DIETARY SUPPLEMENT USE AND ITS MICRONUTRIENT CONTRIBUTION DURING PREGNANCY AND LACTATION IN THE UNITED STATES

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Data from 2 Publications

NHANES 2001 - 2014

• Usual total nutrient intakes of pregnant women in the U.S.

NHANES 1999-2014

• Dietary supplement use, product type, doses, etc.
  o Pregnant
  o Lactating
  o Not pregnant, not lactating


NHANES Methods

- Nationally-representative sample of U.S. residents
  - In home interview
    - Demographic and questionnaire collected
    - Product inventory for dietary supplements
  - Medical examination center
    - Clinical and 24-hour dietary recall
  - Follow up telephone call
    - 24-hour dietary recall
The majority of pregnant and lactating women use dietary supplements

- 77% of pregnant women
- 70% of lactating women
- 45% of non-pregnant, non-lactating women

Prevalence (%) of dietary supplement use by younger (20-34y) and older (35-44y) pregnant women in the United States, NHANES 1999-2014

Prevalence (%) of dietary supplement use by family income-to-poverty level among pregnant women (20-44y) in the United States, NHANES 1999-2014

Family Income-to-poverty Ratio (PIR)
- PIR≤130% (n=420)
- PIR 131-350% (n=419)
- PIR>350% (n=379)

* Significant linear trend across PIR categories (p<.001).

Prevalence (%) of dietary supplement use by Race/ethnicity among pregnant women in the United States, NHANES 1999-2014

Race/ethnicity
- Non-Hispanic white (n=578)
- Non-Hispanic black (n=207)
- Hispanic/Mexican American (n=429)

*Estimates with different letter superscripts are significantly different at P<0.0167

Dietary Supplement Use by women (20-44y) by pregnancy and lactation status in the United States, NHANES 1999-2014

**Any supplement use**
- Pregnant women: 77.4%
- Lactating women: 70.3%
- Non-pregnant and non-lactating women: 44.8%

**MVM**
- Pregnant women: 72.9%
- Lactating women: 64.4%
- Non-pregnant and non-lactating women: 31%

**Single- or MV**
- Pregnant women: 11.1%
- Lactating women: 10.1%
- Non-pregnant and non-lactating women: 15%

**Single- or MM**
- Pregnant women: 10.9%
- Lactating women: 12%
- Non-pregnant and non-lactating women: 7.8%

**Prenatal supplement use**
- Pregnant women: 64.4%
- Lactating women: 54.2%
- Non-pregnant and non-lactating women: 3.4%

*Estimates with different letter superscripts are significantly different at P<0.0167

Prevalence of dietary supplement use by trimester of pregnancy among pregnant women (20-44y) in the United States, NHANES 1999-2012 (n=790)

*Estimates with different alphabets are significantly different at P<0.0167

### Prevalence of reasons for dietary supplement use among pregnant and lactating women (20-44y) in the US, NHANES 2007-2014 (n=330)

<table>
<thead>
<tr>
<th></th>
<th>Any supplement</th>
<th>Prenatal supplement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pregnant (n=246)</td>
<td>Lactating (n=84)</td>
</tr>
<tr>
<td>Recommended by a healthcare provider</td>
<td>16.1%</td>
<td>22.8%</td>
</tr>
<tr>
<td>Took on own</td>
<td>39.8%</td>
<td>24.4%</td>
</tr>
<tr>
<td>Motivation unknown</td>
<td>47.4%</td>
<td>22.8%</td>
</tr>
</tbody>
</table>

Percentages of women (20-44y) using dietary supplements containing specified **vitamins** by pregnancy and lactation status in the United States, NHANES 1999-2014

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Pregnant women (n=1,314)</th>
<th>Lactating women (n=297)</th>
<th>Non-pregnant and non-lactating women (n=8,096)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>40.3 ± 2.2 a</td>
<td>41.6 ± 3.7 a</td>
<td>22.0 ± 0.6 b</td>
</tr>
<tr>
<td>Thiamin</td>
<td>69.4 ± 2.2 a</td>
<td>63.7 ± 3.4 a</td>
<td>30.4 ± 0.7 b</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>69.4 ± 2.2 a</td>
<td>63.7 ± 3.4 a</td>
<td>30.4 ± 0.7 b</td>
</tr>
<tr>
<td>Niacin</td>
<td>69.6 ± 2.2 a</td>
<td>63.9 ± 3.4 a</td>
<td>31.2 ± 0.7 b</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>72.8 ± 2.1 a</td>
<td>65.1 ± 3.4 a</td>
<td>32.7 ± 0.7 b</td>
</tr>
<tr>
<td>Folic acid</td>
<td>73.3 ± 2.1 a</td>
<td>65.1 ± 3.4 a</td>
<td>32.9 ± 0.7 b</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>69.9 ± 2.1 a</td>
<td>63.9 ± 3.5 a</td>
<td>32.9 ± 0.7 b</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>73.3 ± 2.0 a</td>
<td>64.6 ± 3.4 a</td>
<td>35.5 ± 0.8 b</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>71.7 ± 2.0 a</td>
<td>66.8 ± 3.3 a</td>
<td>33.1 ± 0.7 b</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>72.0 ± 2.0 a</td>
<td>64.0 ± 3.5 a</td>
<td>32.6 ± 0.7 b</td>
</tr>
<tr>
<td>Choline</td>
<td>4.9 ± 1.1 a</td>
<td>7.6 ± 2.1 a</td>
<td>5.2 ± 0.3 a</td>
</tr>
</tbody>
</table>

