MICROBA

Evidence-based dietary approaches for supporting microbiome health during the management of IBS

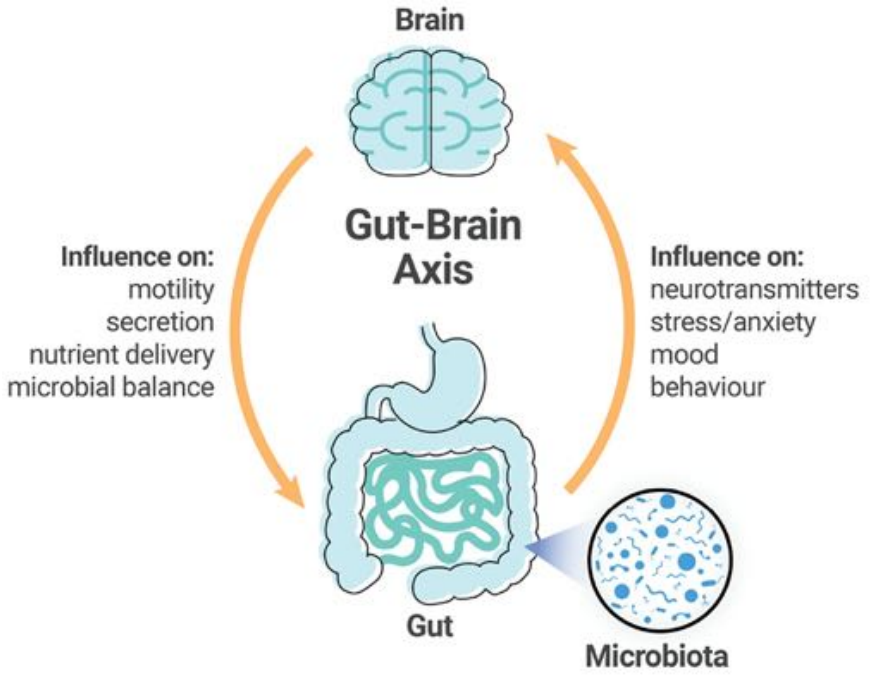
Dr Paula Smith-Brown APD PhD

Around one in five Australians experiences the unpleasant symptoms of IBS at some time.

Gastroenterological Society of Australia

Rome IV Diagnostic Criteria, 2016

Functional GI Disorders re-defined as *Disorders of Gut-Brain Interaction.*

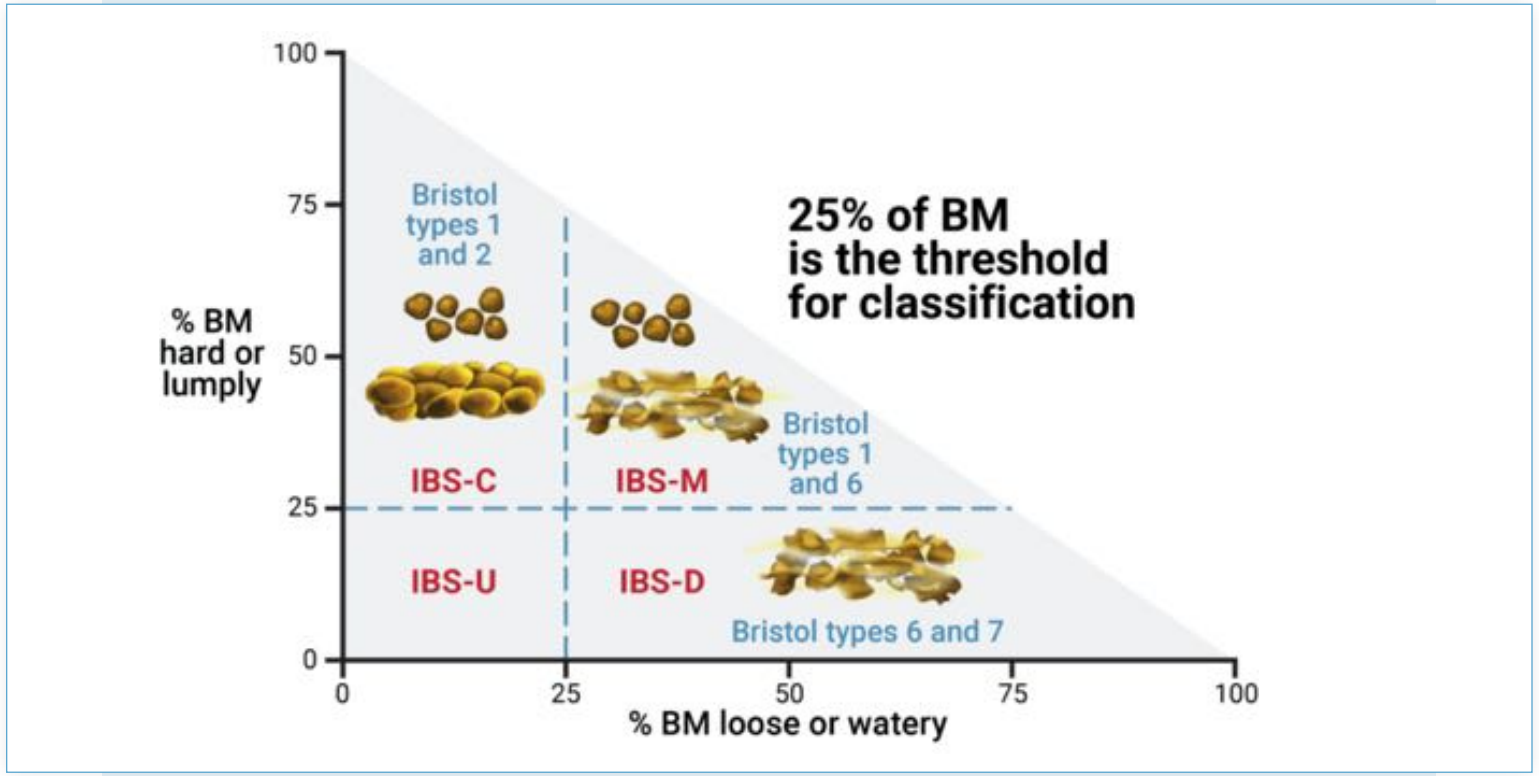


"Symptoms are generated based on a complex interaction among factors such as microbial dysbiosis within the gut, altered mucosal immune function, altered gut signaling (visceral hypersensitivity) and central nervous system dysregulation of the modulation of gut signaling and motor function."

IBS Diagnostic Criteria

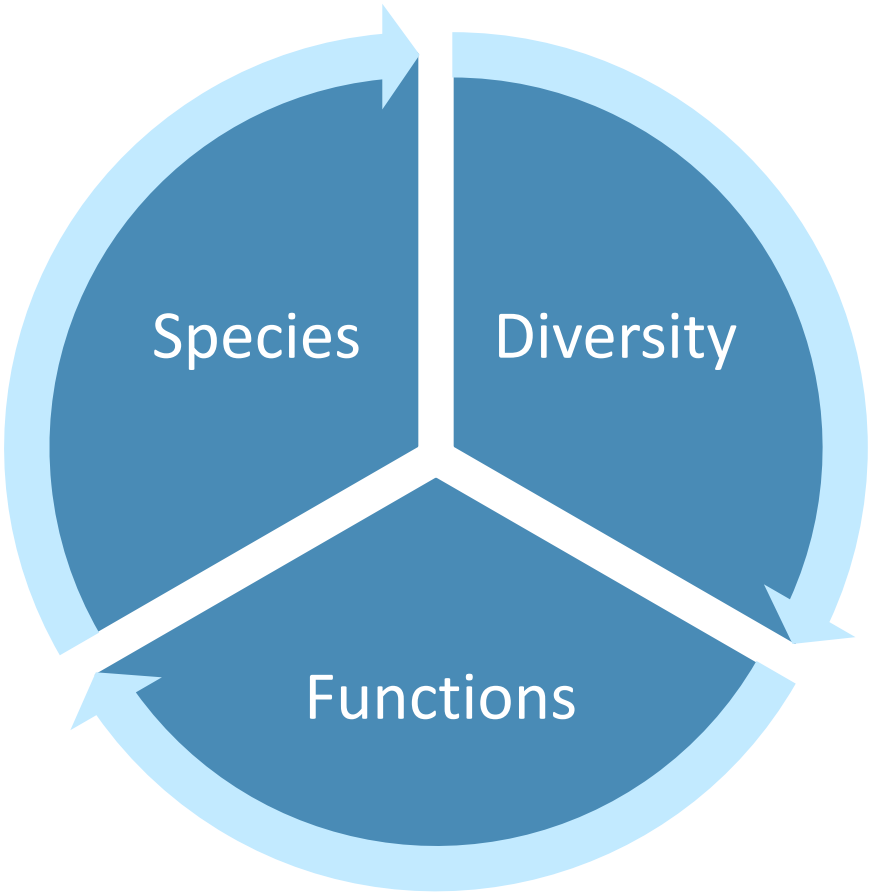
Rome III, 2006	Rome IV, 2016
Recurrent abdominal pain or discomfort ≥ 3 days/month associated with ≥ 2 of the following criteria:	Recurrent abdominal pain on average ≥ 1 day/week, associated with ≥ 2 of the following criteria:
1. Improvement with defecation	1. Related to defecation
2. Onset associated with a change in frequency of stool	2. Associated with a change in frequency of stool
3. Onset associated with a change in form (appearance) of stool	3. Associated with a change in form (appearance) of stool.
Criteria fulfilled for at least 3 months with symptom onset at least 6 months prior to diagnosis	

IBS subtypes exist on a spectrum



Lacy *et al*. 2016 Gastroenterology:150:1393–1407

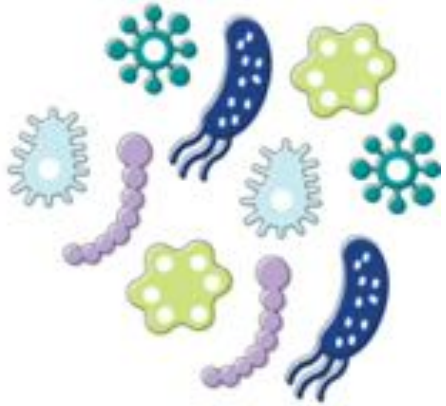
Microbial dysbiosis



Microbial Diversity

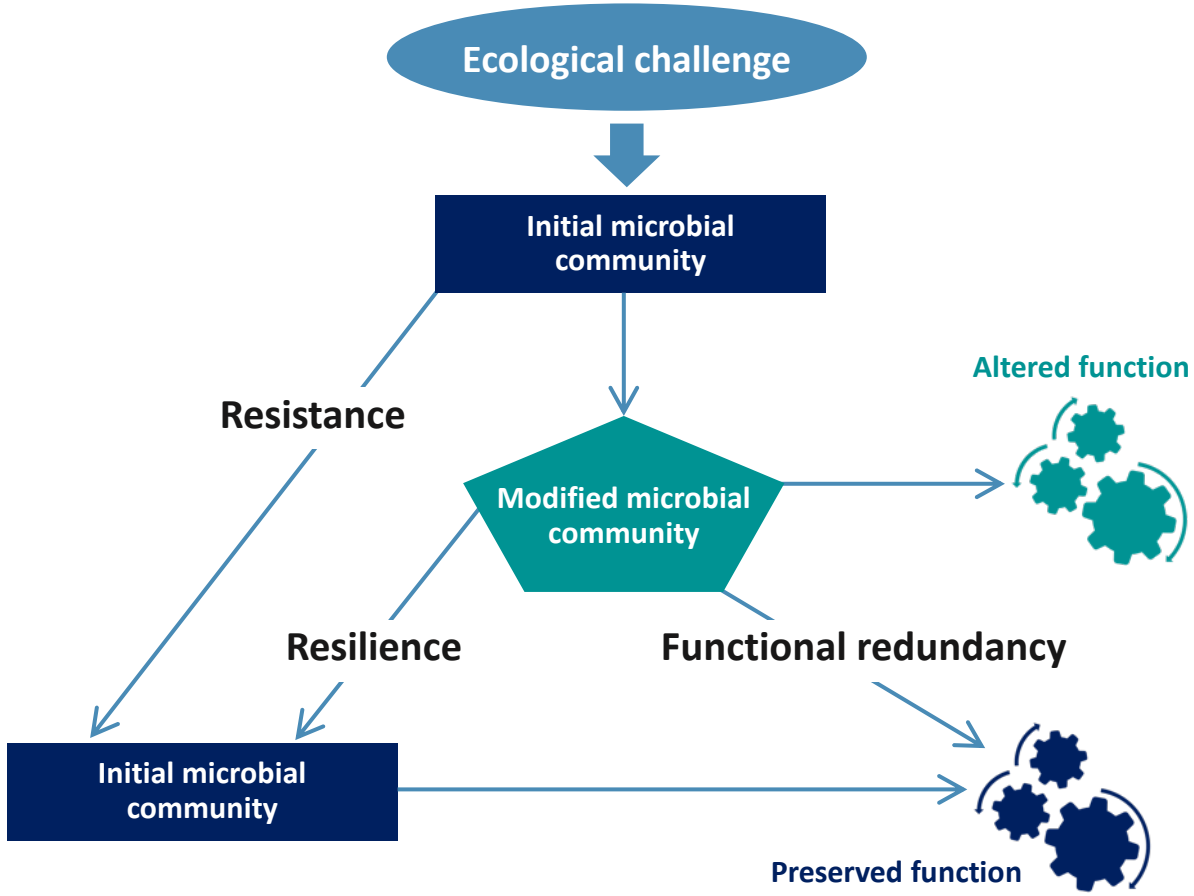
LOW DIVERSITY:
Low richness
High evenness

