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PREDICTION OF BODY WEIGHTS FROM BODY MEASUREMENTS IN HOLSTEIN-FRIESIAN CALVES

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SUMMARY : Prediction of body weight at birth, weaning (2 months of age) and 6 months of age from heart girth, chest depth, height at withers and body length were studied in male and female Holstein-Friesian calves raised in Research Farm of Agricultural College at Atatürk University. Correlation coeficients revealed that the heart girth had the strongest relationship with the body weight at various ages. Also, the results suggested that the heart girth measurement would give acceptable accurate prediction of the body weight when a single body measurement was used for the prediction of the body weight from practical standpoint.

SİYAH-ALACA BUZAĞILARDA VÜCUT ÖLÇÜLERİNDEN CANLI AĞIRLIKLARIN TAHMİNİ

ÖZET : Bu araştırmada, Atatürk Üniversitesi Ziraat Fakültesi Araştırma Çiftliğinde yetiştirilen Siyah-Alaca erkek ve dişi buzağılardan alınan göğüs çevresi, göğüs derinliği, cidago yüksekliği ve vücut uzunluğu ölçülerinden doğum, sütten kesim (2 aylık yaşta) ve 6 aylık yaştaki canlı ağırlıkların tahminleri için regresyon denklemleri geliştirildi. Hesaplanan korelasyon katsayılarından göğüs çevresi ile çeşitli dönemlerdeki vücut ağırlıkları arasında çok güçlü bir ilişki bulunduğu tespit edilmiştir. Elde edilen sonuçlardan vücut ağırlıklarının tahmininde göğüs çevresi ölçüsünün pratik olarak kullanılabileceği anlaşılmıştır.

INTRODUCTION

Determination of the body weight of calves is very important for various management practices such as calculation of the amount of milk based upon birth weight,

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following of the weight gain of calves and selection of culied calves according to their body conformation (Tüzemen et al., 1994). The body weight of calves can be accurately determined by utilizing platform scales. However, the platform scales are not available in the most of the farms located in the eastern region of Turkey. Therefore the body weight of Holstein-Friesian calves has to be predicted on the basis of its relationship with body measurements.

The present study was undertaken to investigate the interrelationship of the body weight, the body length, the hearth girth, the height at withers and the chest depth and to develop prediction equations for estimation of weights at various ages in Holstein-Fresian calves.

MATERIAL AND METHOD

Material

In this study, data pertaining to body measurements and weight at various ages were obtained from Holstein-Friesian (HF) herd reared in the Research Farm of Agricultural Collage At Atatürk University, Erzurum. Distributions of the numbers of the calves used in this study are tabulated in Table 1.

The HF calves were housed in the calf raising unit of the research farm. The HF calves were weaned at 2 months of age. Whole milk was given to the calves by using milk buckets. High quality dry hay and calf starter produced by Turkish Feed Indıstry Inc. Were always available throughout the research project.

Table 1. Number of the Calves Utilized in this Project

	Ages		
Sex	Birth	Weaning (2 months of age)	Six months
Male	44	49	51
Female	63	49	54

Metod

Body weights and measurements such as the body length (from point of the shoulder to the point of the tuber ischii), the hearth girth (circumference of the thoracic cavity immediately behind the fore limbs), the height at withers (from base of the hoof to the highest point of the wither), and the chest depth (from sternum area immediately caudal to the fore limbs to top of the thoracic vertebra area) were measured within 24 hours after calves were born, and at weaning (2 months of age), 6 months of age. A tape measure was utilized for measuring the chest girth. The other measurements were determined boy employing a large caliper. The body weights were also obtained at birth, weaning and 6 months of age.

Interrelationships among the body measurements and weights at different ages were investigated by using simple correlation coefficients. Additionally, stepwise regresion method was used to find out the best fitted prediction equation (Neter, et al. 1989). Coefficient of determination values (R^2) were calculated to compare the efficiency of the prediction equations. The relative contribution of each measurement for explaining variation in body weight was also determined by using coeffient of determination calculated by using SAS Statistics program (Cody and Smith, 1987).

