

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

Gender & Age	Adequate Intake (AI) of fibre per day
Boys & girls 1-3 yr	14g
Boys & girls 4-8 yr	18g
Boys 9-13 yr	24g
Girls 9-13 yr	20g
Boys 14-18 yr	28g
Girls 14-18 yr	22g
Adult men	30g
Adult women	25g
Pregnancy 19 yr+	28g
Lactation 19 yr +	30g

NB: No UL set



Australian Dietary Guidelines: Wholegrains

Gender & age	Grain (cereal) foods, mainly wholegrain*
Men	
19-50	6
51-70	6
70+	4 ½
Women	
19-50	6
51-70	4
70+	3
Pregnant	8 ½
Lactating	9



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

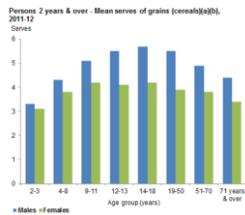
What is a serve?

What is a serve of grain* (cereal) food?
 A standard serve is (500kJ) or:

- 1 slice (10g) bread
- 1/2 medium (40g) roll or flat bread
- 1/2 cup (75-100g) cooked rice, pasta, noodles, barley, buckwheat, amaranth, potatoes, finger or sausage
- 1/2 cup (100g) cooked porridge
- 1/2 cup (50g) wheat cereal flakes
- 1/4 cup (50g) cereal
- 3 (50g) crispbreads
- 1 (80g) crumpet
- 1 small (50g) English muffin or scone

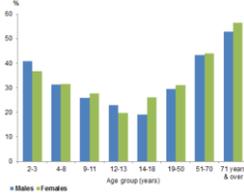


How many grain serves are Australians eating?



What % of grain foods are wholegrain?

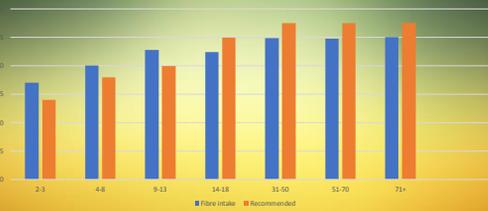
Persons 2 years & over - Proportion of serves, grains (cereals) from wholegrain and high fibre varieties(gb), 2011-12



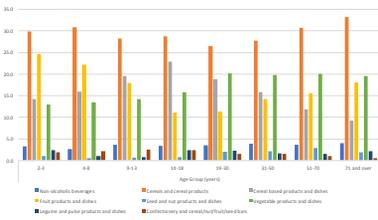
On average 1/3 of grain intake of Australians coming from wholegrains



Fibre intakes 2011-12



Where are we getting our fibre?



ABS data Aus Health Survey 2011-12



Fibre types

Soluble Fibre

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

Sources:
Legumes
Oats & barley
Fruit & veg flesh

Insoluble Fibre

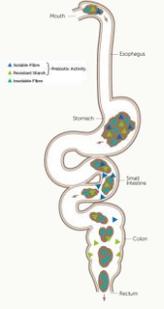
- Bulking agent – efficient laxation agent
- Smaller % are fermentable

Sources:
Wheat bran
Brown rice
Wholemeal breads
Wholegrain cereals

Resistant Starch

- Gold star fuel for colonic bacteria – prebiotic

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



Resistant starch

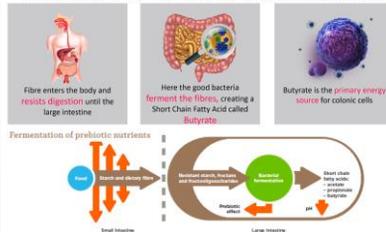
- Comes under the FSANZ definition of fibre – but is only partially assessed in measurements of fibre
- CSIRO research investigating the paradox that we are eating more fibre, but not seeing the improvements in gut health we would expect
- Suggests we are eating enough 'roughage' but not enough fermentable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



Cell Physiol Biochem 2017; 42:306-318

Fermentable fibres play key role

IT ENCOURAGES GROWTH OF HEALTHY BACTERIA – WHICH HAS A PREBIOTIC EFFECT



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

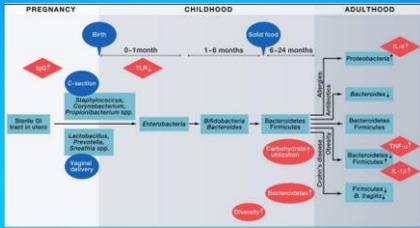
- Collectively, the microbial associates that reside in and on the human body constitute our microbiota
- The genes they encode is known as our microbiome
- Our microbiota are involved in energy harvest, production of nutrients (e.g. Vit K) & produce signalling molecules that interact with our immune 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

