Exploring Temperature Patterns of Leafy Greens in Institutional Kitchens

Ellen Thomas
July 24, 2012
Dr. Benjamin Chapman
**Storage temperature**

- Time/temperature abuse is 2nd highest violation in institutions (FDA, 2001)

- *E. coli* O157:H7 inoculation:
  - 8°C allowed up to 1-2 log growth within just 3-6 days
  - Increase at 12°C, 15°C, and 21°C
  - Decreased in viability when stored at 5°C

- FDA recommends storage at 5°C
  - North Carolina Food Code sets regulation at 5°C or below

(Abdul-Raouf et al., 1993; Li et al., 2001; Luo et al., 2009)

---

**Salads in clamshells**

- No research determining temperature profiles of salads in institutional setting

- Concern about taking temp of leafy greens and ability to keep cold in school kitchens
Schools

- 2,350 school cafeterias in North Carolina
  - Additional 200 meals are catered off site
- 1.8 million meals per day
- 2 major serving plans
  - 3 day rule
  - TILT = time in lieu of temperature
**Objective**

- In a typical school lunch program, how do temperatures of leafy greens fluctuate over the 3 day serving period?
- Should the current policy remain the same?
Methods

- 24 total schools
  - Elementary, middle, and high schools - 11 counties
  - Number of salads prepared varied
    - (3-100 salads)
- Data loggers recorded temperature of leafy greens every 5 minutes over 3 days
  - 3.5 hour window used

Types of serving lines
<table>
<thead>
<tr>
<th>Cooling system</th>
<th>Number of schools</th>
<th>Total recorded time</th>
<th>Time above 5°C</th>
<th>Frequency above 5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling plate</td>
<td>1</td>
<td>555 minutes</td>
<td>394 minutes</td>
<td>71%</td>
</tr>
<tr>
<td>Cooling pan, loose</td>
<td>1</td>
<td>735 minutes</td>
<td>477 minutes</td>
<td>63%</td>
</tr>
<tr>
<td>Cooling well</td>
<td>8</td>
<td>640 minutes</td>
<td>224 minutes</td>
<td>35%</td>
</tr>
<tr>
<td>Display cooler</td>
<td>3</td>
<td>640 minutes</td>
<td>217 minutes</td>
<td>34%</td>
</tr>
<tr>
<td>Healthy cart</td>
<td>4</td>
<td>650 minutes</td>
<td>52 minutes</td>
<td>8%</td>
</tr>
<tr>
<td>Holding cooler</td>
<td>1</td>
<td>645 minutes</td>
<td>0 minutes</td>
<td>0%</td>
</tr>
</tbody>
</table>

Salad temperature during serving over 3 days - cooling well

*Temperature (°C)*

*Time*
Results

- Temperature increased after being placed on line
- Average time above 5°C = 35%
- Lack of consistency within systems
  - Standard deviation = 28%

Significance

- Use in risk assessment calculations rather than assumptions
- Suggests need for policy change
Thank you

- Department of Public Instruction
- School Meals Initiative team
- North Carolina public schools
- Dr. Manan Sharma, Dr. Don Schaffner
- Dr. Audrey Kreske, Allison Smathers