HERBAL AND SEAWEED : ICE CREAM FOR THE FUTURE?
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Outline

• Introduction
• Seaweed
• Herbs
• Herbal and seaweed Ice cream
• Conclusion
World Population

- World Population (in Billions): 1950-2050

- Current population about 7 billion
- By 2050 about 9 billion

How to feed the world?

Can Science Feed The World?
Future Food Source

• Insects
• Lab grown meat
• Vertical farming
Future Food Source

- Worldwide 145 species of red, brown or green seaweed are used as food.
- Abundance: over two million tons.
- About 50% of world production is cultivated.
- 42 countries are involved in the commercial seaweed activity.

Algae - Seaweed
Seaweed

- Excellent sources of components with biological activities (Wijesinghe and Jeon, 2011; Holdth and Kraan, 2011):
  - antioxidants,
  - soluble dietary fibers,
  - proteins
  - minerals
  - vitamins

- Shown to have therapeutic properties for health and disease (Suhaila, Nadia, and Hafeeda, 2012):
  - prevention such as anticancer,
  - anti-obesity
  - Antihypertensive
  - Antioxidant
  - anticoagulant,
  - Antibacterial
Seaweed

- Seaweeds are known as excellent source of bioactive compound that can contribute to the functional properties.
- There are many studies on the effects of seaweed in food products:
  - Eko (2011), determine the quality of dried noodle with addition seaweeds puree substitution
  - Senthil et al. (2010), evaluated the effect of using seaweed (eucheuma) powder on the quality of fish cutlet;
  - Kim et al. (2010), determined the quality characteristics and antioxidant activity of breakfast sausages by adding sea tangle as well as functionality within meat products and utilization in low-fat meat products;
  - Lopez-Lopez, et al. (2009a,b,c), study the effect of chemical, physical, antioxidant, and etc of the effect addition of seaweed in low-fat frankfurters;
  - Prabhansankar et al. (2009b); evaluated the effect of different levels of brown seaweed (Undaria pinnatifida) as ingredient in pasta, on the sensory, cooking, nutritional and bio-functional quality of pasta; and are lots of them.
Seaweed

- *Kappaphycus alvarezii*  
- *Caulerpa lentillifera*
Herbs

• The World Health Organization (WHO) estimates that over 80% of the world’s population uses some form of herbal medicine

• Culinary herbs – use in cooking to give flavors

• Medicinal herbs – use as health benefits
Herbs

• Herbal food plays a major role in the healthcare and functional foods market, both in industrialized and developing nations.

• The market for herbal products varies by region based on factors such as consumer awareness, product availability, and forms of delivery, product acceptance, and regional regulations.

• Herbs are perceived to be safe and healthy, with relatively few side effects in contrast to synthetic drugs.
Herbs

• The global herbal supplement and remedies market is expected to reach $93 billion by 2015 (San Jose, 2011)

• World demand for nutraceutical ingredients will expand 6.2 percent annually to $21.8 billion in 2013, serving a $236 billion global nutritional product industry.
Rohtosammakonputki

• *Centella asiatica* (*pennywort*) - traditional herbal medicine in Malaysia, Indian Ayurvedic medicine, China and other part of Asia for hundreds of years

• Benefits such as:
  – Wound healing
  – Anxiety
  – Eczema
  – Ulcers,
  – Colds
  – Hepatitis
  – Fatigue

• Its impending benefit as a natural antioxidant extracts
Why Ice cream?

- Everyone loves ice cream!
- Changing “guilty pleasures” to “healthy pleasures”
- Healthy food products from natural sources
- Variety in diet
- Both seaweed and herbs offers health benefit – antioxidant!
- Educate children to like “alternative sources”
Objectives

a. To study the possibility of using herb and seaweed as the main ingredient for developing healthy/functional ice cream

b. To determine the characteristics of the functional ice cream on its physical, chemical, and sensory attributes.
Challenges

• To reduce the bitterness and astringency of antioxidant extracts in pennywort
• To get rid the ‘sea taste’ in seaweed
• The addition to food products in considerable amounts → change sensory characteristics → decrease in consumer acceptability and willingness to purchase the product (Tuorila & Cardello, 2002; Verbeke, 2006).
Methodology

