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INTRODUCTION

Overweight (OW; body mass index [BMI] of 25.0 to 29.9 kg/m²), and obesity (OB; BMI of 30 and greater kg/m²) are conditions where excessive fat accumulation presents a risk to health¹. Prepregnancy BMI and maternal gestational weight gain (GWG) above Institute of Medicine (IOM) recommendations (excessive gestational weight gain [EGWG]) are risk factors for higher infant birthweight² and childhood OW or OB³.

Combined nutrition and exercise interventions implemented during pregnancy have been found to decrease EGWG⁴. Some follow-up studies have found no change in infant anthropometrics at 1 year of age^{5,6}, whereas one found a decrease in infant subscapular skinfold thickness (SFT) at 1 year of age⁷.

The Nutrition and Exercise Lifestyle Intervention Program (NELIP) is a combined intervention designed to prevent EGWG in individuals with OW and OB⁸. NELIP has been found to decrease EGWG and high birthweight in individuals with OW⁸.

This study is a convenience sample from a larger trial (ClinicalTrials.gov identifier: NCT01129505) using the NELIP with family-based behavioural treatment (FBBT). FBBT was initially developed to promote weight loss in children with OW⁹. Currently, it is unknown how an antenatal NELIP with FBBT affects infant anthropometrics in the first year of life.

OBJECTIVE & HYPOTHESIS

Objective:

To investigate if an antenatal NELIP with FBBT reinforced at 2 months postpartum (Group A) decreases the prevalence of large infants (BMI ≥85th percentile) up to 1 year of age compared to a postpartum-only NELIP with FBBT (Group B)

Hypothesis:

Group A will have a lower prevalence of EGWG, large infants at birth (macrosomia), low birthweight (LBW), as well as healthy development of other infant growth markers (infant fat mass, SFT, and girth) at 2, 6 and 12 months compared to Group B.

METHODS

The protocol was approved by the Western University Health Sciences Research Ethics Board and written informed consent forms were signed and collected from all participants.

Participant inclusion and exclusion criteria:

- Inclusion: prepregnant BMI of OW/OB, age 18-40 years, 16-20 weeks gestation or 2 months postpartum, singleton pregnancy
- Exclusion: contraindications to exercise, smoking, diabetes

METHODS

NELIP:

- Nutrition: individualized program adapted from an eating guide designed to prevent gestational diabetes mellitus
- Exercise: 1 supervised and 2-3 at home walking sessions per week until delivery

FBBT:

- Antenatal (3 sessions): goal setting and making healthy choices with family support
- Postpartum (3 sessions): limit postpartum weight retention, encourage breastfeeding, and promote a healthy family lifestyle

Measurements:

- Demographic characteristics collected at baseline
- Infant weight, length, SFT and girth at birth, 2, 6 and 12 months
- LBW: birthweight <2500 g; Macrosomia: birthweight >4000 g.
- Infant fat mass: calculated using Catalano formula¹⁰
- EGWG: GWG over 11.5 kg (OW) or 9.0 kg (OB)¹¹
- Adherence: total exercise sessions completed

Statistical Analysis (SPSS Statistics v28):

- Continuous data: Mann-Whitney U Test
- Nominal data: Chi Square Analysis
- Adherent analysis: complete cases with ≥ 50% compliance

RESULTS

Table 1 – Maternal and newborn characteristics

	Group A ^a (n= 48)	Group B ^b (n= 52)	<i>p</i> Value	Group A ^a Adh ^c (n= 18)	Group B ^b Adh ^c (n= 26)	<i>p</i> Value
Maternal age (years)	31.31 ± 4.37	32.29 ± 4.64	0.142	30.65 ± 2.96	33.28 ± 4.92	0.046
Pre-Preg. BMI ^d (kg/m ²)	34.70 ± 6.87	31.76 ± 5.62	0.039	37.44 ± 8.24	30.60 ± 3.92	0.011
Pre-Preg. BMI ^d			0.222			0.140
OW ^e (n, %)	15, 31.2%	22, 43.1%		5, 27.8%	13, 50.0%	
OB ^f (n, %)	33, 68.8%	29, 56.9%		13, 72.2%	13, 50.0%	
Total GWG ^g (kg)	11.68 ± 6.57	15.90 ± 8.76	0.018	10.79 ± 6.91	15.99 ± 9.75	0.050
EGWG ^h (n, %)	26, 56.5%	39, 76.5%	0.037	9, 50.0%	20, 76.9%	0.064
Birthweight (g)	3590.55 ± 434.21	3616.06 ± 499.47	0.601	3656.29 ± 380.52	3555.79 ± 409.17	0.616
Birthweight category (n, %)			0.603			0.341
LBW ⁱ	0, 0.0%	1, 2.0%		0, 0.0%	0, 0.0%	
Adequate ^j	39, 81.2%	39, 78.0%		14, 77.8%	23, 88.5%	
Macrosomia ^k	9, 18.8%	10, 20.0%		4, 22.2%	3, 11.5%	

