Handling of Leafy Greens in Foodservice Operations Serving Older Americans Before and After Intervention
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Presenters: Susan W. Arendt and Kevin Sauer

Advancing Food Safety Through Behavior Change
Research Team:

(in addition to Arendt & Sauer)

Angela Shaw, Associate Professor
Microbiologist

Catherine Strohbehn, Adjunct Professor and Nutrition Extension State Specialist

Lakshman Rajagopal, Associate Professor

Graduate Students at the time: Amber Roy and Kelly Abdelmassih
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Outline:

• Project Objectives
• Background Literature
• Methods
  – Operation
  – Employee
  – Microbial
• Results
• Conclusions
Project Objectives:

• Identify current foodservice employee handling practices.

• Conduct microbial assessment, considering procurement form, source, and contact surfaces.

• Develop effective food safety messaging.

• Implement and evaluate safe food handling messaging.
Background:

• 14.5% of the population is 65 years or older (2014, Administration on Aging)

• Older adults are an “at risk” population for contracting a foodborne illness

• CDC Surveillance Report (2014)
  – 25 multi-state outbreaks
  – leafy green items including: cabbage, pre-packaged lettuce, spinach, leaf lettuce
Leafy Greens:
## Methods:

<table>
<thead>
<tr>
<th>Pre-Intervention</th>
<th>Short Term Post-Intervention</th>
<th>Long Term Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Observations (8 sites, 4 in Kansas and 4 in Iowa)</td>
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</tr>
<tr>
<td>Employee Observations and Interview</td>
<td>Employee Observations and Interview</td>
<td>Employee Observations and Interview</td>
</tr>
<tr>
<td>Micro Sampling</td>
<td>Micro Sampling</td>
<td>Micro Sampling</td>
</tr>
<tr>
<td>- Contact Surfaces (3)</td>
<td>- Contact Surfaces (3)</td>
<td>- Contact Surfaces (3)</td>
</tr>
<tr>
<td>- Product (received, before prep, and served)</td>
<td>- Product (received, before prep, and served)</td>
<td>- Product (received, before prep, and served)</td>
</tr>
</tbody>
</table>
Leafy Green Sample

- About a half a bag is 250 grams
- Micro group only need 25 grams for analysis
Protocol IF Positive Sample:

- Communication Policy Developed:

During our analysis of your operation, the food contact surface or product was positive for __________. As a result of this positive sample, we are notifying you that there is a potential for that surface or product to cause a foodborne outbreak within your facility. We advise you contact your leafy green supplier and your local health inspector. Corrective actions need to be done immediately (Federal Food, Drug and Cosmetic Act Section 402, Section 342).
Poster Development:

• After analyzing data from first visit, eight posters were developed and evaluated using a rigorous process

• Example findings and related message:
  – *Don’t wash bagged leafy greens that have already been washed*
Poster Samples: Three Languages
Poster Implementation
Results: Employee Observations

Observed Food Safety Behavior Compliance Rates by Site Visit

<table>
<thead>
<tr>
<th>Site</th>
<th>0 months</th>
<th>1 month</th>
<th>3 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.77</td>
<td>0.82</td>
<td>0.91</td>
</tr>
<tr>
<td>B</td>
<td>0.89</td>
<td>0.86</td>
<td>0.76</td>
</tr>
<tr>
<td>C</td>
<td>0.79</td>
<td>0.84</td>
<td>0.90</td>
</tr>
<tr>
<td>D</td>
<td>0.63</td>
<td>0.50</td>
<td>0.73</td>
</tr>
<tr>
<td>E</td>
<td>0.74</td>
<td>0.67</td>
<td>0.72</td>
</tr>
<tr>
<td>F</td>
<td>0.81</td>
<td>0.74</td>
<td>0.69</td>
</tr>
<tr>
<td>G</td>
<td>0.60</td>
<td>0.63</td>
<td>0.64</td>
</tr>
<tr>
<td>H</td>
<td>0.64</td>
<td>0.54</td>
<td>0.56</td>
</tr>
</tbody>
</table>

SITE VISIT

Iowa State University
Results: Microbial

Aerobic Plate Counts by Intervention Stage

- Before
- After
- Follow Up

Colony Forming Units per gram or mL
Results: Microbial

Aerobic Plate Counts by Site

Colony Forming Units per gram/ml

- Assisted Living
- Hospital
- Longterm Care
- Restaurant

Assisted Living

Hospital

Longterm Care

Restaurant

A
Results: Microbial

Aerobic Plate Counts by Leafy Sample

Colony Forming Units per gram

- Receiving
- Preparation
- Service
Results: Microbial

Coliform Counts by Intervention Stage

Before

After

Follow Up

Colony Forming Units per gram or mL
Results: Microbial

Coliform Counts by Site

Assisted Living  |  Hospital  |  Longterm Care  |  Restaurant

Colony Forming Units per gram or mL
Results: Generic *E. coli* on Leafy Greens

Mean colony forming units per gram of generic *E. coli* counts collected on leafy greens at different stages of a minimal-text intervention

<table>
<thead>
<tr>
<th>Source</th>
<th>Before&lt;sup&gt;a&lt;/sup&gt;</th>
<th>1 Month After</th>
<th>3-4 Months After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>1.2±1.2(0-3)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Long-term Care</td>
<td>0.0±0.0(0-0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Assisted Living</td>
<td>0.0±0.0(0-0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Restaurant</td>
<td>9.2e-1±1.4(0-3)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0±0.0(0-0)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Least square means ± standard deviation (min-max range)

<sup>a,b</sup>represents a significant difference across rows

Below standard for generic *E. coli*  
<100 CFU per gram

Significant **reduction** after intervention
Results: Microbial

Coliform Counts by Leafy Sample

- Receiving: A
- Preparation: A
- Service: A
Conclusions: Microbial

- **No** *Listeria monocytogenes*, *Escherichia coli* O157:H7, or *Staphylococcus aureus* were detected in *any* samples.
- No significant differences between leafy greens collected at receiving, preparation and service.
- No significant differences between IA and KS.
- No significant differences between site types (except generic E. coli on leafy greens).
Additional Conclusions:

• Multiple interventions needed over time

• Posters available for free download at: 
  https://store.extension.iastate.edu/Product/Leafy-Green-Safe-Handling-Posters
Additional Resources

