https://doi.org/10.61308/WWRO8794

Searching for the Bulgarian donkey: Description, body measurements, population structure and distribution

Victoria Marincheva
University of Forestry, Faculty of Veterinary medicine, 1510 Sofia, Bulgaria
Corresponding author: natyarasa@abv.bg

Citation: Marincheva, V. (2025). Searching for the Bulgarian donkey: Description, body measurements, population structure and distribution. *Bulgarian Journal of Animal Husbandry, 62*(6), 42-54

Abstract: It is believed that the dominant donkey breed on the Balkan peninsula is the Balkan donkey – the term encompasses the population from Bulgaria, Romania, Serbia and other Balkan countries. However, each of these countries claim to have their own unique "Balkan donkey", irrespective of the heterogeneity of the animals. The present study deals with the characteristics of a Bulgarian strain, going in depth about its morphological profile and present day numbers. The profound political changes in the area around the end of the 20th century influenced significantly the distribution of livestock, and the future of indigenous breeds. Therefore, the need of a preservation program and the incorporation of better breeding strategies is also discussed.

Keywords: Bulgarian donkey; Balkan donkey; body measurements; population structure; distribution

INTRODUCTION

Donkeys have been used as valuable working animals since their domestication around 6 000 - 7 000 years ago in Northeast Africa (European Platform on Animal Welfare, 2019). The world population is estimated at 50.5 million donkeys and 7.9 million mules, predominantly distributed in undeveloped countries (Allan, 2021). According to FAO, the period 1961 – 1997 is characterized by a global trend for increase in the donkey population at a rate of ~1% per annum, whilst mule populations are in decline at a rate of ~2% per annum. The same trend is observed during the next report period 1997 - 2018 (Norris et al., 2021). The tendency can be explained by the increase of donkey numbers in specific regions like sub-Saharan Africa, the north of the Indian subcontinent, and the tropical highlands of Latin America (Starkey and Starkey, 2000). However, the situation is completely different in many European countries - the number of donkeys was reduced to more than 80% since the middle of the last century, due to mechanization in agriculture and transport (Camillo et al., 2018). The overall decline affected mostly Eastern European countries (Camillo et al., 2018), with the greatest reduction in population size reported for Bulgaria and Greece (Allan, 2021).

The name used to describe the population in Bulgaria is usually "local donkey", which does not belong to any specific breed (Vlaeva, 2021b). Kugler et al. (2008) mention that the term "Bulgarian Donkey" is found in literature, but it is rarely used within the country. There are several studies published (Barzev, 2001; Vlaeva et al., 2017; Vlaeva and Barzev, 2019; Vlaeva, 2021b), but no official standard and no breeding policies to set the basis for the development of a breed.

The purpose of the study is to analyze the processes that affected the overall distribution and numbers of donkeys on the Balkans, and specifically in Bulgaria. It offers insides to the characteristics of the local population through extensive description and body measurements in order to identify the traits that can reproduce a lost breed or develop a new one.

MATERIALS AND METHODS

Study farm

The survey was carried out in a middle sized donkey milk farm, near the capital of Bulgaria, during the period May - July of 2025. The business was privately owned, and functioned as a family enterprise oriented to direct clients. However, the owners were attempting to develop original products with donkey milk (like chocolate candies) and distribute abroad as well. It opened in 2020 with only 13 donkeys, but slowly increased the number. The facility was divided into a milking parlor, stable, storage areas and grazing fields. Milking was done once a day in the morning, using a specially designed machine for donkeys.

Study animals

Seventy donkeys were included in the study, among which 56 females and 14 males. According to the owner records, the age range was between 1 and 30 years. Animals were estimated according to several points, namely: age, gender, origin, body measurements and other exterior characteristics. For the sake of data analysis several groups were formed mostly on the basis of age and gender.

Body measurements

Generally the following body measurements can be estimated: head length, ear length, neck length, thoracic circumference, chest depth, chest width, front leg length, cannon length, cannon circumference, cannon height, withers height, back length, back height, hips width, body length, height at the rump, umbilical circumference together with many additional measurements (Andreev et al., 1993; Stanišić et al. 2020; Putra et al., 2021). Several of these may need further explanation like height at the withers (the distance from the top of the withers to the ground), height at the rump (the distance from the top of the rump to the ground), oblique body length (the distance between the point of the shoulder, corresponding to the outer and central tuberosity of the left humerus, to the left tuber ischii) and heart girth (the body circumference immediately posterior to the front leg) (Andreev et al., 1993; Vlaeva, 2021a; Vlaeva, 2021b).

Body measurements can be taken by measuring sticks, leather rulers, tape measures, and goniometers (Qin et al., 2022). During the study, a flexible meter was used to measure widths and circumferences, while a Lidtin rod was applied for heights. Animals were fixed with the help of one caretaker within a metal restraint facility with levelled ground surface; head was placed in a neutral position and legs were set equally apart. The conditions were familiar, and most of the donkeys were used to enter the facility by themselves, therefore, the manipulations caused minimal stress. The height at the withers and rump as well as oblique body length were estimated together with heart girth (chest circumference), chest width, head length and width, ear length, neck length, neck circumference up and down, pelvic width, cannon girth (cannon bone circumference) and tail length. Most were selected on the basis of citation frequency and recommendation in literature. Others were introduced by the author for the sake of a more detailed description of the population.

Questionnaire

A questionnaire was developed to analyze the reality in the study farm and a few other donkey farms, which happened to be a valuable tool for the estimation of present population numbers and distribution.

Statistical analysis

Statistics by Excel 2016 was utilized for the calculation of mean values and standard deviation.

Critical analysis

A comprehensive literature review was initiated on the basis of scientific resources - mainly the database of PubMed and Google Scholar - in order to allow comparison between results and already published information. Data was obtained from international and national resources like FAO Report on Working Equid Population (Allan, 2021),

FAOSTAT website for the years 2000 to 2018 (as no data is available for Bulgaria after 2018) in March 2025 (FAOSTAT), DAD-IS website, BFSA (Bulgarian Food Safety Agency) and Bulgarian Ministry of Agriculture and Food websites.

