

# Whole grains and health



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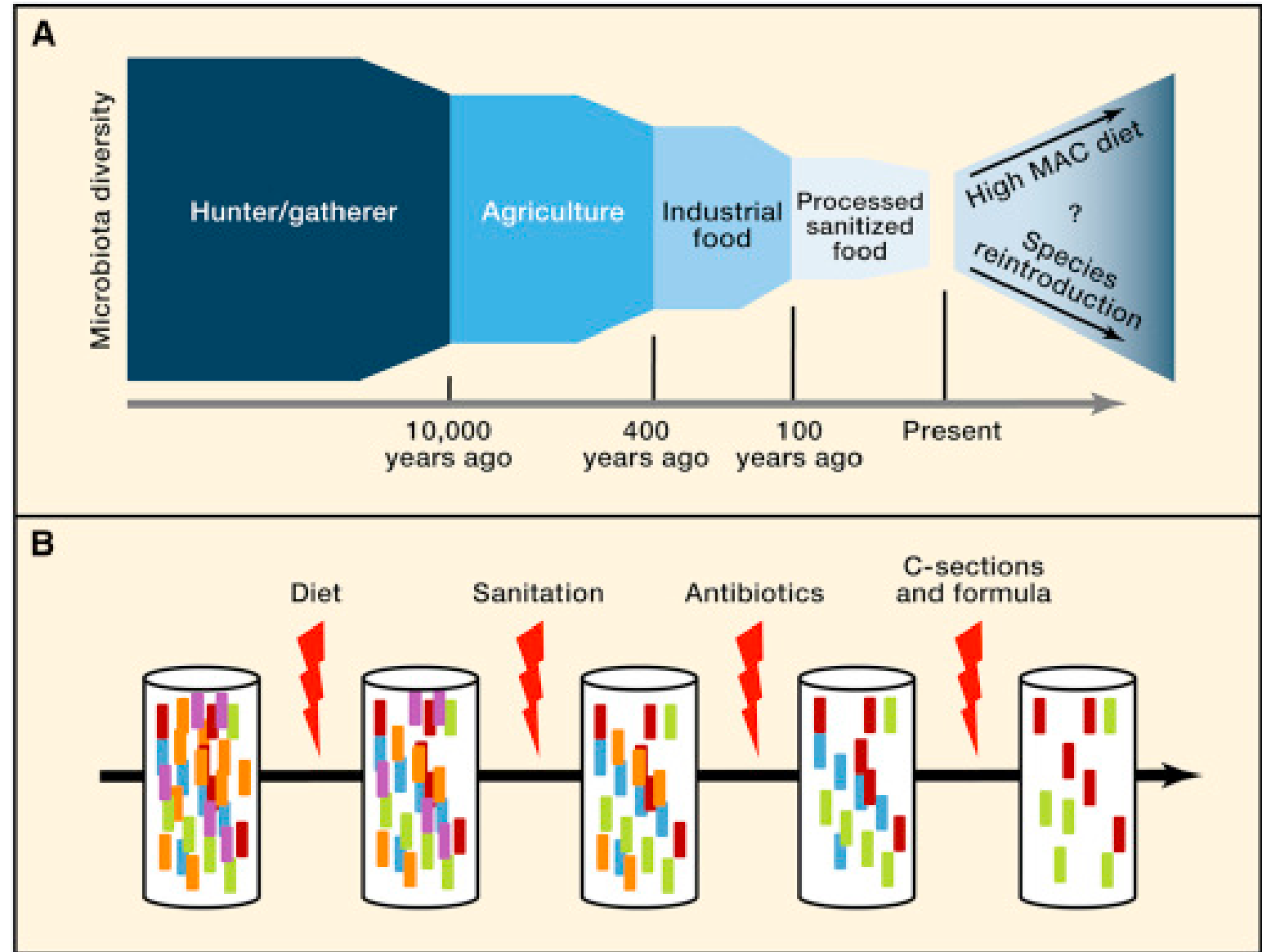
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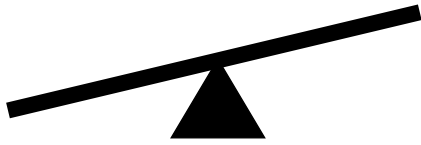
The lifestyle in developed countries depletes the microbiome





