Scientific Papers. Series D. Animal Science. Vol. LXVI, No. 1, 2023
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

BODY CONFORMATION ANALYSIS THROUGH BIOMETRIC TRAITS OF AUBRAC CATTLE BREED

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Abstract

The purpose of this paper was to highlight the results of biometric measurements were performed on cattle of the Aubrac breed, exploited in Romania. Were measured a total number of 84 bovine, both adult females and bulls (12-18 months), in three farms in the region of Moldova. The highest recorded average for biometric parameters was: height at the withers (133.23 cm at females, 130.24 cm at bulls); rump height (140.78 cm at females and 130.46 cm at bulls); chest girth (202.15 cm at females and 204.22 cm at bulls); slantwise body length (159.64 cm at females, respectively 161.22 cm at bulls). Body conformation indices were calculated based on the obtained values. Cattle exploited within farm 2, show the most pronounced massiveness. Weight values between 553.21 and 603.13 were recorded in adult females and between 551.89 and 618.82 in bulls. As a general conclusion, we can state that the animals taken in the study, exploited in the three farms, present overall reports that denote a well-proportioned body development, within the specific morpho-productive type.

Key words*: beef cattle, biometric parameters, performances.*

INTRODUCTION

Aubrac cattle are a breed of cattle that originate from the Aubrac region of southern France. These cattle are known for their hardiness, adaptability to harsh conditions, and high-quality meat.

Physical Characteristics

Aubrac cattle are medium-sized with a weight of up to 1,000 kg for males and 650 kg for females. They have a light-colored coat, which can vary from yellow to dark red. They have a broad face, short but strong horns, and eyes that are usually surrounded by a black circle. Their body is muscular, with a well-rounded back and a deep chest (Mădescu et al., 2021).

Zootechnical Characteristics

The Aubrac breed is valued for its high-quality meat, which is tender and has a distinctive flavor. Additionally, these cattle are also used for milk production, as they have a high fat and protein content. They are also known for other characteristics, such as increased fertility, ease of calving, and adaptability to a variety of environmental conditions.

Aubrac cattle have a long lifespan, and they can graze on rough terrain that other breeds may find challenging. They are well adapted to living in harsh, mountainous regions and can thrive in forested areas. Due to their hardiness and adaptability, Aubrac cattle are often used in crossbreeding programs to improve the adaptability and hardiness of other breeds.

Popularity

Aubrac cattle have gained popularity in recent years outside of France, particularly in Europe and North America. The breed is known for its excellent meat quality and adaptability to various environments (Dransfield et al., 2003). Aubrac cattle can be found in several countries, including the United States, Canada, and the United Kingdom.

In recent years, the Aubrac breed has begun to gain popularity among Romanian farmers due to its special characteristics and superior meat quality. Several Romanian breeders started importing bulls and cows from France to improve their existing herds.

Body conformation is one of the main criteria for evaluating cattle from a zootechnical and economic point of view (Soulat et al., 2016). The term body conformation in cattle refers to the overall external appearance of the examined animal with reference to the development of each body region separately (Castilhos et al., 2018).

In cattle, body conformation differs depending on the direction of reproduction (meat, milk or mixed production). The analytical examination is based on the evaluation of each region of the body separately, in correlation with the development and functioning of the whole organism (Fonseca et al., 2017).
The synthetic examination is based on the evaluation of the animal as a whole, in correlation with its general development, harmony and proportionality of the whole organism (Stimbirys et al., 2016).
It is recommended that in each assessment of body conformation, the analytical examination should be completed with the synthetic examination, which consists in assessing the proportional development of all body regions, as well as how they merge with each other, depending on the morpho-productive type
The synthesis exam can be done by: free method; points method; body measurement method (biometric measurements)
By performing the synthesis test, it is possible to follow the way in which the animal develops in a certain time interval (for example from calving to maturity) and comparisons can be made between the characteristics of the breed.

MATERIALS AND METHODS

Body dimensions can be determined with various measuring instruments. Tools used: the zoometer for large body dimensions, the compass for small body dimensions, the metric tape for perimeters, the weighing scale for body mass (Mădescu et al., 2022).
The position of the animal during the measurements must be in a forced quadrupedal position, with the head and neck oriented in the normal position. Measurements may be made when the animal is outside or in the shelter.

Length measurements

Oblique trunk length - measured from the anterior part of the scapulohumeral joint (point of the back) to the posterior prominence of the ischial tuberosity (point of the buttocks), on which occasion it can provide information on body development and body shape;
Horizontal length of the torso - represents the distance, in the horizontal plane, between the tangent verticals at the point of the back and the point of the buttocks;
Chest length (depth) - represents the distance between the point of the back and the maximum convexity of the last rib, gives us indications on the development of the thorax and body capacity.
All these dimensions can be determined with the zoometer or compass (Ismail Awad et al., 2016).