RESULTS

Origin

Most donkeys were collected from different regions of Bulgaria, and claimed to be from the Bulgarian donkey population. Eight females were imported from Romania.

Sample size

The farm possessed seventy donkeys total plus 3 newly born foals, which were not included in the present research. There were fifty-six females and fourteen males.

Age structure

Age range was between 1 and 30 years. The mean age for the group was 5.54 ± 5.41 years. There were thirty-seven animals aged up to 3 years, and most of them were born in the farm except for one, bought from another part of the country and another imported from Romania. This group (comprised of twenty-nine females and eight males) was characterized by a mean age value of 1.8 ± 0.82 years. The mean age in the female group was 6.1 ± 5.41 years with two older females aged 20 and 30 years, respectively. The mean age in the male group was 3.29 ± 5.18 years with one 20-year old male, and most of the representatives aged 1 to 2 years. Old animals (20+ years) were no longer used for milking or any other purpose. If these are excluded from the estimation, a normal distribution can be obtained. Therefore the mean age of productive females will become 5.41 ± 3.94 years, in males it will change to 2 ± 2 years, and the result for the whole group is calculated to be 4.75 ± 3.87 years.

Sex structure

There were fifty-six females and fourteen males. The 20 year old male was neutered.

Breed

All animals, except the ones originating from Romania, belonged to the "Balkan" or "Bulgarian" breed according to owners. The Balkan donkey is believed to be the dominant breed in the region with distribution to several countries (Kugler et al., 2008; Stanišić et al. 2020) Therefore, one of the points in this study was to find the existence or just the opposite – the absence of common features that correspond to the definition of a breed.

Breeding

There was no written breeding record available though most of the mothers and their progeny were known. Males were let to roam freely and perform natural insemination. The farm started with one male, then increased the number to two and later five. The last to be bought was a large sized animal, presumed to be from the local population, but having a lot in common with the popular breed Martina Franka. One male was neutered and was kept mostly as pet.

Body measurements

The mean value for the height at the withers was 111.14 ± 10.76 cm, with minimal and maximal values of 86 cm and 134 cm. Within the group of females, the mean value was 112.41 ± 11.16 cm with minimal and maximal values of 86 cm and 134 cm. In males, the mean value was 106.07 ± 7.88 cm with minimal and maximal values of 95 cm and 123 cm. Young animals up to 3 years of age were around 105.22 ± 8.57 cm tall with minimal and maximal values of 86 cm and 122 cm.

Oblique body length ranged from 78 to 144 cm with mean value of 109.6 ± 17.95 cm. Female measurements were between 79 to 144 cm with mean value of 113.5 ± 16.73 cm. In males, the oblique body length was between 78 and 123 cm with mean value of 94 ± 14.92 cm. Young animals had values between 78 and 126 cm with mean value of 96.41 ± 12.37 cm.

Heart girth (thoracic circumference) was measured at 121.36 ± 20.8 cm with range between 86 and 188 cm. The values among the categories were 124.05 ± 20.25 cm in females (range 86 to

171 cm), 109.14 ± 15.11 cm in males (range 93 to 152 cm) and 107.46 ± 12.5 cm in young animals (range 86 to139 cm).

Thorax width ranged from 15 to 34 cm with mean value of 23.94 ± 4.8 cm. In females, the mean was 24.71 ± 4.6 cm (range 15 to 34 cm), in males 20.86 ± 4.61 cm (range 15 to 29 cm), and 20.73 ± 3.84 cm in young animals (range 15 to 29 cm).

Head length (nose tip to occipital protruberance) measured 43.8 ± 5.36 cm and values ranged from 32 to 54 cm. The respective results in females were 44.64 ± 5.4 cm (32 to 54 cm), 40.43 ± 4.01 cm (35 to 49 cm) in males, and 40.32 ± 3.66 cm (32 to 47 cm) in young animals.

Head width (between the ears) showed the following results: 13.37 ± 2.73 cm (10 to 23 cm) in the whole group, 13.75 ± 2.91 (10 to 23 cm) in females, 11.86 ± 1.1 cm (10 to 14 cm) in males, and 11.92 ± 1.34 cm (10 to 15 cm) in donkeys up to 3 years of age.

Ear length corresponded to the following values: 27.34 ± 3.78 cm (16 to 35 cm) in the population, 27.84 ± 3.7 cm (16 to 35 cm) in females, 25.36 ± 3.67 cm (20 to 33 cm) in males, and 25.68 ± 2.95 cm (20 to 33 cm) in young.

The mean value for the neck length (first to last cervical vertebra) was 55 ± 8.21 cm with minimal and maximal values of 37 and 70 cm. In females, the mean value was 55.39 ± 8.22 cm with minimal and maximal values of 37 and 70 cm. In males, the respective results were 53.43 ± 8.57 cm (range 41 to 68 cm). In young animals, the mean value was 51.27 ± 8.11 cm (range 37 to 68 cm).

Neck was also measured in respect of circumference up and down with mean values of 55.7 ± 9.17 cm (range 39 to 80 cm) and 71.86 ± 11.68 cm (range 48 to 92 cm). In females, the results were 56.77 ± 9.49 (range 39 to 80 cm) and 73.73 ± 11.73 cm (range 48 to 92 cm). In males: 51.43 ± 6.9 cm (range 43 to 68 cm) and 64.36 ± 8.76 (range 52 to 85 cm). In young: 49.2 ± 5.33 cm (range 39 to 60 cm) and 63.41 ± 7.99 cm (range 48 to 80 cm).

The mean value for the height at the rump was 112.83 ± 10.72 with minimal and maximal values of 88 and 135 cm. In females, the mean value was 114.04 ± 11.19 (range 88 to 135 cm), in males was 108 ± 7.64 (range 97 to 124 cm), in young - 107 ± 8.58 (range 88 to 124 cm).

