

Title: Independent and Combined Effects of Maternal and Paternal Obesogenic Diets on Adult Outcomes in Sprague-Dawley Rats

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Background: The effects of maternal obesogenic (OB, high-fat:high sucrose) diets on offspring outcomes are well established, but limited studies have investigated paternal and combined parental obesity. We investigated the independent and combined effects of parental OB diets on adult offspring.

Methods: Male (pat) and female (mat) rats were fed a control diet (CON) or OB diet for five weeks pre-mating. Mating established four groups: matCON-patCON, matCON-patOB, matOB-patCON, and matOB-patOB. Females continued their diet through lactation. From weaning, offspring were fed CON until adulthood (d180).

Results: In male offspring, patOB diet was associated with greater body weight, adiposity (%total and retroperitoneal fat), and adipocyte area with poorer insulin sensitivity (Matsuda) and higher plasma leptin. In contrast, in female offspring, while patOB was associated with greater retroperitoneal adiposity and adipocyte area, there was no effect on glucose metabolism.

MatOB diet was associated with greater adipocyte area in both sexes, and with impaired insulin secretion (disposition index) in females. The female matOB-patCON group had greater insulin resistance (HOMA-IR) than controls.

Neither maternal nor paternal obesogenic diets influenced energy expenditure or respiratory exchange ratio.

There were maternal-paternal diet interactions particularly for female metabolic outcomes; exposure to combined parental obesity was associated with less impaired metabolic parameters than exposure to one obese parent, except for adipocyte area (additive for both sexes).

Conclusion: Maternal and paternal OB diets independently influenced offspring metabolism and body composition. PatOB more strongly impacted males, while matOB more prominently affected females. Combined paternal and maternal obesity were not always additive.

Keywords: parental obesity, maternal obesity, paternal obesity, adult offspring metabolism, DOHaD, developmental programming.