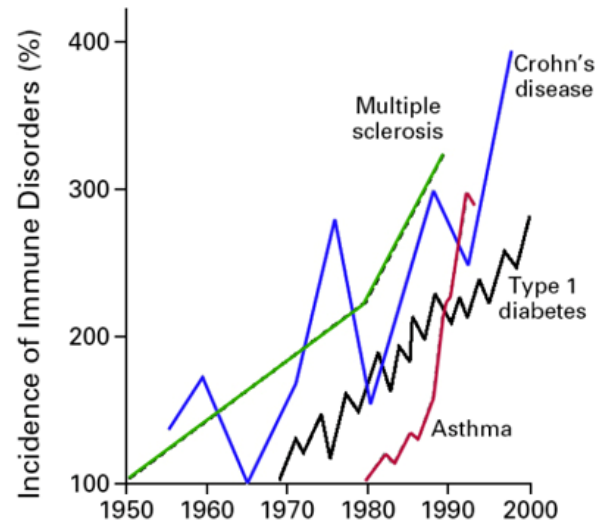
# Implications for health

## Developed societies



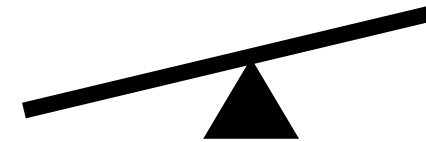
Autoimmune diseases  
Allergies

Infectious  
diseases



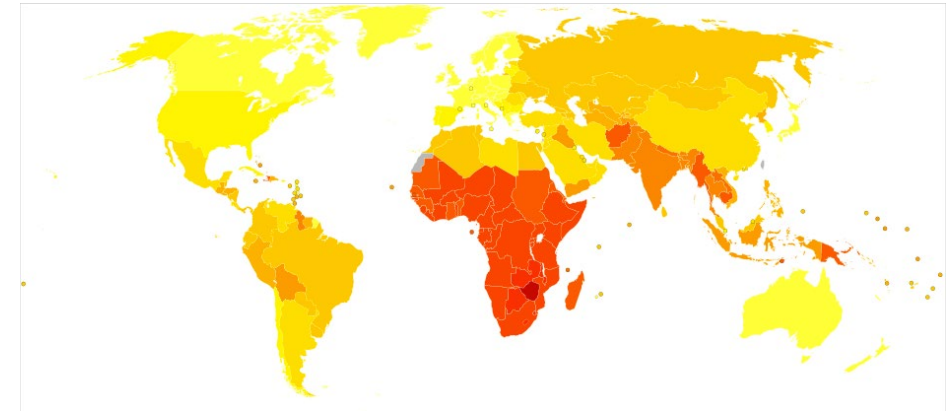
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## Non-industrialized societies



Autoimmune diseases  
Allergies

Infectious  
diseases



Age-standardized disability-adjusted life year (DALY) rates from infectious and parasitic diseases by country (per 100,000 inhabitants).  
wikipedia / WHO



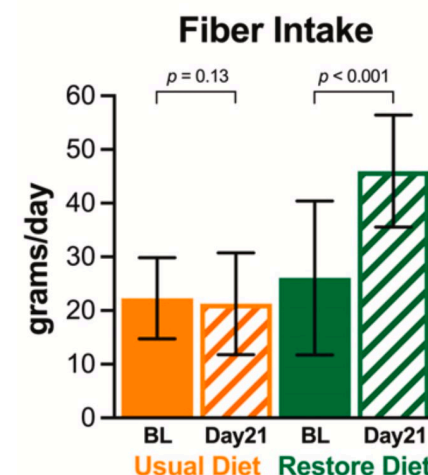
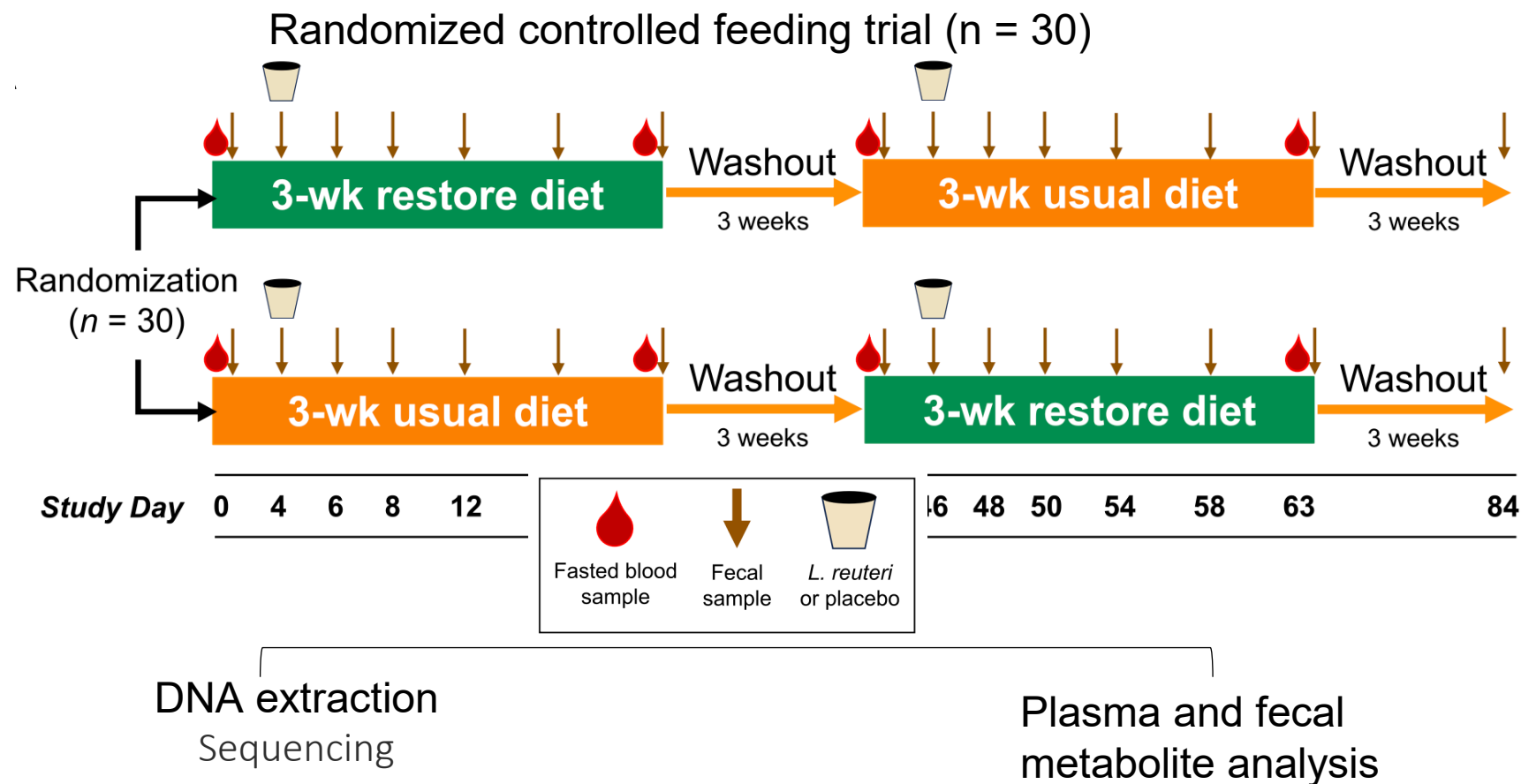
# The human-gut microbiota relationship:

