

Impact of Parental Obesogenic Diets on Cardiac Structure and Function in Adult Rat Offspring

Anna P Ponnampalam^{1,2}, Zoya J Qureshi¹, Meghan B Davenport¹, Khurram J Toor³, Marco Annandale¹, Mehwish Abbasi³, Swetha Muralidharan³, Mark Vickers³, Elwyn C Firth³, David S Musson⁴, Benjamin B Albert³

¹Department of Physiology, University of Auckland, Auckland, New Zealand, ²Pūtahi Manawa|Healthy Hearts for Aotearoa New Zealand, Centre of Research Excellence, New Zealand, ³The Liggins Institute, University of Auckland, Auckland, New Zealand, ⁴Department of Nutrition, University of Auckland, Auckland, New Zealand.

Background: While poor maternal diet can increase cardiovascular disease risk in offspring, the impact of paternal diet on offspring heart health remains poorly understood. We assessed the independent and combined effects of maternal and paternal high-fat:high-sugar obesogenic (OB) diets on cardiac outcomes in adult rat offspring.

Methods: Male (pat) and female (mat) rats were fed a control (CON) or OB diet for five-weeks pre-mating. Females continued diets throughout gestation and lactation. Four groups were established: matCON-patCON, matCON-patOB, matOB-patCON, and matOB-patOB. Offspring were fed a standard chow diet. Echocardiography was undertaken at postnatal day 160 and hearts collected.

Results: Left ventricular mass (LVM) and posterior wall thickness (LVPW) were increased in matCON-patOB group compared to matCON-patCON, with an overall paternal diet effect on LVM and LVPW and parental diet interaction for LVPW in males. Paternal diet decreased females' normalised heart weight. Ejection fraction (EF), fractional shortening (FS) and stroke volume (SV) were reduced in male matCON-patOB offspring compared to matCON-patCON offspring. There was an overall patOB diet effect on increased collagen I stain and reduced EF and FS in both sexes with an interaction with matOB, further reducing SV in males. Cardiac output was decreased in matOB-patOB compared to matCON-patCON in females. MatOB diet reduced left ventricular end diastolic volume (EDV) in females. Parental diet interactions for EDV and LVM/EDV ratio were observed in males.

Conclusion: A patOB diet resulted in adverse sex-specific effects on structural and functional cardiac outcomes in adult offspring with greater impacts in combination with matOB diet.