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Research article

Body measurements of Bardhoka sheep breed from Albania

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Abstract: Bardhoka is an important three purpose sheep breed in Albania. Morphometric parameters of a 50 individuals unrelated and randomly selected were estimated for Wither Height (WH), Rump Height (RH), Body Length (BL), Chest Depth (CD), Chest Width (CW), Rump Width (RW), Chest Circumference (CC), Cannon Bone Circumference (CBC) and Body Weight (BW). The determined values of these body measurements were used to calculate the body development index (index of format, index of the chest, index of body weight, etc.). The average values of wither height is 71.76 cm. the body length is 73.76 cm and the rump heights were 69.36 cm indicating that Bardhoka sheep has almost a square body shape with the rump height slightly smaller than the wither height. The magnitude of correlation coefficient (r) indicated that body weight has high correlation with all body measurements, but the highest correlation was with CC (r = 1). Therefore, the body weight prediction from chest circumference alone or in combination with other body measurements would be a practical option.

Keywords: body measures, correlations, regression.

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Introduction

Bardhoka is one of the most important sheep breed in Albania with triple purpose characteristics: milk, meat and wool, with socio economic significance for the local farmer community. This breed is well adapted to the extensive and semi extensive farming system utilizing the pasture and grassland areas. A detailed description of this breed is previously done (Hoda and Marsan, 2012). Phenotypic characterization is used to identify and document diversity within and between distinct breeds, based on their observable attributes (FAO, 2012). Body measurements and live weight are used to define various characteristics of animals, breed identification and are the most commonly used criteria for scientific research and selection applications (Yilmaz et al., 2013). Shirzeyli et al., (2013) suggest that biometrical measurements can be used as indirect selection criteria It is very important to know the body mass of small ruminants for a good animal management, (Shirzeyli et al., 2013) and for breeding purposes (Sarti et al., 2003). Measurements such as wither height, body length, heart girth, rump height and width have been widely documented (Eyduran et al., 2009; Markovi'c, 2019; Stojiljkovic et al., 2015; Vavzic, 2017; Yilmaz et al., 2013).

The aim of this study is to characterize Bardhoka sheep breed with focus on morphometric analysis. The research will provide additional information on breed characteristics that is of great importance for biodiversity conservation.

Material and Methods

Morphometric traits of a total of 50 indivuals from "Bardhoka" sheep breed were recorded. The individuals were randomly selected from different flocks from the typical area of this breed. The measurements were performed according to the FAO (2012) guidelines, using Lydthin’s stick and flexible measuring tape, while scale was used for the body weight. Data were collected in May-June 2020. For each individual the following body measures were taken: Wither Height (WH), Rump Height

(RH), Body Length (BL), Chest Depth (CD), Chest Width (CW), Rump Width (RW), Chest Circumference (CC), Cannon Bone Circumference (CBC) and Body Weight (BW). Based on the body linear measurements respective body size indices were calculated as described by (Markovi'c, 2019)Markovic et al 2020. Descriptive statistics for the morphometric traits were obtained using Winstat software (Smith and Whitlark, 1994). The following values were calculated: the mean, standard deviation (SD), coefficient of variation (CV) and minimum (Min) and maximum (Max) values. In addition, the Pearson's correlation coefficients were calculated between the morphometric traits of investigated sheep breeds and morphometric indices as well. Live weight was regressed on each of the body measurements.

Results and Discussions

Basic statistics and standard errors (SE) for morphometric measures and body weight are shown in table 1. It can be observed that the values of the Standard Deviation and Coefficient of Variation are relatively small in majority of the observed parameters, which indicates a very uniform population in terms of morphological variability. There is a greater variance between animals in term of rump width (10.92%), followed by chest width (8.20%) and chest depth (8.02%). Bardhoka sheep have greater wither height than rump height. The average value of wither height is 71.76 and body length is 73.75, which indicate that this breed has a square body. (Simon et al., 1993) have used wither height as a prime indicator of type in beef, because it indicates long bone growth. Mean live weight and body characteristics values of Bardhoka sheep breed were similar to the values in other Balkan sheep breeds like Dubska(Vavzic, 2017), Istrian, Pivska and Sjenicka(Markovic et al., 2019).

