Relationships among Body Weight, Body Measurements and Estimated Feed Efficiency Characteristics in Holstein Friesian Cows

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Data concerning body measurements, milk yield and body weights data were analysed on 101 of Holstein Friesian cows. Phenotypic correlations indicated positive significant relations between estimated feed efficiency (EFE) and milk yield as well as 4 % fat corrected milk yield, and between body measurements and milk yield. However, negative correlations were found between the EFE and body measurements indicating that the taller, longer, deeper and especially heavier cows were not to be efficient as smaller cows.

Key words: cattle, body measurements, body weights, holstein friesian.

Siyah Alaca İneklerde Vücut Ağırlığı, Vücut Ölçüleri ve Tahmini Yemden Yararlanma Özellikleri Arasındaki İlişkiler

Yüz bir adet Siyah Alaca ineğin vücut ölçüleri, ağırlıkları ve süt verim kayıtları analiz edilmiştir. Fenotipik korelasyonlar, tahmini yemden yararlanma (TYY) ile süt verimi ve % 4 yağa göre düzeltilmiş süt verimi arasında, ve vücut ölçüleri ile süt verimi arasında önemli pozitif ilişkilere işaret etmektedir. Ancak, TYY ile vücut ölçüleri arasında saptanan negatif korelasyonlar uzun, yüksek ve derin yapılı özellikle ağır ineklerin, daha küçük yapılılar kadar etkin olmadıklarını ortaya koymaktadır.

Anahtar kelimeler: sığırlar, vücut ölçüleri, vücut ağırlıkları, siyah alaca.

Introduction

Significances of body weight and body measurements in dairy cattle have been studied by a number of researchers. Most of the investigators reported that larger cows produced higher amount of milk (Harville and Henderson, 1983; Kerr et al., 1985; Sieber et al., 1988; Glunski and Litwinczuk, 1999; Yanar et al., 2000). Also genetic and phenotypic relationships among body weight, body measurements and milk production have been investigated by several authors (Baginda et al., 1985; Moore et al., 1991; Akbulut et al., 1998), but the results have been inconsistent.

The objective of this study was to determine relationships of body measurements and body weights with estimated feed efficiency as well as production variables of Holstein Friesian cows reared in region of eastern Anatolia.

Materials and Methods

Data were collected from 101 Holstein Friesian cows reared in the Research Farm of Agricultural College at Atatürk University, Erzurum. Body weight and body measurements such as height at withers, hearth girth, chest depth, pelvic length, pelvic width, body length were taken during each parity between 30 and 55 days of postpartum.

Measures of production were actual milk yield, 4 % fat corrected milk yield (FCM), fat yield, fat percentage (% fat), solids non-fat percentage (SNF %). The length of the milk records was up to 305 days. Actual milk yield in stead of mature equivalent milk yield was used to demonstrate more nearly the biological relationships with actual body measurements

and weights.

All lactating cows are housed in a stall barn and managed alike. The daily ration fed to cows consisted of about dried hay ad libitum, 8 to 10 kg of wet sugar beet pulp and 4 to 5 kg of concentrate for milk production. Estimated feed efficiency (EFE) was calculated for each cows as already defined by Sieber et al. (1988). In the present study feed consumption was not recorded, the calculated ratio of output energy to input energy is an estimated value. The highest value indicates these animals with the greatest EFE for milk production. These estimated values are not accurate for individual cows, however, they should give meaningful average values.

Data were analysed by method of least squares analyses of variance by computer programs of Harvey (1987), and a statistical model that included parity (1, 2, 3, ≥4) and birth seasons (1= May to October, 2=November to April) as a fixed effects was used.

Result and Discussion

Means and coefficient of variation (CV) of body measurements and body weights are presented in Table 1. All body measurements except for height at withers and body weights were statistically different ($P<0.01$) among parities. Cows gained more than about 77 kg in weight from first to fourth parities. In general, all body measurements and weights increased as parity advanced. Height at withers had the lowest CV, even though chest depth and heart girth were intermediate among the traits in their overall rank of CV (Table 1). The results were in agreement with findings of Sieber et al. (1988), and Yanar et al. (2000). More flesh at the hooks and pin bones might be accounted for some of increased variation in pelvic length.

Average values and CV for production variables and EFE by parity are tabulated in Table 2. Coefficients of variation for production variables were higher than those for % SNF and % fat. The EFE varied less than milk and fat yield. The finding was similar to result of Hooven et al. (1968). EFE decreased from first to second parity, but milk yield increased. Similar change was reported by Sieber et al. (1988). Differences among means for production variables were statistically significant, and the greatest production was in fourth parity.

