FR 03. EFFECT OF BIRTH SEASON AND BST ON GROWTH RATE IN HOLSTEIN HEIFERS

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Resumen

Efecto de la época de nacimiento y bST sobre la tasa de crecimiento de novillas Holstein

Doscientas cuarenta y siete novillas Holstein nacidas durante cuatro años fueron utilizadas en un arreglo factorial 2x2, para evaluar dos tasas de crecimento (.680 o .900 kg/d) y dos tratamientos de bST (12.36 mg/d o 500 mg/14d; control no-inyectados). Las novillas fueron manejadas en corrales con comederos sombreados, agua ad libitum y alimentadas con ensilaje de maíz y alimento concentrado para cubrir los requerimientos nutricionales para las ganacias de peso preestablecidas. Los datos fueron analizados por cuadrados mínimos, utilizando un modelo mixto. Diferencias significativas sobre peso final, ajustado por el peso inicial, fueron detectadas para época de nacimiento, dieta, bST y la doble interacción año x época, para los períodos de crecimiento global y peripuberal (90-365 y 210-360 días de edad). El efecto de año fue significativo durante el período peripuberal y la interacción época x bST fue significativa durante el período global. Los resultados indicaron que bST incrementó el peso final, independientemente de la época de nacimiento de las novillas. El estímulo del bST parece estuvo asociado con una mejor eficiencia alimenticia, mientras la menor tasa de crecimiento durante la época caliente parece estuvo asociada con una disminución del consumo de energía y un aumento del gasto energético para disipar calor por respiración.
Palabras claves: Crecimiento, bST, novillas, dieta.
Key words: Growth, bST, heifers, peripubertal, diet.

Introduction

Dairy farmers invest money, labor and feed to raise replacements for their dairy herds. Growth of dairy heifers is affected by genetics, nutrition, health, environment and management, among others. Recommendations are that replacement dairy heifers should first calve at about 24 mo of age and at 550 to 560 kg of body weight (NRC, 1989); these growth rates are possible, as long as no limitations exist. Age was inversely proportional to rates of growth (ADGs) between 91-365 d of age (Little and Harrinson, 1981). Heifers with ADGs of .9 kg/d reached puberty at about 9 mo but at 12-13 mo of age when ADGs were .6 kg/d. Season of birth had a significant effect on age and body weight of dairy heifers at puberty. Heifers born in winter-spring and fed for rapid growth were younger and lighter at puberty than those born in summer-autumn, but not when heifers were fed a low plane of nutrition (Little et al., 1981). The endocrine system controls body growth. Weight gains and amount of Somatotropin (ST)/g of anterior pituitary tissue were positively correlated (Armstrong and Hansel, 1956). Somatotropin is considered to be anabolic, anti-INS and lipolytic (Bass and Gluckman, 1990). Injections of bST increased ADGs of heifers 17 to 295% during the period from 1.5-18 mo (Enright, 1989; Early et al., 1990). Clearly, manipulation of growth rates using repartitioning agents such as bST should be evaluated critically. Objectives of this research are to describe effects of season of birth and bST injections on growth rates of Holstein heifers fed two diets and during two growth periods.

Materials and methods

The first 64 heifers used were born during July to February of consecutive years; 16 were assigned to each of four treatment groups at 90 d of age. The second 183 heifers were born during July of first year to April of the third consecutive year; unequal numbers of heifers were assigned to the four treatment groups at 50-120 d of age. For both experimental groups, treatments consisted of control (.68 kg/d) and fast growth rates (.900 kg/d) from 50-120 to 365 d of age. Within growth rates one treatment group also was injected with either 12.36 mg/d or excipient once daily from 210-360 d of age (64 heifers) or 500 mg/14 d or were not-injected from 210-360 d of age (183 heifers). Heifers within a treatment group were housed and managed in a large pen with feed bunk which was covered by shade. All heifers were fed corn silage beginning at about 80 d of age and grain concentrates were top-dressed on the silage to provide energy, CP, and minerals to support desired ADGs (NRC, 1989). All heifers were weighed and height at withers recorded biweekly beginning at 50-120 through 365 d of age and adjustments to feed offered were made within several days after weighing. Heifers were group fed once daily. Water was available ad libitum. Data for body weight and height were analyzed by least squares analysis of variance using the mixed model procedures of SAS. Overall growth period was from 90-120 to 365 d of age and peripubertal growth period was from 210-365 d of age (period when bST was injected). A second series of analyses calculated regression curves and described changes in weight and height during the specified growth periods. Overall and reduced models were used; included as sources of variation were the main effects of year, season of birth, diet, bST, the two- and three-way interactions, and age to the third order polynomial.

