Ethanol levels in kombucha – a concern or a KALAMITea?

NCCEH Environmental Health Seminar Oct 22, 2020

Lorraine McIntyre
Sung Sik Jang

Environmental Health Services, BCCDC
We respectfully acknowledge that we live, work, and play on unceded Coast Salish Territory, the traditional territories of the xʷməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), and Səl̓ilwətaɏ (Tsleil-Waututh) Nations.
Acknowledgements

• Dr. Paula Brown, Dr. Michael Chan & staff
  BCIT Natural Health & Products Group
  NSERC research chairs program
• BCCDC Foundation for Public Health
• BC Liquor and Cannabis Regulatory Board
• Regional Health Authorities
• University of British Columbia Masters Food Science Program (Sally Chen)
Kombucha Alcohol Levels Affecting pregnant Mothers Infants & Toddlers

Study Objective
- To assess the levels of alcohol in kombucha products at retail and food premises in British Columbia

Rounds Objectives
- Explain the public health significance of low levels of alcohol as a health risk
- Recognize alcohol as a health hazard (i.e. chemical hazard) in fermented beverages
- Discuss potential mitigation roles for public health and industry

Partners
- Health Authorities, UBC, BCIT, and BCCDC

Funders
- BCCDC Foundation for Public Health / Liquor & Cannabis Regulation Branch (LCRB) / BCIT NSERC
- Sweetened tea fermented with **SCOBY** 
  *Symbiotic Culture Of Bacteria and Yeasts*
- A fermented, *slightly alcoholic,*
  lightly effervescent, sweetened black or green tea drink
- Also known as tea mushroom, tea fungus,
  or Manchurian mushroom
- Described as a functional beverage for its
  supposed health benefits containing probiotics,
  organic acids & other healthy metabolites.
Low levels of alcohol are a risk
In children
Weight and dose relationship

Children: ethanol dose 50 – 100 mg/dL
- Higher metabolic rate
  - Children overheat rapidly
- Underdeveloped liver enzymes to process alcohol
  - Initial screening of blood alcohol at hospital may increase 2-3X
- Sx: lethargy, hypoglycemia, seizures (death)
## Ethanol content

<table>
<thead>
<tr>
<th>% ABV</th>
<th>Weight (kg)</th>
<th>10 mg/dL</th>
<th>20 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>6.7 mg/dL</td>
<td>3.3 mg/dL</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>13.3 mg/dL</td>
<td>6.7 mg/dL</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>26.7 mg/dL</td>
<td>13.3 mg/dL</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>33.3 mg/dL</td>
<td>16.7 mg/dL</td>
<td></td>
</tr>
</tbody>
</table>

For any toddler weighing 10 kg or less
- as little as 150 mL would be of concern (i.e. reach a 50mg/dL dose)
- 330 mL would be of concern at regulatory limit of 1%

ABV = alcohol by volume (%)
Source: Dr. David McVea, resident
There is no safe exposure level for alcohol and kombucha may expose pregnant women to non-trivial amounts of alcohol.
Low levels of alcohol are a risk

Life time risk of one drink per day increases lifetime cancer risk
Other risks?

Other issues linked to high acid levels in kombucha

Metabolic acidosis and lactic acidosis
- 10 illnesses in total reported
- Underlying conditions reported in most illnesses

Strategies to address alcohol risk

- Labelling
  - Informed consumers
- Availability
  - Restrict access to alcoholic product
- Informed consumers
  - Media campaigns to raise awareness
- Product stability
  - Ethanol will not increase during consumer handling
**Symbiotic Culture Of Bacteria and Yeasts (SCoby)**

*Fermented Foods as Experimentally Tractable Microbial Ecosystems*

*Benjamin E. Wolfe, Rachel J. Dutton*

*Cell*
Volume 161, Issue 1, Pages 49-55 (March 2015)
DOI: 10.1016/j.cell.2015.02.034
How is ethanol produced in Kombucha?