Percentages of women (20-44y) using dietary supplements containing specified minerals by pregnancy and lactation status in the United States, NHANES 1999-2014

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Pregnant women (n=1,314)</th>
<th>Lactating women (n=297)</th>
<th>Non-pregnant and non-lactating women (n=8,096)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>68.1 ± 2.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>62.3 ± 3.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>32.2 ± 0.7&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Iodine</td>
<td>20.4 ± 1.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17.5 ± 2.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18.2 ± 0.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Iron</td>
<td>72.3 ± 2.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>65.0 ± 3.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.3 ± 0.7&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Magnesium</td>
<td>28.1 ± 2.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>26.2 ± 3.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>26.0 ± 0.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>5.2 ± 1.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.2 ± 2.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.3 ± 0.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Selenium</td>
<td>9.9 ± 1.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.7 ± 2.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>21.0 ± 0.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Zinc</td>
<td>68.0 ± 2.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>60.6 ± 3.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>29.8 ± 0.7&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

*Estimates with different alphabets are significantly different at P<0.0167

Pregnant women- median intake from supplements, % of RDA and UL

- **Choline**: 0.3% RDA, 2.2% UL
- **Magnesium**: 13.4% RDA, 13.2% UL
- **Phosphorous**: 2.5% RDA, 14.3% UL
- **Calcium**: 7.9% RDA, 19.7% UL
- **Selenium**: 5.0% RDA, 33.3% UL
- **Iodine**: 12.8% RDA, 64.1% UL
- **Vitamin D**: 9.8% RDA, 65.3% UL

Lactating women
- median intake from dietary supplements, % of RDA and UL

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>RDA (%)</th>
<th>UL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choline*</td>
<td>0.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>10.3</td>
<td>18.9</td>
</tr>
<tr>
<td>Magnesium</td>
<td>13.4</td>
<td>12.8</td>
</tr>
<tr>
<td>Calcium</td>
<td>19.3</td>
<td>15.7</td>
</tr>
<tr>
<td>Selenium</td>
<td>27.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Iodine</td>
<td>37.2</td>
<td>9.8</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>65.3</td>
<td>9.8</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>82.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Pregnancy Data
NHANES 2001-2014

- Two 24-hour dietary recalls
- National Cancer Institute (NCI) method was used to produce usual intakes and prevalence of meeting/exceeding the DRI
- Estimated Average Requirement (EAR, %<EAR)
  ✓ Adequate Intake (AI, %>AI)
  ✓ Tolerable Upper Intake Level (UL, %>UL)

Adapted from the IOM/FNB: Dietary reference intakes applications in dietary assessment, 2000.
Total usual intakes (foods, beverages, supplements)

% < EAR
- Magnesium (48%)
- Vitamin D (46%)
- Vitamin E (43%)
- Iron (36%)
- Vitamin A (16%)
- Folate (16%)
- Calcium (13%)
- Vitamin C (12%)
- Vitamin B6 (11%)
- Zinc (11%)

% > Adequate Intake
- Vitamin K (48%)
- Potassium (42%)
- Choline (8%)

% > UL*
- Sodium (95%)
- Folic Acid (33%)
- Iron (28%)
- Zinc (7%)
- Calcium (3*)

* For all nutrients other than sodium UL estimates are for supplement users only

Prevalence (SE) of usual nutrient intake distributions <EAR and >UL for folate/folic acid and iron stratified by dietary supplement use

Limitations

- Small sample sizes and self-reported data
  - Total intake data for lactating women is largely unknown

- Iodine contributions from foods are not available
  - NHANES 1999-2006: mean urinary iodine content was 148 μg/L, lower than WHO cut off for “insufficiency” (<150 μg/L)
    

- Our team did not publish data on omega-3 fatty acid use or other product types
  - 0.6% of childbearing-age women and 7.3% of pregnant women reported use of DHA/EPA dietary supplements NHANES 2003-2014, no differences in DHA/EPA from diet alone
    
Summary and Conclusions

• Most pregnant and lactating women use dietary supplements

• Dietary supplement use varies by age, race/ethnicity, family income, and trimester of pregnancy

• The “doses” of micronutrients provided exhibit considerable variability

• Dietary supplements help consumers meet the recommended targets, but also contribute to potentially excessive intakes for certain nutrients
Summary and Conclusions

• Many pregnant women do not consume enough of key nutrients; specifically iron, potassium, calcium, magnesium, zinc, and vitamins A, C, D, E, K, B6, folic acid, and choline - even with the use of dietary supplement.

• Almost all pregnant women are at risk of excessive consumption of sodium, and many are at risk of excessive consumption of folic acid and iron, especially among dietary supplement users.

• Improved dietary guidance to help pregnant [and potentially lactating] women meet and not exceed dietary recommendations is warranted.
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