Figure 1. Biometric measurements of adult female Aubrac cattle

Width measurements

Chest width - is the distance between the most prominent points of the ribs, measured immediately behind the shoulders. This measurement provides data on chest development and is determined by the zoometer.
Chest width - is the distance between the scapulo-humeral joints, taking as landmarks the lateral protrusions of the upper humeral extremities; gives indications on the development of the previous train.
The width of the croup - provides information on the development of this region, the degree of muscular dressing and is determined in three points:
- at the hips and represents the distance between the external angles of the iliac bones;
- in the coxo-femoral joints and represents the distance between the most prominent points of the coxo-femoral joints;
- in the ischium and represents the distance between the two sciatic protuberances.
The width of the head (forehead) is the distance between the external points of the orbits and gives us indications on the morpho-productive type. All these measurements are determined with the zoometer or compass.

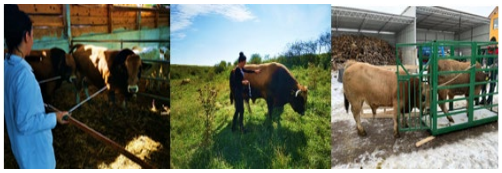

Figure 2. The measurement of the main body dimensions in the studied bovine populations

Perimeter measurements

The perimeter of the thorax is determined with the ribbon, immediately behind the shoulders and gives us indications on the development of the thorax, body capacity and the body as a whole (Paula et al., 2013).

The perimeter of the whistle is determined with the ribbon, on the left front limb, in the area where the whistle is thinner; it correlates with the degree of skeletal development.

Figure 3. Perimeter measurements

Interpretation and use of data - This is done by expressing the results of the measurements in absolute values, in relative values and in body indices.

RESULTS AND DISCUSSIONS

As part of the research, biometric measurements were performed on adult cattle, females and males aged between 12-18 months, from the Aubrac breed operated in 3 farms in Romania. The following biometric parameters were monitored: height at the withers, height at the rump, oblique length of the trunk, length of the rump, width of the forehead, width of the chest, width of the chest, depth of the chest, thoracic perimeter, perimeter of the whistle, width of the rump.

Based on the values obtained from the biometric measurements,the following body conformation indices were calculated: body shape index (I.f.c.%),chest depth index(I.a.t.%), massiveness index (I.m%), height difference index (I.d.i.%), skeleton index (I.o.%), head size index (I.m.c.%), cephalic index (I.c.%), thoracic index (I.t%), basin index thoracic (I.b.t.%), pelvis-pectoral index (I.b.p.%), robustness index (I.r.%), dactylo-thoracic index (I.d.t.%), whistle loading index (I.i.f.%).

Body indices represent the relative values, obtained by relating some dimensions to others, with which they are closely related anatomically and physiologically. These relationships of interdependence between the different body dimensions, serve to a greater extent to the overall appreciation, to the characterization of the type of co-formation and production of the animals.

The value of the same body index varies depending on the morpho-productive type, race, sex and age. In some cases, the value of some indices allows us to appreciate whether an animal has developed normally or not during the growth period.

Results regarding the average values of the main body dimensions, measured on the herds of adult Aubrac females, exploited in the studied farms.

The obtained results were expressed with the help of absolute values, which represent the real value of body dimensions and mass, expressed in physical units (cm or kg). These values give us indications on the general development of the animals and on the uniformity or variability of different characters within a population and on the assessment of the productive abilities of an animal.

Were measured 14 cattle from the Farm 1, 32 from the Farm 2 and 27 from the Farm 3.

In Table 1 are presented the average values on the farms, obtained after the statistical processing of the measurements performed.

Table 1. Average values of the main body dimensions measured on adult Aubrac females, raised on the studied farms

Monitored parameters (cm)	Sample statistics	Farms		
		Farm 1	Farm 2	Farm 3
		n = 14	n = 32	n = 27
Height at the withers	x	**129.10**	**133.23**	**135.46**
	± sx	0.81	0.97	0.91
Height at the rump	x	**137.28**	**139.14**	**140.78**
	± sx	0.53	0.84	0.52
Oblique length of the trunk	x	**149.45**	**159.64**	**157.91**
	± sx	1.12	1.28	1.01
Length of the rump	x	**43.23**	**42.41**	**45.72**
	± sx	0.42	0.48	0.47
Width of the forehead	x	**22.44**	**22.79**	**24.21**
	± sx	0.40	0.56	0.53

