SPROUTS VS. MICROGREENS

HOW DO THE RISKS COMPARE?

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GOOGLE TRENDS

- microgreens
  Search term

Interest over time

Interest by state

CO = #6

https://trends.google.com/trends/explore?date=all&geo=US&q=microgreens

Colorado State University

FOOD SCIENCE AND HUMAN NUTRITION
The Foundry Dining Facility, CSU

Sensory Lab, CSU
LEAFY GREENS & HEALTH: NUTRITION

In general, microgreens contain greater amounts of nutrients and health-promoting micronutrients than their mature counterparts. 

Choe et al. 2018

EAT MORE GREENS

Low in Calories

Vitamins A, B6, C, K

Contain Phytochemicals, Fiber
LEAFY GREENS & HEALTH: FOOD SAFETY

Produce: 45.9%
  Leafy greens: 22.3%
  Fruits-nuts: 11.7%
  Roots: 3.6%
  Vine-stalk: 12.0%
  Sprouts: 0.3%

Commodity Related Outbreaks 1998-2008/10

Painter et al. 2013
The high estimate for illnesses attributable to leafy vegetables was many times higher than the low estimate which indicates that leafy vegetables were frequently found in complex foods.

Painter et al. 2013
<table>
<thead>
<tr>
<th>Sprouts</th>
<th>Microgreens</th>
<th>Baby Greens (Mesclun)</th>
<th>Mature Leafy Greens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8 days</td>
<td>7-21 days</td>
<td>21-28 days</td>
<td>28-60 days</td>
</tr>
<tr>
<td>1-3” long</td>
<td>~2” tall</td>
<td>3-4”</td>
<td></td>
</tr>
</tbody>
</table>

Outbreaks, 1998-2017 (NORS)

57 0 10 350+
## PRODUCTION & CONSUMPTION CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th>Grown in warm, moist environment</th>
<th>Large Surface Area</th>
<th>High Moisture Content</th>
<th>Generally Hand Harvested</th>
<th>Seeds/roots Remain Attached</th>
<th>Cut Surface from Harvesting</th>
<th>Generally Consumed Raw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microgreens</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Leafy Greens</td>
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</tbody>
</table>

Shaded area = food safety challenge
SPROUTS & MICROGREENS ARE DISTINGUISHED BY STAGE OF LEAVES

Sprouts
- Harvested when the cotyledons (or seed leaves) are still un- or under-developed and true leaves have not begun to emerge
- Consumed as entire plant (root, seed, and shoot)

Microgreens
- Reach a later stage of growth before harvest, typically associated with the emergence of ‘true’ leaves
- Stem, cotyledons (seed leaves) and first true leaves are consumed
### MONOCOTS vs. DICOTS

**MONOCOTS**
- Wheat
- Barley
- Popcorn

**DICOTS**
- Alfalfa
- Amaranth
- Arugula
- Basil
- Bean
- Broccoli
- Carrots
- Clover
- Kale
- Lentils
- Lettuce: too delicate
- Mustard
- Mung bean
- Mustards

*Image: [http://biologyclermont.info/wwwroot/courses]*
SPROUTS

Food Safety of Sprouts

• Food safety concerns associated with sprouts
  - Seed can be contaminated on farm
  - Sprout germination conditions also encourage the proliferation of pathogens
  - Sprouts can be contaminated during production
  - Outbreaks associated with sprouts have occurred
MICROGREENS

Photo Credit: UF/IFAS
PRODUCTION

- Sprouts – water
- Microgreens

Soil – recommendation to sterilize, 180 degrees for 30 minutes

Soil-less media

- Coconut coir: middle fibrous coat
- Burlap + fertilizer
- Hemp mats
- Felt-like textiles
- Vermiculite – mineral
- Perlite, volcanic glass
- Rockwool

Similarities:
- warm, moist, environment, nutrient-rich media

The limited amount of data available suggests that microgreens may very well be of lower risk than sprouts…but the background level of bacteria is higher than that of conventional vegetables.

Riggio et al. 2019
MONOCOTS: WHEATGRASS

Harvest 2017, Pines International
HARVESTING

HARVEST TOOLS: KNIVES, SCISSORS, SHEARS
WASHING METHODS & EQUIPMENT: SALAD SPINNERS
DRYING BEFORE PACKAGING

TRAYS MAY BE DELIVERED DIRECTLY TO RETAIL OR CONSUMER TO HARVEST
HARVESTING EQUIPMENT

Immature greens

Microgreens
KNIFE CUTTING

https://www.youtube.com/watch?v=5WTEVn9pnfo
PHOTOS
HOST PATHOGEN DYNAMICS

Contaminated seeds appear to be the source of most sprout-associated foodborne illnesses...

Rhizosphere: region near plant roots influenced by their growth, respiration and nutrient exchange

Reed et al. 2018
RESEARCH

Alfalfa

Broccoli

Radish

Fransisca and Feng, 2012
RESEARCH FINDINGS

Plant-Microbe and Abiotic Factors Influencing Salmonella Survival and Growth on Alfalfa Sprouts and Swiss Chard Microgreens
Reed et al. 2018, CFSAN, Applied and Environmental Microbiology

An increase in the frequency of irrigation water exchange will not reduce the levels of Salmonella, and a decreased irrigation frequency will increase the Salmonella population.
Subpart M

- Applies to the production of all types of sprouts, including alfalfa, clover and mung bean sprouts, except soil grown sprouts harvested without roots
- FDA distinguishes between sprouts and microgreens by the stage of the leaves:
  - Sprouts = cotyledons are still un- or under-developed; true leaves have not emerged
  - Microgreens = harvested after emergence of ‘true leaves’
- For microgreens that are grown using conditions similar to those of sprouts (i.e. warm, moist, and nutrient-rich media), FDA encourages growers consider voluntarily implementing the standards in subpart M, in addition to complying with required provisions of part 112.

FDA; Produce Safety Alliance
Resources

Sprout Safety Alliance, Illinois Institute of Technology, https://www.ifsh.iit.edu/ssa

References


