



# Maternal Glycemic Status in Pregnancy Does Not Influence Early Growth of Offspring

Melissa S. Johnson, Rhonda C. Bell, Noreen D. Willows  
 Dept. of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada.

## Abstract

Exposure to gestational diabetes (GD) in utero may contribute to obesity in offspring. Aboriginal Cree women in James Bay Quebec have a high prevalence of GD (12.5%). Cree women were classified as: normal glucose tolerant (NG) in two adjacent pregnancies (2NG, n=246), GD in two adjacent pregnancies (2GD, n=30), or ΔGD (n=86) meaning GD in one pregnancy (ΔGD) but NG in an adjacent pregnancy (NΔGD) according to their medical chart.

Body weight and length/height of offspring were measured at birth, 2, 4, 6, 9, 12, 18, 24, 36, and 60 months of age. Blood glucose (mM) 1-hour post-50g glucose load of mothers with NG in ΔGD was 7.8±1.4 vs. 10.2±2.6 when GD in ΔGD. Glucose of 2NG mothers was 6.2±1.3 and of 2GD mothers was 10.9±1.9. Birth weight (kg) and length (cm) of siblings born to ΔGD mothers were similar regardless of whether their mother was NG or GD (3.76±0.5 vs. 3.94±0.44, p=0.08; 51.8±2.8 vs. 52.1±2.2, p=0.68). Infants born to 2GD mothers were of comparable weight (4.09±0.58) to those born to mothers with GD in ΔGD (p=0.19). Birth weight and length of infants born to 2NG mothers was 3.83±0.47 and 52.1±2.2. Infants born to 2GD mothers were heavier than those born to mothers with NG in ΔGD (p=0.01); length did not differ between these groups (p=0.11).

All children grew similarly despite some differences in birth weight and regardless of maternal glucose status. Maternal glycemia during pregnancy plays only a small role in the growth of offspring up to 5 years of age.

## Introduction

•Exposure to gestational diabetes (GD) in utero may contribute to the development of obesity in children and in later life.

•Previous studies have compared offspring of mothers who had GD with those whose mothers had normal glucose tolerance (NG) in pregnancy. With this design, the effects of intrauterine exposure to diabetes may be confounded by genetic factors.

•Objective: To reduce the confounding of genetics, we examined differences in growth from birth to 5 years of age in siblings born to mothers who experienced GD in one pregnancy and were NG in an adjacent pregnancy.

## Methods

•Chart Review of all births in James Bay, Quebec, Canada (1994-2000)  
 •Data collected included: maternal age, parity, pre-gravid weight, maternal glucose status, blood pressure, smoking, delivery, complications of pregnancy, offspring date of birth, birth weight and length, head circumference, weight, length/height regularly up 60 months of age (5 years).

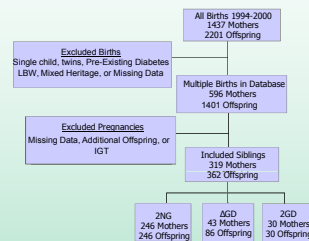
•Mothers with multiple offspring (first offspring pair only) classified as:  
 •ΔGD – NG in one pregnancy; GD in adjacent pregnancy  
 •2NG – NG in adjacent pregnancies  
 •2GD – GD in adjacent pregnancies

•Diagnosis of GD (according to Canadian Practice Guidelines, 1998)  
 •>7.8 mM on 50-g Oral Glucose Challenge Test (OGCT) and positive Oral Glucose Tolerance Test (OGTT)  
 Or  
 •>10.3 mM on OGCT

•Statistical Analyses  
 •Paired t-test and ANOVA, p<0.05.

## Study Design

Fig. 1



## Results

Table 1.

	Characteristics of ΔGD group			
	Women who changed from GD→NG		Women who changed from NG→GD	
	When GD	When NG	When NG	When GD
N <sup>1</sup>	20	20	23	23
Age (years)	23.9±4.5	26.9±4.9	23.6±3.4	26.1±3.8
Parity	1.3±1.1	2.3±1.1	1.2±1.4*	2.3±1.4 <sup>b</sup>
Initial Weight in Pregnancy (kg)	82.4±14.2	85.9±11.2	81.0±17.6	88.8±14.9
Final Weight in Pregnancy (kg)	97.1±14.1	93.2±9.7	91.1±14.0	97.1±14.1
Glucose Testing Results				
50-g OGCT Glucose (mM)	10.8±1.8*	7.9±1.7 <sup>b</sup>	7.8±1.3 <sup>b</sup>	10.6±2.7*
OGTT Fasting Glucose (mM)	5.2±0.6 <sup>a</sup>	4.6±0.4 <sup>b</sup>	4.5±0.6 <sup>b</sup>	4.9±0.7 <sup>b</sup>

<sup>1</sup> Not all measurements were available for every subject  
 Different superscript letters indicate significant differences among groups using ANOVA

Within the ΔGD group, NG & GD pregnancies were similar, therefore pregnancies were pooled according to glucose status.

Table 2.

