

Supplementary material

Maternal Vitamin D Status and Gestational Weight Gain as Correlates of Neonatal Bone Mass in Healthy Term Breastfed Young Infants from Montreal, Canada

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Table S1. Maternal nutrient intake from food and supplements during pregnancy according to gestational weight gain categories

	Gestational weight gain			p-value
	Inadequate (n=31/35)	Adequate (n=42/45)	Excessive (n=51/59)	
Energy (kcal)	2170 ±735 1954 (1782-2426)	2161±952 1964 (1508-2744)	2080±787 1831 (1458-2466)	0.86
Protein (g)	98±33 87 (80-114)	97±45 90 (67-114)	92±35 84 (65-118)	0.71
Carbohydrates (g)	292±134 262 (228-310)	280±141 251 (178-336)	270±105 252 (186-338)	0.74
Fat (g)	74±22 70 (58-83)	79±33 72(54-92)	76±34 66 (50-96)	0.80
Vitamin D (IU)	615 ± 252 593 (503-766)	646±285 635 (468-809)	613±229 586 (479-788)	0.80
Calcium (mg)	1359±426 1233 (974-1673)	1399±587 1289 (943-1695)	1364±503 1287 (1034-1747)	0.93
Magnesium (mg)	471±152 431 (370-548)	486±165 444 (350-608)	476±149 459 (351-599)	0.91
Phosphorus (mg)	1563±519 1426 (1197-1898)	1571±710 1388 (1040-1947)	1471±578 1401(1003-1812)	0.69

Data are reported as mean±SD and median (IQR). Differences between the means of the different GWG categories were analyzed using mixed linear model accounting for the fixed effect studied.

Distinct letter superscripts (^{a,b,c}) indicate statistically significant differences between gestational weight gain categories ($p<0.05$, post hoc adjustment); values that share a common superscript are not different from one another.

Abbreviations: IU: international units.

Table S2. Correlates of neonatal bone mass tested using mixed linear model analysis

	Regression coefficients	p-values	95% CI
Infant WB BMC g (R^2 0.43, R^2_{adj} 0.42)			
Infant Factors			
Sex (male; referent: female)	5.70	0.0035	1.91, 9.48
Age (mo)	16.64	<0.0001	8.66, 24.62
LAZ	5.09	<0.0001	2.94, 7.24
Maternal Factors			
Serum 25(OH)D (<50 nmol/L; referent: \geq 50 nmol/L)	2.96	0.19	-1.49, 7.40
GWG (insufficient; referent: adequate)	-5.14	0.0010	-10.22, -0.06
Pre-pregnancy BMI (<25 kg/m ² ; referent: \geq 25 kg/m ²)	2.43	0.25	-1.72, 6.59
Self-identified population group (all others; referent: white)	1.92	0.36	-2.36, 6.19
Education (elementary/high school; referent: university)	-1.61	0.13	-8.36, 5.13
Family yearly income (<70 000 CAD; referent: \geq 70 000 CAD)	-1.91	0.0161	- 6.54, 2.72
Infant WB BMC/weight g/kg (R^2 0.27, R^2_{adj} 0.26)			
Infant Factors			
Sex (male; referent: female)	0.25	0.57	-0.61, 1.12
Age (mo)	-3.99	<0.0001	-5.81, -2.16
LAZ	-0.72	0.0044	-1.21, -0.23
Maternal Factors			
Serum 25(OH)D (<50 nmol/L; referent: \geq 50 nmol/L)	0.82	0.11	-0.19, 1.84
GWG (insufficient; referent: adequate)	-0.77	0.0002	-1.93, 0.40
Pre-pregnancy BMI (<25 kg/m ² ; referent: \geq 25 kg/m ²)	0.50	0.29	-0.44, 1.45
Self-identified population group (all others; referent: white)	0.01	1.00	-0.97, 0.99
Education (elementary/high school; referent: university)	-0.70	0.0823	-2.25, 0.84
Family yearly income (<70 000 CAD; referent: \geq 70 000 CAD)	-0.28	0.19	-1.34, 0.78
Infant LS BMC g (R^2 0.28, R^2_{adj} 0.28)			
Infant Factors			
Sex (male; referent: female)	-0.06	0.35	-0.18, 0.06
Age (mo)	-0.34	0.0104	-0.60, -0.08
LAZ	0.11	0.0024	0.04, 0.18