## A holobiont perspective of western diseases

**Environmental factors linked to western diseases  
(antibiotics, c-sections, hygiene, high sugar and fat diet)  
→ disrupt the microbiome.**



# What happens if a regular Canadian diet is replaced by a whole plant foods / fibre rich diet?



**Non-industrialized,  
whole foods-based,  
fiber-rich diet  
“restore diet”**





# An intervention study that provided participants with whole grain foods for three weeks



Anissa Armet

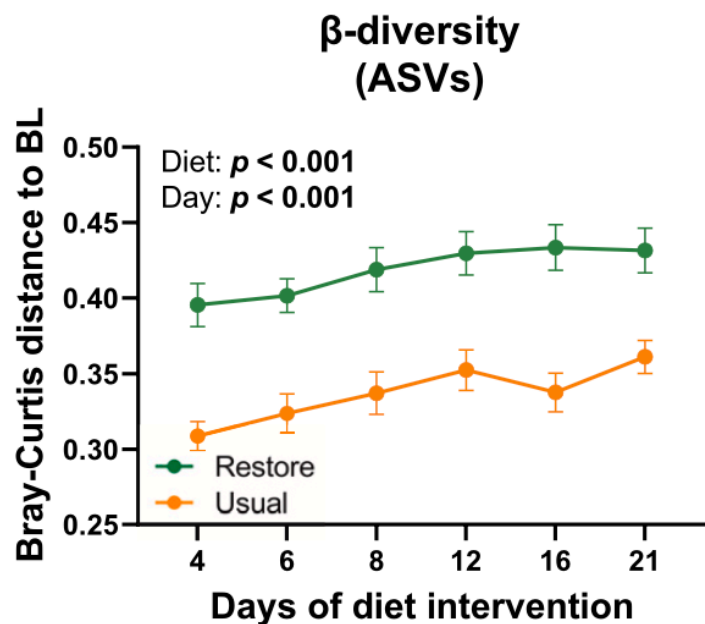


Jens Walter



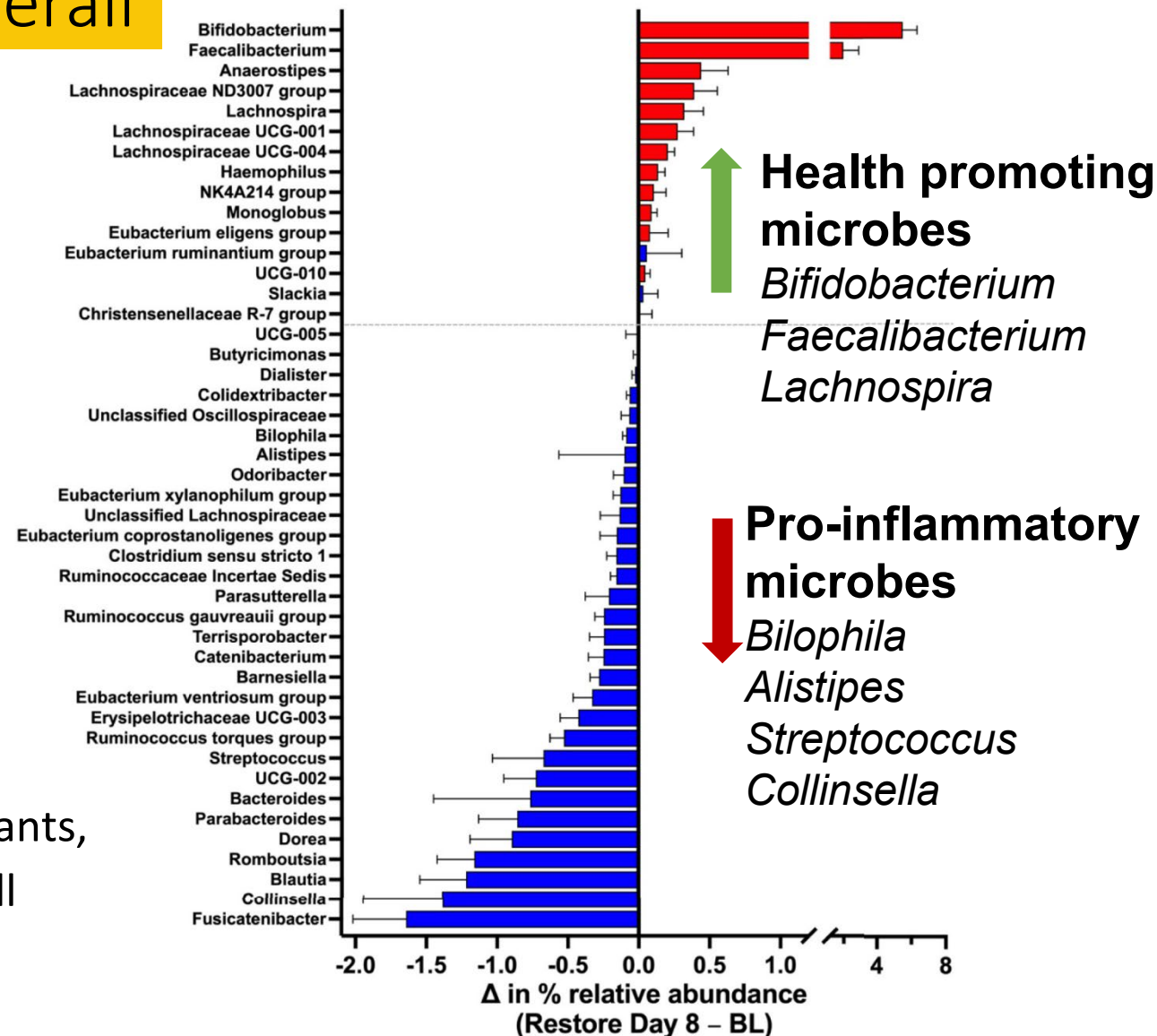


# The restore diet altered the overall gut microbial community



- Despite the large individuality in the 