LOW DIVERSITY:
High richness
Low evenness



HIGH DIVERSITY:
High richness
High evenness

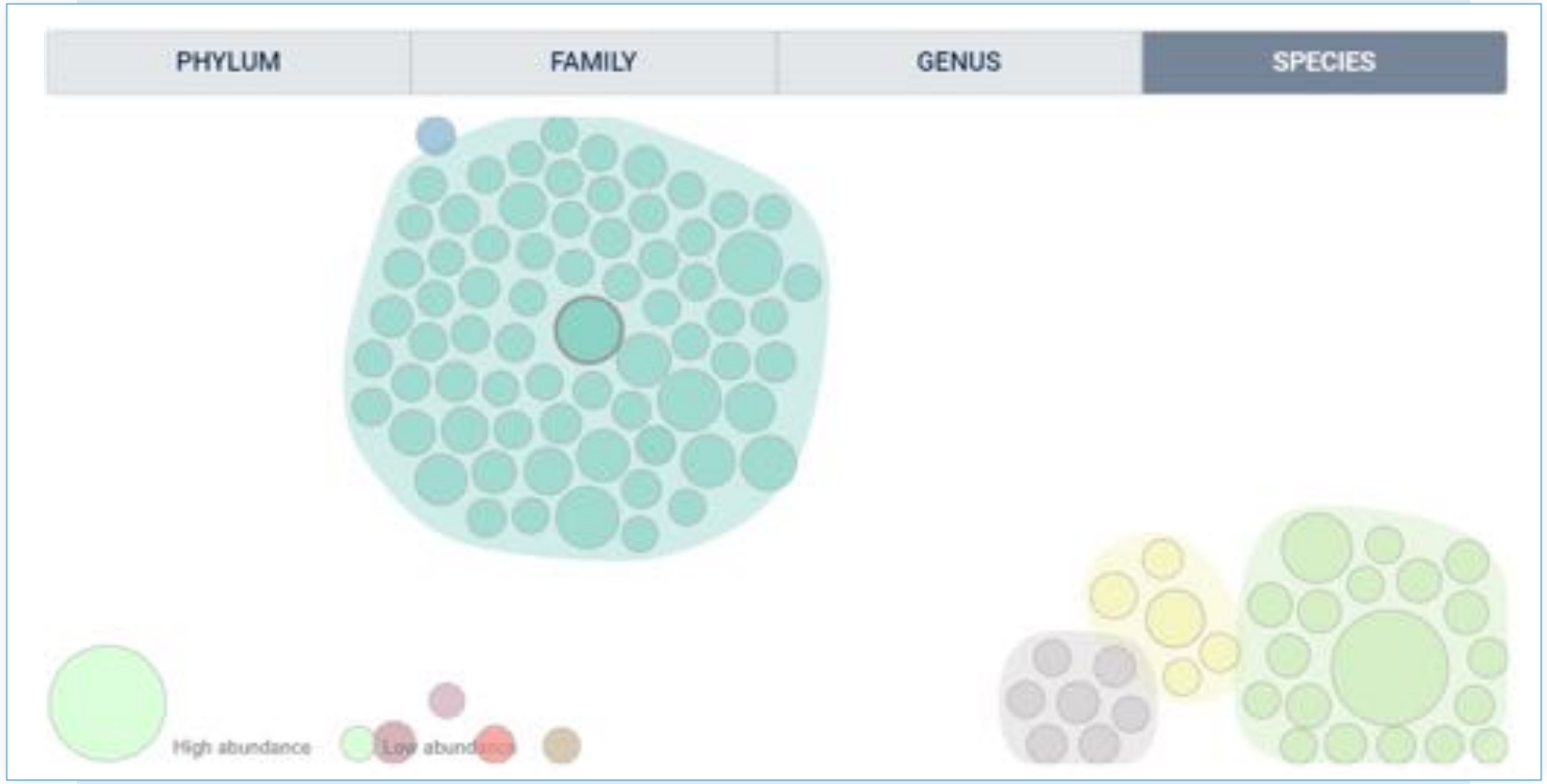
Why diversity matters?



Diversity

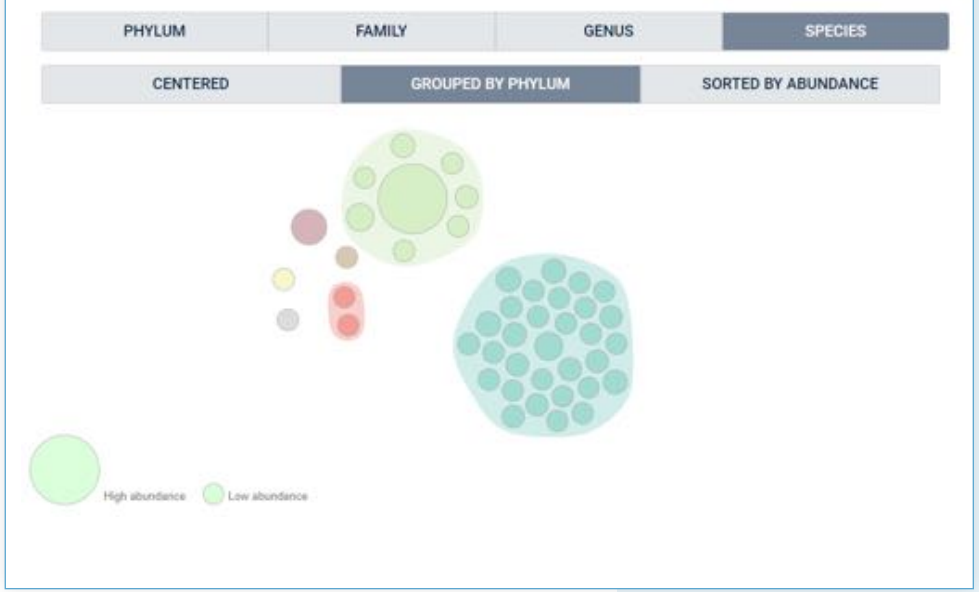

Your diversity level
LOW
AVERAGE
HIGH
You
The diversity of your gut microbiome is important, Paula. Microbial diversity is a measure of both the different types and the amount of bacterial species in your sample. A varied diet rich in plant-based foods such as fruits, vegetables, whole grains and nuts is associated with increased microbial diversity. Low microbial diversity is often associated with poor health.

Your microbiome profile (species)

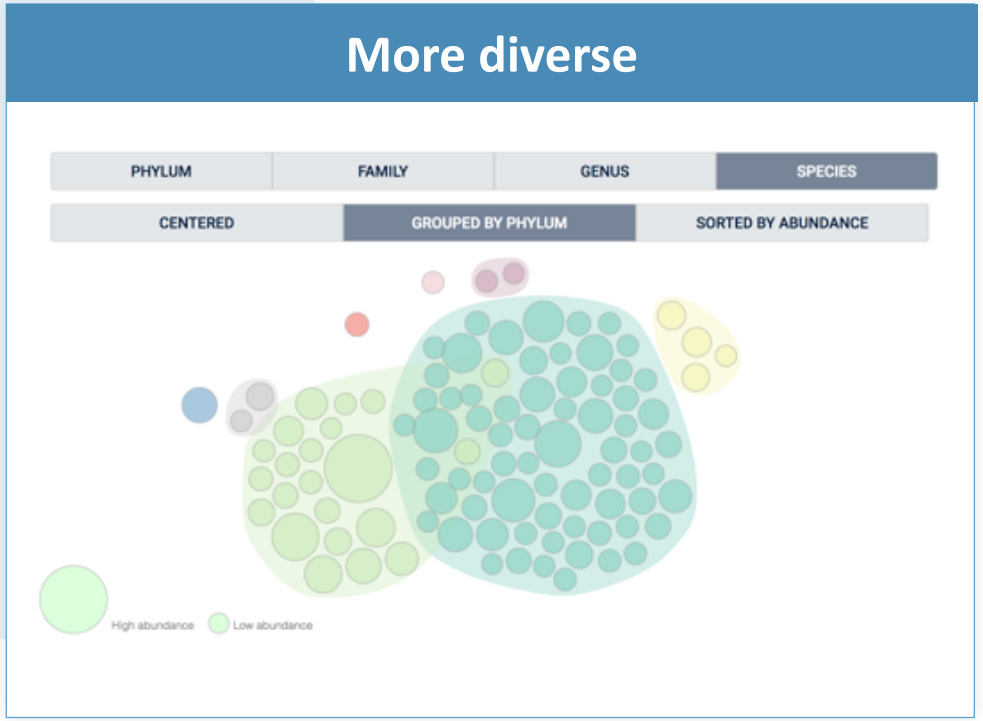


Your microbiome profile (comparison)