RESULTS AND DISCUSSION

Interrelationship Among Body Measurements and Weights

The correlation coefficient values between the birth weight and the various body measurements obtained at birth of the calves are depicited in Table 2.

All correlation coefficients given in Table 2 were possitive and highly significant (P<0.01). The highest correlation coefficient were determined between the birth weight and the heart girth measured at birth of the calves. The result is in agreement with findings of Şekerden and Aydın (1992) who reported high and positive correlation coefficients (r = 0.82 and r = 0.96 for male and female calves respectively) in Israel Friesian calves.

Table 2. The Correlation Coefficients Between the Birth Weight and the Body Measurements Determined at Birth of the Male and Female Calves

	Sex	
	Female	Male
	(n = 63)	(n = 44)
Body Measurements		
height at withers	0.583**	0.633**
body length	0.381**	0.510**
heart girth	0.799**	0.862**
chest depth	0.405**	0.553**

(**) : P<0.01

In Table 3, correlation coefficients between the weaning weight (weight determined at 2 months of age) and the body measurements in HF calves are presented.

As can be seen in Table 3, all correlation coefficients between the weaning weight and the body measurements were highly significant (P<0.01) and possitive. The highest correlation value were obtained between the heart girth and the weaning weight which was r=0.802 and r = 0.901 for the female and male calves respectively. The result was supported by Şekerden (1990) who reported high correlation values between the hearth girth and body weight taken from Jersey calves whose ages were ranged from 1 to 70 day of ages.

Table 3. The Correlation Coefficients Between the Weaning Weight and the Body Measurements Determined at Weaning For Male and Female Calves

	Sex	
	Female (n =49)	Male (n = 49)
Body Measurements		
height at withers	0.477**	0.771**
body length	0.631**	0.775**
heart girth	0.802**	0.901**
chest depth	0.505**	0.782**

(**) : P<0.01

The interrelationship between the body measurements and the weight determined at 6 months of is demonstrated in Table 4.

Table 4. The Correlation Coefficients Between the Body Measurements and the Weight Determined at 6 Month of Age the For Female and Male Calves

	Sex	
	Female (n = 54)	Male (n = 51)
Body Measurements		
height at withers	0.693**	0.807**
body length	0.471**	0.695**
heart girth	0.754**	0.855**
chest depth	0.776**	0.836**

(**) : P<0.01

All correlation coefficients given in Table 4 were positive and highly significant (P<0.01). The highest correlation value obtained from the relation between the hearth girth and the weight determined at 6 month of age was r=0.855 for the male calves. On the other hand, the highest correlation value for the female calves was obtained from the relation between the chest depth and 6 month weight.

Our results revealed thet the strongest intirrelation was determined between the heart girth and the body weights at birth, weaning and 6 months of age except for the female calves at 6 month of age. Similar results obtained from different cattle breeds were reported by Eker (1958), Şekerden (1990), Şekerden et al. (1991), Sosyal and Konak (1992).

Determination of Best Fitted Prediction Equations

The results of the stepwise regression analysis revealed that 74.4 % of the variation in the birth weight for male calves was explained by the heart girth alone. Additional use of other body measurements did not make significant contribution to increase R^2 values. Similar findings were obtained for prediction of the birth weight of female calves. The prediction equation with one independent variable of the hearth girth resulted in relatively high R^2 value (63.93 %) (Table 5). The results related with prediction of the birth weight suggested that heart girth alone would give acceptably accurate prediction of birth weight in both sex. This finding is in agreement with results of Rathi (1979) Mc Rae (1986) Jagtap and Kale (1987), Tüzemen et al. (1994).