Maternal Factors			
Serum 25(OH)D (<50 nmol/L; referent: ≥50 nmol/L)	0.08	0.28	-0.07, 0.22
GWG (inadequate; referent: adequate)	-0.07	0.0051	-0.24, 0.09
Pre-pregnancy BMI (<25 kg/m ² ; referent: ≥25 kg/m ²)	-0.05	0.43	-0.19, 0.08
Self-identified population group (all others; referent: white)	-0.02	0.79	-0.16, 0.12
Education (elementary/high school; referent: university)	-0.13	0.43	-0.35, 0.09
Family yearly income (<70 000 CAD; referent: ≥70 000 CAD)	-0.03	0.56	-0.19, 0.12
Infant LS BMD g/cm² (R² 0.29, R²_{adj} 0.29)			
Infant Factors			
Sex (male; referent: female)	-0.01	0.0236	-0.03, -0.00
Age (mo)	-0.06	<0.0001	-0.09, -0.04
LAZ	-0.00	0.74	-0.01, 0.01
Maternal Factors			
Serum 25(OH)D (< 50 nmol/L; referent: ≥50 nmol/L)	0.01	0.21	-0.01, 0.02
GWG (inadequate; referent: adequate)	-0.01	0.0018	-0.03, 0.01
Pre-pregnancy BMI (< 25 kg/m ² ; referent: ≥ 25 kg/m ²)	-0.00	0.69	-0.02, 0.01
Self-identified population group as (all others; referent: white)	-0.01	0.28	-0.02, 0.01
Education (elementary/high school; referent: university)	-0.01	0.38	-0.04, 0.01
Family yearly income (<70 000 CAD; referent: ≥70 000 CAD)	0.00	0.82	-0.01, 0.02

Data are regression coefficients (95% CI) calculated using mixed linear model accounting for the fixed effects of infant's sex, age, and LAZ-score and mother's 25(OH)D categories, pre-pregnancy BMI categories, gestational weight gain categories, education, self-reported population group as well as family income.

Abbreviations: WB BMC: whole body bone mineral content, LAZ: length-for-age z-score, 25(OH)D: 25-hydroxyvitamin D, GWG: gestational weight gain, CAD: Canadian dollars, WB BMC/kg: whole body bone mineral content per kilogram body weight, LS BMC: lumbar spine bone mineral content, and LS BMD: lumbar spine bone mineral density.

Table S3. Correlates of neonatal bone mass tested using mixed linear model analysis

	Regression coefficients	<i>p</i> -values	95% CI
Infant WB BMC g (R^2 0.42, R^2_{adj} 0.42)			
Infant Factors			
Sex (male; referent: female)	5.57	0.0043	1.78, 9.36
Age (mo)	18.63	<0.0001	10.67, 26.58
LAZ	5.67	<0.0001	3.60, 7.74
Maternal Factors			
Serum 25(OH)D (per each nmol/L)	-0.04	0.32	-0.12, 0.04
GWG (per each kg)	0.64	0.0005	0.29, 0.99
Pre-pregnancy BMI (per each kg/m ²)	0.39	0.0778	-0.04, 0.82
Self-identified population group (all others; referent: white)	2.47	0.26	-1.83, 6.78
Education (elementary/high school; referent: university)	-1.41	0.16	-8.11, 5.30
Family yearly income (<70 000 CAD; referent: ≥70 000 CAD)	-2.34	0.0051	-6.99, 2.30
Infant WB BMC/weight g/kg (R^2 0.26, R^2_{adj} 0.25)			
Infant Factors			
Sex (male; referent: female)	0.20	0.65	-0.67, 1.07
Age (mo)	-3.51	0.0002	-5.33, -1.68
LAZ	-0.57	0.0174	-1.05, -0.10
Maternal Factors			
Serum 25(OH)D (per each nmol/L)	-0.01	0.20	-0.03, 0.01
GWG (per each kg)	0.16	0.0001	0.08, 0.24
Pre-pregnancy BMI (per each kg/m ²)	0.09	0.07	-0.01, 0.19
Self-identified population group (all others; referent: white)	0.14	0.78	-0.85, 1.13
Education (elementary/high school; referent: university)	-0.63	0.10	-2.17, 0.90
Family yearly income (<70 000 CAD; referent: ≥70 000 CAD)	-0.35	0.08	-1.41, 0.72
Infant LS BMC g (R^2 0.28, R^2_{adj} 0.27)			
Infant Factors			
Sex (male; referent: female)	-0.06	0.33	-0.18, 0.06
Age (mo)	-0.29	0.0289	-0.55, -0.03
LAZ	0.13	0.0002	0.06, 0.20

Maternal Factors			
Serum 25(OH)D (per each nmol/L)	-0.0002	0.85	-0.003, 0.002
GWG (per each kg)	0.02	0.0031	0.01, 0.02
Pre-pregnancy BMI (per each kg/m ²)	0.02	0.0045	0.01, 0.03
Self-identified population group (all others; referent: white)	0.01	0.85	-0.13, 0.15
Education (elementary/high school; referent: university)	-0.13	0.43	-0.34, 0.09
Family yearly income (<70 000 CAD; referent: ≥70 000 CAD)	-0.04	0.34	-0.19, 0.12
Infant LS BMD g/cm² (R² 0.30, R²_{adj} 0.29)			
Infant Factors			
Sex (male; referent: female)	-0.02	0.0201	-0.03, 0.00
Age (mo)	-0.06	<0.0001	-0.08, -0.03
LAZ	-0.001	0.83	-0.006, 0.008
Maternal Factors			
Serum 25(OH)D (per each nmol/L)	0.00004	0.75	-0.0003, 0.0002
GWG (per each kg)	0.002	0.0005	0.001, 0.003
Pre-pregnancy BMI (per each kg/m ²)	0.002	0.0034	0.001, 0.002
Self-identified population group as (all others; referent: white)	-0.004	0.58	-0.019, 0.010
Education (elementary/high school; referent: university)	-0.01	0.38	-0.04, 0.01
Family yearly income (<70 000 CAD; referent: ≥70 000 CAD)	0.003	0.63	-0.013, 0.019

Data are regression coefficients (95% CI) calculated using mixed linear model accounting for the fixed effects of infant's sex, age, and LAZ-score and mother's 25(OH)D concentration, pre-pregnancy BMI, gestational weight gain, education, self-reported population group as well as family income.

