Prediction of Body Weight of Friesian Crossbred and Buffalo Male Calves during Fattening Using Live Body Measurements

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ABSTRACT

Five live body measurements were taken on 142 Friesian crossbred and 49 buffalo male calves belonging to the rations and fattening unit, Faculty of Agriculture, Alexandria University to study the relationships between body weight and live body measurements and predict body weight. All simple correlation coefficients between body weight and live body measurements of Friesian crossbred and buffalo male calves were positive. The highest estimates were between the heart girth (HG) and body weights in Friesian crossbred and buffalo male calves. HG was the best predictor of body weight of Friesian crossbred and buffalo male calves throughout the months of fattening period.

Keywords: body weight, body measurements, Friesian crossbred, buffalo.

INTRODUCTION

Body weight is a sufficient parameter to evaluate the progress of fattening operation and to predict carcass weight and dressing percentage of fattened animals. Determination of live body weight is, thus, necessary to calculate feed requirements, animal growth rate, marketing weight, dressed carcass weight and animal's cash value (Payne, 1990). In Egypt, approximately 90% of the cattle and buffalo populations are owned by small holders. Most of these small holders have no scales available to weight their animals in order to determine live body weight and estimate growth rate during fattening. Weighing devices are always expensive for small holders to buy. Salama and Schalles (1992), El-Koussey *et al.*(1993), Salama *et al.*(2001) and El-Ashry *et al.*(2001) used body measurements to predict body weight. Rahim *et al.* (1996) estimated body weight using body measurements of fattened Japanes Black Beef steers. Several authors have demonstrated that there is a relationship between body measurements especially heart girth and body condition score with live weight of animals (Mscangi *et al.,* 1999; Nesamvuni *et al*., 2000 and Abdelhadi and Babiker, 2009). If it is easy to predict body weight through utilization of some body measurements, prediction equation will be widely applied for estimating body weight and,hence, evaluating the fattening performance at each stage of the fattening operation without using scales.

The objective of this study was to develop equations to estimate body weight of Friesian crossbred and buffalo male calves accurately during fattening period using some body measurements.

MATERIALS AND METHODS

Data on 142 Friesian crossbred (FC) and 49 buffalo (B) male calves were used in this study. These animals belong to the commercial flock of the rations and fattening unit, Faculty of Agriculture, Alexandria University. Calves were bought from local markets in Delta area at an average weight of 195 kg and estimated age were between 9-11 months at the start of the experiment. The calves were enrolled in a fattening trial under usual management and environmental conditions. The calves were housed free in open yards. Concentrate ration was fed as pelleted commercial mixture (14% TP and 65% TDN) at rate of 2% of body weight. Chopped wheat straw was fed at the rate of 1% of body weight. Sorghum was offered as a green fodder at the rate of 5kg/ head/ day.

Body weight and five live body measurements were recorded monthly during period of the experiment which lasted for 6 months. The measurements taken were described by (Fisher, 1976); height at withers (HW), body length (BL), diagonal length (DL), heart girth (HG) and circumference of round (CR).

The data were statistically analyzed by the statistical analysis system (SAS, 2004). Simple correlation and regression coefficients between body weight and body measurements at 2, 4 and 6 months of fattening period were calculated. Besides, stepwise multi regressions of body weight on body measurements were used to get the best equations to predict the former.

RESULTS AND DISCUSSION

1. Body weights and body measurements

Mean squares of live body measurements of FC and B male calves at different periods of fattening are presented in Table 1. Least squares means and

standard errors of body weights and measurements of the two groups of male calves at different periods of fattening are presented in Figure 1 and Table 2. Body weight and live body measurements of FC and B calves tended to increase with progress of fattening period. This reflected the increase in body muscles, size and skeleton.

Table 1: Mean squares for body measurements (cm) of Friesian crossbred and buffalo male calves at 2, 4 and 6 months of fattening period.

S.O.V	D.F	M.S				
		HW	BL	DL	HG	RC
At 2 months						
Species	1	65.01****	56.45****	24.41**	117.07***	5.98
Regression	1	1168.35****	2705.41****	2471.17****	3750.40****	1754.92****
Error	188	2.73	4.26	3.69	10.62	2.36
At 4 months						
Species	1	147.85****	157.11****	95.16***	287.79****	45.72*
Regression	1	569.16****	1512.42***	1268.12****	1756.65****	960.8****
Error	187	4.46	11.52	7.70	17.09	12.11
At 6 months						
Species	1	222.92****	329.43****	89.59***	788.09****	424.20****
Regression	1	402.49****	1084.44****	671.59****	1302.91****	427.73****
Error	183	7.61	14.10	7.94	23.36	13.58

* significant at P<0.05
** significant at P<0.01
*** significant at P<0.001
**** significant at P<0.0001

