Introduction

- Food Standards Australia New Zealand (FSANZ) defines Dietary Fibre as follows:
  Dietary fibre means that fraction of the edible parts of plants or their extracts, or synthetic analogues, that are resistant to the digestion and absorption in the small intestine, usually with complete or partial fermentation in the large intestine.

- Dietary fibre includes polysaccharides, oligosaccharides & lignans and promotes one or more of the following beneficial physiological effects:
  - Laxation
  - Modulation of blood glucose; and
  - Reduction in blood cholesterol

**NHMRC Recommendations**

<table>
<thead>
<tr>
<th>Gender &amp; Age</th>
<th>Adequate intake (g) of fibre per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys &amp; girls 1-3 yr</td>
<td>14g</td>
</tr>
<tr>
<td>Boys &amp; girls 4-6 yr</td>
<td>16g</td>
</tr>
<tr>
<td>Boys 7-9 yr</td>
<td>20g</td>
</tr>
<tr>
<td>Girls 9-11 yr</td>
<td>15g</td>
</tr>
<tr>
<td>Boys 11-13 yr</td>
<td>20g</td>
</tr>
<tr>
<td>Girls 11-13 yr</td>
<td>17g</td>
</tr>
<tr>
<td>Adult men</td>
<td>30g</td>
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<tr>
<td>Adult women</td>
<td>25g</td>
</tr>
<tr>
<td>Pregnancy 19 yr+</td>
<td>28g</td>
</tr>
<tr>
<td>Lactation 19 yr+</td>
<td>30g</td>
</tr>
</tbody>
</table>

NB: No UL set
Australian Dietary Guidelines: Wholegrains

<table>
<thead>
<tr>
<th>Gender &amp; age</th>
<th>Grain (cereal) foods, mostly wholegrain*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>19-50</td>
<td>6</td>
</tr>
<tr>
<td>51-70</td>
<td>6</td>
</tr>
<tr>
<td>70+</td>
<td>4 ½</td>
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<tr>
<td>Women</td>
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</tr>
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<td>70+</td>
<td>3</td>
</tr>
<tr>
<td>Pregnant</td>
<td>8 ½</td>
</tr>
<tr>
<td>Lactating</td>
<td>9</td>
</tr>
</tbody>
</table>

*Specifies at least 2/3 should be wholegrain or higher fibre

What is a serve?

How many grain serves are Australians eating?
What % of grain foods are wholegrain?

On average 1/3 of grain intake of Australians coming from wholegrains.

Fibre intakes 2011-12

Where are we getting our fibre?

ABS data Aus Health Survey 2011-12
Foods delivering our fibre within cereals

Fibre from grains seems to be especially important to health

Australians do not have good gut health
**Fibre types**

**Soluble Fibre**
- Slows enzyme attack & carbohydrate breakdown – lowers GI
- Reduces cholesterol re-absorption
- Largely fermentable by colonic bacteria – prebiotic

Sources:
- Legumes
- Cereals & legumes
- Fruits & veg/tech

**Insoluble Fibre**
- Bulking agent – stool bulk is increased
- Smaller % are fermentable

Sources:
- Wheat bran
- Brown rice
- Wholesome bread
- Wholegrain cereals

**Resistant Starch**
- Gold star fuel for colonic bacteria – prebiotic

Sources:
- Legumes
- Unripe bananas
- Cooked & cooled pasta, rice, potatoes or wholegrains
- Barley+ products

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**Resistant starch**

- Comes under the FSANZ definition of fibre – but is only partially assessed in measurements of fibre
- CSIRO research investigating the paradox that we are eating more fibre, but not seeing the improvements in gut health we would expect
- Suggests we are eating enough ‘routhage’ but not enough fermentable fibres, especially resistant starch
- CSIRO suggest we need 20g/d

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**Fermentable fibres play key role**

- It encourages growth of healthy bacteria – which has a prebiotic effect
- Helps to maintain the body’s microorganisms throughout the large intestine
- Reduces problems of constipation
- Helps maintain the health of the gut lining
- Helps reduce the risk of some colon cancer cells
Redefining fibre

- A prebiotic has been defined as “a selectively fermented ingredient that allows specific changes, both in the composition and/or activity in the gastrointestinal microflora that confers benefits upon host well-being and health.”