Phenotypic correlations between body measurements, production variables, EFE and body weight from all lactation records are presented in Table 3. Generally, there were positive correlations between milk yield, fat yield, FCM and all body measurements and body weights. Correlation values between milk yield and all body measurements except for pelvic width were statistically significant. The results indicated that phenotypically larger cows had higher milk yield, and the result was similar to previous reports (Moore et al., 1991; Glunski and Litwinczuk, 1999). Correlation coefficients for % SNF and % fat are small and not statistically significant. However, the EFE showed statistically significant negative correlations for all body measurements. The taller, longer, deeper and especially heavier cows tend not to be efficient as smaller ones. The result was in accordance with findings of Hooven et al. (1968), Dickinson et al. (1969), and Sieber et al. (1988).

Table 4 contains phenotypic correlation coefficients among production variables and EFE. Correlations with EFE were 0.23 for FCM and 0.21 for milk yield. The values were statistically significant, and the result was in agreement with findings of Sieber et al. (1988).

Table 1. Means and coefficient of variation (CV) of body measurements and weight by parity.

Parity	n	Body Length	Height at Withers	Heart Girth	Chest Depth	Pelvic Length	Pelvic Width	Body Weight
				Means (cm)				
1	21	135.6	122.7	182.1	62.8	41.2	42.0	447
2	27	137.2	122.5	186.6	66.2	41.7	43.7	482
3	20	146.4	125.3	193.6	66.4	43.0	45.8	517
≥4	33	144.3	123.8	193.5	67.2	44.3	46.4	524
Overall	101	141.0	123.5	189.3	65.9	42.7	44.6	495
				CV (%)				
1	21	5.49	4.02	4.34	4.20	10.69	8.23	10.83
2	27	4.27	3.60	5.67	5.46	9.04	10.16	12.78
3	20	6.18	4.02	3.53	7.70	9.03	9.51	8.09
≥4	33	5.29	3.14	6.12	5.89	8.07	8.12	8.68
Overall	101	6.18	3.67	5.73	6.57	9.43	9.11	11.69

Table 2. Means and coefficient of variation (CV) of measures of production and estimated feed efficiency (EFE) by parity

Parity	N	Milk Yield (kg)	Fat %	Fat Yield (kg)	SNF %	FCM (kg)	EFE
			Means				
1	21	3318	3.63	122.2	8.45	2854	0.7536
2	27	3787	3.67	136.6	8.52	3026	0.6978
3	20	3628	3.61	130.4	8.78	3213	0.7044
≥4	33	3899	3.65	139.4	8.52	3460	0.7283
Overall	101	3694	3.64	133.3	8.56	3217	0.7207
			CV (%)				
1	21	19.79	13.49	31.21	10.29	18.16	16.77
2	27	35.09	12.14	31.49	17.48	27.88	23.94
3	20	17.69	9.69	32.26	11.95	26.54	14.79
≥4	33	29.03	14.79	30.38	11.73	24.73	14.85
Overall	101	30.15	12.84	31.15	13.20	25.64	17.92

Table 3. Phenotypic correlation coefficients between body measurements, production variables and estimated feed efficiency (EFE)

Variable	Body Length	Height at Withers	Heart Girth	Chest Depth	Pelvic Length	Pelvic Width	Body Weight
Milk Yield (kg)	0.28*	0.30*	0.31**	0.27*	0.22*	0.08	0.34**
Fat %	-0.16	-0.03	0.01	0.03	-0.10	0.16	0.01
Fat (kg)	0.19	0.17	0.22**	0.17	0.14	0.07	0.25*
SNF %	0.09	0.19	0.02	-0.01	0.06	0.00	0.08
FCM (kg)	0.30**	0.26*	0.32**	0.17	0.18	0.08	0.35**
EFE	-0.18	-0.36**	-0.53**	-0.31**	-0.32**	-0.18	-0.51**

* : P<0.05, ** : P<0.01

Table 4. Phenotypic correlation coefficients between measures of production and estimated feed efficiency (EFE)

Variable	Fat %	Fat (kg)	SNF %	FCM (kg)	EFE
Milk Yield (kg)	-0.11	0.92**	0.04	0.90**	0.21*
Fat %	-	-0.04	-0.10	0.07	0.11
Fat (kg)	-	-	0.07	0.91*	0.07
SNF %	-	-	-	0.07	0.10
FCM	-	-	-	-	0.23*

* : P<0.05, ** : P<0.01

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