30 participants, average abundance of several microbial taxa still showed a significant diet induced changes.

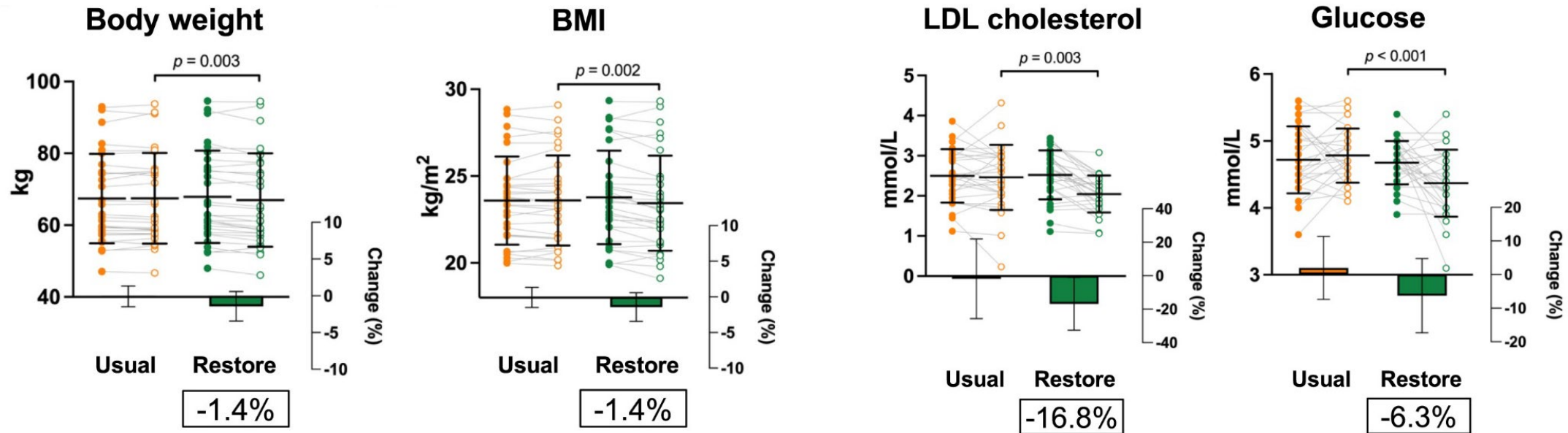
## Shifts in Genera







# The restore diet and risk markers for chronic disease



- Reduced bio-accessibility of macronutrients due to their encapsulation within structures in plant foods.
- Despite variation in individual microbiota responses, individual changes of risk markers are consistent
- Population-wide benefits that require no personalization
- **Risk makers (BMI, Glucose, Cholesterol, CRP) were not improved by fiber supplements**





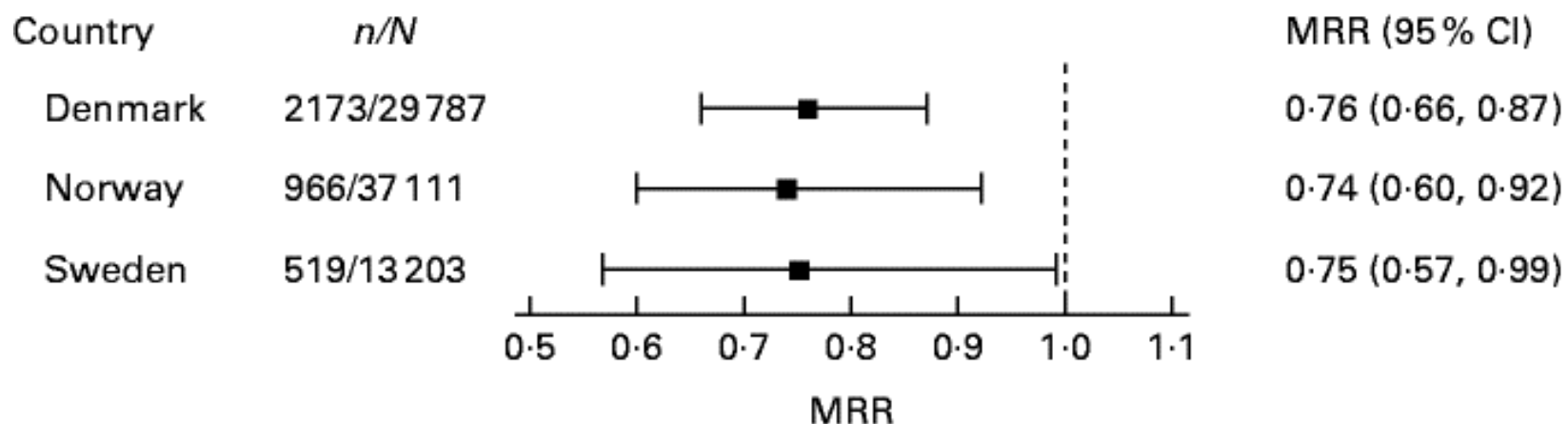
# Food choices and all-cause mortality (U.K.)