Pelvic width was measured between sacral protuberances. The mean value within the population was 32.54 ± 8.23 with minimal and maximal values of 18 and 48 cm. Sample results were as follows: 33.91 ± 8.24 cm (range 18 to 48 cm) in females, 27.07 ± 6.11 cm (range 19 to 39 cm) in males, and 26.89 ± 6.16 cm (range 18 to 41 cm) in young.

Cannon girth was 16.9 ± 3.15 cm with minimal and maximal values of 13 cm (in three 1 year old females) and 28 cm (in a large female). In females, the mean value was 17.16 ± 3.17 cm (range 13 to 28 cm), in males 15.86 ± 3.06 cm (range 14 to 26 cm), and 15.22 ± 1.66 cm (range 13 to 20 cm) in young animals.

Tail length (without the hairs at the tip) was 43.36 ± 7.3 cm with the shortest of 31 cm and the longest of 64 cm. Female tails measured between 31 to 64 cm (mean 44.25 ± 7.84 cm), male between 34 to 44 cm (mean 39.79 ± 3.09 cm), and 31 to 52 cm in young donkeys (mean 39.78 ± 4.86 cm).

Body indexes

Among many the following body indexes were selected (Barzev, 2009; Putra et al., 2021; Vlaeva, 2021a):

- body extension = body length /withers height;
- body ratio = rump height / withers height;
- massiveness = chest girth / withers height;
- compactness = chest girth / body length.

The body extension index ranged from 0.79 to 1.14 with mean value of 0.98 ± 0.1. The values below 1 and especially below 0.9 were calculated for the group of young animals. Body ratio ranged from 1 to 1.03 with mean value of 1.02 ± 0.01.

The mean value for the massiveness index was 1.09 ± 0.1, with a range of 0.88 in a 1 year old female and 1.46 in a 12 year old female. Values were generally closer to 1 or below in young animals, but the index was influenced neither by sex, nor by age group. The mean value for the compactness index was 1.11 ± 0.09, with a range of

0.92 in another 1 year old female to 1.37 in two adult females. Again, there was no correlation to sex or age.

Live weight

Live weight in donkeys is essential for good health care and estimation of productivity. Weighing with a balance is the most accurate way; however, it is difficult to be incorporated in field work. Therefore, alternative methods have been proposed in the literature. Among many the calculation through equations that include different body measurements seems most practical.

The body weight was extrapolated according to the Donkey Weight Estimator presented in "The Clinical Companion of the Donkey 2nd Ed." (Evans et al., 2022). The method is presented in Figure 1.The ratio between two body measurements was used – heart girt and height at the withers in centimeters. The body weight in the group of females was 189.87 ± 73.39 kg with minimum and maximum values of 67 to above 400 kg. In females above two years of age, the mean estimated body weight was 224.32 ± 57.85 kg, ranging from 145 to above 400 kg. The body weight in the group of males was 138.71 ± 63.2 kg with minimum and maximum values of 83 to above 325 kg. Only three males were above two years of age and their mean estimated body weight was 235 ± 79.37 kg ranging from 175 to 325 kg.

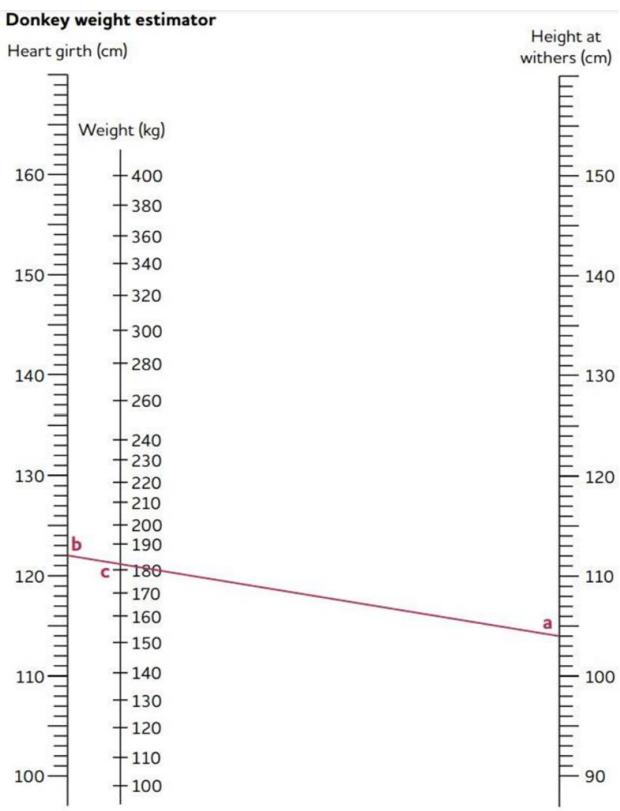


Figure 1. Donkey Weight Estimator according to "The Clinical Companion of the Donkey 2nd Ed." (Evans et al., 2022)

For donkeys up to two years of age, only the heart girth is used to help estimate the weight according to a table (Polidori and Vincenzetti, 2017). However, this method allows calculation for donkeys with heart girth up to 100 cm, while many animals were characterized by higher values. Therefore, these were estimated using the chart for donkeys above 2 years of age, which may result in a relative overestimation. Twenty-eight animals comprised the group with mean estimated body weight of 112.86 ± 27.45 cm. The lowest body weight estimate was 67 kg, while the highest reached 160 kg.

In order to compare the accuracy of above results, the following live weight estimation equation was also applied (Nininahazwe et al., 2017):

Estimated LW (kg) = 2.55 × heart girth (cm) - 153.49.

According to this formula, the mean body weight in females (irrespective of age) was 162.39 ± 51.62 kg, with minimal and maximal values of 65 and 282 kg. In males, the same calculation resulted in a mean value of 124.21 ± 38.57 kg, with minimal and maximal values of 83 and 234 kg.

