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PREDICTION OF LIVE WEIGHT FROM CHEST GIRTH FROM BIRTH TO 12 MONTHS OF AGE IN YERLI KARA CATTLE

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Abstract

This research was carried out to estimate live weights with linear regression models from various body measurements in the period between birth and twelve months age in Yerli Kara (Anatolian Black) cattle. The animal material of this study was composed of 104 head Yerli Kara cattle located in Ankara province. In the study, all correlation coefficients (except for the rump height - chest depth relationship in birth period) were found to be positive and statistically significant (P<0.01). The highest correlation coefficient value was found between live weights and chest girth in all periods. R^2 values were found as 64%, 77.1%, 75.4% and 77.1% at birth, 3, 6 and 12 months of age respectively. It is concluded that the equations found as a result of regression analysis between the chest girth and live weight can be used to accurately estimate live weights in Yerli Kara cattle. Besides, live weights were estimated using the regression model in the specified periods and the results are presented in tables for practical use.

Keywords: Correlation coefficients, Live weights, Regression, Anatolian Black cattle

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1. Introduction

Growth and development are economically important features. Growth is determined by measurement and weighing, and its calculation is based on live weight. Furthermore, growth and development can be followed by using various correlations between live weight with body measurements such as withers height, chest girth, body length (Akbulut et al., 2002; Yalçın et al., 2017). Determination of the body weights of cattle at certain ages is important for various management practices such

as selection of culled calves according to their body conformation, calculation of amount of milk to be given to calves based on birth weight and determination of end of fattening period. (Ozhan et al., 2004; Putra et al., 2014). Relationships between body measurements and live weight may vary depending on many factors, including the animal's age, breed and nutritional level (Ozkaya and Bozkurt, 2009). Therefore, regression equations should be determined and prepared separately for cattle breeds raised in different countries and regions (Sekerden and Aydın, 1992; Ashwini et al., 2019).

The weight of a calf can be precisely known with the help of measuring instruments. However, in the farms based on extensive breeding such as Yerli Kara, there are either no measurement-weighing instruments or making measurements is considered insignificant. In field studies, such problems can be eliminated with the help of a simple tape measure. Thus, the live weights of animals can be more easily estimated by various body measurements. This study was carried out to investigate the relationship between live weight and body measurements of Yerli Kara at birth, 3, 6 and 12 months of age and to estimate the live weights of animals with linear regression models.

2. Material and Method

The animal material of this study was composed of Yerli Kara Cattles protected In-Situ within the scope of the Conservation of Genetic Resources Project by the General Directorate of Agricultural Research and Policies (TAGEM) in Çamlıdere District of Ankara Province. In this study, body weights and body measurements of 104 head calves, born in 2018, were taken from total of 20 farms, at birth of calves and 3, 6 and 12 months of age.

In the study, the data of birth and 3 months of age from 104 head calves, 6 months of age from 102 head calves and 12 months of age from 97 head calves were collected in the year 2018 and 2019. In addition to live weight (LW), phenotypic measurements were taken such as withers height (WH), rump height (RH), chest girth (CG), body length (BL), chest depth (CD), front wrist girth (FWG). Measurements were taken using a precision scale up to 200 g, a measuring stick and a measuring tape. The points where measurements are taken from the animals are shown schematically in Figure 1.

In the study, the relationship between live weights and body measurements was determined by "Pearson Correlation". Regression analysis was performed between live weights and chest girth measurements in order to make live weight estimation with body measurements. Regression analysis was done with Linear model. The determination coefficient (R^2) was calculated to compare the effectiveness of the prediction equations. Statistical calculations were done with "Minitab 16" package program. The predicted live weights were calculated using the Excel computer program.

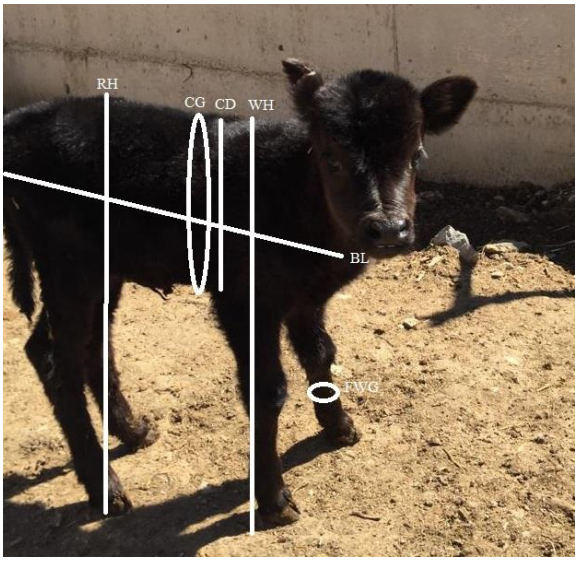

Figure 1. Points where measurements are made in animals.

