



The prebiotic potential of Australian honeys

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Introduction

- Gut bacteria significantly impacts host health & disease
- Prebiotics alter bacterial composition of gut
- Honey has prebiotic potential

Gut bacteria

**10^{14} bacteria
(100,000 billion!!)**

> 500 different types

Lactobacilli

Streptococci
Lactobacilli

Enterobacteria
Enterococcus faecalis
Bacteroides
Bifidobacteria
Peptococcus
Peptostreptococcus
Ruminococcus
Clostridia
Lactobacilli

and.....



Stomach 10^2 to 10^3

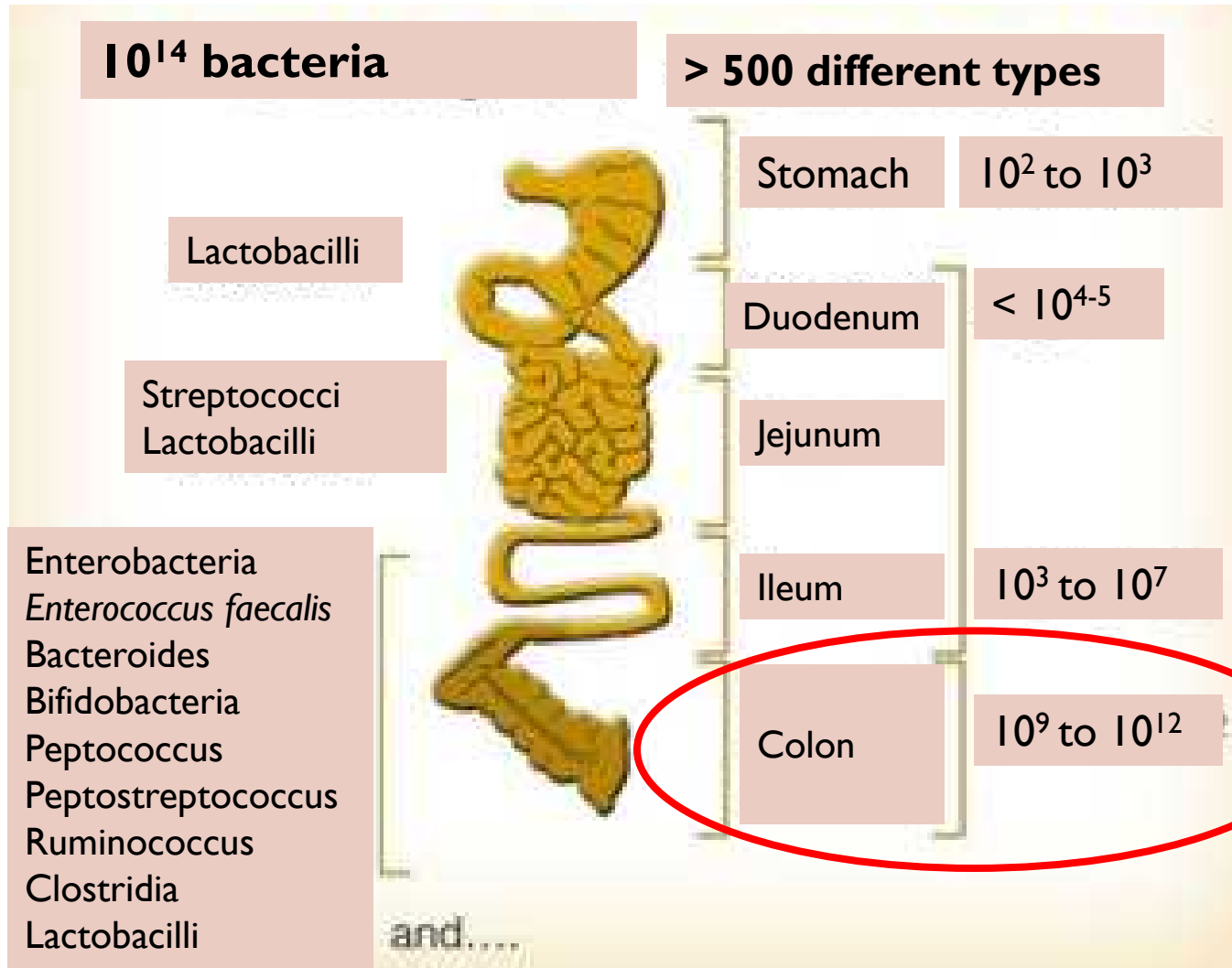
Duodenum $< 10^{4-5}$

Jejunum

Ileum 10^3 to 10^7

Colon 10^9 to 10^{12}

Gut bacteria



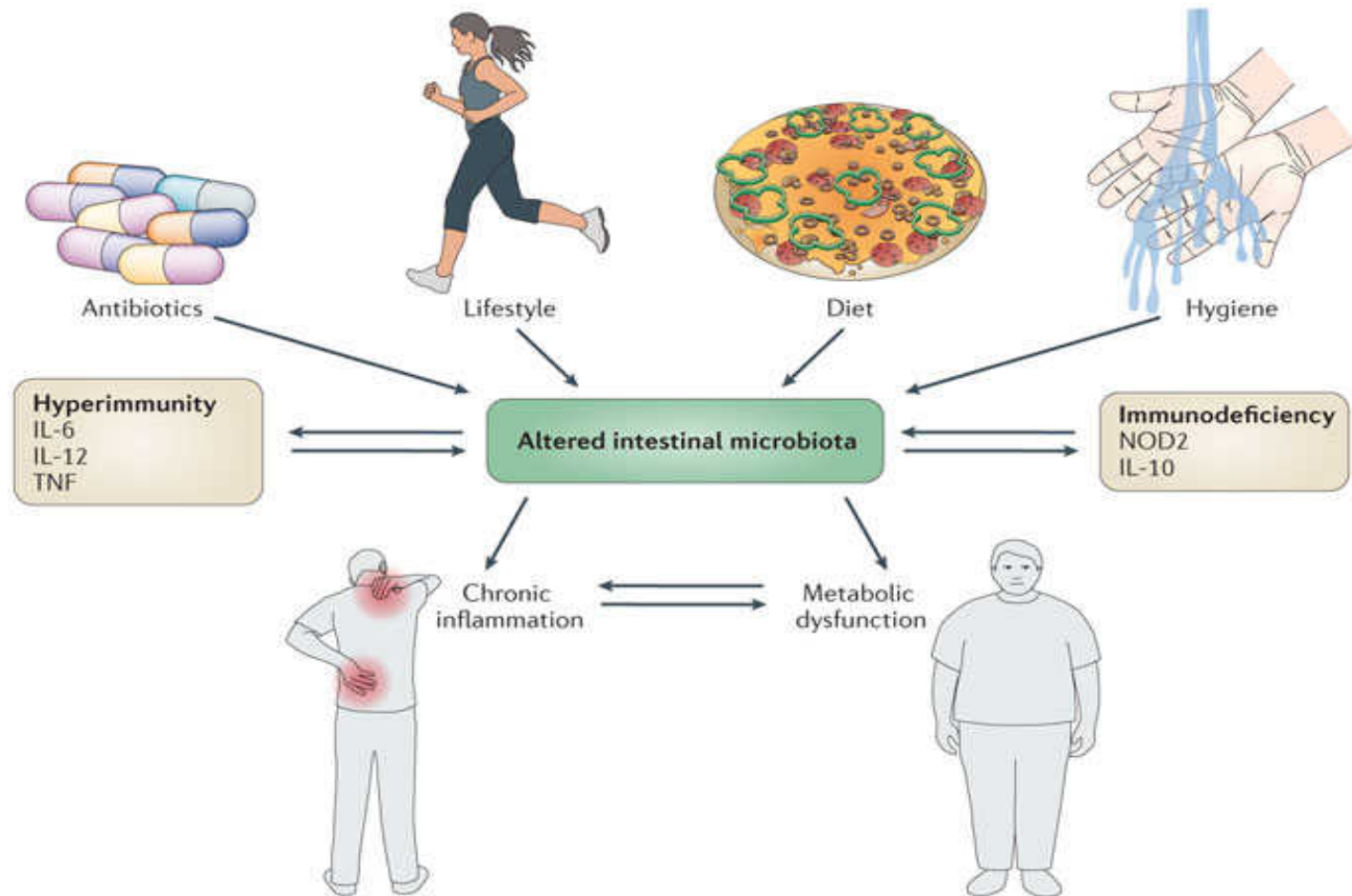
Why are gut bacteria important?

