LIVE WEBINAR

Personalised Prebiotic Prescription:

Optimising Gut Microbiome Health with Prebiotics

Tuesday 13 February 2024 | 7PM AEDT

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Meet your speakers

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All participants have been muted

There is an optional 15 minutes for questions at the end

Add your questions in the chat and we will come back to them at the end

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Disclaimers

- The information provided in this webinar is for the use of qualified healthcare professionals.
- The information contained in this webinar is in no way to be taken as prescriptive or to replace a healthcare professional's duty of care and personalised care practices.
- The clinical opinions and patient case studies shared by presenters are solely those of the individual presenters and do not necessarily represent the view of Co-Biome.

Learning objectives

1. Learn how the gut microbiome can be modulated using prebiotics to support patient outcomes in different clinical conditions
2. Become familiar with a variety of prebiotic foods and supplements that can be used in clinical practice
3. Understand how common clinical consideration such as a patient's dietary requirements, gut transit time, bowel habits and methane production can enable a personalised prebiotic prescription
4. Learn how gut microbiome testing can support personalised prebiotic prescription

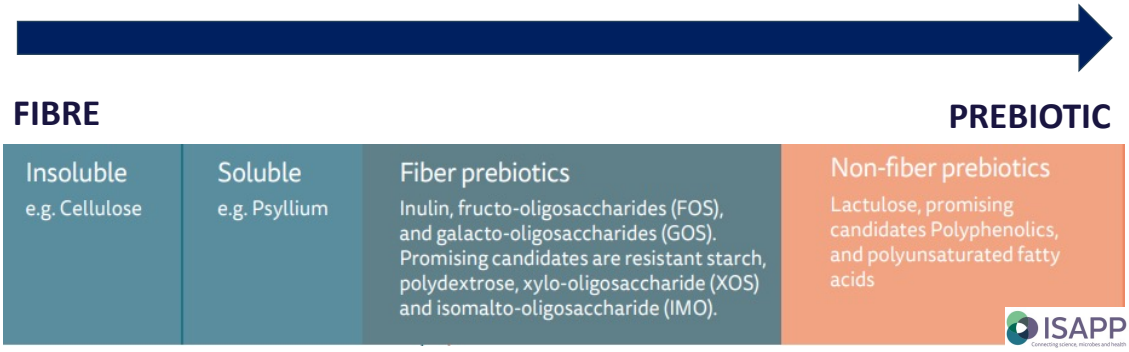
Part 1: Introduction to prebiotics and the gut microbiome

What are prebiotics?

Substrates that are selectively utilised by host micro-organisms conferring a health benefit[29]

- Health promoting bacteria
- Site of effect
- Confirmed *in vivo*

Prebiotics: How are they different from fibre?[1]



"selective"? "health benefit"?

Prebiotics: Patient translation

"Food for your good gut bugs, which results in them making compounds that benefit not only your gut health, but the health of your whole body"

Mechanisms

Modulation of the gut microbiome

- Increase in butyrogenic bacteria
- Bifidogenic
- ”Crowding out” pathobionts
- Altering colonic pH

Immunomodulatory

- Anti-inflammatory
- ↓ reactive oxygen species (ROS)

Increase in SCFA production

Decrease in secondary bile acid formation[2]

Effect on gut epithelial barrier

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Prebiotics: Impact on gut microbiome [3,4,5,6,7,8,9]

Prebiotic	Influence on microbial metabolites	Influence on microbial taxa
Inulin (medium/long-chain)	↑ methane production* ↓ faecal beta-glucuronidase activity*	↑ *Bifidobacterium* spp.[3,4,5] ↑ *Faecalibacterium spp.*[3] ↑*Akkermansia muciniphila*[6] ↑ *Veillonella parvula/ atypica*[7] ↓*Bilophila* spp[4,5]
FOS and short-chain inulin	↓hydrogen sulphide production*	↑ *Bifidobacterium* spp.[8,9] ↑ *Faecalibacterium* spp.[8,9] ↓ *Ruminococcus/ Faecalicatena* spp.[8,9]

* Co-Biome Insight

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Prebiotics: Impact on gut microbiome

Prebiotic	Influence on metabolite production via microbial populations	Other microbiome impacts
GOS	↓ hexa-LPS-producing microbes (↓ *E. coli*)* ↓ faecal beta-glucuronidase activity* ↑ faecal secretory IgA*	↑ *Bifidobacterium* spp.[11,12,13,14] ↑ *Anaerostipes* spp [11,12] ↓ *Bacteroides* spp[13,14]
PHGG	↑ butyrate-producing microbes[10]	↑ *Bifidobacterium* spp.[10] ↑ *Faecalibacterium* spp.[15]
Oat beta-glucan	↑ butyrate-production*	↑ *Bifidobacterium* spp.[16.17]
Resistant starch type 2 (RS2)	↑ butyrate-producing microbes* ↑ acetate production* ↑ methane production*	↑ *Ruminococcus_E bromii* [18]

* Co-Biome Insight

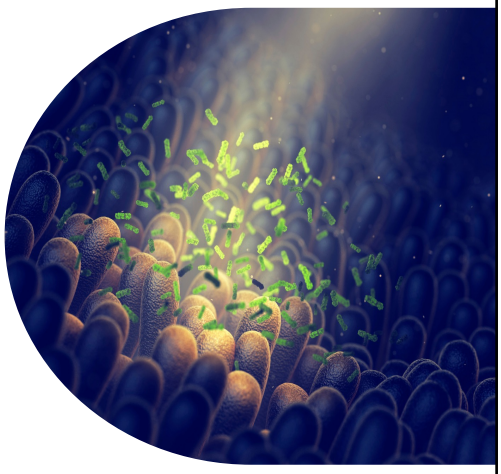
Prebiotics: Impact on gut microbiome

Prebiotic	Influence on metabolite production via microbial populations	Other microbiome impacts
Glucomannan	↓ faecal beta-glucuronidase activity*	↑ *Bifidobacterium* spp.[24]
Acacia gum	↑ butyrate production [19]	↑ *Bifidobacterium* spp.[25,26]
Lactulose	↑ propionate production* ↓colonic production and absorption of ammonia[20,21,22] ↓faecal beta-glucuronidase[23]	↑*Bifidobacterium* spp.[27] ↓*Faecalibacterium*[28] ↓*Enterococcus* [27] ↓*Escherichia-Shigella*[29]

* Co-Biome Insight

What impacts do prebiotics have via gut microbiome modulation?

