Maternal Secretor Status and Child Microbiota Composition

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The First 1000 Days
Development of Microbiota

Yatsunenko et al. Nature 000, 1-7 (2012)
WHO, Infant Feeding Recommendations, 2001

Infants should be exclusively breastfed for the first six months of life. Thereafter, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond.
Breast Milk Composition

Angela M. Zivkovic et al. PNAS 2011;108:4653-4658
Human Milk Oligosaccharides (HMOs)

Lewis Blood Group and HMOs

Group 1: Secretor, Lewis-positive (Se+Le+)
Lewis a-b+

Group 2: Nonsecretor, Lewis-positive (Se-Le+)
Lewis a+b-

Group 3: Secretor, Lewis-negative (Se+Le-)
Lewis a-b-

Group 4: Nonsecretor, Lewis-negative (Se-Le-)
Lewis a-b-

Prevalence of Non-Secretor Status

Microbiota of Breastfed Infants by Maternal Secretor Status.

Lewis et al. Microbiome 2015; 13
Study Design

Recruit

• Feeding Queensland Babies Study Cohort
• 37 children (2 -3 yrs) + 17 mothers

Secretor Status

• Blood and saliva samples
• Hemagglutination Inhibition Technique

Microbiota

• Faecal samples
• Illumina sequencing of rRNA gene (V6-8)
UniFrac Distance Metric
<table>
<thead>
<tr>
<th></th>
<th>Unweighted UniFrac</th>
<th>Weighted UniFrac</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample size (secretor)</td>
<td>R²</td>
</tr>
<tr>
<td>Child Secretor Status</td>
<td>28 (20 S)</td>
<td><strong>0.069</strong></td>
</tr>
<tr>
<td>Mother’s Secretor Status</td>
<td>17 (11 S)</td>
<td><strong>0.071</strong></td>
</tr>
<tr>
<td>Mother’s Secretor Status - ABF</td>
<td>14 (10 S)</td>
<td><strong>0.111</strong></td>
</tr>
<tr>
<td>Mother’s Secretor Status – EBF</td>
<td>11 (8 S)</td>
<td><strong>0.167</strong></td>
</tr>
</tbody>
</table>

Smith-Brown et al, PLOS One, 19 Sept 2016
### Prevalent Abundance by Secretor Status

<table>
<thead>
<tr>
<th>Secretor Status</th>
<th>Sample Size (secretor)</th>
<th>$p$</th>
<th>pFDR</th>
<th>S</th>
<th>N-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Secretor Status</td>
<td>28 (20 S)</td>
<td>$&lt; 0.001$</td>
<td>$&lt; 0.001$</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mother’s Secretor Status</td>
<td>17 (11 S)</td>
<td>$&lt; 0.001$</td>
<td>$&lt; 0.001$</td>
<td>0</td>
<td>4</td>
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<tr>
<td>Mother’s Secretor Status – ABF</td>
<td>14 (10 S)</td>
<td>$&lt; 0.001$</td>
<td>$&lt; 0.001$</td>
<td>0</td>
<td>4055.5</td>
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<tr>
<td>Mother’s Secretor Status – EBF</td>
<td>11 (8 S)</td>
<td>$&lt; 0.001$</td>
<td>$&lt; 0.001$</td>
<td>0</td>
<td>8106</td>
</tr>
</tbody>
</table>

Smith-Brown et al, PLOS One, 19 Sept 2016
Genus Mean Abundance by Maternal Secretor Status

- **Bifidobacterium**
  - Secretor: 3000
  - Non-secretor: 100
  - $p = 0.036$

- **Bacteroides**
  - Secretor: 5000
  - Non-secretor: 10000
  - $p = 0.592$

- **Streptococcus**
  - Secretor: 1500
  - Non-secretor: 1500
  - $p = 0.105$

*Smith-Brown et al, PLOS One, 19 Sept 2016*
PICRUSt PREDICTED METAGENOME

Visualizing Metabolic Activity of a Microbiome

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KEGG Functional Pathway Abundance
Child Secretor Status

Smith-Brown et al, PLOS One, 19 Sept 2016
KEGG Functional Pathway Abundance
Mother Secretor Status

Smith-Brown et al, PLOS One, 19 Sept 2016
KEGG Functional Pathway Abundance
Mother Secretor Status - EBF

Smith-Brown et al, PLOS One, 19 Sept 2016
Conclusion

Non-secretor mother

- No α1,2 HMO
  - ↓ Bifidobacteria
  - ↑ Prevotella
- ↑ acidic HMO

Non-secretor child

- No α1,2 glycans
  - ↑ Prevotella
  - ↑ Arachidonic Acid Metabolism
  - ↑ Inflammation
Acknowledgements

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References