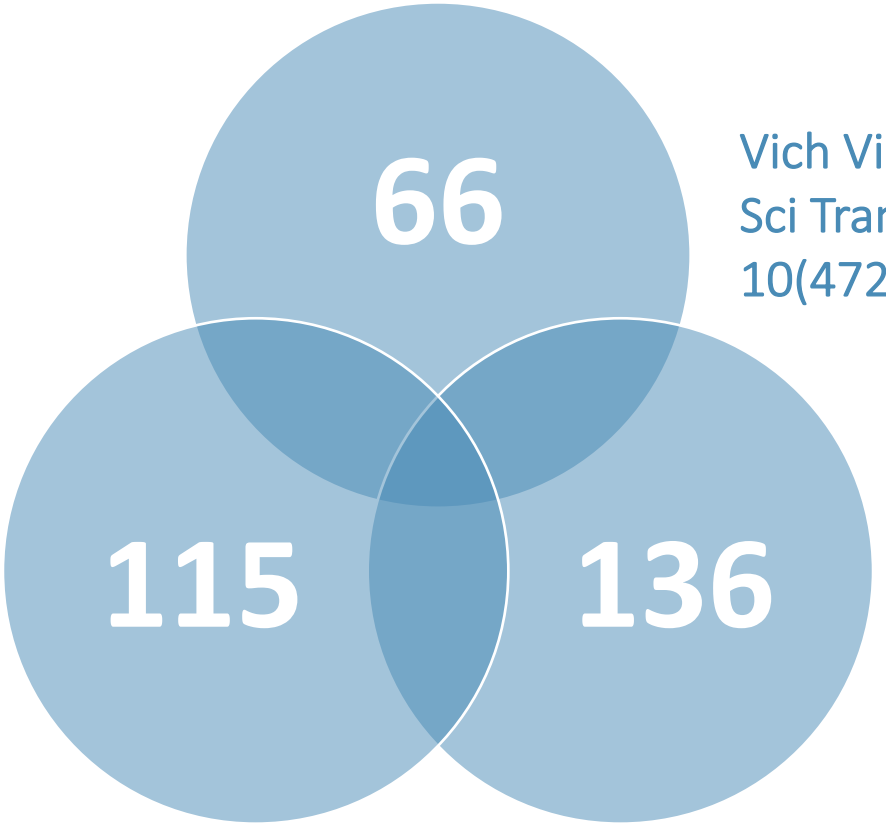
Less diverse



More diverse



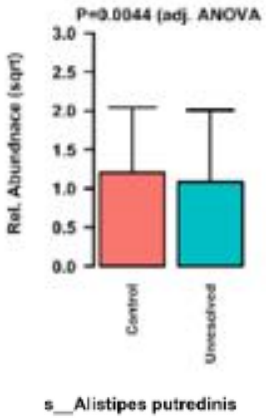
Differentially abundance species in IBS



Vich Vila *et al,* 2018.
Sci Transl Med.
10(472): eaap8914

Microba Data

Jeffery *et al,* 2020
Gastroenterology.
158(4): 1016-1028



Ruminococcus gnavus

Eggerthella lenta

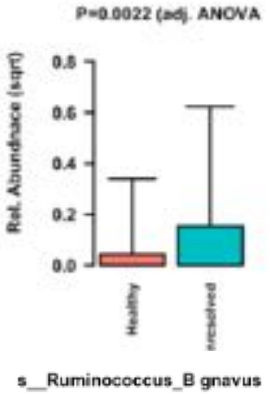
Eubacterium sp 31_1_31

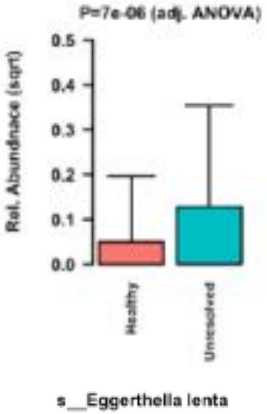
Alistipes senegalensis

Alistipes putredinis

Lachnospira eligens

Odoribacter splanchnicus





Your Microbiome Profile

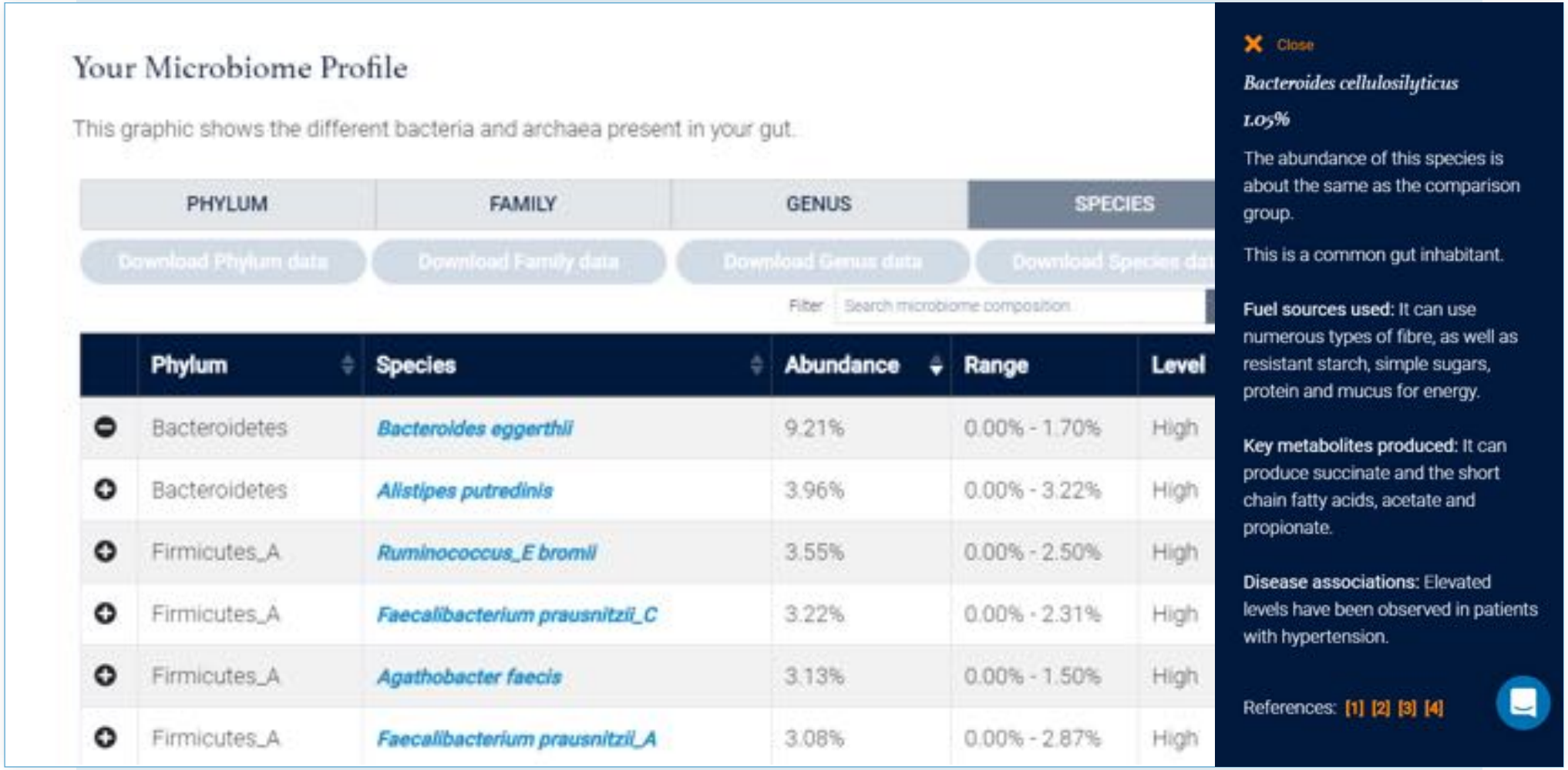
This graphic shows the different bacteria and archaea present in your gut.

PHYLUM | FAMILY | GENUS | SPECIES

Download Phylum data | Download Family data | Download Genus data | Download Species data

Filter: Search microbiome composition | Clear

	Phylum	Species	Abundance	Range	Level
⊖	Bacteroidetes	*Bacteroides eggerthii*	9.21%	0.00% - 1.70%	High
⊕	Bacteroidetes	*Alistipes putredinis*	3.96%	0.00% - 3.22%	High
⊕	Firmicutes_A	*Ruminococcus_E bromii*	3.55%	0.00% - 2.50%	High
⊕	Firmicutes_A	*Faecalibacterium prausnitzii_C*	3.22%	0.00% - 2.31%	High
⊕	Firmicutes_A	*Agathobacter faecis*	3.13%	0.00% - 1.50%	High
⊕	Firmicutes_A	*Faecalibacterium prausnitzii_A*	3.08%	0.00% - 2.87%	High


Your Microbiome Profile
This graphic shows the different bacteria and archaea present in your gut.
PHYLUM
FAMILY
GENUS
SPECIES
Download Phylum data
Download Family data
Download Genus data
Filter
Search microbiome composition
Phylum
Species
Abundance
Range
Level
Bacteroidetes
Bacteroides eggerthii
9.21%
0.00% - 1.70%
High
Bacteroidetes
Alistipes putredinis
3.96%
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3.22%
0.00% - 2.31%
High
Firmicutes_A
Agathobacter faecis
3.13%
0.00% - 1.50%
High
Firmicutes_A
Faecalibacterium prausnitzii_A
3.08%
0.00% - 2.87%
High
Close
Bacteroides cellulosilyticus
1.05%
The abundance of this species is about the same as the comparison group.
This is a common gut inhabitant.
Fuel sources used: It can use numerous types of fibre, as well as resistant starch, simple sugars, protein and mucus for energy.
Key metabolites produced: It can produce succinate and the short chain fatty acids, acetate and propionate.
Disease associations: Elevated levels have been observed in patients with hypertension.
References: [1] [2] [3] [4]

