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Basics Characteristics of the Digestive Tract of Donkeys

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Abstract

The domestic donkey (*Equus asinus* L. 1758) originates from a wild ancestor in the region of East Africa, specifically Somalia and Nubia. The donkey belongs to the large family of equids (*Equidae*), which includes horses and zebras in addition to donkeys.

To better understand the specifics of donkey nutrition, it is necessary to be familiar with the basic characteristics of the donkey's digestive tract. As with other animals, the digestive tract of donkeys begins with the oral cavity and ends at the anal opening. Ungulates, including the donkey, do not belong to the group of animals that do not chew their food like ruminants. However, the food introduced into the oral cavity is crushed to the required and desired sizes of

individual parts. The esophagus is a conduit tube that connects the oral cavity to the stomach. A donkey has a simple stomach (*ventriculus simplex*). After the stomach, the food, now quite changed in relation to the one from which a bite was made and entered the esophagus, continues its journey into the small intestine.

As a monogastric animal, the donkey has a well-developed cecum. After the processes in the cecum are completed, the contents are pushed into the next part of the large intestine—the first section of the colon.

Anatomically, the caudal end of the digestive tract is represented by the anus.

Keywords: Donkey, Digestive Tract, Nutrition

Introduction

The domestic donkey (*Equus asinus* L. 1758) originates from a wild ancestor in the region of East Africa, specifically Somalia and Nubia. Among domesticated animals, the donkey is one of the earliest to have been domesticated. Our ancestors realized quite early the many advantages of breeding donkeys. It was quickly discovered that the donkey is an extremely hardy animal, excellent for draft work and carrying loads. It could also be ridden and thus served as a means of transportation.

The donkey belongs to the large family of equids (*Equidae*), which includes horses and zebras in addition to donkeys. It is a hoofed animal, meaning it belongs to the order of "odd-toed ungulates" (*Perissodactyla*). Regarding its digestive system, the donkey, like other equids, is a monogastric animal. This means it has a simple stomach. Its stomach consists of a single "chamber" and is located between the esophagus (*oesophagus*) and the small intestine (*intestinum tenue*), which then continues into the large intestine (*intestinum crassum*). Due to its feeding habits and ability to utilize certain nutrients, the donkey's digestive tract has specific adaptations.

It is important to note that in the regions where wild donkeys—ancestors of the domestic donkey—live, food and water are not

always readily available. This is why wild donkeys spend more than half of their day searching for food. Given the limited food options, donkeys have adapted to consuming coarse feed with a high fiber content. As a result, their digestive tract has evolved physiologically to process nutrients with a higher cellulose content. The ability to digest a greater amount of cellulose has become a physiological necessity, and today, donkeys must consume feed with a higher fiber content than horses do.

When discussing donkey nutrition, it is essential to consider the regions, areas, and continents where donkeys live. Natural conditions vary significantly across different parts of the world, affecting the availability of grazing opportunities and the ability of donkeys to find and consume food on their own. In contrast to Europe, where much of the continent has favorable natural conditions that allow for the growth and development of green forage readily available to donkeys, many parts of the world have climates unsuitable for the growth of pasture grasses. In Europe, in addition to good pastures, such grass also provides an opportunity for producing high-quality hay, which is essentially the primary feed for donkeys.

For example, in Central Asia, donkeys primarily have access to dry grass and coarse vegetation. Their digestive system is well adapted to such conditions, and their locomotor system is structured to enable prolonged movement in search of food and water.

Digestive Tract

To better understand the specifics of donkey nutrition, it is necessary to be familiar with the basic characteristics of the donkey's digestive tract. As with other animals, the digestive tract of donkeys begins with the oral cavity and ends at the anal opening.

The oral cavity (Cavum oris) is the first point of contact with food and water. It consists of a bony base, lips, soft and hard palate, tongue, tongue muscles, hyoid bones, the bony foundation for the teeth, and the teeth themselves.

The intake of food and liquids from the external environment, as well as the assessment of their quality and suitability for consumption, is performed through organoleptic testing in the cranial part of the oral cavity—by the lips. If food enters the oral cavity, it undergoes a series of mechanical and chemical processes. After these processes are completed, a food bolus is formed, which is then directed into the next part of the digestive tract—the esophagus. The oral cavity is practically filled by the tongue, and it also contains the teeth.