3. Results

Correlation coefficients between live weights and body measurements obtained in the study were calculated. The correlation coefficients at birth, 3, 6 and 12 month periods are presented in Table 1.

Regression analysis was performed between the chest circumference with the highest correlation coefficient and body weight in order to make live weight estimation with live weight parameters. The calculation of live weight estimation from chest girth values, with linear regression model, in Yerli Kara cattle at birth of calf, 3, 6 and 12 months of age are presented in Table 2.

Prediction live weights obtained from the regression equations using the chest girth in male and female Yerli Kara Cattles, during the age of birth, 3, 6 and 12 months are presented in Table 3.

Table 1. Correlation coefficients between live weights and body measurements

Age	Measurement	LW	WH	RH	BL	CG	CD
Birth	WH	0.692**					
	RH	0.700**	0.965**				
	BL	0.532**	0.488**	0.491**			
	CG	0.800**	0.724**	0.711**	0.458**		
	CD	0.573**	0.528**	0.483	0.200**	0.658**	
	FWG	0.486**	0.546**	0.500**	0.247**	0.683**	0.570**
3 months	WH	0.762**					
	RH	0.756**	0.991**				
	BL	0.692**	0.520**	0.531**			
	CG	0.878**	0.728**	0.716**	0.557**		
	CD	0.666**	0.730**	0.750**	0.525**	0.624**	
	FWG	0.684**	0.465**	0.470**	0.529**	0.628**	0.499**
6 months	WH	0.770**					
	RH	0.777**	0.985**				
	BL	0.750**	0.588**	0.594**			
	CG	0.868**	0.769**	0.787**	0.690**		
	CD	0.728**	0.743**	0.760**	0.603**	0.792**	
	FWG	0.830**	0.711**	0.714**	0.648**	0.836**	0.699**
12 months	WH	0.793**					
	RH	0.760**	0.968**				
	BL	0.778**	0.605**	0.595**			
	CG	0.878**	0.784**	0.715**	0.722**		
	CD	0.808**	0.837**	0.800**	0.626**	0.825**	
	FWG	0.654**	0.669**	0.580**	0.459**	0.720**	0.620**

** P<0.01: Statistically significant.

Table 2. Prediction of live weight from chest girth values with linear regression model

Age	Gender	n	Regression Equation	R^2
Birth	General	104	-15.08 + 0.5500 CG	64
	Female	50	-21.32 + 0.6686 CG	74.6
	Male	54	-10.32 + 0.4616 CG	54.6
3 months	General	104	-60.39 + 1.309 CG	77.1
	Female	50	-67.58 + 1.392 CG	77.7
	Male	54	-54.46 + 1.241 CG	77.1
6 months	General	102	-98.18 + 1.806 CG	75.4
	Female	48	-98.95 + 1.798 CG	78.9
	Male	54	-97.44 + 1.812 CG	74.2
12 months	General	97	-156.7 + 2.391 CG	77.1
	Female	47	-138.1 + 2.212 CG	70.9
	Male	50	-173.3 + 2.549 CG	82.3

Table 3. Live weight prediction for Yerli Kara cattle at the age of birth, 3, 6 and 12 months