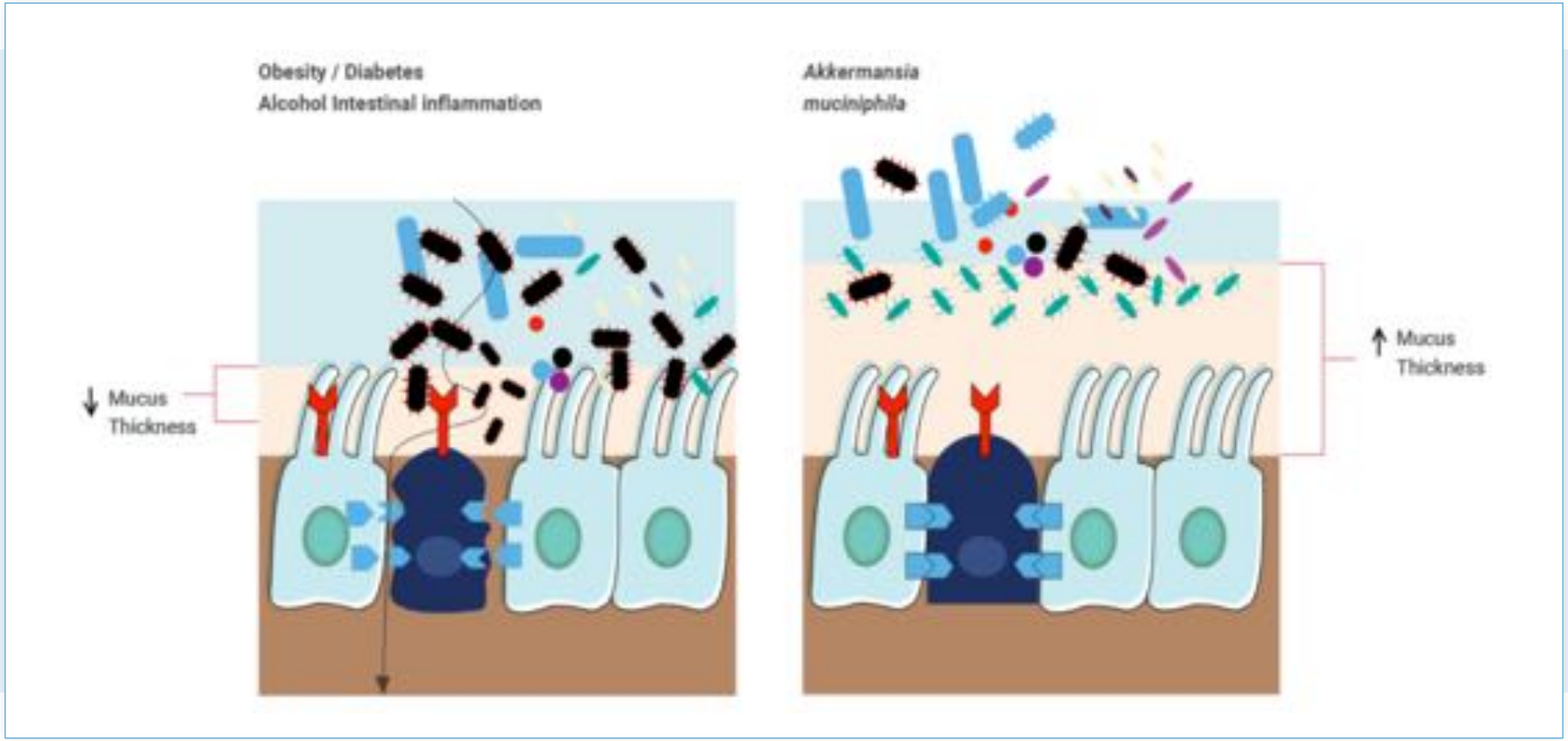
Methane associated with IBS-C

Slows intestinal transit time [1,2] = **↓ Gut motility**

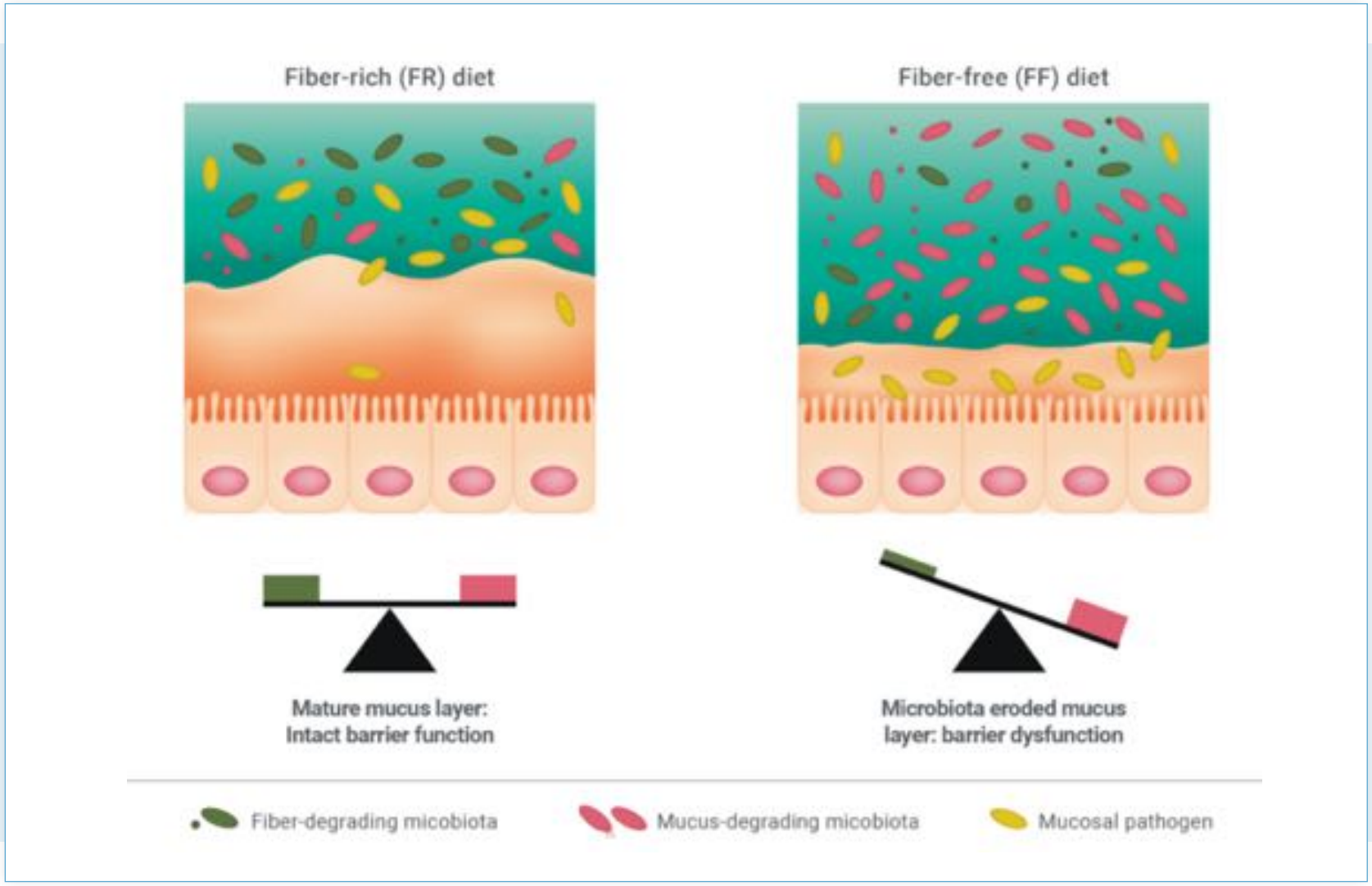
Associated with[3] = **Constipation, IBS-C**

1.Triantafyllou, K. *et al.* J Neurogastroenterol Motil. 20, 31-40. (2014).
2.Pimentel, M. *et al.* Am J Physiol Gastrointest Liver Physiol 290, G1089-1095. (2006).
3.Kunkel, D. *et al.* Dig Dis Sci. 56,1612-1618. (2011).

Akkermansia muciniphila regulates mucus barrier



Microbiome Functional Potential is more important than species composition


Fiber-rich (FR) diet
Fiber-free (FF) diet
Mature mucus layer:
Intact barrier function
Microbiota eroded mucus
layer: barrier dysfunction
Fiber-degrading micobiota
Mucus-degrading micobiota
Mucosal pathogen

Fibre and Protein Digestion Potential

Your gut microbiome's ability to break down fibre

This is a good level! Your potential to break down fibre is similar to the healthy group in this sample. This is an important gut microbiome function to maintain because it results in the production of beneficial substances that promote good gut health. To ensure the production of these beneficial compounds ensure your diet contains plenty of fibre.

A **This sample reported a level higher than the healthy group**

Fibre-degrading bacteria are responsible for producing important by-products such as short chain fatty acids which play a critical role in keeping your gut healthy. Specific prebiotic fibres—detailed in your food suggestions—will promote the growth of your beneficial, fibre-degrading bacteria. A similar or high proportion of species that can break down fibre compared to the healthy group is considered beneficial.

Take a deeper look at the detail associated with this insight here +

Your gut microbiome's ability to break down protein

This is not a good level. The proportion of bacteria present in your sample that can break down protein is at a high level, which is not ideal. When protein is broken down by bacteria in the gut microbiome it can lead to the production of substances that promote inflammation. To balance this function, try increasing your consumption of complex fibres such as resistant starch.

A **This sample reported a level higher than the healthy group**

Everyone's microbiome contains species that can break down protein into a variety of compounds, including some compounds that promote inflammation. Having a high proportion of these species may reflect an insufficient amount of fibre in the diet or an excessive intake of protein. A high proportion of protein-degrading bacteria suggests that not enough fibre is reaching the lower colon to feed the bacteria that specialise in eating fibre.

Take a deeper look at the detail associated with this insight here +

Microbiome Digestion Potential

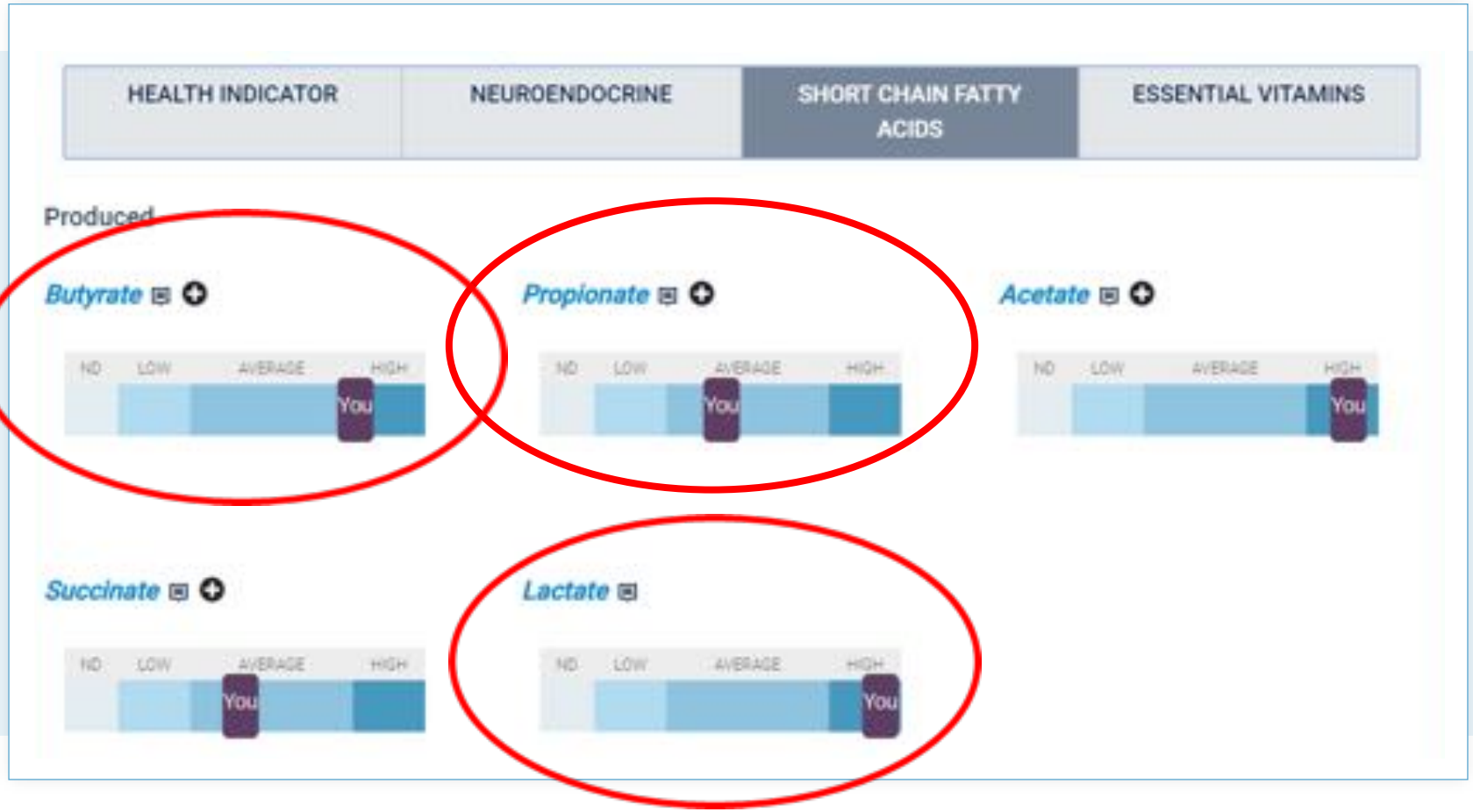
Below we show the proportion of species in your gut microbiome that can break down macronutrients, which include fibre, protein, simple sugars and fat. After you eat a meal, food gets broken down in your stomach and travels to your small intestine, where most nutrients are absorbed. The food components that cannot be absorbed in the small intestine, such as fibre and excess protein, make their way to your large intestine where your gut microbiota transform these components into a variety of products called metabolites. These metabolites can play an important role in your health.Read more about each of the macronutrients and their metabolites on each of the tabs below.

Compared with Healthy Group (default)

