

INFLUENCE OF GROWTH RATE ON BODY COMPOSITION OF BEEF HEIFERS AT PUBERTY

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Story in Brief

Eighteen Angus x Hereford heifers were blocked by body weight to three nutritional regimes to evaluate the effect of growth rate on body composition at puberty: 1) full fed to gain 3.0 lb/day; 2) limit fed to gain 1.5 lb/day; 3) maintenance fed to gain .4 lb/day for 16 weeks then fed to gain 3.0 lb/day. Progesterone in plasma was quantified weekly to determine the onset of puberty (luteal activity). Heifers were slaughtered within 10 days after puberty. Total body fat was determined in five categories: 1) omental-mesenteric, 2) udder, 3) kidney-pelvic-heart, 4) subcutaneous and 5) intermuscular. At puberty, full fed animals had greater body weights, greater body condition scores and more total body fat (as a proportion of carcass weight) than either the limit or maintenance fed animals. We conclude that carcass composition, body weight and body condition score at puberty can be altered by rate of gain.

(Key Words: Beef Heifer, Body Fat, Carcass, Progesterone, Puberty.)

Introduction

Improvements in reproductive efficiency could greatly increase the profitability of beef production. Weaned calf production is very inefficient. Bellows et al. (1979) estimates that less than 75% of postpartum cows and replacement heifers exposed to bulls, become pregnant during the breeding season and calve the following year. Of the nonpregnant animals, postpartum cows remained anestrous while heifers did not reach puberty during the breeding season. Adequate growth and development of the replacement heifers could greatly increase the efficiency of production.

Most producers set a target age at puberty of 12 to 16 months. However, age is not the only factor affecting puberty. Factors such as breed, weight and body condition or body energy reserves may influence when the

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first estrus occurs. Body energy reserves influence reproductive performance in postpartum cows and could regulate the onset of puberty. Wagner et al. (1988) indicated that total fat in the carcass of beef cows could be accurately estimated by using a body condition scoring (BCS) system of 1 to 9. Steers fed diets to achieve greater daily gains had increased fat in their carcasses (Waldman et al., 1971). Consequently, alterations in growth rate may influence carcass composition which, in turn, could affect age and/or weight at puberty.

The objectives of this experiment were to determine the effect of growth rate of heifers on carcass composition, age and weight at puberty.

Materials and Methods

Eighteen Angus x Hereford heifers were blocked by weight to three treatments. Treatments were: 1) full fed to gain 3.0 lb/day (n=7); 2) limit fed to gain 1.5 lb/day (n=5); 3) maintenance fed to gain .4 lb/day for 16 weeks then fed to gain 3.0 lb/day (n=6). Heifers were weighed and BCS was recorded every 28 days after a 16 hour withdrawal of feed and water.

Progesterone in plasma was quantified weekly to determine onset of luteal activity. Progesterone concentrations greater than 1 ng/ml for two consecutive weeks were used as the criterion for the onset of puberty. Date of first sample greater than 1 ng/ml was used to determine age at puberty. Heifers were slaughtered within 10 days after the second progesterone sample greater than 1 ng/ml.

Omental-mesenteric (OM), kidney-pelvic-heart (KPH) and udder fat were physically removed from the carcasses at slaughter and carcass weight was determined. After a 48 to 72 hour chill, one side of each carcass was physically separated into lean, bone, subcutaneous fat, intermuscular fat and soft tissue. Total body fat represents the sum of OM, KPH, udder, subcutaneous and intermuscular fat; intramuscular fat was not determined. Percent total body fat was calculated by dividing total body fat by adjusted carcass weight (carcass weight + KPH+OM+udder).

Results and Discussion

Rate of gain had a significant effect on the age and weight (Table 1) at which heifers reached puberty. Full and maintenance fed heifers were younger (389 and 371 days; respectively) at puberty ($P<.01$) than the limit fed heifers (431 days). Conversely, the full fed heifers were heavier (829 lb; $P<.01$) at puberty than either the limit (692 lb) or maintenance (664 lb) fed

Table 1. Influence of rate of gain on age and weight at puberty

Measurement	Treatment			SE
	Full	Limit	Maintenance	
No. of animals	7	5	6	-
Age, days	389 ^c	431 ^b	371 ^c	38
Live weight, lb	829 ^b	692 ^c	664 ^c	39
Adj. carcass weight ^a , lb	505 ^b	412 ^c	381 ^c	50

^a Adj. carcass weight = carcass weight + (KPH + OM + udder).

^{b,c} Values in the same row not sharing a common superscript differ ($P < .01$).

heifers. Increased live weight of the full fed heifers is further reflected in their heavier ($P < .01$) carcass weights compared with the limit and maintenance fed heifers.

Body energy reserves or BCS at puberty was also affected by rate of gain (Table 2). Full fed heifers had a BCS of 6.8 ($P < .01$) at puberty compared with 5.7 for the limit and maintenance fed heifers. This one unit increase in BCS was reflected by a greater ($P < .01$) amount of total fat (178.8 lb) in the full fed heifers compared with either limit (89.6 lb) or maintenance (69.2 lb) fed heifers. Hence, heifers did not initiate estrous cycles when they attained a certain percentage body fat. When fat was expressed as a percent of adj. carcass weight, the full fed animals had a greater ($P < .01$) proportion of fat at puberty than the limit or maintenance fed animals. These results support the findings of Wagner et al. (1989) in postpartum cows indicating that BCS can be used to estimate total carcass fat in heifers.

In conclusion, carcass composition, live weight and BCS at puberty can be altered by rate of gain. Thus, body energy reserves may not be the only factor that regulates puberty in the heifers.

Table 2. Influence of rate of gain on BCS^a and carcass fat at puberty

Measurement	Treatment			SE
	Full	Limit	Maintenance	
BCS	6.8 ^d	5.7 ^e	5.7 ^c	.2
Total fat, lb ^b	177.8 ^d	89.6 ^e	69.2 ^c	13.3
Carcass fat (%) ^c	35.2 ^d	21.2 ^c	18.2 ^c	2.3

^aBCS = Body condition score (1 = emaciated; 9 = extremely fat).

^bTotal fat = OM + KPH + udder + subcutaneous + intermuscular.

^cCarcass fat = Total fat, lb / Adj. carcass weight, lb.

^{d,e}Values in the same row not sharing a common superscript differ (P < .01).

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