Endocrinologic and somatic changes during the peripubertal period in Standardbred colts

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The onset of puberty and its association with somatic growth and testicular development is well-characterized in many species of livestock, and neonatal and peripubertal somatic development has been shown to influence the sperm production in future bull sires. In contrast there are no studies assessing the association between sexual and somatic development in peripubertal colts. We hypothesized that onset of puberty would correspond with an increase in total body fat and exponential testicular growth and that it is associated with an increase in gonadotropins and sex steroid hormones. The objectives of this study were: (i) to determine plasma follicle stimulating hormone (FSH), luteinizing hormone (LH), and estradiol 17β concentrations during the peripubertal period in colts and (ii) to characterize changes in body fat deposition and testicular development during the peripubertal period. Twenty-five healthy Standardbred colts were enrolled in the study when they reached six months of age. All colts were managed and fed in similar conditions and comparable to industry standards. Blood samples were collected via jugular venipuncture between 8 and 10 am every four weeks for twelve months, and plasma samples were stored at -80°C until analysis. The colts were weighed monthly (WE) using a weight tape. Testicular volume (TV) was estimated using measurements acquired by B-mode ultrasound according to the formula (length x width x height x 0.5233), and percent body fat (BF) was estimated using the following equation BF = 3.83 + 5.58x; x = rump fat (cm). Rump fat was measured over the hindquarters approximately 5 cm lateral to midline at the center of the pelvis. Serum testosterone was analyzed by radioimmunoassay (RIA) from six to eighteen months of age, and the onset of puberty was determined to be the month when testosterone was at least two standard deviations above the previous mean. Plasma FSH and LH were analyzed for the seven month peripubertal period by RIA. Data were analyzed using RStudio v 0.99.489 (RStudio Team, Boston, MA). Continuous variables not normally distributed were log-transformed and analyzed with mixed models. Pearson’s coefficient of correlations (r) were performed between variables. Data are expressed as mean ± SEM and significance was set at p < 0.05. At the onset of puberty, colts were 13.0 ± 0.3 months of age, weighed 759 ± 17 lbs, with a BF of 6.2 ± 0.2%, and a TV of 53.5 ± 8.6 cm³; plasma testosterone was 3.01 ± 0.32 ng/ml, estradiol 17β was 42.1 ± 5.2 ng/ml, LH was 0.52 ± 0.06 ng/ml, and FSH was 10.97 ± 0.89 ng/ml. Age was significantly correlated with weight (r=0.67), testosterone (r=0.57), and TV (r=0.68). Testosterone was significantly correlated with weight (r=0.4) and with testicular volume (r=0.5). Follicle stimulating hormone was significantly different from the peripubertal period at the onset of puberty than pre and post-pubertal months, but was not correlated with age. There was no significant change in LH during the peripubertal period. In conclusion, spring born Standardbred colts undergo puberty at 13 months of age, and the onset of puberty coincides with exponential testicular growth. The onset of puberty does not coincide with an increase in cutaneous body fat deposition. Knowledge of normal testicular development in the colt lays the groundwork for future studies into long term testicular function and the relationship between testicular development and future total sperm output and fertility.