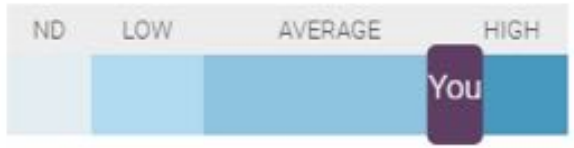
FAT	FIBRE	PROTEIN	SUGAR

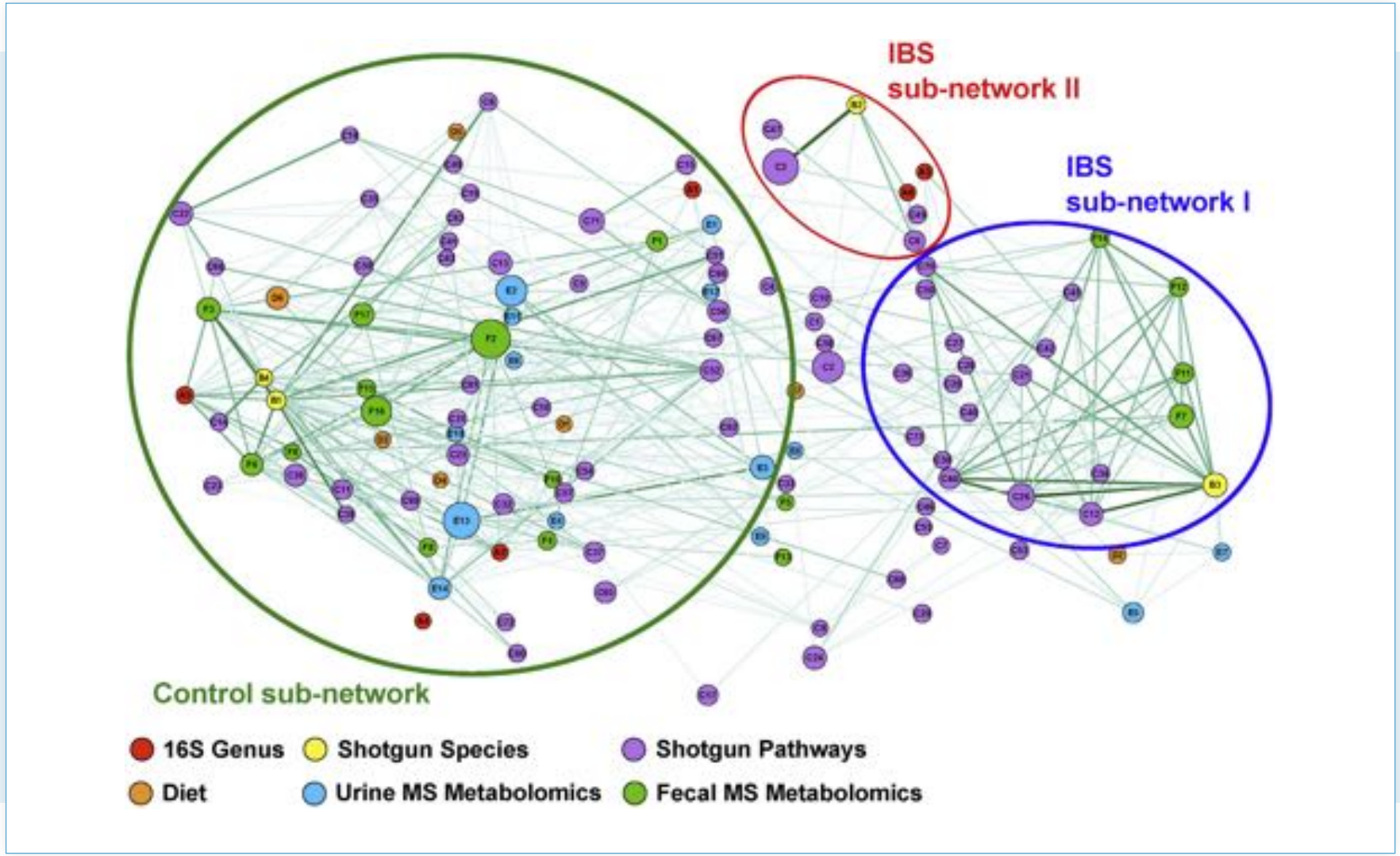
This scale indicates the proportion of species in your gut microbiome that can break down fibre. If you have a low proportion, consider adding more fibre to your diet to improve your gut health. Fibre is the main energy source of gut bacteria, who break it down into beneficial metabolites such as short chain fatty acids and B vitamins. Short chain fatty acids such as butyrate play an important role in keeping us healthy, and is one of the reasons fibre is an important component of a healthy diet.

Reduced SCFA production

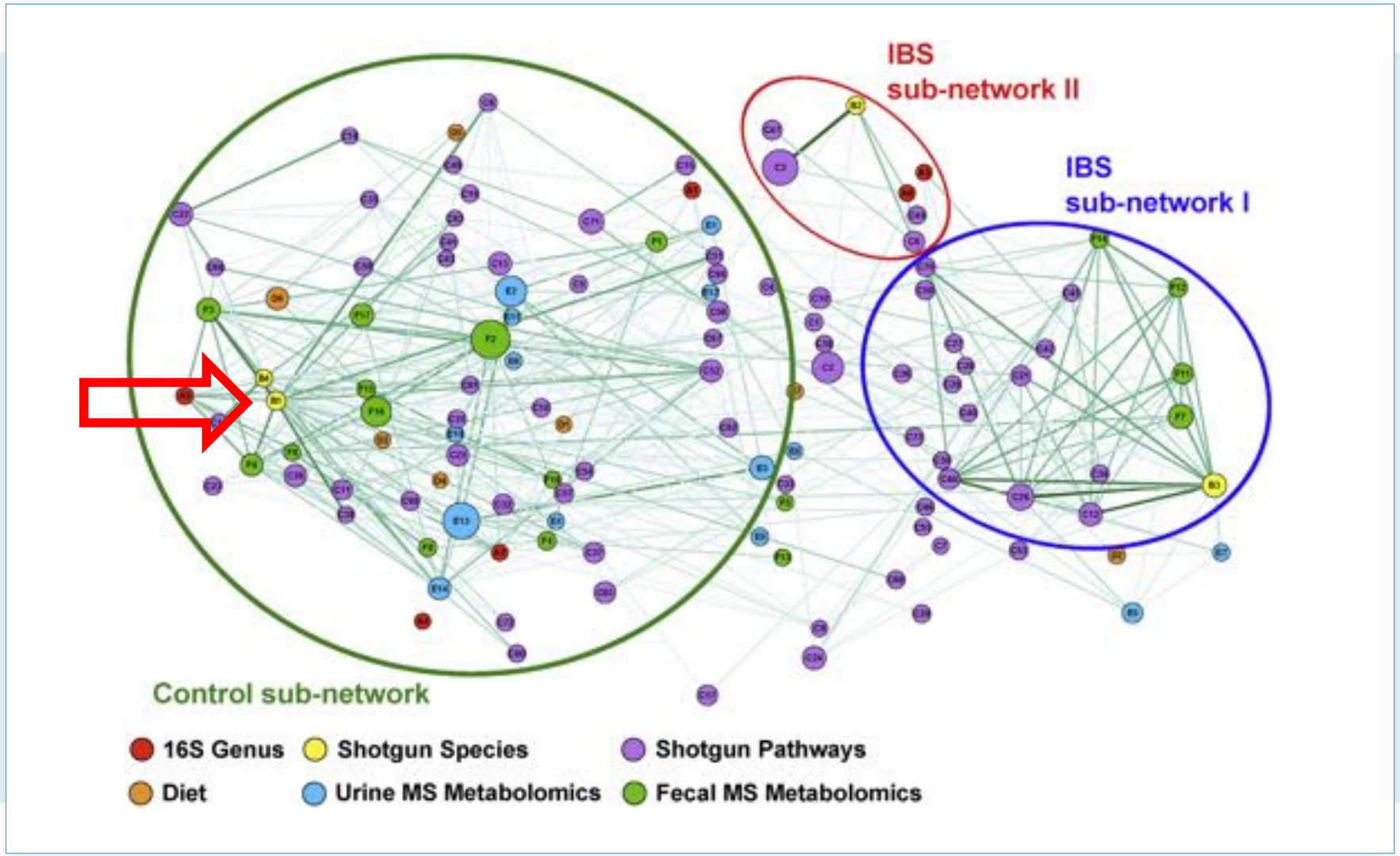


Branched chain amino acids





Jeffery *et al*, 2020 Gastroenterology. 158(4): 1016-1028



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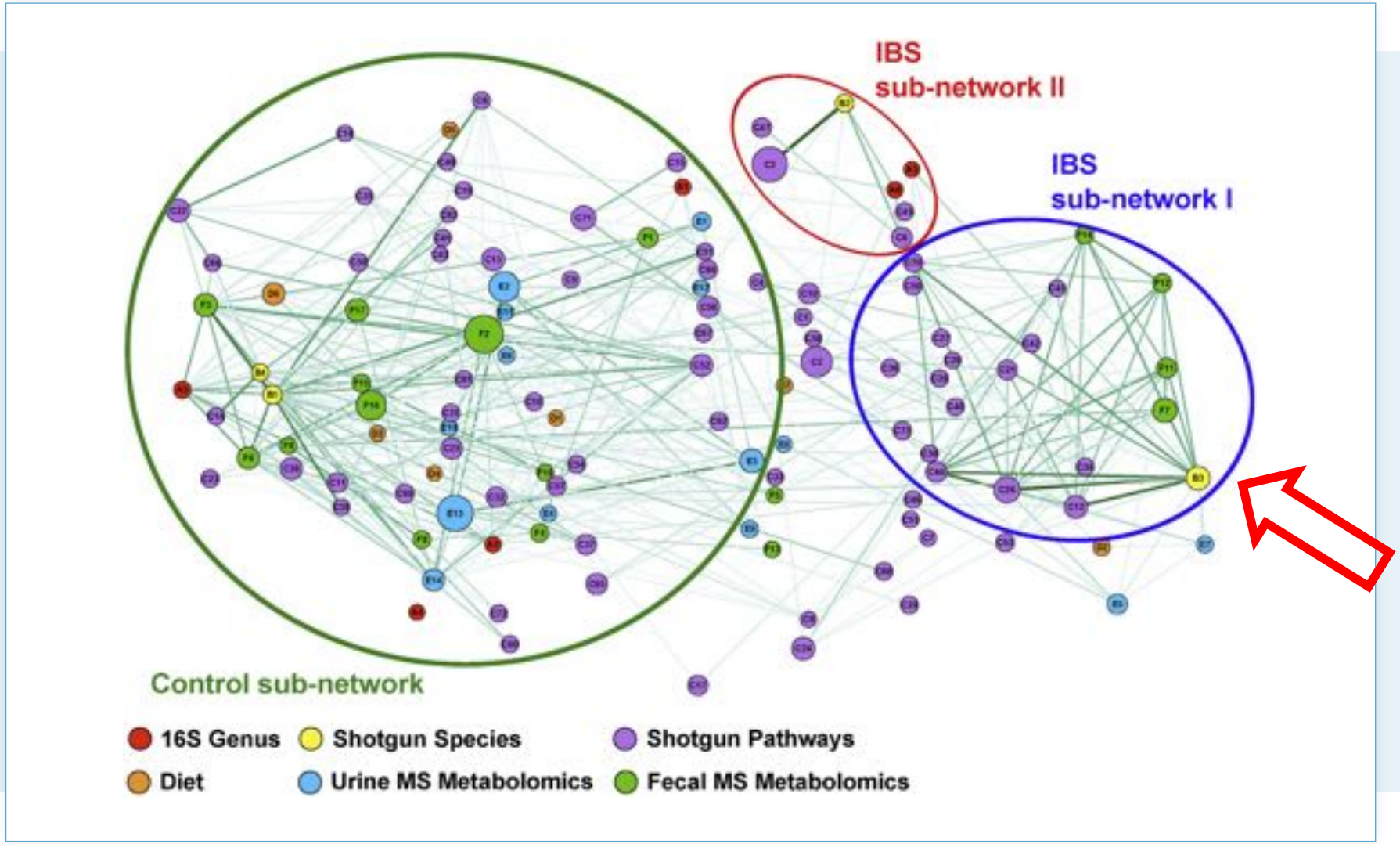
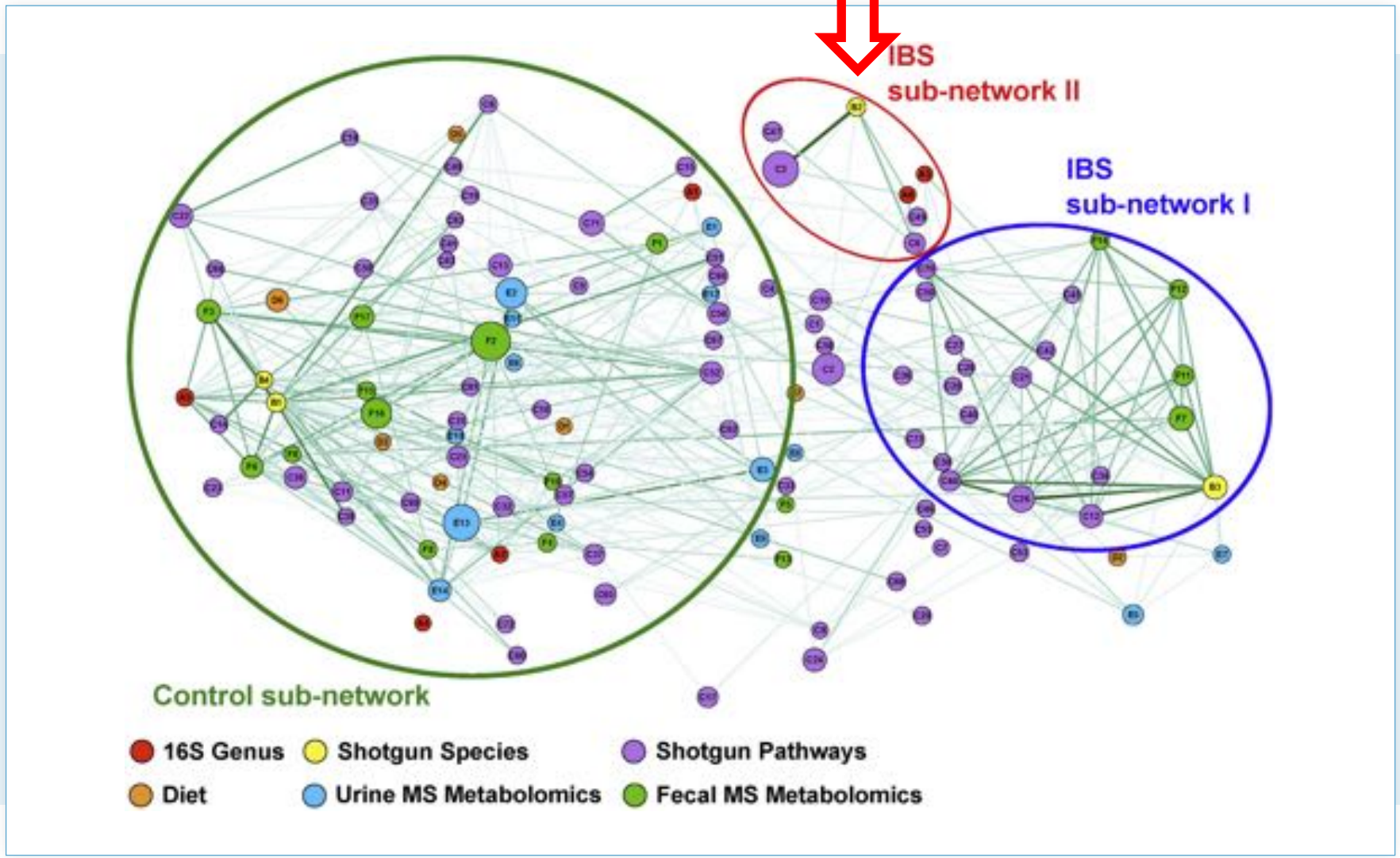


