Introduction

For centuries, Inuit had to rely on animals and plants such as wild berries and seaweeds to survive in the Arctic. However, since the 1990’s, the consumption of country foods has decreased markedly, and the rapid transition towards a western diet has led to excessive intake of carbohydrates, salt and trans-fat acids. In Nunavut, the prevalence of obesity is increasing, and cardiovascular diseases and associated risk factors have become major health issues [1]. Global environmental changes also affect Inuit dietary patterns in many ways including the availability of local animal and plant species and/or environmental contaminant concentrations [2,3].

With limited access to fruits and vegetables, wild berries, seaweeds and other plants found in Nunavut may provide plant-derived nutrients and secondary metabolites that offer unique potential for the prevention or management of metabolic disorders and associated cardiovascular complications. They may be an important source of antioxidants, especially polyphenols (flavonoids and tannins) and carotenoids, as well as fiber and vitamins C and E. Several of these phytochemicals and nutrients have been reported to prevent or decrease lipid peroxidation, LDL oxidation, decrease glycosylation, improve insulin secretion and sensitivity, and/or act as anti-inflammatory and anti-inflammatory agents, possibly due to their diverse actions on metabolic processes [4,5]. Moreover, in addition to their antioxidant activity, certain phytochemicals chelate heavy metal ions, possibly reducing the bioavailability and subsequent toxicity of environmental contaminants [6,7].

Objectives of the project

1. Collect selected wild berries, seaweeds and other plants in different Nunavut villages;
2. Characterize and quantify different phytochemicals, macronutrients, minerals and environmental contaminants in these samples;
3. Assess the bioactivity (evaluate the protective potential) of the different plant extracts in in vitro models pertinent to the prevention and treatment of chronic diseases;
4. Conduct an animal study to evaluate the impact of wild berries on insulin resistance and obesity in mice;
5. Contribute to develop community-based intervention projects in Nunavut villages to:
   a. Improve wild berry consumption, distribution and availability throughout the year;
   b. Propose local healthy alternatives to soft drinks and snacks;
   c. Stimulate youth empowerment and employment.

Wild berry, seaweed and plant harvest

Figure 1: Map of Nunavut
- Specimens of targeted species were collected from 3 different sites in each of the 3 villages, selected according to geographic location, climatic conditions and Inuit recommendations.
- In all villages, community members mentioned avoiding dump or sewage areas for picking because of possible environmental contamination; no samples were collected in these areas.

Wild berry, seaweed and other plant species included in the study

<table>
<thead>
<tr>
<th>Berry Type</th>
<th>Sample Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloudberry</td>
<td>Brown seaweed</td>
</tr>
<tr>
<td>Labrador</td>
<td>Mountain sand</td>
</tr>
<tr>
<td>Bearberry</td>
<td>Red seaweed</td>
</tr>
<tr>
<td>Alpine birch</td>
<td>Mountain birch</td>
</tr>
<tr>
<td>Alpine cranberry</td>
<td>Mussel shell</td>
</tr>
<tr>
<td>Alpine blueberry</td>
<td>Labrador blueberry</td>
</tr>
<tr>
<td>Alpine purpleberry</td>
<td>Labrador purpleberry</td>
</tr>
<tr>
<td>Alpine blackberry</td>
<td>Labrador blackberry</td>
</tr>
</tbody>
</table>

Wild berry, seaweed and other plant health benefits in a changing Canadian Arctic

Figure 2: Wild berry, seaweed and other plant species included in the study

For further information please contact Dr Mélanie Lemire: meline@cruch.unilav.ca

Impacts of wild berries on adiposity and insulin sensitivity in mice

This experimental study is done by Dr André Marette research team [INAF, Laval].
- Mice (C57BL/6) Jackson were fed with a high-fat, high-sucrose (HFHS) diet to induce obesity and insulin resistance [8].
- For each berry species, mice (n=12) were treated for 8 weeks with the berry extract (200 mg/kg) and compared with 2 reference groups (n=12 each): non-dose non-insulin resistant mice on chow diet and obese insulin resistant mice on HFHS diet.
- Measured outcomes: weight gain and adiposity, glycosuria and insulinemia from Oral Glucose Tolerance Test (OGTT) and Insulin Tolerance Test (ITT).

Preliminary results
- All the berries present very low sugar, salt, fat and environmental contaminant concentrations and are good sources of minerals (like magnesium, manganese, chromium and iron).
- In a parallel study [8], blackberry and alpine bearberry were found to have the strongest antioxidant and antityant of 12 species of edible berries in Quebec;
- All the berries except cloudberry present a higher TPC than lowbush blueberry extract (2.1 mg/g), which grows all over southeastern Quebec and has demonstrated significant anti-diabetic activities [8].
- Mountain cranberry, alpine bearberry and blackberries prevent the highest TPC.

Community-based intervention with IPL students from Tasiujaq and Kangisualujuaq: The purple tongue project

While visiting communities in 2012, many persons mentioned that the main factors reducing their consumption of berries from the land is the lack of space to store them in freezer. Elders also mentioned that the youth should learn more about native plants and eat more of them. Thus, we developed an intervention pilot-project to:
- Develop berry products that do not need to be stored in freezers (dried berries, baby puree, fruit roll-up, granola bars, juice, yogurt products) with low sugar concentration, at low cost and using locally available food items, simple cooking techniques and in accordance with Inuit taste and culture;
- Engage Individual Path Learning (IPL) students in berry picking and harvest assessment using GPS techniques, traditional knowledge sharing activities and berry recipe design and food transformation (and create employment) in the two communities;
- Evaluate the outcomes and the impact of the intervention on local berry consumption and youth empowerment, and develop a pedagogical guide for implementation of the pilot project in other schools.

Activities
- April-July 2013: Three workshops with Inuit colleagues to test and improve berry products.
- September 2013: Workshop with 14 students in Tasiujaq (berry harvesting, samianecing, berry processing, traditional knowledge activity, GPS methods, berry picking)
- September 2013: Workshop with 14 students in Kangisualujuaq (berry consumption assessment, berry transformation techniques, berry culture in a historic, GPS mapping).

Figure 5: Workshop in Tasiujaq

Coming soon...
- Measure polyphenol metabolites in Inuit blood samples to study the properties of berries, seaweeds and other plants with respect to diabetes and cardiovascular risk factors in Nunavut adults.
- A larger interdisciplinary research-intervention project combining the nutritional properties and traditional knowledge of these plants in relation to heart disease and diabetes, and community-based interventions to improve food security and youth empowerment, and to promote social economy.

Understanding the benefits of country foods consumed in Nunavut will support and orient public policies aiming at improving food security, promote Inuit culture, minimize the risks from environmental contaminant exposure, and the emergence of obesity, diabetes and cardiovascular diseases in the Arctic.

We are grateful to all community members who participated in the berries, seaweeds and plants sampling and the design of the intervention project. The research project is funded by...