Gestational weight gain in normal weight women is associated with offspring cardio-metabolic risk factors at 20 years of age

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BACKGROUND

Limited knowledge exists on the long-term implications of maternal gestational weight gain (GWG) on offspring health. Our objective was to examine whether high GWG in normal weight women is associated with adult offspring cardio-metabolic risk factors.

METHODS

We used a cohort of 308 Danish women who gave birth in 1988-89 and whose offspring participated in a clinical examination at 20 years of age. Main outcome measures were offspring BMI, waist circumference, weight-regulating hormones, blood lipids, and glucose metabolism. Associations were assessed using multivariate linear and logistic regression models.

RESULTS

A weak positive association was observed between GWG during the first 30 weeks and offspring anthropometry. Each 1-kg increase in maternal GWG was associated with 0.1-kg/m^2 increase (95%CI: 0.01, 0.2) in offspring BMI and 10% (95%CI: 0.1%, 20%) increased odds of offspring overweight at the age of 20 years, with similar associations observed in both sexes. However, sex differences were observed for the association between maternal GWG and specific cardio-metabolic risk factors. Hence, per 1-kg increase in GWG, HOMA-IR increased 3.4% (CI; 0.8, 6.0%), insulin increased 3.7% (95%CI: 1.4%, 6.2%), and leptin increased 10.7% (95%CI: 5.7%, 15.9%) in male offspring. These associations were not observed in females, which may partly be explained by more frequent reports of dieting and physical exercise at follow-up among female offspring.

CONCLUSIONS

In normal-weight women, high GWG may have modest long-term implications on offspring cardio-metabolic risk factors at adult age. Measurements over longer periods of time are needed to add to the current understanding of the long-term influence of non-optimal GWG on offspring's anthropometry and cardio-metabolic health.

Table 1. Associations of maternal gestational weight gain with offspring BMI at follow up (n=308).

	Offspring BMI (kg/m2)		Offspring overweight	
	β[a]	95% CI	OR[b]	95% CI
GWG in week 30 (per 1 kg increase)[c]	0.10	(0.01, 0.20)	1.10	(1.00, 1.20)
IOM categories:				
Suboptimal (<11.5 kg)	-0.4	(-1.2, 0.4)	0.6	(0.2, 1.4)
Optimal (11.5-16 kg)	ref.	ref.	ref.	ref.
Excessive (>16 kg)	0.6	(-0.2, 1.4)	1.8	(0.9, 3.8)
p for trend[d]	0.02		0.01	

GWG indicates gestational weight gain; IOM, Institute of Medicine guidelines; OR, odds ratio.
[a] Linear regression model, adjusted for offspring´s sex, maternal pre-pregnancy BMI, age, parity, smoking status, educational level and whether offspring thinks their father is overweight.
[b] Logistic regression model, reflecting the odds of offspring being overweight (BMI ≥25) at ~20 years or having waist circumference >88 cm for females and > 102 cm for males, adjusted for same covariates as in a).
[c] Showing increase in the outcome variable per 1-kg increase in gestational weight gain (continuous) or by the IOM categories.
[d] T-test for linear regression, Chi-square test for logistic regression.

Table 2. Associations of maternal gestational weight gain during the first 30 weeks of gestation with offspring cardio-metabolic risk factors at follow up (n=308).

	Men (n=121)[a]			Women (n=187)[a]		
Outcome[b]	β	95% CI	*P*	β	95% CI	*P*
Insulin (%)	**3.7**	(1.4, 6.2)	<0.01	-0.2	(-1.9, 1.5)	0.82
HOMA_IR (%)	**3.4**	(0.8, 6.0)	0.01	-0.1	(-1.8, 1.7)	0.94
Fasting glucose (mmol/liter)	-0.01	(-0.04, 0.01)	0.32	0.01	(-0.00, 0.02)	0.35
Leptin (%)	**10.7**	(5.7, 15.9)	<0.01	0.4	(-2.4, 3.3)	0.76
Adiponectin (%)	-0.6	(-2.8, 1.6)	0.58	1.5	(0.0, 2.9)	0.04
Total cholesterol	-0.1	(-1.0, 0.8)	0.81	-1.3	(-2.1, -0.6)	<0.01
LDL (%)	0.1	(-1.2, 1.5)	0.85	-2.2	(-3.4, -0.9)	<0.01
HDL (%)	**-1.1**	(-2.1, -0.0)	0.05	-0.1	(-1.0, 0.8)	0.80
Triglyceride (%)	1.7	(-0.5, 3.9)	0.12	-1.1	(-2.8, 0.6)	0.21
SBP (mm Hg)	0.4	(-0.1, 0.9)	0.09	0.2	(-0.2, 0.5)	0.30
DBP (mm Hg)	**0.4**	(0.0, 0.8)	0.03	0.0	(-0.2, 0.3)	0.92
Resting pulse (bpm)	**0.9**	(0.3, 1.5)	<0.01	-0.3	(-0.6, 0.1)	0.17

DBP indicates diastolic blood pressure; SBP, systolic blood pressure.
[a] Adjusted for maternal pre-pregnancy BMI, age, parity, smoking status and educational level and whether offspring thinks their father is overweight.
[b] Increase in the outcome variable per 1-kg increase in gestational weight gain.

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