Other exterior characteristics

Among other exterior characteristics, coat color and length were recorded to determine variation within the group. Fifty-four donkeys (77%) were described as having brown to dark brown coat color, with lighter markings around the eyes and muzzle. Four animals (6%) were fawn to fawn grey. One was estimated to have all the characteristics of the Martina Franka donkey breed concerning, not only the color, but also the body structure; however, it was not a pure bred animal, had no pedigree and originated from

Bulgaria. Another one exhibited black coloration with white markings around the eyes, and muzzle and greyish legs. Yet another had brown coat color with longer blondish hairs in the ears and sides of the thorax. Fifteen donkeys (21%) had pronounced dark brown cross on the back, and most of them were from the animals with lighter basic color; however, some were brown with darker back cross. Romanian donkeys were light grey with a back cross (2), greyish-brown with a back cross (2), brown with a back cross (1), solid brown (1), dark brown (1) and greyish-brown longhaired (1). All individuals lacked primitive markings covering the legs. The mane was short and upright and the tail finished with long dark hairs.

Number of donkeys in Bulgaria

According to a report from 2008, Bulgaria was among the European countries with the highest number of donkeys – 185 744; however, it was mentioned that the number of animals was not accurate due to unreliable governmental estimates (Kugler et al., 2008). The census from 1905 and 1910, published in the official journal of the National Statistical institute of Bulgaria, showed that the number of donkeys was 124 080 for 1905 and 118 488 for 1910. The number of hinnies was 11 947 and 12 238, respectively (Bobeva, 2019). Data from local authors (Vlaeva and Barzev, 2019) states that the number of donkeys in Bulgaria is constantly decreasing. It used to be around 348 769 in 1985 and fell to 35 000 in 2013. The same tendency was observed in mules – from 27 196 to 3 000 during the same period. The statistics from another study follow the recession after the democratic changes in the country. The number of donkeys decreased from 207 689 in 2000 to 90 000 in 2005, and then to 45 000 in 2010 and 35 000 in 2013. The number of mules was also subject to decrease with 15 539 in 2000, 9 500 in 2005, 4000 in 2010 and 3000 in 2013 (Vlaeva et al., 2017). Analysis of the FAOSTAT database resulted in different values. Starting from 2000, the number of donkeys used to be 207 689, 90 000 in 2005, 40 189 in 2010 and 18 500 in 2017. The number of mules ranged from 15 539 in 2000, 9500 in 2005, 3069 in 2010 to 1500 in 2017. Unfortunately, no data is available after 2018. It is important to note that the data is estimated, not official, probably due to lack of documentation.

The Ministry of Agriculture and Food issues statistical data about the country livestock annually. According to a report from 2010, there were 112 632 farms with ungulates. It was not mentioned if these were only horses or donkeys as well (Ministry of Agriculture and Food, 2010). An article form 2020 attempted to track the decrease in the number of farms for ungulates after the political changes in the 1990s, which was calculated at -81%; for example, 121 766 (2007), 51 232 (2010), 48 783 (2013) and 23 160 (2016) (Ivanov et al., 2020).

Some data can also be extrapolated from reports dedicated to meat production. However, horses and donkeys are listed together with bullocks under the section for small ruminants. According to the preliminary data from the monthly activity of the slaughterhouses processing red meat in 2024, there were 150.84 thousand slaughter animals, which resulted in the production of 3523.5 tons live weight and 1590.3 tons carcass weight (Ministry of Agriculture and Food, 2024a).

No information was available about donkey milk productivity in the report for the "Activity of the dairies in Bulgaria in 2024" (Ministry of Agriculture and Food, 2024b).

According to the official site of the Bulgarian Food Safety Agency (BFSA), the number of registered donkeys in 2025 was 286 plus 1 mule (BFSA, 2025). The data is presented in Table 1.

A survey was initiated among larger donkey farms, to check the number of animals. The information was collected through a questionnaire. Therefore, only farms whose contacts were available online were included. According to owners of the biggest one - situated in the village of Seliminovo - there were around 400 heads. Other farms possessed 70 (2 places), 40, 20 and 11 donkeys. Most of them were used for milk, but some were also bred for meat and entertainment. All were set as family business and depended on a

Table 1. Number of donkeys registered by the Bulgarian Food Safety Agency (BFSA)

	Number of donkeys	Donkey registration status	Province	Total number of farms
Donkeys registered under pasture husbandry	5	Meat production	Plovdiv	5
	3	Working animals	Blagoevgrad	5
	2		Pernik	
	2	Reproductive animals	Blagoevgrad	9
	5		Burgas	
	-		Kyustendil	
	2		Pernik	
	1	Not mentioned	Sofia	6
	5		Burgas	
	-	Meat production	-	-
Donkeys registered under farm husbandry	2	Working animals	Blagoevgrad	101
	30		Burgas	
	2		Gabrovo	
	2		Pernik	
	2		Ruse	
	60		Silistra	
	1		Smolyan	
	1		Stara Zagora	
	1		Vidin	
	60	Reproductive animals	Vratsa	107
	25		Pazardzik	
	22		Pernik	
	2	Mini donkeys	Kardzali	2
	5	Not mentioned	Burgas	51
	5		Lovech	
	3		Kardzali	
	31*		Sofia	
	5		Stara Zagora	
	2		Vratsa	
Mules	1	Not mentioned	Sofia	1

**For one of the farms it was noted that the number of donkeys was up to 10, so they were calculated as 10.*
Source: Authors' own elaboration

few or no external workers. Smaller farms were usually mixed and had 1 to 3 working animals. It is above the scope of this study to count individual animals in village yards. Eventually, the number of donkeys in bigger farms was at least 611 heads. A significant problem in the sector was the low level of identification. According to one owner, only 47% of his stock were officially registered, while on another farm, only 20% had microchips.

