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Performance Characteristics of Lactating Ankole and Ankole x Friesian Upgrades Under Open Grazing Systems in Nyagatare District, Rwanda

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Abstract: Feeding guides for animals are based on body weight. Advisory service providers often depend on Heart Girth (HG) and Body Conditions Scores (BCS) as proxy indicators of Live Body Weight (LBW) in mature cattle. But the relationship is affected by a number of factors including breed, parity and physiological status of the animal. There is a tacit gap in understanding the relationships between BCS and LBW and their implications on animal management decisions in developing countries including Rwanda. A study was therefore conducted to determine the effect of genotype and parity on the relationship between BCS and LBW in lactating Ankole cows and their crossbreds with Friesian genotypes. Results revealed that BCS and LBW were more correlated ($r \geq 0.90$) in Ankole than in crossbred cows ($r \leq 0.40$). The correlation improved the correlation to similar levels in all breeds ($r \geq 0.90$) when parity was considered independently. The cows gained 11-20 kg/Unit BCS because of low frame size. It was concluded that BC Systems were pertinent management tools for developing countries and the relationships between BCS and LBW could be an important selection tool for dairy cattle improvement in Rwanda.

Key words: Ankole, Friesian crossbred, Body Condition Scores (BCS), Body Weight (BW), animal

INTRODUCTION

In order to cope with the demand of an increasing population for milk and dairy products, using declining per capita land resource, Rwanda adopted intensification policy in agricultural production. In the dairy sector, intensification has entailed introduction of exotic germplasm through an elaborate Artificial Insemination (AI) program. High producing dairy cattle require improved extension service for improved health, feeding and reproductive management; all of which are based on weight of the animals. In the absence of portable scales, veterinarians, animal nutritionists and AI practitioners rely of Body Conditions Score (BCS) as proxy indicators of Live Body Weight (LBW). BCS is a subjective assessment of body energy reserves and in his review Berry noted that the repeatability between classifiers and within the same classifier has not been consistent. In developed countries both automated and non-automated systems of measuring weights are available. In a number of developing countries including Rwanda these systems are not functionally available at both institutional and farm levels. Therefore, BCS remains to be the major tool for informed decisions in animal management. The credibility in BCS is based on several studies which suggested that BCS and LBW were either genetically linked or controlled by the same set of genes (Enevoldsen and Kristensen, 1997; Berry *et al*., 2002).

However, Grainger *et al.* (1982), Enevoldsen and Kristensen (1997) and Stockdale (1999) have shown that the correlations between BCS and LBW depended on several factors including breed in the context of body frame, parity and stage of gestation among others. This implied that different breeds at different physiological conditions required different conversion equations of BCS to LBW. However, this state of knowledge has not been sufficiently investigated and translated to practical applications in Rwanda. Therefore, the objective of this study was to determine the effects of genotype and parity on the relationships between BCS and LBW.

MATERIALS AND METHODS

The study was conducted in four sectors (Rwimiyaga, Katabagemu and Karama) of Nyagatare district, north of the Eastern province of Rwanda. The district is a major cattle production zone of the country. It was implemented on farm (n = 8) and involved 20 Ankole cows and 30 crossbred cows (Ankole x Friesian) at different parities (1-5) and stages of lactation. On each

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farm, cows (n≥5) were randomly selected for weekly monitoring for 45 days. Information on their pedigree, parity and stage of lactation was extracted from the farmers' records. During the monitoring visits BCS (scale = 1-5) were estimated by visual inspection and palpation body prominences. LBW were estimated using body weight tape. Correlation and regression analyses were used to examine the relationships between BCS and LBW by genotype and parity categories.

RESULTS AND DISCUSSION

BCS is a very important management tool because of its association with production, health and reproduction in cattle. It is an indicator of the probability of AI success (Domecq *et al.*, 1997). Wildman *et al.* (1982) also reported that changes in BCS during lactation were indicators of the level of efficiency of milk production in dairy cattle. Changes in BCS between dry-off and parturition affected milk yield during the first 120 days of lactation (Domecq *et al.*, 1997) in high yielding dairy cows. Loker *et al.* (2012) showed that BCS had genetic basis can be used in selection for dairy traits. Both BCS and weight have been associated with milk production Irish-Holstein (Berry *et al.*, 2007a, b; Alphonsus *et al.*, 2010). However, the relationship between BCS and BW has been variable across breeds, parity and locations of study. Hence, the objective of the study.

The animals, researchers encountered during the study were cows in parity 1-4. Parity 5 and 6 were excluded because they were not represented in all the genotypes. They animal did not differ significantly in BCS ($p>0.05$) because researchers used the same instruments for estimating body conditions scores. Average body weight different significantly among the genotypes ($p<0.0001$) and parity ($p<0.0001$). Crossbred cows were heavier and their milk yield was higher that than Ankole cows. Body weight also increased with parity in all breeds (Table 1). The observation confirmed that BCS Systems used in this study were dependable tools for assessing body reserves that was independent of body weight and frame size (Wildman *et al.*, 1982).

LBW on BCS were highly correlated in the Ankole ($p<0.0001$) throughout the 7 weeks of lactation. The correlation was low and not significant ($p>0.05$) in the crossbred cows (Table 2). Despite lack of significance the Berry reported Pearson correlations within the same range of this study. They also cited other studies that were within the same range of values recorded in this study for crossbreds (Table 2). Wildman *et al.* (1982) associated low Pearson correlations with cows with high efficiency for milk production. Table 1 demonstrated that the Ankole cows grazing the same pasture were inferior in milk production trait. Therefore, their BCS were highly correlated with LBV (Table 2).