- Fresh Centella
- Centella drying
- Ice cream processing
- Bioactive compound analysis (HPLC Test determination for madecassoside, asiaticoside, asiatic acid & madecassic acid) (Inamdar et al, 1996)
- Antioxidant assay (TPC, DPPH radical scavenging essay & FTC method)
- End product: Pegaga ice cream + control ice cream
- Physicochemical test
- Proximate analysis
- Sensory Test
- Microbiology test
<table>
<thead>
<tr>
<th>Analysis</th>
<th>Pennywort (per 100g)</th>
<th>Control ice cream</th>
<th>Pegaga herbal ice cream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>86.2 ± 0.01</td>
<td>66.23 ± 0.16a</td>
<td>67.26 ± 0.16a</td>
</tr>
<tr>
<td>Fat</td>
<td>0.1 ± 0.05</td>
<td>15.51 ± 0.15ab</td>
<td>15.16 ± 0.08ab</td>
</tr>
<tr>
<td>Protein</td>
<td>2.0 ± 0.11</td>
<td>2.7 ± 0.20ab</td>
<td>2.63 ± 0.34ab</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>7.0</td>
<td>15.56</td>
<td>14.95</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>1.7 ± 0.04</td>
<td>NIL</td>
<td>0.03 ± 0.01</td>
</tr>
<tr>
<td>Ash</td>
<td>1.70 ± 0.23</td>
<td>0.01 ± 0.00a</td>
<td>0.01 ± 0.00a</td>
</tr>
</tbody>
</table>

Table 1. Proximate analysis for pennywort, control and herbal ice cream
Physicochemical analysis

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Control ice cream</th>
<th>Pegaga herbal ice cream</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.89 ± 0.03</td>
<td>6.79 ± 0.00</td>
</tr>
<tr>
<td>Overrun</td>
<td>33 ± 4.4</td>
<td>46.6 ± 8.5</td>
</tr>
<tr>
<td>Viscosity (cPas⁻¹)</td>
<td>896 ± 15.4</td>
<td>1368 ± 25.5</td>
</tr>
</tbody>
</table>

**Table 2.** Physicochemical analysis for control and herbal ice cream
## Total Phenolic Content

<table>
<thead>
<tr>
<th>Day</th>
<th>TPC (mg/ml sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pennywort Ice cream</td>
</tr>
<tr>
<td>1</td>
<td>5.08 ± 0.82&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>4.8± 1.06&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>4.8± 0.34&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>4.6± 0.15&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>4±  1.19&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>6</td>
<td>3.96± 0.58&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>7</td>
<td>3.77± 0.98&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Sensory Score for Attributes

- **Color**
  - Frequency distribution for color preferences

- **Texture**
  - Frequency distribution for texture preferences

- **Punganess**
  - Frequency distribution for pungency preferences

- **Milkiness**
  - Frequency distribution for milkiness preferences
Seaweed ice cream

- Seaweed preparation: KA – 25% (w/w) puree: CL – fresh

Flowchart:
- Mixing ingredients at 50°C
- Homogenization and cool down at 4°C
- Freezing at -5°C
- Pasteurize at 80°C, 25 sec
- Age at 4°C, at least 4 hours
- Hardening at -20°C
### Sensory test

<table>
<thead>
<tr>
<th>Formulation</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>2.30 ± 1.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.60 ± 0.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.10 ± 0.74&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Odour</td>
<td>2.30 ± 0.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.50 ± 0.97&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.40 ± 0.52&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Body and texture</td>
<td>2.90 ± 0.99&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.70 ± 0.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.90 ± 0.99&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Seaweed taste</td>
<td>2.00 ± 0.67&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>2.60 ± 0.70&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.60 ± 0.70&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Melting quality</td>
<td>2.80 ± 1.14&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.40 ± 1.35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.20 ± 0.79&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Overall acceptance</td>
<td>2.60 ± 0.84&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.00 ± 0.47&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.30 ± 0.48&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**F1: ratio 2:3 ; F2 ratio 3:2 ; F3: ratio 2.5:2.5**

Mean value followed by different letters in the same column are significantly different (p<0.05).

The smaller mean value indicate most acceptable.
Conclusions

• Herbal and seaweed have the potential to be utilized as a healthy/functional ice cream
• The sensory test showed both ice cream are acceptable with herbal ice cream showed there is still antioxidant compounds
• It is a good source of alternative for the future flavors of ice cream
THANK YOU!