EARLYNUTRITION
Long-term effects of early nutrition on later health

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Cord blood adiponectin as a predictor for childhood obesity at 5 years of age: analysis within the INFAT-study

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Scientific Background

Dramatic ↑ overweight and obese preschool children in recent years (de Onis et al., 2010, AJCN)

Research is now being directed toward identifying prognostic biomarkers which could predict obesity in early childhood

Adiponectin plays a key role in energy regulation and metabolic homeostasis (Rosen and Spiegelman, 2006, Nature)

Inverse relationship between adiponectin levels and BMI as well as type II diabetes is well documented in adults

Few studies have examined the role of adiponectin in early childhood

Current Scientific Evidence

Cord blood

Birth — Sivan et al., 2003, Clin Endocrinol; Lindsay et al. 2003, Diabetes Care; Fonseca et al. 2015, Arch Gynecol Obstet; Kotani et al., 2004, Clin Endocrinol — Inconclusive results

3 years — Mantzoros et al., 2009, Pediatrics — Predicted central adiposity

? — 1 Adiponectin related to child body composition up to 5 yrs

Plasma/Serum

1&2 years — Iniguez et al., 2004, J Clin Endocrinol Metab — No relationship to wgt/BMI

? — 2 Adiponectin measured at 3 yrs related to body composition at 3–5 yrs

6–8 years — Asayama et al., 2003, Obes Res; Ogawa et al., 2005, Hypertens Res — Inverse association with obesity

Study objectives

1

Cord blood HMW adiponectin

2

Plasma HMW adiponectin from 3 yrs old children

Obesity Indices:

- Anthropometry
  - Weight
  - Height
  - BMI percentiles
- Skinfold Thickness
  - Lean body mass (LBM)
  - Fat mass
- Abdominal Ultrasound
- Abdominal MRI (subgroup at 5yrs)

HMW = high molecular weight

Study design

→ Data came from the INFAT study: Intervention group + Control group pooled for analysis

