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Prediction of body weight from body measurements in Pirlak Lambs

Koray ÇELİKELOĞLU[1,*], Mustafa TEKERLİ[1]

[1]Afyon Kocatepe University, Veterinary Faculty, Department of Zootechny, Afyonkarahisar, Turkey
*Corresponding Author: *kcelikeloglu@aku.edu.tr*

Keywords

Prediction,
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Abstract

Determination of body weight from body measurements with nonlinear $y = ax^b$ model in Pırlak lambs was aimed in this study. 140 heads Pırlak lambs, born at Afyon Kocatepe University Animal Research and Application Center in 2008 - 2009 lambing seasons were used. They were measured biweekly until reaching yearling age. The body measurements used were wither height (WH), chest circumference (CC), chest depth (CD), chest width (CW), shank circumference (SC), rump width (RW) and body length (BL). Coefficient of determination (R^2) were used to compare the fitting of model to body measurements. The squared-R orders was RW>CC>WH>CW>BL>CD>SC. The best fitted body measurement model was that of rump width. The prediction model using rump width was found to be $y = 0.1993959X^{2.0051241}$ in Pırlak lambs.

Introduction

Knowledge of live weights of farm animals is useful in the determination of daily feed needs, assessment of growth, and correct dosing of medicines. In addition, changes in live weight makes interpretation to be done in terms of health and herd management (Pares et.al., 2014). Body measurements are good method for determining live weight in the absence of a weighbridge (Atta and El khidir, 2004). There are many studies using body measurements to estimate live weights in farm animals such as cattle, buffalo, sheep, goats and pigs. Ulutaş et al. (2002) benefited from the six-months-old body measurements to estimate the live weight in Eastern Anatolian Reds Cattle. Paul and Das (2012) reported that the variability that can be explained by the models developed for predicting live weight for different ages in Nili-Ravi buffalo calves was between 66.66 - 83.21%. The body weight estimates of Morkaraman, İvesi, Kilakarsal, Farta, Sardi, Timahdite, Yankasa, Kajli and Nilotic sheep breeds were predictedwith different mathematical models by using body measurement (Topal and Macit, 2004;Topal at al., 2003; Ravimurugan et.al., 2013; Taye et al., 2012; Boujenane et al., 2015; Afolayan et al., 2006; Iqbal et al., 2014; Atta and El khidir, 2004). Paramasivam et al. (2002) and Pares et al. (2012) found that the coefficients of determination for live weight between 0.71 and 0.94 for the Barbari and Gwenbe goats.

Many estimation studies were carried out with linear models. However, the nonlinear $\mathbf{y = ax^b}$ model used by Brody (1945) in Jersey, Holstein, Gurnsey and Ayrshire cattle breeds and Atta and Al khidir (2004) and Nilotic sheep breed was applied to estimate the live weight in this study.

Materials and Methods

The study was approved by the local animal ethics committee of Afyon Kocatepe University (AKÜHADYEK 70-08) in accordance with ethical principles that have their origins in European Union Directive 2010/63/ EU.Data analyzed in this study were from doctorate thesis experiment of first authors supported by the committee of scientific research and projects numbered 08.VF.19at Afyon Kocatepe University. Pırlak is amedium sized, white colored and robust sheep raised in Afyonkarahisar, Kütahya, Uşak, Burdur, Isparta and Eskişehir provinces located in the western part of Turkey. The research was carried out at the Afyon Kocatepe University Livestock Research and Application Center (KÜHAM) in Afyonkarahisar. The center's position is between $38^0$42'09 " N latitude and $30^0$40'06'E longitudes. The material of this study was 140 Pırlak lambs born in 2008-2009 birth season. In the study, lambs were weighed biweekly with ascalesensitiveto100 grams until theageof 12 months. Wither height (WH), chest circumference (CC), chest depth (CD), chest width (CW), shank circumference (SC), rump width (RW) and body length (BL) measurements were taken at each controls. The body measurements were taken for the WH from the highest point to the vertical distance, for CC around the back of the scapules, for CD the distance between wither and sternum, for CW distance between the right and left articulatiohumeri, for SC around the shin of the metacarpus, for RW the distance between tuber coxaes, for BL the distance between the articulatiohumeri and the tuber ishii (Akçapınar, 1994; Arpacık, 1999; Ünal, 2002). All measurements were taken by the same person. The obtained data set was analyzed by using the nonlinear $\mathbf{y = ax^b}$ model with computer software named NLREG(Sherrod, 2010).In the model, y is observation of live weight (kg), x is body measurement (cm), a is the constant value and b is the regression coefficient. The coefficient of determination (R^2) was used to compare the goodness of fits for estimating the live weight from different body measurements.

Results and Discussion

Coefficients of a and b and the R^2 values of different body measurements for estimating the live weights are presented in the table.1.

Table.1 Coefficients of a and b and R^2 values of the body measurements in the nonlinear $y = ax^b$model for predicting live weights in Pırlak lambs.

Body Measurement	a	b	R^2
Wither Height	0.017	3.003	0.897
Chest Circumference	0.008	2.332	0.905
Chest Depth	0.144	1.864	0.831
Chest Width	0.037	2.617	0.872
Shank Circumference	0.116	3.301	0.729
Rump Width	0.199	2.005	0.930
Body Length	0.002	2.945	0.871

As regards to R^2 values, the model including Rump Width had the highest value. The R^2 value used to detect the goodness of fit in this function extended to 0.930 among all the seven body measurements. This model was followed by the formulas containing Chest Circumference (0.905),Wither Height (0.897),Chest Width (0.872),Body Length (0.871),Chest Depth (0.831) and Shank Circumference (0.729).

Chest circumference provided the most successful live weight estimation for Yankasa, Kilakarsal, Mengali, Balochi, Harnai, Beverigh, Rakshani, Nilotic and Farta sheep breeds with different mathematical models used in literature (Atta and El khidir, 2004; Afolayanet al., 2006;Tayeet al., 2011;Mohammadet al., 2012;Ravimuruganet al., 2013).Topal et al. (2003) found that the coefficient of determination was the highest in the rump width for Awassies in the same way as this study. Second best fitted body measurement chest circumference is more advantageous because of the ease of measurement and the low cost of the measuring device. It could be preferred in predicting live weight, due to these reason. Atta and El khidir (2004) were found

the coefficients of a and b as 0.00017 and 2.87 in the male lambs and 0.0011 and 2.41 in female lambs by using $y = ax^b$ model for the chest circumference in Nilotic sheep. Differences in the aspects of parameters of the function between current research and literature may be due to reasons such as breed, measurement interval and data structure.

This is the first study to establish a relation between body measurements and live weight in Pırlak. It was concluded that a measure tape for chest circumference unique to Pırlak could be developed by using nonlinear $y = ax^b$ model.

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