Pathways to Kombucha tea products

Adapted from Journal of Food Science, 83(3):580-588
What did we find?
Can & Bottle

Bulk Sample
Chain of custody
BCIT Natural health products laboratory
Dr. Paula Brown / Dr. Michael Chan

- GC/MS head-space method
- LOD provided for each sample; sensitivity to 0.001% ethanol
- Validated using AOAC guidelines

684 samples collected across BC Jun-Oct 2019

- 142 premises visited;
  - Retail (77%),
  - Restaurant (11%),
  - Processor (9%),
  - Farmers Market/Gym/Rec Centre (3%)

- 53 processors
- 31.5% exceeded regulatory limit, 1% ethanol (ABV)
# Places of processing

<table>
<thead>
<tr>
<th>Province/Country</th>
<th>Alberta</th>
<th>BC</th>
<th>Ontario</th>
<th>Quebec</th>
<th>USA</th>
<th>Australia</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td># samples (%)</td>
<td>42 (6.1%)</td>
<td>333 (48.7%)</td>
<td>13 (1.9%)</td>
<td>61 (8.9%)</td>
<td>220 (32.2%)</td>
<td>15 (2.2%)</td>
<td>684 (100%)</td>
</tr>
<tr>
<td># processor</td>
<td>4</td>
<td>38</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>53</td>
</tr>
</tbody>
</table>

![Bar chart showing distribution of places of processing](chart.png)
Summary of Ethanol results

<table>
<thead>
<tr>
<th>Ethanol Concentration (%)</th>
<th>Product (%)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1%</td>
<td>68.5%</td>
<td>469</td>
</tr>
<tr>
<td>&gt;1-2%</td>
<td>25.2%</td>
<td>173</td>
</tr>
<tr>
<td>&gt;2-3%</td>
<td>5.5%</td>
<td>38</td>
</tr>
<tr>
<td>&gt;3%</td>
<td>0.58%</td>
<td>4</td>
</tr>
</tbody>
</table>
Ethanol results by the place of processing

<table>
<thead>
<tr>
<th>Region</th>
<th>BC*</th>
<th>Ontario</th>
<th>Quebec</th>
<th>Alberta</th>
<th>Australia</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Samples</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Legal limit
No Problem: ethanol concentration is always below 1% ABV;
Potential problem: Less than 20% of samples are above 1% ABV;
Definite problem: More than 20% of samples are above 1% ABV.

For processors with sample sizes of less than 6, any value over 1% ABV resulted in coding with yellow
No Problem: ethanol concentration is always below 1% ABV;
Potential problem: Less than 20% of samples are above 1% ABV;
Definite problem: More than 20% of samples are above 1% ABV.

For processors with sample sizes of less than 6, any value over 1% ABV resulted in coding with yellow.
All samples were negative (n=47)

Petrifilm™ plates (3M Company)
• Safe range is $2.5 < \text{pH} < 4.2$ (Nummer, 2013)
• No samples had pH above 4.2 → no *E. coli* tests done
• 47 Kombucha samples $< \text{pH} 2.5$ (~7% failure rate).
Kombucha samples stored at room temperature
Room temperature display?

Image: Refrigerator display with various beverages.
Yeast Activity

Many samples quickly show production of gas. Others develop gas after two weeks (slowly). Some never.
Labelling assessments

1. Precautionary Statements for Alcohol Content
2. Handling information
3. Federally required labelling
4. Market advertising labels

Results

1. Found in 54% of brands
   • 25% of BC brands
2. Found in 92% of brands
   “keep refrigerated”
   53% “do not shake or “contents under pressure”
3. Found in 100% nutrition facts & ingredient lists.
   Issues in some BBD and address labels
4. Most common (72%)
   “raw and living”
Noticeably, some alcohol labels are too small to be read/found
MILLIONS OF LIVE CULTURES
DES MILLIONS DE CULTURES VIVANTES

Our Kombucha is an effervescent fermented beverage. The result is a refreshing, well balanced alternative delivered to enlighten your taste buds.

