

Obesogenic Gut Microbial Composition in the Malaysia Multiethnic Community

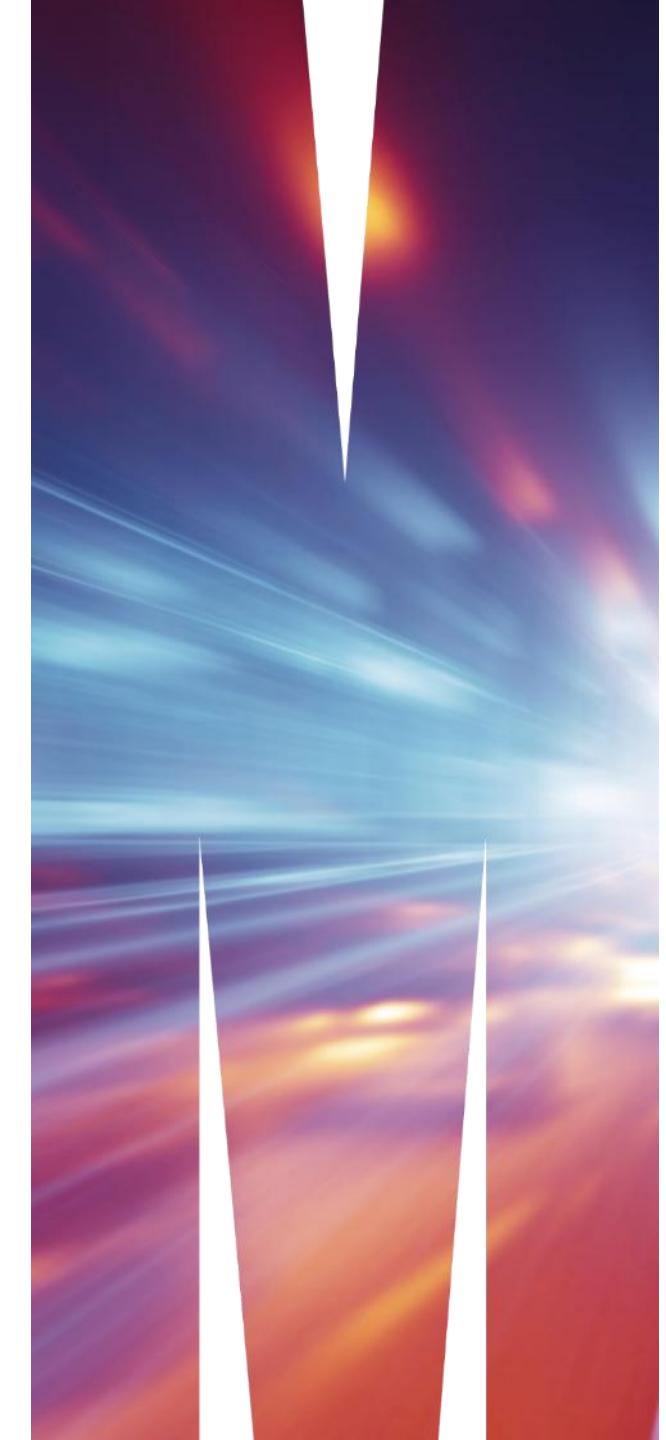
Chong Chun Wie

Associate Professor, School of Pharmacy
Director, MUM Microbiome Research Centre
Monash University Malaysia



Outline

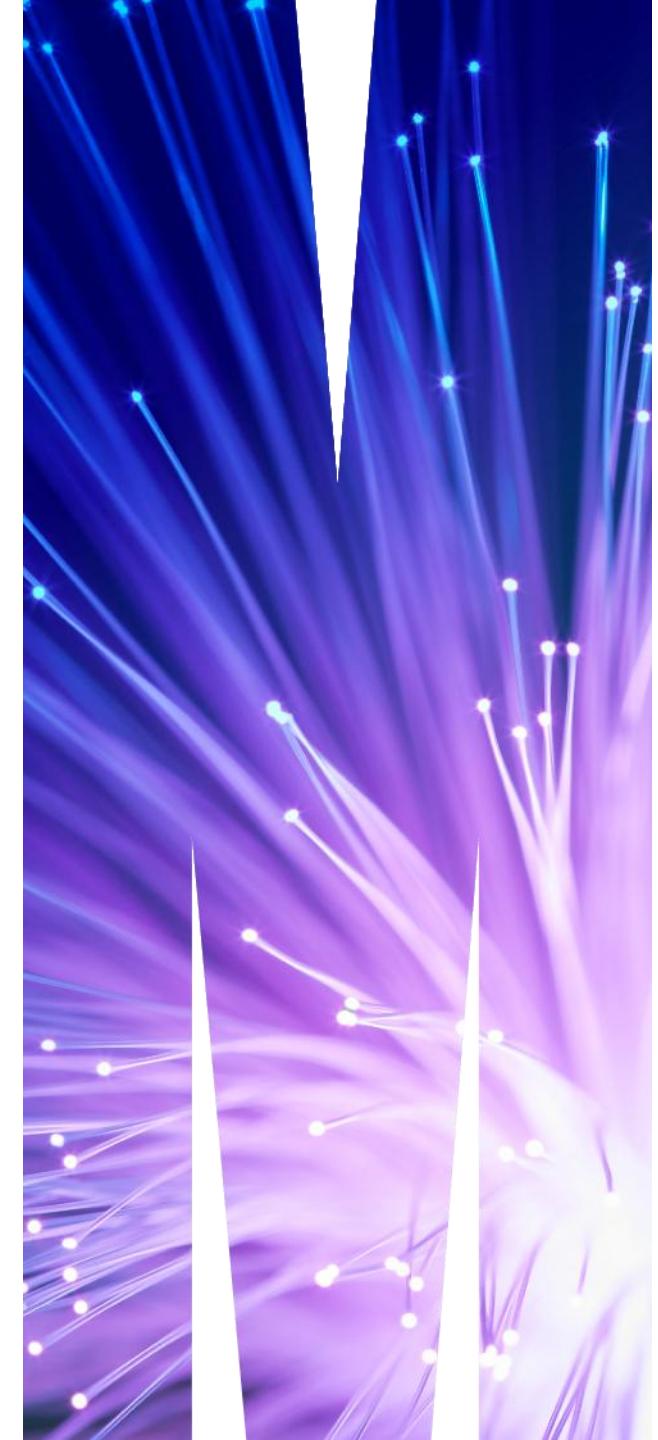
- Role of Gut Microbiome
- Obesity in Malaysia
- Ethnicity Specific Gut Microbial Composition
- Obesity and Microbiome
- Obesogenic Microbial Composition – Importance
- Summary





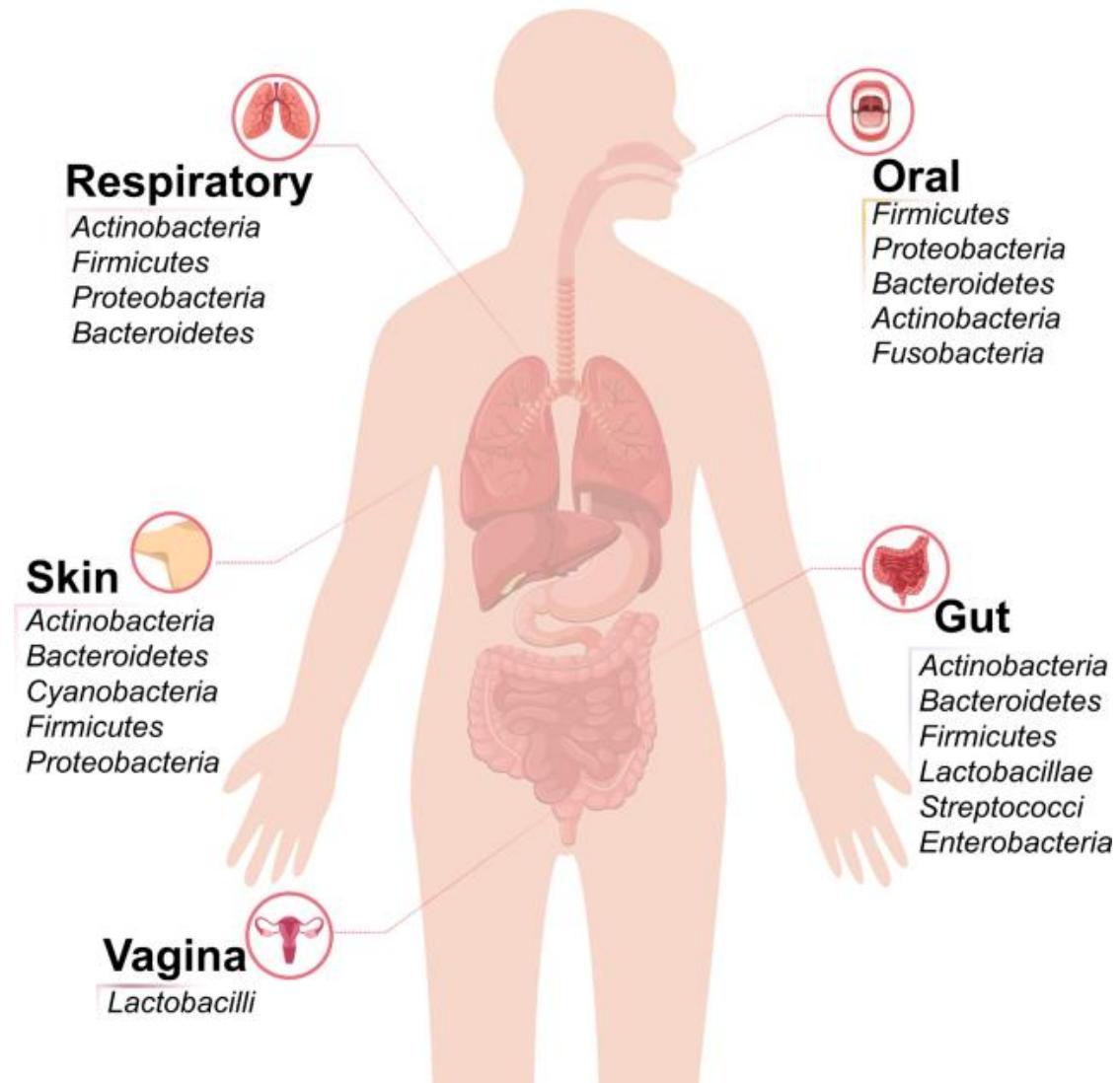
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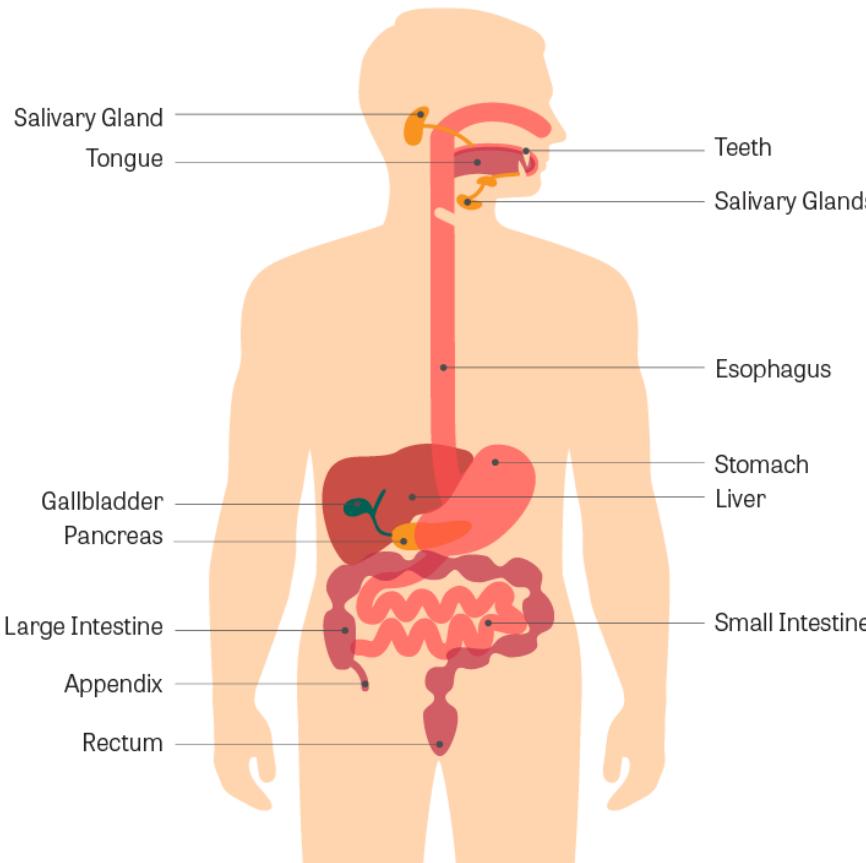
Role of Gut Microbiome



