Comparison of Some Biometric Index Values in Anatolian Black Cattle Calves Raised in Different Locations

ÇAĞRI MELİKŞAH SAKAR[1]*, İLKER ÜNAL[1], YASİN ERGİDEN[1], UĞUR ZÜLKADİR[2]

[1] International Center for Livestock Research and Training, Mamak, Ankara, Turkey
[2] Selçuk University, Faculty of Agriculture, Department of Animal Science, Konya, Turkey

SUMMARY

In this study, some biometric index values of locally adapted Anatolian Black cattle raised in two different regions here defined as institute and village. The measurements were taken from the total of 829 animals in different growth periods such as birth (n=220), 3rd (n=208), 6th (n=206) and 12th month (n=195) of ages. In the study, a total of seventeen biometric indices were used to assess the general conformation of the animals as well as the development in the different regions. Examined biometric indexes were consist of Massiveness Index (MI), Area Index (AI), Height Index (HI), Height Slope Index (HS), Lateral Body Index (LBI), Pectoral Index (PI), Thoracic Index (TI), Length Index1 (LI1), Length Index2 (LI2), Chest Depth Index (CDI), Under Sternum Index (USI), Conformation Index (CI), Thoracic Development Index (TDI), Cannon Bones Index (CBI), Dactylo-Thoracic Index (DTI), Dactyl Costal Index (DCI) and Cannon Bone Load Index (CBL). Mostly of these values (MI, AI, LI2, CDI, PI, HS, CI, TDI) increase with the age of the animals, while some of them (LBI, USI, BI, DTI, DCI, CBL) decrease, and also there are also values (HI, TI, LI1) that are generally linear. In all examined periods, biometric indexes such as MI, AI, LI1, LI2, USI, HS, TDI, BI, DTI and DCI were found significantly higher in animals raised at the institute, while indexes like HI, LBI, TI, CDI, PI, CI, CBL were found significantly higher in animals raised at the village. The highest positive correlations were found between MI&AI, MI&TDI, PI&CDI, DTI&DCI and DTI&CBL values. On the other hand, the highest negative correlations were determined between MI&CBL, AI&DTI, AI&CBL, HI&HS, LBI&LI2, PI&USI, CDI&USI values. As a result, the indexes representing area and size were found to be higher in animals raised under Institute conditions, while the indexes determining long walks in mountainous and rough terrains were found to be superior in cattle raised in villages.

KEY WORDS

Biometric index, Anatolian Black Cattle, body measurement, conservation.

INTRODUCTION

The steady increment in the world population lead to increase importance of animal production[1]. In Turkey, cattle breeding has an important place in animal husbandry. While there are approximately 18 million cattle in Turkey, approximately 8% of these belong to local breeds. Domestic cattle are raised in rural areas, which is especially important for the evaluation of weak pasture areas. Among the domestic cattle breeds in Turkey, Anatolian Black cattle has the widest living area. This breed, which is mostly bred in rural mountainous lands in the Central Anatolian Region of Turkey, is known as a low-yielding breed. In general, meat and a little milk yield are used. They have adapted to unfavourable conditions in the regions where they are grown, and have gained resistance to harsh winters, drought, hunger, thirst and diseases[3,4].

Corresponding Author:
Çağrı Melikşah Sakar (melikksahi@gmail.com).

Considering the phenotypic characteristics of the Anatolian Black breed grown under these conditions, studies that reveal the descriptive and actual yields of the breed are insufficient. The need to characterize and document local animal populations has gradually gained global importance[5]. Since these animals are adapted to these regions, their characterization studies should be performed and evaluated. Zootechnical indexes provide information about the functional characteristics of animals, the definition of structure and proportions, and the breed, ability and production performance of the animal[5]. Body measurements of the cattle represent by different body conformation that important for selection criteria[6]. In addition, the body dimensions of the animal are important criteria in the selection of quality animals. Body indices are used to determine aptitude for certain services such as velocity, resistance and traction[7]. Indices such as Conformation Index, Body Ratio, Height Slope Index are relatively easy-to-measure indicators of skeletal development and these related to the health and resilience of animals.

In this study, it was aimed to determine the biometric index values of Anatolian Black cattle raised under the breeder con-

Table 1 - Number of Animals Examined by Region and Sex.

