Assessment of Food Expenditure In The Canadian Arctic

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Background:

- Aboriginal population in Arctic Canada have increasing risk of mortality and diabetes, heart disease, cancer, and other diseases
- Life expectancy at least 12 years lower than national average \(^\text{(1)}\)
- In Nunavut and the Northwest Territories, obesity has increased up to 88% more rapidly than national average in last 10 years \(^\text{(2)}\)
- Obesity increases risk of mortality, type II diabetes, heart disease, and cancer \(^\text{(3)}\)

Transition in diet and lifestyle
Background

- Diet as a risk factor for chronic diseases; diet modification can significantly impact the incidence of chronic disease \(^{(1)}\)
- Diet modification toward nutrient-dense, low calorie, low fat and low sugar content foods (healthy foods)
- The recommended healthier and balanced diets are associated with higher costs than are the “unhealthy” diets \(^{(2)}\)
- Food prices affect food purchases and food consumption \(^{(3)}\)
- Few dietary guidelines have considered the issue of food costs and nutrient-to-price ratios \(^{(4,5)}\)

Background

Chronic Diseases

Genetic

Environment

Lifestyle

Dietary and Cooking Habits

Geographic Location (soil composition, natural disasters)

Knowledge and Culture

Food Choice and Expenditure
Aim

• To determine the **pattern of food expenditure** among people under food transition and high risk of chronic diseases

• To find out the **factors may affect the pattern** of food expenditure

• To provide information for a **dietary guideline** specific for the people living in Canadian Arctic considering actual food costs and nutrient-to-price ratio
Methods
An intervention program to improve diet and reduce risk of chronic disease in Aboriginal populations in Canada
Setting: 6 communities in Nunavut and the Northwest Territories (NWT)
Data collection between Summer 2008 and Fall 2009 on:

- Demographic (including Material Style of Life (MSL) score*)
- Food intake (using a culturally validated food frequency questionnaire)

* Developed by Dr J Gittelsohn, Johns Hopkins University
Data collection between Summer 2008 and Fall 2009 on:

- Demographic
- Food intake (using a culturally validated food frequency questionnaire)
- Food price (using store shelf labels, the Hunters and Trappers Organization for traditional foods)
Data Analysis

- Food price data
- Food intake data (FFQ)
- Food composition data

Daily nutrient obtained from and price for 100 g of food items

Daily nutrient obtained from and price for food groups
Six main food groups:

<table>
<thead>
<tr>
<th>Fruit and vegetables</th>
<th>Grains</th>
<th>Dairy</th>
<th>Replacement meats</th>
<th>Traditional foods</th>
<th>Non-nutrient-dense foods (NNDF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fresh fruits</td>
<td>• White bread</td>
<td>• Milk</td>
<td>• Beef &amp; pork</td>
<td>• Land caribou,</td>
<td>• Butter</td>
</tr>
<tr>
<td>• Packaged fruits</td>
<td>• Whole wheat</td>
<td>• Cheese</td>
<td>• Chicken &amp; Turkey</td>
<td>muskox</td>
<td>• Jam</td>
</tr>
<tr>
<td>• Vegetables</td>
<td>• Cereals</td>
<td>• Yogurt</td>
<td>• Turkey</td>
<td>• Sea seal, char,</td>
<td>• Pizza</td>
</tr>
<tr>
<td></td>
<td>• Noodles</td>
<td>• Eggs</td>
<td>• Seafood</td>
<td>fish</td>
<td>• Juice</td>
</tr>
<tr>
<td></td>
<td>• Rice</td>
<td></td>
<td>• Soups &amp;</td>
<td>• Sky</td>
<td>• sweetened</td>
</tr>
<tr>
<td></td>
<td>• Potatoes</td>
<td></td>
<td>stews</td>
<td>goose, ptarmigan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Coffee/tea</td>
</tr>
</tbody>
</table>
Calculating nutrient density score* (NDS) for each food groups

\[ NDS_{ig} = \left[ \left( \sum_{n=1}^{22} \left( \frac{\text{Nutrient}_{ign}}{\text{RDA}_n} \right) \right) / 22 \right] \times 100 \times \text{OC} / \text{CC}_{ig} \]

