Introduction and Research Goals

Research on the effects of dietary protein on body composition is conflicting. Some studies highlight positive metabolic effects of protein consumed at breakfast, which may optimize body composition (Leidy et al., 2015). Others suggest that consuming a higher ratio of animal to plant protein may increase BMI (Del Mar Babiloni et al., 2010). Therefore, the purpose of our study was to understand how the type and amount of protein consumed at breakfast might affect body composition measures such as fat mass percentage, waist-to-height ratio, body mass index z-score, and waist circumference in preschool-aged children.

Parents of preschool-aged children enrolled in the Guelph Family Health Study recorded all foods their children consumed for breakfast over three days. We questioned:

- What was the three-day average of protein consumed at breakfast?
- What was the three-day ratio of animal to plant protein consumed at breakfast?
- What was the association between quantity and quality of protein consumed at breakfast and various measures of body composition in children?

Background

Approximately 27% of Canadian children are overweight or obese (Rodd & Sharma, 2016). Childhood obesity increases the risk of developing obesity-related non-communicable diseases at a younger age and increases the risk of obesity into adulthood (World Health Organization, 2010). There is evidence to suggest that dietary protein may influence body composition. Protein consumed at breakfast may confer positive metabolic mechanisms for optimizing body composition. These findings suggest that increasing protein consumption at breakfast may help reduce the rates of childhood obesity. Despite this, a trend of breakfast skipping in children and adolescents persists (Reick, 2010).

The high levels of childhood obesity and the unclear link between breakfast protein consumption and body composition warrant a study using more thorough methods of assessment.

Methods

Study Design: Cross-sectional analysis of preschool-aged children (N=57) from the Guelph Family Health Study. Thirty-seven (37) families were included in the analysis.

Anthropometrics:

Height (cm) using a wall-mounted stadiometer.

Body mass (kg) using the BOD POD® digital scale.

BMI (kg/m²) using the WHO Anthro 3.2.2 software.

Waist circumference (cm) at the top of the iliac crest.

Body Composition:

Fat mass percentage (FM%) measured using bioelectrical impedance analysis and computed using Kushner et al. (1992) equations.

Protein Consumption:

Parent-reported three-day food records were analyzed using ESHA food processor.

Statistical analysis:

Random effects models adjusted for age, sex, and sibling effect were used to assess associations between protein consumption at breakfast and body composition.

Reference


Del Mar Babiloni, N., et al. (2010). Medicine, 89(21), e468. doi.org/10.1097/MD.0b013e3181e90208


Table 1. Demographics of 57 preschool-aged children

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>33 (58%) boys</td>
</tr>
<tr>
<td>Female</td>
<td>24 (42%) girls</td>
</tr>
<tr>
<td>Age, mean ± SD</td>
<td></td>
</tr>
<tr>
<td>3.24 ± 1.90 years</td>
<td></td>
</tr>
<tr>
<td>Number of children enrolled in study per family</td>
<td></td>
</tr>
<tr>
<td>16 (43%) families with 1 child</td>
<td></td>
</tr>
<tr>
<td>19 (28%) families with 2 children</td>
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<tr>
<td>2 (6%) families with 3 children</td>
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</tbody>
</table>

Table 2. Children’s protein consumption at breakfast and body composition

<table>
<thead>
<tr>
<th>Total protein (g)</th>
<th>N</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein</td>
<td>59</td>
<td>13.0 ± 7.87</td>
</tr>
<tr>
<td>Animal protein (g)</td>
<td>59</td>
<td>5.78 ± 3.66</td>
</tr>
<tr>
<td>Plant protein (g)</td>
<td>59</td>
<td>7.20 ± 4.24</td>
</tr>
<tr>
<td>Animal:Plant protein</td>
<td>59</td>
<td>1.20 ± 2.49</td>
</tr>
<tr>
<td>BOD POD Score</td>
<td>54</td>
<td>0.40 ± 1.41</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>51</td>
<td>51.1 ± 5.04</td>
</tr>
<tr>
<td>Waist-to-height ratio (cm)</td>
<td>56</td>
<td>0.51 ± 0.0529</td>
</tr>
<tr>
<td>Fat Mass (%)</td>
<td>42</td>
<td>12.6 ± 2.97</td>
</tr>
</tbody>
</table>

Table 3. Associations between children’s protein consumption at breakfast and body composition

<table>
<thead>
<tr>
<th>BPM 2 Score</th>
<th>WC</th>
<th>WHR</th>
<th>Fat Mass %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Breakfast Protein Consumed</td>
<td>-0.39</td>
<td>-0.27</td>
<td>-0.18</td>
</tr>
<tr>
<td>Animal Protein Consumed</td>
<td>-0.24</td>
<td>-0.076</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Models adjusted for age, gender and sibling effect

Research Findings

- Every 1 g total protein consumed at breakfast was associated with 0.18 cm lower waist circumference.
- For every 1 unit increase in the animal:plant protein intake, waist circumference and fat mass % increased by 0.729 cm, and 0.33% respectively.
- There was no significant association between total protein consumption and either waist-to-height ratio or fat mass %, or animal:plant protein and body mass index z-score.

Conclusions

- This data suggests that breakfasts higher in total protein are associated with lower waist circumference however, those with a higher ratio of animal:plant protein are associated with greater waist circumference and fat mass %.
- Analyses to determine the association between calorie and fat intake at breakfast, and children’s body composition, are ongoing.

Limitations

- The study had a small sample size.
- Data set not representative of entire population of preschool-aged children living in Guelph.
- The participants’ satiety levels were not measured.
- Cannot infer cause and effect – only shows associations between explanatory and response variables.

References

- Del Mar Babiloni, N., et al. (2010). Medicine, 89(21), e468. doi.org/10.1097/MD.0b013e3181e90208

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