Whole Grain Processing, Functional Components for Positive Food Attributes and Health

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How We Decide What Food to Buy?

- Nutrition
- Convenience
- Value

Taste
Convenience Time Management

• 1887: Half of a households labor hours were for preparing foods

• 2010:
  – Food preparation < 25 min/day
Convenience
Time Management

• Households are also spending less time shopping for foods (< 15 min/day)
  – Requires foods will long shelf-life so food shopping is not a daily event
  – Requires one stop shopping vs. individual food vendors

www.ers.usda.gov

www.getreallmaine.com
Value
Increased Spending Power

- Food Cost are declining

![Graph showing percentage of disposable income over years, with 23.4% in 1929 and 9.6% in 2008.](image-url)
Whole Grains and Value

www.mlive.com
Whole Wheat Flour

• Typically made by recombining the bran, germ and white flour at proper proportions
• Straight grinding of the wheat berry can cause breaking of the germ and spreading of the germ oil throughout the flour
• Germ Oil
  – 83% linoleic acid (18:2; omega 6)
  – 7% linolenic acid (18:3; omega 3)
Impact of Unsaturation on Susceptibility to Lipid Oxidation

18:1
RELATIVE OXIDIZIBILITY 1

18:2
10

18:3
20

20:4
30

20:5
40

Impact of Unsaturation on Susceptibility to Lipid Oxidation
Newspapers soaked in linseed oil caused fire due to spontaneous combustion
(Hampshire Gazette; Northampton, MA)
Why are Whole Grain Flour and Products More Expensive?

- **Shelf-life**
  - Whole wheat flour has a limited shelf-life due to rancidity = 1-3 months
  - Short Shelf-Life = $$$$$
    - White flour with no germ oil has shelf-life of 3-6 months
- **Harder to Process**
  - Bread must rises longer to get same loaf volume
- **Economy of Scale**
Whole Grains and Convenience
Consumers Spend < 25 min/day Cooking

• Long cooking times
  – Brown Rice = 45 min
  – Farro = 30 min
  – Steel Cut Oats = 25 min
  – Barley = 45 min

eatoutsidethebag.com
Rolled/Flaked Oats
cooking time = 3 min
Pre-gelatinization Whole Grains

- Pre-cook grain and then dry
- Dried grain has holes that allow for rapid absorption of water
- Usually fortified with minerals and vitamins lost during processing
- Less flavor
Whole Grain K-Cups

DIRECTIONS

Pour
EMPTY pouch of Nature Valley Oatmeal into mug.
PLACE mug on tray of Keurig® Single Serve Brewing System.

Brew
INSERT Bistro Cups™ into brewer as instructed in Keurig user manual.
SELECT 6 oz. cup size; BREW oatmeal

Enjoy
STIR until oatmeal is thoroughly blended; LET STAND 1 minute before enjoying.* Refrigerate leftovers.

CAUTION: Oatmeal and mug can be very hot!
*After brewing oatmeal, we recommend running a brew cycle without a Bistro Cups™ to cleanse Keurig® Brewing System.
**Keurig 2.0 Compatible. Ring color may vary.

NATURALLY FLAVORED WITH OTHER NATURAL FLAVOR WITH CRANBERIES

APPLE CINNAMON ALMOND

BROWN SUGAR PECAN

© GENERAL MILLS
Taste

www.healthtap.com

www.pinkjooz.com
Whole Grains and Taste

• Astringency is a feeling of dryness in the mouth (tea, unsweetened chocolate)
• Mainly caused by polyphenols forming complexes with saliva proteins
• Sweetness can help overcome astringent flavors (Gaudette and Pickering, 2012).
• General Mills conversion to all whole grain cereals increased whole grain consumption by 38 million servings/day
  – Kids Cereals are 10 g or less per serving
Whole Wheat White Flour

• Made from hard white spring wheat
  – Lacks the genes for pigmentation
• Polyphenols are astringent so removal provides milder flavors
• Expensive, production levels not increasing
Nutritional profiles (per 100 g)

