ESSENTIALY FATTY ACID ABNORMALITIES AND LOW LINOLEIC ACID INTAKE IS COMMON IN THE SECOND YEAR OF LIFE IN CHILDREN WITH CYSTIC FIBROSIS

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2015-2016
BACKGROUND

saturated fatty acid

unsaturated fatty acid

**BACKGROUND**

- Essential fatty acids cannot be synthesized by the body
  - n-6 (Omega-6)
  - n-3 (Omega-3)

- Sources of EFA
  - **Omega-6**: Safflower, Soybean, Grapeseed, Sunflower oils
  - **Omega-3**: Flaxseed oil, Salmon, Walnuts

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BACKGROUND

- Decreased levels of linoleic acid
- Decreased levels of DHA
- Alterations involving arachidonic acid
Does the prevalence of essential fatty acid abnormalities differ among feeding types in infants?
OBJECTIVES

1. To determine if similar fatty acid abnormality is present in the first 2 years of life

2. To evaluate feeding type and phenotype at baseline and explore relationships with fatty acid pattern observed
   - Feeding types: exB, exF, mixed (B+F)
   - Phenotypes: MI, PS, PI

3. To assess total dietary fat intake and its association with fatty acid pattern observed in the 2nd year of life
Feeding Infants Right... from the STart (FIRST) Study
a prospective multicenter longitudinal study launched in 2012
to investigate the potential benefits & risks of
exclusive breastfeeding in CF
FIRST Study Design

- Enroll 160 infants from 5 CF centers in the US from 2012-2016

- Systematically collect data on complete feeding history

- Phase 1: 0-2 years
  - Diagnosed through newborn screening

- Phase II: 2-6 years
FIRST Study Design

- **Primary outcomes**
  - Weight gain
  - Incidence of Pseudomonas infection at 2 years of age

- **Secondary outcomes**
  - Nutritional – Growth measurements, EFA status, fat-soluble vitamin status
  - Pulmonary – Inflammatory markers, other respiratory pathogens, respiratory symptoms, CXR scores
**FIRST Study Design**

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<thead>
<tr>
<th>Visit number</th>
<th>1</th>
<th>A&lt;sup&gt;§&lt;/sup&gt;</th>
<th>B&lt;sup&gt;§&lt;/sup&gt;</th>
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<td><strong>FIRST Study Specific Components:</strong></td>
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<td>Reminder phone calls</td>
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<sup>※</sup>Dx=Diagnosis, ideally by age 2-4 wks (J Pediatr 2008). Enter data collected at the diagnosis visit in this column after enrollment.

<sup>§</sup>Visits A, B and C are extra visits/columns to enter data if infant is diagnosed early and has clinic visits between diagnosis and age 2 mo.

<sup>※</sup>Window periods for visit number 2-6: ±1 wk, for visit number 7-9: ±2 wks, and for visit number 10-13: ±1 mo.

<sup>※</sup>First (baseline) chest radiograph and blood sample collected at age 4 mo.

<sup>※</sup>Fecal elastase-1 should be measured at these visits until PI is demonstrated by 2 consecutive values of < 100 μg/g.

R=Routine clinic visit activity

S=study-only activity; these study-only activities are conducted during routine clinic visit by usual medical personnel.

SS=activity will be done two times between visits.
Data Collection

- Nutrition
  - Feeding, supplements, GI symptoms

- Pulmonary
  - Acute infections, respiratory symptoms, medication

- Specimens
  - Feces, blood, sputum
Biomarkers

- Fatty acid composition from erythrocytes
  - Concentrations were quantitated by capillary gas liquid chromatography

- Elevated Pathologic Triene (mead acid)
  - > 0.1% of total fatty acid concentration

- EFA Insufficiency
  - Triene:Tetraene ratio > 0.01

- EFA Deficiency
  - Triene:Tetraene ratio > 0.02
Preliminary Results
Characteristics of Study Population

- 62 infants born during 02/2012 to 05/2014
- Diagnosed through newborn screening
- Enrolled at age 1.4 ± 0.1 months

- Blood specimen collected at 4, 12, 18, and 24 months
  - Baseline, n=52 (3.5 ± 0.2 months)
  - 12 months, n=29
  - 18-24 months, n=28
OBJECTIVES 1 + 2

- To determine if similar fatty acid abnormality is present in the first 2 years of life

- To evaluate phenotype at baseline and explore relationships with fatty acid pattern observed
  - Phenotypes: MI, PS, PI
EFA abnormalities tended to be highest in MI, followed by PI, lowest in PS, but these differences were not significant.