• Daily content of nutrient “n” provided by food group “g” to a subject “i”
• RDA: recommended dietary allowance (age and sex specific) based on Canadian Dietary Reference Intake (DRI) table
• OC: optimal calorie intake per day (2200 kcal for men and 1800 kcal for women)
• CC: calorie content (in kcal) provided by food group “g” to a subject “i”

Results
Demographic information and annual expenditure on foods

<table>
<thead>
<tr>
<th></th>
<th>NWT</th>
<th>Nunavut</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>52 (23)</td>
<td>35 (17)</td>
<td>87 (20)</td>
</tr>
<tr>
<td>Women</td>
<td>178 (77)</td>
<td>176 (83)</td>
<td>354 (80)</td>
</tr>
<tr>
<td><strong>Age groups</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤50 y</td>
<td>164 (71)</td>
<td>164 (78)</td>
<td>328 (74)</td>
</tr>
<tr>
<td>&gt;50 y</td>
<td>66 (29)</td>
<td>47 (22)</td>
<td>113 (26)</td>
</tr>
<tr>
<td><strong>Age (year)</strong></td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>44 (14)</td>
<td>42 (13)</td>
<td>43 (14)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No or primary</td>
<td>55 (33)</td>
<td>89 (43)</td>
<td>144 (38)</td>
</tr>
<tr>
<td>High school</td>
<td>70 (42)</td>
<td>84 (41)</td>
<td>154 (41)</td>
</tr>
<tr>
<td>College</td>
<td>42 (25)</td>
<td>34 (16)</td>
<td>76 (21)</td>
</tr>
<tr>
<td><strong>MSL score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>44 (28)</td>
<td>64 (31)</td>
<td>108 (30)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>50 (31)</td>
<td>77 (37)</td>
<td>127 (35)</td>
</tr>
<tr>
<td>High</td>
<td>65 (41)</td>
<td>66 (32)</td>
<td>131 (35)</td>
</tr>
<tr>
<td><strong>Food expenditure</strong></td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CAD$/year)</td>
<td>7065 (3997)</td>
<td>7338 (3900)</td>
<td>7195 (3949)</td>
</tr>
</tbody>
</table>

* Low: 0-8, Intermediate:8-12, High: 13-20
Average of annual food expenditure
(pooled data from Nunavut and NWT)
Proportion of daily food expenditure for food groups (pooled data from Nunavut and NWT)
Average of annual food expenditure (Gender specific data)

- **NNDF**: < 0.05
- **Traditional foods**: < 0.05
- **Replacement meats**: < 0.05
- **Fruit & Vegetables**: < 0.05
- **Grains**: < 0.05
- **Dairy**: < 0.05

* P < 0.05
Nutrient density score (NDS) and energy cost for optimal calorie (OC) intake

(OC: 1800 kcal/day for women and 2200 kcal/day for men)
## Factors associated with NNDF expenditure

<table>
<thead>
<tr>
<th></th>
<th>Crude Model</th>
<th>Full Adjusted Model†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>B coefficient</td>
</tr>
<tr>
<td><strong>Sex</strong> (Men vs Women)</td>
<td>87 - 354</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Age</strong> (&gt;50 vs ≤50)</td>
<td>113</td>
<td>-3.91</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>154</td>
<td>2.56</td>
</tr>
<tr>
<td>College</td>
<td>76</td>
<td>1.82</td>
</tr>
<tr>
<td>MSL*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>127</td>
<td>-1.07</td>
</tr>
<tr>
<td>High</td>
<td>131</td>
<td>0.24</td>
</tr>
</tbody>
</table>

† sex, age, education, marital status, smoking, Material Style of Life, % in working and % in income support

* Low: 0-8, Intermediate:8-12, High: 13-20
Discussion
Women participated more than men in the study because those primarily responsible for food getting and preparation in each household were recruited.

Men and younger participants spend more on NNDF probably because those groups spend more time out of house. Younger participants are more interest to taste store-bought canned / processed foods.