Jeffery *et al*, 2020 Gastroenterology. 158(4): 1016-1028

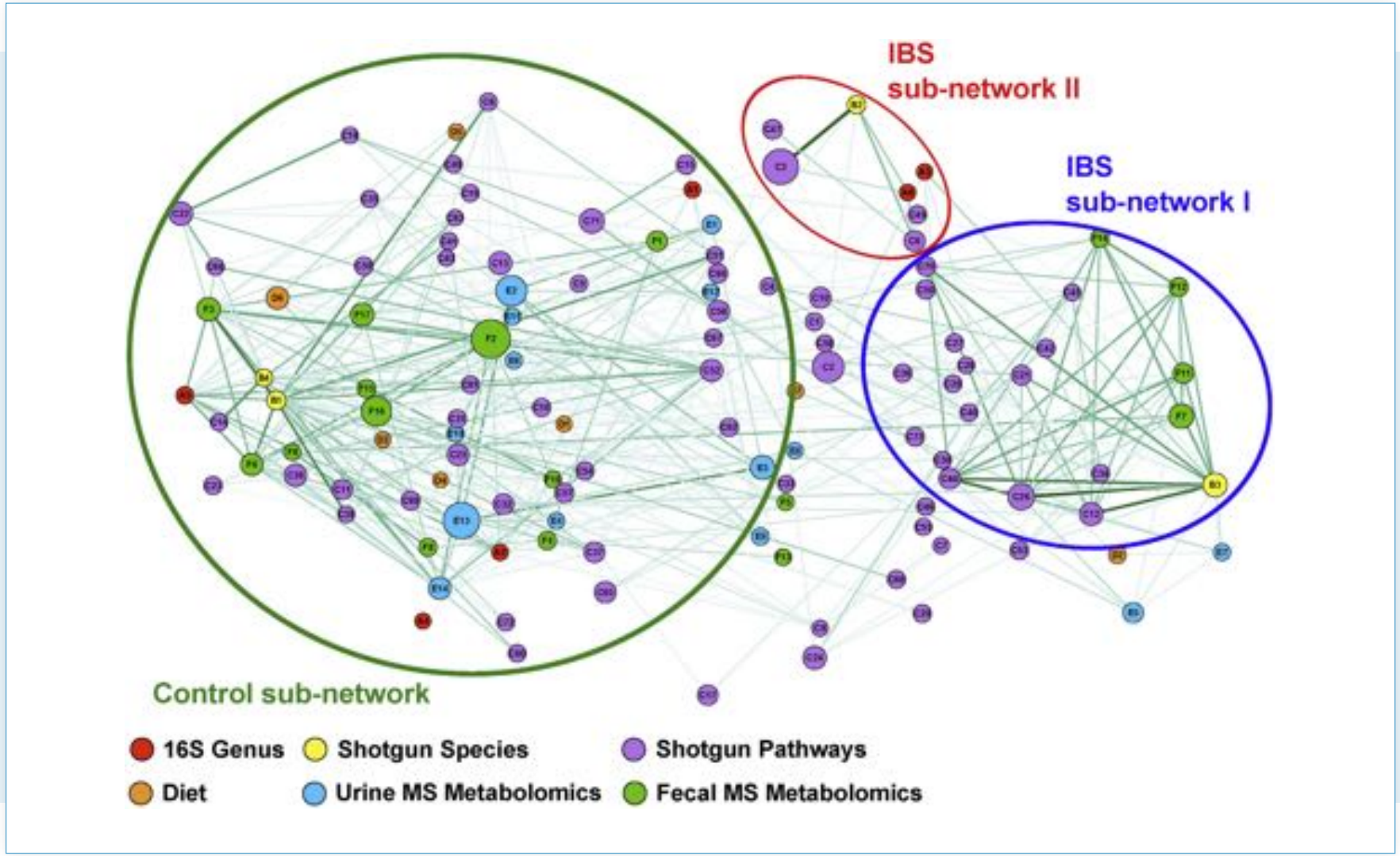


Jeffery *et al*, 2020 Gastroenterology. 158(4): 1016-1028

The main structure in control subnetwork represents covariation of microbiome with diet.

IBS patients ate less

- Vegetables – leeks, onions, garlic, spinach, beetroot, brussel sprouts, zucchini
- Fruit – blueberries, tomatoes
- Legumes – dried legumes, beans, peas
- Wine
- Coffee
- Cornflakes, Rice Krispies
- Salad dressing



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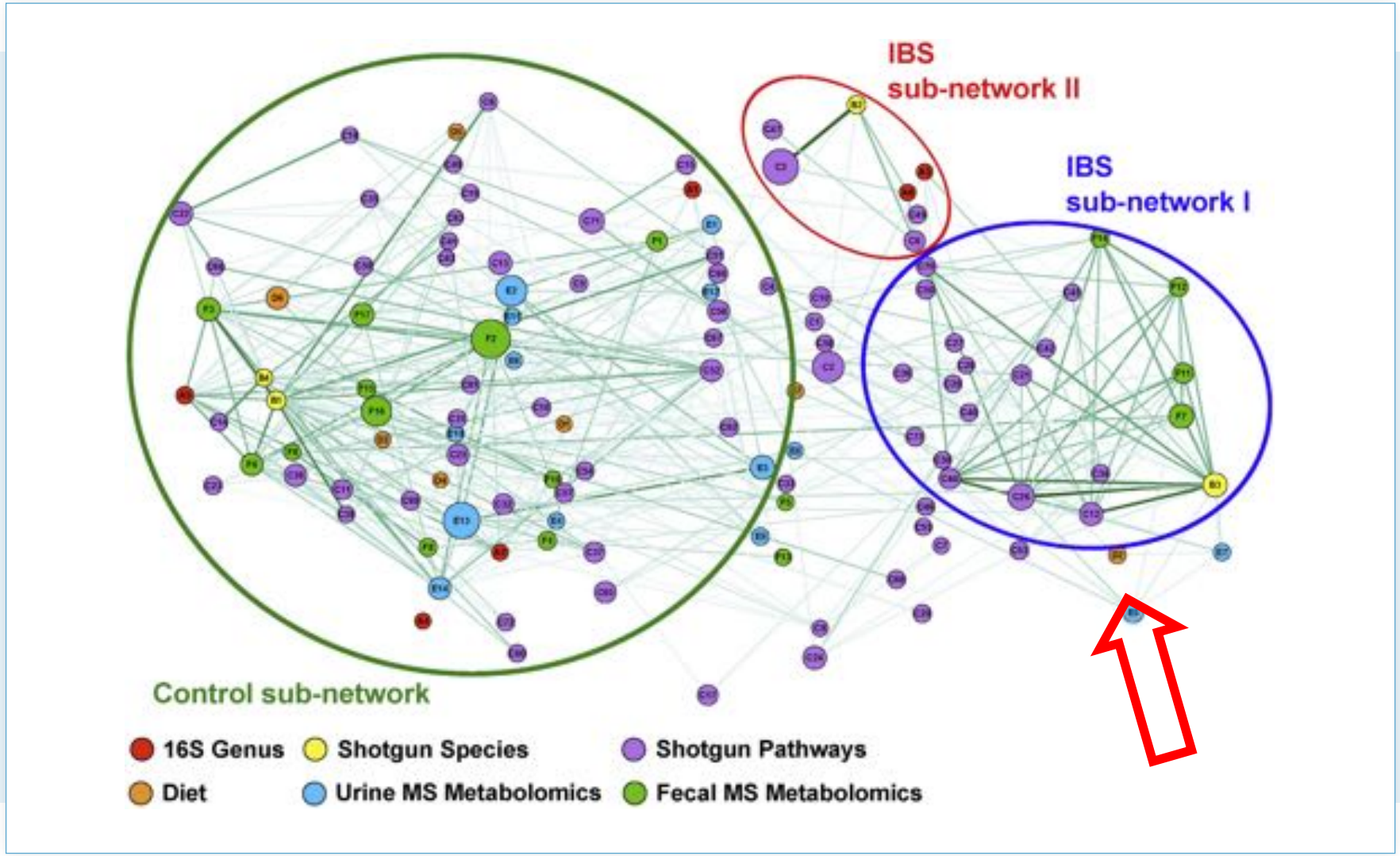
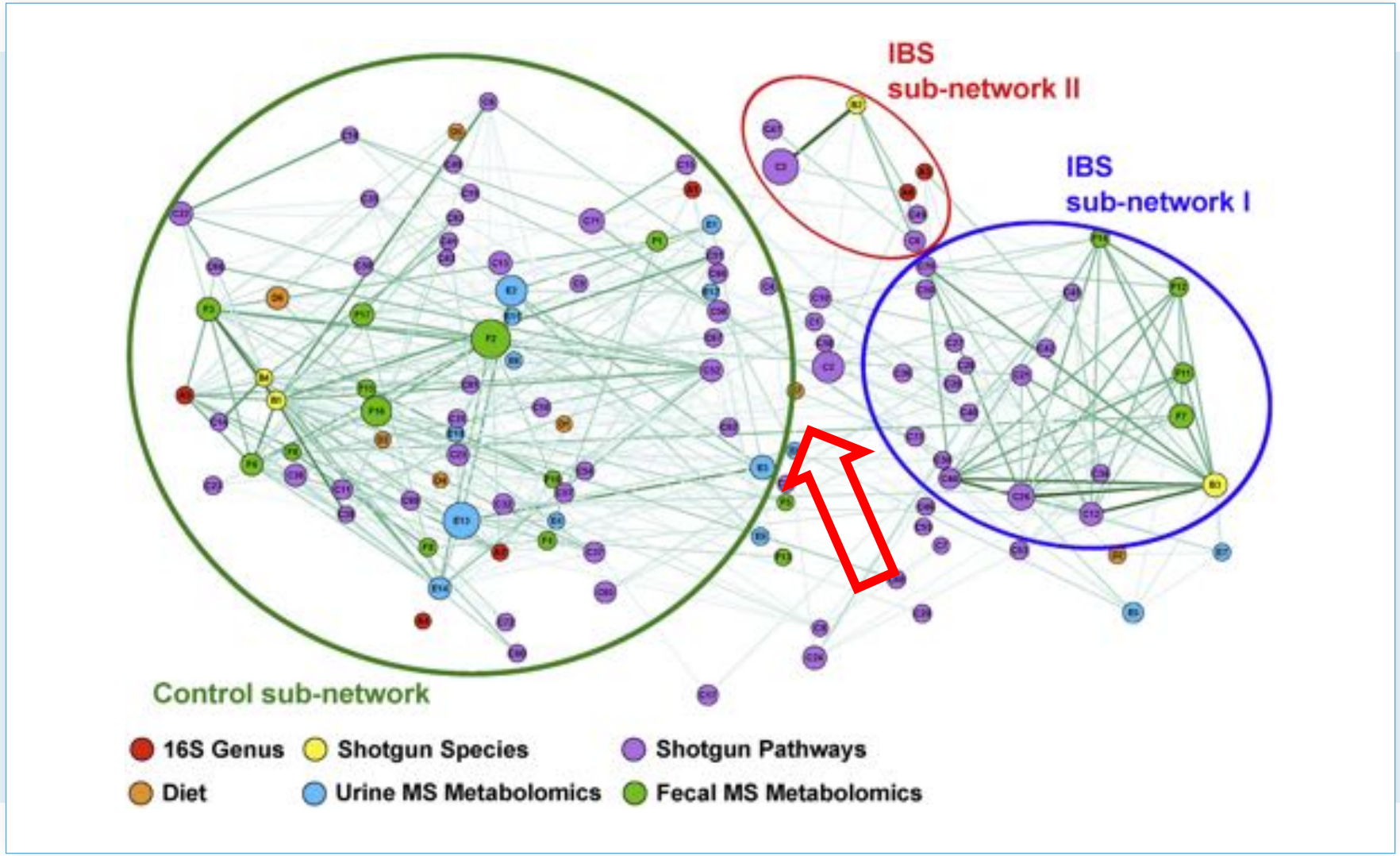


