Effect of a postnatal high-fat diet exposure on puberty onset, estrous cycle regularity, and kisspeptin expression in female rats

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Abstract

Kisspeptin, encoded by Kiss1, plays a key role in pubertal maturation and reproduction as a positive upstream regulator of the hypothalamic-pituitary-gonadal (HPG) axis. To examine the role of high-fat diet (HFD) on puberty onset, estrous cycle regularity, and kisspeptin expression, female rats were exposed to HFD in distinct postnatal periods. Three groups of rats were exposed to HFD containing 60% energy from fat during the pre-weaning period (postnatal day (PND) 1–16, HFD PND 1–16), post-weaning period (HFD PND 21–34), or during both periods (HFD PND 1–34). Puberty onset, evaluated by vaginal opening, was monitored on days 30–34. Leptin, estradiol (E2), Kiss1 mRNA levels, and number of kisspeptin-immunoreactive cells in the anteroventral periventricular nucleus (AVPV) and arcuate nucleus (ARC) were measured at day 34. Body weight increased only in rats exposed to HFD during post-weaning period, whereas the timing of vaginal opening was unaffected in all three groups. Leptin, Kiss1 mRNA levels, and number of kisspeptin-immunoreactive cells at day 34 were not affected by HFD. Additionally, the estrous cycle regularity was monitored in rats exposed to HFD for 40 days from weaning. Leptin, E2, and Kiss1 mRNA levels in the AVPV and ARC were measured after the HFD exposure. Thirty-three percent of rats exposed to HFD exhibited irregular estrous cycles and a two-fold increase in leptin. By contrast, E2 level and Kiss1 mRNA levels were not affected by the treatment. These data show that postnatal HFD exposure induced irregular estrous cycles, but had no effect on puberty onset or kisspeptin.

Keywords

Kisspeptin; Puberty onset; Estrous cycle; High-fat diet; ARC; AVPV; Leptin