

# Relationship between weight at puberty and mature weight in beef cattle

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## STORY IN BRIEF

The relationship between weight at puberty and mature weight was evaluated in Angus x Hereford heifers born in the spring of 1997 (n = 12), 1998 (n = 12), and 2003 (n = 10). Weight at puberty was calculated from shrunk body weights taken before and after the onset of luteal activity as determined from concentrations of progesterone in plasma. Mature body weight was a shrunk body weight in mid-gestation, adjusted to a body condition score (BCS) of 5. Mature weights were taken at 5 to 7 yr of age. Weights at puberty were similar ( $P = 0.27$ ) for heifers born in the springs of 1997, 1998 and 2003 (316, 316, and 335 kg, respectively). Mature body weight of the cows was similar ( $P = 0.90$ ) for cows born in all years. This research determined that the percentage of mature body weight at puberty averaged 56% and was similar ( $P = 0.44$ ) for heifers in the three years. There was minimal variation in the percentage of mature weight at puberty and 79% of the heifers initiated the first ovarian cycles between 51 and 60% of the mature weight. Additional studies are necessary to determine the influence of breed of heifer on the percentage of mature body weight at the initiation of ovulation and estrus cycles.

**Key Words:** Angus x Hereford, heifer, mature weight, puberal weight

## INTRODUCTION

Age at which a heifer calves for the first time is an important factor that determines the profitability of a beef herd. Heifers that reach puberty prior to the breeding season have a greater ability to calve at 2 y of age and wean more pounds of beef in their reproductive lifetime compared with heifers that calve at 3 y of age (Lesmeister et al., 1973). When puberty is not attained before the start of the breeding season, fertility (Byerley et al., 1987) and potential income for cow-calf producers are reduced (Werth et al., 1991). Manipulation of the diet, rate of gain, and plasma metabolites and hormones can hasten the onset of puberty (Yelich et al., 1996). Management decisions should be made to hasten the onset of puberty in heifers, increase the number of pubertal heifers prior to the breeding season, and increase the number of heifers that calve at 2 y of age to improve profitability.

The relationship between body weight at puberty and mature weight in beef cattle is not established. An accurate determination of the percentage of mature weight that a beef heifer needs to achieve for puberty to occur will allow producers to manage heifers to increase the number that are pubertal prior to breeding season.

There are both genetic and environmental components that influence mature weight in beef cattle. Mature weight is heritable and can be altered by selection (Kaps et al., 1999). Selection for weaning weight and yearling weight will indirectly increase mature weight. Environment, including type of nutrient consumption, may influence mature weight of beef cattle. Brahman heifers that grazed Bermuda grass had greater mature weights than Brahm cattle that grazed fescue (Sandelin et al., 2002).

Development of replacement heifers is critical for profitable beef production. An understanding of the relationship of weight at puberty with mature weight will allow development of management strategies to enhance performance. Beef producers must consider resources and environmental conditions when developing feeding programs for replacement heifers to increase the probability that heifers will calve at 2 y of age. The objective of this study was to determine the relationship between weight at puberty of individual Angus x Hereford heifers and mature weight.

## **MATERIALS AND METHODS**

Weights at puberty and mature weights were obtained for Angus x Hereford heifers born in the spring of 1997 (n = 12), 1998 (n = 12) and 2003 (n=10). Heifers were at least 75% Angus and 25% or less Hereford, and were maintained in the research herd and used for a variety of projects to study reproductive physiology at the Oklahoma Agricultural Experiment Station. Weights obtained at 5 to 7 yr of age were taken after cows were withdrawn from feed and water for 16 h and BW was adjusted to a BCS of 5 (Tennant et al., 2002).

Weight at puberty was expressed as shrunk body weight (restriction of feed and water for 16 h) and determined by extrapolation of body weights taken monthly for 1997 and 1998 heifers and at 8- to 12-wk intervals before and after the onset of puberty for the 2003 heifers.

Blood was collected weekly from heifers into tubes containing EDTA, placed on ice, and centrifuged at 1,800 x g within 4 h after collection. Plasma was aspirated and stored at -20° C until progesterone was quantified (Vizcarra et al., 1997) with a solid phase RIA (Coat-A-Count progesterone kit, Diagnostic Products Corp., Los Angeles, CA) to determine the onset of ovarian luteal activity. Concentration of progesterone greater than 0.5 ng/mL for two consecutive samples was the criterion to determine the onset of puberty. Date of the first of the two consecutive samples with progesterone greater than 0.5 ng/mL was considered age at the onset of puberty.

Percentage of mature weight at puberty was determined for each animal. Differences in weight at puberty, mature weight and percentage of mature weight at puberty for the year of birth were analyzed as one-way ANOVA using GLM procedures of SAS. Regression analysis was used to evaluate the relationship between weight at puberty and mature weight.

## **RESULTS AND DISCUSSION**

Weights at puberty and maturity are in Table 1. Spring born heifers in 1997, 1998 and 2003 attained puberty at similar ( $P = 0.27$ ) body weights (316, 316, and 335 kg, respectively). Heifers born in all years had similar ( $P = 0.90$ ) mature weights ( $577 \pm 9$  kg). Heifers initiated puberty at 56% of the mature weight and year did not influence ( $P = 0.44$ ) percentage of mature weight at puberty. Regression analysis of mature weight and weight at puberty for spring born heifers revealed that mature weight accounted for 32% of the variation in weight at puberty ( $P < 0.001$ ).