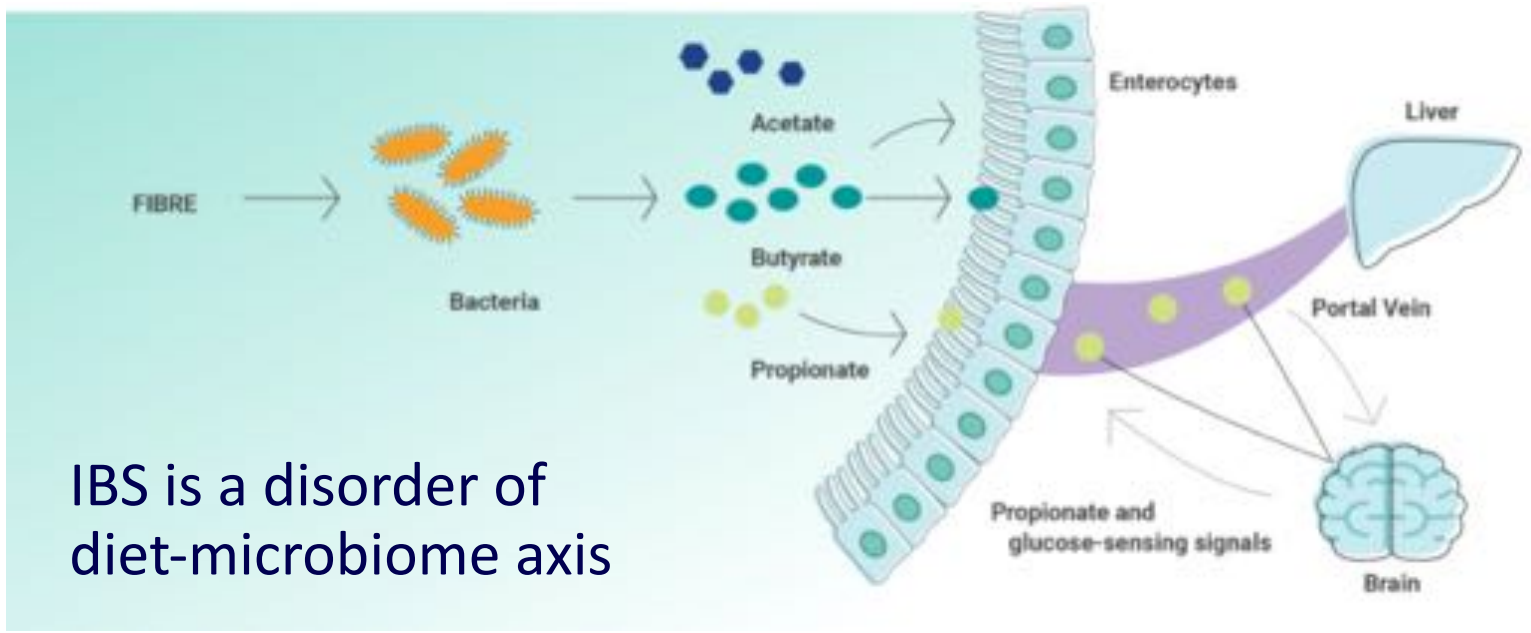
Jeffery *et al*, 2020 Gastroenterology. 158(4): 1016-1028

D2	Sugar added to tea coffee, cereals (teaspoons)
D2	Boiled, instant or jacket potatoes
D2	White bread and rolls (including ciabatta & pannini)
D2	Chocolates, singles or squares
D2	Chocolate coated sweet biscuits e.g. digestive (one)
D2	Mashed potatoes
D2	Plain biscuit e.g. marietta, digestives, rich tea (one)
D2	High fibre (All Bran/flakes, Weetabix, Shredded wheat)
D2	Chips / Roast potatoes
D2	Sweets, toffees, mints
D2	Crisps or other packet snacks
D2	Fruit squash (small glass)
D2	Cornflakes, Rice Krispies
D2	Breaded chicken, chicken nuggets, chicken burger
D2	Ice cream, choc ices, frozen desserts
D2	Fizzy Soft drinks e.g. (Coca Cola - Glass)
D2	Takeaway (specify)
D2	Sugar-coated cereals (e.g. Frosties, Crunchy nut cornflakes)



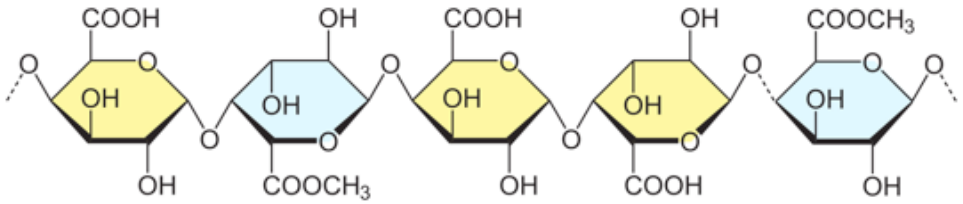
Jeffery *et al*, 2020 Gastroenterology. 158(4): 1016-1028

D7	Chicken or other poultry e.g. turkey: roast
D7	Sugar substitute e.g. canderel (teaspoon)
D7	Low calorie or diet soft fizzy drink (glass)
D7	Sauces e.g. white, cheese, gravy (tablespoon)
D7	Bacon / Ham
D7	Processed meat (Corned beef, Luncheon meats, sausages)
D7	Beef (roast / steak)
D7	Beef burger (1 burger)
D7	Beef: stew
D7	Pork (roast / chops / escalopes)
D7	Lamb (roast / chops / stew)



IBS is a disorder of diet-microbiome axis

Pectin



Although short chain highly fermentable prebiotic supplements should be restricted to avoid the risk of a rapid increase in gas, bloating/distension, and abdominal pain/discomfort, the consumption of long-chain or complex, soluble and more slowly fermentable, butyrate producing fibers, such as fruit pectin may have a role in helping to control IBS symptoms.

Dreher, 2018. Nutrients, 10, 1833; doi:10.3390/nu10121833

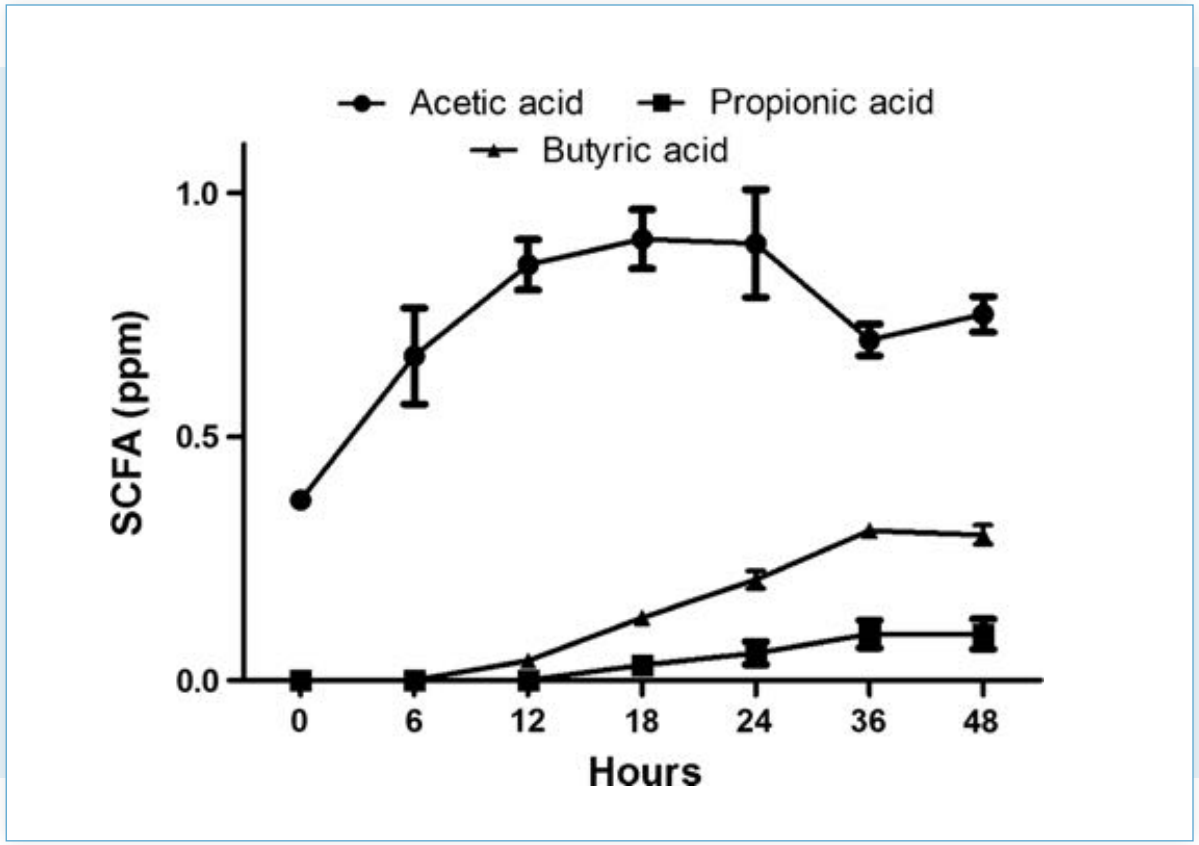
Pectin

2–3 servings/day of low FODMAP fruits
or 5–10 g/day fruit fiber
may help to reduce IBS risk or prevent IBS flare-up

Allow 2–3 h between each fruit serving to avoid over-loading the gastrointestinal system and to confirm the effectiveness of any specific fruit

