Micronutrients for ADHD in Youth
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Center for Mental Health and Innovation

HEAT FLOW

HOT

COLD

ENTROPY

HEAT FLOW
Student Behavior contributes to Teacher Stress

Teachers: 178
Students: 2,339 (age 6-10)
• Students with ADHD 4.98%

<table>
<thead>
<tr>
<th>Survey</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom Behavioral Survey</td>
<td>Prevalence of specific student issues</td>
</tr>
<tr>
<td>Psychological Stress Measures</td>
<td>Perceived stress of teachers</td>
</tr>
<tr>
<td>Structural Education-School Entropy</td>
<td>Structure in the classroom and school.</td>
</tr>
<tr>
<td>Personal Teacher Entropy</td>
<td>Teacher’s attributes influence classroom</td>
</tr>
</tbody>
</table>

Fabio et al. 2023

Increased frequency of ADHD students increased teachers’ entropy

Rate of children with ADHD

Rate of children exhibiting aggression

PERSONAL ENTROPY

STRESS

β = 0.22, p < 0.05

β = 0.43, p < 0.01

β = 0.37, p < 0.01

β = 0.50, p < 0.05

Fabio et al. 2023
A special thanks to:
The Moore Institute
And to Bob and Charlee Moore for highlighting the importance of nutrition for Oregonians

Conflicts of Interest

• No conflicts of interest to report
• All images from power point stock images, Pixaby, personal or Bing Dalle-3 AI

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**ALL ABOUT ADHD**

**Definition**

is a condition which includes difficulties with attention, increased activity, and impulsivity. About 11% of children and 4% of adults have ADHD.

*ADHD = ADD as this term is no longer used*

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**Presentations of ADHD**

- Inattentive
- Hyperactive/Impulsive
- Combined

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**When do symptoms appear?**

As early as toddler years

**BUT**

Diagnosis is closer to age 6 or older

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**What do parents notice?**

- "Cannot sit still in school and is even worse after a full school day."
- "Runs in trouble for talking when they are not supposed to at school."
- "Would run before they could walk."

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**To get a formal diagnosis symptoms must occur in two or more settings:**

- HOME
- SCHOOL
- FAMILY or FRIENDS

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3/14/2024
Racial Disparities

- Under diagnosis
  - “Black children are 17% less likely to be diagnosed with ADHD but are over 2.4 times more likely to receive a diagnosis of conduct disorder.” (CHADD)

- Barriers to treatment
  - Asian community had the highest odds of not receiving treatment compared to Black, White, LatinX

- Perception of ADHD driven by individual biases

Resources:
CHADD:
- Why are Black Preschoolers with ADHD expelled?
- Black History Month Resources

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When you think about the content of food, what do you think about?

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Comparing Macronutrients

<table>
<thead>
<tr>
<th>Protein</th>
<th>26g</th>
<th>20g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbs</td>
<td>42g</td>
<td>43g</td>
</tr>
<tr>
<td>Fat</td>
<td>33g</td>
<td>24g</td>
</tr>
<tr>
<td>Calories</td>
<td>467</td>
<td>468</td>
</tr>
</tbody>
</table>

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What are micronutrients?

- Minerals
  - Magnesium
  - Calcium
  - Chromium
  - Lithium
  - Copper
  - Iodine
  - Iron
  - Molybdenum
  - Nickel
  - Phosphorous
  - Potassium
  - Selenium
  - Vanadium
  - Boron

- Vitamins
  - Vitamin A
  - Vitamin D
  - Vitamin E
  - Vitamin B12
  - Vitamin C
  - Vitamin K

The need for micronutrients

Modern farming practices have altered soil nutrients
- Herbicides and pesticides chelate (pull) minerals
- Monocropping

Individual differences in genetics
- Example: MTHFR gene

Gut dysbiosis (leaky gut)
The Brain Needs Nutrients

It accounts for ≈ 2% of our body weight
represents 20-50% of our metabolic demands

The MADDY Study (Micronutrients for ADHD in Youth)

Micronutrients for ADHD in Youth (MADDY) Study

<table>
<thead>
<tr>
<th>Micronutrients</th>
<th>Baseline Visit</th>
<th>Week 1 Visit</th>
<th>Week 18 Visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo Followed by Micronutrients</td>
<td>Baseline Visit</td>
<td>Week 5 Visit</td>
<td>Week 5 Visit</td>
</tr>
</tbody>
</table>

Created with BioRender.com
• No between group differences on parent reports of 43 possible adverse events
• No concerning blood work (CBC, CMP) or values from urinalyses

TREATMENT RESPONDERS

Micronutrient Group: 54%  Placebo Group: 18%

38 Responders  35 Non-responders

10 Responders  45 Non-responders
HEIGHT GROWTH

Children in the micronutrient group grew more than 6 mm than those in the placebo group within 8 weeks (p=0.002)

RESPONDERS ACROSS 3 RCTs

<table>
<thead>
<tr>
<th>Adults</th>
<th>Children - C11d</th>
<th>Children - C11d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rucklidge et al., 2014, JNP (n=68)</td>
<td>Rucklidge et al., 2018, JCPP (n=93)</td>
<td>Johnstone et al., 2021, JAACP (n=126)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percent improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults - C11d</td>
</tr>
<tr>
<td>Children - C11d</td>
</tr>
<tr>
<td>Children - C11d</td>
</tr>
</tbody>
</table>

Micronutrients, Multivitamins and Food

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>Studied Formulas</th>
<th>Over-the-Counter Formulas</th>
<th>Amount in Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vit B6</td>
<td>70 mg</td>
<td>0.4 mg</td>
<td>47 cups of wheat bran</td>
</tr>
<tr>
<td>Vit D</td>
<td>40 mcg</td>
<td>6 mcg</td>
<td>60-100 mg average of almonds</td>
</tr>
</tbody>
</table>
Why do micronutrients work?