	Q1 (lowest)	Q2	Q3 (typical)	Q4	Q5 (highest)
Whole grains	1	0.78 (0.74–0.81)	0.77 (0.73–0.8)	0.82 (0.78–0.86)	0.82 (0.79–0.86)
Vegetables	1	0.95 (0.9–0.99)	0.94 (0.9–0.98)	0.92 (0.87–0.96)	0.93 (0.89–0.97)
Fruit	1	0.88 (0.84–0.91)	0.84 (0.79–0.89)	0.85 (0.81–0.89)	0.86 (0.82–0.9)
Nuts	1	0.82 (0.76–0.89)	0.91 (0.8–1.03)	0.89 (0.73–1.08)	0.81 (0.2–3.24)
Legumes	1	0.91 (0.83–0.98)	1.02 (0.87–1.21)	1.02 (0.6–1.72)	0.72 (0.1–5.11)
Fish	1	0.97 (0.92–1.02)	0.96 (0.92–1.00)	1.03 (0.98–1.09)	0.99 (0.94–1.03)
Egg	1	0.82 (0.73–0.93)	0.85 (0.78–0.93)	0.90 (0.83–0.96)	1.08 (0.95–1.23)
Milk	1	0.99 (0.85–1.16)	0.98 (0.85–1.13)	0.95 (0.82–1.1)	0.93 (0.8–1.08)
Refined grains	1	1.20 (1.12–1.28)	1.17 (1.11–1.23)	1.23 (1.18–1.28)	1.16 (1.11–1.21)
Meat, red	1	1.02 (0.95–1.09)	1.05 (0.99–1.13)	1.18 (1.07–1.29)	1.21 (1.08–1.37)
Meat, processed	1	1.02 (0.96–1.08)	1.13 (1.06–1.2)	1.25 (1.14–1.37)	1.47 (1.27–1.69)
Meat, white	1	0.97 (0.90–1.04)	0.91 (0.85–0.98)	1.00 (0.88–1.15)	0.97 (0.71–1.33)
Sugar-sweetened beverages	1	0.91 (0.83–1)	1.02 (0.9–1.16)	1.22 (0.98–1.52)	1.59 (1.1–2.31)

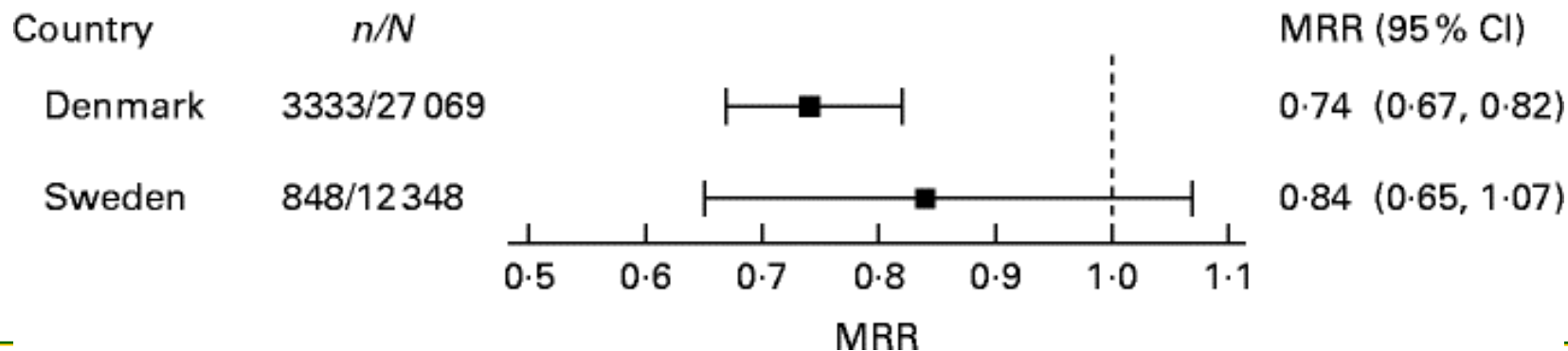


# Mortality rate ratios (MRR) in the Scandinavian HELGA cohort: Association between intake of total whole-grain types and all-cause mortality of female (a) and male (b) participants

(a)



(b)



MRR = mortality rate ratios

Number less than 1 indicates a reduced risk of mortality.

Results:

