The Influence of Dam Weight, Body Condition and Udder Scores on Calf Birth Weight and Preweaning Growth Rates in Beef Cattle

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ABSTRACT : Records of weight, age, body condition at calving and udder characteristics scores of 425 beef cows and birth weights and periodical weights of their offspring from birth to weaning were analyzed to study the effect of body weight, condition and udder characteristic scores of dams on birth weight and Preweaning growth of their offspring. Dam's body condition (fat reserve) at calving were scored on a scale of 1 to 5 (1=extremely thin and 5=extremely fat) and dam's udder characteristics were scored on a scale of 1 to 7 (1=udder well attached with small teats and 7=at least one quarters not functional). Dams were from three distinct breed groups and were mated in single sire mating groups within each breed group for 45 days. Within each breed group and year, the dams were classified into high, medium and low based on their weights at the time of parturition. The data were analysed using covariance analysis. In general, calves born to heavier dams were heavier at birth and had higher rate of Preweaning growth. The effect of dam's body condition score on the calf birth weight was not significant. However, cows with average body condition score of 2.5 or 3.0 gave birth to calves that had higher preweaning growth rates up to weaning than those born to calves with higher body condition score. The udder characteristics score did not affect calf birth weight as expected; however, cows with udder score of 3 (udder well attached with large teats) produced calves with higher preweaning growth rate than those with smaller teats. Based on the results, it can be concluded that maintaining animals with average body condition and weight would result in more efficient calf production. In addition, cows with well attached udder and large teats would provide a better maternal environment for Preweaning growth rates of their calves. (*Asian-Aus. J. Anim. Sci. 2000. Vol. 13, No. 4 : 435-439*)

Key Words : Dam Weight, Body Condition, Udder, Calf Preweaning Weight

INTRODUCTION

Preweaning calf growth is emphasized in cow-calf production as it directly affects weaning weight. The early growth traits such as birth, weaning, 200-day and 400-day weights of the calves are related to their mature size (Meyer, 1995). Information on parent's mature weight and body condition could be helpful in estimating the mature size of the progeny as well (Meyer et al., 1993).

Cows can be scored for body condition regularly, particularly in cases where weighing is not practical. The technique is easy to learn and does not require special equipment. It can be used efficiently in making management decisions (Fields and Sand, 1994; Hamilton and Giesen, 1996a). Dam weight at calving may also influence birth weight and preweaning growth rate of the calf. Spitzer et al. (1995) reported that cows with heavier body weight at parturition gave birth to heavier calves.

The positive effect of dam's milk production on the weaning weight of the calf is well documented. The amount of milk suckled by the calf may be influenced by the udder characteristics of the dam. Roger et al. (1991) and Short and Lawlor (1992) reported high genetic correlation between cow longevity and traits describing udder characteristics. The physical characteristics of the cow's udder such as extremely large teats, loosely attached udders (suspended close to the ground) may affect calf's success in initiating suckling or receiving enough milk. Hamilton and Giesen (1996b) reported that suckling time was not related to udder attachment, udder capacity, front or rear teat placement; however, the period of time to first suckling tended to be negatively correlated to teat size, indicating a trend for calves to take longer time to start suckling from dams with larger teats compared to dams with relatively smaller teats.

Numerous genetic and environmental factors influence birth weight and preweaning growth rate of beef calves (Holland and Odde, 1992; Fields and Sand, 1994).

The objective of this study was to evaluate the effect of dam's weight and body condition score at parturition on birth weight and preweaning growth rates of the calf. The influence of dam's udder characteristics on the preweaning rate of calf growth was also studied.