Region	Sex	BM	3M	6M	12M	Total
Institute	Female	48	44	44	38	174
	Male	65	60	60	60	245
Village	Female	51	50	48	47	196
	Male	56	54	54	50	214
Total		220	208	206	195	829

ditions and at the institute conditions at birth, 3, 6 and 12 months and also to compare the values between regions.

MATERIAL AND METHODS

Animal Material

The animal material of this study consisted of Anatolian Black (AB) cattle grown under protection in two different regions. These places are the "International Center for Livestock Research and Training (39°97 N, 33°10 E; elevation 826 m)" and "Osmansin village of Çamlıdere district of Ankara (40°43 N, 32°24 E; elevation 1175 m)". This breed has been conserved within the scope of the project "Conservation of Domestic Genetic Resources and Sustainable Use" conducted by the General Directorate of Agriculture Research and Policies (TAGEM).

Anatolian Black calves are raised with their dams from birth and they are allowed to suckle their dams freely. ABCs are not milked in the farm. Feeding of ABC breeds cows are two meals a day, morning and evening, ad libitum in the form of total mixed feed. 80% barley bales and 20% dry meadow grass as roughage are given to the AB cows.

Data Set

In the study, measurements were taken from a total of 829 AB calves born between 2015-2020 and these are shown in Table 1 in detail. Measurements made in the village were only taken in 2018. These measurement periods were birth, 3, 6 and 12 months of age. All animals measured in the herd were also recorded regularly information such as birth date, sex, maternal ear tag ID number and age.

Then, between the specified periods biometric indices were determined by means of linear statistics. Also, the calculations of the indexes obtained from this growth and development are shown in Table 2[5, 8-11].

Statistical analysis

The analyses of data were used Minitab 16 package programme[12]. The test of Tukey provided by Minitab was realized for multiple comparisons. All indexes were analyzed by using the following General Linear Model (GLM) procedure. The difference between the averages was tested by the «Tukey Multiple Comparison» test. The relationship between body indices was determined by «Pearson Correlation». This (GLM) formula;

$Y_{ijklmn} = \mu + a_i + b_j + c_k + e_{ijkl}$

Where; Y_{ijkl}: observed data;

μ: Overall mean;

a_i: i. effect of region (1:institute, 2:village);

b_j: j. effect of calf's sex (1:female, 2:male);

c_k: k. effect of dam age (2-3, 4-7, 8-10, 11+);

e_{ijkl}: random error.

RESULTS

In the study, a total of seventeen biometric indices were used to assess the general conformation of the animals as well as the development in the different regions. Biometric index values and P values in Table 3 were presented at BM, 3M, 6M and 12M in AB Cattle. Mostly of these values (MI, AI, LI2, CDI, PI, HS, CI, TDI) increase with the age of the animals, while some of them (LBI, USI, BI, DTI, DCI, CBL) decrease, and also there are also values (HI, TI, LI1) that are generally linear. The statistical differences between the biometric index values in the growth periods of the animals were generally found to be significant between the institute and the village, but insignificant between the females and the males with dam age values.

In the study, biometric index values according to regions and gender were prepared in graphics and presented in Figure 1. It has been explored to enable earlier ages assessment of animals and, the comparison of the breed by establishing a standard format. Then, the value of each index determined type and function.

In the study, phenotypic correlations between biometric indices values are presented in Table 4. Correlations were prepared as a single correlation, taking into account the data of a feature in all periods (BM, 3M, 6M and 12M). A total of 136 correlations were estimated using 17 biometric indices examined in AB's. Of these correlations, 123 (118 $P<0.001$, 5 $P<0.05$) were found to be significant, and 13 of them were found to be insignificant. Of these significant correlations, 58 were positive and 65 were negative.

DISCUSSION

The general body shape of animals is called conformation, and although environmental factors help shape the animal's body, it is mainly the result of many hereditary traits[7]. Most of the traits examined in study were not affected by maternal age. This may be due to the fact that AB calves raised both in the institute and in the village are kept free with all other calves from birth along with their mothers and the maternity ability is high in AB. In addition, it may be a factor that births in AB's are later than the culture breeds, so that the mother candidates complete the necessary size development.