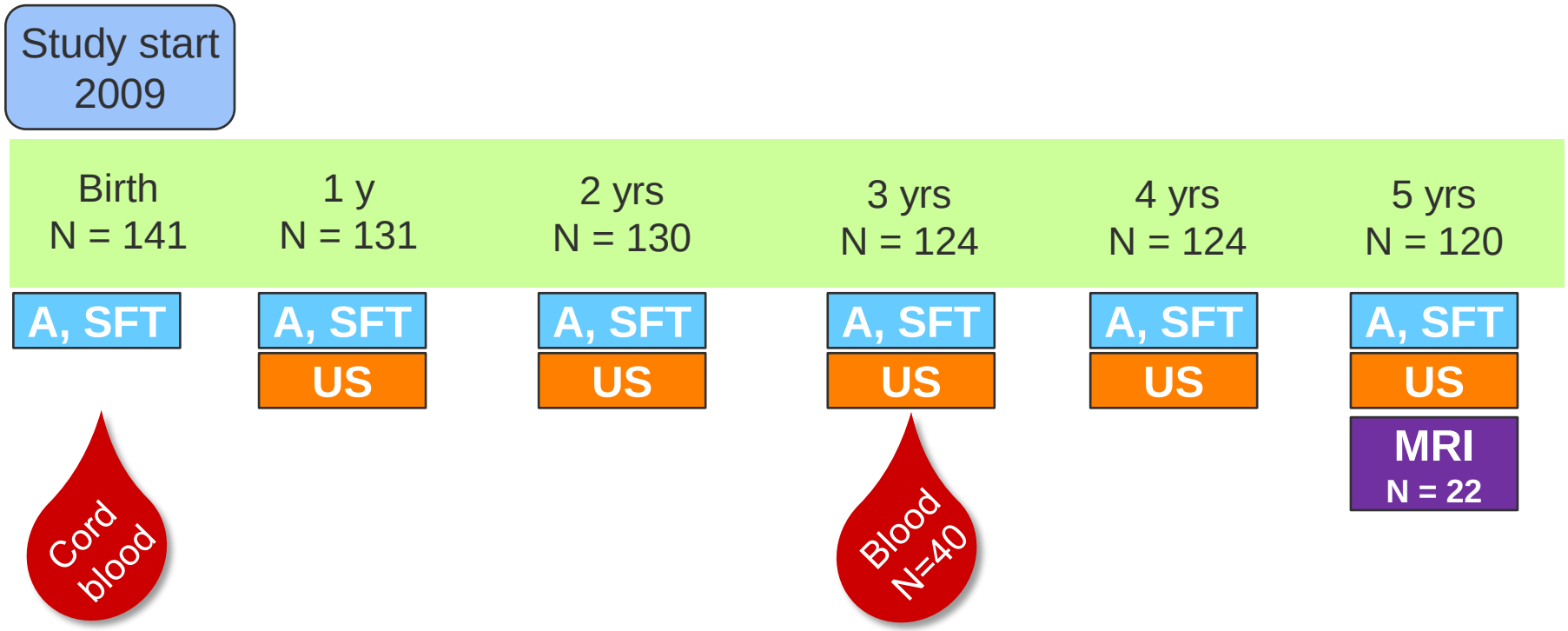

Figure legend: A = Anthropometry, SFT = Skinfold thickness, US = Ultrasound, MRI = Magnetic resonance imaging

1

Cord blood HMW adiponectin related to child clinical outcomes

Body composition variables	Unadjusted Analysis			Adjusted Analysis*		
	n	Beta (95% CI)	*P*	n	Beta (95% CI)	*P*
Birth						
Weight, kg	141	0.03 (0.01; 0.05)	**0.004**	139	0.02 (0; 0.04)	**0.022**
BMI percentiles	141	1.20 (0.05; 2.35)	**0.041**	139	0.53 (0; 1.05)	0.050
Sum 4 SFT, mm	134	0.10 (−0.01; 0.20)	0.082	132	0.07 (−0.05; 0.18)	0.241
Fat mass, kg	134	0.01 (0; 0.01)	**0.011**	132	0.01 (0; 0.01)	0.070
Body fat (%)	134	0.09 (−0.02; 0.20)	0.113	132	0.0 (−0.0; 0.1)	0.324
Lean body mass, kg	134	0.02 (0.01; 0.04)	0.002	132	0.02 (0; 0.03)	**0.011**
1 year						
Weight, kg	131	0.02 (−0.03; 0.06)	0.415	131	0.04 (−0.02; 0.10)	0.149
BMI percentiles	131	0.72 (−0.59; 2.03)	0.281	131	0.80 (−0.50; 2.10)	0.227
Sum 4 SFT, mm	126	−0.03 (−0.21; 0.16)	0.770	126	0.03 (−0.16; 0.23)	0.756
Fat mass, kg	126	0 (−0.02; 0.02)	0.783	126	0.01 (−0.01; 0.03)	0.373
Body fat (%)	126	−0.01 (−0.14; 0.12)	0.665	126	0.02 (−0.11; 0.16)	0.741
Lean body mass, kg	126	0.02(−0.01; 0.05)	0.283	126	0.03 (−0.01; 0.06)	0.100
Area sag pp, mm^2	120	−0.06 (−0.32; 0.20)	0.661	120	−0.06 (−0.34; 0.22)	0.657
Area sag sc, mm^2	121	0.39 (−0.22; 0.99)	0.208	121	0.42 (−0.21; 1.06)	0.190
Area ax sc, mm^2	123	0.29 (−0.41; 0.99)	0.415	123	0.24 (−0.49; 0.97)	0.517
2 years						
Weight, kg	130	0.04 (−0.02; 0.10)	0.240	130	0.04 (−0.02; 0.10)	0.163
BMI percentiles	130	0.96 (−0.24; 2.18)	0.124	130	0.98 (−0.27; 2.23)	0.122
Sum 4 SFT, mm	90	0.18 (−0.02; 0.39)	0.082	90	0.21 (−0.01; 0.43)	0.056
Fat mass, kg	90	0.02 (−0.01; 0.06)	0.114	90	0.03 (−0.01; 0.06)	0.126
Body fat (%)	90	0.12 (−0.02; 0.26)	0.102	90	0.14 (−0.02; 0.29)	0.079
Lean body mass, kg	90	0.03 (−0.04; 0.09)	0.400	90	0.02 (−0.05; 0.08)	0.542
Area sag pp, mm^2	89	0.60 (0.12; 1.07)	**0.014**	89	0.61 (0.09; 1.12)	**0.022**
Area sag sc, mm^2	89	0.47 (−0.21; 1.15)	0.173	89	0.71 (−0.02; 1.44)	0.056
Area ax sc, mm^2	89	0.40 (−0.38; 1.19)	0.307	89	0.66 (−0.16; 1.48)	0.111

*Multiple regression models adjusting for pre-pregnancy BMI, gestational weight gain, pregnancy duration, sex, ponderal index at birth, group, and breastfeeding status

Meyer and Brei et al., 2016 Ped Res (under revision)