- Neurological
- Detoxification
- Immune
- Inflammation
- Cardiometabolic
- Gastrointestinal



Neurological impacts[8,13,30,31]

Prebiotic	Condition	Impact	Associated gut microbiome effects
Inulin (MC)	Obesity	Moderate ↑ mood, cognition	↑ *Bifidobacterium* spp,. ↑ response in those with↑ baseline *Coprococcus*
Inulin (MC)	Alcohol use disorder	↑serum BDNF (brain derived neurotrophic factor)	↑ *Bifidobacterium* spp., *Faecalibacterium* spp. ↓ *Dorea*, *F. torques*, *E. ruminantium*
GOS 6.9g/d	Anxious young females IBS	No change in anxiety ?↓depression	↑ *Bifidobacterium* spp, *Bacteroides* spp ↓ *Clostridium spp*

MC = medium chain

Indirect research / areas to watch

- Brain ageing and cognitive decline
- Neurogenerative disease and metagenomics
- Neuroinflammation in Alzheimer's disease
- Gut microbiome and depression – teasing associations apart from medication use

Detoxification impacts[7,23,24,32,33,34,35,36,37]

Prebiotic	↓Faecal beta-glucuronidase	Alters bile acid metabolism	↓Blood urea nitrogen	↓Colonic production/absorption ammonia
Inulin (MC/LC)	✓	✓	✓	
Resistant starch type 2 (RS2)		✓	✓	
Glucomannan	✓			
Lactulose	✓			✓
GOS	✓	✓		
PHGG		✓		

MC = medium chain; LC = long chain

Immune impacts[38,39]

	GOS
URTI duration	↓
Gastroenteritis incidence/severity	↓

Production of T-regulatory cells stimulated by *Bifidobacterium* spp. as well as microbially-derived butyrate –> –> –>
Can we promote *Bifidobacteria* and butyrate-producing taxa for immunoregulatory effects?

Inflammation impacts[7,14,40,41,42,43,44,45,46,47]

	Inulin (LC/MC)	FOS /Inulin (SC)	GOS	PHGG	RS2	Lactulose
CRP	↓	↓	↓	↓	=	↓
Inflammatory cytokines	↓		=		=	
Faecal calprotectin	↓	↓	↓			
Intestinal permeability			↓(colonic)			

SC = short chain; MC = medium chain; LC = long chain

Cardiometabolic impacts[41,43,48,49,50,51,52,53,54,55,56]

	Inulin (LC/MC)	FOS/Inulin (SC)	PHGG	Oat BG	RS2	Acacia gum	Lactulose
Fasting glucose	↓	↓			↓	↓	
Fasting insulin	↓	↓	↓		↓		
HbA1c	↓	↓			↓		
HOMA-IR	↓	↓			↓		
NASH/steatosis		↓					
TG	=		↓	↓	↓		↓
TC	=			↓	↓		
LDL-C	↓		↓	↓	↓		
HDL-C	=		↑	=			
ApoB				↓			
BMI/BW					↓	↓	
BP						↓	
Lactate threshold		↑					

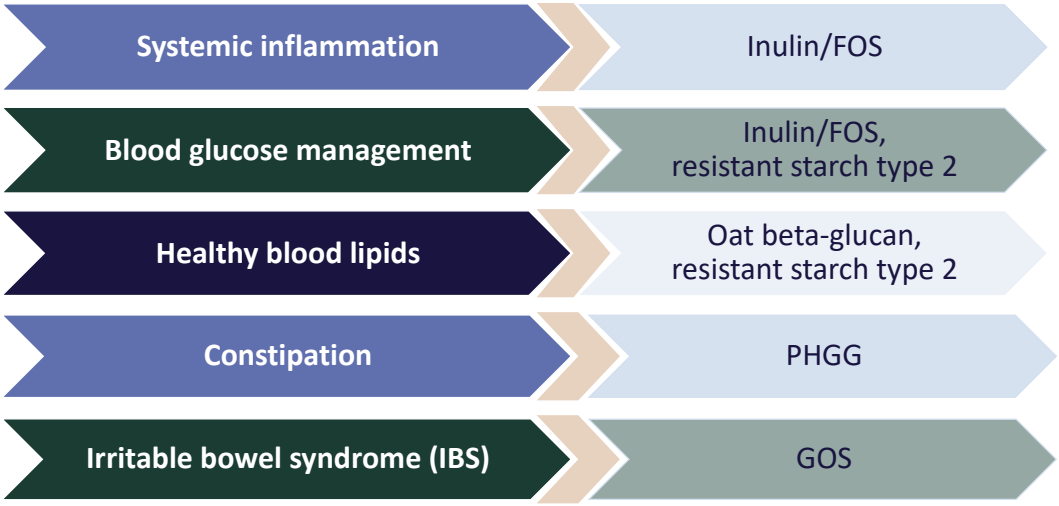
SC = short chain; MC = medium chain; LC = long chain

Gastrointestinal impacts[30,34,57,58,59,60]

GI IMPACTS	Inulin (LC/MC)	FOS/Inulin (SC)	GOS	PHGG	RS2	Lactulose
Transit time				↓	↑	
Improved stool form	↑		=	↑	=/↑	
Incomplete emptying	=		=	=		
Straining			↓	=/↓		
Flatulence	↑	↑	↓	↓<6g	↑	↑
Bloating	↑		↓	↑/=/↓	=	
Abdominal pain	↑		↓	=/↓	=	
Diarrhoea				↓	↓	

SC = short chain; MC = medium chain; LC = long chain

Clinical takeaways



Individualised response [61,62, 63]

Inulin

- Better mood improvements in those with ↑baseline *Coprococcus*
- Better reduction in BMI in those with ↑baseline *Akkermansia* + *Butyricicoccus* + ↓ *Anaerostipes*
- Often ↑ baseline *Bifidobacterium* predicts ↓magnitude of increase in *Bifidobacterium* from prebiotic
- Higher baseline fibre intake predicts broader taxonomic response to inulin e.g. ↑*Faecalibacterium*, not just ↑*Bifidobacterium*

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Individualised response [63,64]

Resistant starch type 2

- Hormonal and metabolic effects associated with baseline abundance of *Streptococcus*, *F. torques*, *E. hallii*

Condition-specific changes

- Certain conditions have distinct microbiome signatures, and we may need to apply research from the specific patient group e.g. Crohn's disease

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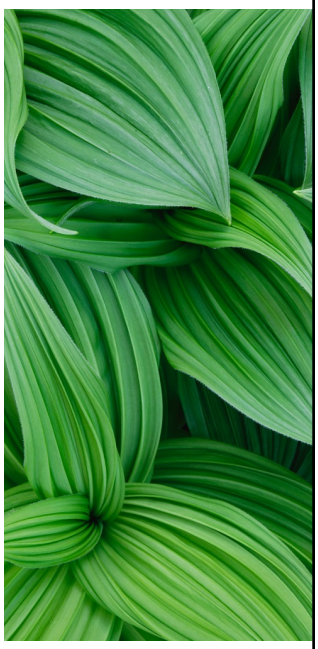
Part 2: Prebiotics in the diet vs supplements