Monitored parameters (cm)	Sample statistics	Farms		
		Farm 1	Farm 2	Farm 3
		n = 14	n = 32	n = 27
Chest width	x	**45.36**	**48.34**	**47.11**
	± sx	0.82	0.87	0.52
Thorax witdh	x	**78.72**	**80.19**	**81.28**
	± sx	0.24	0.48	0.36
Depth of the chest	x	**95.22**	**96.63**	**98,42**
	± sx	0.32	0.59	0.33
Thoracic perimeter	x	**200.08**	**202.15**	**199.76**
	± sx	0.80	0.83	0.74
Perimeter of the whistle	x	**23.14**	**22.43**	**22.81**
	± sx	0.33	0.41	0.40
Width of the rump	x	**56.38**	**60.71**	**57.15**
	± sx	0.97	0.93	0.42
Weight (kg)	x	**552.21**	**602.13**	**581.60**
	± sx	8.01	12.82	9.45

The bovines exploited in Farms 2 and 3 have a more pronounced massiveness compared to those in Farm 1. Thus, the average body weights recorded for adult Aubrac cattle varied between 552.21 kg for Farm 1, 581.60 kg for Farm 3, and 602.13 kg for Farm 2.

The average values recorded within the three farms included in the study are represented for each biometric parameter analyzed. For example, the average values of withers height were obtained as 135.46 cm in Farm 3, 133.23 cm in Farm 2, and 129.1 cm in Farm 1.

Table 2. The average values of the main body indices, determined based on the biometric measurements carried out on adult female Aubrac cattle exploited in the studied farms

Monitored parameters	Sample statistics	Farms		
		Farm 1	Farm 2	Farm 3
		n = 14	n = 32	n = 27
I.f.c., %	x	**115.76**	**119.82**	**116.57**
	± sx	0.32	0.38	0.21
I.a.t., %	x	**73.78**	**72.52**	**72.66**
	± sx	0.22	0.48	0.30
I.m., %	x	**427.73**	**451.94**	**429.35**
	± sx	8.10	9.45	8.45
I.d.i., %	x	**106.33**	**104.44**	**116.57**
	± sx	0.08	0.55	0.19
I.o., %	x	**17.92**	**16.84**	**16.84**
	± sx	0.35	0.52	0.43
I.m.c., %	x	**33.49**	**31.83**	**33.75**
	± sx	0.78	0.76	0.59
I.c., %	x	**51.90**	**53.74**	**52.95**
	± sx	0.44	0.51	0.28
I.t., %	x	**82.67**	**82.99**	**90.90**
	± sx	0.76	0.89	0.78
I.b.t., %	x	**139.62**	**132.09**	**142.22**
	± sx	1.02	0.98	0.75
I.b.p., %	x	**84.98**	**79.62**	**82.43**
	± sx	0.25	0.56	0.32
I.r., %	x	**133.88**	**126.63**	**141.90**
	± sx	0.58	0.87	0.76
I.d.t., %	x	**11.57**	**11.10**	**11.42**
	± sx	0.49	0.53	0.23
I.i.f., %	x	**4.19**	**3.73**	**3.92**
	± sx	0.34	0.33	**0.78**

From the obtained values, it is observed that within Farm 2, higher average values were recorded for some indices such as the body format index (119.92%) and the massiveness index (451.94%). A higher value of the chest depth index is observed in the case of Farm 1 with a value of 73.78%, compared to Farm 3, where an average value of 72.66% was obtained. Within Farm 3, the highest average values were recorded for the height difference index (116.57%) and the robustness index (141.90%).

For example, it can be observed that the massiveness index recorded values ranging from 451.94% (Farm 2), 429.35% (Farm 3) and 427.73% (Farm 1). This is an index that illustrates the ratio between the animal's body weight and height, with higher values for meat breeds, and it also increases from birth to adulthood.

Additionally, within the study, biometric measurements were taken on adult males aged between 12-18 months from the Aubrac breed, which were raised on the same farms.

Table 3. The average values of the main body dimensions measured on the populations of Aubrac bulls raised on the studied farms

Monitored parameters (cm)	Sample statistics	Farms		
		Farm 1	Farm 2	Farm 3
		n = 2	n = 5	n = 4
Height at the withers	x	**125.08**	**130.24**	**129.52**
	± sx	1.63	1.05	1.24
Height at the rump	x	**127.31**	**133.62**	**130.46**
	± sx	1.52	1.35	1.43
Oblique length of the trunk	x	**148.96**	**161.22**	**155.62**
	± sx	1.84	1.62	1.53
Length of the rump	x	**36.74**	**38.73**	**37.99**
	± sx	1.58	1.12	1.43
Width of the forehead	x	**20.52**	**20.98**	**22.53**
	± sx	0.40	0.56	0.53
Chest width	x	**48.63**	**51.53**	**49.13**
	± sx	1.23	1.16	1.34
Thorax witdh	x	**80.72**	**82.99**	**83.85**
	± sx	1.72	1.96	1.76
Depth of the chest	x	**96.88**	**98.97**	**99.52**
	± sx	1.68	1.87	1.70
Thoracic perimeter	x	**201.92**	**204.22**	**200.74**
	± sx	1.24	1.53	1.39
Perimeter of the whistle	x	**24.78**	**23.63**	**23.26**
	± sx	0.89	1.01	0.98
Width of the rump	x	**57.01**	**59.98**	**58.14**
	± sx	1.49	1.58	1.46
Weight (kg)	x	**551.89**	**618.42**	**572.26**
	± sx	8.01	12.82	9.45