In this study, the MI value of the animals in the institute was higher than the animals in the village and the values of the males were higher than the females in all periods. This may be an indication that the live weights of the animals and male animals in the institute and that their meat abilities are at a higher level. This value was found to be higher in males than females in Borgou cattle (2.43, 2.21; $P<0.01$) and in Ecuadorian Criollo Santa Elena Peninsula cattle (433.06, 310.35; $P<0.0001$) as in this study[13,7]. The same value was found to be higher similarly in males (2.92, 2.46; $P<0.001$ and 2.51, 2.25; $P<0.01$) in studies with Gudali cattle[10,9].

The AI value, like the MI value, appears to be higher in institute and male animals. This is an indication that these animals are larger in size. This value was found to be higher in males than in females in Wonosobo (5393, 4384) and Batur (5178, 4374) sheep[14].

The HI value was found to be less than 1.0 in both the institute and the village animals in all periods, this is due to the fact that the withers of the animals are lower than the rump. This

Table 2 - Indexes and Their Formulas Used in the Study.

Index Name	Abb.	Index Formula	Significance
Massiveness Index (Relative Weight Index, Compact Index, Index of Body Weight)	MI	live weight / withers height	As the values increase, meat-type characteristic of the animal increases. (Increases as the calf grow).
Area Index	AI	withers height × body length	The greater the index, the larger the animal. (Increases as the calf grow).
Height Index (Body Ratio)	HI	withers height / rump height × 100	If the withers are lower than the rump the animal is low in the front and vice versa.
Height Slope Index	HS	rump height - withers height	Positive: healthy posture quality
Lateral Body Index (Proportionality)	LBI	withers height / body length × 100	
Pectoral Index	PI	(withers height + rump height) / 2) / sternum height	When the back height is less than the space under the animal is considered “far from ground”, this being a trait that favors due to relatively long legs.
Thoracic Index	TI	body length / chest girth (thorax perimeter) × 100	TI>0.90: longilineal animal TI between 0.85 and 0.89: mediolineal animal TI<0.85: brevilineal animal
Length Index 1	LI1	body length / chest (thorax) depth x 100	
Length Index 2 (Relative Body Index, Body Length Index)	LI2	body length / withers height × 100	90>LI2<110: square body shape LI2>110: oblong body shape
Chest Depth Index (Relative Thorax Depth Index)	CDI	chest depth / withers height × 100	
Under Sternum Index	USI	sternum height / withers height × 100	
Conformation Index (Baron & Crevat, Anamorphosis Index)	CI	chest girth^2 / withers height	The greater the index, the more robust the animal. (Increases as the calf grow).
Thoracic Development Index	TDI	chest girth / withers height	DT>1.2: indicating animals with good.
Cannon Bones Index (Relative Cannon Bone Thickness Index)	CBI	cannon circumference (shin bone perimeter, front wrist girth) / withers height ×100	Animal robustness
Dactylo-Thoracic Index (Boniness Index, Chest Dactyl Index)	DTI	cannon circumference / chest girth × 100	Not exceed 10.5 in light animals DTI>10.8 in intermediate animals DTI>11.00 in slightly meat animals DTI>11.5 in heavy meat animals
Dactyl Costal Index	DCI	cannon circumference / body length × 100	
Cannon Bone Load Index	CBL	cannon circumference / live weight × 100	

value was found to be 1.0 in Borgou cattle[5] and 0.994 in Pantaneiro horses[7]. It is desirable that the HI value is close to 1, as it is an indication that a balanced animal has better production and better health, especially in rough terrain. The fact that the value of the animals in the village is higher than the ones in the institute indicates that these animals are genetically more resistant to long walks. Imbalance in this index may indicate a susceptibility to problems in the joints in the anterior and posterior limbs of the animal, thereby damaging the skeleton[7].

While the HS value of the animals in the institute was higher than those in the village in all periods, it is seen that the values of the female and male animals are close to each other. The fact that this value is close to zero is important for a healthy posture quality and may indicate that the animals in the village are more suitable for walking in rough terrain conditions. This value was reported as 3.79 in Pasundan cattle[6].