There was minimal variation in the percentage of mature weight at puberty in the heifers (Figure 1). Seventy-nine percent of the heifers attained puberty at 51 to 60 percent of the mature weight. Only 9% of the heifers initiated the first normal ovarian cycles at greater than 69% of the mature

weight. Twelve percent of the heifers were estrus before they attained 50% of the mature weight.

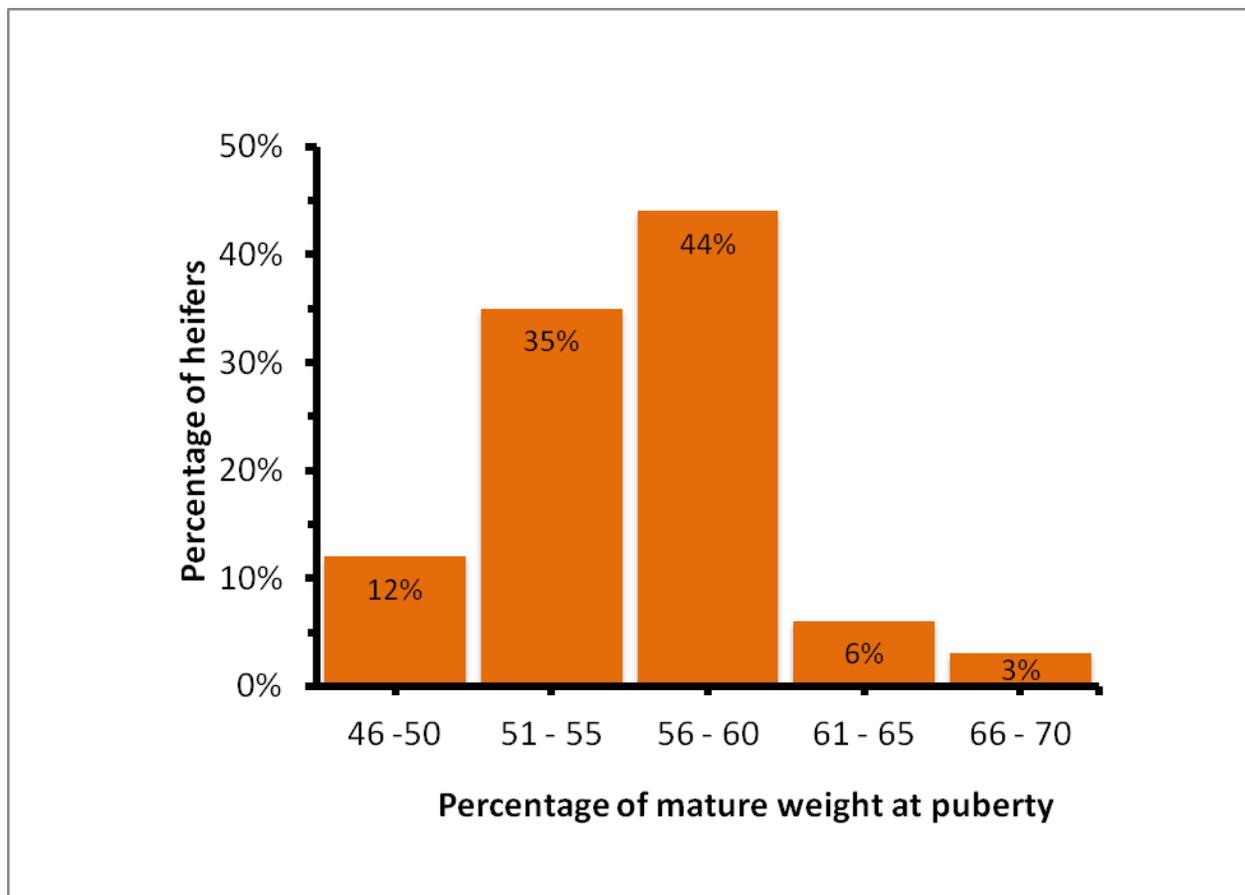
Prepubertal growth of the heifers in this experiment was similar to normal management used in the beef industry of the Great Plains. When evaluating the relationship between weight at puberty and mature body weight of cows, comparisons should be made between cows of similar age, because age at which mature weight is determined can influence the percentage of mature weight at which the heifer reaches puberty. Body weight of a cow can vary as much as 100 kg during a production year, and BCS can be used to adjust for the amount of fat or body composition of a cow. In this study, Angus x Hereford heifers reached puberty at approximately 56% of the mature weight that was determined at 5 to 7 y of age and at a BCS of 5. Breed of heifers may influence the percentage of mature BW at puberty. Additional studies are necessary to determine if different breeds and crossbred heifers initiate ovarian luteal activity at approximately 56% of their mature weight.

The specific percentage of mature weight at which a heifer attains puberty can be used in management of heifers to increase the probability that heifers will become pregnant and calve by 2 y of age. In the current study, the percentage of mature weight the heifer attained puberty was consistent when the value was calculated using 5 to 7 yr old cows to determine maturity and adjusting body weight to a BCS of 5. This is an easy to obtain measurement that producers could use to increase reproductive performance, productive life, and profitability of a cow herd.

**Table 1.** Weight at puberty, mature weight, and percentage of mature weight at the attainment of puberty in beef cattle

Items	Birth Year			SE	P-value
	1997	1998	2003		
Cows, no.	12	12	10		
Weight at puberty, kg	316	316	335	13	0.27
Mature weight, kg <sup>a</sup>	577	571	582	15	0.90
Percentage of mature weight at puberty	55	56	58	1	0.44

<sup>a</sup> Mature weights of cows at mid-gestation at 5 to 7 yr of age and adjusted to a BCS of 5.



**Figure 1.** Percentage of heifers that became puberal at different percentages of mature weight.

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