

GROWTH RATE OF BEEF HEIFERS

II. CARCASS LIPID AND LIPID PARTITIONING AT PUBERTY

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Story in Brief

Thirty-eight Angus x Hereford heifers were blocked by body weight and age to three nutritional regimes to evaluate the effect of growth rate on carcass lipid and lipid partitioning at puberty: 1) full fed to gain 3.0 lb/day; 2) limit fed to gain 1.5 lb/day; 3) maintenance-full fed to gain .4 lb/day for 16 weeks then full 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 ether extractable lipid was determined in five fat categories: 1) omental-mesenteric, 2) kidney-pelvic-heart, 3) subcutaneous, 4) intermuscular and 5) intramuscular. At puberty, full fed animals had a greater percentage carcass lipid than either limit or maintenance-full fed animals. Percentage of total lipid in lean was reduced while percentage lipid in omental-mesenteric was greater in full fed heifers compared with limit and maintenance-full fed heifers. We conclude that carcass lipid and lipid partitioning at puberty can be altered by rate of gain and total carcass lipid is not the only factor that regulates the onset of puberty.

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

Introduction

The importance of replacement heifer growth and development and their effect on eventual economic and biological efficiency of the cow-calf operation is unquestionable. Body energy reserves influence reproductive performance in postpartum cows and could regulate the onset of puberty in heifers. 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. Results from the first phase of this experiment support the conclusion that

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carcass composition and BCS at puberty can be altered by rate of gain (See companion paper).

The objective of the second phase of this experiment was to determine the effect of growth rate of heifers on carcass lipid and lipid partitioning into various depots at puberty.

Materials and Methods

Thirty-eight Angus x Hereford heifers were blocked by weight and age to three treatments. Treatments were: 1) full fed to gain 3.0 lb/day (n=13); 2) limit fed to gain 1.5 lb/day (n=12); 3) maintenance-full fed to gain .4 lb/day for 16 weeks then full fed to gain 3.0 lb/day (n=13). Methods for determination of puberty and of processing heifers at slaughter are described in a companion paper.

After physical separation of omental-mesenteric fat (OM), kidney-pelvic-heart fat (KPH), subcutaneous fat (SC), intermuscular fat (SEAM), LEAN and soft tissue (SFT; inseparable lean and fat) pools, each pool was individually ground, mixed and reground and a 150 gram sample was collected. Ether extractable lipid, protein and moisture were determined for each pool (AOAC, 1984). Adjusted boneless carcass weight was calculated as the sum of OM, KPH, SC, SEAM, SFT and LEAN. Total lean lipid is the sum of SFT and LEAN lipid and represents intramuscular fat. Percentage lipid, protein and moisture were calculated by dividing the sum of the five pools for each respective tissue by adjusted boneless carcass weight. Fat free lean represents the sum of LEAN and SFT tissue minus total lipid in LEAN and SFT divided by adjusted boneless carcass weight.

Results and Discussion

Rate of gain had a significant effect on the age and weight at which heifers reached puberty (See companion paper). Full fed heifers were younger and had heavier live and carcass weights at puberty than both the limit and maintenance-full fed heifers. Carcass weight variations were manifested by measurable differences in total separable fat and observed differences in BCS.

The full fed heifers had a greater ($P < .01$) percentage of lipid (33.6%; Table 1) in the adjusted carcass than either the limit (23.4%) or maintenance-full fed (22.0%) heifers. Conversely, the full fed heifers had a reduced percentage ($P < .01$) protein, moisture and fat free lean compared with limit and maintenance-full fed heifers.

Full fed heifers had a greater ($P < .01$) percentage of their lipid deposited in the OM (19.3%; Table 2) than either limit or maintenance-full fed heifers (16.7% and 16.6%; respectively). Whereas, the maintenance-full fed heifers

Table 1. Influence of rate of gain on carcass composition as a percentage of adjusted boneless carcass weight^a.

Measurement	Treatment			SE
	Full	Limit	Maint-Full	
Lipid (%)	33.6 ^c	23.4 ^d	22.0 ^d	1.6
Protein (%)	14.5 ^c	16.8 ^d	17.2 ^d	.4
Moisture (%)	50.8 ^c	58.9 ^d	59.9 ^d	1.2
Fat free lean (%)	60.4 ^c	71.7 ^d	72.7 ^d	1.6

^a Adjusted boneless carcass weight = LEAN + SFT + SC + SEAM + KPH + OM.

^b Fat free lean = ((LEAN weight + SFT weight) - TLL)/adjusted boneless carcass weight.

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

Table 2. Influence of rate of gain on lipid partitioning^a.

Measurement	Treatment			SE
	Full	Limit	Maint-Full	
OM (%)	19.3 ^c	16.7 ^d	16.6 ^d	.6
KPH (%)	10.7 ^c	11.8 ^c	9.2 ^d	.5
SEAM (%)	29.2	27.7	28.2	.6
SC (%)	19.2	17.1	16.9	.9
TLL (%)	21.7 ^c	26.8 ^d	29.1 ^d	1.3

^a Partitioning is expressed as a percentage of total lipid.

^b Total lean lipid (TLL) = SFT lipid + LEAN lipid.

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

had a lower ($P < .01$) percentage of their lipid deposited in KPH (9.2%) than either full or limit fed heifers (10.7% and 11.8%; respectively). There was no difference in lipid partitioning in the SC and seam depots. However, a decreased percentage of lipid ($P < .01$) was deposited in the lean of the full fed (21.7%) compared with the limit (26.8%) and maintenance-full (29.1%) fed heifers.

In conclusion, rate of gain altered percentage carcass lipid and lipid partitioning in heifers at puberty. However, it appears that carcass lipid content does not act alone in the initiation of puberty and age may influence when the first ovulation in the beef heifer occurs.

Literature Cited

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