Microbiota composition in different regions

Human Microbiome

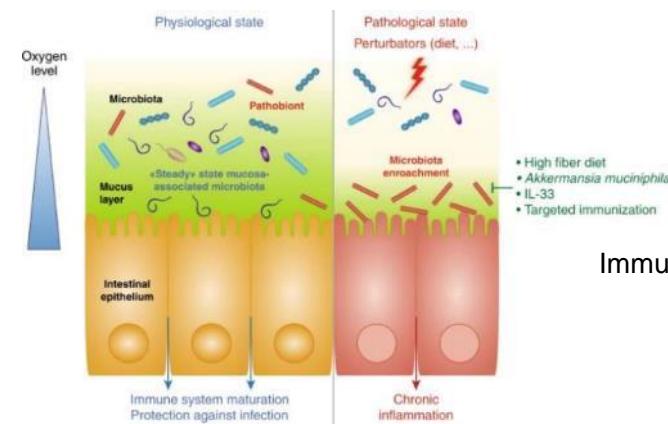




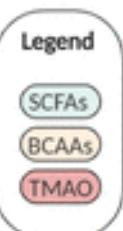
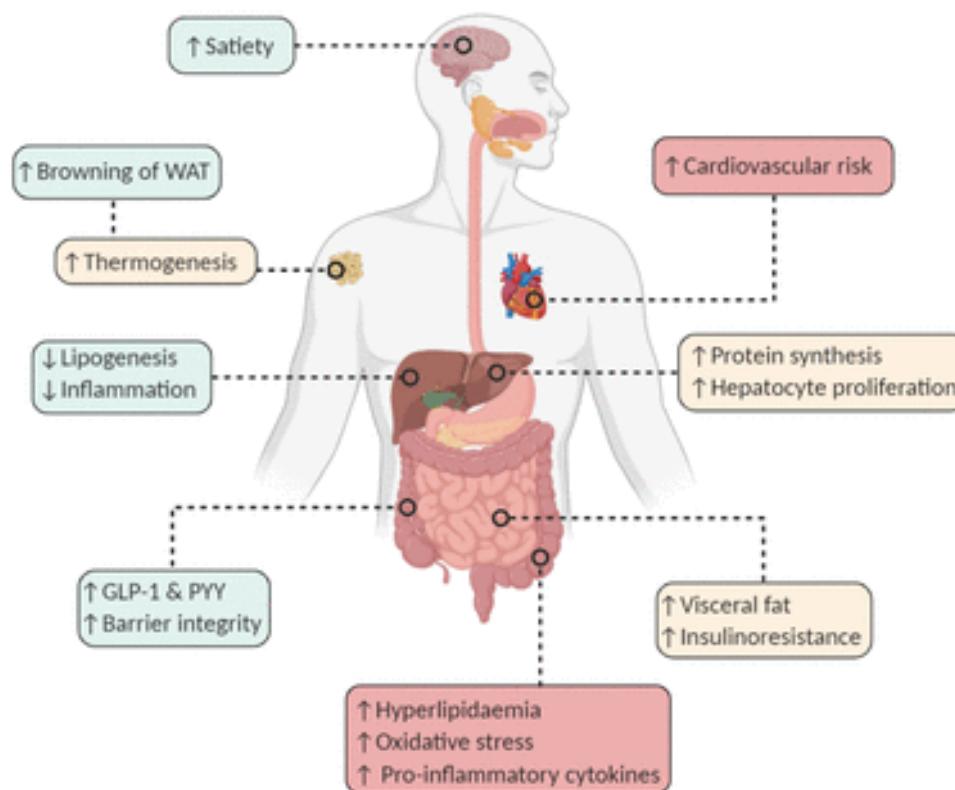
Digestion



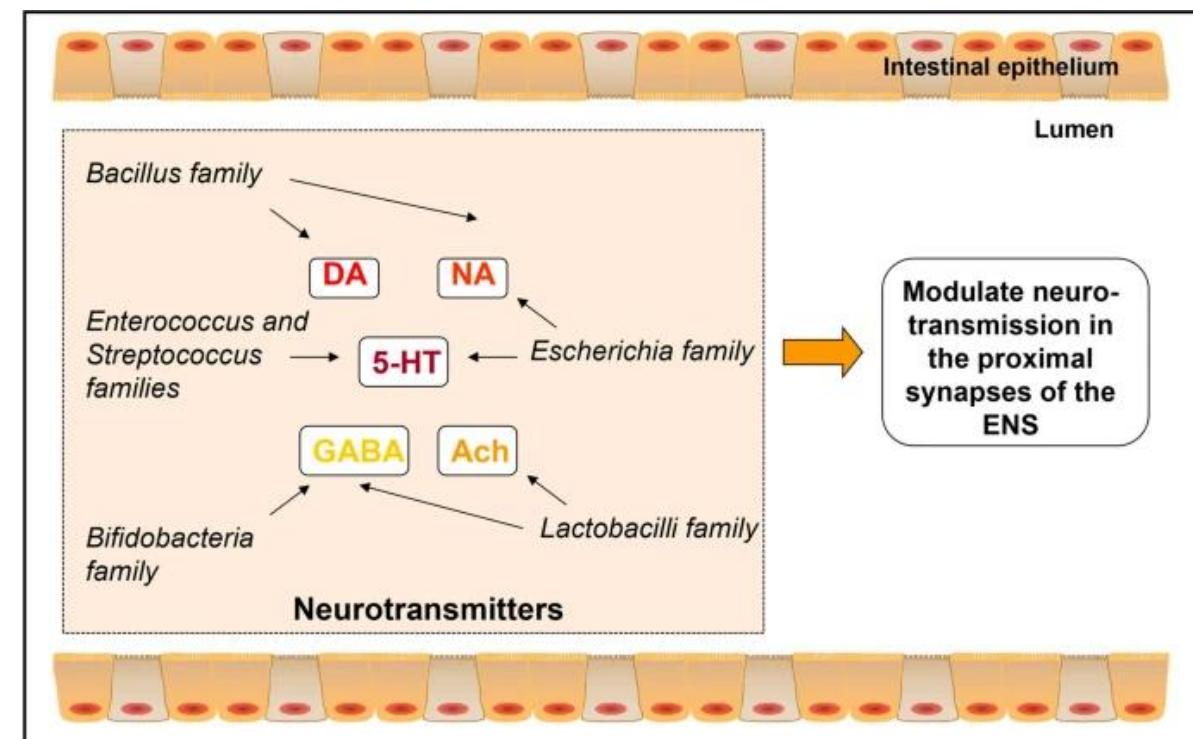
Drug metabolism



Immunity

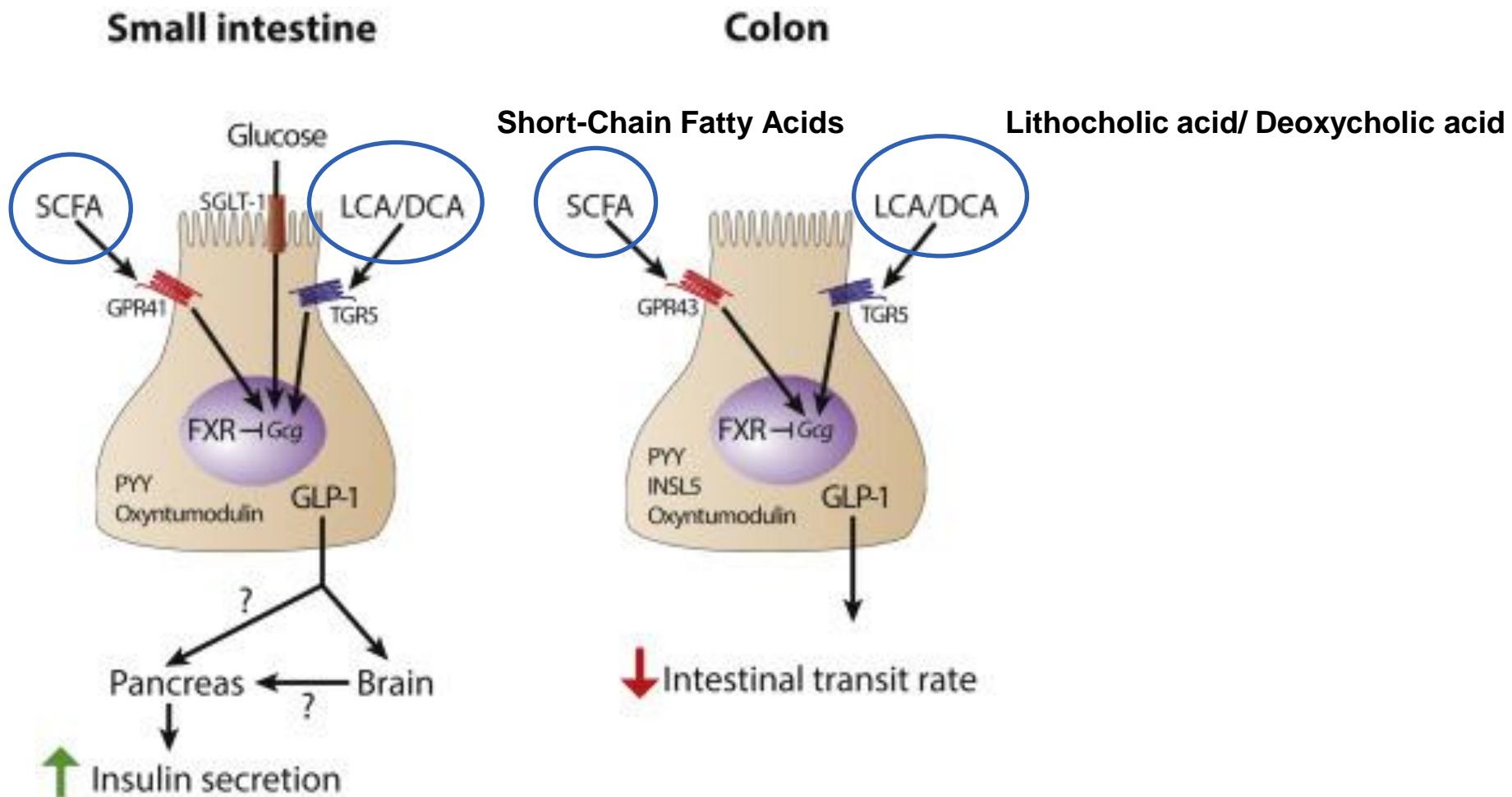


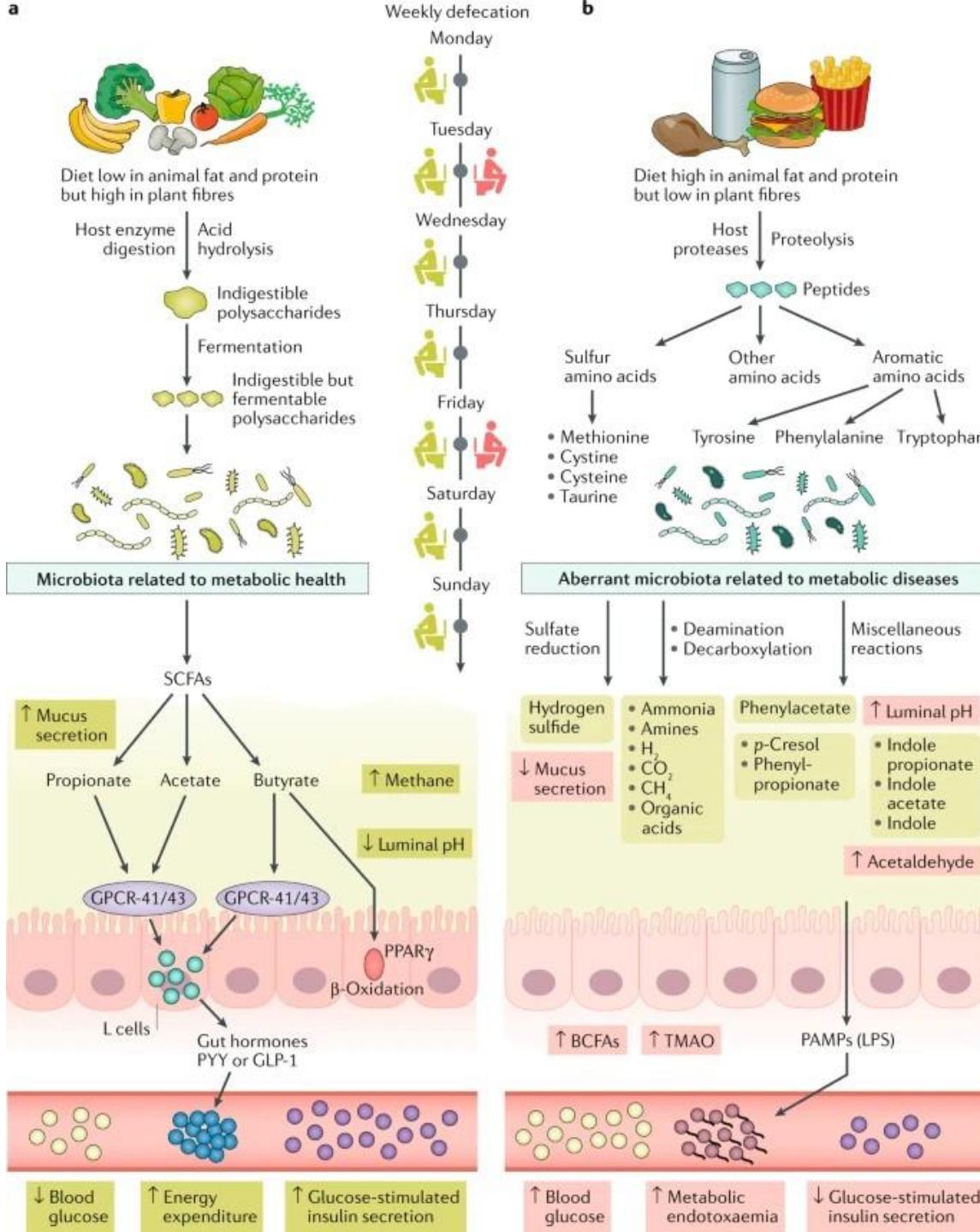
Agus et al. (2021) Gut 70:1174-1182.