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Table 1. Numbers of dams that raised a calf by breed group, dam's weight class, body condition and udder scores

Dam's traits	Breed group						Total
	Dairy synthetic (SD)		Beef synthetic (HY)		Crossbred (XB)		
Condition score							
2.5		6		2		5	13
3.0		53		37		55	145
3.5		36		81		106	223
4.0		6		14		24	44
Total		101		134		190	425
Udder score							
1		32		58		53	143
2		62		67		78	207
3		7		9		59	75
Total		107		134		190	425
Dam's weight class (kg)	n	Mean±SD	n	Mean±SD	n	Mean±SD	
High	28	547.3±46.7	45	547.8±34.4	63	524.9±38.7	136
Medium	40	456.6±24.6	52	467.5±24.9	62	429.1±21.4	154
Low	33	370.6±37.0	37	368.1±41.8	65	347.1±30.9	135
Total	101		134		190		425

MATERIALS AND METHODS

Experimental procedures

Records of weight and body condition scores at calving and udder characteristic scores of 425 cows and birth weight and periodical weights of their calves up to weaning were used in this study. The dams belonged to three synthetic breed groups; Beef Synthetic (HY), crossbred (XB) and Dairy Synthetic (SD) developed and maintained at the University of Alberta Beef Cattle Research Ranch at Kinsella, Alberta, Canada. Details of the genetic compositions of the breed groups, breeding and management of the herd have been described by Berg et al. (1990).

Matings were in single sire groups within each breed group for 45 days starting in July and the calving season started in April. The pregnant cows from the three breed-groups were managed together following breeding. The dams' weights were classified within each breed group and year into three classes (high= cow weights of at least half standard deviation above the breed group mean, medium= cow weights ranging between minus half to plus half standard deviation from the mean and low= cow weights lighter than half standard deviation below the mean).

Dam's body condition (fatness) was scored at calving on a scale of 1 to 5, taking the increment of 0.5 (Fields and Sand, 1994; Hamilton and Giesen, 1996a) with 1.0= extremely thin (emaciated bone structure of shoulder, rib, back, hooks and pins); 1.5= very thin; 2.0= thin; 2.5= fairly thin; 3.0= normal; 3.5= fairly fat; 4.0= fat; 4.5= very fat and 5.0= grossly fat. The body condition scores ranged from 2.5 to 4.0 in the data set.

Dam's udder characteristics were scored at calving on a scale of 1 to 7 (Hamilton and Giesen, 1996b) with score of 1= udder well attached with small teats; 2= udder well attached with medium teats; 3= udder well attached with large teats; 4= bottle or extremely large teats; 5= pendulous udder with normal teats; 6= pendulous udder and large or bottle teats and 7= one or more quarters being hard, infected (mastitis) or dry. There was no udder score of 4 to 7 in the data set.

The calves were weighed within 24 hours after birth and at average ages of 60-days, 90-days and 180-days after birth (weaning). The herd was managed according to the guidelines of the Canadian Council on Animal Care. The distribution of dams within each breed group by condition scores and by the average weights of the dam weight classes, and udder scores are presented in table 1.

Statistical analysis

Data were analyzed by covariance analysis, using GLM Procedure of SAS (1990). Fixed linear models were used for analysis of calf birth weights (as dependent variable), including the fixed effects of the dam weight class, body condition score, udder score, breed group, sex of calf and the independent continuous variables of age of the dam and the calf birth date as covariates. In analyzing the preweaning weights and periodical growth rates (as dependent variables), the independent continuous variables of dam's and calves's ages at the time of measurement were used as covariates. Comparisons of the effects of dam's weight class, body condition and udder scores

Table 2. Least squares means and standard errors of calf preweaning weight and average daily gain (ADG) by dam weight class

Calf weight and growth rate	Dam weight		
	Low	Medium	High
Weight at birth (kg)	32.50±0.63[a]	37.00±0.55[b]	39.50±0.67[c]
Weight at 60-d (kg)	84.00±1.39[a]	95.40±1.21[b]	100.60±1.48[c]
0 to 60-d ADG (kg/d)	0.85±0.02[a]	0.95±0.02[b]	0.99±0.02[b]
Weight at 90-d (kg)	128.20±2.03[a]	142.00±1.76[b]	148.10±2.16[c]
60- to 90-d ADB (kg/d)	1.47±0.01[a]	1.55±0.01[ab]	1.58±0.01[b]
Weight at 180-d (kg)	205.80±2.53[a]	226.30±2.20[b]	236.80±2.70[c]
90- to 180-d ADG (kg/d)	0.86±0.01[a]	0.94±0.01[b]	0.98±0.01[c]

[a,b,c] Means in the same row followed by different letters are significantly different ($p<0.05$).