When grazing, donkeys use their mobile, strong lips and incisors to collect grass from pastures. When consuming hay and grain feed, they primarily use their lips and tongue. When feeding on pasture grass, donkeys first gather a portion of the grass with their lips and then cut it with their incisors. Thus, a donkey does not uproot grass from the ground.



Photo: M. Urošević

Picture 1: Donkey in the pasture. Zasavica Nature Park, Serbia

When it comes to grazing, it is important to emphasize that donkeys, after gathering a certain amount of grass with their lips, cut that "bundle" of grass with their incisors. Therefore, a donkey does not uproot the grass. When consuming hay or straw, intake into the oral cavity is performed using the lips and tongue. After that, within the oral cavity, the teeth play a crucial role by chopping or cutting the hay and straw into pieces of appropriate length. The method of consuming such roughage remains the same, whether it is offered on the ground or placed in a trough.



Photo: S.Fasching

Picture 2: Eating the hay found in the manger

It is also taken in with the lips and tongue when there is hay on the ground.



Photo: M. Nemecek

Picture 3: Hay placed on the ground

It is interesting that donkeys are very happy to take food from the ground. When the hay is placed in the manger, the donkeys, intentionally or unintentionally, drag a considerable amount of hay out of the manger, which falls to the ground. After that, they collect that hay from the ground.



Photo: S.Fasching

Picture 4: Collecting the hay that fell from the manger

In many countries, where the climate allows it, such as Africa, donkeys do not have housing facilities, as is the case in Europe. In such conditions, there are no mangers in which to place the hay, but the hay is placed on the ground or some level surface raised, not high, from the ground.



Picture 5: Example from Zimbabwe, hay is placed on handy wooden base (The Donkey Sanctuary)

When it comes to consuming grain feed (corn), it is clear that the feeding technique must change. The lips gather the grain, and then the selected amount is moved into the oral cavity using the tongue.



Photo: M. Urošević

Picture 6: Consumption of concentrated feed



Photo: M. Urošević

Picture 7: You can see how the donkey collects corn kernels with its lips

Grain food, which is given to donkeys that are not in the box, can be sprinkled on the ground and the donkeys will be happy to take it from the floor.



Photo: M. Urošević

Picture 8: Corn kernels spilled on the substrate. Donkeys work it collect



Photo: S. Fasching

Picture 9: Donkeys gladly eat hay that has been pulled out or has fallen from the trough

Chewing (Masticatio)

Ungulates, including the donkey, do not belong to the group of animals that do not chew their food like ruminants. However, the food introduced into the oral cavity is crushed to the required and desired sizes of individual parts.

Chewing refers to the rhythmic movement of the jaw, tongue, and lips during food intake (Božić, Zvekić, 2017) ^[1]. During the chewing process, the lower jaw moves while the upper jaw remains stationary.

In addition to grinding, an essential role of chewing is the mechanical damage to the outer layers of fresh or dry grass, as well as grain feed. This process facilitates the action of various digestive juices (enzymes) when the food reaches the stomach and later transitions into the intestines.

Once a food bolus is formed in the oral cavity, it is reflexively moved toward the root of the tongue, triggering the act of swallowing. Swallowing itself is under neural regulation. Saliva plays a significant role in the final formation of the bolus. It is a mixture of secretions from

three pairs of salivary glands: The parotid (glandulae parotis), submandibular (glandulae submaxillares), and sublingual glands (glandulae sublinguales).

The secretion of the parotid salivary glands contains little mucin, but in contrast, it has a high concentration of sodium chloride and potassium chloride, along with various enzymes that aid in food breakdown.

The secretion of the submandibular salivary glands contains a significant amount of mucin and enzymes, forming a mixed secretion. In horses, and presumably in donkeys, this secretion contains few enzymes.

The sublingual salivary glands are primarily located in the front and rear parts of the tongue. In horses, there are no salivary glands in the posterior part of the tongue. The available literature does not provide information on whether this is also the case in donkeys, so it remains an assumption. Among the digestive enzymes in saliva, the most important are ptyalin (alpha-amylase) and maltase, whose primary function is the hydrolysis of food entering the oral cavity. The acidity (pH) of saliva varies widely, ranging from 4 to 11.

A very important component of salivary gland secretions is mucus, whose main ingredient is mucin. During chewing and bolus formation, mucus acts as a "glue," binding the finely ground food particles together. This ensures that the food mass becomes more compact and can be directed toward the esophagus through the act of swallowing.

