Maternal Physical Activity and Cardiorespiratory Fitness During Pregnancy and Its Relation to Infant Size

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Recent evidence indicates that U.S.-born infants are larger today compared to 20 years ago. A strong determinant of neonatal size is maternal body mass, where larger mothers deliver larger infants. Consistent evidence indicates that higher levels of maternal physical activity (PA) during pregnancy reduces the risk of delivering a larger infant. However, this protective effect has only been demonstrated in normal weight pregnant women. Little is known about the relationship between maternal PA and neonatal size in overweight or obese pregnant women. Moreover, no studies have examined the association between maternal cardiorespiratory fitness (CRF), an indicator of habitual PA, on infant size in this pregnant subpopulation. Thus, the overall purpose of this dissertation was to determine if maternal PA moderates the association between maternal body mass and infant size and whether maternal PA and-or CRF are associated with neonatal size in overweight or obese pregnant women.

In study one, logistic regression analyses were performed to evaluate the moderating roles of maternal PA in the preconception and prenatal periods on the association between maternal body mass index (BMI) and the risk of delivering a macrosomic infant. Maternal BMI and physical activity served as the main predictor variables. Regression models were adjusted for maternal age and race/ethnicity, gestational age and weight gain, smoking and drinking use, and infant sex. Overweight or obese pregnant women had increased odds of delivering a macrosomic infant (OR = 1.69, p <0.0001; OR = 1.67, p=0.003). Neither maternal PA in the preconception nor prenatal periods modified the association between maternal BMI and the risk of delivering a macrosomic neonate (OR=0.98, p=0.34; OR=1.00, p=0.13, respectively), after adjusting for covariates. It was concluded that the present study does not provide any evidence that maternal PA prior to or during pregnancy alters the relationship between maternal BMI and infant size.

In study two, multiple linear regression models were constructed to determine the independent and joint associations of maternal PA and CRF with infant birthweight. Maternal PA and CRF were the main predictors and regression models were adjusted for gestational age, maternal age and weight gain, and group allocation. After adjusting for covariates, multiple linear regression analyses showed that maternal PA (steps·day$^{-1}$·month$^{-1}$) ($\beta$= 0.03 g, 95% CI: -0.03, 0.08g) and CRF (ml O$_2$·kg$^{-1}$·min$^{-1}$) ($\beta$= -8.83 g, 95%CI: -42.2, 24.5 g) were not independently nor jointly ($\beta$= 0.006 g, 95%CI: -0.005, 0.005 g) associated with offspring birthweight. It was concluded that maternal PA and CRF during pregnancy were not related to infant birthweight in overweight or obese pregnant women.

In study three, individual trajectories for maternal PA in the prenatal period were estimated via repeated measures analyses to represent the change in PA from mid (4$^{th}$ month) to late (8$^{th}$ month) pregnancy. Multiple linear regression models were then performed to determine the association between change in prenatal PA and birthweight. Change in maternal PA was the main predictor and regression models were adjusted for gestational age, weight gain, maternal age and group allocation. PA declined from
the 4th to the 8th month of pregnancy (-399.73 ± 371.38 steps·day^{-1}·month^{-1}). After adjusting for covariates, multiple linear regression analyses showed that the decline in prenatal PA (β= -0.28 g, 95%CI: -0.70, 0.25 g, p=0.35) was not associated with birthweight. In addition, CRF (β= 0.04 g, 95%CI: -0.06 g, 0.14 g, p=0.697) did not exhibit a moderating effect. It was concluded that maternal physical activity declined in mid-to-late pregnancy and the observed decrement was found to be unrelated to infant birthweight.

Overall, the findings from these studies demonstrate that higher levels of maternal physical activity prior to and during pregnancy do not modify the relationship between maternal body mass and neonatal size. In addition, these findings indicate that maternal physical activity and cardiorespiratory fitness do not independently or jointly associate with neonatal weight. These studies provide novel insight into these relationships in an understudied subpopulation and contribute to this rapidly growing area of research. Several recommendations are suggested to address the limitations of these studies including sampling strategies that will increase variability in PA and CRF levels, more rigorous and precise measures of PA and infant anthropometry and the inclusion of metabolic biomarker assessments.