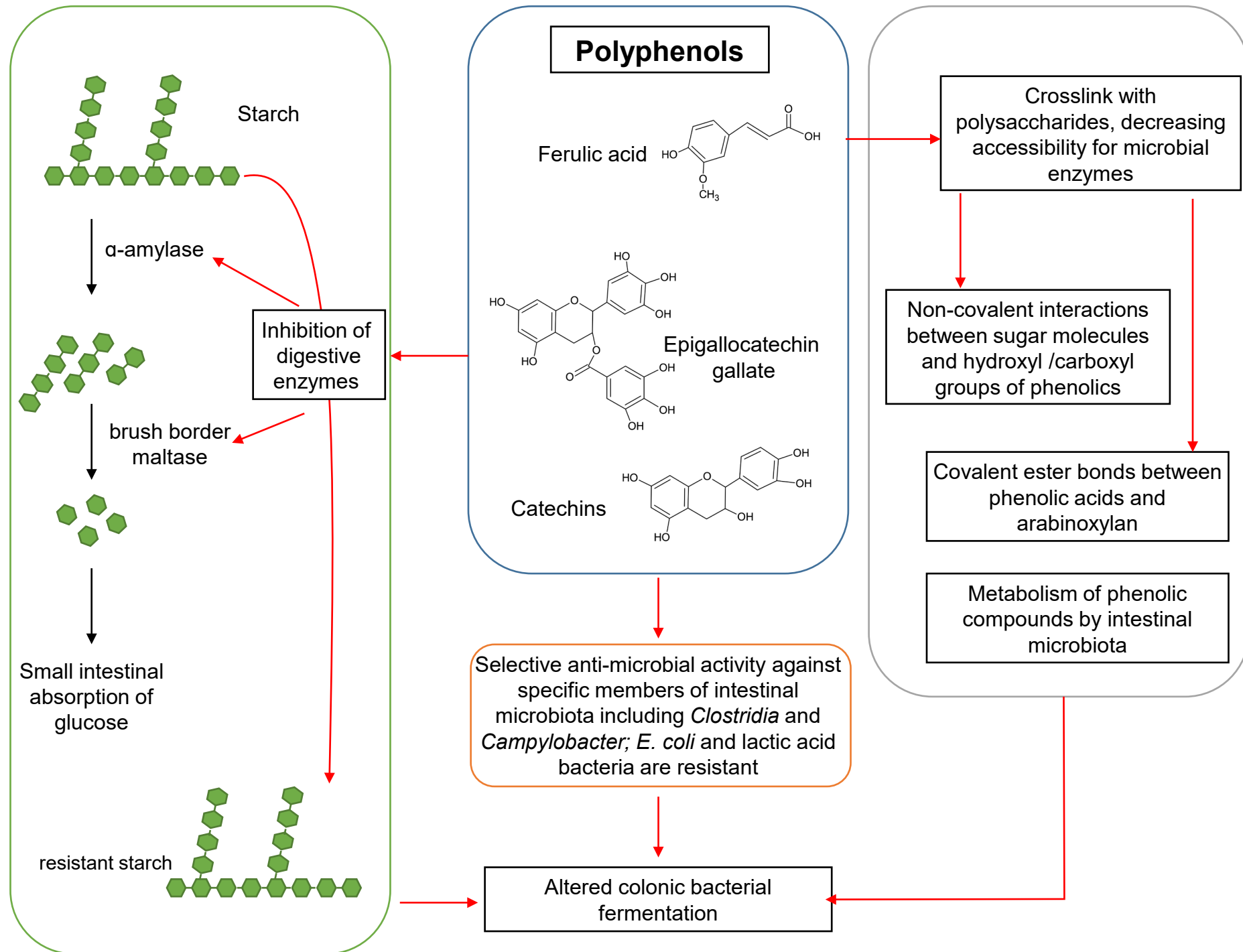
Lower all-cause mortality with higher intake of total whole grain products



# Why whole grains reduce our risk of mortality: it's a soup

Many reasons including:

- Insoluble particles – solid state particle fermentation
- Diversity of carbohydrates stimulating growth of diverse microbiota and increasing resilience to disruption through diet, disease, or medication
- Association with other component in whole grains, including those with anti-oxidant properties like polyphenols







# Summary: Whole grains and health

Consumption of whole grain products are consistently associated with a lower all-cause mortality, including a reduced risk for cardiovascular disease, diabetes, and (colon) cancer

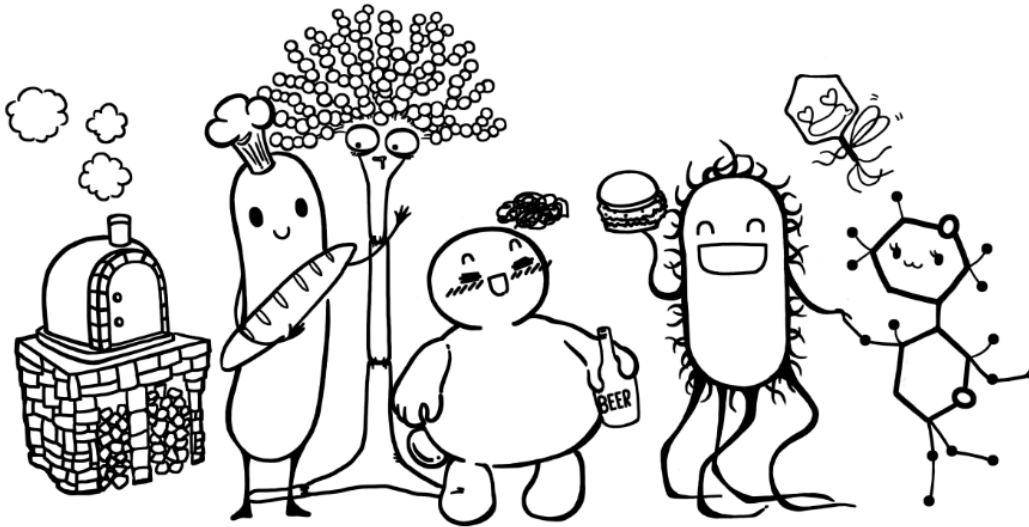
The effect is likely attributable to the effect of dietary fibre in conjunction with other phytochemicals including phenolic compounds.

**The simple answer is likely the right answer:  
Eat the plants (grains) as they come without purification, fractionation, or addition of too much salt and sugar.**

# Acknowledgements

The team...