Results and discussion

Analyses of variance for final body weights during both growth periods are in table 1. Significant differences were detected for effects of season of birth, diet, bST and the two-way interaction, year*season, for both the overall and peripubertal growth periods. Significant effects were detected for year during the peripubertal growth period and for the two-way interaction, season*bST, during the overall growth period (table 1). The covariate initial body weight was significant during both growth periods. The quadratic effect of number of days on experiment was significant for the peripubertal growth period. As expected, final weights of heifers fed for higher ADGs were greater (>25 kg) than those fed for lower ADGs. At 365 d of age heifers injected with bST were about 26 kg heavier than those not-injected. This indicated the growth-promoting and repartitioning effects of exogenous bST, although results were contrary to those of Murphy et al. (1991). Heifers that were born during the moderate and cold seasons were heavier at 365 d of age than those born during the hot season; results agreed with Little et al. (1981). Heifers born during the hot season were exposed to high ambient temperatures which may have caused reduced feed intake and resulted in lower growth rates. Importantly, the interaction of season x bST (Table 2) during the overall growth period, showed that heifers born during the hot season and injected with bST were 20 kg heavier than those not-injected. Heifers born during the moderate season and injected with bST were 40 kg heavier than those not-injected. The bST-injected heifers also were 24 and 50 kg heavier than those born during the hot season either injected and not-injected with bST, respectively. Heifers born during the cold season injected or not-injected with bST were 13 and 27 kg lighter, respectively, than heifers born during the moderate season. However, heifers born during the cold season and injected with bST were 11 and 37 kg heavier, respectively, than heifers born during the hot season injected and not-injected with bST. Results differed for the not-injected heifers; those born during the cold season grew faster than those born during the moderate and hot seasons, but their final body weights always were less than heifers injected with bST no matter the season of birth. Results from analyses of the peripubertal growth period showed that heifers born during moderate, cold, and hot seasons had similar growth patterns as described by the overall model. These results did indicate that injections of bST improved growth rates of heifers during all seasons of birth, but the effects of bST on growth rates of heifers born during the hot season were less than for heifers born during the moderate and cold seasons. This may be due, in part, to reduced energy intake and the greater need to use energy to dissipate heat by evaporative cooling mechanisms and increased respiration rates.

Conclusions

Growth rates of heifers were increased by bST irrespective of whether heifers were fed for normal or rapid growth rates, or the season in which heifers were born. This suggested that bST improved growth rates by increasing feed efficiency and nutrient distribution to priority organs. Energy storage as protein accretion (skeletal and muscle growth), instead of fat deposition, may result in larger heifers at age of breeding. Thus, bST-injected heifers could be bred earlier to calve at a younger age.

Table 1. Least squares analyses of variance for final weights during two growth periods.

Sources	Overall growth period		Peripubertal growth period	
	F	P>F	F	P>F
Year	0.92	0.4317	18.36	.0001
Season of birth	6.46	0.0019	7.07	.0011
Diet	24.48	0.0001	14.92	.0001
bST	9.22	0.0027	15.70	.0001
Year x season of birth	3.19	0.0085	3.25	.0081
Season of birth x bST	3.06	0.0490	1.30	.2752
Diet x bST	1.33	0.2499	0.91	.3416
Initial weight	4.08	0.0447	13.23	.0003
Days	0.00	0.9617	0.75	.3877
Days x Days	0.54	0.4692	3.38	.0673

Table 2. Least squares means and SE of final weights (kg) during two growth periods.

Season of birth	Overall growth period		Peripubertal growth period	
	+ bST Mean ± SE	No bST Mean ± SE	+ bST Mean ± SE	No bST Mean ± SE
Hot	309.6 ± 11.6	283.7 ± 6.3	301.7 ± 4.2	288.1 ± 3.5
Moderate	333.5 ± 11.4	293.9 ± 4.4	317.4 ± 3.3	294.9 ± 2.6
Cold	320.7 ± 7.7	306.1 ± 3.9	311.1 ± 3.3	295.9 ± 2.7

Seasons: Hot= June-August; Moderate= September, October, March-May; Cold= November-February.

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