An official letter was sent to the Bulgarian Food Safety Agency (BFSA), inquiring about the actual number of donkeys in the country. According to the answer, there were 1130 livestock facilities with 1935 donkeys around June of 2025. The animals were distributed unevenly in the country, namely in the following regions: 274 Blagoevgrad; 82 Burgas; 64 Varna; 16 Veliko Tarnovo; 31 Vidin; 60 Vratsa; 27 Gabrovo; 3 Dobrich; 389 Kardzhali; 17 Kyustendil; 47 Lovech; 26 Montana; 24 Pazardzhik; 24 Pernik; 38 Pleven; 10 Plovdiv; 8 Razgrad; 56 Ruse; 16 Silistra; 391 Sliven; 45 Smolyan; 47 Sofia; 57 Sofia City; 21 Stara Zagora; 4 Targovishte; 59 Haskovo; 2 Shumen; 97 Yambol. However, even the authorities confess that many animals remain unregistered, therefore the real number is expected to be higher.

DISCUSSION

The donkeys from the investigated farm were collected from different regions of Bulgaria, and claimed to be from the local population. However, eight females were imported from Romania, which equals 11% of the population or 22% of the adult group (animals that were above 3 years of age, not born in the farm, origin from Bulgaria). None of the Romanian animals had pedigrees, therefore no specific breed could be mentioned. According to the owners, they did not thrive well, two died and the others had lower milk productivity.

The total number of donkeys was seventy, of which 80% females.

The age structure was characterized by a wide range between 1 and 30 years. More than a half (53%) were up to 3 years of age. Animals aged 10 years and up to 19 were 11 (16%). Three animals were 20 years old or above (4%). The actual age of older animals, especially those aged 10 years or above, was not known as they were bought to develop the farm, and it is the usual practice to lower the age in order to sell the animal. Furthermore, they often come with no documentation.

According to Vlaeva and Barzev (2019), the Bulgarian donkey population is characterized by uneven sex distribution and aging. Owners prefer females (58.7%) and neutered male animals (18.4%), as they are calmer and easier to manipulate. The mean age was calculated at 10 years, and young animals were only a small percentage – 4% up to 2 years, 12% between 2 and 4 years, 32% between 4 and 7 years, 58% between 8 and 15 years, 4% between 16 and 20 years and 2% 20 years. These results differ from the analysis of the farm, where more than a half of the animals were up to 3 years of age. The explanation lies in the farmer`s aim to keep as much females as possible from the progeny of her own mothers, and sell or exchange males only when the situation is profitable.

Body measurements and live weight are the most commonly used metrics in scientific research (Qin et al., 2022). Together with body indexes, they can be applied to determine the morphostructure of livestock animals (Putra et al., 2021). According to Popova (2022), body indexes are more accurate compared to separate body measurements for estimating the exterior. They can be used for the estimation of overall body development and aid the analysis of individual abilities related to speed, endurance and traction (Vlaeva, 2021a).

Donkeys in Bulgaria are still not selected on the basis of their milk productivity, though they are mostly used for this purpose. Milk productivity is above the scope of this study. Furthermore, documentation is incomplete. Probably a future study may aim at the correlation between body measurements, body indexes and the above mentioned productive trait.

The height at the withers ranged from 86 to 134 cm. Interestingly, the lowest and the tallest animals fell within the group of females. The standard deviation for the height at the withers was significantly high in the population, as a whole as well as in the separate groups denoting wide variation from the mean value. Oblique body length measurements were highly variable with significant standard deviation. The lowest value was found in males (78 cm), while the highest belonged to a female (144 cm). Heart girth measurements show significant variability with values between 86 to 188 cm. Standard deviation was less prominent in thorax width measurements, though values ranged between 15 and 34 cm. Animals seemed more uniform in respect to head length and width as well as ear length. Concerning neck measurements there were significant differences within the population and between the groups. Variation in height at the rump and pelvic width remain prominent. Cannon girth showed wider range in females, while in animals up to 3 years of age was more uniform. Tail length ranged between 31 and 64 cm.

It was noticed that the minimal and maximum values of most measurements were found in the group of females. Males were generally smaller in size compared to some larger females. All these massive females (maximum height at the withers and/or oblique body length) belonged to a dark brown strain originating from Bulgaria.

It can be concluded that body measurements were characterized by significant variation, which was more pronounced in females.

A scientific research undertaken by the Trakia University in Stara Zagora, Bulgaria, also focused on body measurements of donkeys from different regions of the country. Results exhibited mean height at the withers of 119.8 cm (range 99-148 cm), mean oblique body length of 124 cm (range 102-154 cm), mean chest circumference of 136 cm (range 115-160 cm) and mean cannon girth of 16 cm (range 13-20 cm). Authors concluded that donkeys from plain regions had higher and longer bodies (Vlaeva and Barzev, 2019).

It is worth comparing body measurements with results, published by other authors for the same population or other breeds that are believed to be closely related. As mentioned before the term "Balkan donkey" is widely used unofficially through the Balkan countries. The data is presented in Table 2. Some common tendencies can also be observed, though the overall population can be described as heterogenic.

Body indexes were more uniform in respect of body extension and body ratio. As a whole, the standard deviation was significantly low.

The ability to calculate body weight in donkeys is an important skill, which is connected to practical issues like dietary needs and correct application of medicines. It is a tool that should be used not only by veterinary specialists, but also by owners (Evans et al., 2022).