- Help modulate immune system
- Contribute to metabolism of the host
- Contribute to energy harvest from food
- Some gut bacteria associated with bowel diseases, allergy & obesity
- Need a balance of 'good' and 'bad' bacteria

'Good' vs. 'Bad' bacteria

'Good' Health promoting: Eg Bifidobacteria and Lactobacilli	'Bad' Exert harmful effects: Eg Clostridia and Bacteroides
<p>Inhibit growth of harmful bacteria</p> <p>Stimulate immune functions</p> <p>Improve digestion and absorption of essential nutrients</p> <p>Synthesise vitamins</p>	<p>Involved in diarrhoea, infections and liver damage</p> <p>Can produce carcinogens</p> <p>Cause intestinal putrefaction</p>

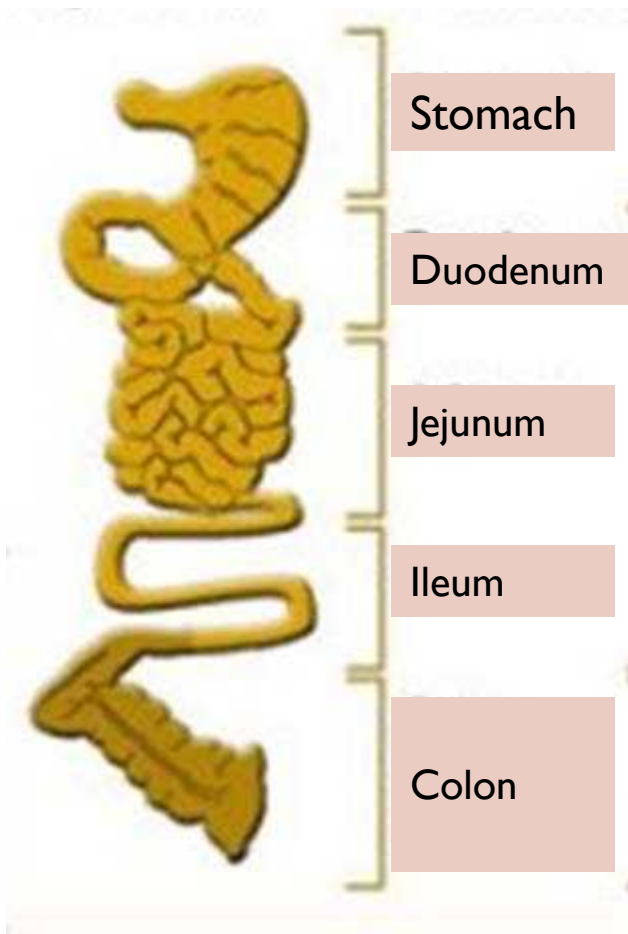
Changes in gut bacteria



Nature Reviews | Microbiology

Sommer and Backhed (2013). Nature Reviews Microbiology, 11:227-238.

The gut system



- Food digested and absorbed in *small intestine*

- Simple sugars absorbed in *small intestine*

→ i.e. fructose, glucose, sucrose



- Good bowel bacteria get left-overs

→ need complex sugars

Honey contains simple AND complex sugars

What is a prebiotic?

- Complex sugars that:
 - are **not digested** in upper gut
→ reach colon intact
 - used as a food source by good gut bacteria

Colon

- Sources of prebiotics:

- breast milk
- some root crops (e.g. chicory)

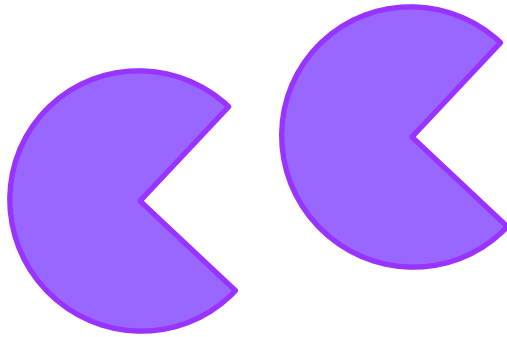


- Differ from **pro**biotics- live bacteria

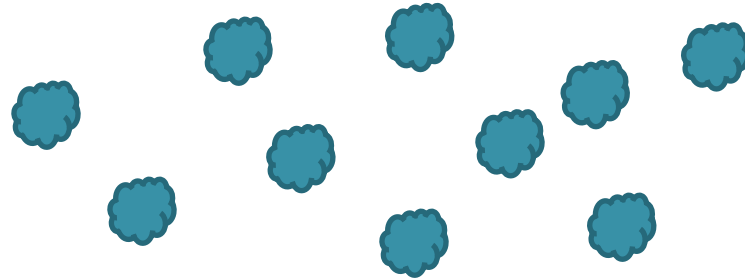


Probiotics vs. prebiotics

Live bacteria



Food for gut bacteria



Honey



- Super saturated sugar solution
 - Mainly fructose (36-50%) and glucose (28-36%) (simple sugars)
 - Oligosaccharide (~1-4%) (complex sugars)
- Exact composition: highly variable dependant on floral source
- Australian floral honeys unique
- Therapeutic properties
 - Antioxidant, immunostimulatory, wound healing, antimicrobial, prebiotic
- Not all honeys are the same

Is Australian honey a good prebiotic?