LBI value was found close to each other in general, both between regions and between genders. This value was found to be 91.51 and 86.40 in Guaymi Creole cattle[11,15]. The lower this value, the closer it is to the rectangle, which is a dominant shape in meat-producing animals.

While the PI value of the animals in the village was found to be higher than those in the institute in all periods, it is seen that the values of the female and male animals are close to each other. This may be due to the fact that the animals in the village have higher legs, just like the USI values. When the back height is less than the space under the animal is considered “far from

Table 3 - Biometric Index Values and P Values in Anatolian Black Cattle.

Factor	Period	General	P Values			R^2 (%)	CV
			P1	P2	P3		
MI	BM	0.290±0.0034	***	***	**	38.33	17.94
	3M	0.790±0.0115	***	NS	*	38.97	21.00
	6M	1.055±0.0140	***	**	NS	34.72	18.57
	12M	1.330±0.0258	***	**	NS	52.54	27.56
AI	BM	3066±29.92	***	**	**	16.95	13.34
	3M	6154±63.52	**	*	NS	6.33	12.71
	6M	8215±80.15	NS	**	**	0.00	11.86
	12M	9769±111.0	***	NS	NS	22.47	13.58
HI	BM	95.28±0.156	***	NS	NS	28.69	2.40
	3M	94.78±0.185	***	NS	NS	29.86	2.75
	6M	95.06±0.142	***	***	*	43.95	2.30
	12M	95.35±0.171	***	NS	NS	25.31	2.18
LBI	BM	115.90±0.802	**	NS	NS	4.16	8.58
	3M	93.90±0.667	NS	NS	NS	0.00	8.14
	6M	94.16±0.543	*	NS	NS	1.76	6.81
	12M	94.67±0.582	NS	NS	NS	0.00	6.33
TI	BM	90.57±0.581	***	*	NS	6.67	8.20
	3M	91.62±0.569	***	NS	NS	19.13	7.86
	6M	89.89±0.532	***	NS	NS	28.63	8.16
	12M	87.89±0.511	***	NS	NS	47.43	8.54
LI1	BM	238.8±2.753	***	NS	NS	39.94	18.24
	3M	246.6±2.404	***	NS	NS	29.87	13.72
	6M	233.7±2.386	***	NS	NS	21.30	12.98
	12M	229.2±2.643	***	NS	NS	14.25	12.36
LI2	BM	87.95±0.614	***	NS	NS	5.66	8.77
	3M	108.59±0.773	NS	NS	NS	0.00	8.18
	6M	107.49±0.673	**	NS	*	4.77	7.10
	12M	106.67±0.647	NS	NS	NS	0.00	6.27
CDI	BM	38.41±0.325	***	NS	NS	40.33	13.32
	3M	44.94±0.345	***	NS	*	35.01	10.57
	6M	47.14±0.376	***	NS	NS	12.29	9.79
	12M	47.83±0.464	**	*	NS	5.52	10.18
USI	BM	62.16±0.313	***	NS	NS	43.64	8.31
	3M	55.51±0.322	***	NS	*	35.01	8.74
	6M	53.49±0.365	***	NS	NS	19.20	8.78
	12M	52.98±0.445	***	NS	NS	13.48	9.29
PI	BM	1.672±0.0088	***	NS	NS	35.04	7.79
	3M	1.870±0.0128	***	NS	*	21.14	8.52
	6M	1.954±0.0147	NS	*	NS	5.93	8.52
	12M	1.979±.0.0189	NS	*	NS	1.62	9.33
HS	BM	3.461±0.125	***	**	NS	30.72	51.20
	3M	4.852±0.181	***	NS	NS	37.30	52.83
	6M	5.039±0.147	***	*	**	45.47	46.72
	12M	5.362±0.208	***	NS	NS	30.68	48.86
CI	BM	164.57±2.922	***	NS	NS	89.75	65.51
	3M	245.40±2.817	***	NS	NS	94.10	53.89
	6M	308.31±2.993	***	NS	NS	96.24	55.42
	12M	370.97±3.341	***	*	NS	97.60	55.71
TDI	BM	0.975±0.0046	***	NS	NS	30.44	6.79
	3M	1.192±0.0068	***	NS	NS	26.25	7.70
	6M	1.205±0.0065	***	NS	NS	47.27	8.14
	12M	1.224±0.0062	***	NS	NS	58.70	8.01
CBI	BM	13.60±0.087	***	***	NS	42.24	9.95
	3M	13.45±0.087	***	***	NS	26.67	8.64
	6M	12.81±0.087	***	NS	*	32.04	8.82
	12M	12.44±0.074	***	***	***	55.85	8.53
DTI	BM	13.96±0.073	***	***	NS	20.61	7.02
	3M	11.34±0.079	NS	***	NS	9.42	7.75
	6M	10.66±0.062	NS	***	NS	4.20	6.58
	12M	10.23±0.068	NS	**	**	9.20	6.61
DCI	BM	15.66±0.124	***	***	NS	22.65	10.60
	3M	12.49±0.082	***	***	NS	22.97	8.36
	6M	11.96±0.076	***	*	NS	23.91	8.15
	12M	11.74±0.092	***	***	**	39.13	9.67
CBL	BM	50.06±0.642	***	NS	**	11.33	16.07
	3M	18.73±0.299	***	NS	NS	17.31	18.55
	6M	13.09±0.202	**	NS	NS	3.23	16.44
	12M	10.39±0.182	***	NS	NS	37.67	21.31