Theories:
• Meeting nutrient needs
• Example: MTHFR gene
• Addressing inflammation
• Influencing gut health

What impact do micronutrients have on our body?
Inflammation

Preliminary analyses point towards changes in the Th2 pathway in children who received micronutrients.

Classic Clinical Triad

- Allergies
- Eczema
- ADHD

Gut Microbiome

Definition: A diverse array of microorganisms consisting of bacteria, viruses, fungi, and other microbes.

Symbiosis

WHERE IS IT ON YOUR BODY?

- All OVER!
- Bacteria: Human Cells ratio is 1:1
- 2,000 different species of bacteria.
- It is said to weight 4 pounds in a 200lb person.
- Think of it as another organ.
Results

Micronutrients versus Placebo:

- *Actinobacteria* (phylum) was significantly decreased in children who received micronutrients.

Responders versus Non-Responders:

- *Oscillospiraceae* and *Rikenellaceae* (families) were significantly increased in responders.

Big Picture: Micronutrients led to a change in the microbiome over the course of 8 weeks.

Why is this child not paying attention?
Did they poop today?

It is important to poop every day to:
• Remove toxins
• Relieve discomfort
• Reduce anxiety
• Optimize the gut microbiome

Liang et al. 2022

How can you help?
• Movement
• Yoga Dice
• Moving mindfulness
• Dancing
• Guided Imagery

Did they eat breakfast?

Eating breakfast is important for:
• Blood sugar regulation
  • Fiber
  • Protein
The Top 20 Fiber-Rich Foods to Add to Your Plate

<table>
<thead>
<tr>
<th>Food</th>
<th>Fiber (grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentils = 1 cup</td>
<td>10</td>
</tr>
<tr>
<td>Black beans = 1 cup</td>
<td>15</td>
</tr>
<tr>
<td>Peaches = 1 cup</td>
<td>12</td>
</tr>
<tr>
<td>Oatmeal = 1 cup</td>
<td>8</td>
</tr>
<tr>
<td>Asparagus = 1 cup</td>
<td>10</td>
</tr>
<tr>
<td>Peas = 1 cup</td>
<td>9</td>
</tr>
<tr>
<td>Oatmeal = 1 cup</td>
<td>8</td>
</tr>
<tr>
<td>Raspberries = 1 cup</td>
<td>6</td>
</tr>
<tr>
<td>Avocado = 1/2</td>
<td>7</td>
</tr>
<tr>
<td>Pears = 1 medium</td>
<td>6</td>
</tr>
<tr>
<td>Seaweed = 1 tablespoon</td>
<td>8</td>
</tr>
<tr>
<td>Broccoli = 1 cup</td>
<td>3.4</td>
</tr>
<tr>
<td>Kale = 1 cup</td>
<td>2.6</td>
</tr>
<tr>
<td>Spinach = 1 cup</td>
<td>4.3</td>
</tr>
<tr>
<td>Celery = 1 cup</td>
<td>1.9</td>
</tr>
<tr>
<td>Dark chocolate = 1 ounce</td>
<td>2.1</td>
</tr>
</tbody>
</table>

According to the Linus Pauling Institute, 60 percent of younger children (5 to 8 years old) and 78 percent of older children (9 to 11 years old) do not meet the recommended intake for fiber.

Recommended Fiber:
- Ages 3-7 years old: 10 grams of fiber per day
- Ages 7+ years old: 15 grams of fiber per day

How can you help?

- Snack
  - Ask parents/guardians to pack snacks with protein and fiber
    - According to the Linus Pauling Institute:
      - 60 percent of the younger children (5 to 8 years old) and
      - 78 percent of the older children (9 to 11 years old) do not meet the recommended intake for fiber.
  - Recommended Fiber:
    - Ages 3-7 years old: 10 grams of fiber per day
    - Ages 7+ years old: 15 grams of fiber per day
  - Lead by example

- Movement after meals
  - Unclear guidelines for kids

How do children with ADHD thrive?
How can you help?

- Embrace creativity
- A classroom that can nourish spontaneity
  - Redirection, Self-Management, Frequent Breaks
- Talk to parents about:
  - Learning styles
  - Breaks with homework
  - After school let it OUT!
  - Masking

Harrison et al. 2022
Hinshaw et al. 2023
The Atlantic article on Finnish School

Key Messages

- ADHD is a common disorder can be managed with an actively supportive community.
- By addressing nutrient needs, ADHD symptoms can improve.
- Your health and health education influences students.

“You’re only given one little spark of madness. You mustn’t lose it.”
-Robin Williams

Thank you to the teachers!
Thank You

SNACK Lab at OHSU

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Resources

- The Disruptors Film:
  - ADHD can be a superpower
  - The Poo in You Video
  - Nutrition and Mental Health TED TALK
  - Smiling Mind
  - GoZen
  - SNACK Lab at OHSU
  - How to Swallow Pills by Bonnie Kaplan