On the basis of parity BCS was highly correlated with LBW in all genotypes (Table 3). The range of the correlation coefficients was higher than expected for dairy breeds (Berry *et al.*, 2002). Difference in frame size could partially explain the high correlations in the study.

The linear correlation coefficients were high and highly significant at all genotypes and parity levels (Table 4). However, the slopes regressions were lower and regression coefficients were higher than expected. Most studies reported regression correlations ranging from 44-64 and regression slopes of 30-77 kg/Unit BCS in animals with large body frames. Assuming linear relationship, live-weight gain/unit BCS in this study would be within expected range (Table 4).

The intercepts of regression were lower in Ankole than in crossbred cows (Table 4). They also increased with parity except with Ankole cattle. This suggested that by the beginning of parity 2, Ankole cattle on range will have attained optimum frame size. The crossbreds would still be growing.

Table 1: Characteristics of the cows encountered during the study

Parameters	Parity	Pure ANK	Ankole x Friesian (F1)	Ankole x Friesian (F2+)
BCS	1	2.25±0.35	2.80±0.91	2.83±0.28
	2	3.00±0.94	2.83±1.03	2.67±0.57
	3	2.67±1.08	2.40±0.96	2.90±0.22
	4	3.12±1.31	2.16±0.28	3.00±0000
Average body weight (kg)	1	268.00±10.5^{b}	309.00±6.60^{a}	303.00±8.60^{a}
	2	293.50±6.10^{b}	329.20±6.10^{a}	314.30±8.60^{a}
	3	293.60±6.10^{b}	347.00±6.70^{a}	332.80±6.60^{a}
	4	302.00±7.50^{b}	365.70±8.60^{a}	364.80±7.70^{a}
Average milk yields	All	2.70±0.08^{c}	7.70±0.07^{b}	9.20±0.14^{a}

Table 2: Effect of genotype on correlation coefficients of LBW on BCS in lactating Ankole and Friesian Ankole crossbreds in Nyagatare district, Rwanda

	Ankole			Ankole x Friesian (F1)			Ankole x Friesian (F2+)		
Weeks	Weight	Coeff.	Significance	Weight	Coeff.	Significance	Weight	Coeff.	Significance
1	295	0.90	p<0.0001	336.5±29.6	0.26	NS	338.3±29.4	0.29	NS
2	295	0.92	p<0.0001	338.1±29.1	0.29	NS	339.8±27.9	0.32	NS
3	297	0.91	p<0.0001	337.0±36.9	0.31	NS	341.5±27.1	0.34	NS
4	299	0.92	p<0.0001	344.3±26.5	0.31	NS	342.8±25.8	0.33	NS
5	300	0.91	p<0.0001	346.3±25.4	0.34	NS	344.1±24.6	0.33	BS
6	301	0.91	p<0.0001	249.1±25.6	0.34	NS	346.1±24.2	0.33	NS
7	303	0.90	p<0.0001	352.4±25.5	0.38	NS	347.7±22.9	0.35	NS

Table 3: Effect of parity on the correlation relationships of LBW on BCS in lactating Ankole cows and the Friesian crossbreds in Nyagatare district, Rwanda

	Parity 1			Parity 2			Parity 4		
Weeks	Weight	Coeff.	Prob.	Weight	Coeff.	Prob.	Weight	Coeff.	Prob.
1	293.0±13.9	0.94	0.0040	293.7±22.1	0.91	0.0107	302.0±27.1	0.99	0.0073
2	293.5±15.9	0.94	0.0031	293.7±21.9	0.92	0.0100	302.0±26.3	0.99	0.0031
3	295.7±15.9	0.93	0.0072	295.3±21.7	0.92	0.0085	303.8±25.4	0.99	0.0006
4	297.5±16.9	0.93	0.0057	296.2±21.7	0.91	0.0114	305.8±24.9	0.99	0.0013
5	299.2±16.9	0.93	0.0070	297.8±22.1	0.91	0.0121	307.5±23.5	0.99	0.0038
6	300.5±17.9	0.94	0.0047	299.8±22.9	0.88	0.0208	397.5±22.5	0.98	0.0134
7	302.8±18.7	0.96	0.0024	301.5±23.7	0.86	0.0269	309.0±21.3	0.96	0.0332

Table 4: Linear regression coefficients between body condition score (dependent variable) and body condition scores (predictor variable) of lactating Ankole cows and Ankole x Friesian crossbreds under open grazing conditions

Animal descriptors			Regression coefficients (±SE)					
Breeds	N	Parity	Intercept	Pr>|t|	Slope	Pr>|t|	Adjusted R^2	Pr>F
Ankole	42	2	247.9±3.52	***	16.4±1.13	***	0.8381	***
	42	3	247.2±4.22	***	18.6±1.48	***	0.7928	***
	28	4	247.8±2.36	***	18.4±0.71	***	0.9614	***
Ankole x Friesian (50-75%)	28	2	288.3±7.53	***	11.8±2.70	***	0.3990	***
	35	3	294.3±13.5	***	14.5±4.64	**	0.2048	**
	28	4	366.7±0.72	***	0^1	NS	0^1	NS
Ankole x Friesian (>75%)	42	2	299.3±4.41	***	12.6±1.48	***	0.6382	***
	35	3	303.0±4.07	***	20.6±1.60	***	0.8289	***
	21	4	342.9±4.61	***	11.1±2.11	***	0.5723	***

CONCLUSION

Because of its independence from breed, parity and morphological characteristics, BCS Systems are pertinent tools in routine animal management. The relationships between BCS and live-body weight are tacit indicators of milk production efficiency. The possibility for using the relationship in breeding and selection needs to be explored.

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