- Can good bacteria use honey to grow?
- Can honey help good bacteria out-compete bad bacteria?

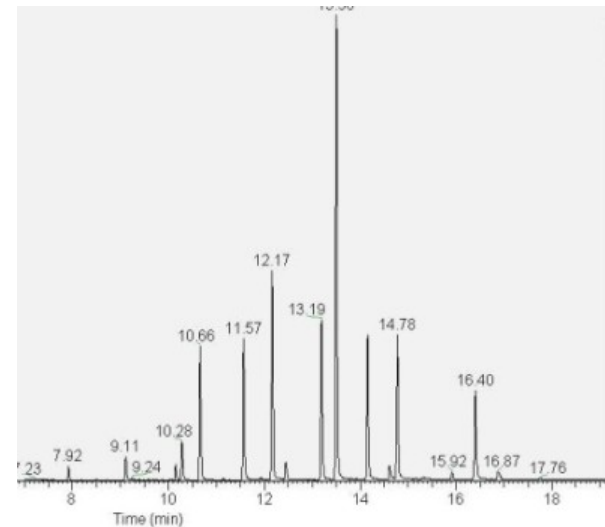


Stage I

- **Can good bacteria use honey to grow?**
(tested 17 honeys)

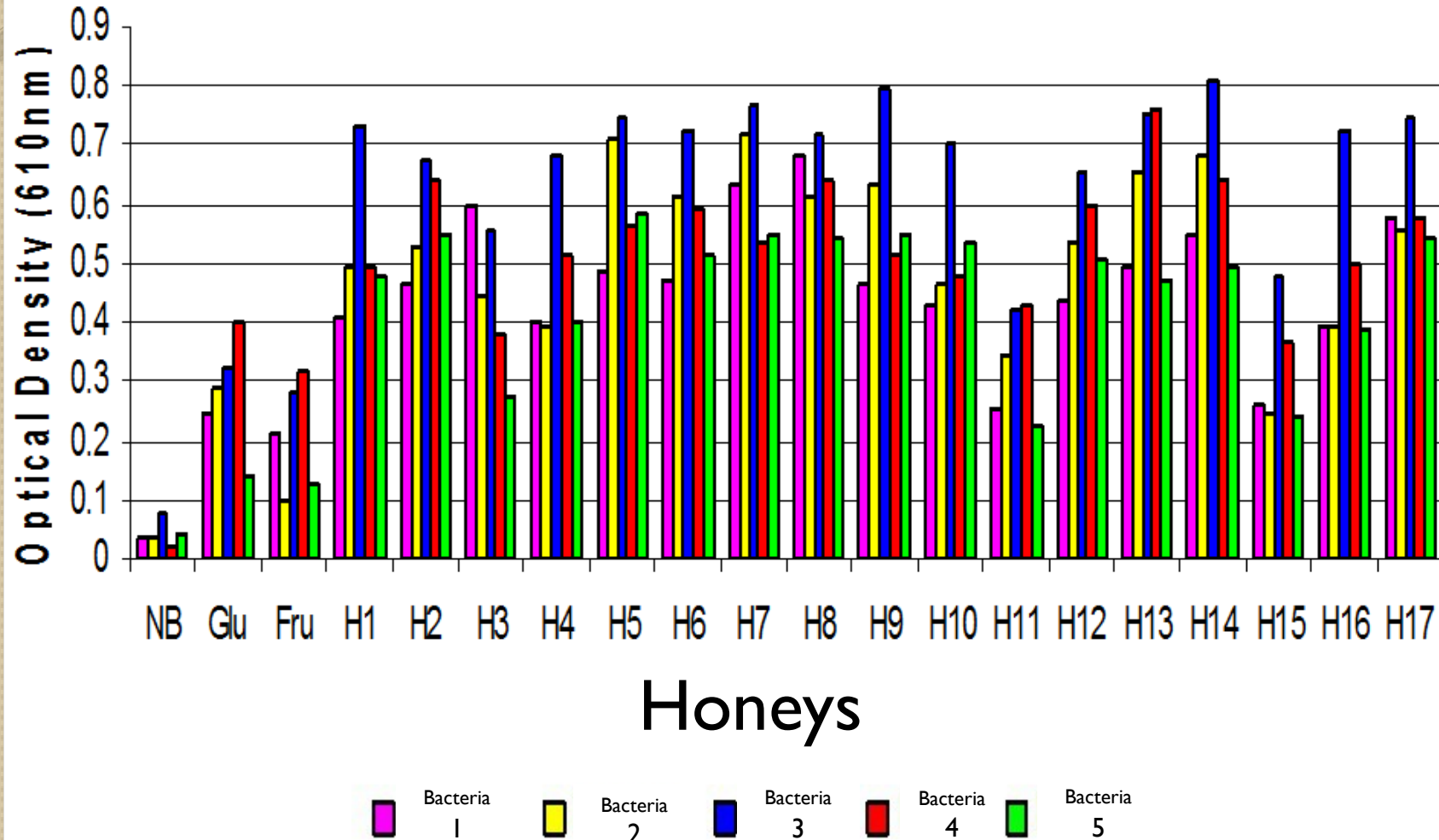


Bacterial counts

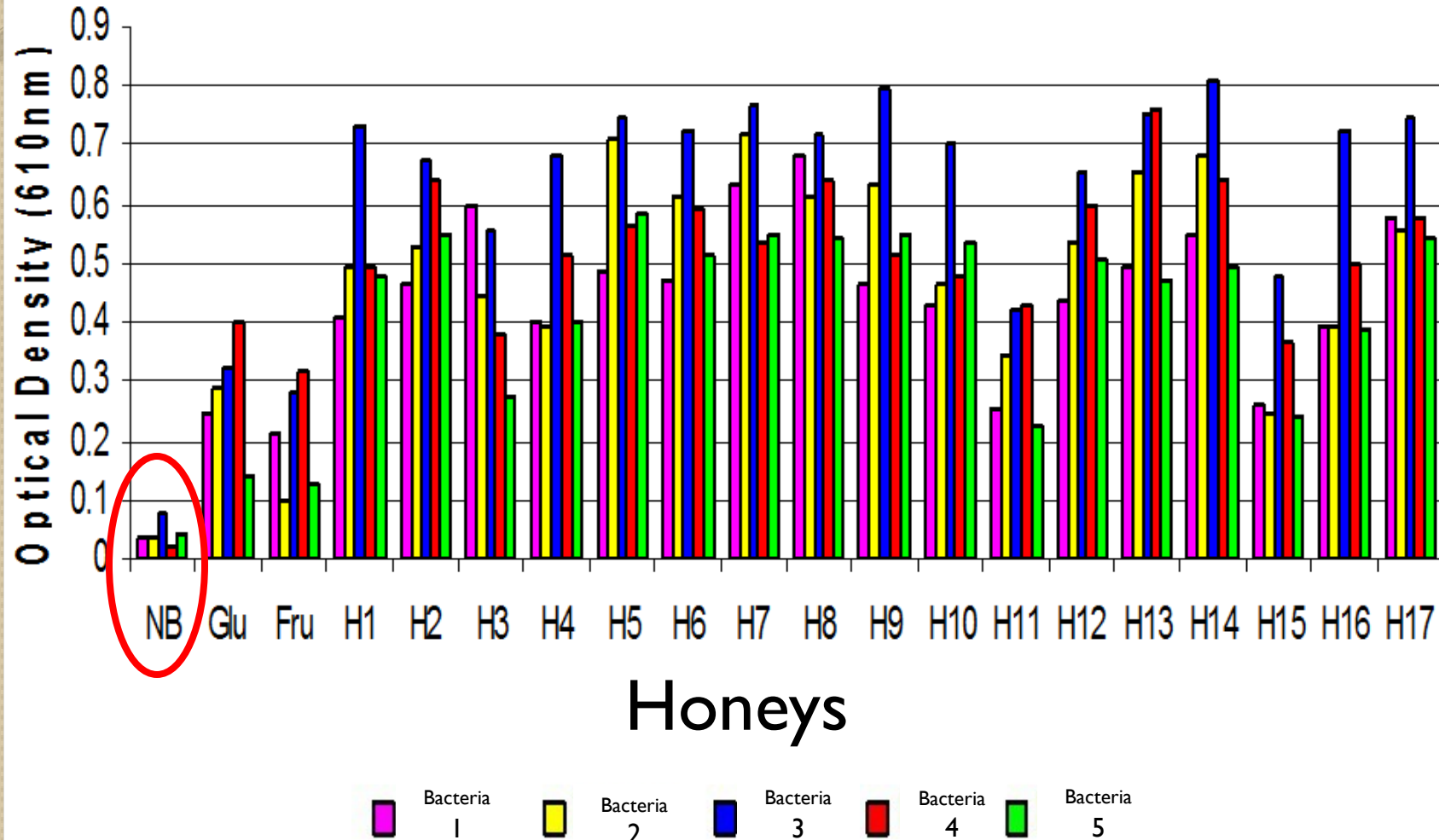


Chemical analysis

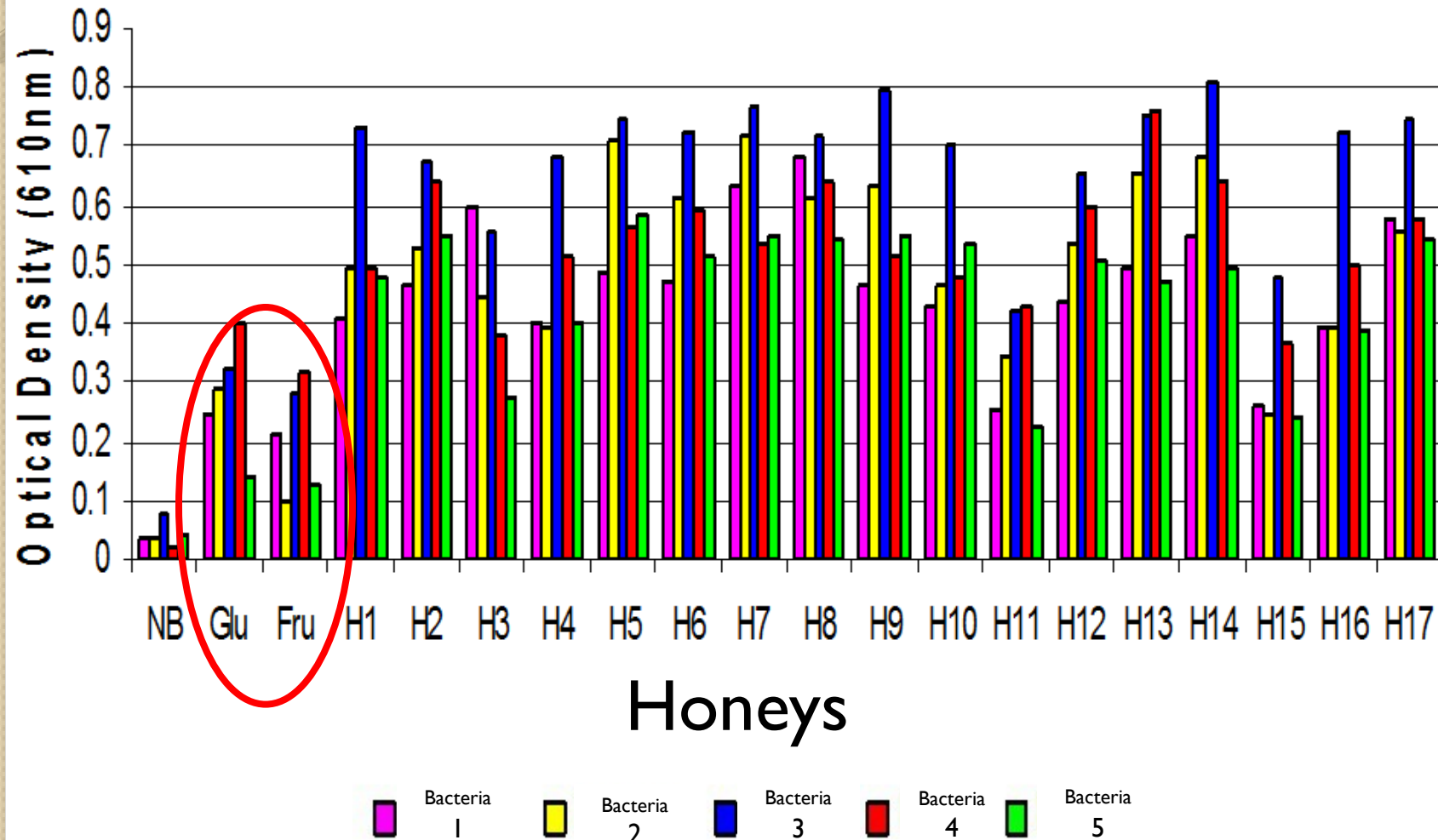
Prebiotic effect of Australian honeys on the growth of good bacteria