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Prebiotics in the diet

Prebiotic	Food sources	
Fructooligosaccharides (FOS)	Jerusalem artichoke Broccoli stalks	Red onion Watermelon
Galactooligosaccharides (GOS)	Borlotti beans Chickpeas	Green lentils Soy flour
Inulin	Jerusalem artichoke Asparagus	Globe artichoke Leek
Pectin	Mandarins Kale	Blackberries Avocado
Arabinoxylan	Pumpernickel bread Wholegrain rye	Wheat bran Popcorn
Resistant starch (RS)	Green banana Green banana flour	Barley Lentils
Beta-glucan	Oats Wholegrain barley	Wheat bran Sorghum

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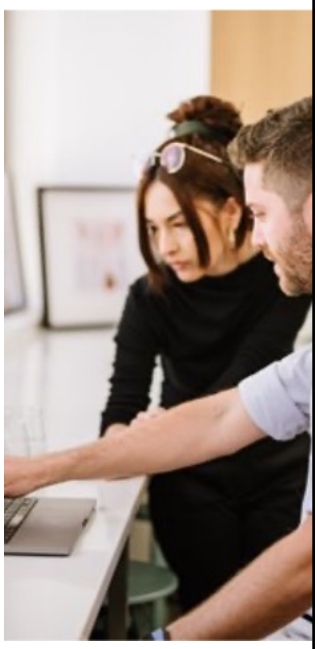
Why not just a high-fibre diet, rather than using prebiotics?

Effect on gut metabolites	Evidence for high-fibre diet/foods	Evidence for supplemental prebiotics
↑ butyrate microbes	Rye bran-enriched bread (6-10 pieces/d)	RS2 with high RS foods (combination) PHGG (6g/d)
↓ BCAAs	Rye bread (8 pieces/d)	
↑ IPA production	Very high fibre diet; wholegrain wheat, rye	
↓ TMAO	Brussel sprouts (300g/day)	
↓ beta-glucuronidase enzyme	Grain/legume fibres	Glucomannan with low-fat diet (4.5 g/d) Inulin (5-20g/d) Lactulose (3g/d)
↓ hydrogen sulphide microbes		FOS (12g/d)
↓ hexa-LPS microbes		GOS (5.5g/d)
↑ secretory IgA		GOS (5.5g/d)

Summary of dietary fibre vs dietary prebiotics vs supplemental prebiotics

- Considerable overlap
- Some metabolites have fibre studies but not prebiotic studies to support
- Overall, effective dietary studies use (often unrealistically) high quantities of high-prebiotic food (e.g. 6, 8, 10 pieces of bread/day)
- Non-athletes and those on restricted diets may find it difficult to meet these dietary targets

Part 3: Clinical considerations for personalised prebiotic intervention



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Questions I ask before prescribing prebiotics

Part 1: IF a prebiotic is indicated

- How is a prebiotic likely to influence the clinical picture?
- Is now a good time to start a prebiotic?

Part 2: WHICH prebiotic options we have

- Which of the six Personalised Prebiotic Prescription (PPP) factors are important here?
- In what order are they important?

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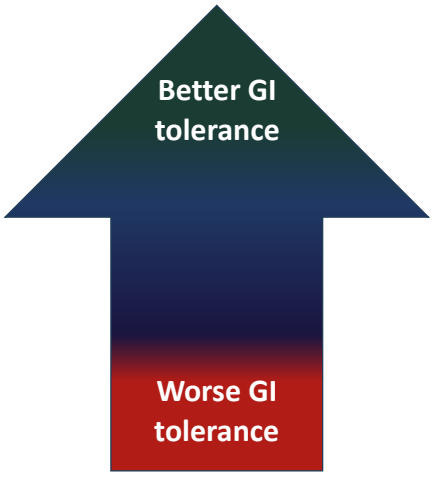
Personalised Prebiotic Prescription (PPP) Factors – which are important?

Specificity of feeding	Site of fermentation	Ability to alter stool form
Tolerability	Convenience	Price

Tolerability and acceptability[30,47,48,49,50]



Acacia gum
Oat beta glucan
PHGG

Resistant starch
Glucomannan
GOS
MC and LC inulin

FOS and SC inulin
Lactulose

Prescribing practicalities: Flavour, texture, convenience

Prebiotic	Flavour	Texture	Convenience
Lactulose	✓ Sweet	Liquid	X Must be poured
FOS/Inulin	✓ Sweet	Soluble	✓ Mixes in food, drink
GOS	✓ Sweet	Soluble	✓ Mixes in food, drink
PHGG	✓ Neutral	Soluble	✓ Mixes in food, drink
Oat beta-glucan	Slight oat	Viscous	X Thickens, creates lumps
Resistant starch banana flour	Slight banana	Viscous	X Thickens, separates

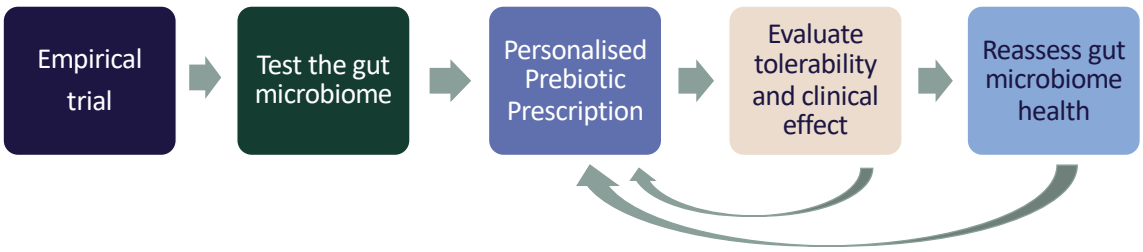
Prescribing practicalities: Dosing guidelines

Prebiotic	Research - supported daily dosage range	Approx. equivalent	Common clinically effective dose	Approx. equivalent	References
Inulin	10g – 15g	8 tsp – 12 tsp	10g	8 tsp	7,8,31,32,33,40,42, 47,49,51,56, 58,59
FOS	7.5g – 30g	3.75 tsp – 15 tsp	10g	5 tsp	7,8,31,32,33,40,42, 47,49,51,56,58,59
GOS	3g – 11g	½ tsp – 2 tsp	5.5g	1 tsp	13,14,30,33,39,43,4 4,58,59
PHGG	5g – 20g	2.5 tsp – 10 tsp	8g	4 tsp	34,58
Oat beta-glucan	3g – 6.6g	1 ½ tsp – 3 ¼ tsp	3.5g (lipids) 10g (stool form)	1 ¾ tsp 5 tsp	50,55
RS2	10g – 40g	3 ⅓ tsp	15g	5 tsp	35,37,41,45,46,53,5 4,57,60
Glucomannan	4.5g	7 x 600mg capsules	4.5g	7x 600mg capsules	24
Lactulose	3g – 25g	5-40 mL	10g	15mL	23,48,52