Disease	Microbiota Change	Reference
Alzheimer's disease	↓ Lactobacillus, ↓ Clostridium, ↓ Veillonella, ↓ Streptococcus	McGeer et al., 2015
Autism spectrum disorder	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Handberg et al., 2015
Chronic obstructive pulmonary disease	↑ Veillonella, ↑ Streptococcus, ↓ Lactobacillus, ↓ Clostridium	Wong et al., 2015
Depression	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Diabetes	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Heart disease	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Hypertension	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Intestinal inflammation	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Multiple sclerosis	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Obesity	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Parkinson's disease	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Rheumatoid arthritis	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Schizophrenia	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Sickle cell disease	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Spondyloarthritis	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Typhoid fever	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Ulcerative colitis	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015
Yersinia enterocolitica infection	↑ Clostridium, ↑ Veillonella, ↓ Lactobacillus, ↓ Streptococcus	Shankar et al., 2015

Clemente et al. (2012) Cell 148(6) 1258-70

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

Genome Med. 2016; 8:77

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

Frontiers in Immunology 2017, 8:548

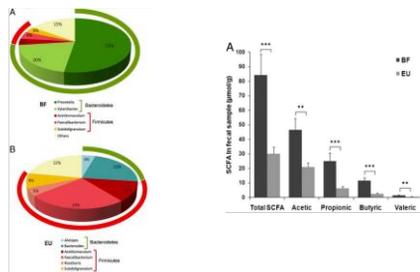
Diet & fibre intake affects microbiota

- 14 younger kids from Burkina Faso (BF) of 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



Proc Natl Acad Sci USA 2010; 107(13): 14691-6

Diet & fibre intake affects microbiota

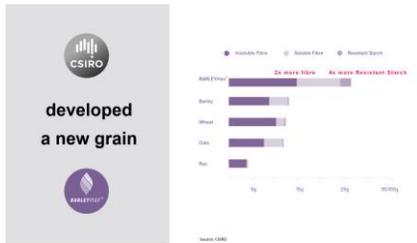


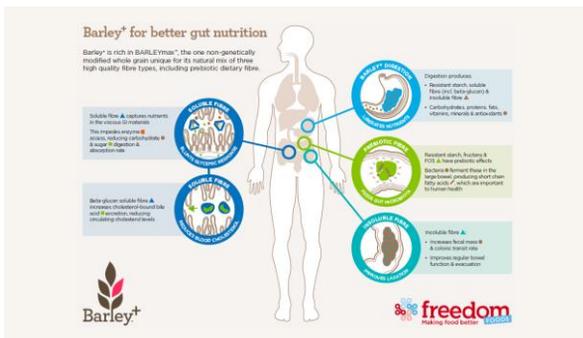
FODMAPs

- 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





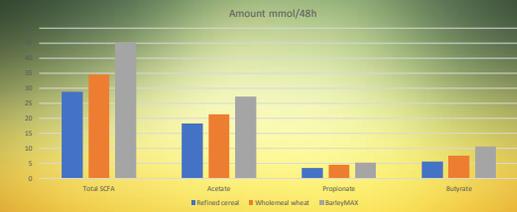
Barley+ Muesli Nutrition Profiles

Barley+ Muesli - Cranberry		Barley+ Muesli - Fruit & Nut		Barley+ Muesli - Pomegranate	
Nutrient	Amount	Nutrient	Amount	Nutrient	Amount
Energy	450 kJ	Energy	450 kJ	Energy	450 kJ
Total Fat	10g	Total Fat	10g	Total Fat	10g
Saturated Fat	0.5g	Saturated Fat	0.5g	Saturated Fat	0.5g
Trans Fat	0g	Trans Fat	0g	Trans Fat	0g
Carbohydrate	75g	Carbohydrate	75g	Carbohydrate	75g
Sugars	15g	Sugars	15g	Sugars	15g
Fibre	10g	Fibre	10g	Fibre	10g
Protein	10g	Protein	10g	Protein	10g

Barley+ Bars Nutrition Profiles

Barley+ Bars - Cranberry		Barley+ Bars - Fruit & Nut		Barley+ Bars - Honey Almond		Barley+ Bars - Peanut Butter	
Nutrient	Amount	Nutrient	Amount	Nutrient	Amount	Nutrient	Amount
Energy	450 kJ	Energy	450 kJ	Energy	450 kJ	Energy	450 kJ
Total Fat	10g	Total Fat	10g	Total Fat	10g	Total Fat	10g
Saturated Fat	0.5g	Saturated Fat	0.5g	Saturated Fat	0.5g	Saturated Fat	0.5g
Trans Fat	0g	Trans Fat	0g	Trans Fat	0g	Trans Fat	0g
Carbohydrate	75g	Carbohydrate	75g	Carbohydrate	75g	Carbohydrate	75g
Sugars	15g	Sugars	15g	Sugars	15g	Sugars	15g
Fibre	10g	Fibre	10g	Fibre	10g	Fibre	10g
Protein	10g	Protein	10g	Protein	10g	Protein	10g

Barley+ boosts fibre, faecal bulk & butyrate production



BAR 2006, 99(5):1032-40

Summary: What's good for gut health

- Diet with a variety of different fibres, especially MACs
 - Varied 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