University of Alberta



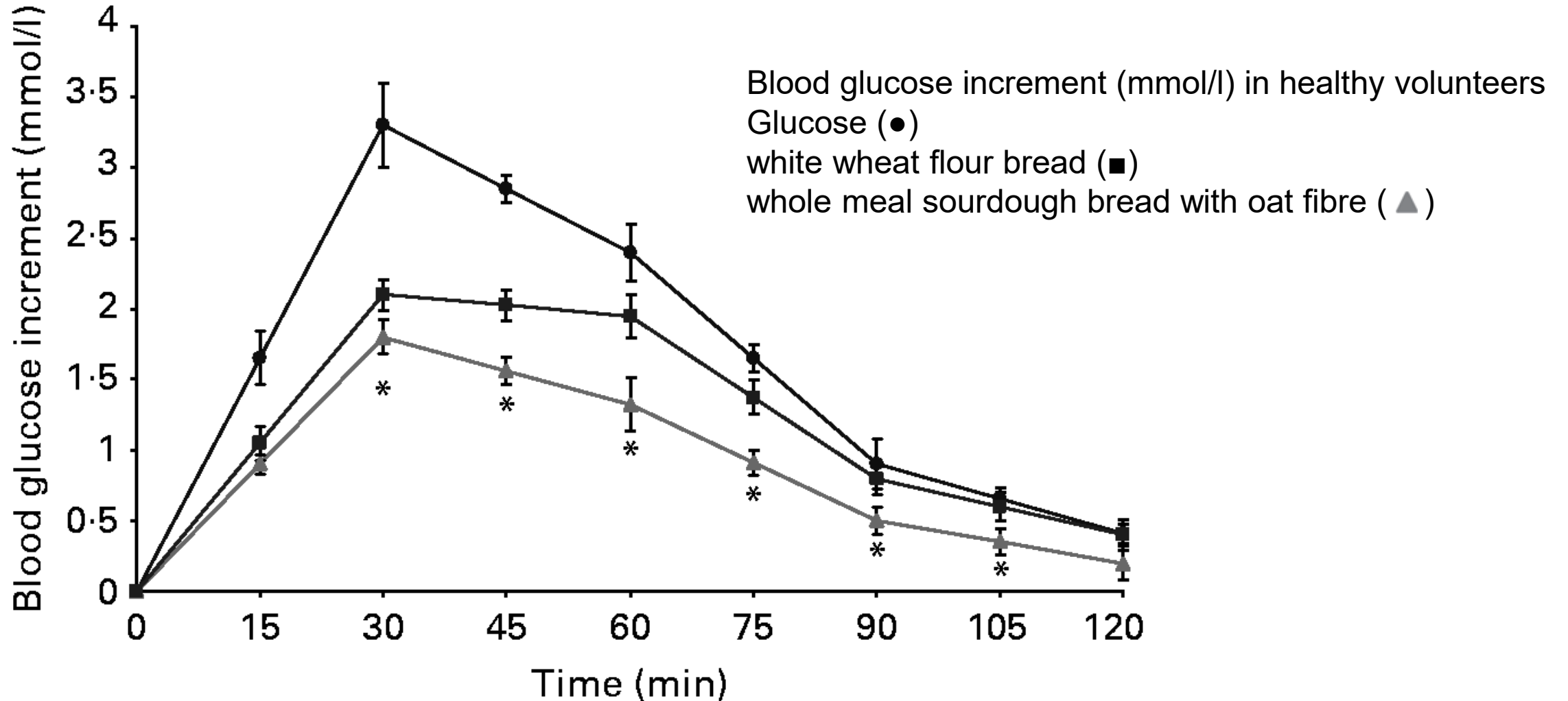
Food microbiology lab 2-50

By: Lingxiao...

...You for your attention



# The same story in a controlled comparison:





# Fructan degradation in rye baking with FruA expressing *L. crispatus*

Fructan, fructose and mannitol content of bread

Strain	FruA addition	Contents in dry basis (mmol/kg)		
		Fructans	Fructose	Mannitol
Whole rye		242.8 ± 26.2	n.d.	n.d.
Whole wheat		120.4 ± 7.7	n.d.	n.d.
<i>L. crispatus</i>	N	10.9 ± 3.5	9.7 ± 1.3	0.7 ± 0.4
<i>Lm. reuteri</i>	N	40.9 ± 11.7	8.2 ± 7.6	8.9 ± 4.5
Straight dough	N	120.1 ± 20.9	20.9 ± 14.8	3.1 ± 1.3
	Y	n.d.	8.0 ± 1.6	3.5 ± 2.4

n.d., not detected.

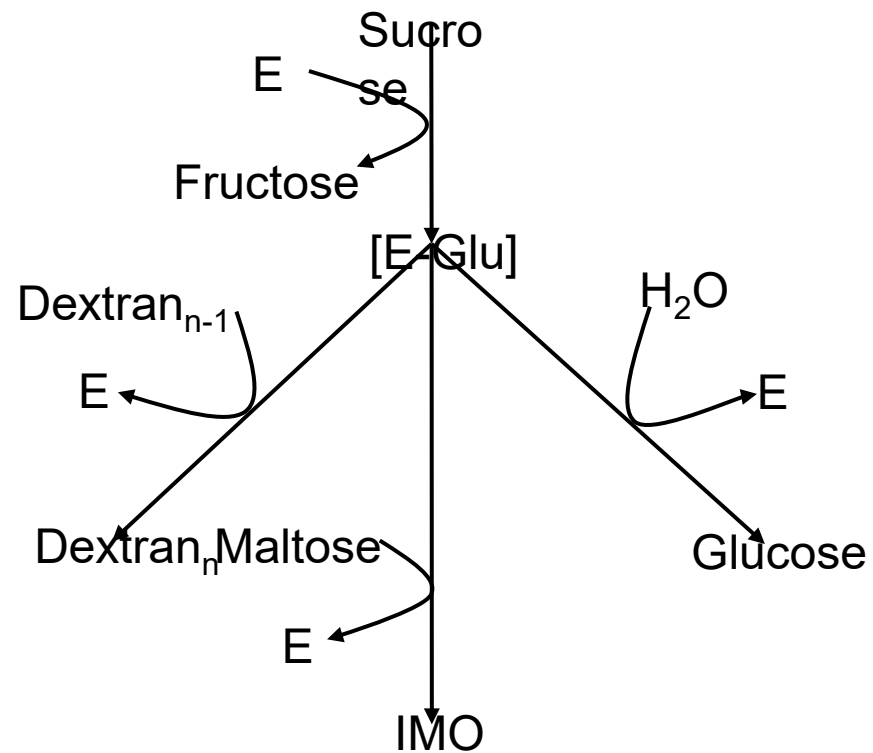
Straight dough: half a slice; sourdough: two slices; *L. crispatus*: four slices