Additionally, the bulls raised on Farms 2 and 3 have a more pronounced massiveness compared to the individuals from farm 1 included in the study. Thus, the average body weights recorded varied between 551.89 kg (Farm 1), 618.42 kg (Farm 2), and 572.26 kg (Farm 3).

Regarding the oblique length of the torso, the bovine specimens from Farm 2 had the highest average of 161.22 cm, followed by the average of 155.62 cm from Farm 3, and the average oblique length of the torso recorded in the bulls from Farm 1 was 148.96 cm. Regarding the height at withers, the bulls raised on Farm 2 have the highest average height of 130.24 cm, followed by the bulls from Farm 3 with an average height at withers of 129.52 cm, and 125.08 cm for the males included in the study from Farm 1.

Regarding the thoracic depth, average values ranging from 83.85 cm for males from Farm 3 to 80.72 cm for males from Farm 1 were obtained.

Table 4. The average values of the main body indexes, determined based on the biometric measurements taken on Aubrac bulls raised on the studied farms

Monitored parameters	Sample statistics	Farms		
		Farm 1	Aubrac Butea	Aubrac Hălăucești
		n = 2	n = 5	n = 4
I.f.c., %	x	**119.09**	**123.78**	**120.151**
	± sx	1.12	0.89	0.85
I.a.t., %	x	**77.45**	**75.99**	**76.83**
	± sx	0.46	0.31	0.48
I.m., %	x	**440.51**	**474.83**	**441.83**
	± sx	10.55	8.48	9.15

Monitored parameters	Sample statistics	Farms		
		Farm 1	Aubrac Butea	Aubrac Hălăucești
		n = 2	n = 5	n = 4
I.d.i., %	x	**101.78**	**102.59**	**100.72**
	± sx	0.37	0.28	0.52
I.o., %	x	**19.81**	**20.44**	**17.95**
	± sx	0.42	0.23	0.37
I.m.c., %	x	**29.37**	**29.73**	**29.33**
	± sx	0.56	0.41	0.39
I.c., %	x	**55.85**	**54.16**	**59.30**
	± sx	0.36	0.43	0.41
I.t., %	x	**83.31**	**83.85**	**84.25**
	± sx	0.84	0.72	0.64
I.b.t., %	x	**141.58**	**138.36**	**144.22**
	± sx	1.24	1.03	1.06
I.b.p., %	x	**85.30**	**85.91**	**84.50**
	± sx	0.58	0.62	0.64
I.r., %	x	**135.55**	**126.67**	**128.99**
	± sx	0.94	0.93	0.84
I.d.t., %	x	**12.27**	**11.57**	**11.58**
	± sx	0.34	0.48	0.39
I.i.f., %	x	**4.49**	**3.82**	**4.06**
	± sx	0.29	0.21	**0.40**

Indices calculated based on the results obtained from biometric measurements can be particularly useful in assessing productive performance, especially in the case of cattle used for meat production. In the present study, it is observed that values of the bone index ranged from 20.44% in the case of bulls from farm number 2 to 17.95% in the case of males exploited within Farm 3. The bone index is an important indicator that can be a determining factor of carcass quality, influencing the meat-to-bone ratio.

Additionally, the average values recorded during the measurements carried out in the three farms included in the study can be observed. Regarding the robustness index, the bulls exploited in the first farm included in the study have the highest average of 135.55%, followed by the bulls exploited in Farm 3, where a robustness index average of 128.99% and 126.67% was recorded for males included in the study, respectively, the latter.

average being recorded in males taken from Farm 2. As a general conclusion, we can state that the animals included in the study, exploited in the three farms, present overall ratios that denote a well-proportioned body development, framed in the specific morpho-productive type.

CONCLUSIONS

As a general conclusion, we can say that the animals studied, exploited in the three farms, present overall ratios that denote a well-proportioned body development, framed in the specific morpho-productive type.

Biometric measurements are of particular importance in the study of beef cattle because through the exterior of the animals, we understand the totality of the external aspects of the animals' body that give us indications about their economic and zootechnical value. The scientific basis for assessing their economic value consists of the indissoluble link between function and form.

The body dimensions of Aubrac cattle can vary significantly between individuals, depending on the growth technology applied, the age of introducing young females to reproduction, the chemical composition of the administered diet, genetic factors, etc.

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