1 Cord blood HMW adiponectin related to child clinical outcomes

Body composition variables	Unadjusted Analysis			Adjusted Analysis*		
	n	Beta (95% CI)	*P*	n	Beta (95% CI)	*P*
3 years						
Weight, kg	124	0.02 (−0.06; 0.10)	0.610	124	0.03 (−0.05; 0.11)	0.402
BMI percentiles	124	0.35 (−0.84; 1.83)	0.561	124	0.62 (−0.56; 1.80)	0.300
Sum 4 SFT, mm	90	0.23 (0.02; 0.45)	**0.030**	90	0.30 (0.10; 0.51)	**0.005**
Fat mass, kg	90	0.03 (0; 0.07)	0.085	90	0.04 (0; 0.08)	**0.041**
Body fat (%)	90	0.16 (0; 0.31)	**0.046**	90	0.21 (0.06; 0.35)	**0.006**
Lean body mass, kg	99	0.01 (−0.06; 0.09)	0.719	90	0.01 (−0.07; 0.08)	0.894
Area sag pp, mm^2	80	0.57 (−0.14; 1.28)	0.114	80	0.55 (−0.22; 1.33)	0.161
Area sag sc, mm^2	80	0.56 (−0.19; 1.30)	0.142	80	0.73 (−0.05; 1.51)	0.066
Area ax sc, mm^2	79	0.63 (−0.49; 1.74)	0.266	79	0.87 (−0.29; 2.04)	0.139

*Multiple regression models adjusting for pre-pregnancy BMI, gestational weight gain, pregnancy duration, sex, ponderal index at birth, group, and breastfeeding status

Meyer and Brei et al., 2016 Ped Res (under revision)

1

Cord blood HMW adiponectin related to child clinical outcomes

Body composition variables	Unadjusted Analysis			Adjusted Analysis*		
	n	Beta (95% CI)	*P*	n	Beta (95% CI)	*P*
4 years						
Weight, kg	124	0.03 (−0.06; 0.11)	0.553	124	0.04 (−0.05; 0.13)	0.411
BMI percentiles	124	0.57 (−0.63; 1.77)	0.351	124	0.73 (−0.48; 1.93)	0.236
Sum 4 SFT, mm	80	0.18 (0.04; 0.40)	0.111	80	0.24 (0; 0.47)	**0.048**
Fat mass, kg	80	0.03 (0.01; 0.07)	0.165	80	0.04 (−0.01; 0.08)	0.124
Body fat (%)	80	0.13 (−0.04; 0.30)	0.126	80	0.19 (0.02; 0.35)	**0.027**
Lean body mass, kg	80	0.03 (−0.08; 0.13)	0.609	80	0 (−0.11; 0.11)	0.962
Area sag pp, mm^2	75	0.08 (−0.80; 0.96)	0.854	75	0.06 (−0.91; 1.04)	0.896
Area sag sc, mm^2	74	0.41 (−0.36; 1.18)	0.292	74	0.61 (−0.21; 1.43)	0.143
Area ax sc, mm^2	75	0.33 (−0.78; 1.45)	0.553	75	0.62 (−0.60; 1.84)	0.315
5 years						
Weight, kg	120	0 (−0.13; 0.13)	0.986	120	0.02 (−0.11; 0.15)	0.752
BMI percentiles	119	0.12 (−1.17; 1.42)	0.851	119	0.49 (−0.82; 1.79)	0.460
Sum 4 SFT, mm	89	0.06 (−0.21; 0.34)	0.646	89	0.12 (−0.17; 0.40)	0.408
Fat mass, kg	89	0.01 (−0.05; 0.07)	0.710	89	0.02 (−0.04; 0.08)	0.551
Body fat (%)	89	0.06 (−0.14; 0.26)	0.545	89	0.08 (−0.10; 0.27)	0.363
Lean body mass, kg	89	−0.01 (−0.12; 0.09)	0.848	89	0 (−0.11; 0.10)	0.962
Area sag pp, mm^2	74	0.32 (−0.51; 1.15)	0.445	74	0.56 (−0.33;1.46)	0.214
Area sag sc, mm^2	75	0.17 (−0.58; 0.92)	0.658	75	0.26 (−0.57; 1.10)	0.534
Area ax sc, mm^2	76	0 (−1.10; 1.09)	0.996	76	0.15 (−1.07; 1.38)	0.804
SAT volume, cm^3	33	0.33 (−15.10; 15.76)	0.965	33	7.22 (−10.17; 24.62)	0.400
VAT volume, cm^3	33	−0.10 (−3.40; 3.21)	0.954	33	1.57 (−2.20; 5.34)	0.399
NAT volume, cm^3	33	−4.75 (−37.90; 28.39)	0.772	33	4.00 (−32.40; 40.40)	0.823

