Dietary diversity, global change, and human health

Timothy Johns

Centre for Indigenous Peoples’ Nutrition and Environment (CINE) and
School of Dietetics and Human Nutrition, McGill University, Montréal, Canada
Dietary Diversity = Health
### Dietary Diversity & Health - Mortality -

<table>
<thead>
<tr>
<th>Variety Score (median)</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>1</td>
</tr>
<tr>
<td>10.0</td>
<td>0.82</td>
</tr>
<tr>
<td>12.0</td>
<td>0.71</td>
</tr>
<tr>
<td>15.0</td>
<td>0.69</td>
</tr>
</tbody>
</table>

P for trend < 0.001

Kant et al. 2000. JAMA 283:2109-2115
## Dietary Diversity & Gastric Cancer


<table>
<thead>
<tr>
<th>Vegetable diversity</th>
<th>Percentage of Cases</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td># of items</td>
<td>Stomach cancer</td>
<td>Controls cancer</td>
</tr>
<tr>
<td>&lt;5</td>
<td>39.9</td>
<td>29.4</td>
</tr>
<tr>
<td>5</td>
<td>18.0</td>
<td>18.1</td>
</tr>
<tr>
<td>6</td>
<td>19.4</td>
<td>19.3</td>
</tr>
<tr>
<td>≥7</td>
<td>22.7</td>
<td>33.2</td>
</tr>
</tbody>
</table>

**P for trend** < 0.001
“Processed foods containing ingredients that aid specific bodily functions in addition to being nutritious”.

http://vm.cfsan.fda.gov/~dms/fdhclm.html
Urinary tract infections

Vaccinium macrocarpon
cranberry; canneberge

Vaccinium spp.
blueberry, bluet
Lepidium meyenii
maca

Andean roots and tubers: Ahipa, arracacha, maca, and yacon

Lepidium meyenii
maca
(“Peruvian ginseng”)

Food Functionality for Developing Areas
Food Functionality for Developing Areas

CONSIDERATIONS

• traditional ecology
Food Functionality for Developing Areas

CONSIDERATIONS

• traditional ecology

• urbanization
Food Functionality for Developing Areas

CONSIDERATIONS

- traditional ecology
- dietary transition
- urbanization
Population growth
Industrialization
Urbanization
Biodiversity loss
Climate change
Oxidative status
Malnutrition
Toxicants & Xenobiotics
Immunity & Infection
ENVIRONMENTAL DISTURBANCE
HEALTH CHALLENGES
DIET / NUTRITION

ENVIRONMENTAL DISTURBANCE

Inadequacy

HEALTH CHALLENGES

Population growth
Industrialization
Urbanization
Biodiversity loss
Climate change

Oxidative status
Malnutrition
Toxicants & Xenobiotics
Immunity & Infection
DIET / NUTRITION

Inadequacy

ENVIRONMENTAL DISTURBANCE

Population growth
Industrialization
Urbanization
Climate change

Biodiversity loss

HEALTH CHALLENGES

Oxidative status
Malnutrition
Immunity & Infection
Toxicants & Xenobiotics
DIET / NUTRITION

ENVIRONMENTAL DISTURBANCE

Population growth

Industrialization

Urbanization

Biodiversity loss

Climate change

Inadequacy

DIET / NUTRITION

Oxidative status

Malnutrition

Health challenges

Toxicants & Xenobiotics

Immunity & Infection
## Premature Mortality Rates
(45-64 years of age/1000)

### Ratios Relative to Canada

<table>
<thead>
<tr>
<th>Country</th>
<th>CVD</th>
<th>Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>2.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Argentina</td>
<td>4.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Mexico</td>
<td>1.9</td>
<td>8.2</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>4.6</td>
<td>4.7</td>
</tr>
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Inadequacy
Population growth
Industrialization
Urbanization
Climate change