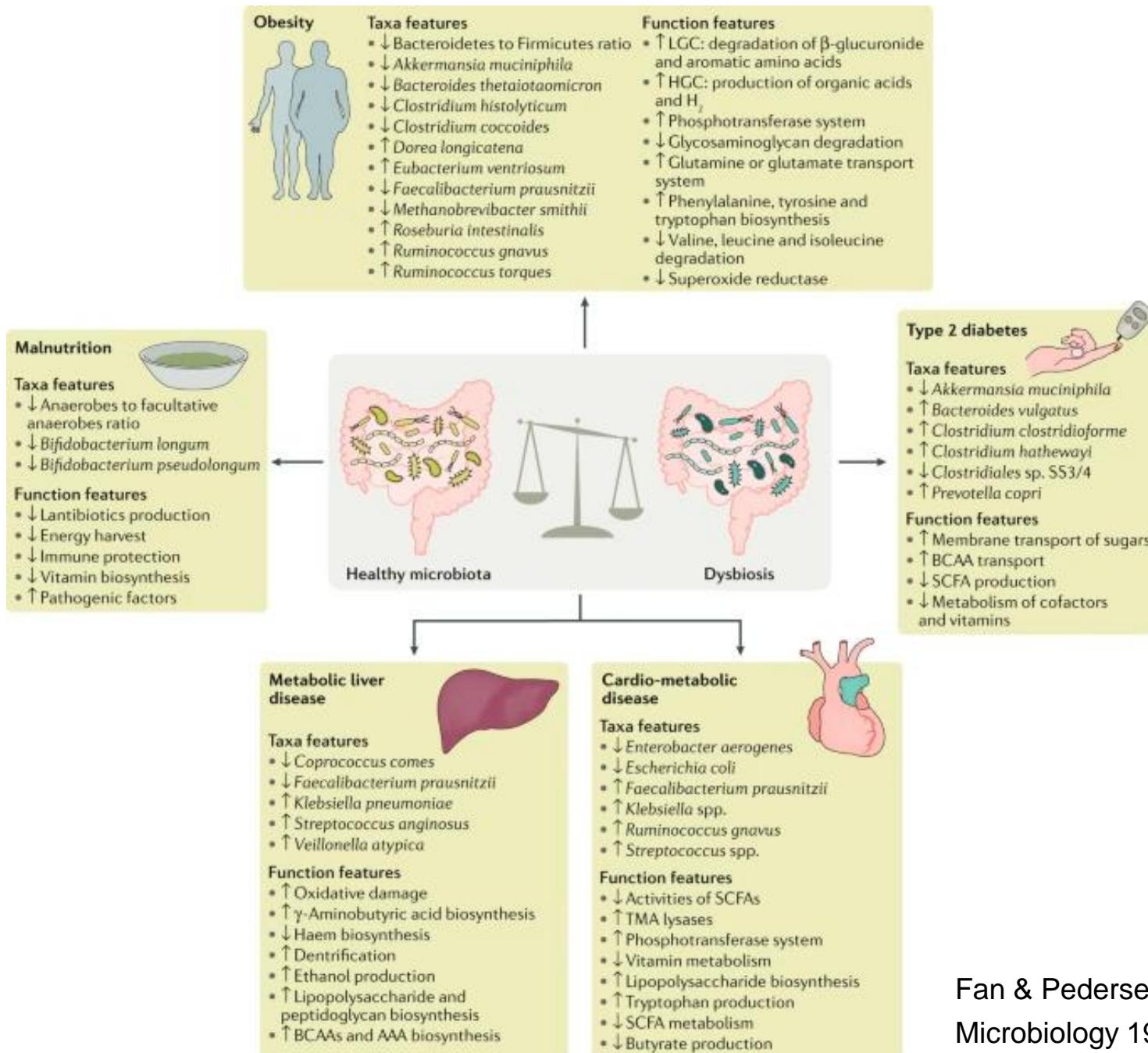
DA dopamine, 5-HT 5-hydroxytryptamine, NA noradrenalin, GABA γ-aminobutyric acid

Yue et al. (2022) Cell Mol Neurobiol 42: 439–453





Fan & Pedersen, (2021) Nature Reviews Microbiology 19(1): 55-71.



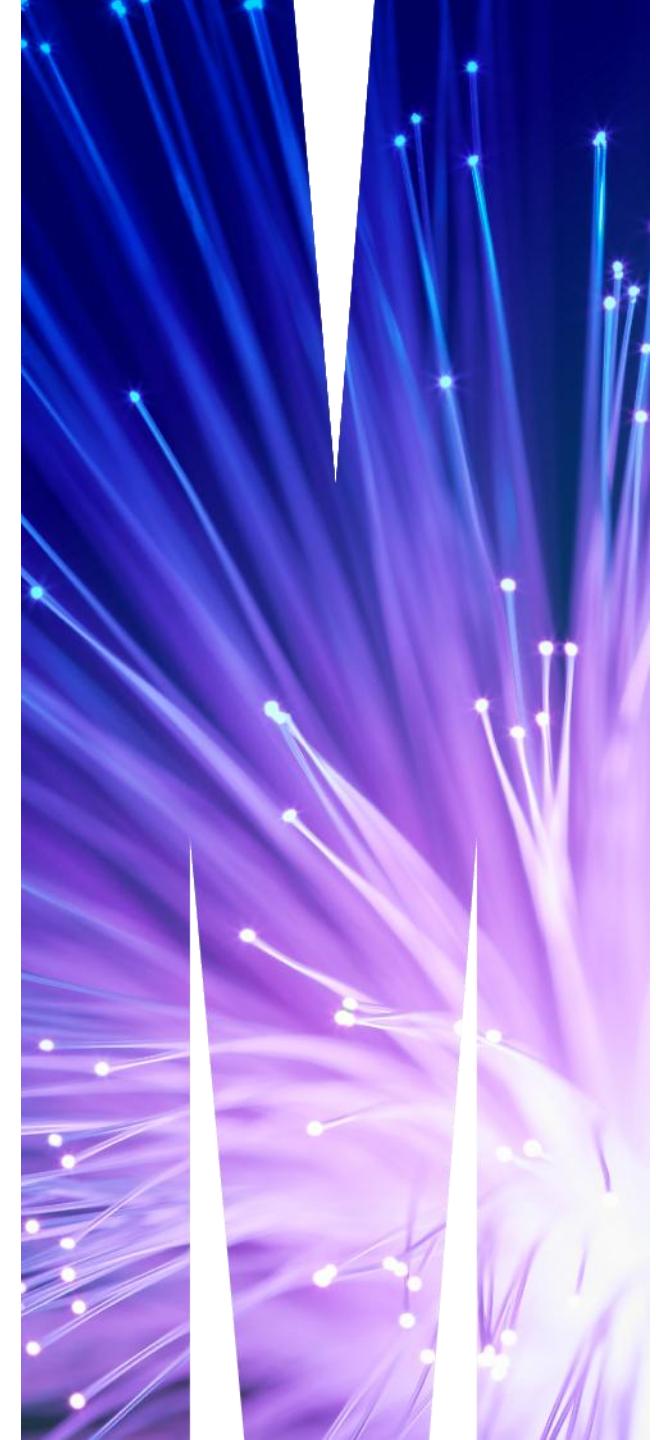
Fan & Pedersen, (2021) Nature Reviews Microbiology 19(1): 55-71.



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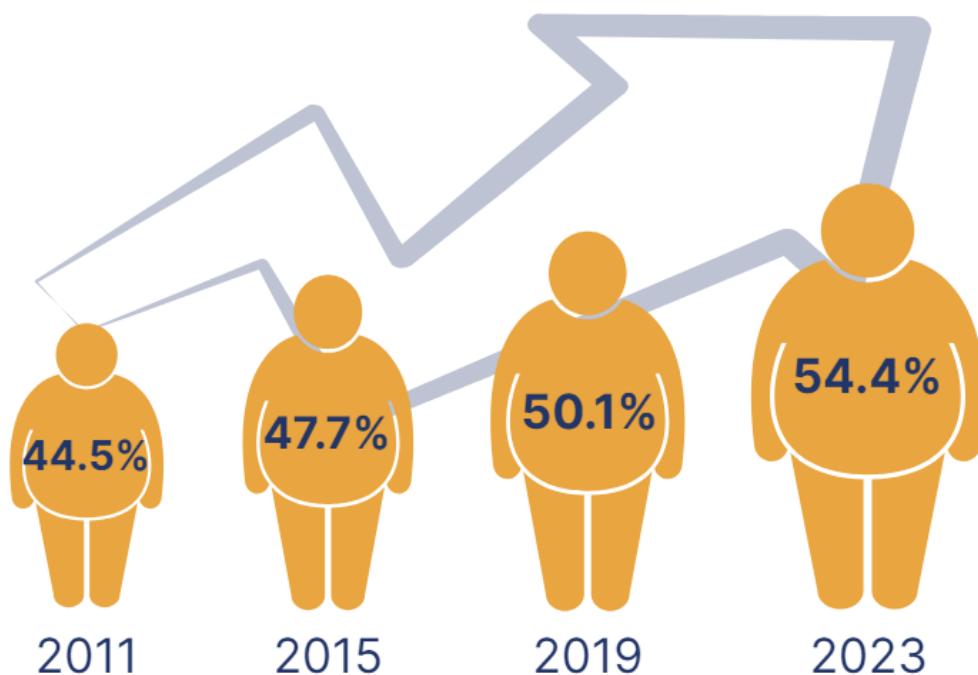
Obesity in Malaysia



We are getting fatter!

Trend in overweight & obesity among adults in Malaysia from 2011 to 2023

(Based on Body Mass Index (BMI): $\geq 25.0 \text{ kg/m}^2$)



1 in 2

adults in Malaysia
were **overweight**
or **obese**

OVERWEIGHT =

Body mass index (BMI)
more than 25 kg/m^2

OBESSE =

Body mass index (BMI)
more than 30 kg/m^2

This was found to be
highest among:



Females
54.7%



Indian ethnicity
63.9%



**50-59 years old
age group**
60.9%

Are you **active enough?**

1 in 3 adults in Malaysia are
NOT PHYSICALLY ACTIVE



84% of adults are **NOT ACTIVE** in sports, fitness and leisure activities; and



84% of adults **DO NOT WALK or CYCLE** from one place to another



1 in 2
adults in Malaysia lead sedentary lifestyles
(spend **over 2 hours a day** either sitting, lying down, or reclining while awake)

Off the mark: Fruit, vegetables and plain water intake



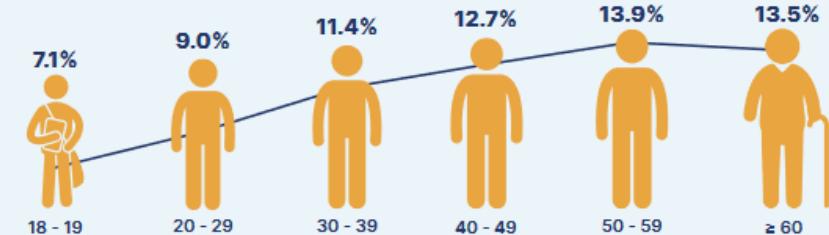
95.1% Adults in Malaysia consume **INADEQUATE** fruit and vegetables daily

On average, adults consume only **2 servings*** of fruit and/or vegetables daily instead of the recommended 5 servings daily



*1 serving of vegetables = 1 cup (250ml) of raw vegetables / $\frac{1}{2}$ cup of cooked vegetables
1 serving of fruit = 1 medium apple / 1 medium banana / 1 slice of papaya / $\frac{1}{2}$ medium guava

Prevalence of adequate fruit intake by age group



1 in 5 adults do not drink *enough plain water everyday



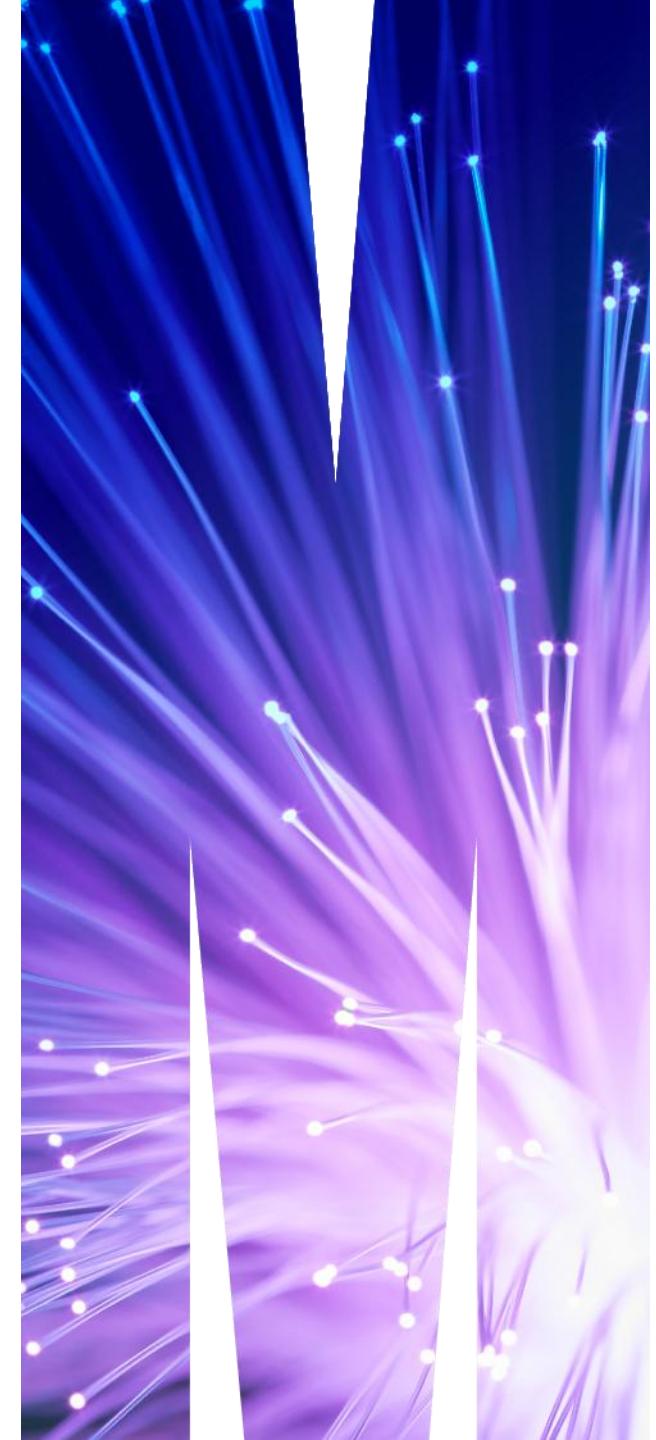
*Note: 6-8 glasses (1 glass = 250ml)