The daily saliva production in donkeys is not known based on available literature. In horses, this amount can reach up to 40 liters per day. It has been determined that the amount of water consumed does not affect the rhythm of saliva production and secretion.

Swallowing (Deglutitions)

When a bite is formed in the oral cavity, this mass reflexively moves towards the root of the tongue and the act of swallowing follows. Swallowing itself is under nervous regulation.

A bolus is a finely ground and moistened mass of food that, through the act of swallowing, moves from the oral cavity, through the pharynx, into the esophagus, and then reaches the stomach. The swallowing process consists of three phases:

- Oral phase:** The bolus is pushed toward the base of the tongue. The oral cavity is closed, and the lower jaw remains motionless.
- Pharyngeal phase:** The bolus must pass through the pharynx, a hollow organ located between the oral cavity and the esophagus. The pharynx serves as a crossover point for air and food pathways, preventing their mixing. This phase of swallowing is reflexive.
- Esophageal phase:** Once the bolus enters the esophagus, peristaltic movements of the esophageal muscles are activated. The esophagus expands in front of the bolus, while the muscles behind it contract, propelling the bolus toward the stomach.

The esophagus serves as a passage from the oral cavity to the stomach. Liquids (water) and liquid food pass through the esophagus due to gravity and as a result of increased pressure in the oral cavity (Аксенова, Осипов, 2013) ^[8]. Solid food boluses move toward the stomach through the activity of esophageal muscles. Smooth muscle fibers appear in the first third of the esophagus and are present

throughout the digestive tract until the very end, where they are completely replaced by striated muscle fibers.

Esophagus

The esophagus is a conduit tube that connects the oral cavity to the stomach. Liquids (water) and liquid food pass through the esophagus by the force of gravity and as a result of increased pressure in the oral cavity (Aksenova, Osipov, 2013). Solid food boluses are moved toward the stomach by the activity of the musculature. Smooth muscle fibers appear in the first third of the esophagus and are present throughout the entire digestive tract until near the end, where they are completely replaced by striated muscle fibers.

The muscular layer of the esophagus is made up of two layers of muscles:

- Internal:** In this part the muscle fibers are placed in a circle (**stratum circulare**).
- External:** Here the muscle fibers are placed longitudinally (**stratum longitudinale**).

The inside of the esophagus is lined with a specifically constructed epithelium. There are no glands in it that would produce mucus to facilitate the passage of morsels through the esophagus. Therefore, it is very important that the salivary glands function well and soak the bite.

The mucosal layer, which lines the inside of the esophagus, is made of squamous epithelium. The mucous membrane has slight folds that allow the volume to increase during the passage of a bite, since then these folds are straightened.



Photo: M. Urošević

Picture 10: Clearly visible folds of the mucous membrane of the esophagus

When the bite enters the esophagus, the circular muscles in the wall of the esophagus expand caudally, in front of the bite, and increase the lumen, and behind the bite, cranially, they contract and push the bite towards the stomach.

As is known, donkeys consume coarse food, with a lot of cellulose fibers. Regardless of soaking with saliva and crushing in the oral cavity, this type of bite causes increased friction on the surface layer of the epithelium. Therefore, this layer is resistant to increased coefficient of friction.

The epithelium in the esophagus of a donkey is not keratinized (**epithelium stratificatum squamosum non corneifatum**). This fact indicates that no keratinous thickenings are formed on the surface of the esophagus epithelium, which would additionally protect the transitory, epithelial surface of the esophagus. The length of the esophagus of one male donkey was 43 cm.

The diameter of the cardiac part of the esophagus is about 2.5 cm (Urošević *et al.* 2025 a).

Stomach (Latin, *ventriculus*, Greek *gaster*)

A morsel passes through the esophagus and enters the stomach. A donkey has a simple stomach (**ventriculus simplex**). Basically, it is a muscle-glandular organ, created as an extension at the end of the esophagus, and at the

beginning of the intestinal system. It is an extension of the tubular organ of the digestive tract. Accordingly, the stomach wall has a complex structure and consists of 4 layers. Viewed from the inside to the outside, the walls are:

- mucous membrane (**tunica mucosa**)
- submucosa (**tunica submucosa**)
- muscle layer (**tunica muscularis**)
- serous coat (**tunica serosa**) – peritoneum.

In relation to the type and structure of the mucous membrane that covers the inside of the stomach, this one, in the case of a donkey, belongs to the group of complex stomachs, since its interior is lined, partly with skin, and mostly with glandular mucous membrane (Božić, Zvekić, 2017)^[1].