Table 3. The correlation coefficients between dam's weight at calving and preweaning calf weight and average daily gain (ADG) within each breed group

Calf weight and periodical growth	Dam weight at calving within breed		
	Dairy synthetic (SD)	Beef synthetic (HY)	Crossbred (XB)
Weight at birth (kg)	0.55**	0.63**	0.53**
60-d old weight	0.49**	0.50**	0.50**
0 to 60-d ADG	0.51**	0.44**	0.51**
60- to 90-d ADG	0.32**	0.28**	0.15*
90- to 180-d ADG	0.37**	0.27**	0.25**

* $p<0.05$; ** $p<0.02$.

on the calf birth weight and periodical preweaning growth rates were performed by separation of least squares means.

RESULTS AND DISCUSSION

Least square means for the preweaning growth of calves by dam's weight classes are presented in table 2. Dam weight at calving had significantly positive effects on birth weight and preweaning growth rate of the calf ($p<0.05$). The results indicated that the heavier cows had allocated more nutrient to the development of the calf during the fetal period, resulting in heavier calves at birth and produced relatively more milk, which had positive effect on growth rate of the calves during the preweaning period. The fact that dam's weight was positively correlated with the calf weight at birth and its periodical preweaning growth confirms the conclusions (table 3). The results are in agreement with those reported by Spitzer et al. (1995) who found that cows with heavier weights at parturition gave birth to heavier calves. However, Rutledge et al. (1971) found that cow weight was negatively correlated with calf weaning weight.

Effect of dam's body condition score on the calf growth

Least squares means for calf birth weight and the periodical preweaning growth rates by the dam's body condition score are presented in table 4. Body condition score was a significant source ($p<0.05$) of variation in calf birth weight as well as calf growth rates at the ages of 60 days, 90 days and 180 days. Higher body condition scores which represent greater body fat reserve were associated with lighter calf birth weights and generally lower preweaning growth rates.

Body condition scores of 2.5 and 3.0 which represent normal and desirable body condition of the dam resulted in heavier birth weight and higher preweaning growth rates of the calf compared to the higher body condition scores. The results may be attributed to the lower milk production of dams with higher body fat reserves compared to those with lower body condition scores. This is in agreement with the results of some researchers who reported that higher body condition scores were associated with lower milk production (Jeffery et al., 1971; Wilson et al., 1971; Johnston et al., 1995). Spitzer et al. (1995) reported that calf birth weights were progressively heavier for cows with body condition scores of 4, 5 and 6 respectively (scored from 1 to 9). They also reported that cow body condition score at calving had no effect on weaning weight of the calves and concluded that body fat reserves did not have a major role in milk production. In the present study, dam's body condition score had a negative effect on the calf's weaning

Table 4. Least square means and standard errors of calf preweaning weight and average daily gain (ADG) by dam body condition scores