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Ethnicity-Specific Gut Microbial Composition





Map of Peninsular Malaysia –Johor highlighted in red

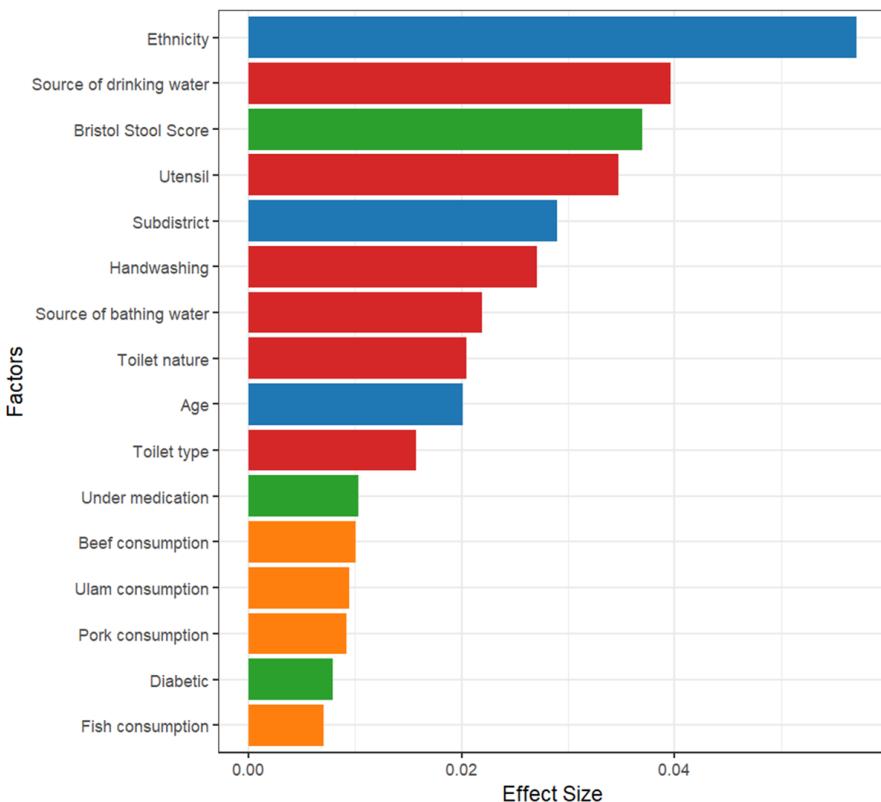


Inset of Johor with District of Segamat highlighted in red

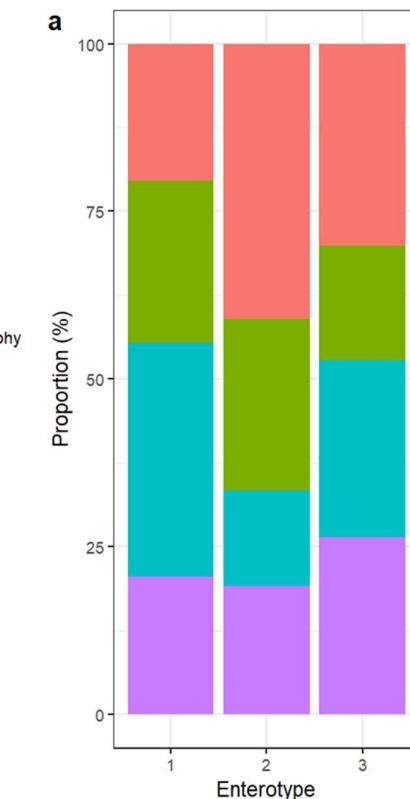
Ethnicity

Diet

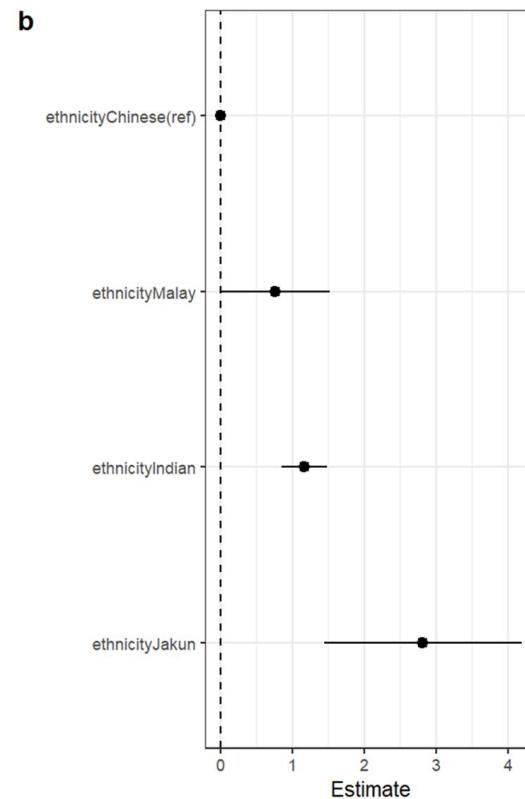
Lifestyle

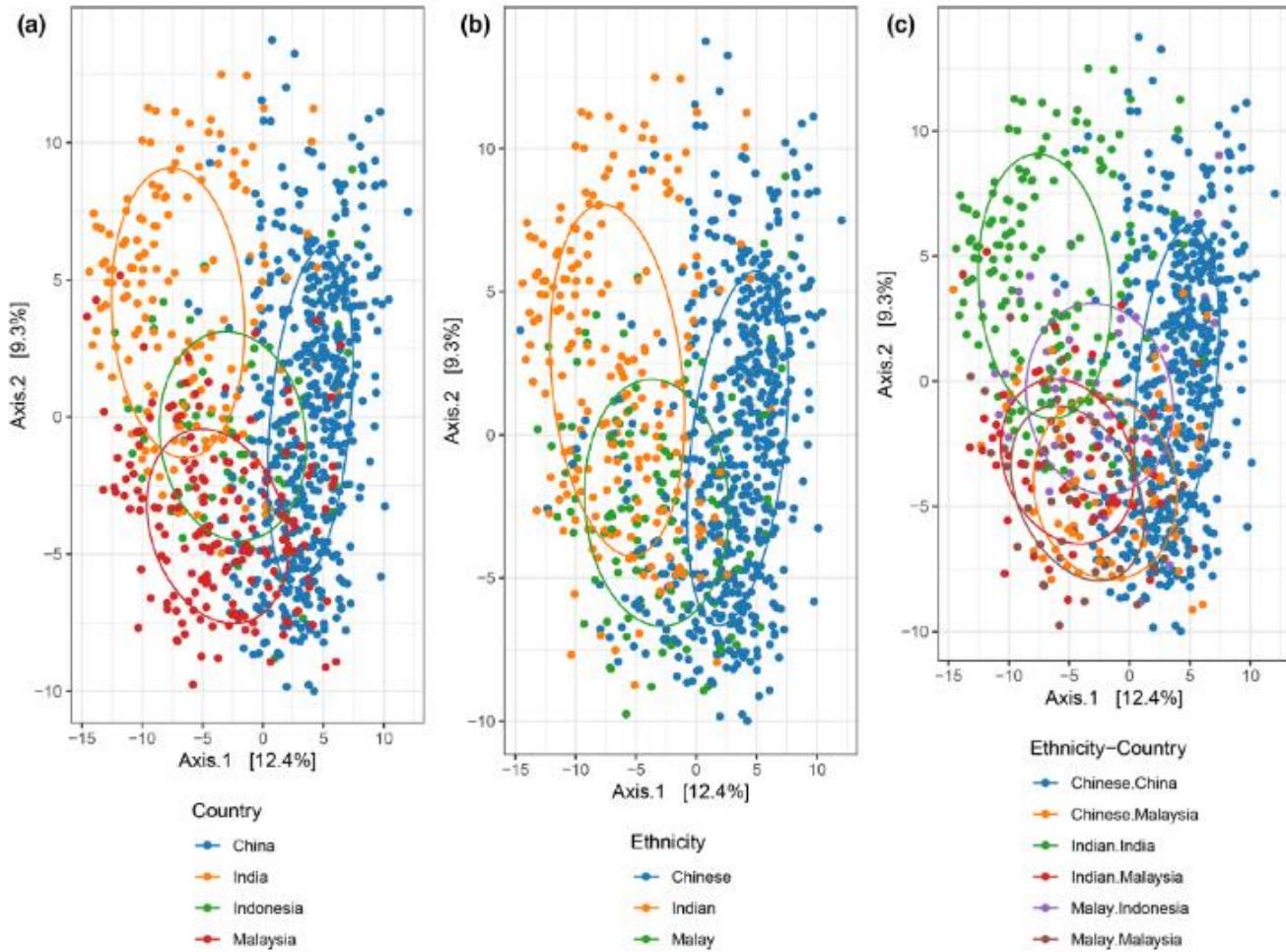


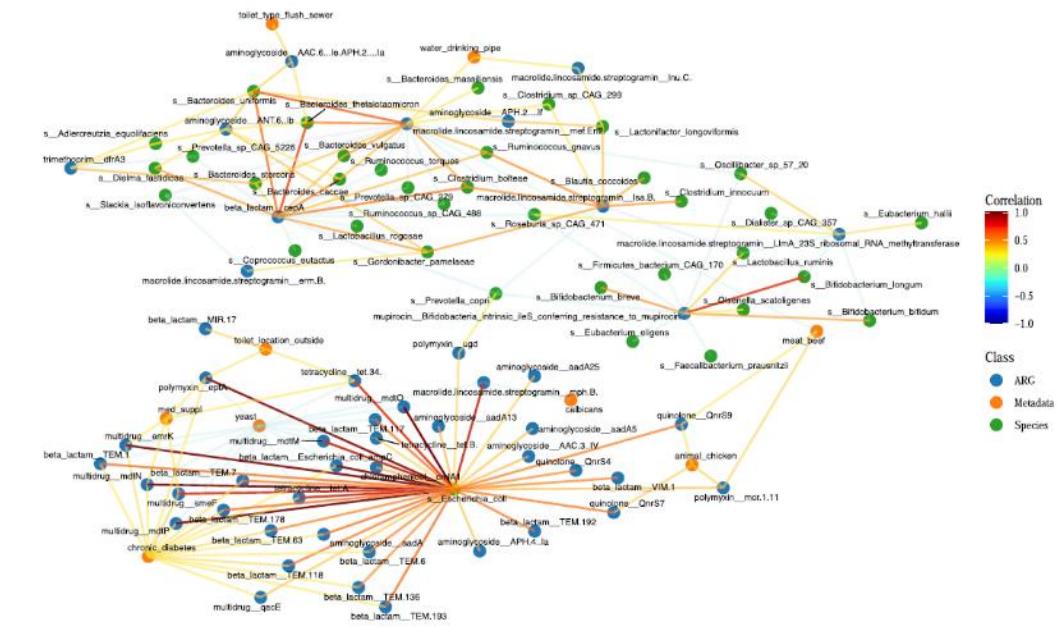
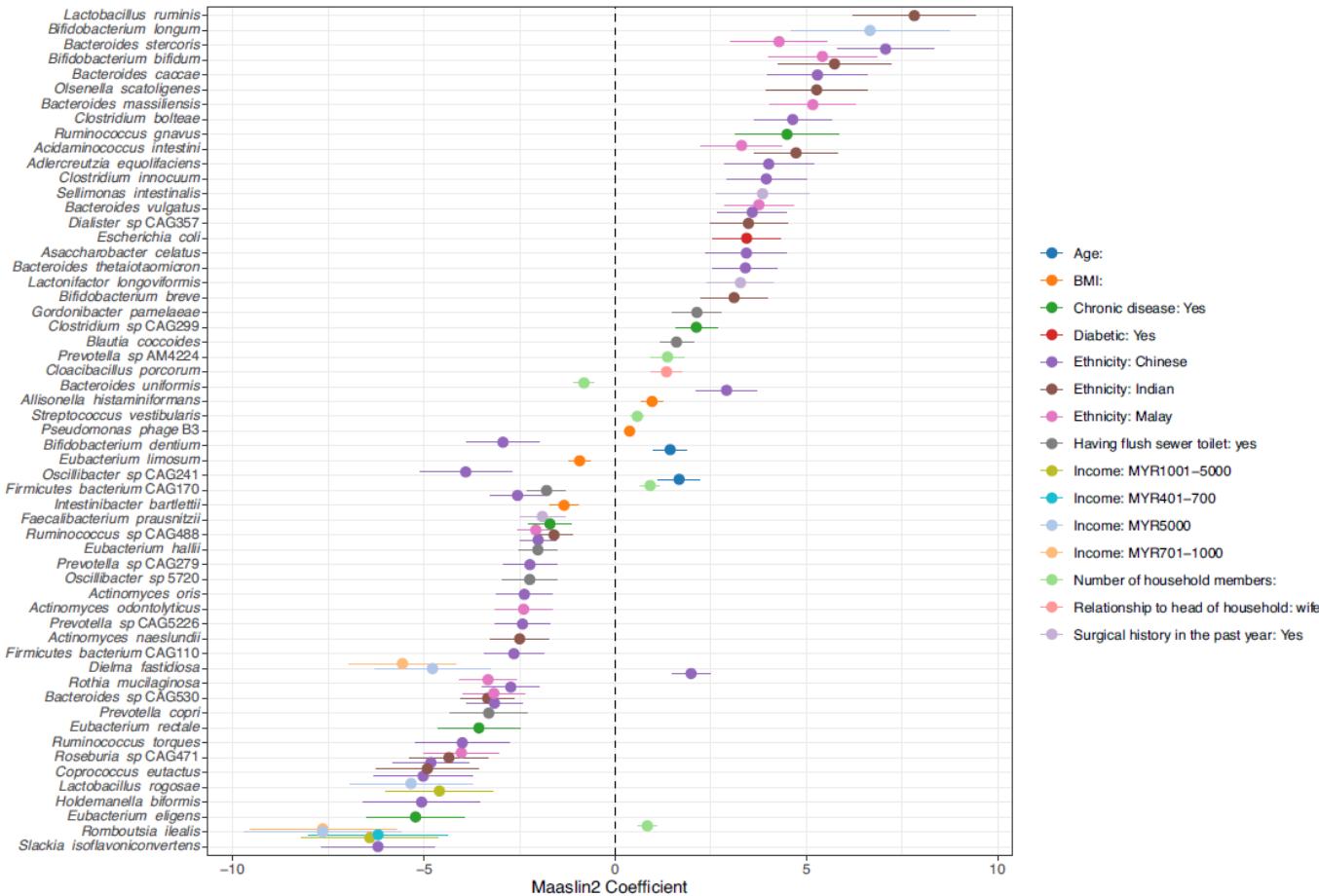
Association of microbial composition with various confounding factors