• Hard White Wheat
  – Fat = 1.7 g
  – Dietary Fiber 12.2 g
  – α-tocopherol = 1.1 mg
  – Polyunsaturated fatty acids = 0.75 g
  – Lower in non-essential antioxidants

• Hard Red Wheat
  – Fat = 1.9 g
  – Dietary Fiber 12.2 g
  – α-tocopherol = 1.0 mg
  – Polyunsaturated fatty acids = 0.77 g

From King Arthur Flour
Whole Grain/Wheat Pasta

- Original whole wheat pastas were very gummy and not firm
- Utilizing wheat varieties high in protein and addition of dietary fiber helped increased firmness
- Can also find pastas with other whole grains such as farro, buckwheat, brown rice, quinoa
  - Not all whole grain and high in fiber
Sprouted Whole Grain Flours

• Set conditions for whole grain to sprout
• Activates enzymes which break down starch and proteins and also releases antioxidants from fiber
• Can also stimulate production of nutrients such as tocopherols (2-3 fold increase)
• Breaks down proteins which could decrease allergenicity(?) but also increase asparagine = acrylamide

nourishedkitchen.com
Sprouted Whole Grain Flours

• Improved flavor?
  – Increased sweetness
  – Decrease in phenolics on fiber = decreased astringency

• Improved baking parameters
  – Increased loaf volume
  – Decrease proofing time
Drinkable Whole Grains

• Quinoa Snack
  – 1 g fiber (from both quinoa and fruit)
    • Unable to tell how much whole grain
  – 26 g sugar
  – Amazon Reviewer Quote
    “So gross. Rather drink the water from my bath after running a marathon”

• Beer
  – The original drinkable whole grain
Its About Time!
"There is just no acceptable level of any chemical to ingest, ever,"
INGREDIENTS: WATER (75%), SUGARS (12%) (GLUCOSE (48%), FRUCTOSE (40%), SUCROSE (2%), MALTOSE (<1%)), STARCH (5%), FIBRE E460 (3%), AMINO ACIDS (<1%) (GLUTAMIC ACID (19%), ASPARTIC ACID (16%), HISTIDINE (11%), LEUCINE (7%), LYSINE (5%), PHENYLALANINE (4%), ARGinine (4%), VALINE (4%), ALANINE (4%), SERINE (4%), GLYCINE (3%), THREONINE (3%), ISOLEUCINE (3%), PROLINE (3%), TRYPTOPHAN (1%), CYSTINE (1%), TYROSINE (1%), METHIONINE (1%)), FATTY ACIDS (1%) (PALMITIC ACID (30%), OMEGA-6 FATTY ACID: LINOLEIC ACID (14%), OMEGA-3 FATTY ACID: LINOLENIC ACID (8%), OLEIC ACID (7%), PALMITOLEIC ACID (3%), STEARIC ACID (2%), LAURIC ACID (1%), MYRISTIC ACID (1%), CAPRIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, E515, OXALIC ACID, E300, E306 (TOCOPHEROL), PHYLLOQUINONE, THIAMIN, COLOURS (YELLOW-ORANGE E101 (RIBOFLAVIN), YELLOW-BROWN E160a), FLAVOURS (3-METHYL BUTYL 1-YL ETHANOATE, 2-METHYL BUTYL ETHANOATE, 2-METHYLPRO Pan-1-OL, 3-METHYL BUTYL 1-OL, 2-HYDROXY-3-METHYLETHYL BUTANOATE, 3-METHYL BUTANAL