There is a significant difference in the body weight calculated by the two methods. The first one seems to overestimate, while the use of the equation probably underestimates. The most significant differences are observed in animals with higher body weight. In young animals, the results are almost identical. High values of standard deviation of estimated body weight can be explained by the variation in body size. There have been other calculations proposed by different authors, and again the problem is how precise these can be. For example, Pearson and Ouassat (1996) developed an equation on the basis of heart girth and body length, and claimed that the inclusion of a second body measurement increased the sensitivity of the prediction. Zhang et al. (2021) offered a best fitted regression model on the basis of several body measurements. However, it was noticed that the prediction equation used by the first authors either overestimated or underestimated the weight of the research animals in the second study. These were two different populations - Morocco working donkeys and the Chinese Dezhou breed. According to Quaresma et al. (2019), the tendency was to underestimate the live weight of larger frame breeds when using smaller frame breeds formulas. Zhang et al. (2021) concluded that the unsatisfactory results were due to

Table 2. Body measurements in the donkey (cm) – comparison between the present study and other authors

Authors	Height withers		Body length		Heart girth		Cannon girth	
	Males	Females	Males	Females	Males	Females	Males	Females
Present study	106.07	112.41	94	113.5	109.14	124.05	15.86	17.16
Vlaeva (2021b)	120.40	119.75	124.47	123.71	137.08	134.16	16.15	15.65
Vlaeva & Barzev (2019)	119.8		124		136		16	
Stanišić et al. (2015)*	103.3 – 104.9		110.3 – 117.2		114.2 – 119.6		-	
Stanišić et al. (2020)*	126	117.9	145	131.1	134	137.4	-	-

**The studied animals were divided into two groups.*
Source: Authors' own elaboration

applying a method, developed for a different population. Is it the same in the case of the Bulgarian local population? Probably yes as the two methods, selected for their practical advantages, eventually resulted in quite different measurements. Therefore, it is recommended to use such tables or equations only as a reference. Additional studies should be initiated to increase the accuracy of the calculations.

The predominant coat color in the investigated population was brown to dark brown, with lighter markings around the eyes and muzzle (77%). Another prominent feature was the presence of a dark brown cross on the back (21%), especially in animals with lighter basic color. Therefore, these traits can be accepted as commonly appearing in the population, and their frequency should be compared to other similar populations in order to create an exterior profile for the Bulgarian donkey.

The so called "Domestic Balkan donkey" inhabits the mountainous regions on the Balkan Peninsula. It is believed to originate from two ancestors: the Namibian donkey (*Equus asinus africanus*) and the Somalian donkey (*Equus asinus somaliensis*) (Bunevski et al., 2018). This is a common term used in all Balkan countries, though not scientifically accepted (Kugler et al., 2008).

According to Vlaeva and Barzev (2019), Bulgarian local donkeys are characterized by low stature, rough medium sized head with long ears, short straight muscular neck, even withers, even and elongated back, short and sloping croup, well developed thorax, short sturdy limbs with well outlined tendons and small hooves. Coloration may range from brown to grey, often with dark stripes on the back and shoulders in grey animals. Grey donkeys are usually of lower stance. Brown coloration was observed in 57% of the research animals.

Unfortunately, no exterior description was found about the Serbian Balkan Donkey. Stanišić et al. (2017) mention that the population is heterogeneous with difference in body size and coat coloration. Stanišić et al. (2020) described the Banat donkey as different morphologically from the middle sized Balkan donkey, not only by its larger body, but also by its lighter coat color and unique pigmentation with a cross on the back and black stripes on the legs, resembling those typical for Somali wild donkeys. There is no scientific data available about donkey populations in Romania. According to a short description in a site "the Romanian donkey is a breed of domestic donkey native to Romania", they are a small to medium-sized breed, typically ranging in height from 10-13 hands at the shoulder. They have a distinctive appearance, with a sloping back, short legs, and large, floppy ears" (Livestock of the world). Kugler et al. (2008) briefly mention Domaci Balkanski Magarac from Serbia, the Romania donkey population, the Greek donkeys known as the Arcadian donkey, the Ellinikon (local Greek Ass) and the Cyprus Ass. The last breed is described as large sized usually of dark brown to black color, short haired, with white markings at the belly, nose, mouth and around eyes.

The identification, classification and control of the breeding process of the local donkey population in Bulgaria lacks methodology as no breeding associations are found till the present day (Vlaeva, 2021b), and there is no financial support from the state (Ciganovic, 2019). In the past, donkey breeding sections were established near Yambol, Nova Zagora, Plovdiv and Samokov, in order to control reproduction and produce mules as working animals (Vlaeva et al., 2017), but lost their function during the economical cataclysms in the 1990s.

The situation is similar in the neighboring countries (Arsenos et al., 2010; Ciganovic, 2019). Distinguishing an indigenous donkey breed from Greece turned out to be almost a "mission impossible" as less than 5% of the estimated animals, possessed the distinctive morphological characteristics of the Arcadian donkey (Arsenos et al., 2010). Little is known about the Cyprus donkey breed as well, though it is briefly mentioned in internet sites. More information is available about the Serbian Balkan donkey as an endangered autochthonous breed, with sexually mature population size of 250-300 individuals (Stanišić et al., 2015).

The lack of a breeding goal (Vlaeva, 2021b) and the import of animals from abroad can explain the wide phenotypic variation observed in the local population of Bulgaria. Donkeys in the country were bred to correspond to the Mediterranean type. Breeding units probably used Martina Franca and Cyprus donkey jacks (Barzev, 2001). In the early 20th century, the Martina Franca breed was exported to countries like France, Germany, Poland, and others, suggesting potential export to the Balkan region as well (De Berardinis et al., 2024).

Concerning stock numbers, the data from sited articles and statistical analysis is generally controversial, therefore, the actual number of Bulgarian donkeys cannot be calculated. The situation is similar in neighboring countries. The donkey numbers from Greece continue to fall despite the import of animals for milking in the recent years (SAVE Foundation, 2013). Estimates from the country are also not reliable, as there is considerable variation between different resources. A decrease by 96% was reported between 1955 and 2005 (508 000 to about 21 000). The official data from 2007 showed 15 483 donkeys and 13 370 mules (Kugler et al., 2008). The donkey population in Romania had remained relatevely stable at about 33 000 for several decades (Starkey and Starkey, 2000). A nearby country with important economic connections to the European market like Turkey had seen a rapid decline in donkey population from 1.7 million in 1949 to 800 000 by 1996 (Starkey and Starkey, 2000) and 170 000 by 2014 (Camillo et al., 2018).

Obviously the data collection concerning the status of donkey breeds and numbers is challenging, which was also outlined in the report by Kugler et al. (2008). Scientists call for action, in order to save the existing breeds and increase donkey numbers in Europe.