Continuous and nominal data were analyzed using a Mann-Whitney U Test and Chi Square Analysis, respectively. **Bold:** significant <0.050. **a.** Group A: NELIP with FBBT during pregnancy and postpartum; **b.** Group B: NELIP with FBBT postpartum only; **c.** Adherent analysis: complete cases with with ≥ 50% compliance; **d.** BMI: body mass index; **e.** OW: BMI 25.0 to 29.9 kg/m²; **f.** OB: BMI ≥30 kg/m²; **g.** GWG: gestational weight gain; **h.** EGWG: excessive gestational weight gain; **i.** LBW: low birth weight, birthweight < 2500 g; **j.** Adequate: birthweight between 2500 g and 4000 g; **k.** Macrosomia: birthweight > 4000 g

Table 2 – Prevalence of large infants up to 1 year of age

	Group A ^a Full (n= 48)	Group B ^b Full (n= 52)	<i>p</i> Value	Group A ^a Adh ^c (n= 18)	Group B ^b Adh ^c (n= 26)	<i>p</i> Value
Large infant ^d (n, %)						
Birth	12, 25.0%	14, 28.0%	0.737	4, 22.2%	4, 15.4%	0.563
2 mo.	9, 22.5%	11, 22.0%	0.955	4, 22.2%	4, 15.4%	0.563
6 mo.	9, 29.0%	6, 17.6%	0.277	6, 33.3%	6, 23.1%	0.453
12 mo.	12, 46.2%	12, 42.9%	0.808	10, 55.6%	11, 42.3%	0.387

Nominal data was analyzed using a Chi Square Analysis. **a.** Group A: NELIP with FBBT during pregnancy and postpartum; **b.** Group B: NELIP with FBBT postpartum only; **c.** Adherent analysis: complete cases with with ≥ 50% compliance; **d.** Large infant: BMI (body mass index) ≥85th percentile on WHO growth charts for infant sex¹²

Table 3 – Infant body fat mass, SFT and girth up to 1 year of age

	Group A ^a Full (n= 48)	Group B ^b Full (n= 52)	<i>p</i> Value	Group A ^a Adh ^c (n= 18)	Group B ^b Adh ^c (n= 26)	<i>p</i> Value
Total body fat ^d (g)						
2 mo.	1242.72 ± 331.79	1086.14 ± 295.59	0.039	1214.78 ± 279.53	1004.41 ± 293.87	0.019
6 mo.	2094.22 ± 456.24	1738.04 ± 376.24	0.001	2134.74 ± 491.47	1791.93 ± 386.29	0.021
12 mo.	2532.17 ± 574.35	2261.47 ± 389.65	0.087	2588.35 ± 586.62	2276.01 ± 399.00	0.141
Percent body fat ^d						
2 mo.	21.77 ± 3.88	20.33 ± 3.71	0.158	21.63 ± 3.14	19.22 ± 3.76	0.036
6 mo.	25.75 ± 3.36	22.63 ± 3.40	<0.001	26.23 ± 3.70	23.06 ± 3.63	0.006
12 mo.	24.33 ± 2.89	22.94 ± 2.22	0.058	24.76 ± 2.87	23.03 ± 2.20	0.056
SFT ^e at 6 mo. (mm)						
Suprailiac	11.91 ± 5.75	8.47 ± 4.49	0.007	13.22 ± 5.82	8.77 ± 4.93	0.007
Biceps	8.50 ± 3.36	9.92 ± 3.27	0.049	8.06 ± 2.39	10.15 ± 3.65	0.053
Arm circ. (cm)						
2 mo.	13.09 ± 1.09	12.49 ± 1.18	0.011	12.84 ± 1.24	12.24 ± 1.18	0.109
6 mo.	14.82 ± 1.36	14.20 ± 1.03	0.036	14.71 ± 1.59	14.35 ± 1.03	0.426
12 mo.	15.67 ± 1.19	15.07 ± 0.92	0.035	16.01 ± 1.16	15.13 ± 0.92	0.008
Head circ. ≥85 th % ^f						
2 mo. (n, %)	18, 42.86%	7, 14.00%	0.002	8, 44.4%	3, 11.5%	0.013
Arm circ. ≥85 th % ^f						
6 mo. (n, %)	15, 46.88%	7, 19.44%	0.016	9, 50.0%	6, 23.1%	0.064
12 mo. (n, %)	12, 48.00%	5, 18.52%	0.024	11, 64.7%	5, 25.0%	0.003

Continuous data was analyzed using a Mann-Whitney U Test. **Bold:** significant <0.050. **a.** Group A: NELIP with FBBT during pregnancy and postpartum; **b.** Group B: NELIP with FBBT postpartum only; **c.** Adherent analysis: complete cases with with ≥ 50% compliance; **d.** Infant fat mass¹⁰ = 0.39055 (weight) + 0.0453 (suprailiac SFT) – 0.03237 (length) + 0.54657; **e.** SFT: skin fold thickness; **f.** ≥85th percentile on WHO growth charts for infant sex¹³

DISCUSSION

Antenatal NELIP with FBBT decreases GWG and EGWG:

