table, it can be further classified into more specific categories under L, M and F.

Practical guidance. Donkeys need to have their teeth checked regularly. Regular antiparasitic treatment is necessary to enable a donkey to chew the food as well as possible. It is preferable to feed donkeys after watering, not before. If dehydrated, the donkey will not eat well or stop eating. It must have enough time to eat. Food should be given in the shade, after a short break from work. The daily meal should be divided into 3-4 meals during the day.

A donkey cannot eat the required daily amount of food at once, in one big meal. A portion of roughage is given along with green food, when available. Since it has little dry matter (it can be 80% water) it is best to feed it in addition to dry roughage and let the donkey choose. One kg per day (about 200 g of dry matter) is sufficient. If the roughage is of poor quality, more should be offered.

Table 7

Body condidtion evalution for working donkeys

Score	Condition	Features
1	L -	Markedly emaciated; bone structure easily seen over body, little muscle present, nimal weak, lethargic
2	L .	Animal emaciated; individual spinous processes, ribs, tuber covae, tuber ishii and scapular spine all prominent; some muscle development; neck thin, prominent withers, shoulders sharply angular
3	L +	Vertebral column prominent and individual vertebral spines are pointed to the touch; little fat, but superspinous musculature over spinous processes apperent. Ribs, tuber ischii and tuber coxae prominent; loin area and rump concave; little muscle or fat covering over withers and shoulders.
4	M -	Vertebral column visible; tuber ischii palpable but not visible, tuber coxae rounded but visible; rump flat rather than concave; ribs palpable but not obvious, withers, shoulders, neck with some muscle and fat cover; scapular are less clearly defined.
5	M .	Superspinous muscles developed and readily apparent; can palpate vertebral column; tuber coxae rounded; rump rounded, convex; tuber ischii not visible; some fat palpable in pectoral region and at the base of neck; can palpate ribs, but not visible.
6	M +	Can not palpate spinous processes easily; back becoming flat, well covered; rump convex and well muscled; some fat palpable on neck, base of neck and pectoral region; neck filled into shoulder; tuber coxae just visible. Animal smooth and well covered.
7	F -	Animal smooth and well covered; back flat cannot palpate spinous processes; tuber coxae just visible; fat on neck and pectoral region beginning to expand over ribs; flank filling, neck thickening.
8	F .	Animal body rounded, appears well covered with fat and bones not discernible; flanks broad, broad flat back.
9	F +	Bones buried in fat; back broad or flat, in some cases crease down back; large accumulations of fat on neck, over pectoral area and ribs; flank filled with fat.

Source: [1]

Fig. 5. Hay can be placed in mangers that are mounted on the wall. In that case, whatever a donkey pulls out, which is not a small amount, falls on the floor (Photo by: S. Fasching)

Fig. 6. Donkeys are happy to eat from the floor, but then there is much more pollution and scattering of food (Photo by: M.Nemecek)

Fig. 7. It is much better to chop corn, grind it, rather than give it in grains

It is recommended to give a mixture of two to three types of concentrated food instead of just one type. It is mandatory to give a handful of salt a day, mixed in the food, to the working donkey. They should be allowed to graze as often as possible, but should not rely on grazing only, unless it is a good pasture. Good pastures are rare where working donkeys are found. Roughage must be chopped, and grains, barley, wheat, corn, peas should be mashed/broken to improve digestion. If crushing is not possible, soaking is an alternative before feeding barley and wheat. They should be soaked, no more than 12 hours before feeding. If a donkey is working, it is fed with concentrates during the day and roughage at night, since then it has more time to eat.

According to Đorđević et al. [8] in case a donkey performs medium or heavy work, it is recommended to add 1.0–1.25 kg of concentrate for every 100 kg of body weight. At the same time, the same amount of hay is given. In case the hay is leguminous, the concentrates can be different grains. If the hay is made from grass, an additional source of protein must be provided, at a level of about 10%.

When it comes to easier work, the quality of the hay can be somewhat lower. Individuals who are not working, as well as yearlings, can meet all their nutritional needs in the pasture. When the mating season comes, the level of protein and energy in the meal must be increased. The simplest way to achieve this is to add alfalfa hay in the amount of 1 kg/100 kg of body weight. Along with such hay, it is necessary to give an appropriate amount of concentrated feed.

As a monogastric animal, a donkey uses feeds with increased levels of cellulose [1]. Such food must be well chewed to enable the digestive enzymes and intestinal microflora to work more successfully. Food preparation begins in the oral cavity. For every kilogram of hay, a donkey makes 2000 chewing movements. The hay is practically ground, the length of individual parts of the hay is 1.6 mm [14].

Some farm owners give donkeys silage. That is absolutely unacceptable. The moisture content of this food is high, and the pH value is low, extremely acidic. The crude fibre content is low and the protein level is high

Fig. 8. Silage in a feeding trough. Donkeys try to find parts that fit them

Fig. 9. A gnawed part of a wooden wall

Sugar beet is a good complementary food. It is recommended to give it in small quantities to sick donkeys. The sugar beet must be cut into rings and fed to the donkey within the next 24 hours [15]. Food must be low in sugar and high in cellulose fiber.