The present study attempts to estimate the characteristics of the local donkey population in Bulgaria, in order to outline the perspective for a future breed. Of course, the sample size encompasses only one farm, but it is among the bigger and representative for the overall situation in the country. The main problems in donkey farming include lack of a breeding program, no selection goal, unproper documentation and import of animals from abroad. As mentioned above, the same issues are observed in other Balkan countries. Therefore, the solution lies in the joint effort of farmers together with veterinary specialists and officials.

CONCLUSION

The wide diversity in body measurements, body weight and other exterior characteristic makes it difficult to describe a uniform breed. Therefore, the term "population Bulgarian local donkey" seems reasonable. However, within this local population, two strains can be observed – one of smaller size like the Serbian Balkan Donkey and another of larger size, probably similar to the Banat Donkey or other large sized European breeds like Martina Franka. A significant problem is the lack of a breeding program and selective control that will allow the inheritance of desired traits. There is also no clarity about the exact number and distribution within the country. The Bulgarian donkey population has adapted to the specific conditions in the area, which makes it a first choice for investment by farmers. The biological basis for developing a breed is there. It is the responsibility of owners and specialists to make it happen.

Acknowledgements

Това изследване е подкрепено от Министерство на образованието и науката по Национална програма „Млади учени и постдокторанти – 2"/ This research is supported by the Bulgarian Ministry of Education and Science under the National Program "Young Scientists and Postdoctoral Students – 2".

REFERENCES

Allan, F. K. (2021). A Landscaping Analysis of Working Equid Population Numbers in LMICs, with Policy Rec-

ommendations. Brooke: Action for Working Horses & Donkeys and Supporting Evidence-Based Interventions, Royal (Dick) School of Veterinary Studies, University of Edinburgh. https://www.thebrooke.org/sites/default/files/Images/Equid_Population_Landscaping_Analysis.pdf. Accessed: 21.02.2025.

Andreev, A., Lozanov, V., Sinivirski, G., Venev, I., Ovesenska, L., Necov, N., Todorov, N., Gotev, R., Grigorov, I., Kabakchiev, M. & Nechev, P. (1993). Animal Husbandry. Textbook for agricultural schools. Publisher: *Dionysus* (Bg).

Arsenos, G., Gelasakis, A. & Papadopoulos, E. (2010). The status of Donkeys (Equus asinus) in Greece. *Journal of the Hellenic Veterinary Medical Society, 61*(3), 212 - 219. doi: 10.12681/jhvms.14888.

Barzev, G. (2009). Practical guide in horse breeding. Publisher: Tih Trud Ltd., Stara Zagora, 119, (Bg). ISBN: 954-8180-71-5.

Barzev, G. (2001). Donkey utilization in Bulgaria. Donkeys, people and development. A resourse book. *Starkey P. and Fielding D. (eds)*. ACP-EU Technical Center for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands, p 244. ISBN 92-9081-219-2.

BFSA (2025). Bulgarian Food Safety Agency Online register https://iisr.egov.bg/BABHRegsExt/pagesPublic/registers/registerAnimalDefault.xhtml?reg=61&locale=bg Accessed: 28.02.2025.

Bobeva, Z. (2019). Census of cattle, poultry and bees in Bulgaria in 1905 and 1910. Statistics 4. https://nsi.bg/sites/default/files/files/publications/Spisanie_statistika_br4_19.pdf. Accessed: 03.03.2025.

Bunevski, G., Nikitovic, J., Janzekovic, M., Mergedugh, A., Prishenk, J., Trjkovski, B. & Antic, M. (2018). Defining breed standards and breeding goals for domestic donkey. *Acta Agric. Seerbica, 46*, 213 - 221. doi: 10.5937/AASer1846213B.

Camillo, F., Rota, A., Biagini, L., Tesi, M., Fanelli, D. & Panzani D. (2018). The Current Situation and Trend of Donkey Industry in Europe. *Journal of Equine Veterinary Science, 65*, 44 - 49. doi: 10.1016/j.jevs.2017.11.008.

Ciganovic, N. (2019). Donkeys in north Macedonia, Bulgaria and Croatia – actual situation, new opportunities and business models for new future. https://donkey.mk/wp-content/uploads/2020/10/IO4-Donkey-farm-breeding-EN.pdf. Accessed: 25.03.2025

DAD-IS (Domestic Animal Diversity Information System) https://www.fao.org/dad-is/browse-by-country-and-species/en/. Accessed: 02.03.2025.

De Berardinis, A., Bucci, R., De Amicis, I., Del Signore, F., Parrillo, S., Massirio, I., Vignoli, M. & Carluccio, A. (2024) Phenotypic Characterization of the Martina Franca Donkey: An Endangered Italian Donkey Breed. *Animals (Basel), 14*(13), 1950. doi: 10.3390/ani14131950.

European Platform on Animal Welfare (2019). Guide to good animal welfare practice for the keeping, care, training and use of donkeys and donkey hybrids. https://food.ec.europa.eu/system/files/2021-03/aw_platform_plat-conc_guide_donkeys_en.pdf. Accessed: 20.10.2024.

Evans, L., Crane, M., & Preston, E. (2022) The Clinical Companion of the Donkey (2nd Ed.). The Donkey Sanctuary. Appendix 2: Donkey Weight Estimator. https://www.ivis.org/library/clinical-companion-of-donkey-2nd-edition. Accessed: 17.04.2025.

FAOSTAT https://www.fao.org/faostat/en/#data/QCL Accessed: 02.03.2025.

Ivanov, B., Popov, R., Bashev, H., Koteva, N., Malamova, N., Chopeva, M., Todorova K., Nacheva, I. & Mitova, D. (2020). Analysis of the state of agriculture and food industry (Bg). Agricultural academy. Institute for agricultural economics. https://sp2023.bg/media/com_dpattachments/attachments/com_content.article.pdf. Accessed: 28.02.2025.