The morphometric indices were used to describe the proportions among body parts of animals. Index of Body Frame (IBF) indicate how compact the animal is (Dauda, 2018). This value indicate that Bardhoka breed have squared body frame, similar to Bardhoka and Pivskapramenka obtained by (Markovic et al., 2019). According to (Peter and Egbu, 2016) this index is a useful indicator of the overall value of the animal and provides an accurate picture of type and function of ruminant animals. The value of chest index imply a good skeletal fitness of this breed, like most of Pramenka breeds. ITD value is close to 120 and CDI close to 45 indicating a good thorax development of Bardhoka. The baron crevet value obtained in this study is 102.326, indicating that this breed is not very strong. DTI also indicates thoracic development. It has a value of 9.630 indicating light individuals.

Table 1. The Basic statistics of body measurement

Type of trait	Mean±SD	CV (%)	Min	Max
WH	71.76±2.218	3.09	68	76
RH	69.36±3.968	5.72	65	89
BL	73.76±2.646	3.59	70	79
CD	32.18±2.584	8.03	26	42
CW	21.52±1.764	8.20	17	24
RW	23.04±2.514	10.92	19	30
CC	85.62±2.671	3.12	80	89
CBC	8.238±0.640	7.77	7	9.5
BW	53.404±1.870	3.50	47.5	55.6

WH: wither height, RH: rump height, BL: body length, CD: chest depth, CW: chest width, RW: rump width, CC: chest circumference, CBC: cannon bone circumference, BW: body weight.

Table 2. The basic statistics of morphometric indices of six sheep breeds

Indices	Mean±SD	CV (%)
IBF	102.86±4.57	4.45
CI	67.220±7.081	10.53
IH	103.71±5.551	5.35
CDI	44.850±3.374	7.52
ITD	119.412±4.944	4.14
DTI	9.630±0.804	8.35
BCI	102.327±6.742	6.59
RCBI	11.490±0.968	8.43
IBW	74.484±3.366	4.52

IBF: Index of body frame, CI: chest index, IH: Index of height, CDI: Chest depth index, ITD: Index of thorax development, DTI: dactyl thorax index, BCI: Baron-Crevat index, RCBI: Relative cannon bone index, IBW: Index of body weight.

The total phenotypic correlations among all morphometric measures for all animals is presented in the Table 3. The growth and development of Bardhoka sheep is reflected in the correlations between the morphometric measurements of the selected individuals. The correlation is one of the most common and useful statistics that describes the degree of relationship between two variables. Most of correlation coefficients are moderate positive. There is a very weak correlation between RH and WH with all measurements except of BW. High correlations are observed between BL and all the other morphometric measurements. Correlation coefficients may be affected by factors like age, sex, season, feeding condition (Shirzeyli et al., 2013). Body weight is a very important characteristic in animal husbandry due to selection criteria and economical profit (Cam et al., 2010). BW is highly positively correlated with all measurements BW showed full correlation (value 1) with CC. This is in consent with the finding of (Kunene et al., 2009; Mengistie et al., 2010).

