Investigating associations between child bone mineral density and vitamin D status, diet, physical activity, and body composition at 5 years of age – Findings from the ROLO Kids Study

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Bone health is extremely important in early childhood because children with low bone mineral density (BMD) are at a greater risk of bone fractures⁴. Physical activity is beneficial for bone health in adolescents and body composition has also been associated with BMD during teenage years²,³. While adequate intake of both calcium and vitamin D are important for bone health in pre-pubescent children, there is limited research on the determinants of good bone health in early childhood.

Whole body BMD was measured by dual-energy X-ray absorptiometry (DXA) in 102 children from the ROLO Kids Study. Physical and sedentary activity levels were measured using the Children’s Leisure and Activities Study Survey (CLASS). Dietary intakes were measured using a food frequency questionnaire, which were both completed by the mother. Child weight, height, circumferences and skinfolds were measured by the research team. Blood samples were drawn for measurement of circulating serum 25-hydroxyvitamin D (25OHD) concentrations. Statistical analysis was carried out using Pearson and Spearman correlations with multiple linear regression analysis.

There was no association between physical activity, sedentary behaviour, dietary calcium, dietary vitamin D, or 25OHD with BMD. Body composition was significantly associated with BMD; weight, body mass index, arm circumference and chest circumference were positively associated with BMD (p < 0·01) as was abdomen, hip and thigh circumference (<0·05). Length also correlated positively with BMD (p < 0·012).

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Meeting Recommendation N</th>
<th>BMD</th>
<th>Not Meeting Recommendation N</th>
<th>BMD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary Calcium Intake (&gt;800 mg)¹</td>
<td>46</td>
<td>0·674</td>
<td>51</td>
<td>0·674</td>
<td>0·942</td>
</tr>
<tr>
<td>Physical Activity Level (&gt;400mins/week)²</td>
<td>50</td>
<td>0·678</td>
<td>23</td>
<td>0·675</td>
<td>0·795</td>
</tr>
<tr>
<td>Screen time Level (&lt;1hour/day)³</td>
<td>19</td>
<td>0·663</td>
<td>53</td>
<td>0·679</td>
<td>0·173</td>
</tr>
</tbody>
</table>

BMD: Bone Mineral Density (cm/g). Significant at P<0·05


We found no association between self-reported lifestyle and dietary factors with bone health in early childhood as measured by BMD analysis using DXA. Increased body size was linked with higher bone mineral density. This is important for bone health in later life as optimizing BMD during childhood may reduce the risk of fractures in adolescence and adult life.


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