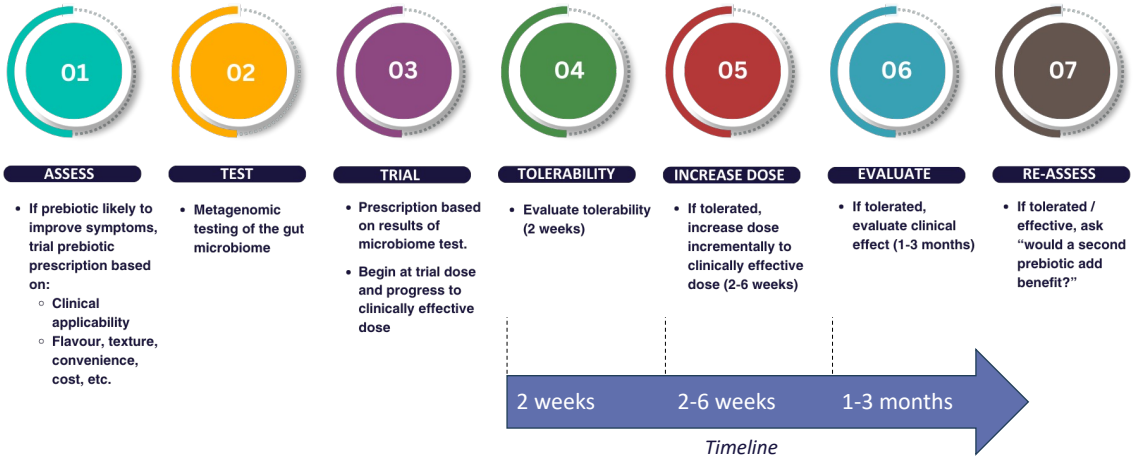
Prescribing practicalities: Cost (Australia, 2024)

Prebiotic	Approx. cost/serve (low end dosage)	Approx. cost for common clinical serve	Approx. cost/serve (high end dosage)
Inulin (long-chain)	$1.20 for 10g	$1.20 for 10g	$1.80 for 15g
FOS/Inulin	$0.70 for 5g	$1.40 for 10g	$2.80 for 20g
GOS	$0.70 for 3g	$1.20 for 5.5g	$2.60 for 11g
PHGG	$0.50 for 5g	$0.80 for 8g	$2.00 for 20g
Oat beta-glucan	$0.80 for 3.5g	$0.80 for 3.5g	$2.30 for 10g
Resistant starch banana flour	$1.00 for 10g	$1.50 for 15g	$4.00 for 40g
Lactulose	$0.10 for 3g	$0.33 for 10g	$0.80 for 25g ($1.60 if bd)
Glucomannan	$2.20 for 4.5g in capsules	$2.20 for 4.5g in capsules	$2.20 for 4.5g in capsules

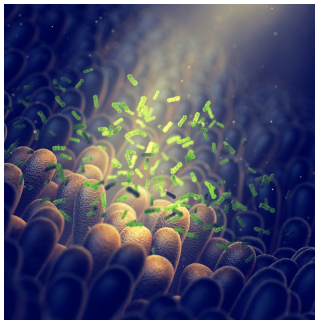
How does gut microbiome testing allow me to make personalised prebiotic recommendations for my patient?



Framework for Personalised Prebiotic Prescription: which prebiotics are in the shortlist for my patient?



Part 4: Prebiotic prescription for gut microbiome modulation



Case 1: Buffering the impact of continuous antibiotics

Age - 61 years

Gender - Female

Case history – Lifelong constipation, history of "methane-dominant SIBO" with use of herbal antimicrobials e.g. berberine. Keen to re-start berberine

Medication - prucalopride prokinetic 1-2x/week; continuous antibiotics for chronic UTI, plus:

- 1 year of trimethoprim + sulfamethoxazole for skin condition in 1992
- 7 courses of antibiotics in 2007 and 7 courses in 2017
- 2017-2022 prophylactic nitrofurantoin post-intercourse

Diet - Paleo diet (no grains) and time-restricted eating

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Her recent antibiotic history

Medication	Current Dose	17-Oct-23	28-Sep-23	31-Jul-23	16-Jun-23	March to June	27-Mar-23		27-Feb-23	12-Jan-23	20-Dec-22	mid-2022	prior to mid-202
LDN	1/d												
Cephalexin	qid					restart							
Trimethoprim 300mg	1/d prn												
Nitrofurantoin 50mg													
Hiprex	1/d					restart							
Cipramil													
Amoxicillin+clavulanic acid	125g/d						stopped around this time						
Citalopram	20mg/d												
Ovestin pessary/ cream	2x week												
Prucalopride	1/d												
Symbicort	6mcg as req												

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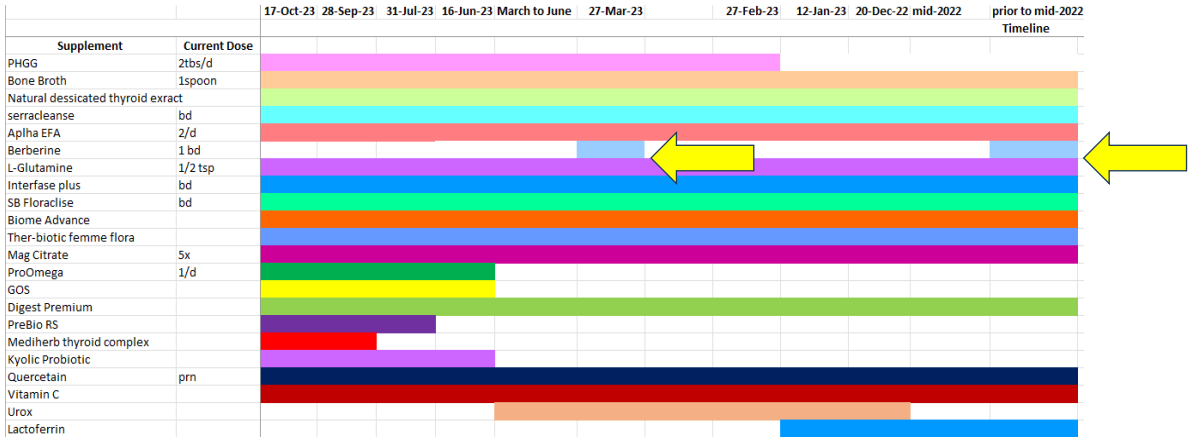
Her supplementation regime



Supplement	Current Dose
PHGG	2tbs/d
Bone Broth	1spoon
Natural dessicated thyroid exract	
serracleanse	bd
Aplha EFA	2/d
Berberine	1 bd
L-Glutamine	1/2 tsp
Interfase plus	bd
SB Floraclise	bd
Biome Advance	
Ther-biotic femme flora	
Mag Citrate	5x
ProOmega	1/d
GOS	
Digest Premium	
PreBio RS	
Mediherb thyroid complex	
Kyolic Probiotic	
Quercetain	prn
Vitamin C	
Urox	
Lactoferrin	

Part 1: Personalised Prebiotic Prescription - is a prebiotic indicated?

