

Abstract (2464 / 2600 characters)

Title (144 characters)

Maternal overweight and obesity's impact on long-term neurodevelopmental outcomes in premature infants (<29 weeks) at 18-24 months corrected age

Authors

Neha Bansal,^{1,2} Marina Journault,^{1,2} Prashanth Murthy,^{1,2} Selphee Tang,² Essa Al Awad,^{1,2} Dianne Creighton,¹ Susan Crawford,² Abhay Lodha,^{1,2,3,4}

¹ Department of Pediatrics, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

² Alberta Health Services, Calgary, Canada

³ Department of Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

⁴ Alberta Children's Hospital Research Institute, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

Background (416 characters)

Increasing rates of obesity are of growing concern to maternal and child health as mothers with obesity are at risk of pregnancy complications. Infants of mothers with overweight/obese pre-pregnancy body mass index (BMI) may also be at significant risk of neurodevelopmental disorders. The relationship between maternal pre-pregnancy BMI and neurodevelopmental outcomes in preterm infants is not yet clearly defined.

Objective (183 characters)

To determine the association of pre-pregnancy BMI of mothers of infants born <29 weeks gestational age (GA) and neurodevelopmental impairment (NDI) at 18-24 months corrected age (CA).

Design/Methods (787 characters)

Preterm infants (born <29 weeks GA) between January 2005 and December 2015 were evaluated in the neonatal follow-up clinic at 18-24 months CA were included. Demographic characteristics as well as neurodevelopmental status including Bayley-III cognitive, language, and motor scores and sensory impairments were compared between three groups based on maternal pre-pregnancy BMI (BMI₁ [18.5-24.9 kg/m²] vs. BMI₂ [25-29.9 kg/m²] vs. BMI₃ [≥30 kg/m²]) using univariate and multivariable regression models. The primary outcome was a composite of death or NDI.

NDI was defined as the presence of Bayley-III <85 on one or more of the cognitive, motor, or language composite scores, any cerebral palsy (GMFCS ≥1), sensorineural or mixed hearing impairment, or unilateral or bilateral visual impairment.

Results (821 characters)

Of 771 eligible infants, 53 were lost to follow-up and 21 born to mothers with BMI <18.5 kg/m² were excluded. Of the remaining 697 participants, 315 (45%) infants were in BMI₁, 235 (34%) in BMI₂, and 147 (21%) in BMI₃ groups. Infants in BMI₁, BMI₂, and BMI₃ groups had mean (SD) birth weight of 897 (231), 854 (208), and 867 (234) grams and median GA (IQR) of 27 (3), 26 (2), and 27 (3) weeks respectively (Table 1). Rates of associated impairments are shown in Figure 1. The odds of a composite of death or NDI in BMI₂ vs. BMI₁ and BMI₃ vs. BMI₁ groups were 1.33 (95%CI 0.86-2.06) and 0.76 (95%CI 0.47-1.22) respectively (Table 2). Infants born

to mothers in the BMI₂ group had twice the odds of scoring <85 on the Bayley-III language composite than those in BMI₁ (adjusted odds ratio 2.06 [95% CI; 1.28-3.32]).

Conclusion(s) (249 characters)

Pre-pregnancy body mass index was not associated with death or neurodevelopmental impairment in very preterm infants at 18-24 months corrected age. However, infants born to mothers who were overweight were more likely to have lower language scores.

Table 1

Table 1. Maternal and neonatal characteristics

	BMI ₁ (N=315)	BMI ₂ (N=235)	BMI ₃ (N=147)	p-value*
Maternal Characteristics				
Maternal age at delivery				<0.001
<25 years, n (%)	50 (16%)	18 (8%)	13 (9%)	
25-34 years, n (%)	202 (64%)	154 (66%)	82 (56%)	
≥35 years, n (%)	63 (20%)	63 (27%)	52 (35%)	
mean (SD)	30 (6)	32 (5)	32 (6)	
Nulliparous, n (%)	132/314 (42%)	64/233 (27%)	35/144 (24%)	<0.001
Smoking during pregnancy, n (%)	54/314 (17%)	30 (13%)	20/145 (14%)	0.320
Gestational diabetes, n (%)	14/267 (5%)	10/197 (5%)	16/135 (12%)	0.024
Gestational hypertension, n (%)	31/268 (12%)	26/197 (13%)	34/135 (25%)	0.001
Rupture of membranes ≥24h, n (%)	90 (29%)	67 (29%)	46/146 (32%)	0.783
Antenatal steroids, n (%)	291/313 (93%)	220 (94%)	139 (95%)	0.810
Chorioamnionitis, n (%)	84/309 (27%)	52/229 (23%)	43/144 (30%)	0.273
Multiple birth, n (%)	93 (30%)	87 (37%)	48 (33%)	0.179
C-section delivery, n (%)	166 (53%)	138 (59%)	91 (62%)	0.131
Maternal education post-secondary or more†, n (%)	194/273 (71%)	140/202 (69%)	90/128 (70%)	0.918
Neonatal Characteristics				
Gestational age, weeks, median (IQR)	27 (3)	26 (2)	27 (3)	0.178
Birth weight, grams, mean (SD)	897 (231)	854 (208)	867 (234)	0.076
Male, n (%)	172 (55%)	131 (56%)	72 (49%)	0.404
Outborn, n (%)	16 (5%)	15 (6%)	1 (1%)	0.030
5 minute Apgar score <7, n (%)	100/311 (32%)	77/232 (33%)	60 (41%)	0.171
Caffeine, n (%)	288 (91%)	220 (94%)	143 (97%)	0.061
SGA <10 th percentile, n (%)	26 (8%)	27 (11%)	22 (15%)	0.086

