Sources of Dietary Folate in US Women of Different Races: What is the Role of Fortified and Enriched Products?
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Background
- Folate: water-soluble, B vitamin, naturally occurring in foods; folic acid: added to foods
- Recommendation, women of childbearing age: 400µg/day.
- 19 - 30% of neural tube defects (NTDs) prevented with folic acid1
- 19 - 30% of NTDs observed in subpopulations3
- In US, enriched grain products fortified with folic acid

Objective
Examine disparities in total dietary folate intake from fortified, enriched, and intrinsic sources among US non-pregnant women 15-44 yr by race and Hispanic origin

What’s the difference?
- Fortified – voluntarily added vitamins and nutrients, not naturally present in the food
- Enriched – vitamins or nutrients added to them to meet standard of identity
- Intrinsic - occur naturally in a food

Data
National Health & Nutrition Examination Survey (NHANES) 2009-12
- Cross-sectional, nationally representative
- In person 24 hour recall
ILSI North America Nutrient Database
- Nutrient intake by source for foods in NHANES 2009-12

Analytic sample
- Non-pregnant women age 15-44 years, with valid dietary recall

Analysis
- Mean dietary folate intake by source and race and Hispanic origin
  - Covariates: age, country of birth, income (poverty income ratio)
  - Differences in means tested using Linear regression analyses
  - Proportion of total folate by source
  - Food group contribution to total folate
  - SUDAAN 9.3, Day 1 dietary weights

Conclusion
- Mean intake of total folate and fortified folic acid were lower among non-Hispanic black women of childbearing age compared to non-Hispanic white and Hispanic women of childbearing age
- Patterns in the contribution of different food groups to total folate intake vary by race/Hispanic origin
- These data provide a baseline to compare intake post fortification of corn masa flour which occurred in April 2016

References

Strengths
- Nationally representative
- New database allows for estimates on sources of total folate

Limitations
- 24-hr recall does not capture usual intake and has known biases
- Totals do not include supplement intake

Table 1 – Mean (SE) folate (µg) intake by source, women 15-44 y, US, 2009-2012

<table>
<thead>
<tr>
<th>Source of folate</th>
<th>All</th>
<th>Non-Hispanic white</th>
<th>Non-Hispanic black</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>2916</td>
<td>1100</td>
<td>641</td>
<td>810</td>
</tr>
<tr>
<td>Total Folate</td>
<td>488 (11.4)</td>
<td>501 (17.5)</td>
<td>416 (11.6)</td>
<td>492 (14.5)</td>
</tr>
<tr>
<td>Fortified</td>
<td>104.2 (8.5)</td>
<td>117.3 (13.6)</td>
<td>62.7 (8.7)</td>
<td>106.0 (12.5)</td>
</tr>
<tr>
<td>Enriched</td>
<td>195.4 (3.9)</td>
<td>194.1 (5.0)</td>
<td>186.4 (7.5)</td>
<td>196.9 (7.0)</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>188.2 (2.9)</td>
<td>189.6 (4.4)</td>
<td>176.2 (5.0)</td>
<td>186.9 (6.1)</td>
</tr>
</tbody>
</table>

1Significant difference from non-Hispanic white, p<.05
2Significant difference from non-Hispanic black, p<.05
3Standard error; Source: NHANES

Table 2 – Adjusted1 mean (SE) folate (µg) intake, women 15-44 y, US, 2009-2012

<table>
<thead>
<tr>
<th>Source of folate</th>
<th>Non-Hispanic White</th>
<th>Non-Hispanic Black</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Folate</td>
<td>512.7 (27.0)</td>
<td>434.7 (17.9)</td>
<td>509.0 (22.6)</td>
</tr>
<tr>
<td>Fortified</td>
<td>115.4 (21.1)</td>
<td>54.2 (14.9)</td>
<td>109.0 (12.9)</td>
</tr>
<tr>
<td>Enriched</td>
<td>203.6 (18.0)</td>
<td>198.2 (11.0)</td>
<td>205.8 (11.8)</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>192.7 (7.0)</td>
<td>182.3 (8.7)</td>
<td>194.2 (9.8)</td>
</tr>
</tbody>
</table>

1Adjusted for age, country of birth and income
2Significant difference from non-Hispanic white, p<.05
3Significant difference from non-Hispanic black, p<.05
SE: Standard error; Source: NHANES

Figure 1 – Percent contribution of different sources to total folate, by race/Hispanic origin, US women 15-44 years, 2009-2012

Figure 2 – Contribution of food groups1 to total folate intake, by race/Hispanic origin, women 15-44 y, US, 2009-2012

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