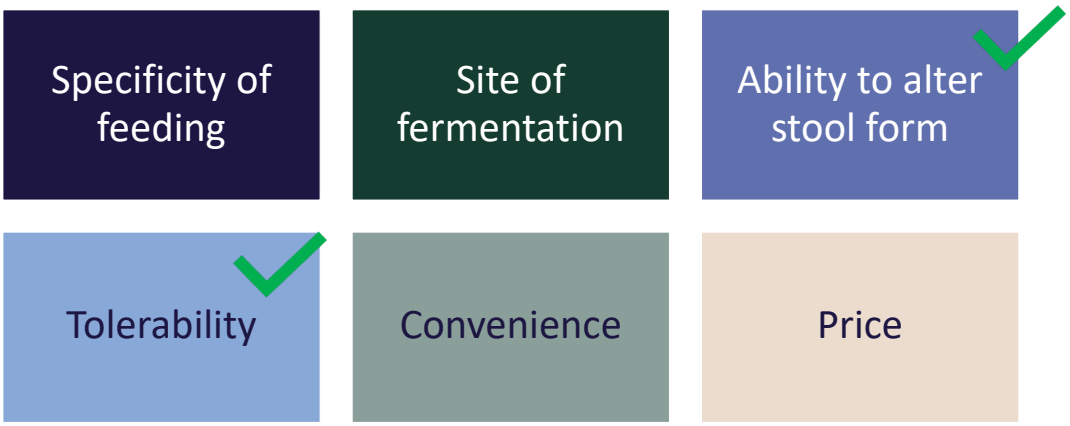
How is a prebiotic likely to influence the clinical picture?

→ Symptoms, long-term health risks

Is now a good time to start a prebiotic?

→ YES!

Part 2: Personalised Prebiotic Prescription (PPP) Factors – which are important?



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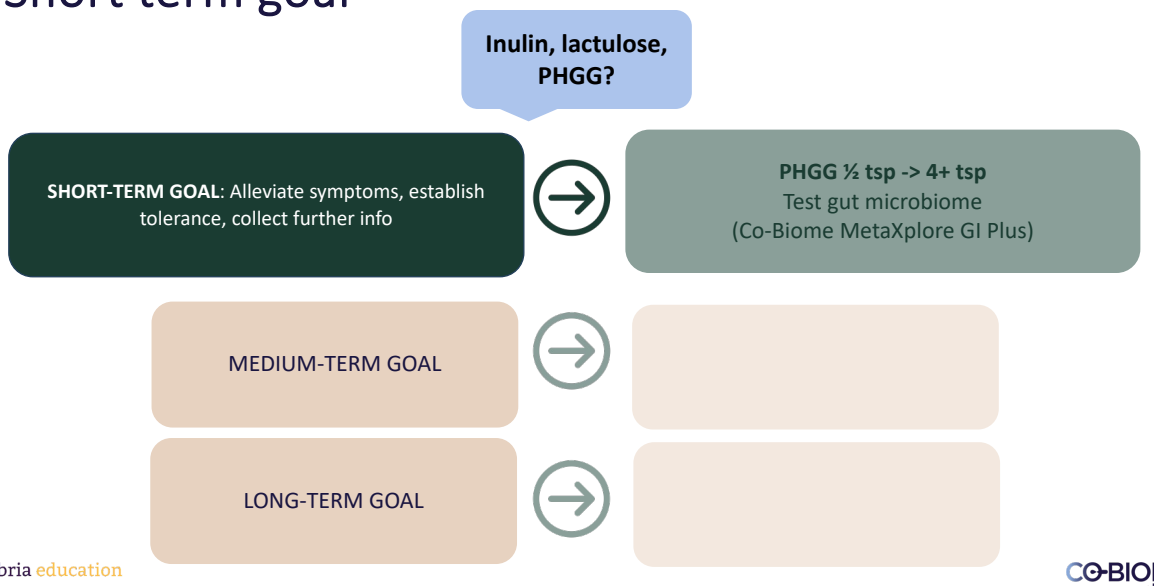
Short term goal



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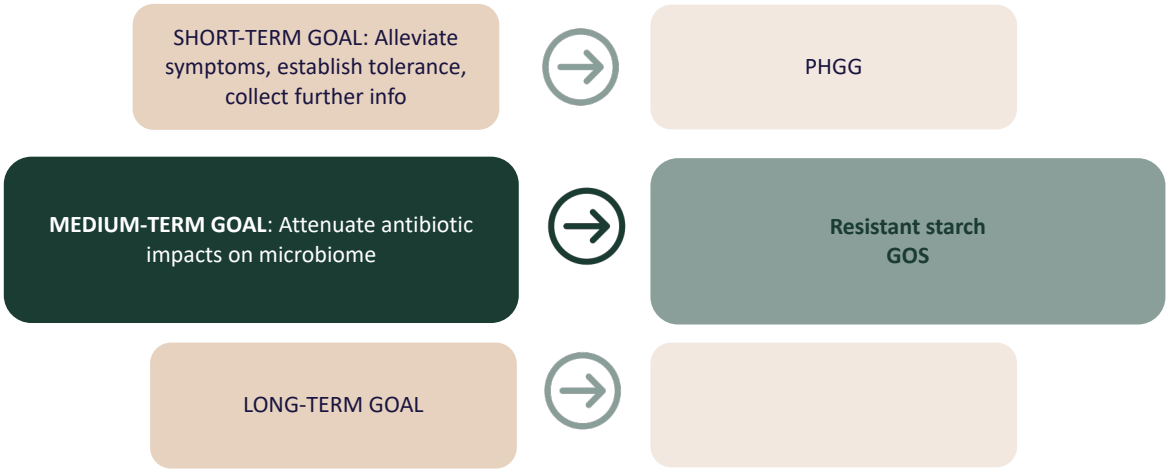
Test Results

Initial management

- Stay off berberine
- Stop time-restricted eating
- Increase fibre – quinoa, daily cruciferous vegetables
- Increase healthy oils (olive, macadamia)
- Replace coconut cream/milk with coconut flour
- Increase seafood and reduce red meat
- Add omega 3 supplement
- Add *Lactobacillus gasseri* KS-13, *Bifidobacterium bifidum* G9-1 and *Bifidobacterium longum* MM2 to reduce *E. coli*
- Add GOS to reduce hexa-LPS via ↓ *E. coli*
- Add resistant starch to reduce faecal pH