Prebiotic effect of Australian honeys on the growth of good bacteria



Prebiotic effect of Australian honeys on the growth of good bacteria



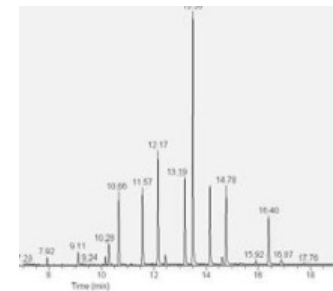
Stage 2

- **Can honey help good bacteria out-compete bad bacteria?**

(17 + 22 honeys)



Bacterial counts



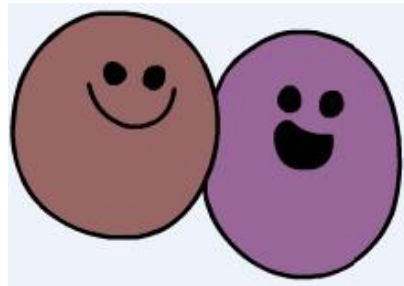
Chemical analysis

Phase 1: Simulate gut conditions

Phase 2: Use complex sugars in tests

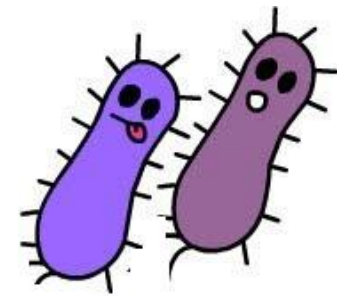
Prebiotic Index (PI)