Prevotella:Bacteroides ratio





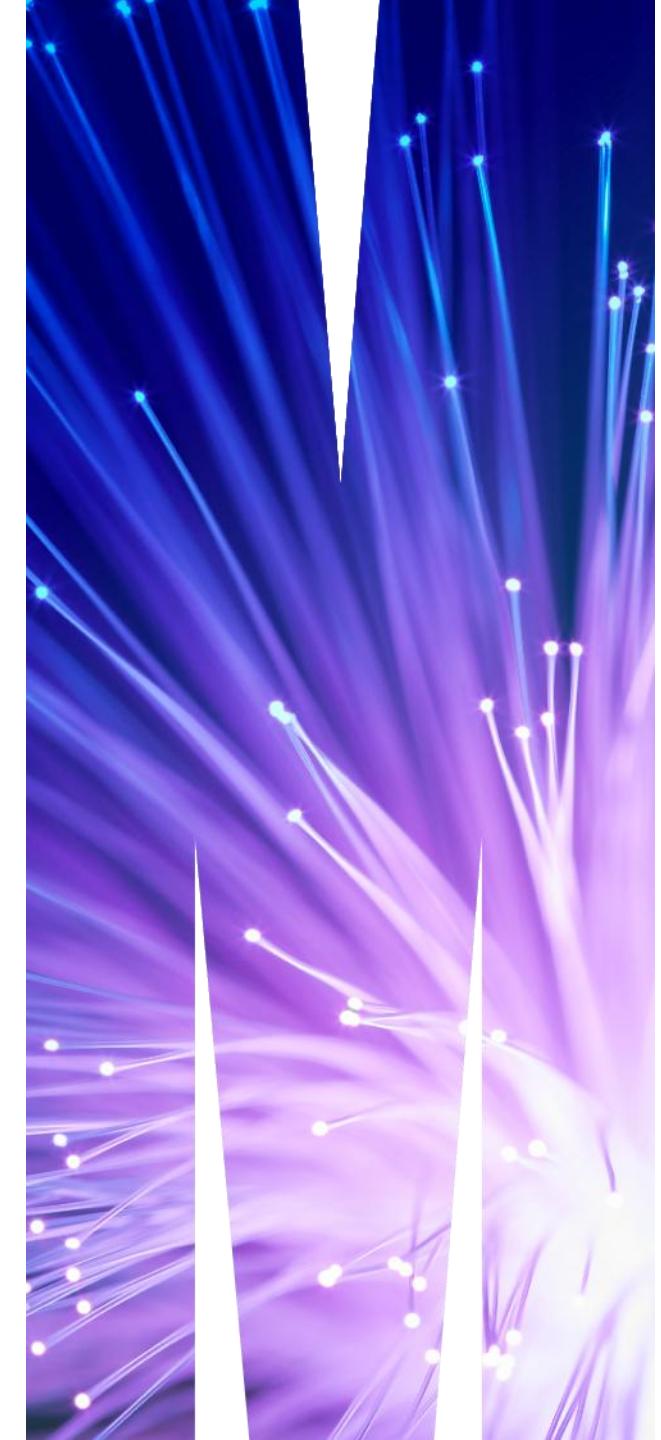




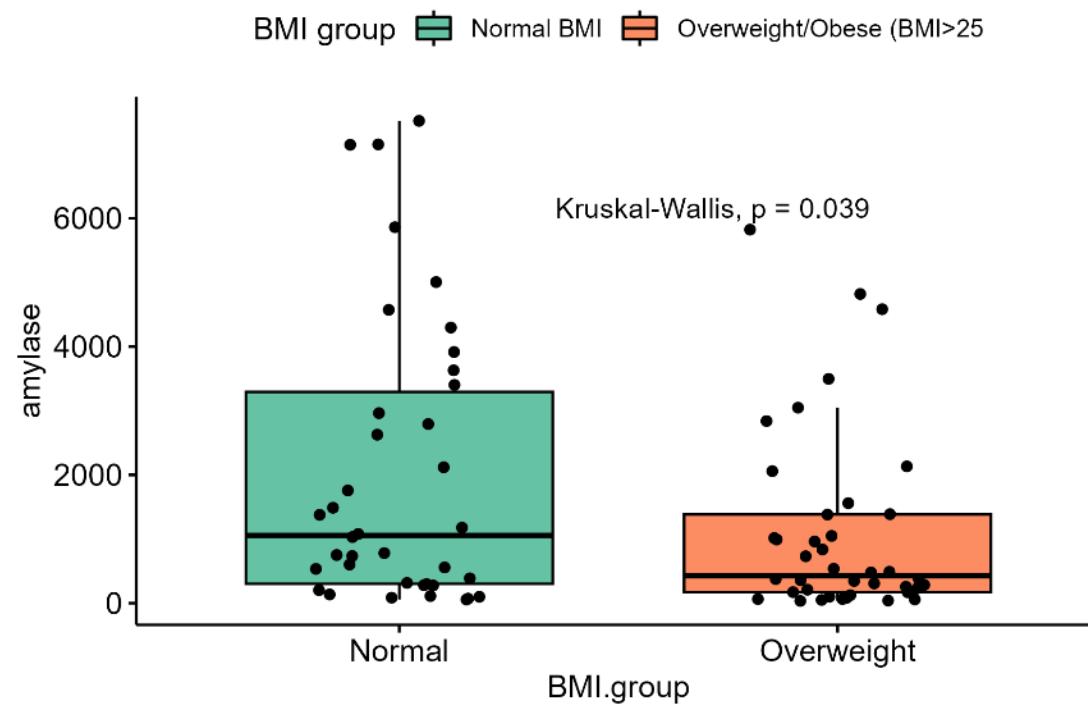
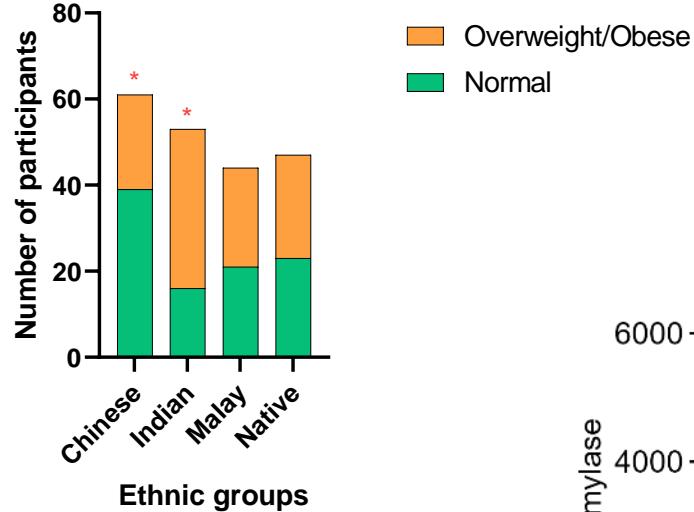
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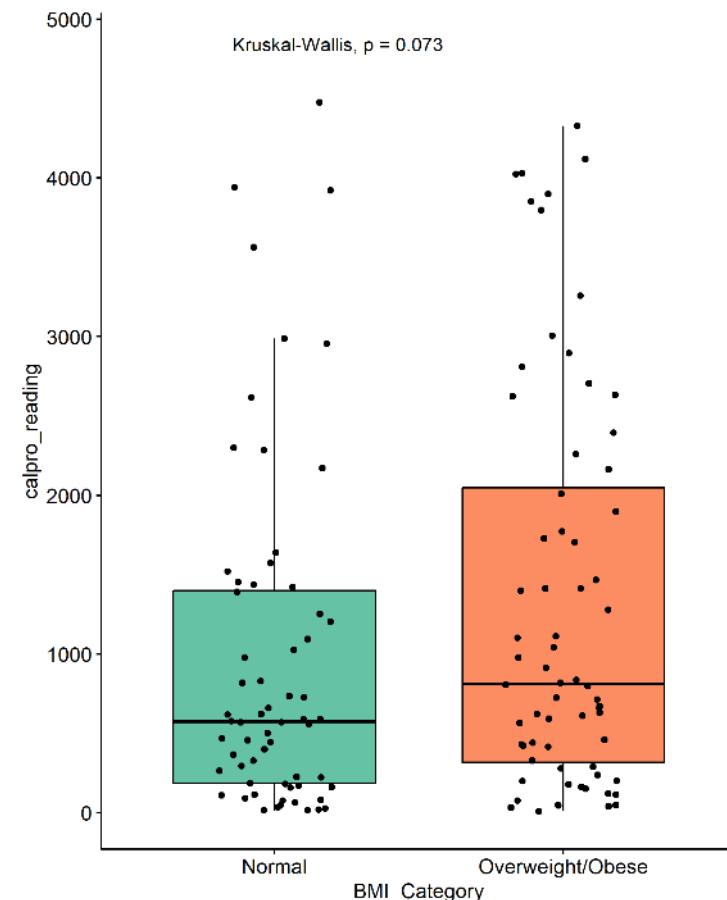
Obesity and Microbiome

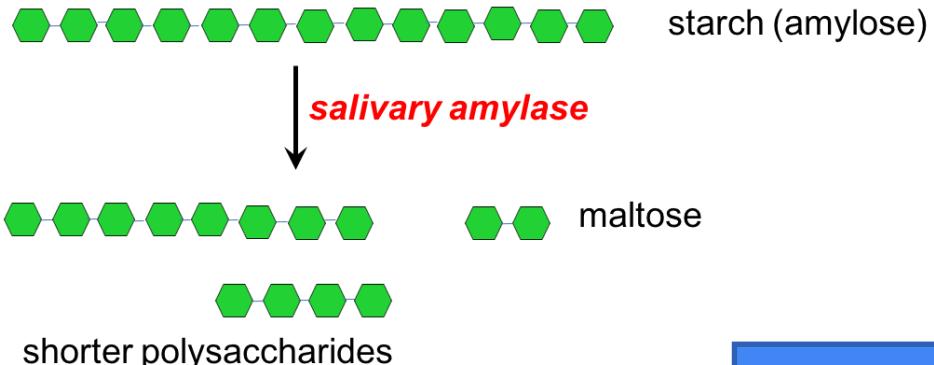


Ethnic Distribution (n=202)

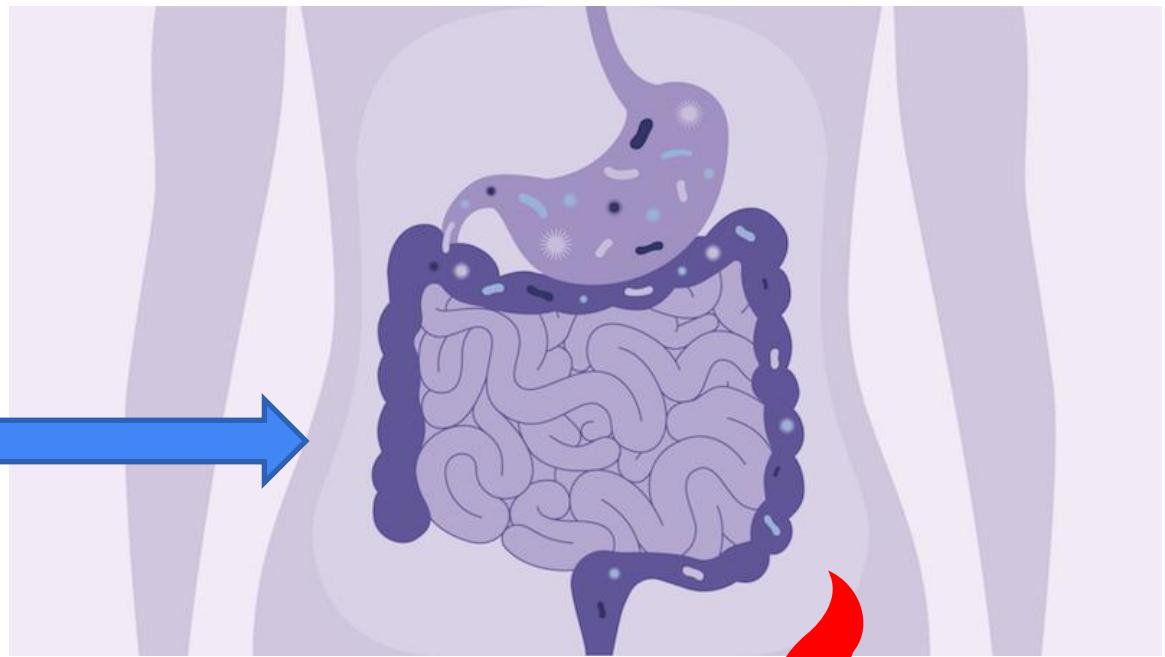


BMI group Normal BMI Overweight/Obese (BMI>25)





Dextrin?