Immediately before the esophagus enters the stomach, a muscular sphincter is formed in the wall of the esophagus, which prevents the return of food from the stomach to the esophagus. The entry of the esophagus into the stomach is referred to as the cardia. The mucous membrane from the esophagus (**cutaneous**) enters the stomach and covers the cardiac part of the stomach. That part has no glands.



Photo: M. Urošević

Picture 11: The ratio of the surfaces of the cutaneous mucous membrane (white color) around the cardia and glandular mucosa with pronounced folds

The folds on the mucous membranes, both cutaneous and glandular, significantly increase the surface of the inside of the stomach. In this way, the number of secretory glands, whose secretion produces gastric juice, significantly increases on the glandular part of the mucous membrane. In relation to the function, the most important is the fundus part of the mucous membrane, where they are located:

- pepsinogenic glands - they secrete enzymes - pepsinogen, lab ferment,
- marginal or parietal glands - secrete hydrochloric acid
- neck or mucinogenic cells - they secrete mucin.

Gastric juice is produced as a product of cardiac, fundus and pyloric glands. This juice has a rather acidic reaction and the pH is 1.5-2.5.



Photo: M. Urošević

Picture 12: Stomach immediately after evisceration

The stomach of the male donkey with a height at the withers of 104.7 cm and a body weight of 109.00 kg, which can be seen in the previous photo, had a major curvature of 67.00 cm, a minor curvature of 21.00 cm and the diameter of the non-emptied stomach was 12.23 cm.

The second throat, male, whose height at the withers was 98.7 cm, and body mass 70.00 kg, had a stomach with a large curve of 57.5 cm and a small curve of 5.5 cm. The oblique length (from the most protruding cardiac part to the most protruding pyloric part) was 24 cm. (Urošević *et al.* 2025)

The part of the stomach that is located around the cardiac part is called the fundus (**pars fundica**). That part continues into the body (corpus ventriculi), and after the body, caudally, is the pyloric part (**pars pylorica**). The connection between the exit part from the stomach and the entry, continuation, into the small intestine (duodenum) is represented by the pylorus. And there is a muscular sphincter on it, the main role of which is to prevent the uncontrolled exit of stomach contents into the intestines.

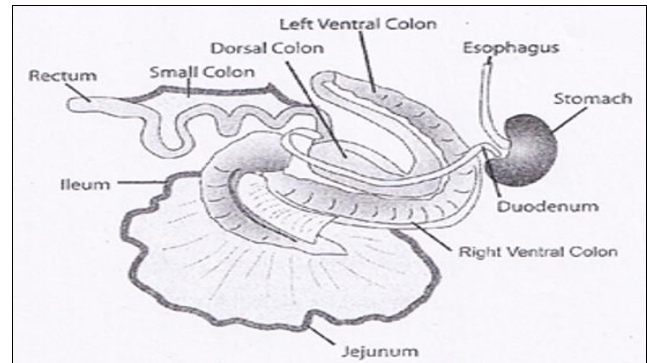
Food stays in donkeys' stomachs for a short time, 2-2.5 hours. This fact means that donkeys should be given food more often, but in smaller quantities. We must not forget where donkeys come from, namely the arid areas of eastern Africa. There is not enough or abundant food there, so the donkey has a genetically inscribed need to eat everything that is available to him. There is no mechanism of satiety and auto-blocking of food consumption.

As already pointed out, in the stomach of a donkey, there are basically two parts: Fundus and pylorus. The fundus part represents a place for storing food and in the wall of this part there is a weak muscular structure. In contrast to this part, the pyloric part has strong musculature and this part, with the movements of its musculature, conditions the emptying of the stomach, that is, the passage of food to the small intestine.

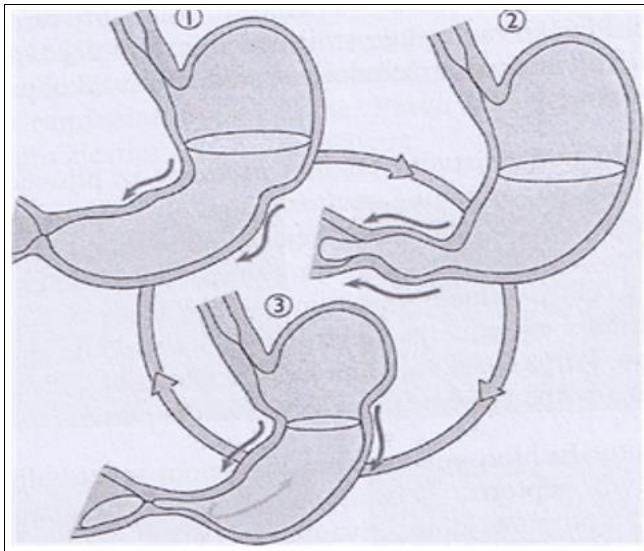
When food enters the stomach, it is subjected to the processes of dissolution and decomposition. Soluble substances are subject to dissolution, and ingredients with high molecular structures are subjected to the decomposition process.