- Measures prebiotic capacity
- Generates 'score' of prebiotic effect



Bifidobacteria & Lactobacilli

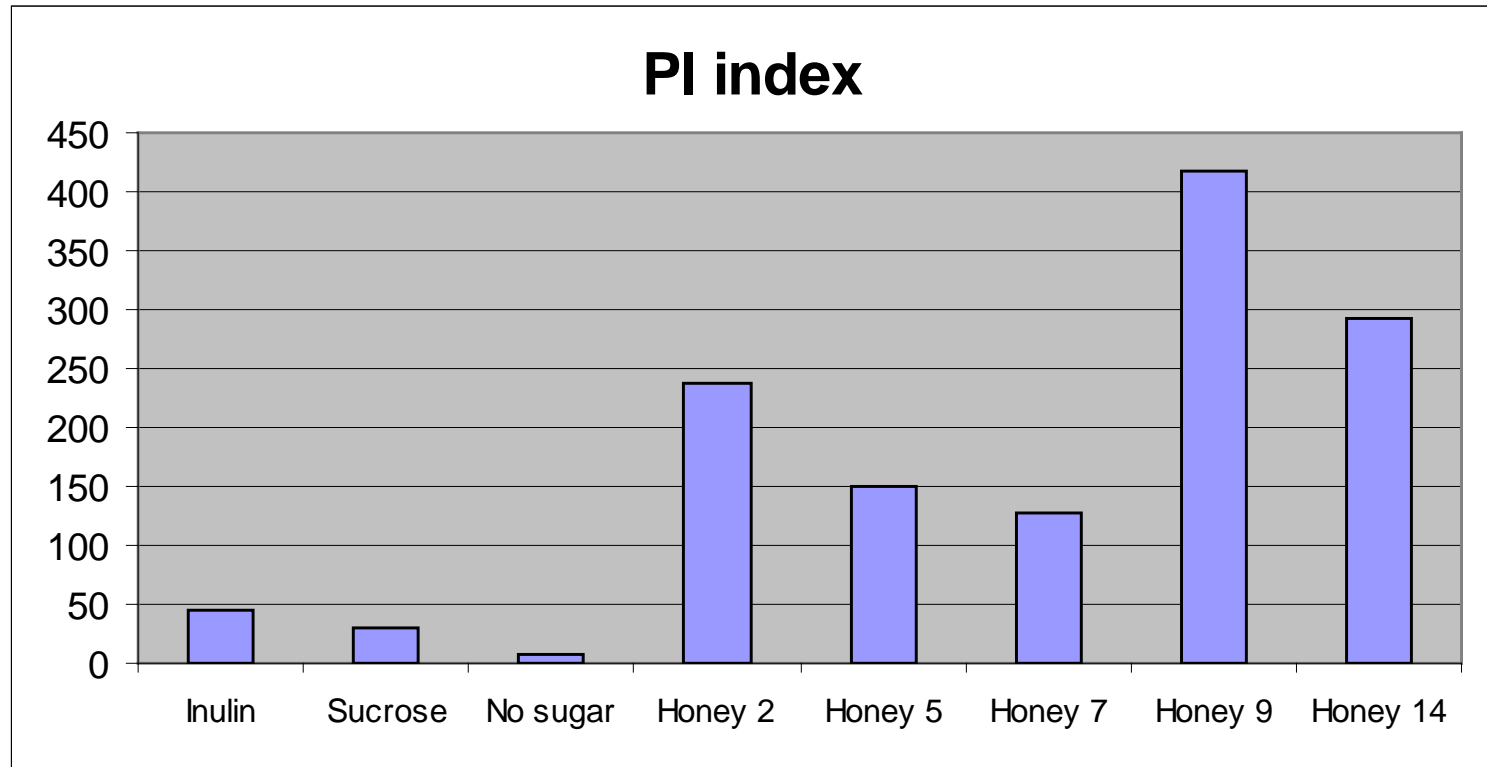
(+)ve value



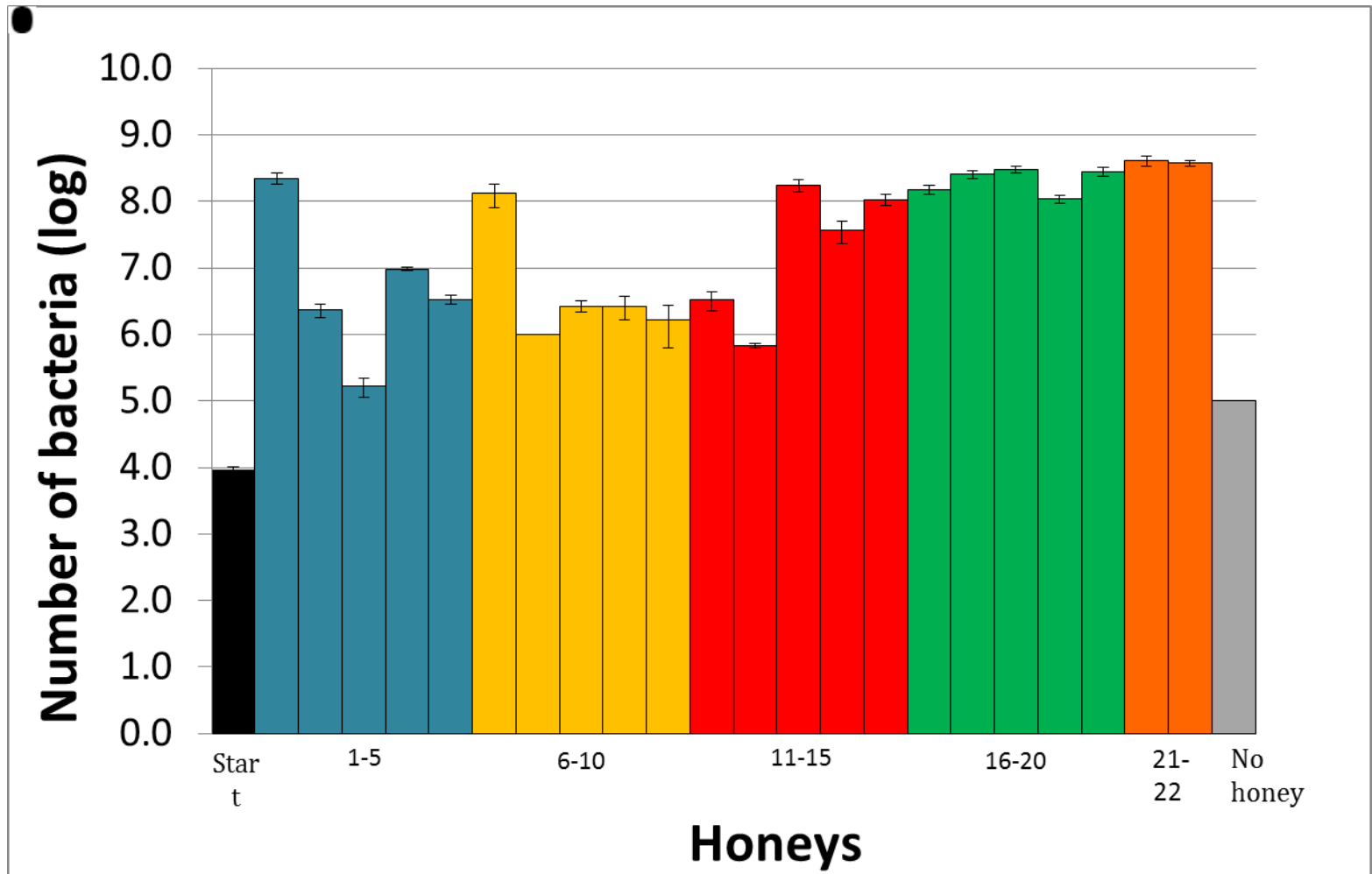
Bacteroides & Clostridia

(-)ve value

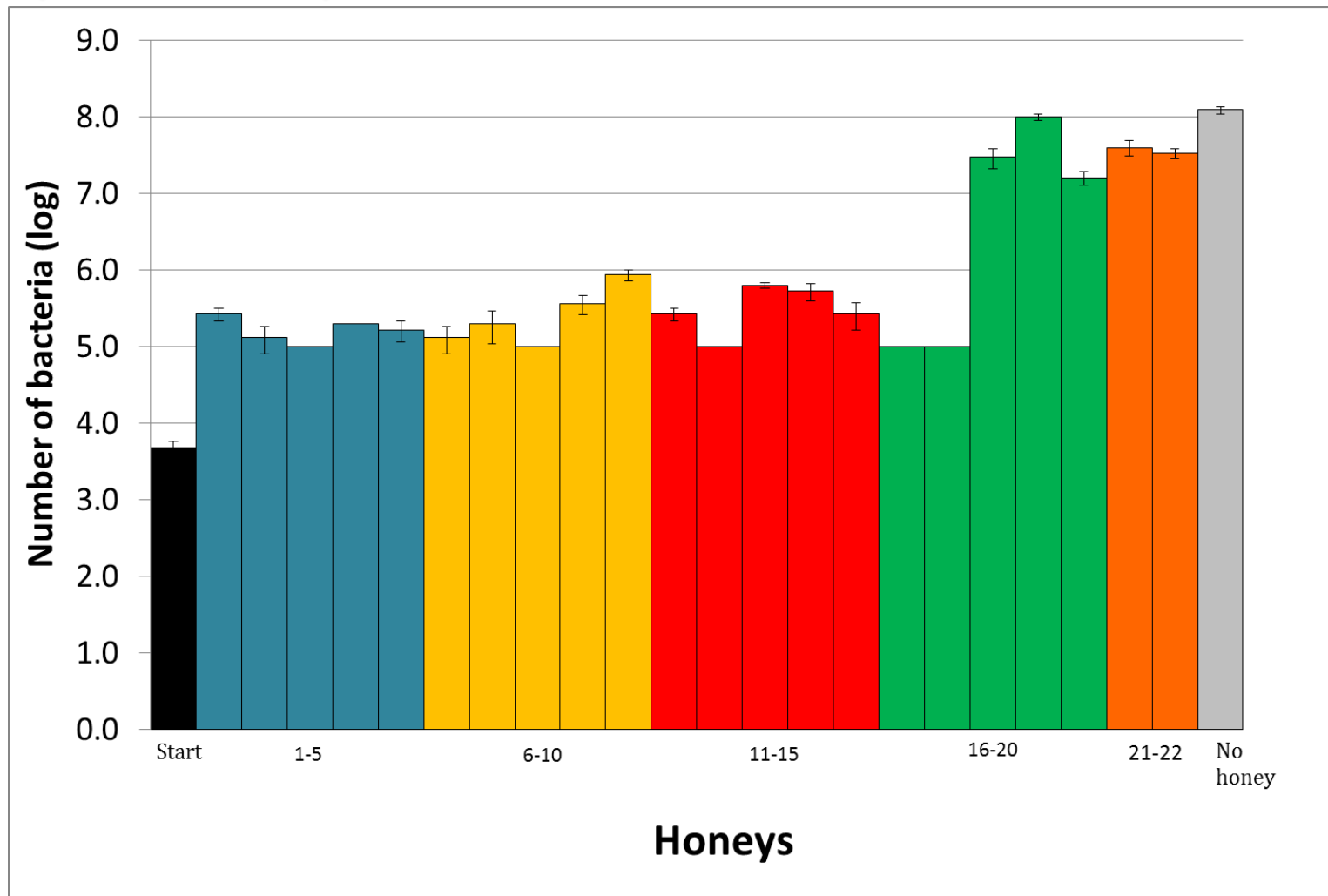
Prebiotic index values for Australian honeys