Medium term goal



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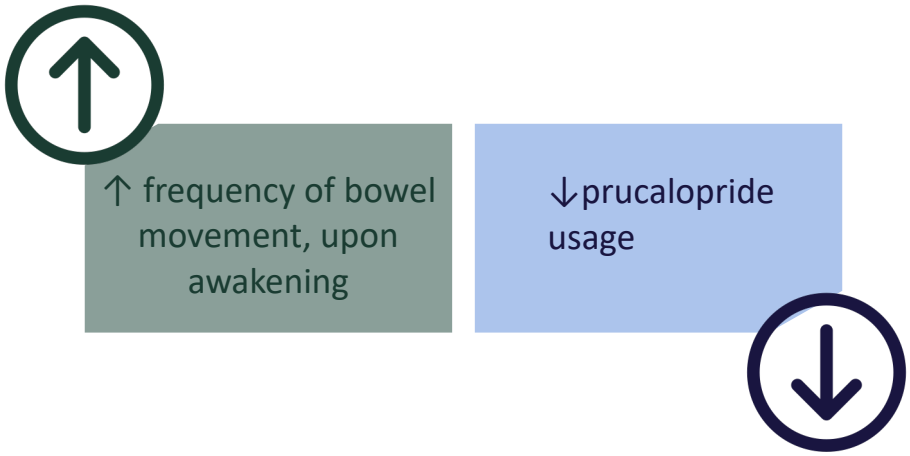
Initial outcome: Clinical



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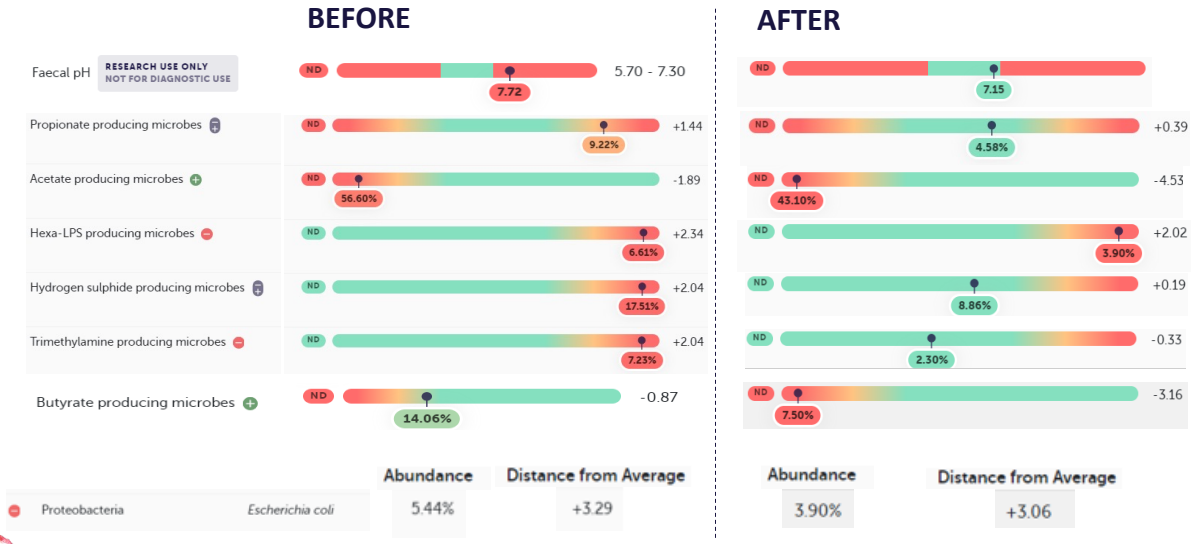
Results of treatment: Testing



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Long term goal

SHORT-TERM GOAL: Alleviate symptoms, establish tolerance → PHGG

MEDIUM-TERM GOAL: Attenuate antibiotic impacts on microbiome → Resistant starch, GOS

LONG-TERM GOAL: Improve microbiome → **Increase fibre, Add prebiotics, Increase prebiotic dosage**

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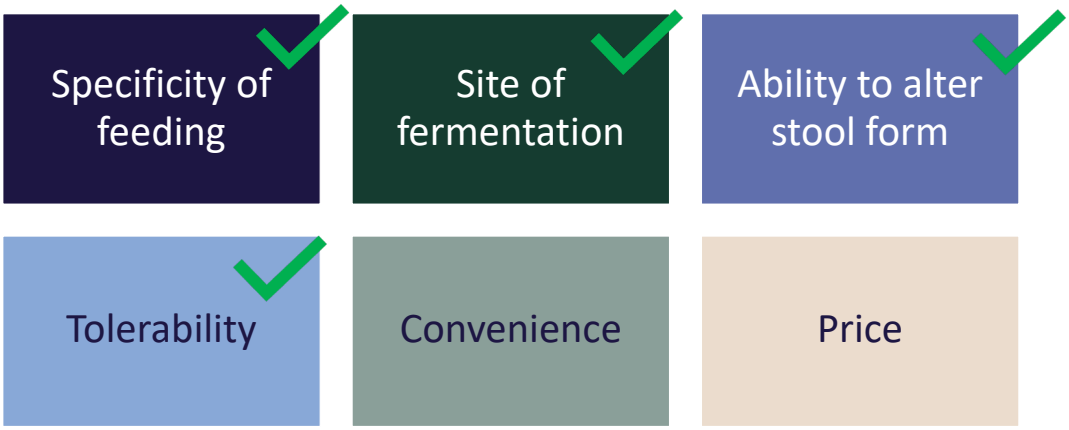
How will I decide whether to add different prebiotics, or increase prebiotic dose?



Clinical outcome and plan

Current issue	Possible action	Potential problem	Alternative
pH remains high	Add lactulose	Tolerability Site of fermentation (too proximal)	Increase RS2 dose
Hexa-LPS microbes remain high	Add inulin or lactulose	Tolerability	Increase GOS dose
↓ Acetate and butyrate microbes	Add inulin	Tolerability	Increase RS2/GOS Counsel re trial off antibiotics
Persistent "thought viruses" around SIBO and fibre	Gradual increase in fibre		

Prebiotic	Current dose	Dose to trial
GOS	1 tsp (5g)	2 tsp (10g)
Resistant starch banana flour	2 scoops (30g)	2.5 scoops (37.5g)

Case 2: If you're not testing, you're guessing (the underlying cause of symptoms)

Age - 65 years

Gender - Female

Case history – faecal urgency, occasional incontinence, nocturnal nausea, bloating affecting sleep, high LDL and total cholesterol, anxiety re impending trip to South America

Medication - Relying on loperamide

Part 1: Personalised Prebiotic Prescription - is a prebiotic indicated?