ENVIRONMENTAL DISTURBANCE

Biodiversity loss

DIET / NUTRITION

HEALTH CHALLENGES

Oxidative status
Malnutrition
ADAPTATION

Toxicants & Xenobiotics
Immunity & Infection
DIET / NUTRITION

ENIRONMENTAL DISTURBANCE

Population growth
Industrialization
Urbanization
Climate change

Inadequacy
Optimization

Biodiversity loss

HEALTH CHALLENGES

Oxidative status
Malnutrition
Toxicants & Xenobiotics
Immunity & Infection

ADAPTATION
Functionality of Ingested Phytochemicals

- **Nutrition**
  - Gastrointestinal function
  - Antioxidants
  - Glycemic control
- Antibiotic
- Immunostimulant
- Nervous system
- Detoxification
- Anti-inflammatory / anti-gout
Correlation Between Nutrient Adequacy Ratio (NAR) and Food Variety

<table>
<thead>
<tr>
<th>NAR</th>
<th>Food Variety Score Correlation</th>
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<tbody>
<tr>
<td>Energy (MJ/d)</td>
<td>0.01</td>
</tr>
<tr>
<td>Fat Energy (%)</td>
<td>0.29*</td>
</tr>
<tr>
<td>iron (mg/d)</td>
<td>-0.15</td>
</tr>
<tr>
<td>vitamin C</td>
<td>0.38**</td>
</tr>
<tr>
<td>vitamin A</td>
<td>0.27*</td>
</tr>
<tr>
<td>Mean Adequacy Ratio (MAR)</td>
<td>0.33**</td>
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</table>
Adansonia digitata

baobab
<table>
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<tr>
<th>Per 100 g edible</th>
<th>Ca (mg)</th>
<th>Fe (mg)</th>
<th>β-car. (ug)</th>
<th>Vit C (mg)</th>
<th>kcal (g)</th>
<th>Protein (g)</th>
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<tr>
<td>baobab, ripe, raw</td>
<td>285</td>
<td>7.4</td>
<td>63</td>
<td>270</td>
<td>280</td>
<td>2.2</td>
</tr>
<tr>
<td>orange, raw</td>
<td>28</td>
<td>0.1</td>
<td>730</td>
<td>46</td>
<td>44</td>
<td>0.6</td>
</tr>
<tr>
<td>cowpea leaves, raw</td>
<td>255</td>
<td>5.7</td>
<td>700</td>
<td>56</td>
<td>45</td>
<td>4.7</td>
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<tr>
<td>maize, white, dried</td>
<td>16</td>
<td>3.6</td>
<td>0</td>
<td>0</td>
<td>345</td>
<td>9.4</td>
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<tr>
<td>cassava, fresh</td>
<td>68</td>
<td>1.9</td>
<td>15</td>
<td>31</td>
<td>140</td>
<td>1.2</td>
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Crotalaria brevidens

> 4900 µg β-carotene per 100 g edible portion

Gynandrostopis gynandra

Solanum nigrum

provitamin A, vitamin C, folate
iron, calcium, fibre, protein
Functionality of Ingested Phytochemicals

- Nutrition
- Gastrointestinal function
- Antioxidants
- Glycemic control
- Hypolipidemic
- Antibiotic
- Immunostimulant
- Nervous system
- Detoxification
- Anti-inflammatory / anti-gout
Anti-giardial activity

Solanum nigrum


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Acacia nilotica  “olkiloriti”
Inhibition of LDL oxidation by Maasai soup additives

Conjugated dienes

Lindhorst and Johns
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- **Anti-inflammatory / anti-gout**
Commiphora mukul

“guggul”  Indian Bdellium
RESIN OF COMMIPHORA AFRICANA

E- Guggulsterone content

RESIN 0.03 %
CHEWED RESIN 0.006%
RELEASED BY MASTICATION: 80%
0.24mg/g

Xanthine oxidase inhibition - Maasai milk & soup additives

Guertin and Johns, 2001
Xanthine oxidase inhibition-Maasai milk & soup additives

Guertin and Johns, 2001
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<tr>
<td>Other indications (n=18)</td>
<td>38.2 (28.9)</td>
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Student’s t-test p = 0.03
CONCLUSIONS

- Biodiversity $\Rightarrow$ Dietary Diversity $\Rightarrow$ Health
- Global change impacts traditional ecology
- Health rationale for managing biodiversity
- Health not simply absence of disease
- Rural / Urban linkages are key