The basic food for donkeys is good hay [13]. Obtaining quality hay depends on many factors. First of all, it depends on the quality of the grass mixture in the meadows where the hay is obtained, and in addition, it depends much on the suitability of weather conditions. Sufficient moisture and heat (sun) are needed to obtain a good grass mass, and after mowing it is necessary to have dry weather, without rain, for the grass mass to dry well. If grass that is insufficiently dry is collected, quality hay cannot be obtained from it. Such hay will become moldy rather quickly, and then it is unusable. As approximate daily needs, it can be taken that 100 kg of body weight requires 1–1.5 kg of hay, 0.5–0.8 kg of straw and 5–10 liters of water [1]. Donkeys that do not work, and there are more and more of them in Europe, do not need concentrated feed [10]. With a daily portion of hay, the presence of straw, and the possibility of grazing, from spring to autumn, they are quite fine for a normal life, even if they are fat.

Donkeys like to eat dry bread. However, bread must not be given every day. It is possible to give a small piece from time to time. The same is the case with carrots. They are very happy to eat it, but the amount of sugar must be taken into account. Daily consumption of carrots and apples in large quantities leads to health problems. Half an apple a day can be given without fear of harmful consequences. Fresh green foods contain much more water than other foods. If this is the only source of food the donkey gets, quantity of feed should be increased. In the absence of cellulose, donkeys will bite and eat available wooden structures in buildings

Conclusion. The nutritional needs of donkeys require a careful approach that takes into account their physiological characteristics, work requirements and the quality of

available feed. Water, as an often neglected component, is crucial for thermoregulation and general health, especially in working and lactating animals. Energy needs vary significantly depending on the intensity of work, so it is necessary to provide easily digestible sources of energy, especially when the intake of bulky food is limited. Proteins are of particular importance for growth, pregnancy and lactation, so great attention is paid to their proportion in the diet. Minerals and vitamins, although needed in smaller quantities, are essential for the proper functioning of the body, especially in conditions of increased physical effort. Improperly balanced meals, poor in nutrients, lead to reduced productivity, weight loss and health problems. Therefore, a rational and adapted diet, based on an understanding of the digestive physiology and nutritional needs of donkeys, is the basis of successful and sustainable breeding of these animals.

References

1. Pearson RA. *Nutrition and Feeding of Donkeys*. In book: Matthews N, Taylor T (Eds). *Veterinary Care of Donkeys.* 2005. URL: https://www.ivis.org/library/veterinary-care-of-donkeys/nutrition-and-feeding-of-donkeys-0 (accessed: 01.07.2025)

2. Stanaćev V, Kovčin S. *Hraniva i Tehnologija Stočne Hrane i Osnovi Ishrane Domaćih Životinja*. Novi Sad: Poljoprivredni fakultet; 2003.

3. Urošević M, Ćupić Miladinović D, Štastna D, Dameski P, Cukić N, Đorđević M. Basic Characteristics of the Digestive Tract of Donkeys. *International Journal of Advanced Multidisciplinary Research and Studies*. 2025;5(3):90–99. https://doi.org/10.62225/2583049X.2025.5.3.4206

4. Cuddeford D. *Equine Nutrition*. UK: The Crowood Press; 1997.

5. Martin-Rosset W. Donkey Nutrition and Feeding: Nutrient Requirements and Recommended Allowances – A Review and Prospect. *Journal of Equine Veterinary Science*. 2018;65:75–85. https://doi.org/10.1016/j.jevs.2018.01.014

6. Popov IS. *Ishrana Domaćih Životinja*. Beograd: Naučna Knjiga. 1949.

7. Urošević M, Mandić R, Trailović R, Trailović D, Namsraijav T, Stanišić G. *Divlji Magarci*. Beograd-Zemun: COAR; 2022.

8. Đorđević N, Grubić G, Maković M, Jokić Ž. *Ishrana Domaćih i Gajenih Životinja*. Beograd-Zemun: Univerzitet u Beogradu, Poljoprivredni Fakultet; 2009.

9. Wood SJ. *Some Factors Affecting the Digestible Energy Requirements and Dry Matter Intake of Mature Donkeys and a Comparison with Normal Husbandry Practices*. PhD Thesis. Edinburgh: Edinburgh University; 2010.

10. Burden F. Practical Feeding and Condition Scoring for Donkeys and Mules. *Equine Veterinary Education.* 2011;24(11):589–596. https://doi.org/10.1111/j.2042-3292.2011.00314.x

11. Duncan J. *The Clinical Companion of the Donkey*. 1st Edition. The Donkey Sanctuary; 2018.

12. Urošević M, Štastna D, Drobnjak D, Mandić R, Ograk YuZ. Correlation between Morphometric Parameters and the Body Weight of Donkeys. *International Journal of Advanced Multidisciplinary Research and Studies*. 2024;4(6):692–696. https://doi.org/10.62225/2583049X.2024.4.6.3497

13. Hafner M. *Esel Halten*. Stuttgart: Ulmer Verlag, 2013.

14. Smith D, Wood SJ. Donkey Nutrition. In book: Svendsen ED, Duncan J, Hadrill D (Eds.). *The Professional Handbook of the Donkey (4th Edition).* Whittet Books Limited; 2008. P. 10–27.

15. Svendsen E. *Eselbuch*. Stuttgart: Ulmer Verlag; 2011. 224 p.

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***Conflict of Interest Statement*: the authors declare no conflict of interest.**

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Заявленный вклад авторов:

Н. Матеевич: поиск и анализ научных статей, подготовка текста, формирование выводов.

М. Урошевич: научное руководство, корректировка текста и выводов.

***Конфликт интересов*: авторы заявляют об отсутствии конфликта интересов.**

Все авторы прочитали и одобрили окончательный вариант рукописи.

Поступила в редакцию / Received 08.08.2025
Поступила после рецензирования / Reviewed 02.09.2025
Принята к публикации / Accepted 09.09.2025