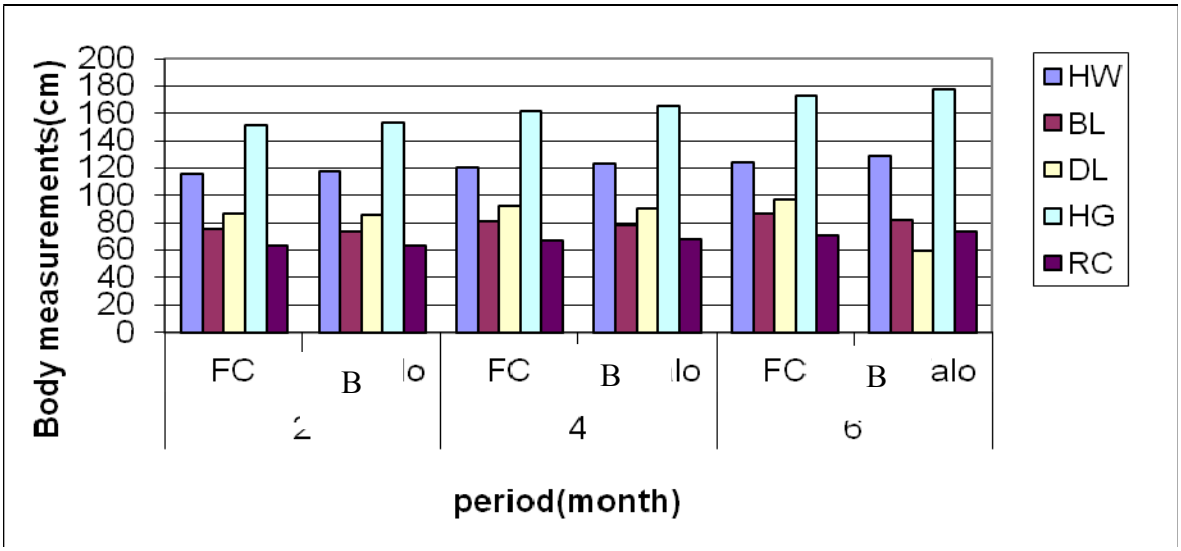

Figure 1: Body measurements (cm) of Friesian crossbred (FC) and buffalo (B) male calves at different periods of fattening

Table 2: Least squares means ± S.E. for body weight at 2, 4 and 6 months of fattening (BW_2, BW_4 and BW_6) and body measurements of Friesian crossbred (FC) and buffalo (B) male calves under study.

Body weight(kg)		Body measurements(cm)				
		HW	BL	DL	HG	RC
BW2	FC (246.06±3.05)	113.6±0.24	77±0.39	88.0±0.37	149.5±0.40	62.6±0.30
	B (252.85±3.62)	123.3±0.42	67.9±0.41	83.5±0.38	157.5±0.76	64.2±0.39
BW_4	FC (301.63±2.33)	118.8±0.22	82.5±0.38	93.0±0.33	160.7±0.42	66.5±0.26
	B (302.29±4.27)	127.3±0.40	74.2±0.51	88.6±0.42	168.1±0.72	68.6±0.87
BW_6	FC (351.54±3.06)	123.2±0.23	87.8±0.37	97.8±0.28	171.7±0.45	70.4±0.32
	B (370.56±3.58)	131.7±0.54	78.9±0.62	94.1±0.48	180.4±0.78	74.6±0.61

2. Relationship between body weight and body measurements

2.1. Simple Correlation and regression

The simple correlation coefficients between body weights of FC and B male calves at 2, 4 and 6 months of fattening and each of body measurements are presented in Table 2. These correlations were positive and significant for FC male calves. They ranged from 0.16 to 0.65. The highest estimates were between HG and BW at 2, 4, and 6 months (0.48, 0.65, 0.54), between DL and BW4 (0.53) and between BL and BW4 (0.44). While, the lowest were between RC and BW2 (0.16), between HW and BW6 (0.18) and between RC and BW6 (0.20).

With respect to B male calves, simple correlation coefficients between body weights at 2, 4, 6 months of fattening and each of body measurements were positive and highly significant ranging from 0.02 to 0.65. Higher but still moderate estimates were recorded between BW2 and HG (0.65), BW2 and RC (0.56), BW6 and HG (0.48), BW2 and DL (0.46) and between BW6 and DL (0.43). However, the lowest non significant correlations were between BW4 and HW (0.02), BW4 and RC (0.13) and between BW6 and RC (0.18). Thus, the strong significant positive correlation between body weight of both FC and B male calves and each of heart girth and diagonal length permitted the latters to be good predictors of the formers than any other body measurements.

Simple regression coefficients (Table 3) and simple regression equations for FC and B male calves indicated that the best simple equations to predict BW4 and BW2 were BW4= -270.7+3.5 HG with accuracy (R^2 =43.2%) and BW2= -224.2+3.0 HG with accuracy (R^2= 43.1%), respectively. Similarly, Salama and Schalles (1992), El-Koussy *et al.*(1993), Salama *et al.*(2001) and El-Ashry *et al.*(2001) found that heart girth was a suitable predictor for body weight.

