Investigating Infant Lean Body Mass using Free-Breathing Magnetic Resonance Imaging

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Background

- Lean body mass (LBM) is an important measure of metabolic ability[1,2].
- Decreased lean body mass during infancy may be associated with impaired growth and an increased risk for future metabolic disease[2,3].
- A large component of LBM is skeletal muscle mass[1,4]. Skeletal muscle has been used as a proxy for LBM in body composition measurements[4-6].
- The Pediatric Magnetic Resonance Research Imaging (MRI) research team at UCLA has developed and validated new free-breathing MRI technology, which they have successfully used to measure visceral adipose tissue, subcutaneous adipose tissue, and hepatic proton-density fat fraction (a biomarker for hepatic fat) in infants[7,8].

Objectives

To determine a practical approach to measure lean body mass in infants using free-breathing MRI,

To measure and report LBM in a cohort of infants using this approach, and

To characterize associations between body composition and infant growth parameters.

Methods

- Free-breathing MRI scans were previously obtained for infants enrolled in one of two research studies.
- Infant MRIs were analyzed for skeletal muscle area measurements at the **L4-L5 intervertebral disc level**. This site was chosen based on previous literature and available scan levels.
- Skeletal muscle measurements were compared with previously measured markers of infant growth and body composition.

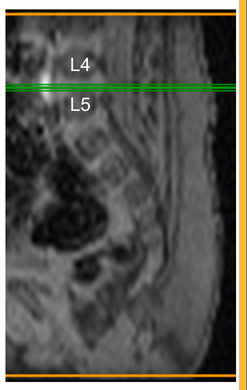

Figure 1. Sagittal view of infant MRI

Results

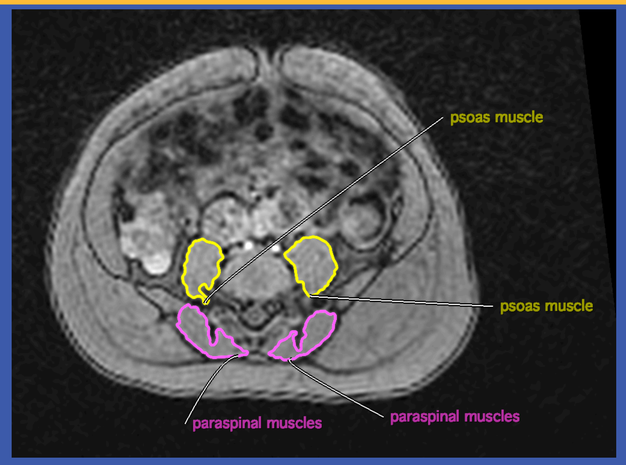

Figure 2. Axial view of L4-L5 intervertebral disc level for a normal weight 11-week-old infant. Psoas muscles and paraspinal muscles are labeled.

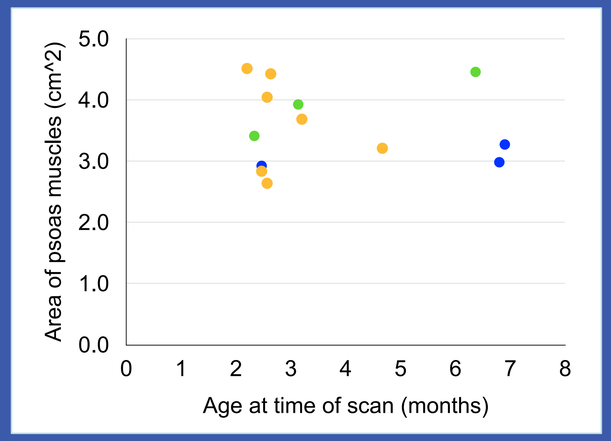

Figure 4. Total area of psoas muscles at the L4-L5 intervertebral disc level versus age of the infant at time of scan.
Golden circles represent infants born AGA. Green circles represent infants born LGA. Blue circles represent infants born SGA.

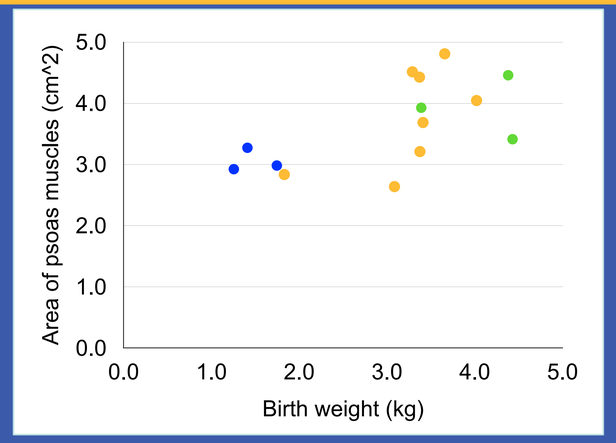

Figure 3. Total area of psoas muscles at the L4-L5 intervertebral disc level versus birth weight of the infant.
Golden circles represent infants born at a weight appropriate for gestational age (AGA). Green circles represent infants born large for gestational age (LGA). Blue circles represent infants born small for gestational age (SGA).

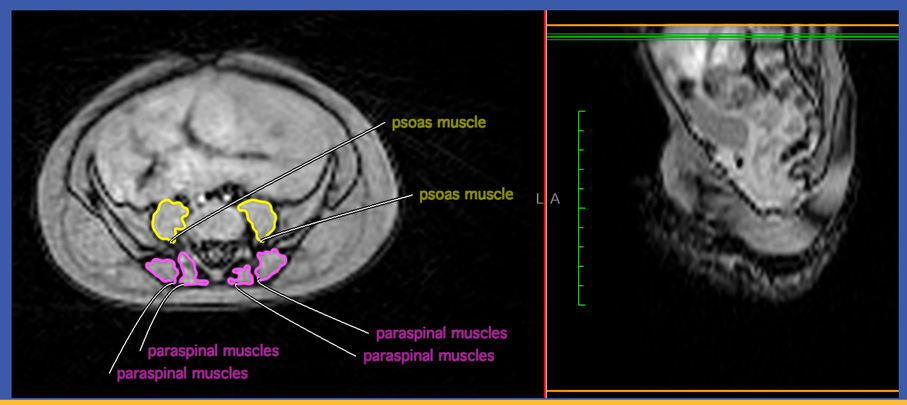

Figure 5. Axial view of L4-L5 intervertebral disc level and corresponding midsagittal view for a 6-month-old infant who was born SGA. Psoas muscles and paraspinal muscles are labeled.

Conclusions

- LBM was measured in infants using free-breathing MRI.
- Cross-sectional area of the psoas and paraspinal skeletal muscles at the L4-L5 disc level was used as a proxy for LBM.
- Infants who were born SGA appeared to have less psoas muscle area on MRI than those born LGA.
- More work is needed to determine statistical correlations.

Limitations

The infant MRIs analyzed are from two different studies: 10 infants were scanned in 2018 and 4 infants in 2021 with different image resolution.

Future Directions

- Examine free-breathing MRIs of infants born to healthy mothers vs mothers with known pre-existing liver disease or diabetes.
- Examine MRIs of each infant subject's brain to study relationship between LBM and neurodevelopment.
- Continue to use free-breathing MRI in infants to study early body composition and its potential impacts on development of metabolic disease.

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Acknowledgements

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