Peristaltic muscle movements start from the cardia in the direction of the duodenum. The movements of the pylorus musculature allow the contents to be mixed and crushed. These movements have a rhythmic flow, every 15-20

seconds. When food enters the stomach, it moves from the stomach wall to its center. This is how food is decomposed, from the periphery to the center. In the central part, which is farthest from the glandular walls, it takes a certain amount of time for the gastric juice to pass through all the layers of stacked food. During this time, the digestive processes that began in the oral cavity continue in this central part. Mixing of food with gastric juice is done only in its pyloric part.

**Picture 13:** Schematic representation of the digestive tract of a donkey (Onyango *et al.* 2009)^[4]**Picture 14:** Digestive tract of a donkey, without esophagus (Foto: M.Urošević)

In order for the contents of the stomach to be pushed into the small intestine, it is necessary to open the pyloric sphincter. The opening or closing of the sphincter depends on the degree of acidity in the part of small intestine (duodenum). When there is a basic reaction in the duodenum, or a large amount of salt is present, the reflex opening of the sphincter occurs and food goes into the duodenum. Contrary to this process, when there is an acidic reaction in the duodenum, the pyloric sphincter automatically closes, and it remains closed until the moment when the reaction in the duodenum does not become weakly alkaline again.



Picture 15: Schematic representation of the digestive tract of a donkey (Onyango *et al.* 2009)^[4]

As stated by Božić and Zvekić (2017)^[1], the peristaltic wave starts in the front part of the stomach and spreads towards the pylorus (1). When the contractions reach the pylorus, the pressure in its lumen increases and a small amount of food goes into the duodenum (2). In the pyloric part, due to strong contractions, the pressure becomes higher than in the duodenum. When the peristaltic wave reaches the pyloric sphincter, it causes rhythmic contractions and periodically pushes the contents of the stomach into the duodenum (3).

Small intestine (Intestinum tenue)

After the stomach, the food, now quite changed in relation to the one from which a bite was made and entered the esophagus, continues its journey into the small intestine. The small intestine is the place where digestion and absorption processes take place. Liver (bile) and spleen products are excreted in the small intestine. In the mucous membrane of the small intestine, there are cells that secrete juices (enzymes) for digestion, which, with the help of bile and juice from the pancreas, participate in the digestion process.

Regardless of which part of the small intestine is being discussed, the walls of all sections share the same basic structure. Viewed from the outside inward, the intestine is surrounded by a serous membrane. Beneath this layer is the muscular section, which consists of two layers of smooth muscle fibers: An inner circular layer and an outer longitudinal layer. This muscular layer is responsible for intestinal motility.

Beyond the muscle layer, the innermost section is the mucous membrane. Inside the intestine, the mucous membrane forms intestinal villi (villi intestinales). These villi are most abundant immediately after the stomach, in the duodenum, and their number decreases in the caudal direction until they are absent in the large intestine.

The mucous membrane of the small intestine is wrinkled due to the presence of longitudinal and transverse folds.

The small intestine consists of three parts:

- a) **Duodenum:** This is the initial section of the small intestine, starting from the pylorus and extending to the jejunum. The caudal end of the duodenum is marked by the cranial border of the duodenocolic fold (plica duodenocolica). In donkeys, it can reach a length of up

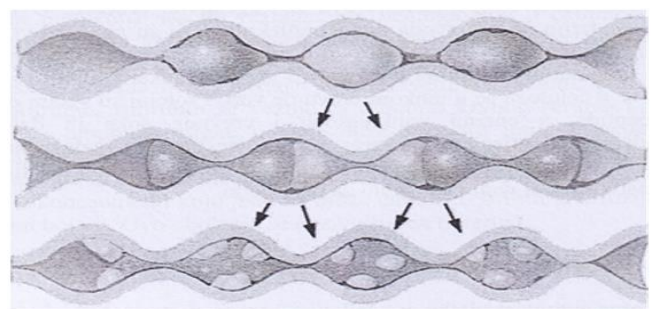
to 1 meter. The excretory ducts of the liver and pancreas empty into this section.