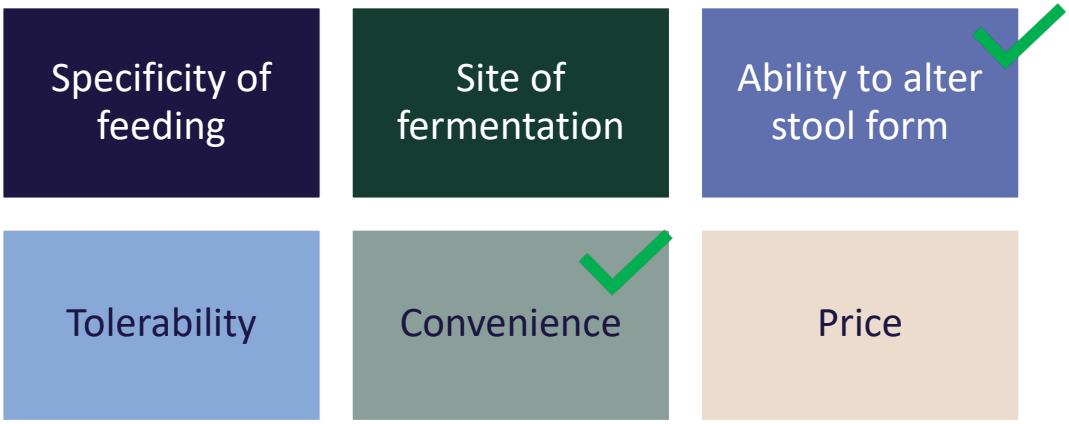
How is a prebiotic likely to influence the clinical picture?

→ Symptoms

Is now a good time to start a prebiotic?

→ YES!

Part 2: Personalised Prebiotic Prescription (PPP) Factors – which are important?



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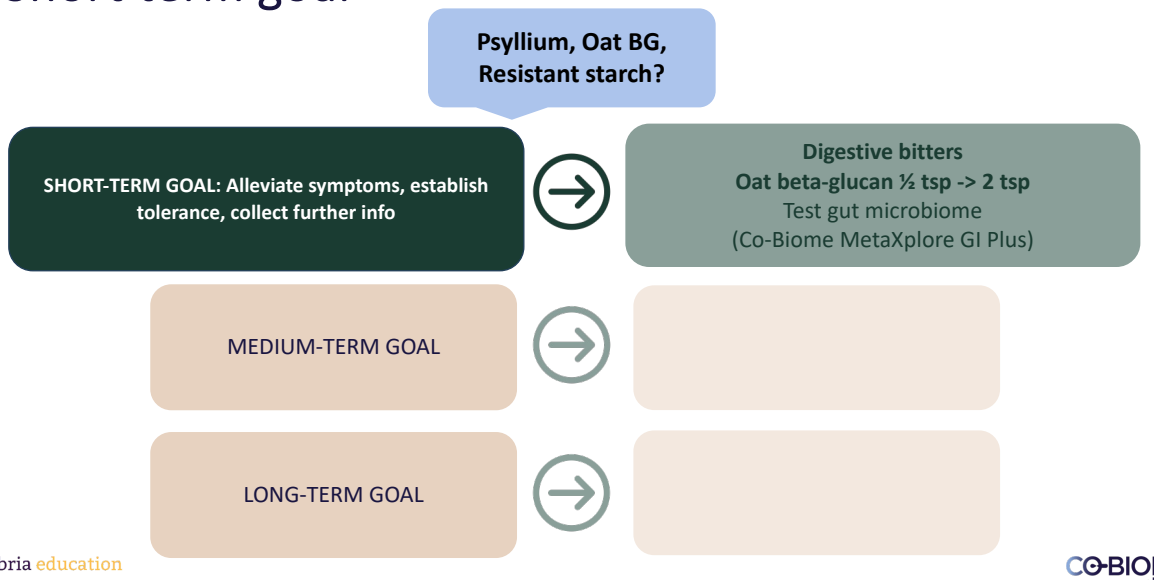
Short term goal



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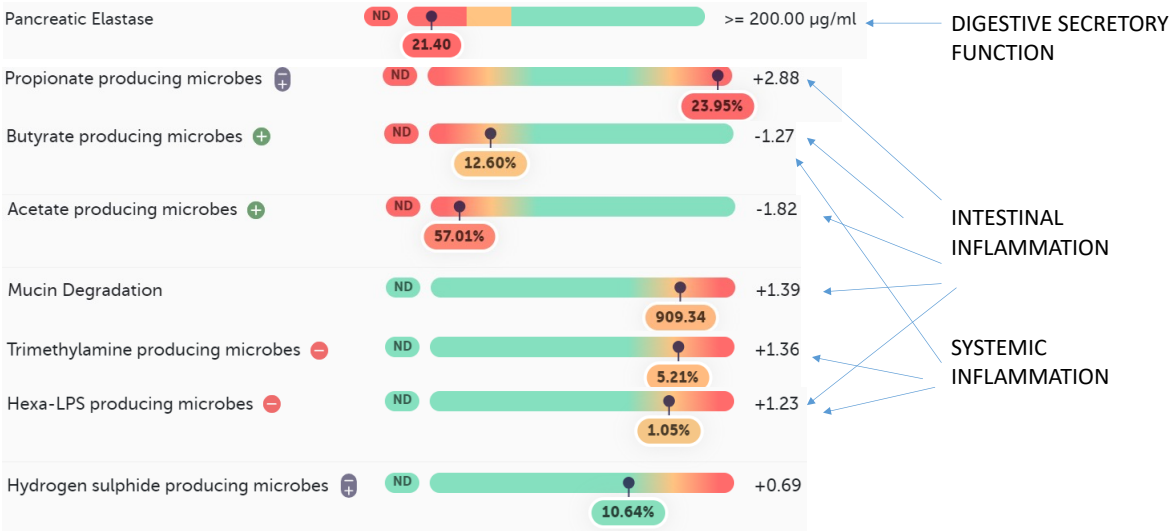
Key functional marker and microbiome results



Species results

Oral Species

Streptococcus salivarius	0.11%	Common
Streptococcus anginosus	0.06%	Less common
Streptococcus parasanguinis	0.04%	Rare
Fusobacterium vincentii	0.02%	Rare
Peptostreptococcus anaerobius	0.02%	Less common

Outcome of screening and initial treatment

Oat beta glucan and bitters

- ↓ bloating
- ↓nocturnal nausea
- No diarrhoea or faecal urgency
- ↓faecal incontinence
- Complete emptying

Low pancreatic elastase suggests severe pancreatic exocrine insufficiency

→ Refer to specialist

Medium term goal

SHORT-TERM GOAL: Alleviate symptoms, establish tolerance, collect further info → Oat beta-glucan ½ tsp

MEDIUM-TERM GOAL: Establish tolerance, screen for causes → **Medical review**
Address pelvic floor dysfunction
Increase oat BG up to 4 tsp

LONG-TERM GOAL →

CT ABDOMEN AND PELVIS WITH CONTRAST

HISTORY:
Pancreatic exocrine insufficiency? Previous gallbladder polyp and liver cyst.

