BC Centre for Disease Control
An agency of the Provincial Health Services Authority

Environmental Health Services

Food Issue

Notes from the Field

Safety assessment for wheat grass

Request received from:	Regional Health Authority
Date of request:	27 May 2013, updated April 2015
Issue (brief description):	Are the risks of wheat-grass similar to or different from bean sprouts?

Disclaimer: The information provided in this document is based on the judgement of BCCDC's Environmental Health Services Food Safety Specialists and represents our knowledge at the time of the request.
It has not been peer-reviewed and is not comprehensive.

Summary of search information

1. Internet sources
2. Ovid – CAB, Food, Nutrition, Health database and FSTA.

Note: search FSTA for "microgreen" only 6 hits, none of interest. Searched "sprouts" key index with "pathogens"/ CAB "microgreens" yielded 14 hits, none of interest. Search using Latin name for wheatarass – Triticum aestivum + mycotoxin + health to find references of value.

Background information

Wheatgrass is commonly grown in retail premises from seed in soil and cuttings of the sprouted grass are put into smoothies and other foods. What is wheatgrass? Should it be considered a sprouted seed, subject to contamination like alfalfa, bean or other sprouts? Or should it be considered a microgreen?

Microgreens

According to wiki a microgreen "has a single central stem which has been cut just above the soil line during harvesting." Wiki defines a microgreen as a young plant, germinated and grown in 7 to 10 days that has formed cotyledon leaves and at least two true leaves. A grass will not form cotyledon or true leaves, it has a single leave. However, since the root of the wheatgrass is not eaten, as would be the case with sprouted seeds, a microgreen appears to be a better definition for this product. Microgreens have been described as the smallest form of salad greens, leafy vegetables or herbs, that are generally as a garnish or as an ingredient in salads. Microgreens as an organic commodity are a rapidly growing industry commanding $1-1.50 per ounce, live wet weight (in 2007) to more than $3 per ounce in today's markets.[1,2] Microgreens encompass a wide variety of products, although they do not typically include lettuces as they wilt quickly. [2] Such plants include cabbage, beet, kale, kohlrabi, mizuna, mustard, radish, swiss chard, amaranth and many others.[2]

Wheatgrass – best definition is a microgreen

Wheatgrass is also defined to Australia/New Zealand food safety authority as a microgreen, rather than a sprouted seed.[3] In a technical review of sprouts that exclude microgreens, reasons for the differentiation of microgreens from sprouts were described in a table, shown below.

Table 2: Some of the differences between seed sprouts and microgreens

	Seed sprouts	Microgreens
Growth medium	In most circumstances, seed sprouts do not require a medium to support its root system but water only.	In most circumstances, microgreens require a medium (such as soil, perlite) to support its root system.
Growth environment	Seed sprouts grown under little light and in a highly moist environment	Microgreens grown under light and in a less moist environment
Growth time	5 – 6 days for most seed sprouts	8 – 21 days for most microgreens
Nutrients for growth	In most circumstances, seed sprouts require no added nutrients for growth	In most circumstances, microgreens require added nutrients for growth
Cotyledon leaves	In most circumstances, cotyledon leaves of seed sprouts at the time of harvest are underdeveloped	At the time of harvest, cotyledon leaves of microgreens are fully developed
Plant development stage	An early stage of plant development between seed and first true leave	A development state that is younger than a baby plant but older than a seed sprout
Harvest	In most circumstances, seed sprouts are harvested before first true leaf is emerged	Microgreens are harvested after at least the first set of true leaves is emerged
Consumption	In most circumstances, the whole plant is consumed including the root system.	Only the leaves and stems are consumed, but not the roots