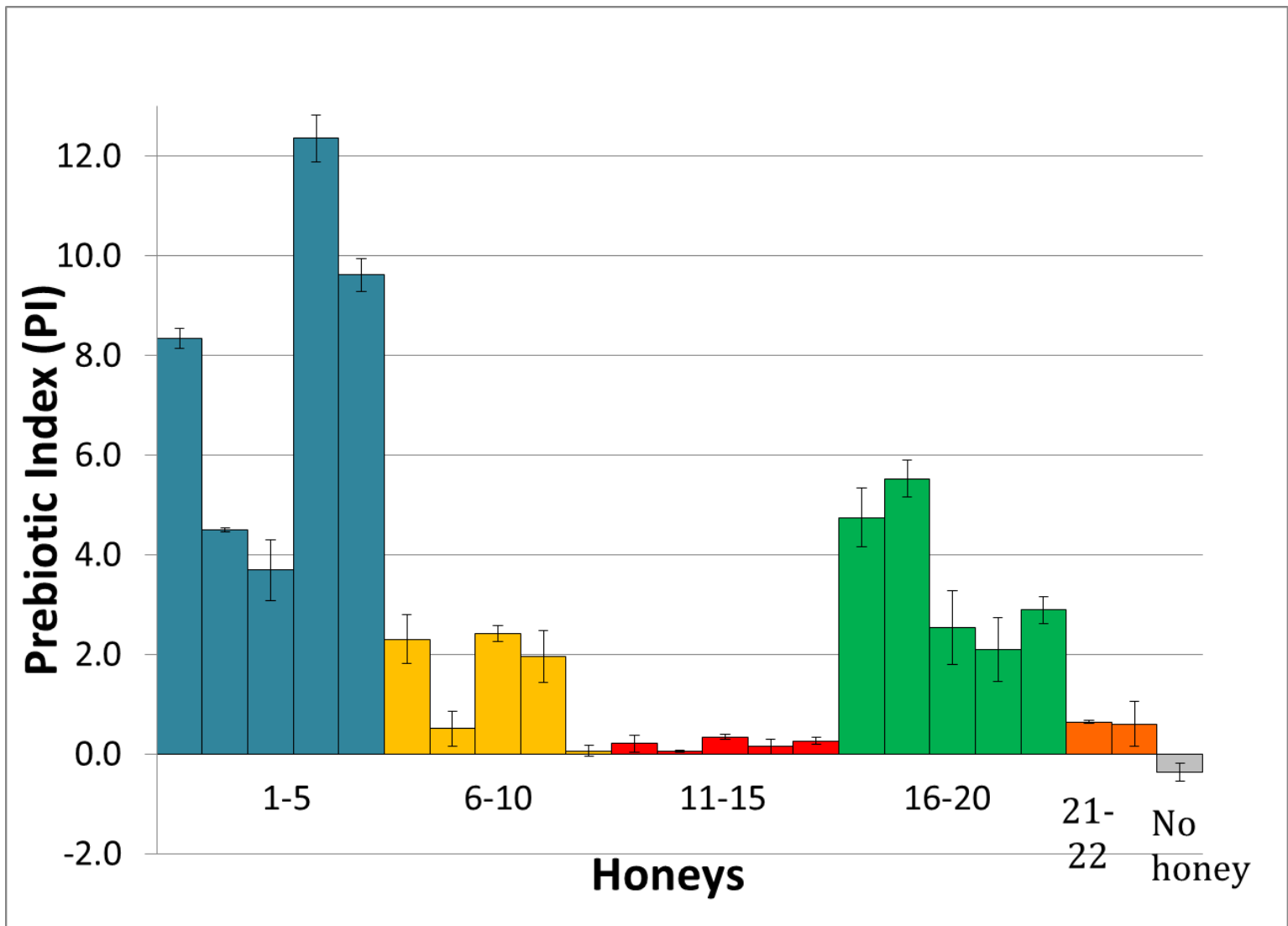
All Australian honeys support growth of good bacteria (lactobacilli)