Overall, most expenditure goes to NNDF because ....
Change in nutrients intake for a reverse expenditure condition of traditional foods and non-nutrient-dense foods (NNDF)

Same expenditure and same calorie intake
Change in nutrients intake for a reverse expenditure condition of traditional foods and non-nutrient-dense foods (NNDF)

Same expenditure but 66% reduction in sugar intake
Change in nutrients intake for a reverse expenditure condition of traditional foods and non-nutrient-dense foods (NNDF)

- Same expenditure
- 82% increase in iron intake
Change in nutrients intake for a reverse expenditure condition of traditional foods and non-nutrient-dense foods (NNDF)

Same expenditure but 106% increase in zinc intake
Change in nutrients intake for a reverse expenditure condition of traditional foods and non-nutrient-dense foods (NNDF)

Same expenditure but 75% increase in vitamin D intake
Change in nutrients intake for a reverse expenditure condition of traditional foods and non-nutrient-dense foods (NNDF)

Same expenditure but 91% increase in omega 3 intake
Summary

Traditional foods provide key substantial amount of nutrients at a reasonable cost

Without changing peoples food budget but with different food option, they can reach high nutritious food.

Effective interventions such as HFN that incorporate nutrition education and identify motivators and barriers to healthy dietary patterns would be able to decrease the risk of chronic disease development in Arctic communities.
**Strengths**

- Using culturally appropriate and validated questionnaires
- Food prices were sampled over a 12-month period and therefore variations in food costs due to seasonality were captured

**Limitations**

- Using a different method for measurement cost of traditional foods comparing with other food groups
- Cost of foods in convenience and fast-food stores were not captured
Implication

Results of this study can be used for:

• **developing a long term intervention** in order to improve general population knowledge and change food consumption attitude/food preference

• **developing an effective dietary guideline** to consider both nutrient profile and nutrient/energy cost

• Comparing with food expenditure pattern in other parts of Canada (e.g. Alberta)
Sources of funding and key supporters

American Diabetes Association Clinical Research Award Grant # 1-08-CR-57

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Government of Nunavut, Department of Health and Social Services

Health Canada Retail Based Nutrition Interventions working group

Government of the Northwest Territories, Department of Health and Social Services

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Ms. Sarah Reaburn,
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Publications

- Supplement with the Journal of Human Nutrition and Dietetics in September 2010, entitled “Assessment of dietary intake and physical activity to inform, develop, implement, and evaluate a nutritional and lifestyle intervention program to reduce risk of chronic disease and improve dietary adequacy in Inuit and Inuvialuit in Arctic Canada”


11. Hopping, B.N., Erber, E., Mead, E., Roache, C. & Sharma, S. High levels of obesity and physical activity among Inuit adults in Arctic Canada.


Publications


Thank You
Any questions????

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### Recommended dietary allowances (RDA) values used to calculate the nutrient density score

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Men ≤50 y</th>
<th>Men &gt;50 y</th>
<th>Women ≤50 y</th>
<th>Women &gt;50 y</th>
<th>Nutrient</th>
<th>Men ≤50 y</th>
<th>Men &gt;50 y</th>
<th>Women ≤50 y</th>
<th>Women &gt;50 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>56</td>
<td>56</td>
<td>46</td>
<td>46</td>
<td>Vitamin B1 (mg)</td>
<td>1.2</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>38</td>
<td>30</td>
<td>25</td>
<td>21</td>
<td>Vitamin B2 (mg)</td>
<td>1.3</td>
<td>1.3</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1200</td>
<td>Vitamin B3 (mg)</td>
<td>16</td>
<td>16</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>8</td>
<td>8</td>
<td>18</td>
<td>8</td>
<td>Vitamin B6 (mg)</td>
<td>1.3</td>
<td>1.7</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td>Vitamin B12 (mcg)</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>4700</td>
<td>4700</td>
<td>4700</td>
<td>4700</td>
<td>Folate-DFE (mcg)</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>420</td>
<td>420</td>
<td>320</td>
<td>320</td>
<td>Vitamin C (mg)</td>
<td>90</td>
<td>90</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Selenium (mcg)</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>Vitamin D (mcg)</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>Vitamin E (mg)</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Iodine (mg)</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>Omega3 (g)</td>
<td>1.6</td>
<td>1.6</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Vitamin A-RAE (mcg)</td>
<td>900</td>
<td>900</td>
<td>700</td>
<td>700</td>
<td>Omega6 (g)</td>
<td>17</td>
<td>14</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>