Birth			3 Months			6 Months			12 Months		
Chest Girth (cm)	Prediction Weights (kg)		Chest Girth (cm)	Prediction Weights (kg)		Chest Girth (cm)	Prediction Weights (kg)		Chest Girth (cm)	Prediction Weights (kg)	
	Female	Male		Female	Male		Female	Male		Female	Male
44	8.10	9.99	67	25.68	28.69	83	50.28	52.96	92	65.40	61.21
45	8.77	10.45	68	27.08	29.93	84	52.08	54.77	93	67.62	63.76
46	9.44	10.91	69	28.47	31.17	85	53.88	56.58	94	69.83	66.31
47	10.10	11.38	70	29.86	32.41	86	55.68	58.39	95	72.04	68.86
48	10.77	11.84	71	31.25	33.65	87	57.48	60.20	96	74.25	71.40
49	11.44	12.30	72	32.64	34.89	88	59.27	62.02	97	76.46	73.95
50	12.11	12.76	73	34.04	36.13	89	61.07	63.83	98	78.68	76.50
51	12.78	13.22	74	35.43	37.37	90	62.87	65.64	99	80.89	79.05
52	13.45	13.68	75	36.82	38.62	91	64.67	67.45	100	83.10	81.60
53	14.12	14.14	76	38.21	39.86	92	66.47	69.26	101	85.31	84.15
54	14.78	14.61	77	39.60	41.10	93	68.26	71.08	102	87.52	86.70
55	15.45	15.07	78	41.00	42.34	94	70.06	72.89	103	89.74	89.25
56	16.12	15.53	79	42.39	43.58	95	71.86	74.70	104	91.95	91.80
57	16.79	15.99	80	43.78	44.82	96	73.66	76.51	105	94.16	94.35
58	17.46	16.45	81	45.17	46.06	97	75.46	78.32	106	96.37	96.89
59	18.13	16.91	82	46.56	47.30	98	77.25	80.14	107	98.58	99.44
60	18.80	17.38	83	47.96	48.54	99	79.05	81.95	108	100.80	101.99
61	19.46	17.84	84	49.35	49.78	100	80.85	83.76	109	103.01	104.54
62	20.13	18.30	85	50.74	51.03	101	82.65	85.57	110	105.22	107.09
63	20.80	18.76	86	52.13	52.27	102	84.45	87.38	111	107.43	109.64
64	21.47	19.22	87	53.52	53.51	103	86.24	89.20	112	109.64	112.19
65	22.14	19.68	88	54.92	54.75	104	88.04	91.01	113	111.86	114.74
66	22.81	20.15	89	56.31	55.99	105	89.84	92.82	114	114.07	117.29
67	23.48	20.61	90	57.70	57.23	106	91.64	94.63	115	116.28	119.84
68	24.14	21.07	91	59.09	58.47	107	93.44	96.44	116	118.49	122.38
69	24.81	21.53	92	60.48	59.71	108	95.23	98.26	117	120.70	124.93
70	25.48	21.99	93	61.88	60.95	109	97.03	100.07	118	122.92	127.48
71		22.45	94	63.27	62.19	110	98.83	101.88	119	125.13	130.03
72		22.92	95	64.66	63.44	111	100.63	103.69	120	127.34	132.58
73		23.38	96	66.05	64.68	112	102.43	105.50	121	129.55	135.13
74		23.84	97	67.44	65.92	113	104.22	107.32	122	131.76	137.68
75		24.30	98	68.84	67.16				123		140.23
76		24.76	99		68.40				124		142.78
77		25.22	100		69.64				125		145.33
78		25.68							126		147.87

4. Discussion

All correlation coefficients (except for the RH-CD relationship in birth period) were found to be positive and statistically significant (P<0.01). The highest correlation coefficient value was found between live weights and chest girth in all periods. This result was consistent with the findings in studies with different breeds reported by various researchers (Tüzemen et al., 1995; Ulutas et al., 2001; Bozkurt, 2006; Ozlütürk et al., 2006; Koc and Akman, 2007; Ozkaya and Bozkurt, 2009; Bhagat et al., 2016; Yalcın et al., 2017; Ashwini et al., 2019).

In Table 2, regression equations and determination coefficients (R^2) were calculated at birth 3, 6 and 12 months of ages. These evidences from the study indicate that the calculation of live weight from the chest circumference will give an acceptable accurate

estimation. These findings were consistent with the R^2 values reported by some researchers on various models such as linear, quadratic, cubic and stepwise (Tüzemen et al., 1995; Ulutas et al., 2001; Bozkurt, 2006; Ozlütürk et al., 2006; Koc and Akman, 2007; Bhagat et al., 2016; Yalcın et al., 2017; Ashwini et al., 2019).

In the study, the value of CG measured as 66 cm in the birth period was calculated 22.81 kg in females and 20.15 kg in males. The same value in studies conducted in the Eastern Anatolian Red breed, Özlütürk et al. (2006) found similarly as 20 and 21 kg in females and males respectively, while Tüzemen et al. (1995) found higher 29.2 kg and 27.5 kg. The value of CG measured as 80 cm in the 3-month period was calculated 43.78 kg in females and 44.82 kg in males. The same value found higher as 47 kg and 49 kg by Özlütürk et al. (2006) with as 50.5 kg and 49.7 kg by Tüzemen et al. (1995). The value of CG measured as 100 cm in the 6-month period was calculated 80.85 kg in females and 83.76 kg in males. The same value, Özlütürk et al. (2006) found lower as 74 and 70 kg, while Tüzemen et al. (1995) found higher 96.4 kg only in male. The value of CG measured as 122 cm in the 12-month period was calculated 131.76 kg in females and 137.68 kg in males. The same value, Özlütürk et al. (2006) found lower as 125 and 124 kg.

In previous studies conducted by researchers using different breeds, it has been shown that live weight can be estimated in cattle with a high accuracy rate from chest girth measurements. As far as we know, this recent study is the first study to show that, using the correlation coefficient values, the chest girth measurements can be used with high accuracy rate in estimating live weight in Yerli Kara cattle. As a result, live weight can be reliably estimated with the help of a simple tape measure in Yerli Kara farms where live weights cannot be measured. Thus, animals can be selected as breeding cattle candidates at early ages.

Conflict of interest

The authors declare that there is no conflict of interest.

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