Benefits of microgreens and wheatgrass

Wheatgrass is purported on many sites to contain nutrients[1], and recent assessments do demonstrate that cotyledon leaves in microgreens do contain higher nutritional densities that plants with mature true leaves.[4] In a survey of 25 microgreens, red cabbage, cilantro, garnet amaranth, and green daikon radish had the highest concentrations of ascorbic acids, carotenoids, phylloquinone, and tocopherols, respectively.[4] Wheat grass appears to have antihelminthic and antimicrobial properties as well, which may contribute to the lore that this product has anti-cancer and anti-ulcerative properties.[5] Studies have shown that wheatgrass exhibits anti-inflammatory activity in chronic inflammation (in rats), reduce iron overload in thallasemia major patients, has anti-poliferative affects on cancer cells and successfully

[1] Two example sites: http://www.freshorigins.com/microgreens.html and http://www.mayoclinic.com/health/wheatgrass/AN02108

treated ulcerative colitis, reducing disease and bleeding and peritoneal cancer in one case.[6-10] Wheatgrass, in addition to being commonly used in smoothies, is also grown as a habitat enrichment for pet animals such as cats, rabbits and various rodents.[11]

Potential hazards of microgreens and wheatgrass

One issue commonly associated with wheatgrass is mold growth [see http://www.dynamicgreens.com/dynamic-greens-wheatgrass-juice.html#mold]. Mycotoxins present in commercial grains as a result of mold issues in wheat heads (fully grown wheat) are well recognized, and risk assessments and guidelines for these commodities exist.[12,13] However, the affects of mycotoxins/mold in the young stem, rather the seed head does not appear to be researched (we could not find any scientific literature looking at this aspect). Similarly, an extensive review of the literature did not uncover any issues with pathogens associated with use of wheatgrass. This is in contrast with sprouts, which is a well known food commodity associated with outbreaks, here in BC and elsewhere.[14-17] However, there is some evidence to suggest that microgreens (wheatgrass) grown in a facility that also produces sprouts may share some risk, especially if the risk is associated with poor control of compost, manure and water sources
[see http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/ucm256991.htm].

Recommendations

Wheatgrass use in Food Services Establishments

- Wheatgrass and microgreens should be grown in clean pasteurized soil. Compost soil should be treated with a process to remove bacteria from the compost before being used.
    - Note: to pasteurize soil, wet and place into oven, heat to 180°F (82°C) for 30 minutes
- Wheatgrass and microgreens should be grown in clean sterile trays.
    - Note: to sanitize, use a 10% solution of domestic bleach.
- Only potable water is to be used.
- When using wheatgrass for foods, such as smoothies, cuttings should be made well above the soil level, at least 1 inch.
- The flats of wheatgrass should be stored in a manner that protects them from potential sources of contamination – i.e. dirt, dust, contaminated aerosols, etc.
- Visibly moldy flats of wheatgrass should not be used and discarded.

In addition,

- BCCDC will recommend this as a project to BCIT ENVH students, requesting a comparison between sprouts, and wheatgrass, as a microgreen.

Update to microgreens, April 2015

Two projects to report on:

1. BCIT student project:

http://contentpro.lib.bcit.ca/iii/cpro/DigitalItemViewPage.external?lang=eng&sp=1005108&sp=T&sp=1&suite=def

In this project a qualitative evaluation was performed between wheatgrass and alfalfa sprouts grown in water and soil. E.coli was detected in all samples that were grown from seeds inoculated with E.coli, including wheatgrass cut one inch above roots and the whole alfalfa sprouts.
This study concluded that microgreens and sprouted seeds should be assessed at the same level of risk.

2. University of Marland PhD Project, Zhenlei Zhao

http://drum.lib.umd.edu/handle/1903/14900

The final part of this project was a quantitative comparative microbiological study between radish sprouts and radish microgreens produced from artificially contaminated radish seeds. Starting from seeds with same contamination levels, E. coli O157: H7 and E. coli O104: H4 populations on harvested radish microgreens were 3-5 logs lower than that on radish sprouts. **These results demonstrated that the microbial growth on sprouts were much faster than that on microgreens, which poses great risk of microbiological hazard to sprout-consumers**. In contrast, **microgreens seem to bear a relatively low food safety risk.**

Based on the second quantitative study, our 2015 recommendation in the Temporary Food Market Guidelines are amended:
Microgreens are currently listed under appendix 2 as a PHF. They should be transferred to Appendix 1 as a lower risk food based on this reference and most up-to-date research.