P1:Region, P2:Sex, P3:Dam Age;
***:P<0.001, **:P<0.01, *:P<0.05, NS:non-significant
CV:Coefficients of variance, R^2: Coefficient of determination

ground", this being a trait that favours due to relatively long legs[7]. This value was found to be 0.572 and 0.584 in males and females, respectively, in Pantaneiro horses[7].

The TI is a measure of the proportionality of a breed[7]. While this value was found to be higher in the animals in the village than the animals in the institute in all periods, the values of females and males were found close to each other. In the study, while the animals in the village were found to be longilineal (BI 0.90) at all periods, the animals in the institute were found to be mediolineal (BI between 0.85 and 0.89) at the BM, 3M

Table 4 - Phenotypic correlations between body indices in Anatolian Black cattle.

Trait	MI	AI	HI	HS	LBI	PI	TI	LI1	LI2	CDI	USI	CI	TDI	BI	DTI	DCI
AI	**0.925** ***															
HI	-0.134 ***	0.004 NS														
HS	0.450 ***	0.334 ***	**-0.924** ***													
LBI	-0.634 ***	-0.683 ***	0.209 ***	-0.386 ***												
PI	0.527 ***	0.540 ***	0.160 ***	0.033 NS	-0.444 ***											
TI	-0.264 ***	-0.066 NS	0.149 ***	-0.208 ***	-0.344 ***	-0.039 NS										
LI1	-0.021 NS	-0.006 NS	-0.486 ***	0.411 ***	-0.376 ***	-0.602 ***	0.204 ***									
LI2	0.616 ***	0.657 ***	-0.228 ***	0.396 ***	**-0.989** ***	0.435 ***	0.356 ***	0.388 ***								
CDI	0.496 ***	0.537 ***	0.287 ***	-0.080 *	-0.428 ***	**0.978** ***	-0.070 *	-0.661 ***	0.418 ***							
USI	-0.496 ***	-0.537 ***	-0.286 ***	0.079 *	0.428 ***	**-0.978** ***	0.070 *	0.661 ***	-0.418 ***	**-1.000** ***						
CI	0.135 ***	0.348 ***	0.472 ***	-0.339 ***	-0.244 ***	0.473 ***	0.365 ***	-0.394 ***	0.224 ***	0.556 ***	-0.556 ***					
TDI	**0.815** ***	0.705 ***	-0.333 ***	0.546 ***	-0.738 ***	0.405 ***	-0.365 ***	0.239 ***	0.735 ***	0.365 ***	-0.364 ***	-0.046 NS				
BI	-0.116 ***	-0.303 ***	-0.437 ***	0.274 ***	-0.012 NS	-0.274 ***	-0.167 ***	0.423 ***	0.048 NS	-0.355 ***	0.356 ***	-0.613 ***	0.158 ***			
DTI	-0.753 ***	**-0.807** ***	-0.029 NS	-0.257 ***	0.653 ***	-0.536 ***	0.132 ***	0.067 ***	-0.624 ***	-0.561 ***	0.562 ***	-0.423 ***	-0.727 ***	0.552 ***		
DCI	-0.588 ***	-0.728 ***	-0.089 *	-0.152 ***	0.795 ***	-0.525 ***	-0.386 ***	-0.046 NS	-0.767 ***	-0.562 ***	0.563 ***	-0.559 ***	-0.510 ***	0.592 ***	**0.859** ***	
CBL	**-0.848** ***	**-0.892** ***	0.053 NS	-0.350 ***	0.771 ***	-0.568 ***	0.044 ***	-0.036 NS	-0.742 ***	-0.572 ***	0.572 ***	-0.356 ***	-0.780 ***	0.294 ***	**0.882** ***	0.793 ***