Abbreviations: WB BMC: whole body bone mineral content, LAZ: length-for-age z-score, 25(OH)D: 25-hydroxyvitamin D, GWG: gestational weight gain, CAD: Canadian dollars, WB BMC/kg: whole body bone mineral content per kilogram body weight, LS BMC: lumbar spine bone mineral content, and LS BMD: lumbar spine bone mineral density.

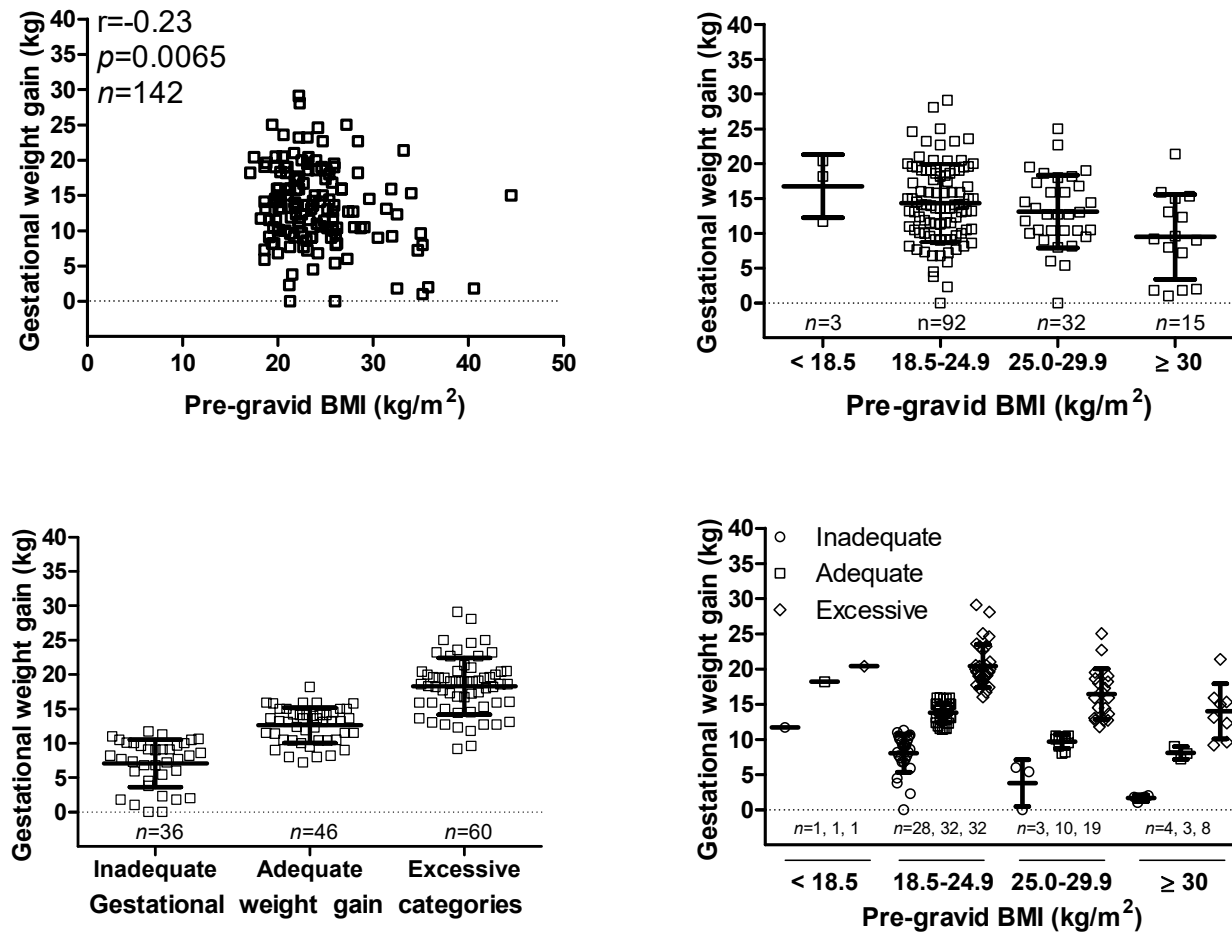


Figure S1. Gestational weight gain relative to pre-gravid BMI expressed as continuous data and according to recommended categories. Data are reported as mean \pm SD. Data were analyzed using Pearson correlation for gestational weight gain (kg) according to pre-gravid BMI (kg/m²). Pregnancy weight gain (kg) is descriptively shown relative to pre-gravid BMI categories and expressed as inadequate, adequate or excessive according to pre-gravid BMI categories.