

## Growth- and breed-related changes of fetal development in cattle<sup>1</sup>

W. H. Mao<sup>2</sup>, E. Albrecht<sup>3</sup>, F. Teuscher<sup>3</sup>, Q. Yang<sup>2</sup>, R. Q. Zhao<sup>2</sup>, and J. Wegner<sup>3,4</sup>

<sup>2</sup>Nanjing Agricultural University, Nanjing 210095, China

<sup>3</sup>Research Institute for the Biology of Farm Animals, D-18196 Dummerstorf, Germany

### ABSTRACT:

Breed differences in adult animals are determined during fetal development. If interventions are to be developed that influence growth of muscle and fat, it is important to know at which time during gestation breed differences appear and are fixed. The objective of this study was to characterize fetal development in cattle of different breeds. Pregnant cows of 4 cattle breeds with different growth impetus and muscularity were slaughtered under normal processing conditions and the fetuses were removed. German Angus, a typical beef cattle; Galloway, a smaller, environmentally resistant beef type; Holstein Friesian, a dairy type; and Belgian Blue, an extreme type for muscle growth were used. Fetuses of each breed were investigated at 3, 6, and 9 mo of gestation. Fetuses were weighed and dissected into carcass, organs, and muscles. Body fat weight was obtained using the Soxhlet extraction method. Fetal weight increased most rapidly in the third trimester of gestation mainly due to the accelerated muscle and fat deposition. The weight to BW ratios decreased in organs and increased in muscle and fat. Galloway fetuses had the smallest ( $P < 0.05$ ) BW, half-carcass weight, leg weight, organ weight, muscle weight and shortest ( $P \leq 0.016$ ) leg length at 3 mo of gestation among the 4 breeds. In contrast, Holstein fetuses had the greatest ( $P \leq 0.038$ ) BW, liver, kidney, and lung weights, and longest ( $P \leq 0.027$ ) leg length among 4 breeds, but no differences between Holstein Friesian and Belgian Blue were detected in half-carcass and leg weight ( $P = 0.103$ ,  $P = 0.589$ , respectively). Indeed, Belgian Blue fetuses had the greatest ( $P \leq 0.027$ ), half-carcass weight, leg weight, and muscle weight at 9 mo of gestation, and Galloway had a greater ( $P = 0.04$ ,  $P = 0.004$ ) body fat to BW ratio than Holstein Friesian and Belgian Blue, respectively. These differences were not evident at 3 and 6 mo of gestation. These data show that the profound increase of tissue and organ weights occurred in later gestation in cattle fetuses even though breed differences were evident as early as 3 mo of gestation. Depending on the tissue of interest, impacting fetal growth likely needs to occur early in gestation before the appearance of breed-specific differences.

Keywords: breed, body composition, cattle, fetal growth, gestation.

---

<sup>1</sup>This study was supported by the Federal Ministry of Food, Agriculture, and Consumer Protection of Germany and The Agricultural Ministry of China (grant no. 26/2005-2006 “Adipogenesis”). The authors wish to thank Karola Marquardt for excellent technical assistance.

<sup>4</sup>Corresponding author: [wegner@fhn-dummerstorf.de](mailto:wegner@fhn-dummerstorf.de)