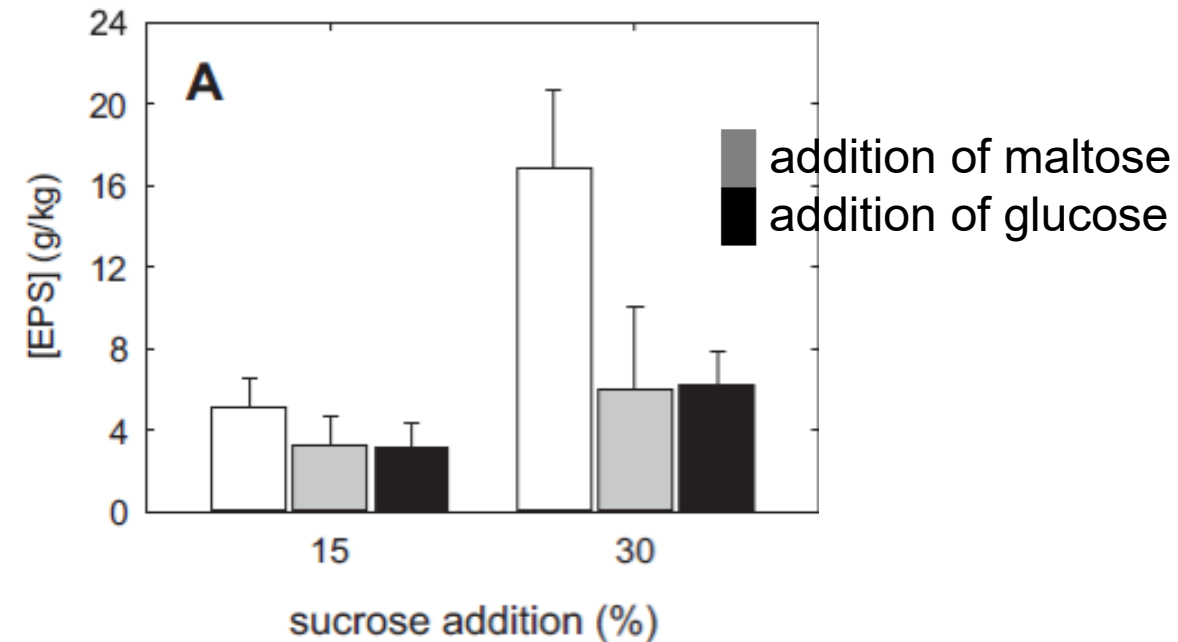


# Conversion of sucrose to dietary fibre (dextran) with dextransucrase-producing *Weissella* species

## Dextransucrase (E) reaction



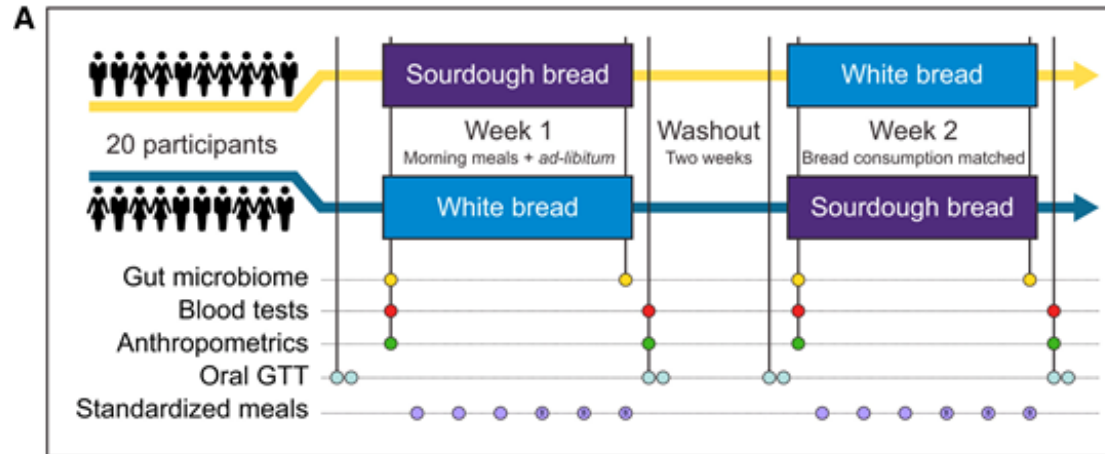
## EPS formation by *W. cibaria* in wheat sourdoughs



- ~ 2 – 5 g / kg dextran in final product
- Increased bread volume
- Increased sweet taste due to fructose



# Does sourdough make a difference for microbiota?



Not for sourdough bread (left)  
nor for sourdough pasta (below)