Abbreviations: BMI: Body mass index; BMI₁: 18.5-24.9 kg/m²; BMI₂: 25-29.9 kg/m²; BMI₃: ≥30 kg/m²; SGA: small for gestational age
Different variables have different denominators due to missing/unknown values

*Chi-square for categorical variables, ANOVA or Kruskal-Wallis test for continuous variables

†Available only for those who survived and were seen in follow-up

Table 2

Table 2. Neurodevelopmental outcomes at 18-24 months corrected age

	BMI ₁ (N=315)	BMI ₂ (N=235)	BMI ₃ (N=147)	BMI ₂ vs. BMI ₁ *aOR (95% CI)	BMI ₃ vs. BMI ₁ *aOR (95% CI)
Death or NDI, n (%)	145/246 (59%)	134/196 (68%)	73/125 (58%)	1.33 (0.86-2.06)	0.76 (0.47-1.22)
Death, n (%)	30 (10%)	23 (10%)	14 (10%)	0.81 (0.42-1.58)	0.86 (0.40-1.86)
Any NDI, n (%)	116/217 (53%)	111/173 (64%)	59/111 (53%)	1.46 (0.93-2.32)	0.75 (0.45-1.26)
Cerebral palsy, n (%)	20/285 (7%)	13/209 (6%)	6/133 (5%)	0.86 (0.39-1.90)	0.59 (0.22-1.59)
Bayley-III cognitive composite score <85, n (%)	39/263 (15%)	43/192 (22%)	21/128 (16%)	1.61 (0.92-2.81)	1.17 (0.62-2.22)
Bayley-III language composite score <85, n (%)	72/220 (33%)	80/161 (50%)	42/105 (40%)	2.06 (1.28-3.32)	1.03 (0.60-1.78)
Bayley-III motor composite score <85, n (%)	55/224 (25%)	47/163 (29%)	28/111 (25%)	1.09 (0.65-1.83)	0.87 (0.48-1.58)
Visual impairment, n (%)	9/285 (3%)	10/210 (5%)	8/133 (6%)	n/a†	n/a†
Hearing impairment, n (%)	10/284 (4%)	5/203 (2%)	2/132 (2%)	n/a†	n/a†

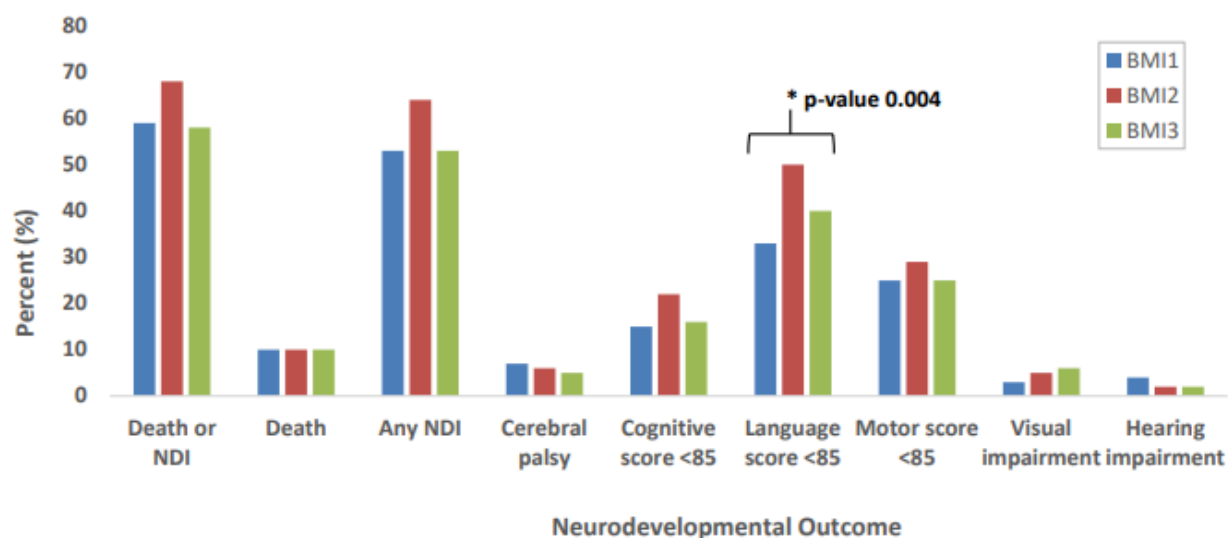
Abbreviations: BMI: Body mass index; BMI₁: 18.5-24.9 kg/m²; BMI₂: 25-29.9 kg/m²; BMI₃: ≥30 kg/m²; NDI: neurodevelopmental impairment

Different variables have different denominators due to missing/unknown values

* Adjusted for maternal age, nulliparous, smoking during pregnancy, antenatal steroids, chorioamnionitis, multiple birth, C-section delivery, gestational age, sex, outborn, 5 minute Apgar <7, SGA, and maternal education (for outcomes not involving death)

†Model could not be fit due to small numbers

Figure 1

**Figure 1. Neurodevelopmental outcomes at 18-24 months corrected age**