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Identification of Measures Predictive of Age at First Puberty

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Summary and Implications

The central hypothesis of this project is that gilts demonstrating tertiary follicle development on their ovaries earlier in life are more likely to achieve puberty at a younger age compared to their counterparts. The objective of this project was to identify physiological markers and specific time-points during pre-pubertal development that could be utilized as valid indices to predict age of first puberty. Five time points (days 75, 85, 95, 105 and 115 of age) were used and at each time point from which phenotypic measures (vulva length, vulva width, and body weight) and blood were collected. These time points represent specific days in age that observations can be made to distinguish gilts with high and low probability of achieving puberty by 200 days of age. Identification of pre-pubertal markers that correlate to age of first puberty will assist producers in making earlier gilt replacement decisions.

Introduction

Sow lifetime productivity is an important factor that determines the profitability of a swine enterprise. Despite the critical need to improve sow lifetime productivity, genetic selection has been met with reduced effectiveness as the complexity of the trait can be significantly impacted by postnatal environment. There are several factors that influence sow lifetime productivity, such as structural conformation, number of non-productive days, and age at first puberty. Age at first puberty represents a useful phenotype that can be utilized to select or reject gilts prior to entering the replacement gilt pool. A significant downside is that age at first estrus is not always documented as many producers do not record or initiate estrus detection procedures until just prior to entering the gilt pool. This results in the inclusion of gilts in the replacement pool that will not demonstrate an estrous cycle prior to day 180. Age at first puberty can be a useful predictive measure of lifetime productivity with the earlier onset of puberty correlating to fewer non-productive days.

Materials and Methods

The experiment utilized 155 cross-bred gilts of similar age (± 2 days). On postnatal days (PND) 75, 85, 95, 105 and 115, gilts were weighed and blood collected for serum and plasma isolation. Additionally, vulva width, length and area were recorded. At each time point, 10 gilts were sacrificed and ovarian follicular activity was determined. Estrus detection was conducted daily on PND days 126 to 200 for the remaining 105 gilts.

Results and Discussion

Phenotypic measurements were analyzed in SAS (Statistical Analysis System) to determine correlations between measurements and time points. Vulva width appeared to be among the most useful phenotypic measurement to predict earlier puberty onset. Of the gilts demonstrating behavioral estrus, 28 were within PND 140-160, 37 were within PND 161-180, and 14 were within PND181-200, while 26 did not demonstrate estrus by PND 200. Correlations existed between age of first estrus and vulva width at both postnatal day 105 ($P = 0.07$) and 115 ($P = 0.01$).

With respect to ovarian development, all gilts euthanized at PND 75 lacked follicular activity as defined by having a minimum of two antral follicles per ovary, while 60%, 80%, 90%, and 100% of gilts demonstrated follicular activity on PND 85, 95, 105, and 115, respectively. These data suggest that vulva width at 115 days of age may be a useful predictive measure for early puberty onset in gilts.
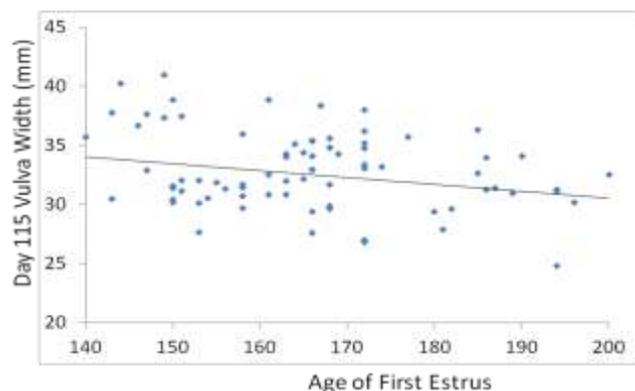

Figure 1. Correlation between vulva width at Day 115 to age at first estrus ($P = 0.01$, r = -0.28).