- Group A had lower mean GWG and EGWG (Table 1)
- This supports previous literature^{4,8} and the hypothesis

Primary outcome:

- No differences in the prevalence of large infants
- This does not support the hypothesis, but corresponds with some previous literature^{5,6}

Prepregnancy BMI vs. GWG and infant anthropometrics:

- Group A had higher prepregnancy BMI, which may explain higher anthropometrics in Group A (Table 3)

Limitations:

- Convenience sample of a larger study
- Adherence to the intervention was low (data not shown)

Future directions:

- Compare breastfeeding between groups
- Compare to a third group: antenatal NELIP only with no postpartum intervention

CONCLUSION

Prepregnancy BMI may be more important than GWG as a determinate of infant anthropometrics up to 1 year of age. Future research is necessary to confirm this finding.

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RESULTS

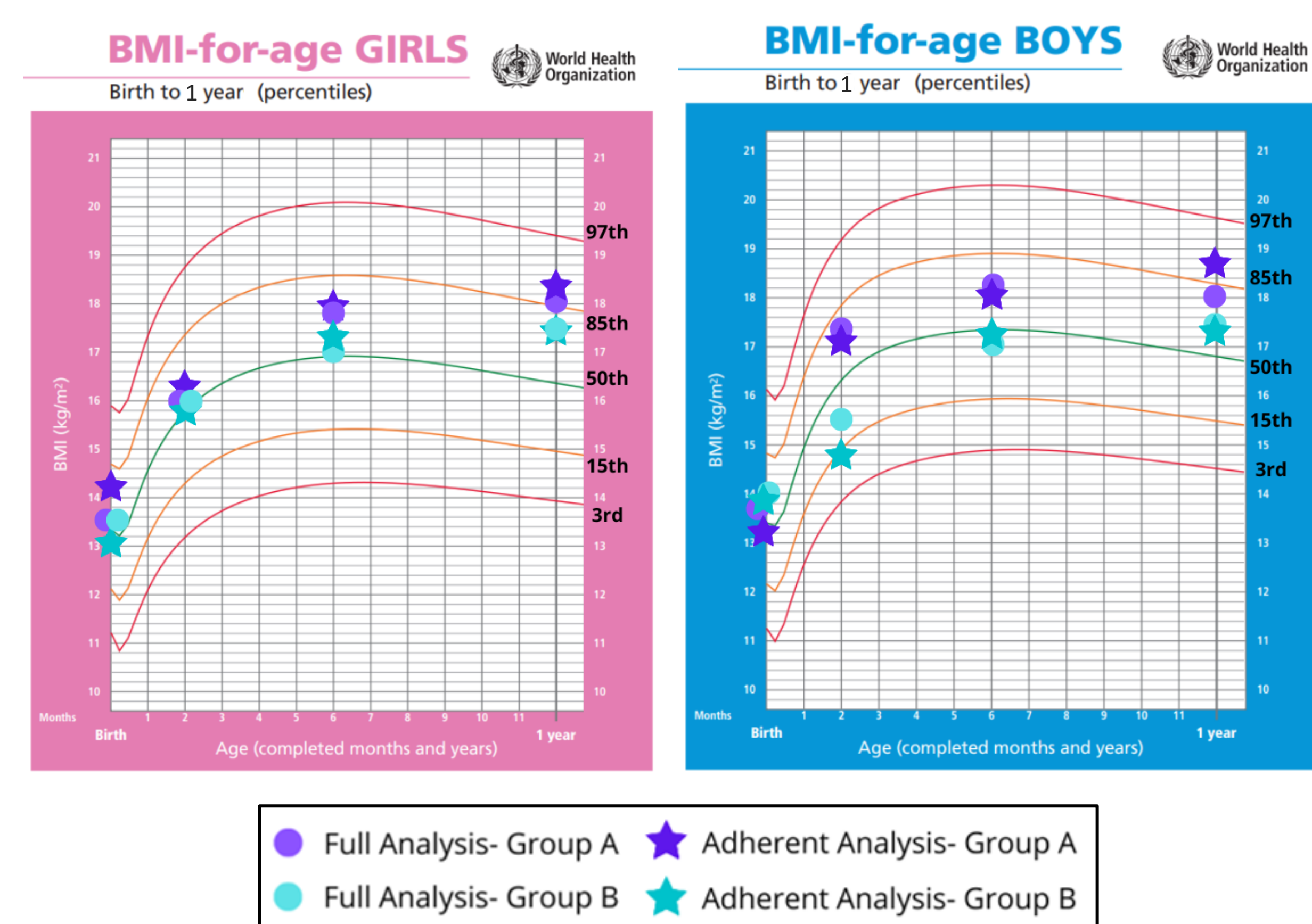


Fig. 1 – Mean infant BMI-for-age up to 1 year of age¹²

No differences between groups (data not shown) in:

- Ethnicity, parity, infant sex, or gestational age
- Triceps or subscapular SFT ≥ 85th percentile at any time
- Head circumference ≥ 85th percentile at 6 or 12 months
- Postpartum adherence