2.2. Stepwise regression of body weight on different body measurements

Stepwise multiple regression analysis of body weights at 2, 4 and 6 months of fattening on different body measurements for FC and B male calves were calculated. The best stepwise multiple regression equations to predict body weight in FC and B male calves on basis of body measurements are shown in Table4. Heart girth of FC male calves was the first independent variable to be included in the stepwise multiple regression analysis of body weights at 2, 4 and 6 months of fattening. HG was preceded with an accuracy of 28% in prediction of BW at 2 months. Adding DL increased accuracy to 54% for BW at 4 months. BL and HG produced accuracy of 33% for prediction of BW at 6 months of fattening. Changes in R^2 caused by inclusion of other body measurements in the previous regression equations were very low and non significant.

In B male calves, similar results were found. HG was the first independent variable to be included in the stepwise multiple regression analysis followed by RC and DL with realized accuracy of 53% and 38%, respectively. DL was the first independent variable to predict BW at 4 months of fattening followed by HG and HW with accuracy 24%.

Table 4: Simple regression and correlation coefficients between body weight (BW, kg) at 2, 4 and 6 months of fattening period and body measurements (cm) of Friesian crossbred and buffalo male calves.

Dependant variable \ Independent variable	Species	HW	BL	DL	HG	RC
BW2	FC	4.14 (0.33****)	2.31 (0.29***)	2.80 (0.34****)	3.16 (0.48****)	1.62 (0.16*)
	B	2.73 (0.32)	3.33 (0.38**)	4.27 (0.46***)	3.02 (0.65****)	5.06 (0.56****)
BW4	FC	3.25 (0.31****)	2.67 (0.44****)	3.67 (0.53****)	3.55 (0.65****)	2.41 (0.27***)
	B	0.29 (0.02)	2.20 (0.26)	3.60 (0.36**)	1.98 (0.34)	0.65 (0.13)
BW6	FC	2.33 (0.18*)	3.00 (0.36****)	3.53 (0.32****)	3.60 (0.54****)	1.90 (0.20*)
	B	1.46 (0.22)	2.09 (0.37**)	3.19 (0.43**)	2.16 (0.48***)	1.08 (0.18)

( ) correlation coefficients
* significant at P<0.05
** significant at P<0.01
*** significant at P<0.001
**** significant at P<0.0001

Table 3: The best multiple regression equations of body weight (BW, kg) on body measurements (cm) of Friesian crossbred (FC) and buffalo (B) male calves.

Species	Regression equations	R^2
FC	BW2= -492.2 + 2.85 HW+2.78HG	0.28
	BW4= -392.7 + 2.4 DL + 2.9 HG	0.54
	BW6= -335.2 +1.6 BL + 3.1 HG	0.33
B	BW2= -332.6 + 2.35 HG + 3.17 RC	0.53
	BW4= -17.96 -2.51 HW+ 3.61 DL+ 1.90 HG	0.24
	BW6= -246.53+2.80 DL +1.95 HG	0.38

The inclusion of other body measurements didn't cause any effective changes in accuracy. From the previous results, HG seemed to be the most important independent variable to predict BW of FC and B male calves at different months of fattening period. Kashoma, *et al*. (2011) reported that the regression analysis of live weight on HG was highly significant (R^2= 0.88 p< 0.01). The TSHZ cattle prediction equations were:

Y= 4.55 X – 409 (± 17.9), Where, Y = live weight (kg), X =heart girth (cm) (Kashoma, *et al*., 2011).

Rahim *et al.* (1996) predicted body weight from body measurements of fattening Japanese black beef steers, their prediction equation was BW= 3.7 girth chest+ 2.4 body length + 2.3 hip height – 862.2 thurl width. Salama *et al.* (2002) used heart girth as the best to predictor for body weight in order to estimate nutrient requirements for fattening FC male calves.

CONCLUSION

Body measurements especially heart girth can be used to predict live body weight of Frisian crossbred and buffalo male calves.

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الملخص العربى

التنبؤ بوزن الجسم لذكور العجول الفريزيان الخليطة والجاموس اثناء فترة التسمين باستخدام قياسات الجسم

داليا قاسم عبد المنعم الحديني، محمد جمال الدين عبد اللطيف واحمد الطاهر مهدي

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تم اخذ خمس مقاييس للجسم الحي علي ١٤٢عجل ذكر من عجول الفريزيان الخليطة و٤٩ من العجول الجاموسى التابعة لوحدة الاعلاف والتسمين بكلية الزراعة– جامعة الاسكندرية. وقد اجري هذ البحث لدراسة العلاقة بين وزن الجسم وقياساته للتنبؤ بوزن الجسم باستخدام مقاييس للجسم الحي. وقد اوضحت النتائج ان معاملات الارتباط بين وزن الجسم ومقاييس الجسم كانت موجبة في كل من العجول الفريزيان الخليطه والجاموسي وكانت اعلي قيم للأرتباط بين وزن الجسم ومحيط الصدر في كل من العجول الفريزيان الخليط والجاموسي. وقد خلصت الدراسة الي ان مقياس محيط الصدر كان افضل مقاييس الجسم كدليل للتنبؤ بوزن الجسم في كل من عجول الفريزيان الخليط والجاموس خلال الاشهر المختلفة لفترة التسمين.