Moderate colonic faecal loading. No bowel obstruction.
The bone mineral density appears reduced. Small sclerotic focus in the L2 vertebral body, likely a small bone island. No pleural or pericardial effusion.

CONCLUSION:
1. Significant pancreatic atrophy, particularly in the head, uncinate process, neck and proximal body, with a few small islands of normal tissue in the distal body and tail. No focal pancreatic lesion or main duct dilatation.

Prescription of enteric-coated pancreatic enzymes

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Results of treatment: Testing

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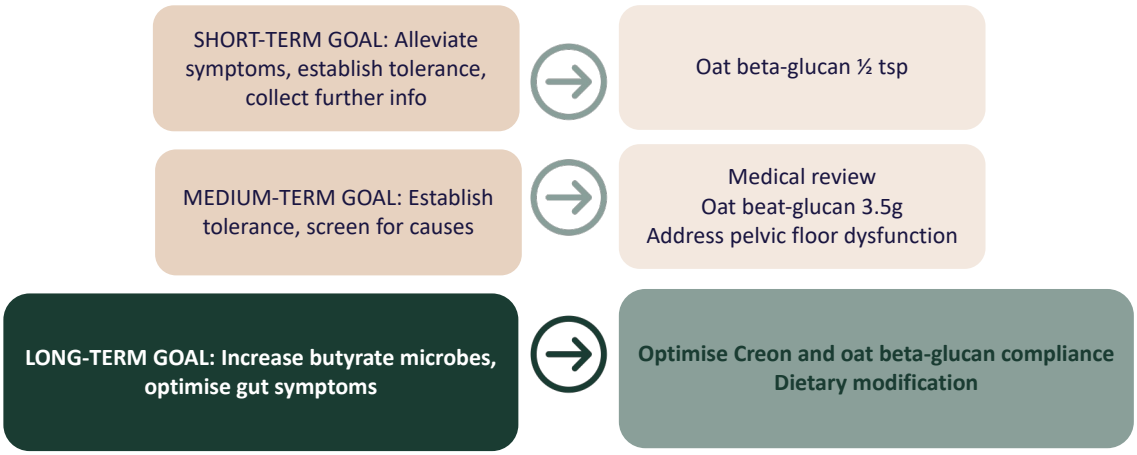
Long term goal



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Meal	Day 1	Fibre (g)	Day 2	Fibre (g)
Breakfast	1 x low-FO bread Cheese 2 tsp protein powder	1	1x low-FO bread Goat's cheese 2 tsp protein powder	1
Morning tea	1 tb muesli 3 tb low-fat Greek yoghurt Strawberries	1 1	-	
Lunch	2 x low-FO bread Goat's cheese 5 cherry tomatoes	2 1	Quinoa Leek Celery Tomato Chicken	2.5 1 1 1
Afternoon tea	Ice cream with oat beta-glucan	4	Ice cream with oat beta-glucan	4
Dinner	Quinoa Chicken Leek, celery, tomato Watermelon	2.5 1 0.3	Broccolini 2g ½ cup brown rice 1.8g Chicken Celery 1g Mandarin 1.8g	2 1.8 1 1.8
TOTAL FIBRE		**~13.8g**		**~17.1g**

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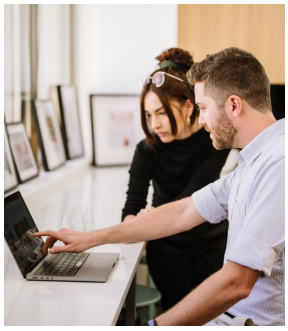
Outcome and plan

Outcome	Plan
Nocturnal nausea if has richer food like pizza for dinner	Discuss Creon dosage with specialist
Moderate compliance with oat beta-glucan ("if I put it in juice or yoghurt it gets gluggy")	Try mixing with protein powder smoothie If all else fails -> almond milk with a little soy ice cream mixed in -> Trial GOS
BMs occasionally too firm	Kiwifruit 2/day 2nd daily legumes Track fibre intake on My Fitness Pal
Total cholesterol reduced from **6.3 -> 5.6** mmol/L LDL-C reduced from **4.5 -> 4.0** mmol/L (no change in HDL-C)	

Key takeaways

- Personalise your prebiotic to the patient, taking into account the clinical picture, goals and preferences, while being guided by the gut microbiome results.
- Dosage varies considerably according to condition – be aware of the research.
- Tolerance and acceptability can be a stumbling block – when in doubt, start conservatively and proceed with caution.
- Dosing via the instructions on the bottle is a minefield – be specific about dosing.
- Even if the clinical outcome improves, re-test the gut microbiome.



The MetaXplore™ range

MetaXplore™
MetaXplore™ provides a metagenomic driven gut microbiome profile, together with the latest research insights for healthcare professionals.
Technology: metagenomics

$369

MetaXplore™ GI
MetaXplore™ GI provides the same comprehensive microbiome profile as MetaXplore™ as well as reporting on seven gastrointestinal health markers and science backed clinical insights to assist clinical decision-making and intervention.
Technology: metagenomics + diagnostic GI health markers + faecal pH

$489

MetaXplore™ GI Plus
MetaXplore™ GI Plus is Co-Biome's most comprehensive functional gut microbiome profile. It provides all the features found in MetaXplore™ and MetaXplore™ GI, plus targeted pathogen panels.
Technology: metagenomics + diagnostic GI health markers + faecal pH + RT-PCR

$529

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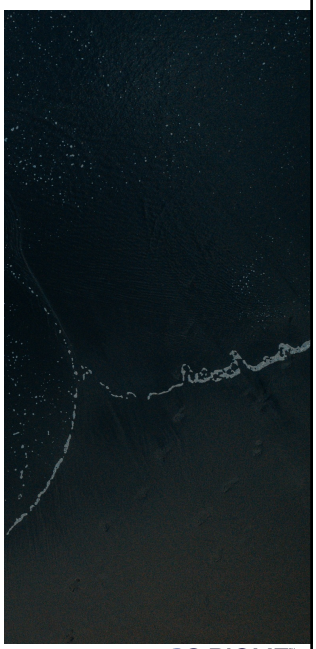
15 minutes

Q&A from the chat

Hayley Parcell
Alyssa Tait



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LIVE WEBINAR

Thank you for attending

Visit the Co-Education Hub All Resources page for additional resources and to watch the webinar replay. You can access this via your Practitioner Portal.

Register as a Co-Biome Clinician today for microbiome educational resources at your fingertips!

Additional resources:

- MetaXplore™ Range Brochure
- Prebiotic Guide
- Low FOMAP Prebiotic Guide
- Patient Handouts – Ellagic acid; Arabinoxylan; Inulin; FOS; GOS; Pectin
- Dietary Impacts on the Gut Microbiome Guide
- Interpretation Guide
- Pathogen and Pathobiont Management Guide

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