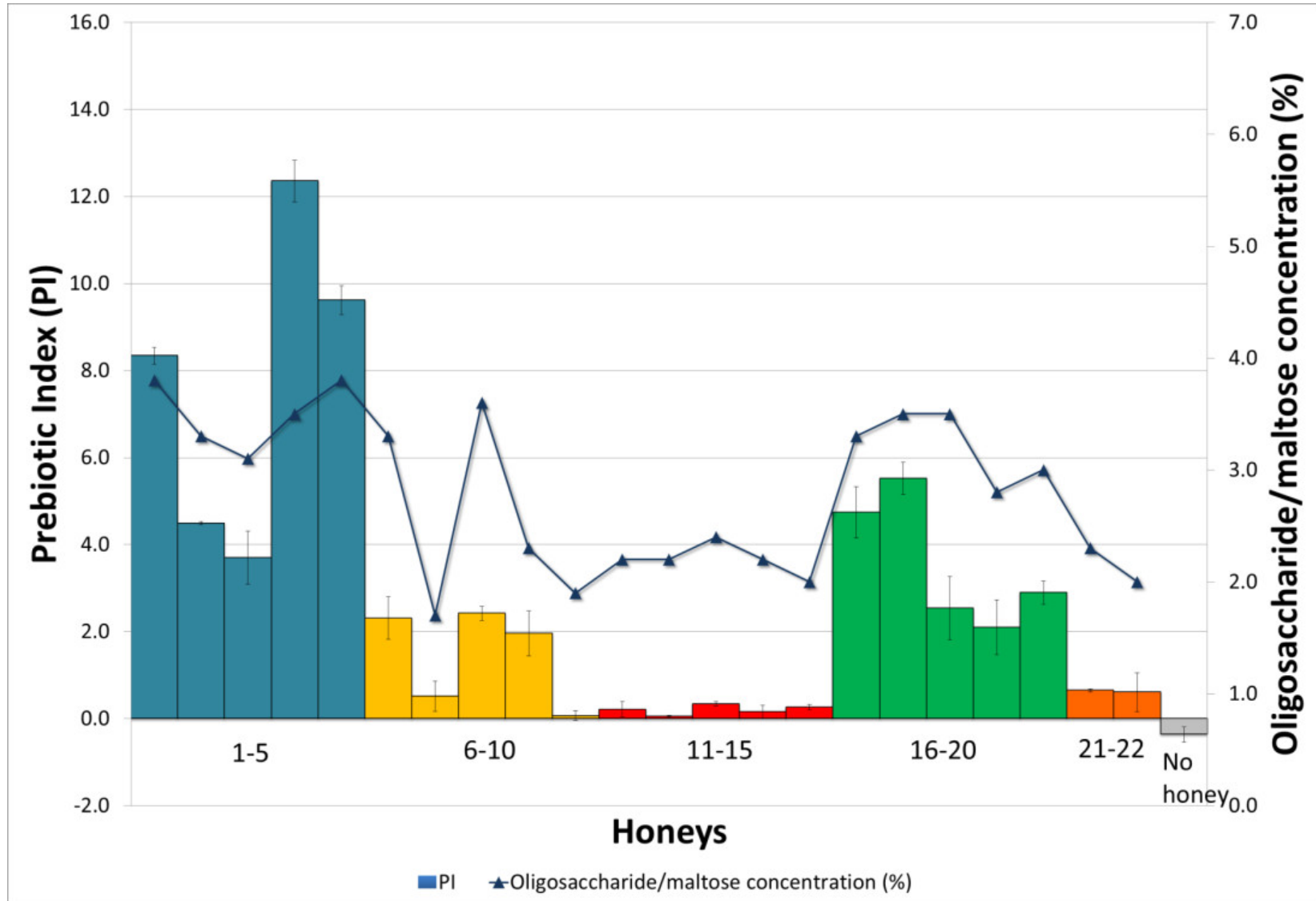
All Australian honeys suppress growth of bad bacteria (clostridia)



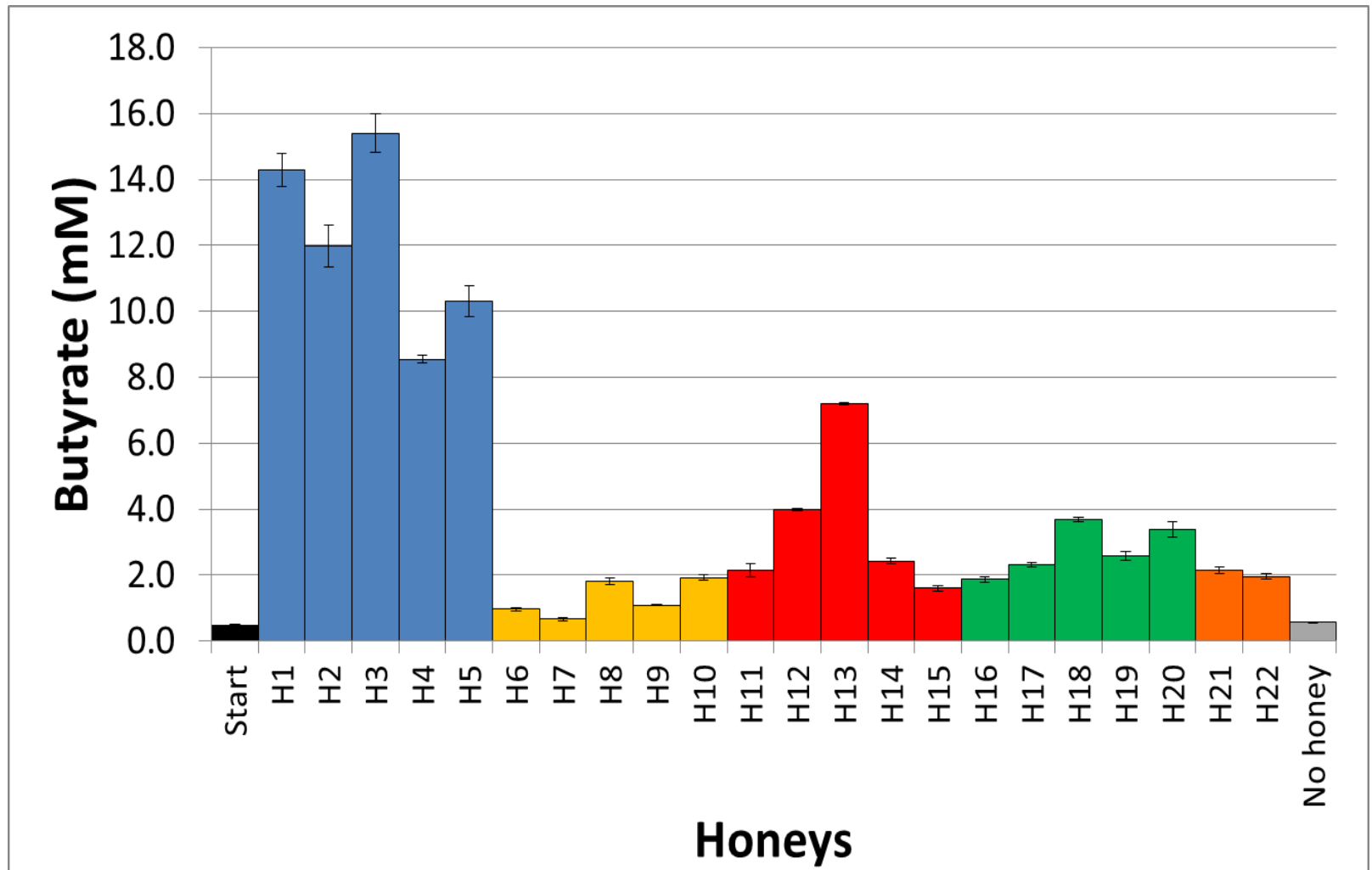
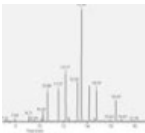
Prebiotic index values for Australian honeys



Prebiotic index and oligosaccharides



Chemical analysis of beneficial end products



What do these results mean?

- Australian honeys:
 - have prebiotic activity
 - oligosaccharides
 - deliver health benefits
 - could be an effective functional food ingredient
- Each honey could provide different health benefits
 - Prebiotic, nutritional, therapeutic



Acknowledgements

- RIRDC funded project
- UNSW Lab
 - Dr Lai Tran
 - Associate Professor Torsten Thomas
 - Dr Meera Esvaran
- Rosie Stern