Dreher, 2018. Nutrients, 10, 1833; doi:10.3390/nu10121833

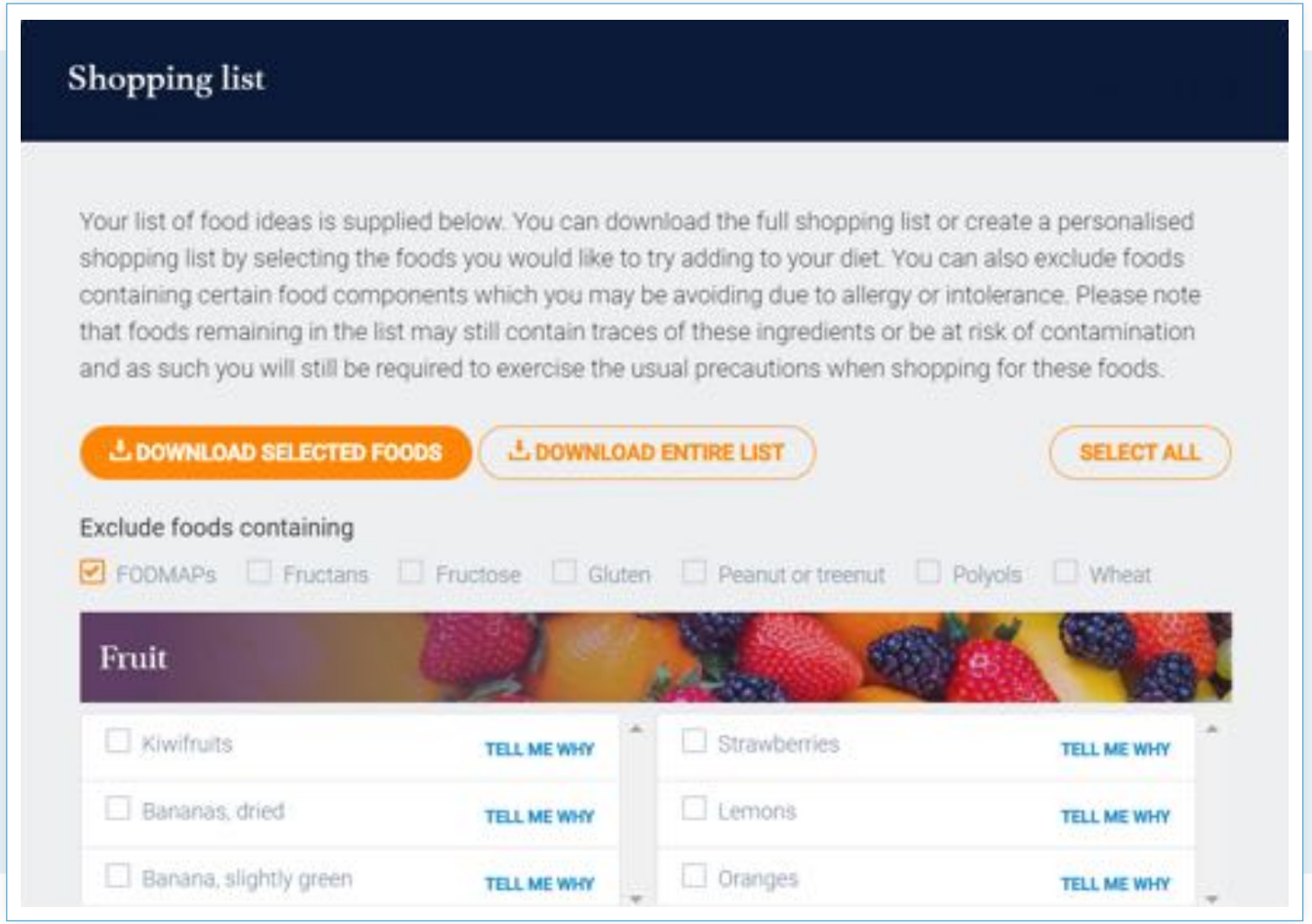
Pectin promotes Acetate and Butyrate production



Bang *et al.* AMB Expr (2018) 8:98

	FODMAP serve	Fibre/ Serve	Pectin/ Serve	Pectin %
Guavas	180	9.7	2.7	27.8
Kiwis	150	4.5	1.1	23.3
Raspberries	60	3.9	1.0	24.6
Plantains	145	3.2	0.6	18.2
Oranges	130	3.1	1.0	33.3
Strawberries	150	3.0	1.1	35.0
Pomegranate	45	2.6	0.9	35.1
Dried figs	20	2.4	0.9	35.8
Papayas	140	2.4	0.7	29.4
Avocado	30	2.0	0.7	35.3
Pineapples	140	2.0	0.7	35.7

Dreher, 2018. Nutrients, 10, 1833; doi:10.3390/nu10121833
Monash University FODMAP Diet App. Version 3.0.4. Acessed 4.4.20

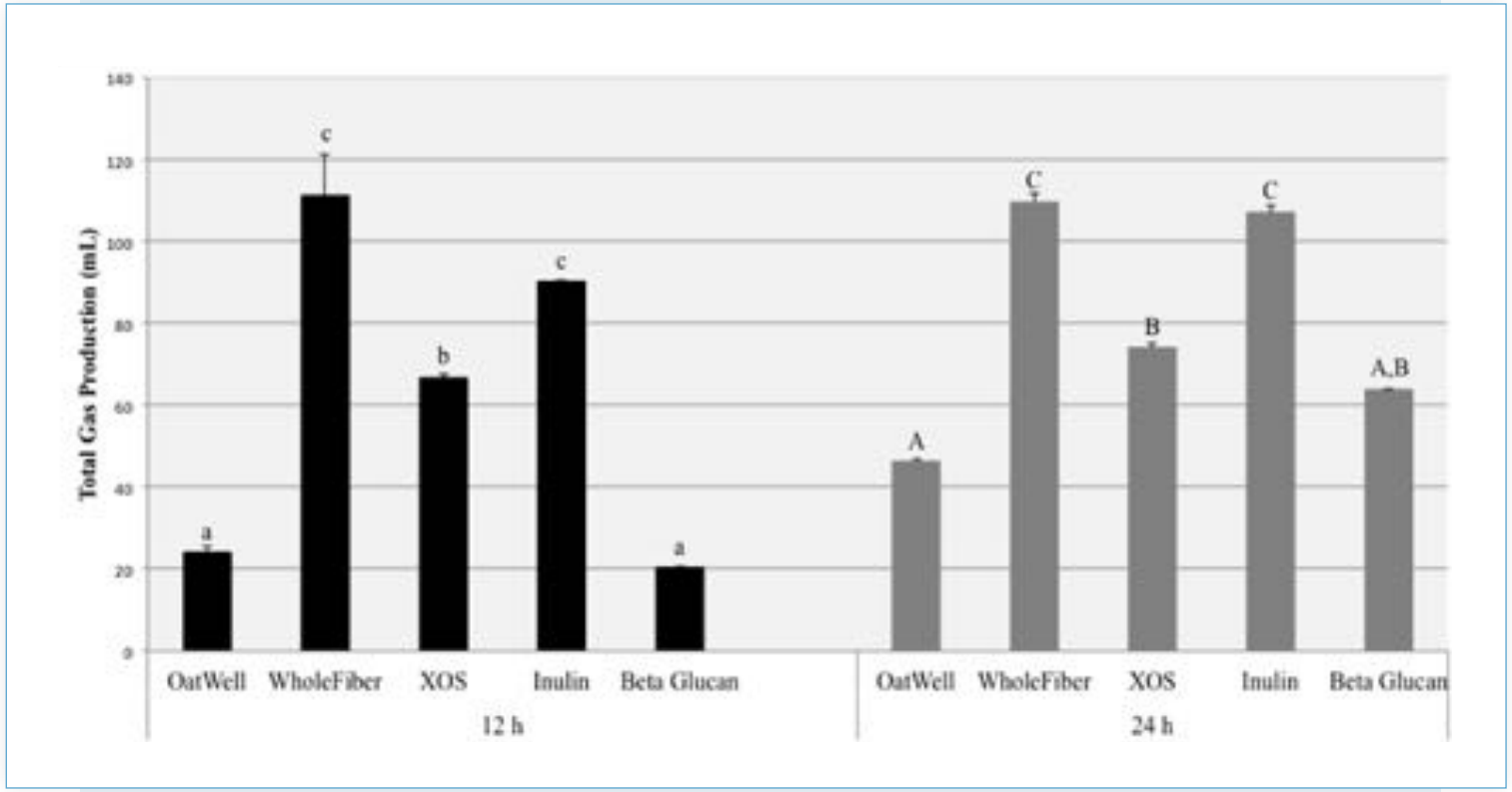

Shopping list
Your list of food ideas is supplied below. You can download the full shopping list or create a personalised shopping list by selecting the foods you would like to try adding to your diet. You can also exclude foods containing certain food components which you may be avoiding due to allergy or intolerance. Please note that foods remaining in the list may still contain traces of these ingredients or be at risk of contamination and as such you will still be required to exercise the usual precautions when shopping for these foods.
DOWNLOAD SELECTED FOODS
DOWNLOAD ENTIRE LIST
SELECT ALL
Exclude foods containing
FODMAPs
Fructans
Fructose
Gluten
Peanut or treenut
Polyols
Wheat
Fruit
Kiwifruits
TELL ME WHY
Bananas, dried
TELL ME WHY
Banana, slightly green
TELL ME WHY
Strawberries
TELL ME WHY
Lemons
TELL ME WHY
Oranges
TELL ME WHY

Oats

- NICE Guidelines, 2006 Updated 2017
  - Reduce intake of 'resistant starch'
  - For wind and bloating consider increasing intake of oats and linseeds.
- ½ cup (52g) rolled oats is considered low FODMAP which contains 5.9g resistant starch and 2g beta glucan.

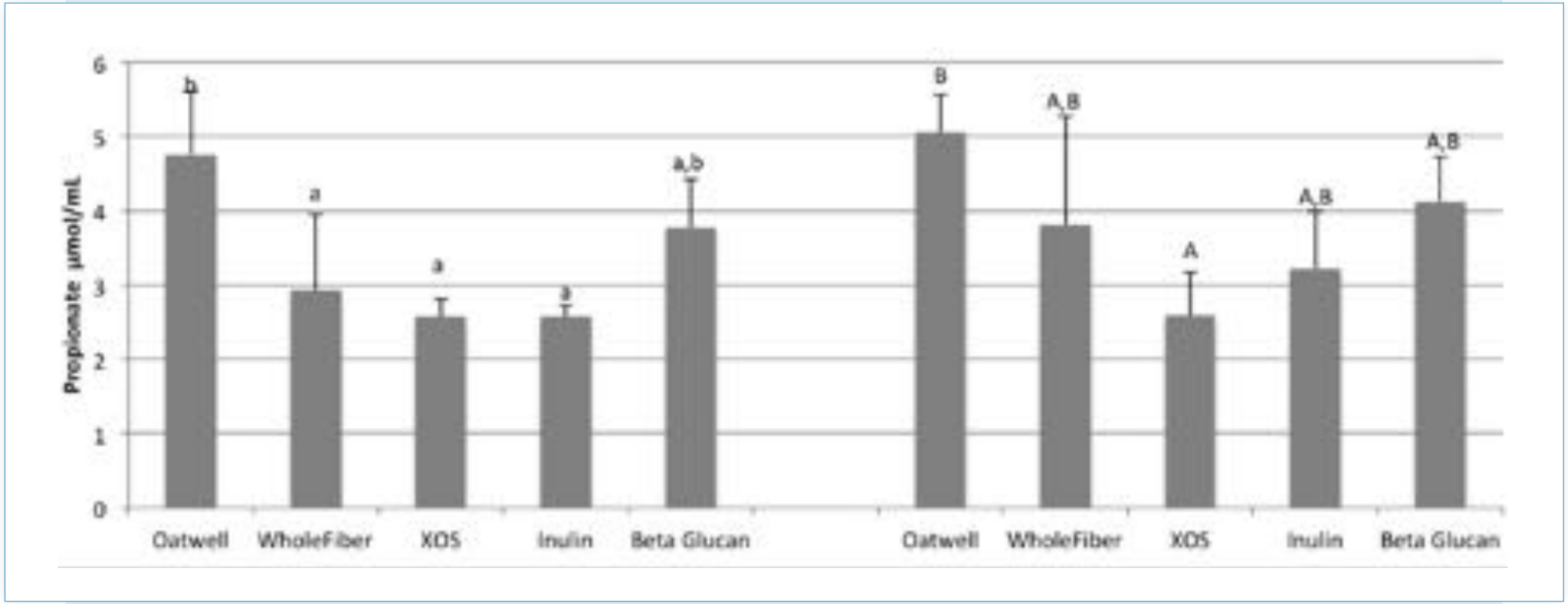
Murphy *et al,* 2008. Journal of American Dietetic Association. 10.1016/j.jada.2007.10.012

Beta glucan creates less total gas



Carlson *et al,* 2017. Nutrients, 9, 1361; doi:10.3390/nu9121361

Beta glucan promotes propionate production



Carlson *et al,* 2017. Nutrients, 9, 1361; doi:10.3390/nu9121361

- IBS is a disorder of diet-microbiome axis
- Need to understand the dysbiosis to target dietary intervention towards microbial balance
- Reduced diversity = increase diversity of prebiotic intake
- Reduced fibre degradation = increase fibre intake
- Reduced propionate production = beta glucan
- Reduced butyrate production = pectin