***:P<0.001 - **:P<0.01 *:P<0.05 NS:non-significant

Figure 1. Cont.

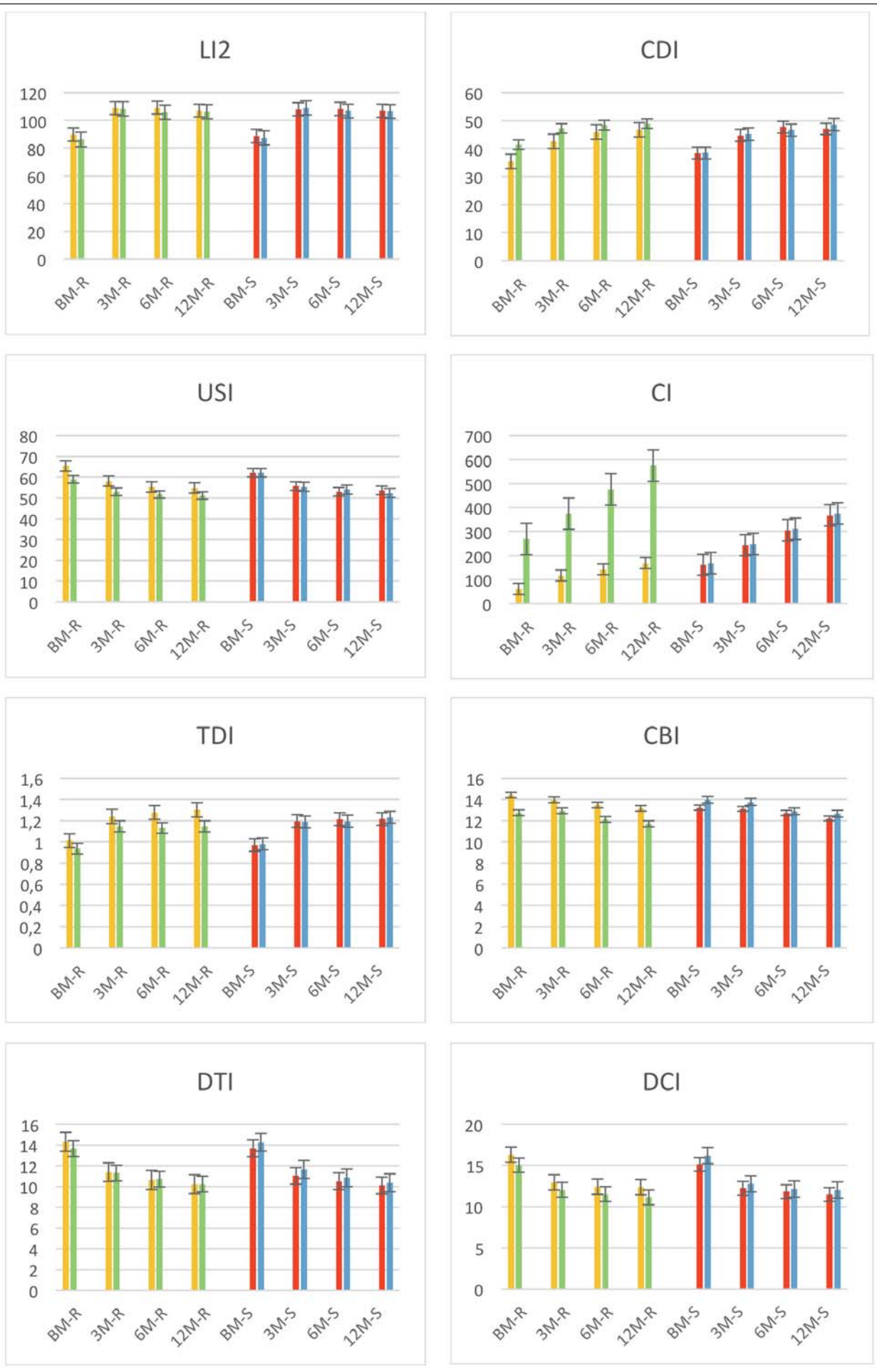
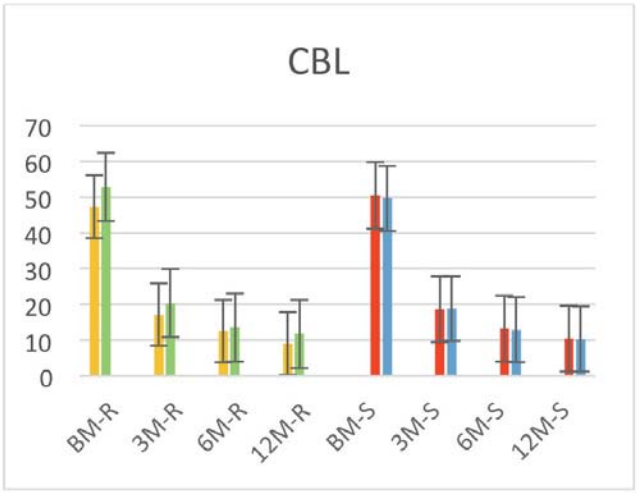