Notre Kombucha est un breuvage fermenté et énergisant. Le résultat final est un délicieux refraîchissant pour vos papilles, au goût exceptionnel.

FIND OUT MORE:
buchabrew.ca @buchabrew

DO NOT SHAKE • NE PAS AGITER
KEEP REFRIGERATED 4°C / GARDER AU REFRIGÉRATEUR 4°C
CONSIGNÉE QUÉBEC 5¢ REFUND

190820

Sunrise over the Garibaldi ranges. One of my all time favourite views.” - @ahpflaum

The elder and sage come together to share their wisdom, creating a soothing flavour.

Known as “The Tea of Immortality,” Kombucha is fermented tea full of probiotics, organic acids and healthy compounds. Cheers!

@talitykombucha

0.5% alc/vol

North Vancouver, BC V7P A03

Bucha Brew
Delta, BC,
V4K 0A4

27843 60867

Provincial Health Services Authority
Province of British Columbia
Better Health.
WHAT DO WE DO NOW?

How do we know “non-alcoholic kombucha” IS non-alcoholic and is meeting the regulations?
Study design: RISK COMMUNICATION STRATEGY
→ developed threshold triggers for rapid communications

WERE NOT MET in the first 150 samples
1. If >50% of samples tested above 1% ethanol
2. If >10% of samples tested above 2.5% ethanol
3. If any sample tested above 5% ethanol
Kombucha Regulatory Oversight

Products made in the province or imported into the province
Progressive enforcement model

- Enforcement
- Education
- Assessment
BC approach: food safety plans (HACCP)


- BC requirements for food safety plans [FPR s. 23(4)]
  - s. 23: identify all health hazards, alcohol meets the definition of a health hazard
- Control of the hazard must be demonstrated
  - Testing of alcohol in product to end of shelf-life must show ≤ 1% ABV
- Records must be available to inspectors
Progressive enforcement model
Progressive enforcement model

Progressive enforcement model

Enforcement

Education

Assessment
**Kombucha alcohol risk in BC**

- **Labelling**
  - Informed consumers
    - US 25% no warning
    - BC 75% no warning

- **Availability**
  - Restrict access to alcoholic product
    - Sold everywhere

- **Informed consumers**
  - Media campaigns to raise awareness
    - Probiotics in kombucha, low awareness for ethanol?

- **Product stability**
  - Ethanol will not increase during consumer handling
    - Evidence that ethanol increases
Recommendations

- Improved labelling
  - Consumers right to know what products have alcohol in them
  - Raw kombucha should be labelled “keep refrigerated”**
  - Include precautionary labels
  - Better BBD labels
- Processors must test for ethanol
  - Demonstrate control during shelf-life and in the event of consumer mishandling

** Required for PHF in Quebec
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample collection (June to Oct 2019)</td>
<td></td>
</tr>
<tr>
<td>Report draft (Nov 2019)</td>
<td></td>
</tr>
<tr>
<td>Report finalized (Mar 2020)</td>
<td></td>
</tr>
<tr>
<td>Industry reports mailed (Apr 2020)</td>
<td></td>
</tr>
<tr>
<td>Public report posted (Aug 2020)</td>
<td></td>
</tr>
<tr>
<td>KT and Health Promotion activities (Aug &amp; ongoing)</td>
<td></td>
</tr>
<tr>
<td>Peer review paper (draft Sep 2020)</td>
<td></td>
</tr>
</tbody>
</table>

Team acknowledgements

Aljosa Trmcic
Sarah Henderson
Leela Steiner
Amani Kafeety
Tom Kosatsky
David McVea
& everyone who purchased kombucha for our project!

----------------------------------------

Gin Lee, PHSA Labs
Questions?