*Multiple regression models adjusting for pre-pregnancy BMI, gestational weight gain, pregnancy duration, sex, ponderal index at birth, group, and breastfeeding status

Meyer and Brei et al., 2016 Ped Res (under revision)

2 Child Plasma HMW adiponectin related to child clinical outcomes

Body composition variables	n	Unadjusted Analysis		Adjusted Analysis*	
		Beta (95% CI)	*P*	Beta (95% CI)	*P*
5 years					
Weight, kg	37	0.13 (−0.23; 0.49)	0.467	0.18 (−0.26; 0.62)	0.414
BMI percentiles	37	−0.85 (−4.95; 3.26)	0.678	−0.62 (−5.50; 4.27)	0.798
Sum 4 SFT, mm	37	0.09 (−0.68; 0.87)	0.807	0.08 (−0.85; 1.00)	0.870
Fat mass, kg	37	0.05 (−0.11; 0.20)	0.560	0.05 (−0.14; 0.24)	0.615
Body fat (%)	37	0.10 (−0.46; 0.66)	0.718	0.10 (−0.55; 0.66)	0.847
Lean body mass, kg	37	0.09 (−0.17; 0.34)	0.508	0.13 (−0.16; 0.42)	0.361
Area sag pp, mm^2	34	−0.79 (−2.05; 1.47)	0.747	0.08 (−2.01; 2.17)	0.936
Area sag sc, mm^2	34	0.55 (−1.31; 2.41)	0.551	−0.03 (−2.26; 2.21)	0.981
Area ax sc, mm^2	35	−0.10 (−2.87; 2.67)	0.943	−0.64 (−3.98; 2.71)	0.699
SAT volume, cm^3	22	−11.44 (−42.95; 20.06)	0.457	−17.19 (−57.76; 23.38)	0.377
VAT volume, cm^3	22	−0.98 (−7.51; 5.55)	0.758	−0.60 (−9.02; 7.82)	0.880
NAT volume, cm^3	22	11.19 (−54.53; 76.90)	0.726	−18.98 (−83.87; 45.91)	0.538

No evidence of a relationship observed

*Multiple regression models adjusting for pre-pregnancy BMI, gestational weight gain, pregnancy duration, sex, ponderal index at birth, group, and breastfeeding status

Meyer and Brei et al., 2016 Ped Res (under revision)

Current Scientific Evidence

Cord blood

Birth	Sivan et al., 2003, Clin Endocrinol; Lindsay et al. 2003, Diabetes Care; Fonseca et al. 2015, Arch Gynecol Obstet; Kotani et al. 2004, Clin Endocrinol	Inconclusive results
3 years	Mantzoros, et al, 2009, Pediatrics	Predicted central adiposity
?	**No evidence that cord blood adiponectin predicts obesity at 5 yrs**	

Plasma/Serum

1&2 years	Inguez et al., 2004, J Clin Endocrinol Metab	No relationship to wgt/BMI
?	**No evidence that plasma adiponectin measured at 3 yrs predicts obesity at 3–5 yrs**	
6–8 years	Asayama et al., 2003, Obes Res; Ogawa et al., 2005, Hypertens Res	Inverse association with obesity

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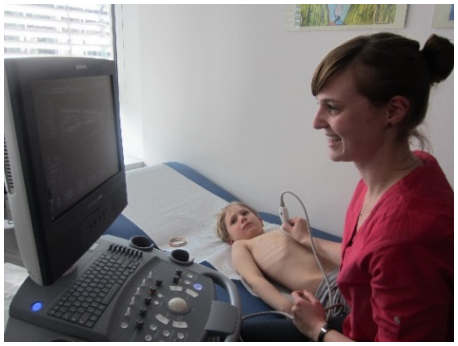
… and all families with their children!



