

Rate of accumulation of abdominal fat is associated with fasting glucose levels in early childhood

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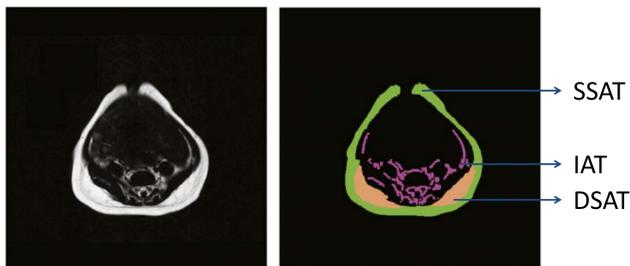
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Introduction

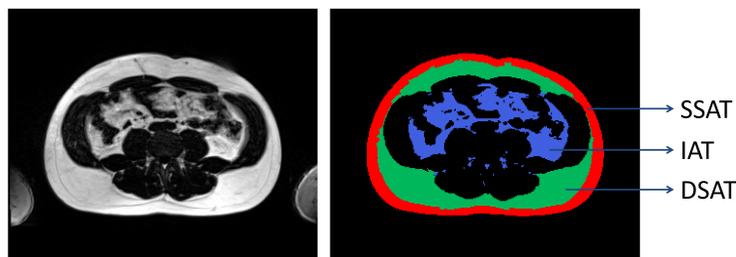
- Abdominal fat has been strongly linked to increased cardiometabolic risk and impaired glucose regulation in adults. Owing to the lack of detailed body composition phenotyping in most previous child cohort studies, the temporal links between abdominal fat accumulation and impaired glucose regulation have not been well established.
- In this study, we evaluated the associations of abdominal fat assessed by MRI at early infancy (≤ 21 days after birth) and at 4.5 years, as well as the rate of fat accumulation during this interval with glucose regulation assessed at 6 years.

Methods

- The participants were from the **Growing Up in Singapore Towards healthy Outcomes (GUSTO) study**, a prospective mother-offspring cohort comprising 1176 children from three ethnic groups (Chinese, Malay, and Indian).
- Abdominal MRI** were obtained from 331 children (180 boys and 151 girls) at **early infancy (≤ 21 days after birth)**.



- Abdominal MRI** were obtained from 316 children (150 boys and 166 girls) at **age 4.5 years**. A total of 128 children had MRI at both ages.



- Abdominal fat between the top of the liver and sacrum was segmented into **deep subcutaneous adipose tissue (DSAT)**, **superficial subcutaneous adipose tissue (SSAT)** and **intra-abdominal adipose tissue (IAT)**. The individual depot volumes at both time points were standardized using z-scores.
- The relative gain in abdominal fat in each depot was calculated as the difference between the z-scores at age 4.5 years and at early infancy.
- Fasting plasma glucose** was obtained from 543 children at age 6 years.
- Covariates:** Ethnicity, sex, maternal education, maternal BMI at recruitment in the first trimester, maternal antenatal fasting glucose, rate of gestational weight gain, and breastfeeding duration.

Results

Table 1. Association between abdominal fat z-scores at age 4.5 years and fasting glucose at age 6 years

Abdominal fat at age 4.5 years	Adjusted difference, 95% CI, p-value
zDSAT	0.062, [0.010, 0.114], 0.019
zSSAT	0.070, [0.016, 0.123], 0.011
zIAT	0.045, [-0.008, 0.098], 0.095

- Boys had higher levels of fasting glucose than girls at age 6 years (4.63 mmol/L vs. 4.44 mmol/L).
- Girls had higher DSAT and SSAT volumes than boys at early infancy and also at age 4.5 years. No significant sex difference was observed in IAT at both time points.
- Higher DSAT and SSAT volumes at age 4.5 years were associated with higher fasting glucose concentrations at age 6 years.
- No significant associations were found between neonatal adiposity and fasting glucose at age 6 years.
- No sex or ethnic differences were observed in the association between adiposity at age 4.5 years and fasting glucose at age 6 years.

Table 2. Association of changes in abdominal fat z-scores between early infancy and age 4.5 years with fasting glucose at age 6 years

Abdominal fat accumulation between early infancy and age 4.5 years	Adjusted difference, 95% CI, p-value
Change in zDSAT	0.109, [0.041, 0.178], 0.002
Change in zSSAT	0.103, [0.023, 0.184], 0.013
Change in zIAT	0.072, [0.006, 0.137], 0.032

- The relative gain in abdominal fat depot volumes between boys and girls was not statistically significant.
- There were no sex or ethnic differences in the association between rate of fat accumulation and fasting glucose.

Summary

- A higher rate of abdominal fat accumulation during early childhood and higher subcutaneous fat levels at age 4.5 years were associated with higher levels of fasting glucose at age 6 years in Asian children.
- Our findings highlight the importance of characterizing the dynamic aspects of abdominal fat accumulation in early life for predicting later metabolic health.

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