Kugler, W., Grunenfelder, H. & Broxham, E. (2008). Donkey Breeds in Europe. Inventory, Description, Need for Action, Conservation. *Report 2007/2008*. https://www.doc-developpement-durable.org/file/Elevages/Anes/donkey%20(1).pdf. Accessed: 20.10.2024.

Livestock of the world:
https://www.livestockoftheworld.com/donkeys/Breeds.asp?BreedLookupID=2230&SpeciesID=7

Ministry of Agriculture and Food (2010). Census of agricultural holdings in 2010 (Bg). https://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Country_info_2010/Reports/Results_1/BGR_BUL_REP_2010.pdf. Accessed: 28.02.2025.

Ministry of Agriculture and Food (2024a). Preliminary data from the monthly activity of the slaughterhouses processing red meat in 2024. https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-zhivotnovdstvo/danni/. Accessed: 28.02.2025.

Ministry of Agriculture and Food (2024b). Activity of the dairies in Bulgaria in 2024. https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-zhivotnovdstvo/danni/. Accessed: 28.02.2025.

Nininahazwe, P. C., Sow, A., Roamba, R. C., Kalandi, M., Ahmed, H. D., Ouédraogo, G. A. & Sawadogo, G. J. (2017). West African donkey's liveweight estimation using body measurements. *Vet. World, 10*(10), 1221 - 1226. doi: 10.14202/vetworld.2017.1221-1226.

Norris, S. L., Little, H. A., Ryding, J. & Raw, Z. (2021). Global donkey and mule populations: Figures and trends. *PLoS One, 16*(2), e0247830. doi: 10.1371/journal.pone.0247830.

Pearson, R. A. & Ouassat, M. (1996). Estimation of the liveweight and body condition of working donkeys in Morocco. *Vet. Rec., 138*(10), 229 - 233. doi: 10.1136/vr.138.10.229.

Polidori, P. & Vincenzetti, S. (2017). Farm management and feeding strategies for donkey milk production. *Agricultural Research Updates,* 14. ISBN: 978-1-53610-344-1.

Popova, M. (2022). Comparative study of the body development of horses from the Breeds Polish Konik and Karakachan Horse. *Bulg. J. Agri. Sci., 28*(1), 91 - 96.

Putra, W. P. B., Aissanou, S., Dergal, N. B. & Ayad, A. (2021). Principal componentanalysis (PCA) in the morphostruc-ture of male Kabylie donkeys (EquusAsinus), Algeria. *Veterinaria, 70*(2), 197 - 208. doi: 10.51607/22331360.2021.70.2.197.

Qin, Q., Dai, D., Zhang, C., Zhao, C., Liu, Z., Xu, X., Lan, M., Wang, Z., Zhang, Y., Su, R., Wang R., Wang, Z., Zhao, Y., Li, J. & Liu, Z. (2022). Identification of body size characteristic points based on the Mask R-CNN and correlation with body weight in Ujumqin sheep. *Front Vet Sci. Sec. Animal Behavior and Welfare, 9*. doi: 10.3389/fvets.2022.995724.

Quaresma, M., Bacellar, D., Leiva, B. & Silva, S. R. (2019). Estimation of Live Weight by Body Measurements in the Miranda Donkey Breed. *Journal of Equine Veterinary Science,* 79, 30 - 34. doi: 10.1016/j.jevs.2019.05.014.

SAVE Foundation (2013). Added Value of Donkey Breeds in Europe. Project Report. http://www.agrobiodiversity.net/topic_network/donkey/Donkey/Donkey-ReportEN.pdf.

Stanišić, L., Dimitrijević, V., Simeunović, P., Lakić, N., Radović, I., Ivanković, A., Stevanović, J. & Stanimirović, Z. (2015). Morphological, biochemical and hematological characterization of endangered Balkan donkey breed. *Acta Veterinaria-Beograd,* 65(1), 125 - 136. doi: 10.1515/acve-2015-0010.

Stanišić, L., Aleksić, J., Dimitrijevic, V., Simeunovic, P., Glavinic, U., Stevanovic, J. & Stanimirovic, Z. (2017). New insights into the origin and the genetic status of the Balkan donkey from Serbia. *Anim. Genet., 48*(5), 580 - 590. doi: 10.1111/age.12589.

Stanišić, L., Aleksić J., Dimitrijevic V., Kovačević B., Stevanovic J. & Stanimirovic Z. (2020). Banat donkey, a neglected donkey breed from the central Balkans (Serbia). *Peer J., 3*(8), e8598. doi: 10.7717/peerj.8598.

Starkey, P. & Starkey, M. (2000). Regional and world trends in donkey populations. In: Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA). *ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA)*, Wageningen, The Netherlands, 244. ISBN 92-9081-219-2.

Vlaeva, R. (2021a). Body Indices of the "Local Donkey" Population in Bulgaria. *Journal of Mountain Agriculture on the Balkans, 24*(6), 78 - 90. ISSN1311-0489.

Vlaeva, R. (2021b). Characteristics of the main body measurements of male and female donkeys in Bulgaria. *Journal of Central European Agriculture, 22*(2), 280-284. doi: /10.5513/JCEA01/22.2.3153.

Vlaeva, R., Barzev, G., Georgieva, S. & Ivanova, I. (2017). Dynamics in the development of donkey population in Bulgaria. *Trakia Journal of Sciences,* 1, 56 - 59. doi: 10.15547/tjs.2017.01.009.

Vlaeva, R. & Barzev, G. (2019). About donkeys around the world and in our country (Bg). https://ezdapress.com/wp-content/uploads/2019/01/Za-magaretata.pdf. Accessed: 12.03.2025.

Zhang, Z., Zhan, Y., Han, Y., Liu, Z., Wang, Y. & Wang, C. (2021). Estimation of Liveweight from Body Measurements through Best Fitted Regression Model in Dezhou Donkey Breed. *J. Equine. Vet. Sci.,* 101, 103457. doi: 10.1016/j.jevs.2021.103457.

Received: **August 05, 2025**; *Approved*: **November 04, 2025; *Published:* December, 2025**