- b) **Jejunum:** The transition between jejunum and ileum is marked by the attachment of the ileocecal fold from the ileum to the dorsal ligament of the cecum. This ileocecal fold serves as a landmark to locate the ileum. In horses, the jejunum can reach a length of up to 20 meters, while in donkeys, one recorded case measured 8.37 meters (Urošević *et al.*, 2025). Most nutrient absorption occurs in this section. It is called the "empty intestine" because, after the animal's death, it is typically found empty.
- c) **Ileum:** This is the final part of the small intestine, which connects to the cecum. Unlike the jejunum, the length of the ileum in a male donkey with a jejunum measuring 8.37 meters was recorded as 31 cm. The wall of the ileum is slightly thicker than that of the jejunum.

Research conducted by Urošević *et al.* (2025) showed considerable variability in the total length of the small intestine in donkeys. The average total length was 952.00 cm, with a minimum of 712.00 cm and a maximum of 1,305.00 cm. The difference between the maximum and minimum lengths was 593.00 cm. It is noteworthy that the withers height of the examined donkeys differed by only a few centimeters.

One of the key characteristics of the small intestine is its motility (peristalsis). These rhythmic contractions of the intestinal muscles serve several functions:

- a) They facilitate the mixing of intestinal contents with glandular secretions (juices) involved in digestion.
- b) They bring fresh contents into contact with the absorptive surfaces of the intestinal mucosa.
- c) They enable the movement of intestinal contents toward the cecum.
- d) These mechanical contractions and relaxations aid in the circulation of blood and lymph in the intestinal wall.



Picture 16: Peristaltic contractions of the stomach (Božić, Zvekić, 2017)^[1]

Thanks to this activity, the intestinal contents are moved in a caudal direction toward the cecum. These contractions are influenced by the autonomic nervous system, which receives impulses from nerve cells located within the intestines. Behind the intestinal contents, muscle contractions occur in the intestinal wall, while in front of the contents, muscle relaxation follows, allowing the lumen of the intestine to expand. In this way, the contents (chyme) move caudally toward the large intestine (Intestinum crassum), the first part of which is the cecum.

Cecum (Cecum)

As a monogastric animal, the donkey has a well-developed cecum. The ileum, the final part of the small intestine,

empties into the cecum at its beginning. The site where the ileum enters the cecum is called the cecal base (basis ceci). The actual entry opening is known as the ileocecal orifice (ostium ileale). At this entry point, the mixing of contents occurs, initiating the digestion process within the cecum.

It is well known that donkeys have the ability to utilize coarse cellulose fibers, and the cecum plays a key role in this process. Donkeys belong to the group of animals characterized by postgastric fermentation (hindgut fermenters).

The wall of the cecum is not smooth but rather highly folded. The longitudinal muscular layer is concentrated in bands visible on the external surface as taenia, between which the caecal wall is ruffled into four rows of sacculations (haustra). There are also four taenia over the caecum, a medial, lateral, dorsal and ventral band, which diminishes towards the apex. This significantly increases the active surface area of the mucosa, which is composed of a single-layer cylindrical epithelium containing numerous goblet cells. Unlike the mucosa of the small intestine, the mucosa of the cecum lacks villi, but the numerous folds compensate by increasing the absorptive surface.

In addition to its digestive function, the cecum also plays a role in immune defense. The lamina propria contains numerous lymphatic vessels and nodes, which contribute to the organ's protective function.



Photo: M. Urošević

Picture 17: Appendix with clearly visible folds, at the top of the photo part of the column, also wrinkled

The cecum is quite large. In studies conducted by Urošević *et al.* (2025) on male donkeys, the length of this part of the digestive tract ranged from 65.0 to 88.0 cm. The cecum has a fermentative role. In a certain sense, it could be said that similar processes take place in the cecum of donkeys as in the rumen of ruminants. The processes occurring in the donkey's cecum include:

Breakdown of cellulose and other complex carbohydrates. These processes are made possible by the activity of specific microflora (bacteria and protozoa). Microbial fermentation leads to the production of volatile fatty acids (acetate, propionate, butyrate). These acids are crucial for biochemical processes and represent a primary energy source.