At baseline ~ 4 months:
- MI: 57% EFAD, 43% EFAI, 29% Elevated Triene
- PS: 7% EFAD, 12% EFAI, 32% Elevated Triene

At 24 months:
- MI: 100% Elevated Triene
- PI: 75% Elevated Triene
- PS: 19% Elevated Triene
- MI: 62% Elevated Triene

At baseline:
- MI: n=7
- PS: n=4
- PI: n=21

At 24 months:
- MI: n=4
- PS: n=3
- PI: n=22

p > 0.09
p > 0.162
No significant age trend in EFAD prevalence
Significant age trend in EFAI and elevated triene

- Prevalence of EFAI and elevated triene is higher at 24 months compared to baseline

<table>
<thead>
<tr>
<th></th>
<th>4 months (n=38)</th>
<th>12 months (n=19)</th>
<th>24 months (n=21)</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>No EFAD</td>
<td>35 (92%)</td>
<td>19 (100%)</td>
<td>17 (81%)</td>
<td>0.107</td>
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<tr>
<td>EFAD</td>
<td>3 (8%)</td>
<td>0</td>
<td>4 (19%)</td>
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<tr>
<td>No EFAI</td>
<td>34 (90%)</td>
<td>18 (95%)</td>
<td>8 (38%)</td>
<td>&lt;0.0001</td>
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<tr>
<td>EFAI</td>
<td>4 (11%)</td>
<td>1 (5%)</td>
<td>13 (62%)</td>
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<tr>
<td>Triene &lt; 0.1%</td>
<td>26 (68%)</td>
<td>18 (95%)</td>
<td>6 (29%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Triene &gt; 0.1%</td>
<td>12 (32%)</td>
<td>1 (5%)</td>
<td>15 (71%)</td>
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</table>
What about linoleic acid, DHA, and arachidonic acid concentrations?
LA concentration significantly lower at baseline compared to 12 months and at 24 months.
DHA concentration was significantly lower at 24 months compared to baseline and at 12 months.
No significant age trend in arachidonic acid concentration

\[ p=0.6001 \]
AA/DHA significantly higher at 24 months compared to baseline and at 12 months.

P < 0.0001
OBJECTIVE 2

- To evaluate feeding type at baseline and explore relationships with fatty acid pattern observed
- Feeding types: exB, exF, mixed (B+F)
Feeding type was significant for EFAD prevalence but not EFAI or elevated triene.

- EFAD: 25% (p=0.0403, n=10)
- EFAI: 25% (p=0.0806, n=16)
- Elevated Triene: 50% (p=0.1975, n=12)

ExB: 42%

ExF: 13%

Mixed: 42%
Objective 3

- To assess total dietary fat intake and its association with fatty acid pattern observed in the 2nd year of life
No significant differences in total caloric intake & dietary fat intake (18-24 months)

- 120% EER
- 130% EER

Total Calories: 120% EER = n=13, 130% EER = n=8

Fat (%kcal): 37.6% kcal, 36.6% kcal
No significant differences in LA & ALA intake at 24 months

AI: 7g/day

Linoleic Acid

AI: 0.7g/day

Alpha Linolenic Acid
Low dietary LA intake is common at 24 months
CONCLUSIONS

- EFA abnormalities are common in children with CF
  - More than 60% of PI subjects had EFAI and/or elevated triene
- Linoleic acid intake is low in the second year of life
  - More than 60% are below the AI
  - Enrich diet to meet AI
MCH LEADERSHIP COMPETENCIES
- MCH Knowledge Base
- Self-Reflection
- Ethics & Professionalism
- Critical Thinking
- Communication
- Cultural Competency
- Family-Centered Care
- Interdisciplinary Team Building
- Working with Communities and Systems
- Policy and Advocacy
Acknowledgements

- PPC
  - Mary Marcus
  - Leslie Lord
  - Erin Seffrood
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  - Mary Schroth

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  - HuiChuan Lai
  - Lisa Davis

- Ntambi Lab
  - Sabrina Dumas

THANK YOU
Questions?