Early BMI Trajectory Classes are Linked to Distinct Body Fat Partitioning Later in Childhood

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BACKGROUND:

- Accelerated growth in the first two years of life has been linked to risks of obesity and cardiometabolic disorders in adulthood.
- Altered body fat partitioning, particularly increased accumulation of abdominal fat, intramyocellular lipids and liver fat has been associated with cardiometabolic disorders in both children and adults [1-3].
- The lack of precise body composition measures in prior longitudinal birth-cohort studies has made it difficult to ascertain if growth patterns in the first two years of life could result in consolidation of metabolically adverse body fat partitioning phenotypes in childhood.

OBJECTIVES:

- We evaluated if children who grew along different BMI trajectories in the first 2 years of life had distinct body fat partitioning at 4.5y.

METHODS:

Subjects

- BMI-for-age z-scores from the first 2 years of life from 1170 children (only singleton pregnancies) belonging to the Growing up in Singapore Towards healthy Outcomes (GUSTO) mother-offspring cohort, were used for BMI trajectory modeling.
- MR imaging for evaluating body fat compartments was performed at 4.5 years in a subset of 335 children.

Exposure

- Using latent class growth mixture modeling of BMI-for-age z-scores in the first two years of life, we had previously identified 4 distinct trajectories: 'stable low', 'normal', 'stable high' and 'rapid gain' [4]. These trajectory classes (shown in Fig. 1) were used as the exposure in the current study.

Outcomes of Interest

- Abdominal subcutaneous adipose tissue (SAT) and intra-abdominal adipose tissue (IAT) measured by magnetic resonance imaging at 4.5y.
- Intramyocellular lipids and liver fat measured by magnetic resonance spectroscopy at 4.5y.

Statistics

- Differences in fat depots across the 4 BMI trajectory classes were evaluated after adjusting for ethnicity, sex, maternal education, maternal BMI at booking, maternal age, parity, gestational fasting glucose (26th week), rate of gestational weight gain (15-35 weeks), gestational age at delivery, and breastfeeding duration.

RESULTS:

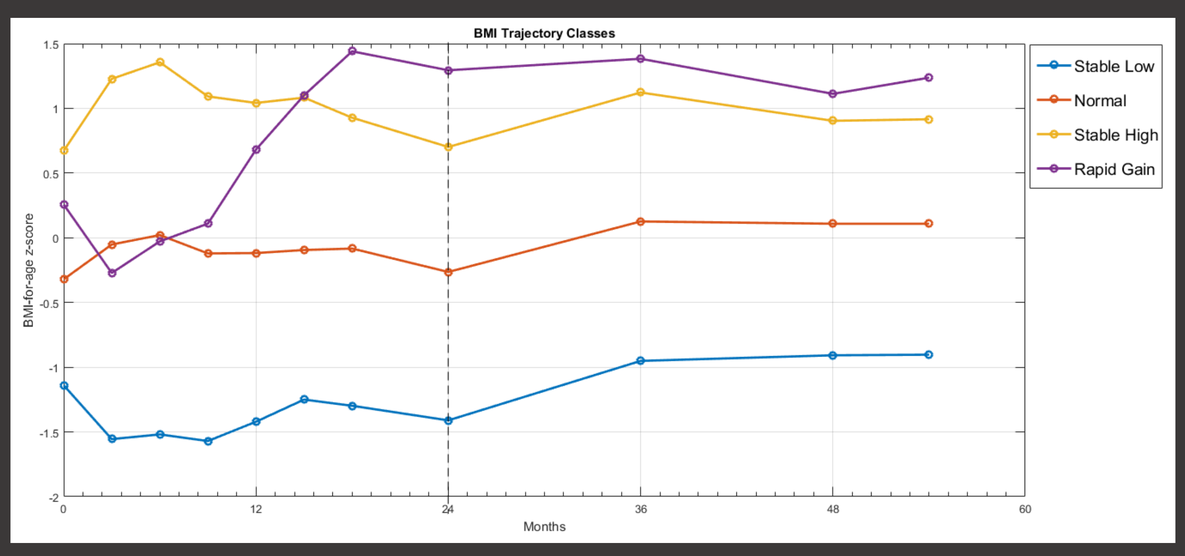

Figure 1: BMI Trajectory classes identified by latent class growth mixture modeling of BMI-for-age z scores in the first two years of life [4].

Table 1: Adjusted differences in fat depots at 4.5y across BMI trajectory classes with reference to the Normal BMI (n=244) trajectory (* p<0.05, ** p<0.01, *** p<0.001).

Fat Depot (4.5y)	Adjusted Difference‡ (95%CI) with respect to Normal Trajectory		
	Stable Low (n=45)	Stable High (n=29)	Rapid Gain (n=17)
Intramyocellular Lipids (% water)	-0.025 (-0.134,0.083)	0.087 (-0.036,0.209)	0.237* (0.057,0.416)
Liver Fat (% weight)	0.077 (-0.107,0.260)	0.008 (-0.186,0.202)	-0.002 (-0.319,0.315)
Subcutaneous Adipose Tissue (cc)	-244.5** (-386.5,-102.4)	170.0* (12.7,327.4)	685.4*** (446.1,924.6)
Intra-abdominal Adipose Tissue (cc)	-32.7* (-62.2, 3.2)	29.0 (-3.7,61.7)	123.6*** (73.9,173.3)

‡**Confounders:** ethnicity, sex, maternal education, maternal BMI at booking, maternal age, parity, gestational fasting glucose (26th week), rate of gestational weight gain (15-35 weeks), gestational age at delivery, and breastfeeding duration

CONCLUSIONS:

- Characterizing the dynamic aspects of early life growth patterns using BMI trajectories revealed distinct body fat partitioning phenotypes even in early childhood.
- Children on the rapid gain trajectory seem highly predisposed to accumulate abdominal fat (both SAT and IAT) and intramyocellular lipids.
- Both central obesity and skeletal muscle lipid accumulation have been linked to increased insulin resistance and cardiometabolic risk.
- Hence, tracking of these fat partitioning patterns to adulthood represents a potential pathway through which early life BMI trajectories can influence adulthood disease risk.

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