CARCASS DEVELOPMENT AND CELLULAR GROWTH OF MUSCLE AND FAT IN MALE AND FEMALE CATTLE

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ABSTRACT

The influence of sex on muscle, fat and bone growth from birth to maturity was investigated by complete dissection of a half carcass of 18 female and 21 male Jersey cattle. In addition, the cellular growth of five muscles: *mm. rhomboideus, splenius, longissimus capitis, longissimus* and *semitendinosus,* and of three fat depots: subcutaneous, intermuscular and perirenal, was examined. Transverse sections of the five muscles were stained for myosin adenosine triphosphatase (ATPase) activity.

Muscle development, especially in the forequarter, is greater in males than in females. In males, the allometric growth of the neck muscles, *mm. rhomboideus, splenius and longissimus capitis,* relative to total muscle weight, was in two phases with two significantly different regression slopes, which describe the growth better than a single regression equation. The second phase had a significantly higher regression coefficient. In contrast, the growth of the neck muscles in females, and the growth of *mm. longissimus* and *semitendinosus* in both males and females, could be described satisfactorily by a single regression equation.

The transverse sectional area of whole muscle and the mean fibre area, which was determined in fresh frozen sections, enabled the estimation of total fibre number in each of the five muscles. Fibre number did not change significantly during growth. Males had about double the number of fibres in these neck muscles as compared with females; functional differences between sexes were reflected in the difference in number and the rate of increase in size of myosin ATPase high fibres.

These results support the concept that sexual dimorphism of overall muscle growth and muscle distribution in all species, is attributable to differences in prenatal development of fibre number, which determines the potential of a muscle to grow.

Differences in fat growth between sexes were due to the overall rate of fat deposition; the order of partitioning was in general

similar between sexes. The allometric growth of the three fat depots relative to total side fat shows that in both sexes, subcutaneous fat was the fastest growing, intermuscular was intermediate, and perirenal was slowest. Between sexes, the growth ratios of all three depots were higher in females than in males; a significant difference was observed for subcutaneous fat.

Determination of total lipid content of each depot, and lipid content of an adipocyte, allowed estimation of adipocyte number. Adipose tissue growth in all three depots of both sexes is characterised by a greater increase in the size of adipocytes than an increase in their number. However, the increase in size of adipocytes did not explain differences in the rate of fat growth between sexes and between depots. The rate of increase in adipocyte number was higher in females than in males for all three depots; the order of the rate of increase in number parallels the order of the growth ratios of the fat depots. Thus sex differences in the rate of fat growth can be attributed to differences in the rate of increase in the number of adipocytes.

Sex differences in bone weight distribution were small. In both sexes, there was a proximodistal gradient of decreasing growth in the limbs; craniocaudally, there was a fluctuating growth gradient in the vertebrae, and an increasing gradient in the ribs. Growth ratios of individual bones suggest a faster developing forequarter in males than in females; the forelimb may be more important for propulsion in males than in females.

External and internal pelvic measurements indicate differences in shape between sexes. From this model, it was suggested that problems of dystocia may arise when female adaptive changes in the vertical plane do not occur postnatally.

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