Table 5. Prediction Equations of Body Weights at Birth, Weaning and 6 Months of Age For the Male and Female Calves

	Male Calves				Female Calves			
Weights at	a®	b©	R^2(%)	F	a	b	R^2(%)	F
Birth	-60.77	1.338	74.41	122.1**	-32.77	0.939	63.93	108.1**
Weaning	-71.17	1.513	81.22	203.0**	-46.96	1.218	64.34	102.0**
6 month of Age	-145.25	2.416	73.18	133.0**	-	-	-	-

® : Intercept
© : regression coefficient of the heart girth
**: Highly significant ($P<0.01$)

The best fitted regression equations obtained for the prediction of the weaning weight are given in Table 5. The heart girth measured at weaning accounted for 81.22 and 64.34 percent of variation in the weaning weight for male and female calves respectively. These R^2 values are reasonably high values and the results are supported by other researchers worked on different cattle breeds (Rathi, 1979; Jagtap and Kale, 1987). The general conclusion that can be drawn from these studies is that heart girth is a good predictor of weight of the male and female calves at 2 or 3 months of age.

For male calves, the prediction equation which contained the heart girth as independent variable provided quite high R^2 value (73.18 %). The relative contributions of the other body measurements were fairly small. The result suggested that the regression equation with one independent variable could be used accurately to predict 6 month weight of the male calves. However, the multiple regression equation for prediction of 6 month weight of the female calves were resulted in more accurate estimation. In this case, the chest depth and the hearth girth were involved in the regression equation. Coefficient of determination value for this particular equation was 72.45 percent. The equation was as follows:

6 month weight of female calves (kg) = -143.2 + 3.845 chest depth (cm) + 1.0 heart girth (cm).

Predicted body weights obtained from the regression equations with one independent variable (heart girth) are presented in Table 6, 7, 8.

The results of the research suggested that birth, weaning and 6 month weight of Holstein-Friesian calves reared in the eastern region of Turkey could be predicted accurately on the basis of the chest girth measurement. On the other hand, prediction of 6 month weight of the female calves should be done by using the multiple regression equation. Many researchers also reported that the heart girth can be used satisfactorily to determine body weights of different cattle breeds (Rao and Nagarcenkar 1979; Akman 1982; Jagtap and Kale 1987; Şekerden 1990; Şekerden et al. 1991; Şekerden and Aydın 1992; and Tüzemen et al. 1994).

Table 6. Predicted Birth Weight For Male and Female Calves

	Predicted birth weight (kg) for	
Heart Girth (cm)	Male	Female
60	-	23.6
61	-	24.5
62	-	25.5
63	-	26.4
64	-	27.4
65	-	28.3
66	27.5	29.2
67	28.8	30.1
68	30.2	31.1
69	31.5	32.0
70	32.9	32.9
71	34.2	33.9
72	35.5	34.8
73	36.9	35.8
74	38.3	36.7
75	39.6	37.8
76	40.9	38.6
77	42.3	39.6
78	43.6	40.5
79	44.9	41.4

Table 7. Predicted Weaning Weight For Male and Female Calves

Heart Girth (cm)	Predicted birth weight (kg) for	
	Male	Female
80	49.7	50.5
81	51.3	51.7
82	52.8	52.9
83	54.3	54.2
84	55.8	55.4
85	57.3	56.6
86	58.8	57.8
87	60.4	59.1
88	61.8	60.3
89	63.4	61.5
90	64.9	62.7
91	66.4	63.9
92	67.9	65.1
93	69.4	66.4
94	70.9	67.6
95	72.5	68.8
96	73.9	70.0
97	75.5	71.2
98	77.0	72.5

Tablo 8. Predicted 6 Month Weight (kg) For Male Calves

Hearth Girth (cm)	Male
99	94.0
100	96.4
101	98.8
102	101.3
103	103.6
104	106.1
105	108.5
106	110.9
107	113.3
108	115.7
109	118.2
110	120.6
111	123.0
112	125.4
113	127.8
114	130.2
115	132.6
116	135.1
117	137.5
118	139.9
119	142.3
120	144.7
121	147.1
122	149.6
123	152.0
124	154.4
125	156.8

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