Table 3. Pearson's correlation coefficients between the morphometric traits of investigated individuals

	RH	BL	CD	CW	RW	CC	CBC	BW
WH	0.233	0.136	0.332	0.288	0.199	0.125	0.011	0.875
RH		0.071	0.260	0.336	0.221	0.048	0.188	0.830
BL			0.845	0.854	0.806	0.952	0.875	0.951
CD				0.785	0.688	0.861	0.782	0.859
CW					0.756	0.888	0.789	0.886
RW						0.743	0.773	0.742
CC							0.861	1.000
CBC								0.860

The results obtained here are in concordance with the results obtained previously (Abera Feyissa et al., 2018; Abera et al., 2014; Cankaya et al., 2009; Mohammed and Kebede, 2013; Sowande and Sobola, 2008) who concluded that BW can be predicted from CG alone or in combination with other body measurements would be of practical use under the field conditions with a reasonable accuracy.Sabbioni et al., (2020) concluded that BW could be predicted by means of linear body measures in Cornigliese sheep with good precision and accuracy. Several authors (Cam et al., 2010; Lavvaf et al., 2012; Worku, 2019; Yilmaz et al., 2013) found positive correlation coefficient of body weight with most body measurements and concluded that the body weight could be predicted more accurately based on the dimension of various body measurements. Therefore, the high correlations values of BW with morphometric measurements can be used indirectly for the improvement of BW (Salamon et al., 2015) or to predict BW (Afolayan et al., 2006; Atta and others, 2004; Fasae et al., 2005). Stojiljkovic et al., (2015) concluded that positive correlations values between morphometric measurements indicate a balanced physical development and adaption of the sheep breed to the environmental conditions through the process of evolution. Afolayan et al., (2006) concluded that the relationships between body weight and body dimensional traits are influenced by other factors like sex differences, and type of birth, therefore adjustment for these factors is required to predict live weight using any of them or their combinations.

Da Costa (2014) concluded that many morphometric are useful to obtain indices in order to evaluate the conformation to be applied in screening programs. The results of correlation among morphometric indices are presented in Table 4.

Table 4. Pearson's correlation coefficientsamong morphometric indices.

	CI	IH	CDI	ITD	BCI	DTI	RCBI	IBW
IBF	0.025	-0.250	0.137	0.456	0.296	0.224	0.443	0.420
CI		0.085	-0.653	0.100	0.121	-0.082	-0.044	0.146
IH			-0.139	-0.165	-0.049	-0.066	-0.158	-0.006
CDI				0.160	0.168	0.140	0.236	0.155
ITD					0.940	-0.238	0.267	0.969
BCI						-0.313	0.164	0.913
DTI							0.871	-0.199
RCBI								0.288

The results revealed both positive and negative correlation among all indices. (Dauda, 2018) concluded that the positive correlation among the indices could be that the indices are controlled by same gene, meanwhile the negative correlation among the indices could be that there are likely to be inherited independently.

The simple regression equations of Bardhoka breed are shown in Fig. 1. The R^2 values from regression show that CC is the most highly related to body weight. Multiple regression equation for estimation of live weight from body measurements is: BW = 6.5 + 0.001495 RW - 0.007831 WH - 0.1162 RH - 0.027 BL + 0.01701 CD + 0.09095 CW + 0.6301 CC + 0.1243 CBC, where R2 - 0.91; R^2 adjusted = 0.953, RMSE = 0.404.

