

Greater maternal BMI early in pregnancy and excessive gestational weight gain are independently associated with adverse health outcomes in the offspring at age 7 years

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Introduction

- There is growing evidence that maternal overweight or obesity during pregnancy is associated with an increased risk of obesity¹ in their children, with some evidence of adverse metabolic outcomes².
- Excessive gestational weight gain (GWtG) has also been recognized as an important early-life risk factor for childhood obesity³.
- We showed in a RCT that moderate-intensity exercise in the last 20 weeks of gestation in healthy nulliparous women led to a birth weight reduction of ~250 g⁴.

Objective

- To examine whether maternal BMI at 20 weeks of gestation and excessive GWtG were associated with alterations in body composition and metabolism in childhood in the offspring of primiparous mothers who participated in the RCT of exercise regimen during pregnancy.

Methods

- Maternal BMI was recorded at trial initiation (~20 weeks of gestation).
- GWtG was calculated as the average weight gain per week during the second and third trimester, as per the Institute of Medicine (IOM) guidelines⁵.
- 84 women completed the RCT, and follow-up data were available on 52 mothers and their children:
 - 25 overweight/obese mothers (BMI ≥25.0 kg/m²)
 - 35 mothers with excessive GWtG as per IOM guidelines
- Children underwent clinical assessments at a mean age of 7.6 years (54% males; 79% Europeans), including:
 - anthropometry
 - body composition (DXA)
 - fasting blood samples (i.e. glucose, insulin, HOMA-IR, lipids)
 - nutritional intake estimated from 3-day food diaries
- Multivariable models were run with maternal BMI (as a continuous variable) and GWtG (excessive or not), while adjusting for other important confounders.

References

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Funding: This study was supported by grants from Gravida, National Centre for Growth and Development, the Italian Society for Paediatric Endocrinology and Diabetes (SIEDP/ISPED), and the European Society for Paediatric Endocrinology (ESPE). The authors have no financial or non-financial interests to declare that may be relevant to this work.

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Results (Maternal BMI)

- Greater maternal BMI early in gestation was associated with greater weight, BMI, and adiposity in the children (Table 1).

Table 1. Association between maternal BMI and offspring outcomes in childhood. Data are adjusted for confounders.

	β (95% CI)	p-value
Weight SDS	0.01 (0.04, 0.166)	0.001
BMI SDS	0.08 (0.03, 0.14)	0.005
Total body fat (%)	0.44 (0.04, 0.84)	0.031

Results (Maternal gestational weight gain)

- Independently of maternal BMI, children born to mothers with excessive GWtG had increased abdominal adiposity, as well as a less favorable lipid profile (Table 2).

Table 2. Characteristics of children born to mothers with adequate or excessive GWtG at age 7 years. Data are means ± SE, adjusted for confounders.

	Multivariable model	Adequate	Excessive	p-value
Anthropometry				
Weight SDS		0.17 ±0.17	0.48 ±0.12	0.14
Height SDS		0.62 ±0.23	0.59 ±0.17	0.92
Height SDS – MPHSDS		0.25 ±0.23	0.14 ±0.17	0.69
BMI SDS		-0.17 ±0.17	0.22 ±0.12	0.07
Body composition				
Total body fat (%)		16.3 ±1.2	17.5 ±0.8	0.39
Android fat (%)		16.6 ±1.6	19.9 ±1.0	0.09
Gynoid fat (%)		29.3 ±1.4	30.4 ±0.9	0.48
Android fat to gynoid fat ratio		0.55 ±0.03	0.64 ±0.02	0.043
Blood pressure				
Systolic (mmHg)		97.4 ±2.9	98.7 ±1.9	0.70
Diastolic (mmHg)		56.6 ±2.2	58.8 ±1.4	0.41
Glucose homeostasis				
Fasting glucose (mmol/L)		4.95 ±0.13	4.76 ±0.08	0.23
Fasting insulin (mIU/L)		7.48 ±1.55	6.66 ±1.02	0.66
HOMA-IR		1.76 ±0.41	1.43 ±0.27	0.51
Lipid profile				
Total cholesterol (mmol/L)		4.46 ±0.22	4.81 ±0.15	0.21
HDL-C (mmol/L)		1.75 ±0.07	1.57 ±0.05	0.038
LDL-C (mmol/L)		2.58 ±0.22	3.06 ±0.15	0.09
TG (mmol/L)		0.63 ±0.06	0.87 ±0.04	0.003
Chol/HDL		2.55 ±0.20	3.13 ±0.13	0.024
TG/HDL		0.36 ±0.06	0.58 ±0.04	0.003

- Note that there were no differences in macronutrient intake or physical activity levels between groups.

Conclusions

- Greater maternal BMI early in pregnancy is associated with increased adiposity in the offspring at age 7.6 years, independently of gestational weight gain.
- Importantly, irrespective of maternal BMI early in pregnancy, excessive GWtG is also associated with adverse effects in the offspring.
- Epigenetic changes of placental genes have been proposed among the mechanisms underlying the short- and long-term effects of excessive GWtG on offspring health.