Molecular Nutrition eFood Research

Research Article |  Open Access | 

Diet Supplementation with NUTRIOSE, a Resistant Dextrin, Increases the Abundance of *Parabacteroides distasonis* in the Human Gut

Florence Thirion, Kévin Da Silva, Florian Plaza Oñate, Anne-Sophie Alvarez, Clémentine Thabuis, Nicolas Pons, Magali Berland, Emmanuelle Le Chatelier, Nathalie Galleron ... [See all authors](#) ▾

First published: 21 March 2022 | <https://doi.org/10.1002/mnfr.202101091> | Citations: 3



Journal of Functional Foods
[Volume 34, July 2017, Pages 398-407](#)



Effects of potato dextrin on the composition and metabolism of the gut microbiota in rats fed standard and high-fat diets

Renata Barczynska ^a  , Adam Jurgoński ^b, Katarzyna Słizewska ^c, Jerzy Juśkiewicz ^b,
Janusz Kapusniak ^a

Home > Nutrition & Metabolism > Article

Resistant dextrin improves high-fat-high-fructose diet induced insulin resistance

Research | [Open access](#) | Published: 15 May 2020
Volume 17, article number 36, (2020) [Cite this article](#)

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Fan Hu, Yixin Niu, Xiaoyuan Xu, Qiuyue Hu, Qing Su  & Hongmei Zhang 



[British Journal of Nutrition](#)

Resistant dextrin, as a prebiotic, improves insulin resistance and inflammation in women with type 2 diabetes: a randomised controlled clinical trial

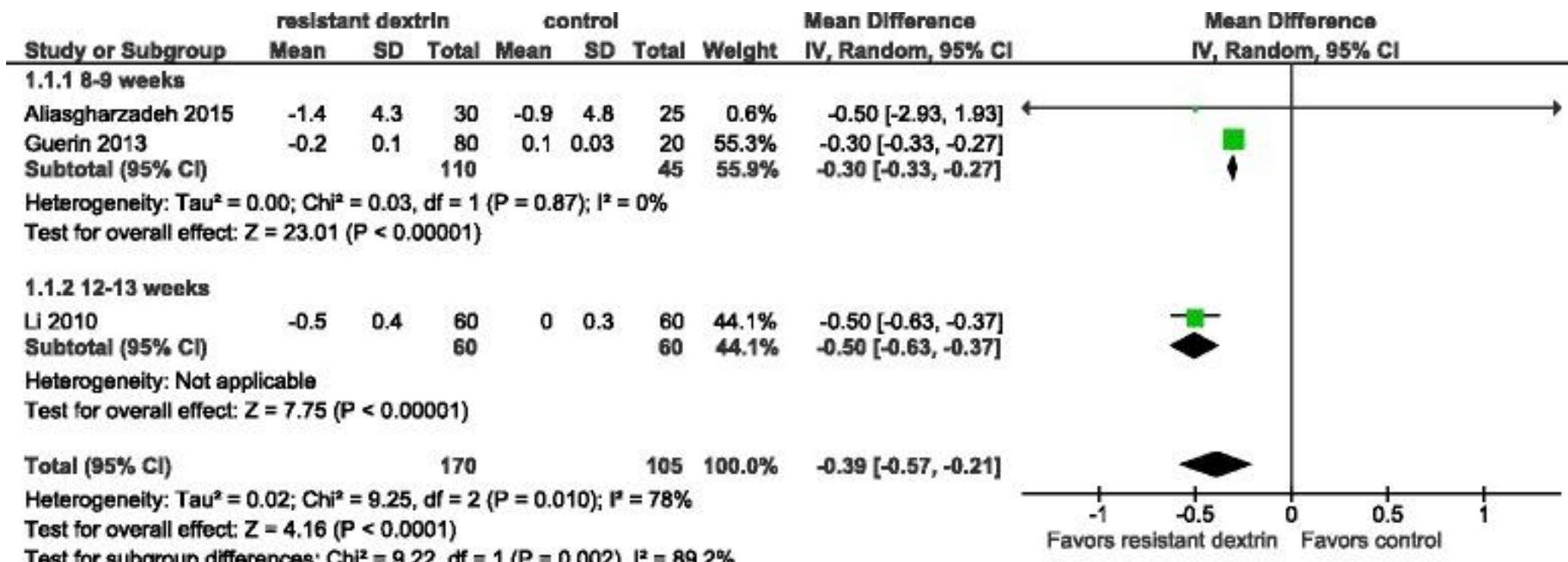
Published online by Cambridge University Press: 21 January 2015

Akbar Aliasgharzadeh, Parvin Dehghan, Bahram Pourghassem Gargari and
Mohammad Asghari-Jafarabadi

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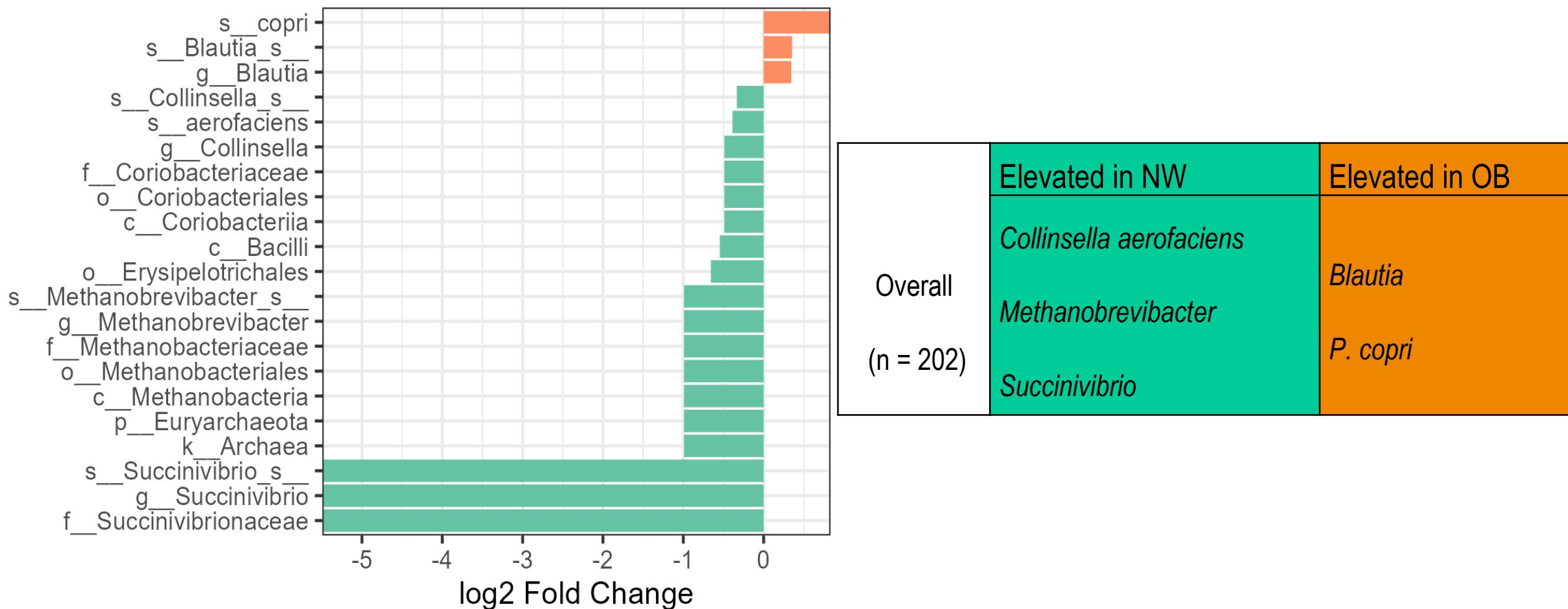
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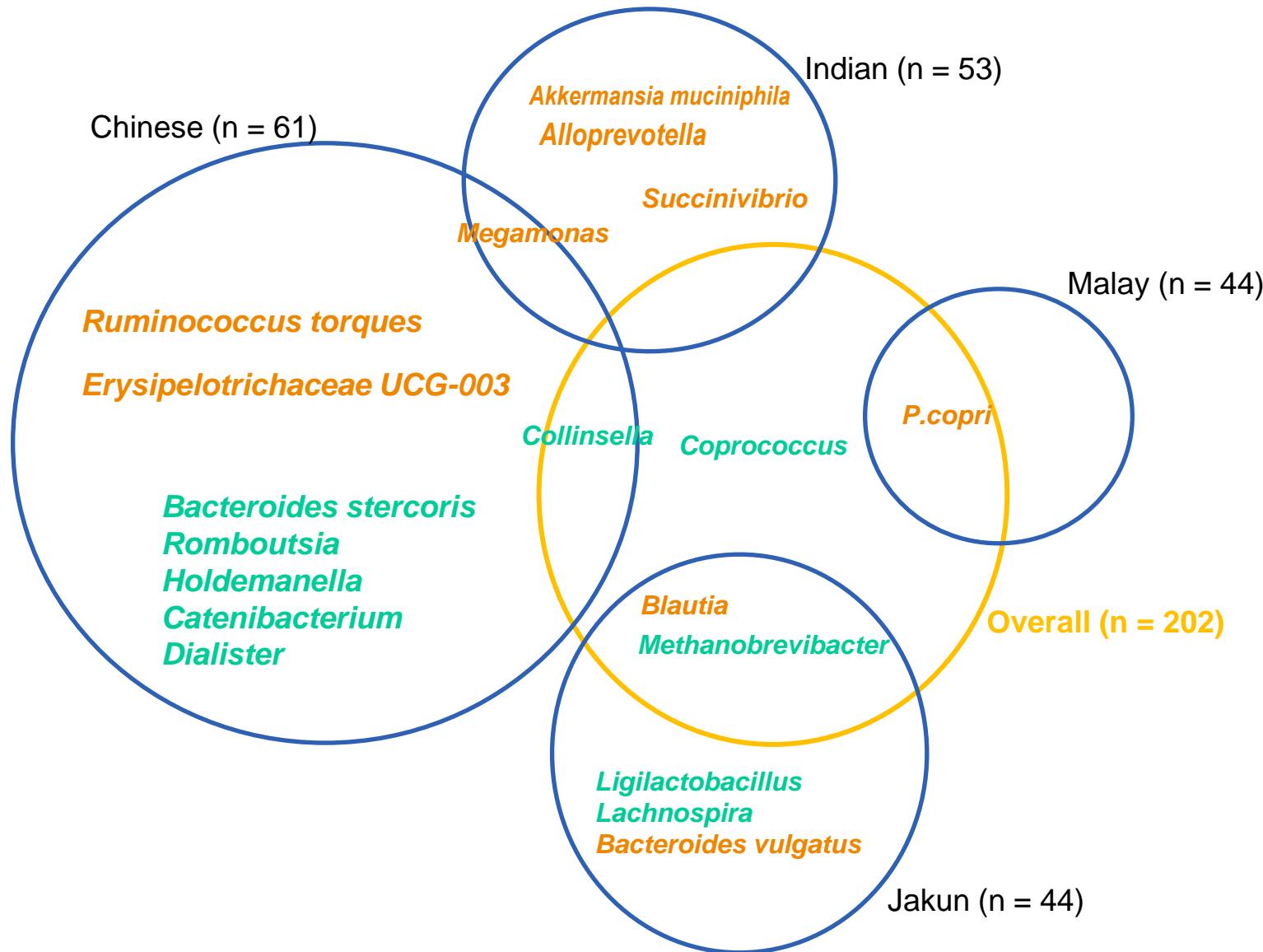
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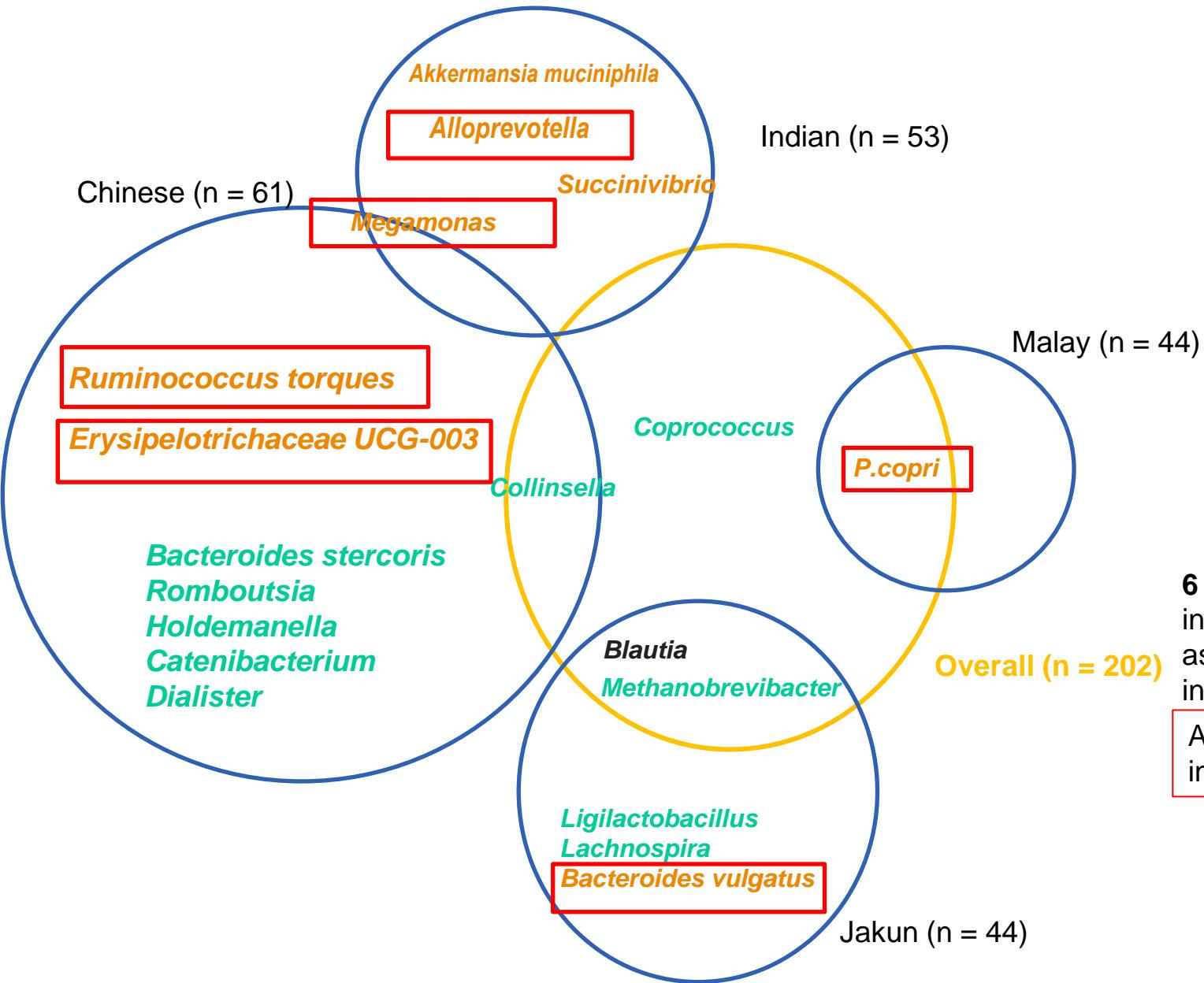


Mukai et al. (2017) J Pharm Health Care Sci 3: 15.