	Maternal Characteristics			
	ΔGD		Comparison Groups (non-ΔGD)	
	When NG	When GD	2NG	2GD
N <sup>1</sup>	43	43	246	30
Age (years)	25.1±4.6*	25.1±4.3 <sup>b</sup>	22.3±4.5 <sup>b</sup>	28.3±6.1 <sup>c</sup>
Parity	1.7±1.4	1.8±1.3	1.4±1.3	2.5±2.5
Initial Weight in Pregnancy (kg)	83.4±14.9 <sup>a</sup>	85.9±14.7 <sup>a</sup>	78.6±15.5 <sup>a</sup>	88.2±13.2 <sup>b</sup>
Final Weight in Pregnancy (kg)	92.3±12.7 <sup>a</sup>	95.4±12.4 <sup>a</sup>	90.2±14.6	98.6±13.3
Smoking Frequency	63.8%*	43.5%	50.8%	43.3%
High Blood Pressure <sup>2</sup>	11.1%	23.9%	7.3%	28.6%
C-section Frequency	8.5%	14.9%	14.1%	20.0%
Glucose Testing Results				
50-g OGCT Glucose (mM)	7.8±1.4 <sup>a</sup>	10.7±2.3 <sup>b</sup>	6.2±1.4	11.2±2.0
OGTT Fasting Glucose (mM)	4.6±0.5 <sup>a</sup>	5.0±0.7 <sup>b</sup>	4.5±0.4 <sup>a</sup>	5.4±0.8 <sup>b</sup>

<sup>1</sup> Not all measurements were available for every subject  
<sup>2</sup> High Blood Pressure includes hypertension and preeclampsia  
 \* Indicates significant differences, p<0.05

- Women in the ΔGD group were older than 2NG and younger than 2GD women.
- Women in the ΔGD-GD and 2 GD groups weighed more than 2NG women early in pregnancy.
- Within the ΔGD group, women weighed more at the end of pregnancy when they were GD vs. NG.
- Women in 2NG and 2GD groups differed significantly on all variables.

Table 3.

Mothers' Glucose Status	Infant Characteristics at Birth			
	ΔGD		Comparison Groups (non-ΔGD)	
	When NG	When GD	2NG	2GD
N <sup>1</sup>	46	47	263	30
Gestational Age (weeks)	38.9±1.2	39.2±1.2	39.4±1.2	38.8±1.5
Birth Weight (g)	3761±499 <sup>a</sup>	3939±443 <sup>a,b</sup>	3828±469 <sup>a</sup>	4098±577 <sup>b</sup>
Frequency of Macrosomia (>4000g)	30.2%	37.2%	33.7%	63.3%
Birth Length (cm)	51.8±2.8	52.1±2.1	52.1±2.2	52.9±2.3
Head Circumference (cm)	35.7±1.4	36.0±1.4	35.8±1.3	36.4±1.1
Ponderal Index (kg/m <sup>3</sup> )	26.9±2.6 <sup>a</sup>	27.8±2.5 <sup>a</sup>	27.2±3.1	28.1±2.5
Weight-for-Length Percentile at Birth <sup>2</sup>	46%ile	56%ile	48%ile	56%ile

<sup>1</sup> Not all measurements were available for every subject  
<sup>2</sup> Percentiles and Z-Scores use CDC reference growth data  
 \* Indicates significant differences, p<0.05  
 Different superscript letters indicate significant differences among groups using ANOVA

- Infants born to 2GD mothers weighed more than infants born to ΔGD-NG and 2NG mothers; birth length did not vary significantly.
- Within the ΔGD group, infants born to GD mothers had a higher ponderal index vs. NG mothers.

Fig. 2.

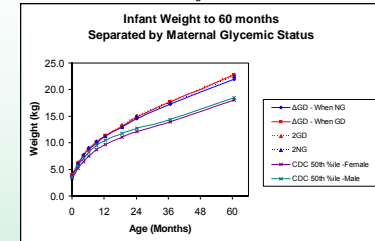
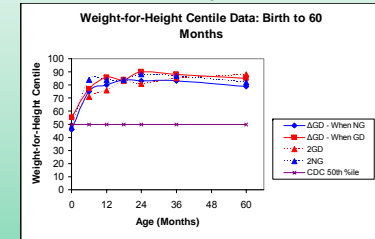


Fig. 3.



- From 0-60 months of age, body weight and height (length; data not shown) of all Cree children was similar, regardless of maternal glycemic status during pregnancy.
- Weight for height of Cree children rose dramatically in the first 6-12 months of life and remained close to the 80th %ile (CDC reference data) until at least 60 months of age.

## Conclusions

- Up to 5 years of age, all children grew similarly despite some differences in birth weight and regardless of maternal glucose status.
- It is likely that growth during this period is affected by external factors (other than in utero conditions), such as the initiation and duration of breast-feeding
- Maternal glycemia during pregnancy plays only a small role in the growth of Cree children up to 5 years of age.

## Acknowledgements

- Alberta Heritage Foundation for Medical Research
- The Cree Board of Health and Social Services of James Bay