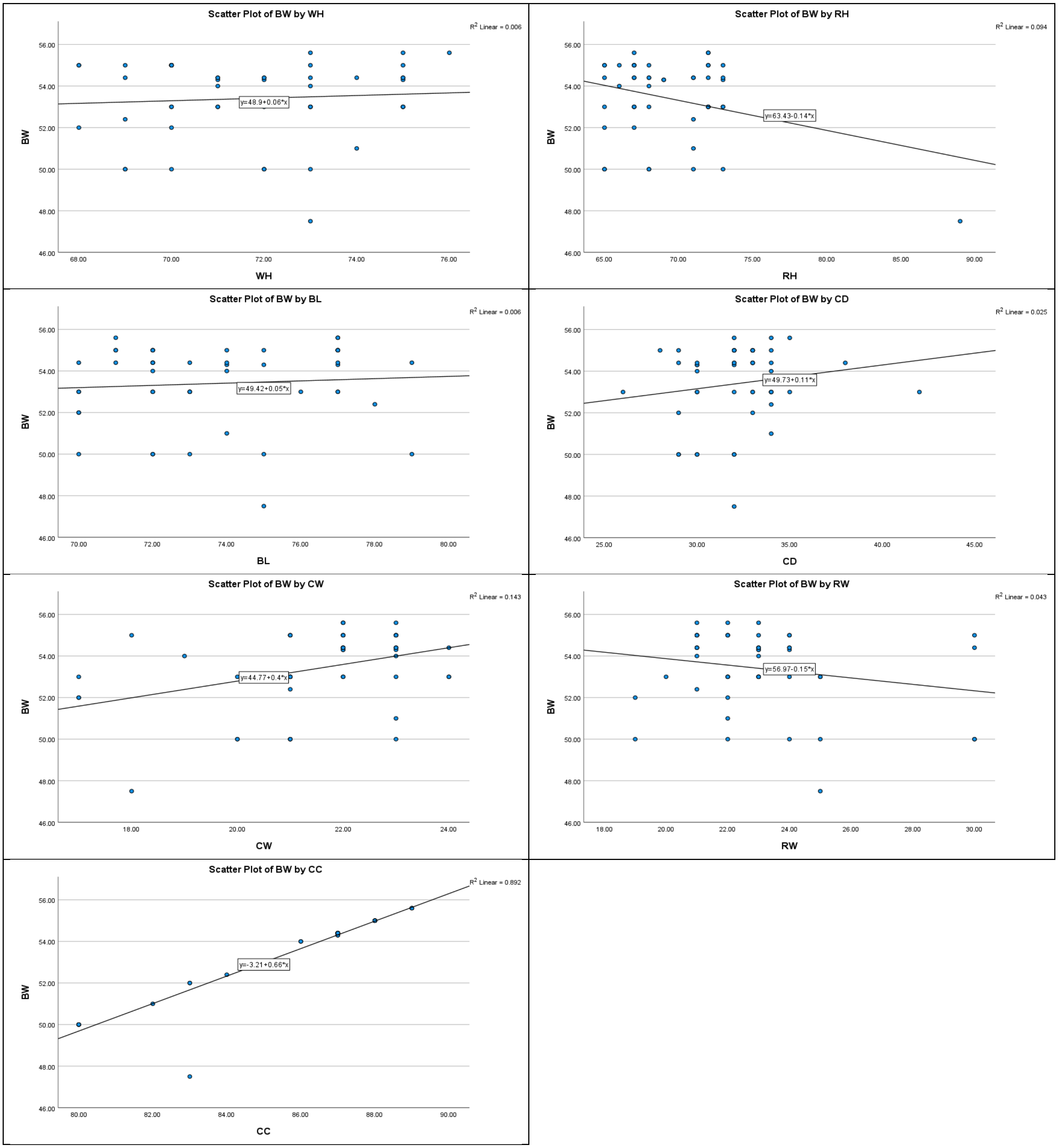

Figure 1. Regressionequationsforestimation of body weightfromeach body measurement

As can be seen from the multiple regression equation we get the highest R^2 when all the body measurements were included in the regression equations, which suggests that weight could be estimated more accurately by combination of measurements.

We may conclude that BW prediction from CC alone or in combination with other body measurements would be a practical option with a reasonable accuracy under the field conditions.

Conclusions

Bardhoka presents an important triple purpose sheep breed in Albania reared in extensive and semi extensive conditions. The data on morphometric measurements of Bardhoka sheep breed reported here provide a detailed morphological characterization of this breed. The results indicate that it has squared body frame and a good thorax development the positive correlation coefficients between the morphometric measurements display the relationship between these parts of the body and body weight. The live weight can be estimated by chest circumference alone or in combination with other body measurements.

Ethical Approval

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

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The authors don't declare any fund.

Conflict of Interest

The authors declare that they have no conflict of interest.

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