Microbiota	Factors	Univariate PERMANOVA	Multivariate PERMANOVA
Gut	BMI Cov : Age group + Ethnicity	0.384	0.054



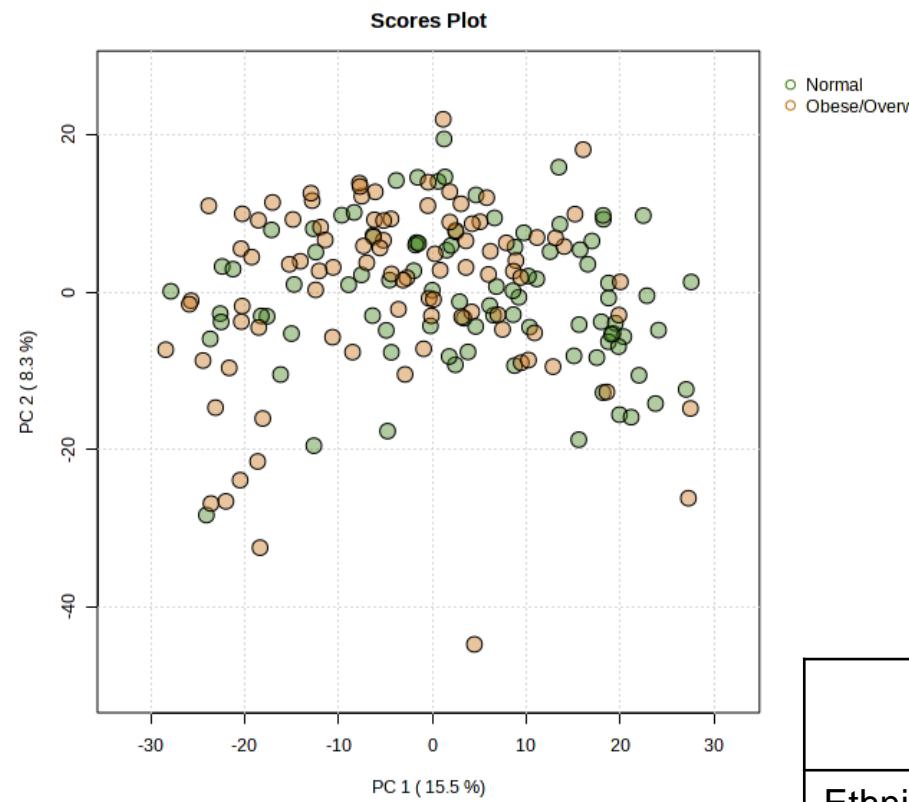
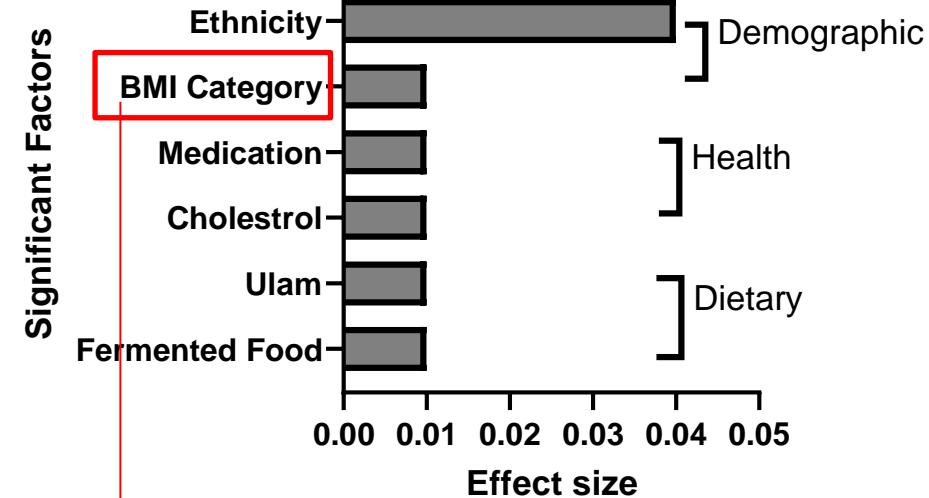




6 out of 9 microbes elevated in OB were previously associated with intestinal inflammation

Associated with intestinal inflammation/pro-inflammatory

Faecal Metabolomics PCA

**PERMANOVA Effect size**

PERMANOVA Effect size

	Effect size	P-value
Ethnicity + BMI	0.01	0.005
All significant factors + BMI	0.01	0.007

Slide 27

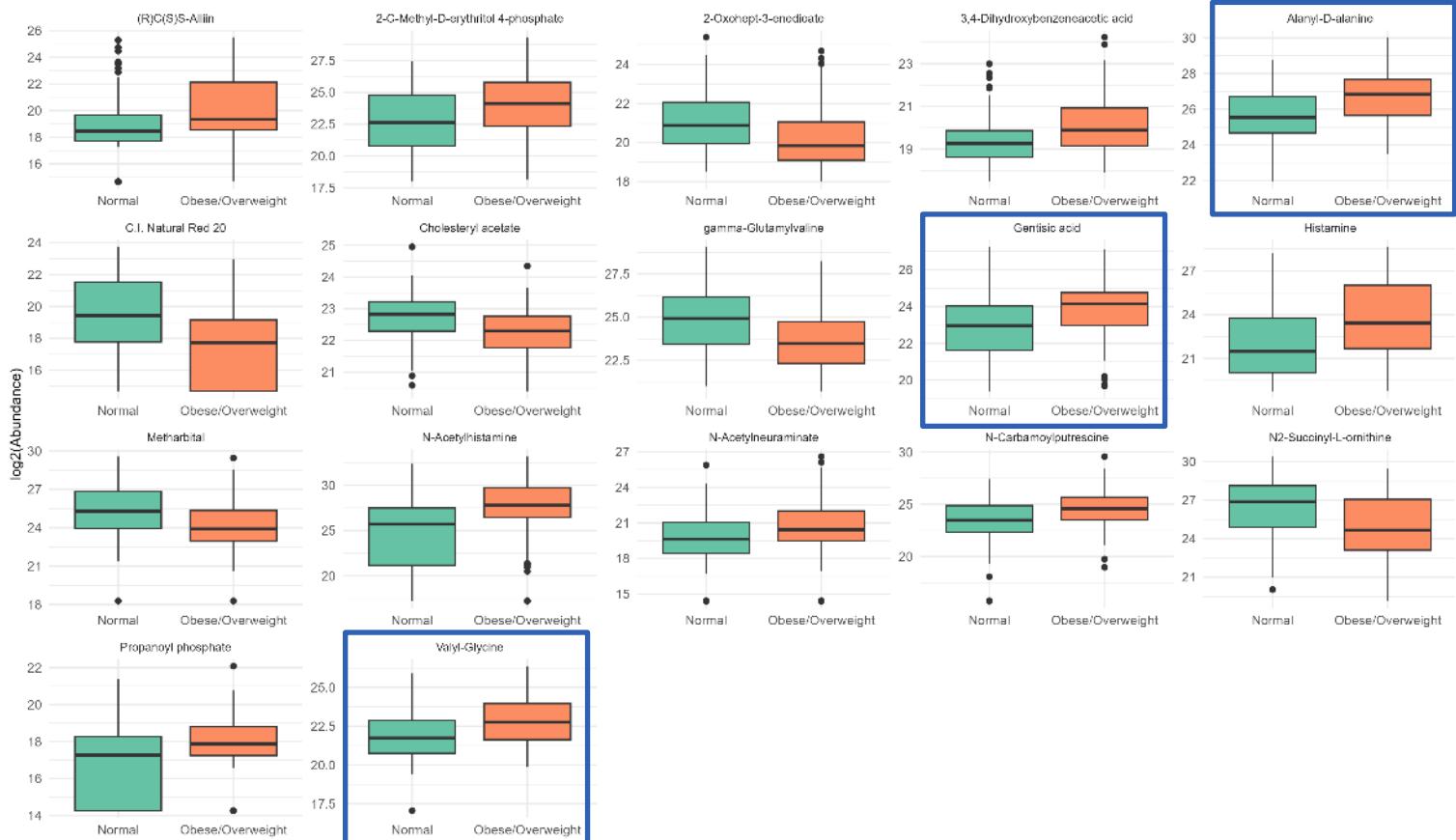


1272 total identified metabolites

T.Test FDR < 0.01 =
25 metabolites

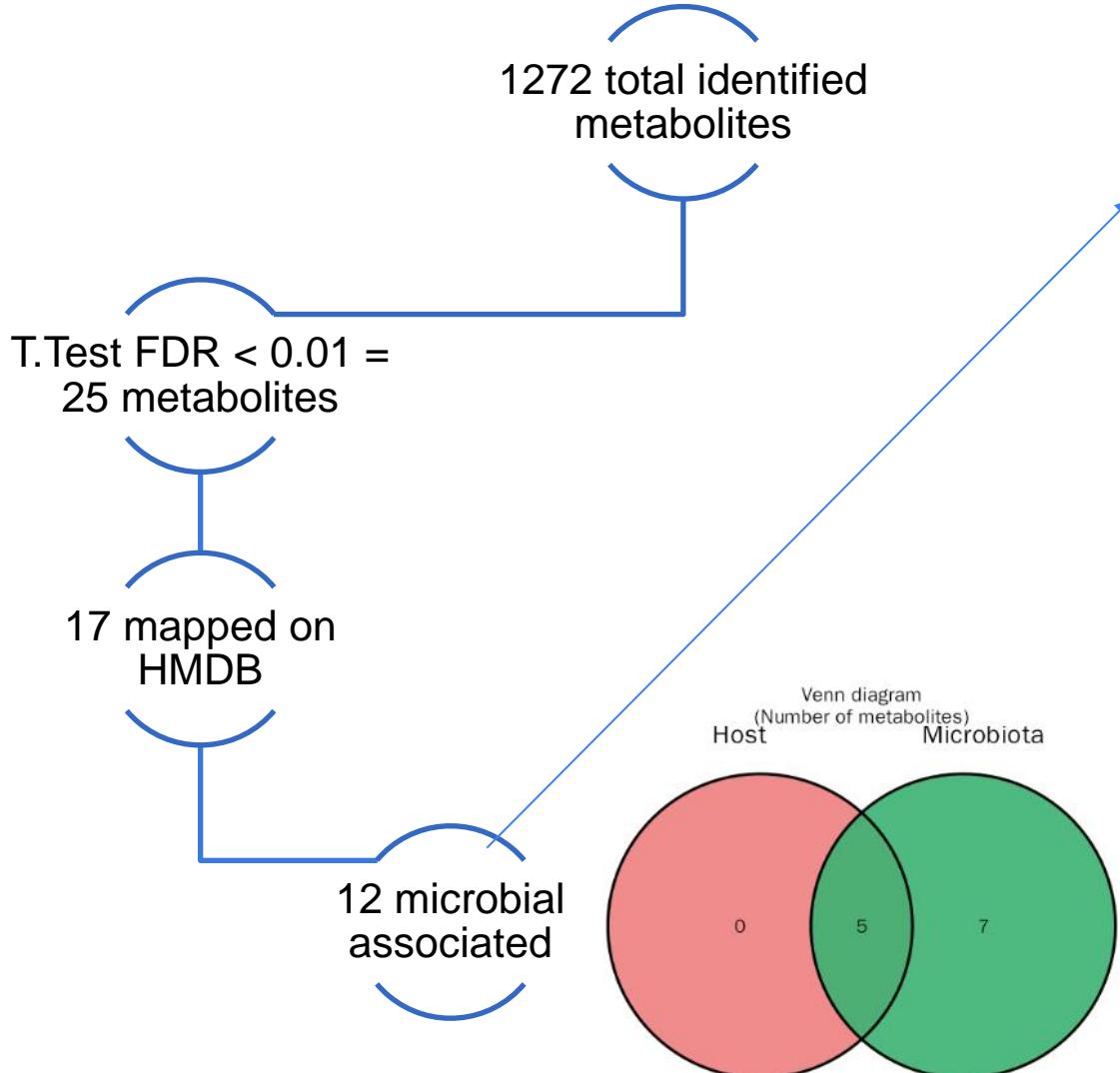
17 mapped on
HMDB

12 microbial
associated



11 metabolites elevated in OB

6 metabolites elevated in NW



Origin	Metabolite	Elevated/Reduced in OB	Pathway
Microbial only (n=7)	(R)C(S)S-Alliin	Elevated	NA
	2-C-methyl-D-erythritol-4-phosphate	Elevated	NA
	2-Oxohept-3-enedioate	Reduced	Tyrosine Metabolism(KO00350)
	D-Alanyl-D-alanine	Elevated	<i>Peptidoglycan biosynthesis (KO00550) *</i> <i>D-Amino acid metabolism (KO00470)</i>
	N2-Succinyl-L-ornithine	Reduced	<i>Arginine and proline metabolism (KO00330) *</i>
	N-Carbamoylputrescine	Elevated	
	Propanoyl phosphate	Elevated	
Host & Microbiota (n=5)	Cholesteryl acetate	Reduced	<i>Steroid Biosynthesis (KO00100) *</i>
	Gentisic acid	Elevated	<i>Tyrosine Metabolism (KO00350)*</i>
	Histamine	Elevated	<i>Histidine Metabolism (KO00340) *</i>
	N-Acetylneuraminate	Elevated	Amino sugar and nucleotide sugar metabolism
	3,4 Dihydroxybenzeneacetic acid	Elevated	Tyrosine Metabolism (KO00350)*