The resident microflora synthesizes B-group vitamins and certain essential proteins.

Water and electrolyte absorption plays a crucial role in maintaining the body's homeostasis.

Colon is divided into three parts:

- Ascending colon (colon ascendens seu colon crassum),
- Transverse colon (colon transversum) and
- Descending colon (colon descendens seu colon tenue).

Ascending colon (Colon ascendens) colon can be subdivided into four parts connected by three flexures (flexura pelvina, flexura diaphragmatica ventralis et dorsalis):

- Right ventral colon (colon ventrale dextrum),
- Left ventral colon (colon ventrale sinistrum),
- Left dorsal colon (colon dorsalesinistrum),
- Right dorsal colon (colon dorsale dextrum).

Ventral Colon (Colon ventrale)

After the processes in the cecum are completed, the contents are pushed into the next part of the large intestine—the first section of the colon, the ventral colon. The walls of the right and the left ventral colon are characterised by four bands (taeniae) with four rows of sacculations (haustra) between them, significantly increasing the active surface of the mucosa. Inside the intestine, the mucosa forms intestinal villi (villi intestinales).

At both its beginning and end, the ventral colon is somewhat narrower, while the remaining portion is approximately of uniform thickness. The width of the ventral colon in male donkeys was measured at 12.67 cm.

In this part of the large intestine, the mucosa is somewhat thicker than in the dorsal colon, with more pronounced folds. This increases the active surface area and enhances the absorption of nutrients. A particularly important function of this section is the absorption of short-chain fatty acids.

Regarding epithelial structure, most of the epithelium is cylindrical. It contains numerous mucous cells responsible for producing and secreting mucus, which protects the mucosa from mechanical or potential chemical damage.

Dorsal Colon (Colon dorsale)

Topographically, this part of the large intestine is positioned above the ventral colon. Unlike the ventral colon, this section of the large intestine has only one mesocolic longitudinal band, and its wall is nearly smooth. At the junction to the pelvic flexure three of the four bands disappear.

The thickness of the dorsal colon increases towards its ends, with the right dorsal colon being the thickest at its caudal termination (Simić, Janković, 1997)^[6]. After this expansion, the right dorsal colon suddenly narrows. In one examined male donkey, the width of this expansion was 15.75 cm, while the narrowest part measured 5.7 cm (Urošević *et al.*, 2025).

Compared to the ventral colon, the dorsal colon has a somewhat thinner mucosa. The folds in this part of the large intestine are significantly reduced. This section is where a more intensive absorption of water occurs, facilitating the formation of drier, more consistent feces. The mucosa contains mucous cells, but in smaller numbers compared.

Physiological Processes in the Colon

Several crucial physiological processes take place in the colon, which can be categorized into the following subgroups:

Cellulose breakdown: The breakdown of cellulose fibers occurs through microbial fermentation. In addition to cellulose, other complex carbohydrates are also decomposed by these processes.

Energy production: A key characteristic of donkeys is their ability to perform sustained work, which requires a steady energy supply. Their primary energy source is short-chain fatty acids.

Water and electrolyte absorption: This section of the digestive tract plays a critical role in absorbing water and electrolytes, which helps maintain hydration and homeostasis.

Feces formation: Until reaching this part of the digestive tract, the intestinal contents do not exhibit the characteristics of feces. Through water absorption, the intestinal content becomes drier, forming distinct fecal pellets. Several of these pellets accumulate and are expelled as undigested food residues through defecation.

The ventral and dorsal colon together form the large (thick) colon (colon crassum). The dorsal colon narrows significantly in its caudal region and transitions into the small colon. This section consists of two parts:

- a) Transverse colon (colon transversum)
- b) Small colon, or descending colon (colon descendens).

Before reaching the cranial opening of the pelvic cavity, the small colon (colon descendens) transitions—without a clear boundary—into the straight, rectal intestine.

The mucosa of the small colon contains significantly fewer folds compared to the previous sections of the large intestine. It is composed of simple columnar epithelium, which contains numerous mucin-producing cells that secrete mucus. In addition to these cells, the mucosa also contains other mucus-secreting cells. The secretions of these glands serve to protect the mucosa and facilitate the smooth passage of intestinal contents toward the rectum.

