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PHYSIOLOGY AND ENDOCRINOLOGY SYMPOSIUM: Factors controlling puberty in beef heifers

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PHYSIOLOGY AND ENDOCRINOLOGY SYMPOSIUM: Factors controlling puberty in beef heifers[1]

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The Physiology and Endocrinology Symposium on "Factors controlling puberty in beef heifers" was held at the Joint Annual Meeting of the American Society of Animal Science and the American Dairy Science Association in New Orleans, Louisiana, July 10 to 14, 2011. The objective of the symposium was to provide attendees with new insights and perspectives from recent research findings on puberty in beef heifers. To that end, the 2011 physiology and endocrinology symposium program was organized to review recent research findings in beef cattle puberty with a broad overview of areas affecting puberty including management, genetics, nutrition, and hormonal manipulation of the estrous cycle.

Lamb et al. (2011), the first speaker of the symposium, discussed the management implications associated with the onset of puberty and persistence of estrous cycles in beef heifers. Significant costs are associated with development and management of replacement beef heifers; therefore, management strategies that maximize the number of replacement heifers attaining puberty before their first breeding season are vital for the efficiency of cow-calf operations. Lamb et al. (2011) presented data demonstrating that fertility in replacement beef heifers was not compromised by delaying the majority of BW gain until the last third of the developmental period before the onset of the breeding season. Body weight at the onset of the breeding season and BW at puberty were not compromised compared with heifers on a constant rate of BW gain during the developmental period. Furthermore, persistence of estrous cycles after establishment of puberty are affected by dietary energy restriction and repletion but may be activated gradually in response to dietary manipulation unrelated to many metabolite changes.

As the second speaker of the symposium, Snelling et al. (2012) speculated that simple tests for DNA variants among animals (i.e., SNP) may replace low-accuracy predictions for expensive or lowly heritable measures of puberty and fertility based on performance and pedigree. Although several SNP from the BovineSNP50 assay have tentatively been associated with reproductive traits including age at puberty, antral follicle count, and pregnancy observed on different sets of heifers, sample sizes are too small and SNP density is too sparse to definitively determine genomic regions containing causal variants affecting reproductive success. In looking toward the future, larger samples and denser SNP chips will increase power to detect real associations with SNP having more consistent linkage disequilibrium with underlying QTL. Snelling et al. (2012) concluded by presenting example analyses to demonstrate how integrating information about gene function and regulation with statistical associations from whole-genome SNP genotyping assays might enhance knowledge of genomic mechanisms affecting puberty and fertility, thereby enabling reliable DNA tests to guide heifer selection decisions.

Funston et al. (2012), the third speaker for the symposium, discussed nutritional aspects of developing replacement heifers. Traditionally, research has shown that puberty in heifers occurs at a genetically predetermined size (around 60 to 65% of their expected mature BW) and that increased pregnancy rates can occur only when heifers reach their target BW. Although these traditional intensive heifer development systems may maximize pregnancy rates, they do not necessarily optimize profit or sustainability. By contrast, altering rate and timing of BW gain can result in compensatory growth periods, providing an opportunity to decrease feed costs, a significant cost associated with beef heifer development. Funston et al. (2012) then discussed novel data showing that feeding replacement heifers to traditional target BW increased development costs without improving reproduction or subsequent calf production relative to development systems in which heifers were developed to reduce target BW ranging from 50 to 57% of mature BW.

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The symposium concluded with a review of basic knowledge of factors controlling puberty to improve synchronization of estrus and fertility in beef heifers (Perry, 2012). Previous research has reported up to a 21% increase in fertility from pubertal estrus to the third estrus in heifers. The use of reproductive tract scores to determine pubertal status showed that peripubertal and pubertal heifers had an increased pregnancy success to synchronization protocols compared with heifers that were prepubertal. Understanding the hormonal changes that occur during the estrous cycle has allowed for the development of estrous synchronization protocols that result in increased control of follicular growth, regression of luteal tissue, and ovulation. Perry (2012) concluded that basic knowledge gained through research has improved and will continue to improve heifer development and pregnancy success.

Raising replacement beef heifers is a significant cost for beef cow-calf operations. The Physiology and Endocrinology Symposium on "Factors controlling puberty in beef heifers" encouraged attendees to consider novel nutritional management approaches to hasten the onset of puberty in beef heifers (Lamb et al., 2011; Funston et al., 2012), to apply basic knowledge gained through research to hormonally manipulate the reproductive process to improve reproductive success (Perry, 2012), and to consider new technologies such as SNP that may play a future role in selecting beef heifers for reproductive success (Snelling et al., 2012). The 2011 Physiology and Endocrinology Symposium enhanced our understanding of the latest nutrition, physiology, and genetic research on puberty in beef heifers.

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