Figure 1. Cont.



Abbreviations:
BM-R:Birth month-region, 3M-R:3 month-region, 6M-R:6 month-region, 12M-R:12 month-region.
BM-S:Birth month-sex, 3M-S:3 month-sex, 6M-S:6 month-sex, 12M-S:12 month-sex.

The first four group; 1. bar=Institute, 2. bar = Village.
The second four group; 1. bar=Female, 2. bar = Male.

Figure 1 - Display of biometric index values by region and gender. Error bar shows the standard error mean of the values.

and 6M periods, and brevilineal (BI 0.85) at the 12M period. In addition, female and male animals were found to be longilineal in the first 3 periods and mediolineal in the 12M period. These findings indicate that the animals in the village are more suitable for speed and walking, and the animals in the institute are more suitable for strength. This value is found 0.77 in both males and females in Borgou cattle[5], 80.52 in Guaymi Creole cattle[11], 116.15 in females and 74.31 in males in Santa Elena cattle[13].

The LI1 value in all periods was found to be higher for the animals in the institute than for the animals in the village and the males than the females. In this case, it can be said that the animals in the institute have longer bodies. This value has been reported as 100.85 at 42 months of age and 100.05 at 60 months of age in beef cattle[8].

The LI2 value was generally found to be close to each other, both between regions and between genders. While this value was found to be lower than 90 in calves during the birth period, it was found to be close to 110 in the other 3 periods. This is an indication that calves have a shorter body in BM and their body lengthens proportionally with advancing age. This value was reported as 91.51 in Guaymi Creole cattle [11], 97.95 at 42 months of age in beef cattle and 98.85 at 60 months of age [8].

While the CDI value was found to be higher in village animals in all periods, it was found to be close to each other in males and females. In Guaymi Creole cattle 54.73[11], in Ecuador native cattle 51.52 in females, 47.74 in males (P=0.0229)[13], in Goudali cattle 48.8 in females, 48.3 in males[9] reported as. The mean CDI value, especially in females, is an indicator of skeletal thinness and its relationship with its suitability for milk production[13]. This value indicates that the population in the village has a dorsolumbar line with an increasing caudal slope that supports movement over rough terrain.

The USI value was found to be opposite to the CDI value and was higher in the animals in the institute, while it was found close to each other in females and males. This value was found to be close to each other in males (51.7) and females (51.2) in Goudali cattle[9].