- MACs = Microbiota-Accessible Carbohydrates

- MAC-deprived diet – disruption of gut homeostasis, aggravation of inflammatory diseases including allergies, infections & autoimmune diseases

- Excellent paper to read: Detrimental Impact of Microbiota-Accessible Carbohydrate-Deprived Diet on Gut and Immune Homeostasis: An Overview Frontiers in Immunology 2017; 8:548

Life within

- Collectively, the microbial associates that reside in and on the human body constitute our microbiota

- The genes they encode is known as our microbiome

- Our microbiota are involved in energy harvest, production of nutrients (e.g. Vit K) & produce signalling molecules that interact with our immune system & communicate with our brains

- The products of fermentation, particularly short chain fatty acids, are key for gut cell health with butyrate having a starring role

- Importantly most of these microbes cannot be cultivated in the lab, therefore don’t make it into probiotic supplements

Changes in the microbiota associated with disease

Development of the microbiota

Maternal diet influences microbiota of offspring

- Recent study from Texas 163 mothers recruited in 3rd trimester
- Diet assessed – fat intake varied from 14-55%E
- Microbiome of neonate stool at birth analysed
- Reanalysed at 6 weeks of age
- Depletion of Bacteroides in neonates exposed to maternal high-fat diet – this persisted to 6 weeks of age
- Bacteroides involved in energy extraction from the oligosaccharides in breast milk and in early immune system ‘training’
- Research showing lots of correlations, but not yet causation & conflicting results make it difficult to interpret what the implications are

Current stool tests cannot diagnose

- Poo is big business & they are cashing in – unfortunately stool tests cannot yet diagnose beyond picking up pathogens
- More advanced gene sequencing giving microbiome analysis is terrific for research & advancing our understanding – but is not diagnostic tool
- Dietary & lifestyle interventions remain most important
Effect of low MAC diet

- Decline in overall bacterial diversity
- Promotes growth of mucin-degrading bacteria
  - Mucin-degrading specialists e.g. Akkermansia muciniphila
  - Mucin-degrading generalists e.g. Bacteroides caccae
- Irreversible loss of some bacterial strains – this gets worse over generations
- Decreased epithelial integrity & increased gut permeability – translocation of bacterial products
  - This was shown recently in patients with IBS (Gastroenterology 2017, in press)
- Increased susceptibility to infections
- Specific immune pathways are affected

Diet & fibre intake affects microbiota

- 14 younger kids from Burkina Faso (BF) cf 15 kids from Florence (EU)
- Diet of BF kids largely vegetarian, high in fibre, low in fat & animal protein
- Diet of EU kids was about half the fibre, high in animal protein, sugar, starch & fat

Diet & fibre intake affects microbiota
FODMAPs

- **Fermentable Oligosaccharides, Di-saccharides, Monosaccharides And Polyols**
  - Fructans & galacto-oligosaccharides (GOS)
  - Excess fructose
  - Lactose
  - Sugar polyols e.g. sorbitol & mannitol

- Low FODMAP effective in 7/10 IBS patients, but has potentially unfavourable effects on microbiota
- Not intended as diet for life – concerns over self-diagnosis and application of diet without dietetic help
- Controversies and Recent Developments of the low-FODMAP Diet Gastroenterol Hepatol 2017; 13(1): 36-45

BARLEYmax is superior for fibre
Barley+ Muesli Nutrition Profiles

Barley+ Bars Nutrition Profiles

Barley+ boosts fibre, faecal bulk & butyrate production

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BJN 2008; 99(5):1032-40
Summary: What's good for gut health

- Diet with a variety of different fibres, especially MACs
- Variety diet with plenty of plant foods = diverse microbiota
- Barley range of muesli and bars can significantly boost fibre & fibre diversity
- Plenty of water
- Activity – active body creates active gut
- Stress management
- Normalising gut function vs social etiquette!
  - What's normal in terms of bowel habits & farting