The No No List

1. Acesulfame K (Acesulfame Potassium)
2. Alum (Aluminum Ammonium Sulfate/Aluminium Potassium Sulfate)
3. Aluminum Calcium Silicate/Bentonite (Calcium Aluminoisilicate, Calcium Silicoaluminate, Sodium Calcium Silicoaluminate)
4. Ammonium Chloride
5. Artificial Colors (Synthetic and Certified FD&C)
6. Artificial Flavors
7. Aspartame
8. Astaxanthin
9. Autolyzed Yeast Extract
10. Azo Dyes
11. Benzocaineamide
12. Benzoic Acid
13. Benzyl Alcohol/Benzoyl Peroxide (Synthetic only)
14. BHA (Butylated Hydroxyanisole)
15. BHT (Butylated Hydroxytoluene)
16. Bromated Flour
17. Brominated Vegetable Oil
18. Caffeine (Added, not naturally occurring)
19. Calcium Bromate
20. Calcium Peroxide
21. Calcium Sorbate
22. Canthaxanthin
23. Caprocaprylobehenin
24. Caramel Color (Classes II-IV)
25. Carboxymethyl Cellulose
26. Carmine/Cochineal
27. DATEM (Diacetyl Tartaric Acid)
28. Diacetyl/Acetoin
29. Dipotassium Sulfate
30. Disodium Guanylate (GMP)
31. Disodium Inosinate (IMP)
32. EDTA (Calcium Disodium EDTA/Disodium Dihydrogen EDTA)
33. Esters of Fatty Acids
34. Ethoxyquin
35. Fat Substitutes (Sucrose Polyester, Microparticulated Whey Protein Concentrate)
36. FD&C Colors
37. Glycerides (Mono & Diglycerides, all forms)
38. Glycerol Ester of Wood Rosin
39. High Fructose Corn Syrup (HFCS)
40. Hydrogenated Starch
41. Hydrolyzed Soy or Corn Protein
42. Lard
43. L-Cysteine (Cystine)
44. Maltodextrin
45. Monosodium Glutamate/Sodium Glutamate (Added MSG, not naturally occurring)
46. Neotame
47. Nitrates/Nitrites (Added, not naturally occurring)
48. Parabens (all)
49. Partially Hydrogenated Oils/Artificial Trans Fat
50. Polydextrose
51. Polysorbates (all)
52. Potassium Benzoate
53. Potassium Bisulfate
54. Potassium Bromate
55. Potassium Lactate
56. Potassium Sorbate
57. Propionates (Calcium, Sodium)
58. Propyl Gallate
59. Propylene Glycol
60. Propylene Glycol Alginate
61. Saccharin (Calcium Saccharin)
62. Salatrim
63. Silicones/Siloxanes (Methyl Silicon, Dimethylpolysiloxane)
64. Artificial Smoke Flavor
65. Sodium Benzoate
66. Sodium Diacetate
67. Sodium Erythorbate
68. Sodium Lactate
69. Sodium Lauryl Sulfate
70. Sodium Metabisulfite
71. Sodium Phosphate/Trisodium Phosphate
72. Stannous Chloride
73. Sucralose
74. Sucroglycerides
75. Sulfites (Added, not naturally occurring)
76. Sulfur Dioxide
77. Tertiary Butylhydroquinone (TBHQ)
78. Theobromine (Added, not naturally occurring)
79. Titanium Dioxide
80. Triacetin/Glycerol Triacetate
81. Vanillin
Panera No No List for Food Additives

- Astaxanthin = Salmon
- Diacetyl = Vinegar
- Esters of Fatty acids = All Fats
- Propriionate = Swiss Cheese
- Vanillin = Vanilla
- Lard = ???

- Maltodextrin = Bread and Beer
Food Additives

• Chemical are chemicals whether naturally occurring or food additives
• Mother Natural has developed numerous chemical that prevent food spoilage, provide great taste and texture and improve health
• The natural additives are critical in making food safer while still allowing us to have a sustainable food supply
  – 40% of food from the farm is wasted
Conclusions

• Whole grains are a great way to design a healthy diet
• Inclusion of whole grains into a healthy diet requires that they taste great, are convenient and can be afforded by everyone
• Food processing can play a critical role in increasing the accessibility of whole grains and improving health and wellness