References

1. Brentlinger DJ. New trends in hydroponic crop production in the U.S. Acta Horticulturae. 2007(742):31-3.

2. University of Florida IFAS Extension. Microgreens: A New Specialty Crop. 2013 [cited 2013 Sep 9]; Available from: http://edis.ifas.ufl.edu/hs1164.

3. Food Standards Australia New Zealand. Proposal P1004 - Primary Production & Processing Standard for Seed Sprouts. 2010 [cited 2013 Aug 11]; Available from: http://www.foodstandards.gov.au/code/proposals/pages/proposalp1004primary4361.aspx.

4. Xiao ZL, Lester GE, Luo YG, et al. Assessment of vitamin and carotenoid concentrations of emerging food products: edible microgreens. Journal of Agricultural and Food Chemistry. 2012;60(31):7644-51.

5. Dubey PK, Bais N, Kakkar A, et al. Studies on antimicrobial and anthelmintic potential of wheatgrass. Journal of Global Pharma Technology. 2012;4(11):8-11.

6. Nalini GK, Patil VM, Ramabhimaiah S, et al. Anti-inflammatory activity of wheatgrass juice in albino rats. Biomedical & Pharmacology Journal. 2011;4(2):301-4.

7. Shah PI, Goyal RK, Tripathi CB, et al. Evidence for the presence of iron chelator constituent in the wheatgrass for the treatment of patients with thalassemia major. Journal of Pharmacy Research. 2012;5(7):3543-7.

8. Simran T, Amrita A, Sonali S, et al. Antioxidant profiling of Triticum aestivum (wheatgrass) and its antiproliferative activity in MCF-7 breast cancer cell line. Journal of Pharmacy Research. 2011;4(12):4601-4.

9. Ben-Arye E, Goldin E, Wengrower D, et al. Wheat grass juice in the treatment of active distal ulcerative colitis: a randomized double-blind placebo-controlled trial. Scand J Gastroenterol. 2002 Apr;37(4):444-9.

10. Forgionne GA. Bovine cartilage, coenzyme Q10, and wheat grass therapy for primary peritoneal cancer. J Altern Complement Med. 2005 Feb;11(1):161-5.

11. Brown C. Organic wheatgrass as environmental enrichment. Lab Animal. 2010;39(3):74-5.

12. Scientific opinion on risks for animal and public health related to the presence of nivalenol in food and feed. EFSA Journal. 2013;11(6):3262.

13. Gräfenhan T, Patrick SK, Roscoe M, et al. Fusarium damage in cereal grains from western Canada. 1. Phylogenetic analysis of moniliformin-producing Fusarium species and their natural occurrence in mycotoxin-contaminated wheat, oats, and rye. Journal of Agricultural and Food Chemistry. 2013;61(23):5425-37.

14. Scientific Opinion on the risk posed by Shiga toxin-producing Escherichia coli (STEC) and other pathogenic bacteria in seeds and sprouted seeds. EFSA Journal. 2011;9(11).

15. Weiser AA, Gross S, Schielke A, et al. Trace-back and trace-forward tools developed ad hoc and used during the STEC O104:H4 outbreak 2011 in Germany and generic concepts for future outbreak situations. Foodborne Pathogens And Disease. 2013;10(3):263-9.

16. Stratton J, Stefaniw L, Grimsrud K, et al. Outbreak of Salmonella paratyphi B var java due to contaminated alfalfa sprouts in Alberta, British Columbia and Saskatchewan. Can Commun Dis Rep. 2001 Aug 15;27(16):133-7; discussion 7-8.

17. Van Beneden CA, Keene WE, Strang RA, et al. Multinational outbreak of Salmonella enterica serotype Newport infections due to contaminated alfalfa sprouts. JAMA. 1999 Jan 13;281(2):158-62.