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DANONE BABY NUTRITION

Thank you for your attention

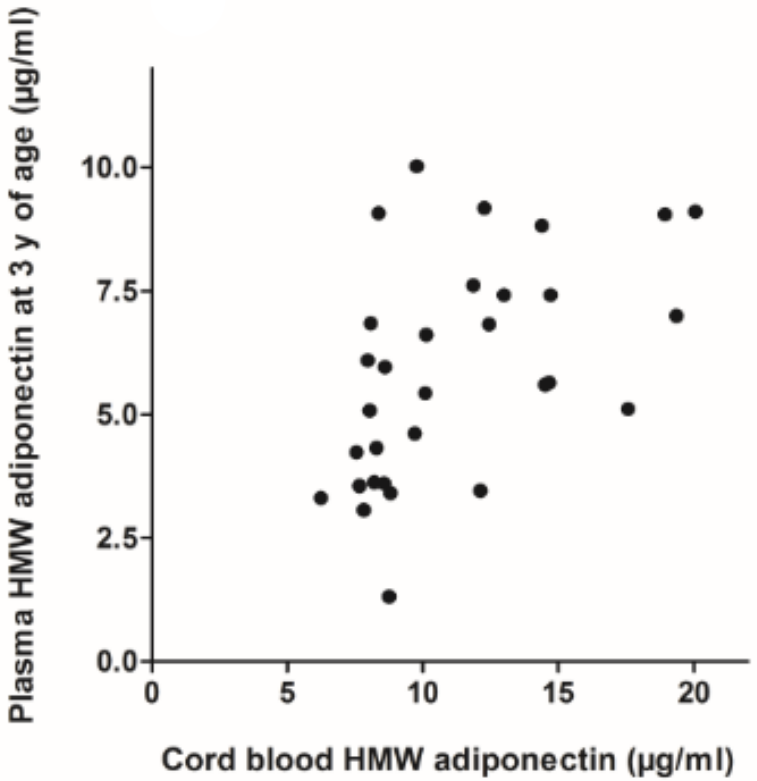
Additional slides

Cord blood HMW adiponectin related to child clinical outcomes

Body composition variables	n	Unadjusted Analysis		Adjusted Analysis*	
		Beta (95% CI)	*P*	Beta (95% CI)	*P*
3 years					
Weight, kg	40	0.13 (−0.10; 0.35)	0.258	0.18 (−0.06; 0.42)	0.143
BMI percentiles	40	−0.90 (−4.70; 2.91)	0.636	−1.05 (−5.10; 3.01)	0.603
Sum 4 SFT, mm	39	−0.06 (−0.47; 0.58)	0.822	−0.01 (−0.61; 0.59)	0.970
Fat mass, kg	39	0.04 (−0.05; 0.11)	0.434	0.03 (−0.06; 0.12)	0.548
Body fat (%)	39	0.04 (−0.34; 0.41)	0.852	−0.03 (−0.44; 0.38)	0.881
Lean body mass, kg	39	0.10 (−0.06; 0.26)	0.226	0.14 (−0.04; 0.31)	0.113
Area sag pp, mm^2	39	−0.06 (−1.56; 1.43)	0.932	−0.18 (−1.65; 1.28)	0.802
Area sag sc, mm^2	39	0.07 (−1.60; 1.74)	0.931	−0.21 (−2.09; 1.67)	0.821
Area ax sc, mm^2	39	−0.22 (−2.75; 2.31)	0.860	−0.44 (−3.20; 2.30)	0.742
4 years					
Weight, kg	38	0.15 (−0.11; 0.42)	0.247	0.19 (−0.11; 0.49)	0.204
BMI percentiles	38	0.20 (−03.94; 4.34)	0.922	0.32 (−4.22; 4.87)	0.886
Sum 4 SFT, mm	34	0.09 (−0.46; 0.64)	0.745	0.09 (−0.61; 0.78)	0.798
Fat mass, kg	34	0.04 (−0.6; 0.14)	0.382	0.04 (−0.08; 0.16)	0.513
Body fat (%)	34	0.12 (−0.29; 0.51)	0.591	0.09 (−0.41; 0.58)	0.725
Lean body mass, kg	34	0.10 (−0.12; 0.31)	0.367	0.11 (−0.13; 0.36)	0.348
Area sag pp, mm^2	34	−1.21 (−3.19; 0.77)	0.222	−1.50 (−3.86; 0.85)	0.200
Area sag sc, mm^2	34	0.06 (−1.63; 1.75)	0.943	−0.12 (−2.17; 1.95)	0.915
Area ax sc, mm^2	35	0.24 (−1.95; 2.43)	0.825	0.77 (−1.88; 3.42)	0.554

Multiple regression models adjusting for pre-pregnancy BMI, gestational weight gain, pregnancy duration, sex , pondural index at birth, group, and breastfeeding status

Correlation between cord blood plasma HMW adiponectin



$r_s = 0.5581$

n = 31 Spearman's correlation, p = 0.001). HMW = high molecular weight

Meyer & Brei, et al, 2016 Pediatric Research (under revision)