While the CI value was found to be higher in all periods in the village animals than in the institute, it is seen that it is close to each other in female and male animals. This value is related to the health and resistance of the animals, which indicates that the animals in the village have a more robust conformation. While it was found 206.02 in males and 195.93 in females in Borgou cattle[5], gender differences were significant (P<0.01) in Pantaneiro horses[7].

TDI value, while the values of animals in the institute were higher than those in the village in all periods, it is seen that the values are close to each other in female and male animals. However, since the animals in the institute have TDI values below 1.2 in the BM and 12M periods, and the animals in the village in all periods, it cannot be said that the calves are in good thoracic development visually. In animals, a small thorax is associated with a lack of musculature and deficiencies in the cardiovascular system[7]. This value was found to be 1.29 in females and 1.31 in males in Borgou cattle[5].

The CBI value was found to be higher in the institute and male animals than the others. This is an indication that these animals are more robust. This value was found to be higher (P=0.0001) in males (14.91) and females (12.53) in Ecuadorian native cattle[13].

While DTI values in all periods were found to be close to each other between regions, the values of male calves were found to be higher than females. While the values of the animals in the institute and in the village were high in the UN, they decreased towards the age of 12 months and fell below 10.5. This may be an indication that AB animals have insufficient meat skills. This value, as in this study, was found to be higher in males (P=0.0001, P=0.01) in Ecuadorian native cattle (11.10, 9.88) and Goudali cattle (11.08, 10.46)[13,9], it was higher (P=0.01) in females (11.92, 11.29) in Borgou cattle[5].

DCI value was found to be higher than the others in the institute and male animals. This value is an indication that these animals have a higher value cannon circumference. This value, as in this study, were found higher (P=0.0001) males (44.60) than females (21.77) in Ecuadorian native cattle[13].

While the CBL value was higher in the animals in the village than the animals in the institute, it was found close to each other in males and females in all periods. This value was found to be higher (P=0.0001) in females (4.05) than males (3.39) in Ecuadorian native cattle[13].

Correlation Between Biometric Indices

Relationships between body measurements and live weight may vary depending on many factors, including the animal's age, breed and nutritional level [16]. For this reason, separate correlation values can be prepared for cattle breeds grown in different regions. In the study, the low level of correlation between the analyzed variables is indicative of the high underlying variability in this population[13]. This may be due to animals being raised using inappropriate selection criteria and breeding programs.

The high correlations are due to the low coefficient of variation for the traits measured and may be related to individual preferences of the technicians who took the measurements[7]. In the study, the highest positive correlation values were found between MI-AI, MI-TDI, PI-CDI, DTI-DCI and DTI-CBL. This is an indication that the indices determining the characteristics such as meat type, area coverage and size in AB cattle effect each other positively. When the literature data is examined, were found to be negative relations between TI-LI2 (0.72), CI-MI (0.62), DTI-Pelvic Index (0.61)[7], Longitudinal Pelvic Index-Rump Length Index (0.92), TDI-CI (0.90) and Transverse Pelvic Index-Witdh Slope (0.86)[6].

The highest negative correlation values also were found between MI-CBL, AI-DTI, AI-CBL, HI-HS, LBI-LI2, PI-USI and CDI-USI. This situation arises from the numerator/denominator relationship, which is generally used in the calculation of the index values of body measurements, and while a feature increases the value of an index, it can decrease its value due to being in the denominator of another feature. In the literature were found to be negative relations between LBI-LI2 (-0.99), Pelvic Index-Rump Length Index (-0.78)[7], HI-HS (-0.99), LBI-LI2 (-0.99) and TDI-Body Index (-0.82)[6].

CONCLUSION

Some biometric indexes of populations raised in two different regions were evaluated in this study, which was carried out with Anatolian Black cattle. According to the findings obtained, the animals raised in the Institute were found to have higher values in terms of features such as area, size and size, it can be said that the meat production abilities of these animals are at a higher level than those in the village. The cattle raised in the village, on the other hand, were found to be superior in terms of long walks in mountainous and rough terrain. According to the biometric index values, it cannot be said that the herd raised both in the institute and in the village is sufficient in terms of dairying characteristics. These results show that selection through biometric traits is possible in Native Black cattle and measures can be taken to increase the genetic potential of the breed.

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Conflict of Interest

The authors declare no conflict of interest.

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