Physiological Processes in the Small Colon (Colon tenue)

Several important physiological processes occur in the small colon, including:

- a) **Water and electrolyte absorption:** This function is considered the primary role of this part of the large intestine. Excess water and electrolytes are absorbed from the intestinal contents, improving the consistency of the fecal matter and making it more compact.
- b) **Feces formation:** After the absorption of excess water and electrolytes, the fecal pellets are formed in this section.
- c) **Mucus secretion:** To facilitate the passage of intestinal (fecal) contents toward the rectum, the mucosal epithelium secretes mucus. This secretion helps ease the movement of feces while also protecting the mucosa from mechanical damage.

Rectum (Intestinum rectum)

This is the final section of the large intestine. Just before its termination at the anal opening, the rectum forms an enlargement known as the rectal ampulla (ampulla recti). The rectal wall lacks taeniae and haustrae. The muscular

layer is thicker compared to other parts of the intestine. The rectal mucosa forms transverse folds.

The mucosa of the rectum contains mucous glands, which secrete mucus to facilitate the passage of feces. The mucosal epithelium is composed of simple columnar cells. Moving distally, there is a transition where the mucosa becomes stratified squamous epithelium. This type of epithelium is more resistant to friction and provides better protection against mechanical injuries.

Physiological Processes in the Rectum

The physiological processes occurring in the rectum can be classified into three main groups:

1. **Final feces formation:** If the fecal content still contains excess water, it will be absorbed in this section, giving the feces the necessary consistency.
2. **Feces storage:** The act of defecation does not occur immediately upon the arrival of fecal material in the rectum. Before being expelled into the external environment, feces are temporarily stored in the rectum.
3. **Defecation reflex:** For feces to be expelled, a sufficient quantity must accumulate in the rectum to trigger the defecation reflex. This process requires the relaxation of the internal anal sphincter, while simultaneously, the smooth muscle fibers in the intestinal wall contract. These contractions push the fecal matter toward the anal opening.

Anus

Anatomically, the caudal end of the digestive tract is represented by the anus. It is a short canal that terminates caudally at the anal orifice (orificium ani). Under normal conditions, this opening remains closed and only opens during defecation.



Photo: M. Urošević

Picture 16: Feces immediately after defecation

The wall of the anal canal is lined with a cutaneous mucous membrane, and it passes into the skin of the anus immediately in front of the opening and in the area of the opening. The mucous membrane is clearly separated from the skin. The opening and closing of the anal opening is regulated by the activity of the anal muscles, and there are smooth and striated ones.

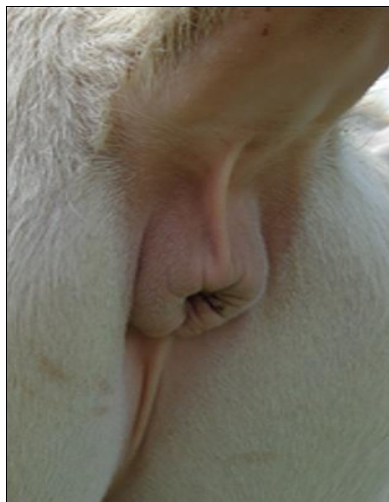


Photo: M. Urošević

Picture 17: Baroque (white) donkey. Position anus in males. Visible folds on the anal skin, they allow it to spread anus during the passage of feces



Photo: M. Urošević

Picture 18: A baroque, white donkey. Position anus in a female

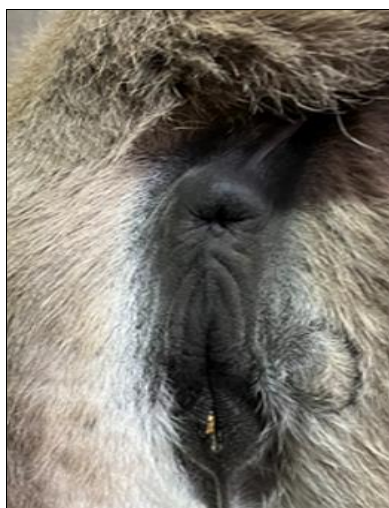


Photo: M. Urošević

Picture 19: Anal opening of darkly pigmented skin



Photo: M. Urošević

Picture 20: The beginning of defecation. Because of its folds the anal opening increases its diameter and enables the exit of feces

Smith and Wood (2008) state that the total length of the donkey intestine is about 24 m, and that the total volumetric capacity is about 160 liters. Individually, the stomach has a capacity of about 9% of the total capacity. The small intestine has a capacity of about 30%, the cecum 16%, the colon about 38% and the rectum about 7%.

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