Calf weight and ADG	Body weight condition scores			
	2.5	3.0	3.5	4.0
Weight at birth (kg)	38.20±1.39[a]	36.70±0.46[a]	35.90±0.38[ab]	34.60±0.78[b]
Weight at 60-d (kg)	98.30±3.06[a]	95.60±1.02[a]	91.50±0.84[b]	88.80±1.72[c]
0 to 60-d ADG (kg/d)	0.97±0.04[a]	0.96±0.01[b]	0.92±0.01[b]	0.88±0.02[c]
Weight at 90-d (kg)	144.10±1.39[ab]	143.50±1.49[a]	137.50±1.2[bc]	132.70±2.5[c]
60- to 90-d ADG (kg/d)	1.53±0.02[abc]	1.60±0.00[bc]	1.53±0.00[bc]	1.46±0.01[c]
Weight at 180-d (kg)	229.60±5.59[a]	227.20±1.86[a]	220.40±1.53[b]	214.50±3.14[c]
90- to 180-d ADG (kg/d)	0.95±0.01[a]	0.93±0.00[ab]	0.92±0.00[bc]	0.91±0.01[c]

[a,b,c] Least square means followed by different letters in the same row are significantly different ($p<0.05$).

Table 5. Least square means and standard errors of calf preweaning weight and average daily gain (ADG) by dam udder scores

Calf weight and ADG	Udder scores		
	1	2	3
Weight at birth (kg)	36.20±0.53[a]	36.10±0.49[a]	36.80±0.70[a]
Weight at 60-d (kg)	91.40±1.16[a]	93.30±1.08[ab]	95.40±1.54[b]
0 to 60-d ADG (kg/d)	0.90±0.01[a]	0.93±0.01[b]	0.96±0.02[c]
Weight at 90-d (kg)	136.60±1.70[a]	139.30±1.58[ab]	142.50±2.25[b]
60- to 90-d ADG (kg/d)	1.51±0.01[a]	1.53±0.01[ab]	1.57±0.01[b]
Weight at 180-d (kg)	217.50±2.12[a]	222.40±1.97[b]	228.90±2.81[c]
90- to 180-d ADG (kg/d)	0.90±0.01[a]	0.92±0.01[a]	0.96±0.01[b]

[a,b,c] Least square means followed by different letters in the same row are significantly different ($p<0.05$).

weight.

There are conflicting results on the subject in literature. Christian et al. (1965) found no significant correlation between birth weight and milk production. Garnsworthy and Gardner (1985) reported that pre-calving condition score did not affect milk yield because leaner cows increased their feed intake and fatter cows tended to deplete labile fat reserves, suggesting that milk yield was maintained at the expense of body weight. Recently, some researchers have reported negative correlation between linear body condition score and functional productive life of dam (Rogers et al., 1991).

Effect of dam's udder characteristic score on the calf growth

Least square means for preweaning calf traits by udder scores are presented in table 5. Non of the scores describing udder and teat characteristics had significant effect on calf birth weight. However, udder score had significant effect ($p<0.05$) on preweaning growth rates of the calves. The analysis indicated that udder score of 3 (udder well attached with large teats) resulted in higher preweaning growth rates of the calves compared with udder score of 1 (udder well attached with small teats), indicating the positive influence of cows with large teats on the calf's preweaning growth rate compared to those with smaller teats. The result is generally in agreement with reports by Vukasinovic et al. (1995) who found that traits describing udder and teats in cattle had significant influence on the functional productive life of cows.

Udder traits together with some body conformation traits provide good criteria for indirect selection for longevity in beef cattle (Bagnato, 1993). This is due to the fact that cows with well-shaped and tightly attached udders and proper teats remain in the herd longer and are easier to nurse and less susceptible to mastitis and injury, which might indirectly contribute to a longer productive live of dams in the herd.

In conclusion, dam weight had generally positive effects on the calf birth weight and preweaning growth rates. The normal body condition score of 2.5 and 3.0 produced progeny which were relatively heavier at birth and had higher preweaning growth rate than those produced by cows with higher body condition scores. Dams with well attached udder and medium or large teats raised calves with higher preweaning growth rates compared to dams with similar udder attachment, but small teats. Therefore, although dam weight and body condition score are important in nutritional management and productivity of the herd, and should be included among the culling criteria of the herd, selection of cows for genetic improvement should be based on the productivity of individual animals in term of their progeny performance.

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