PiCrust2: arginine, ornithine, and proline interconversion pathway (ARGORNPROST-PWY) FDR < 0.05

*significantly differentiated

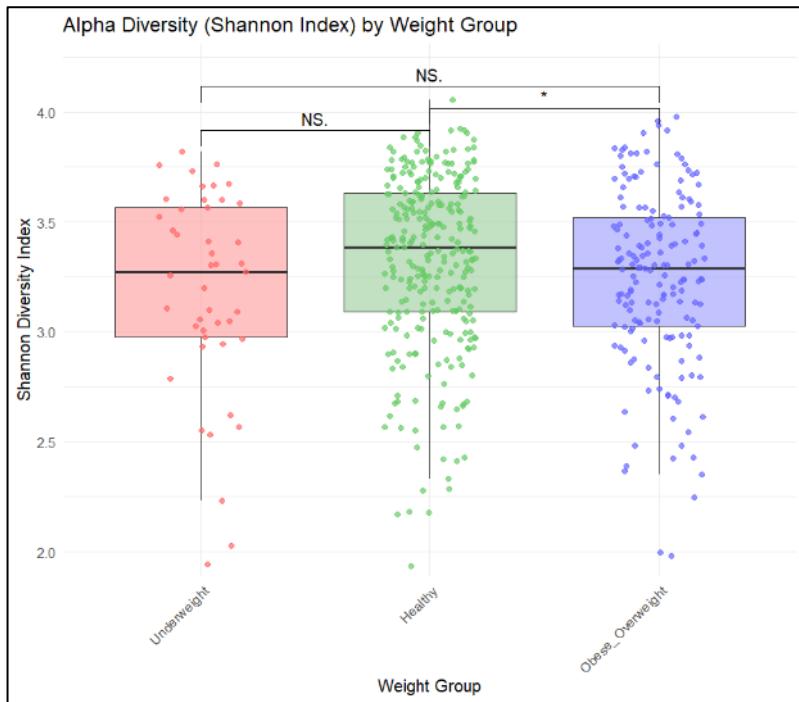
1000MYMicrobiome

Status	Number
Expressed interest	2577
Communicated	1073
Recruited with studyID	617
Completed questionnaire and sample tracking form	528
Stool 16S amplicons and urine NMR profiles	511
Saliva 16S amplicons	194



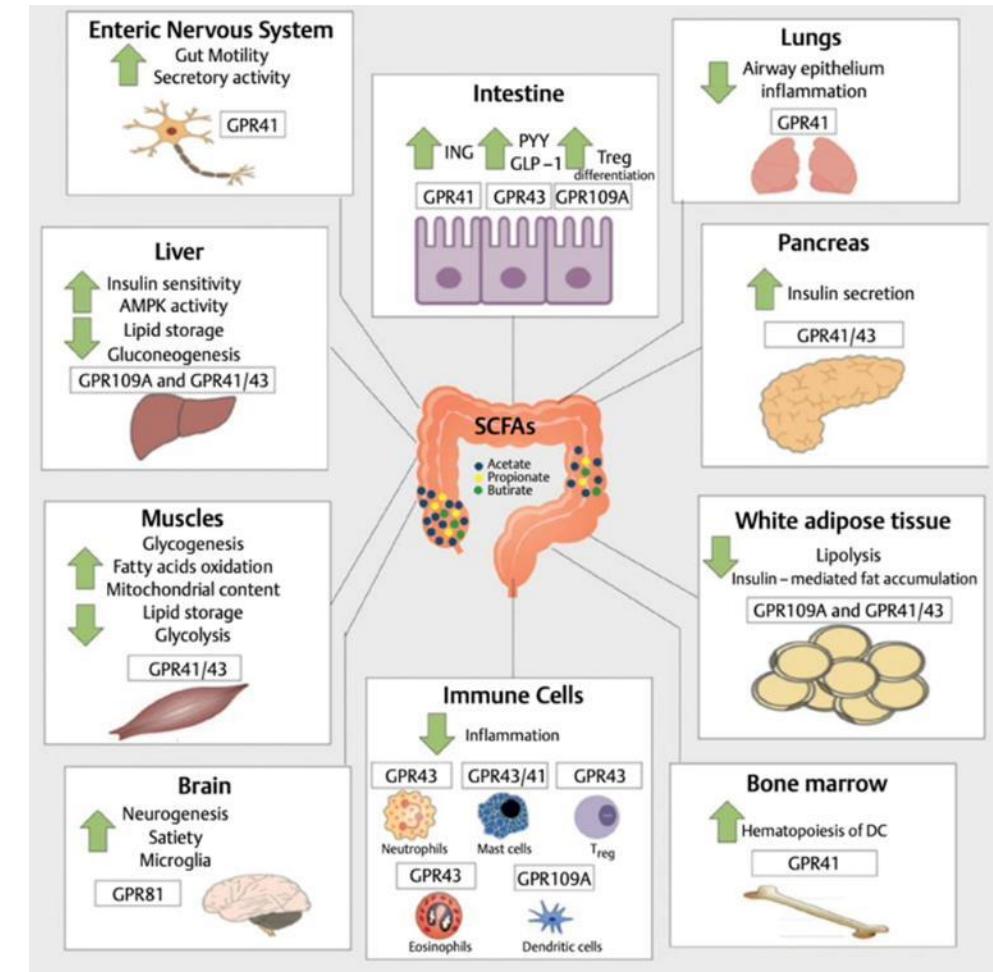
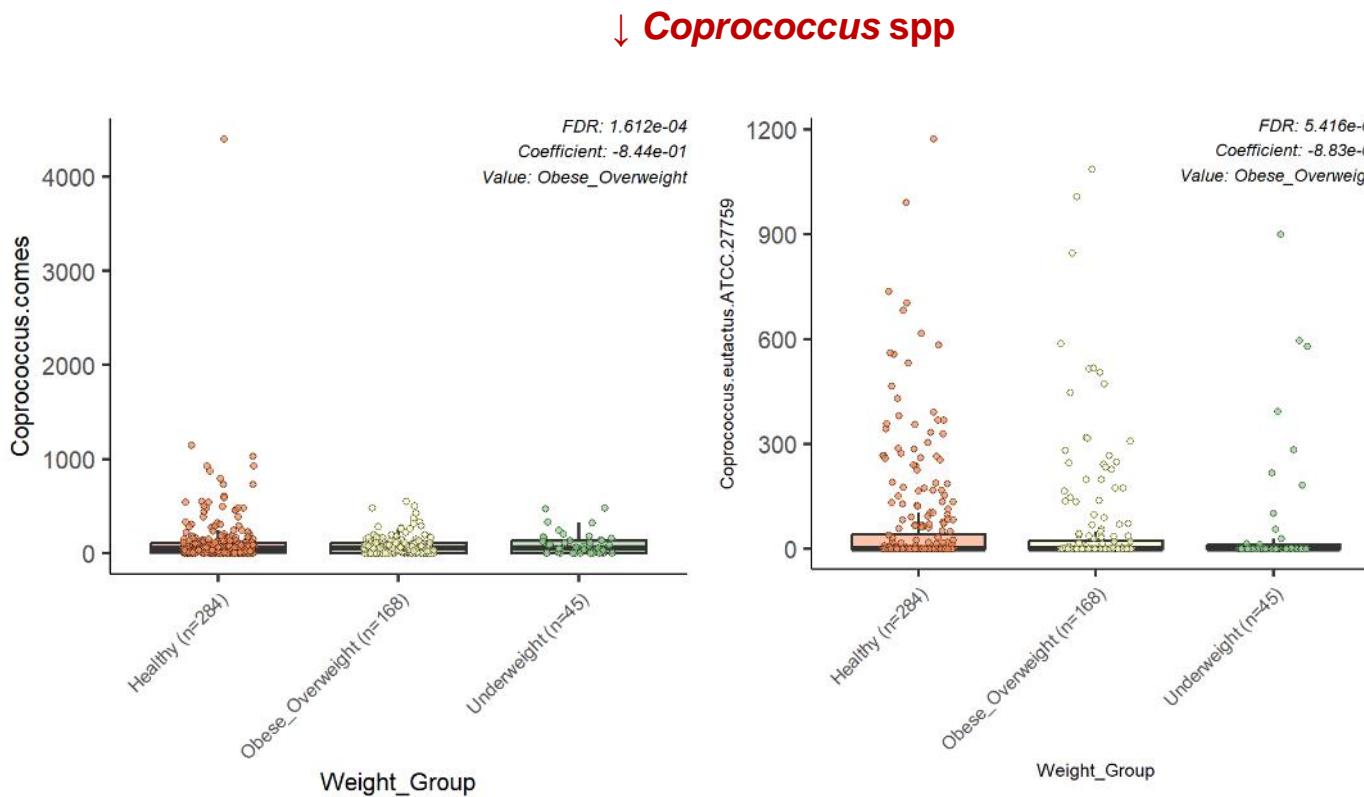
Preliminary data

Obese subjects harbored significantly lower gut microbial diversity



Preliminary data

Obese individuals have reduced levels of *Coprococcus* spp which is involved in Short Chain Fatty Acid synthesis



Diet vs Physical Activity and Gut Microbial Composition

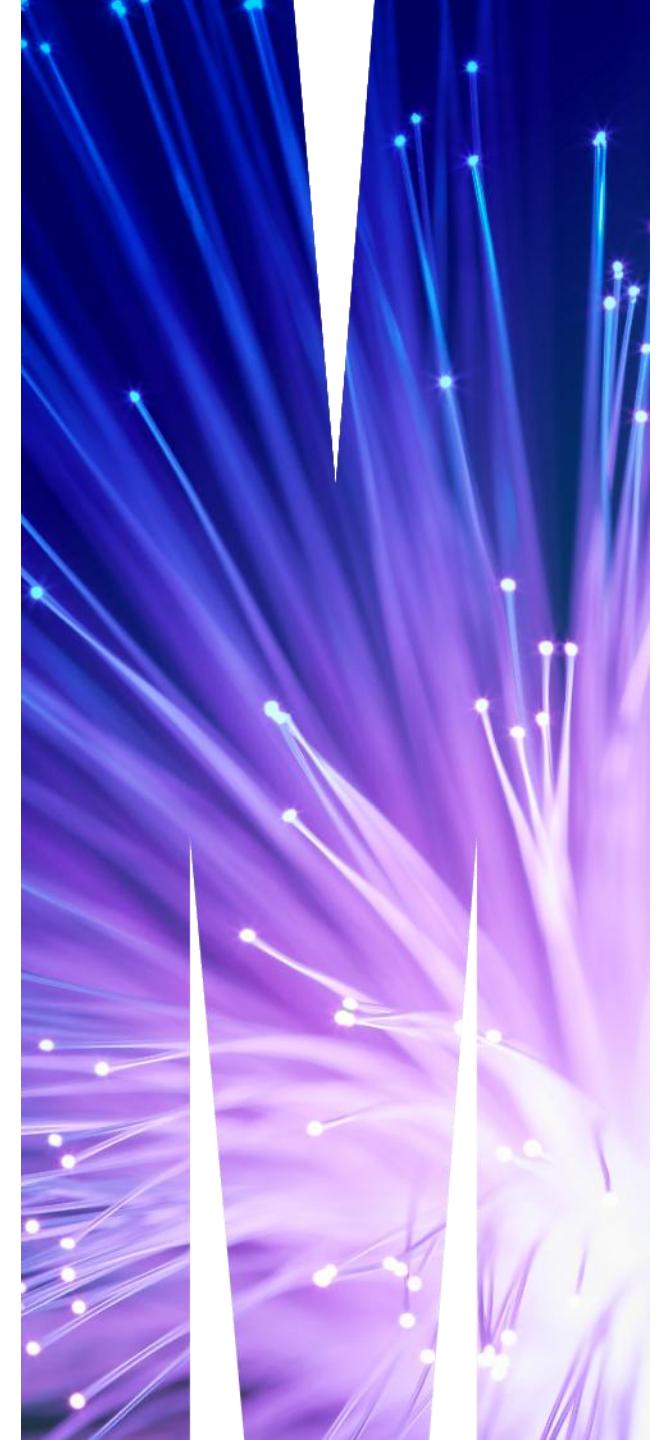
Pairs	PERMANOVA		
	R2	Pseudo-F	P-value
LowxInactive vs HighxActive	0.055	1.801	0.040
LowxInactive vs MediumxActive	0.037	1.616	0.047
LowxInactive vs LowxActive	0.056	1.901	0.010
LowxInactive vs MediumxInactive	0.048	1.948	0.012
LowxInactive vs HighxInactive	0.060	2.150	0.005

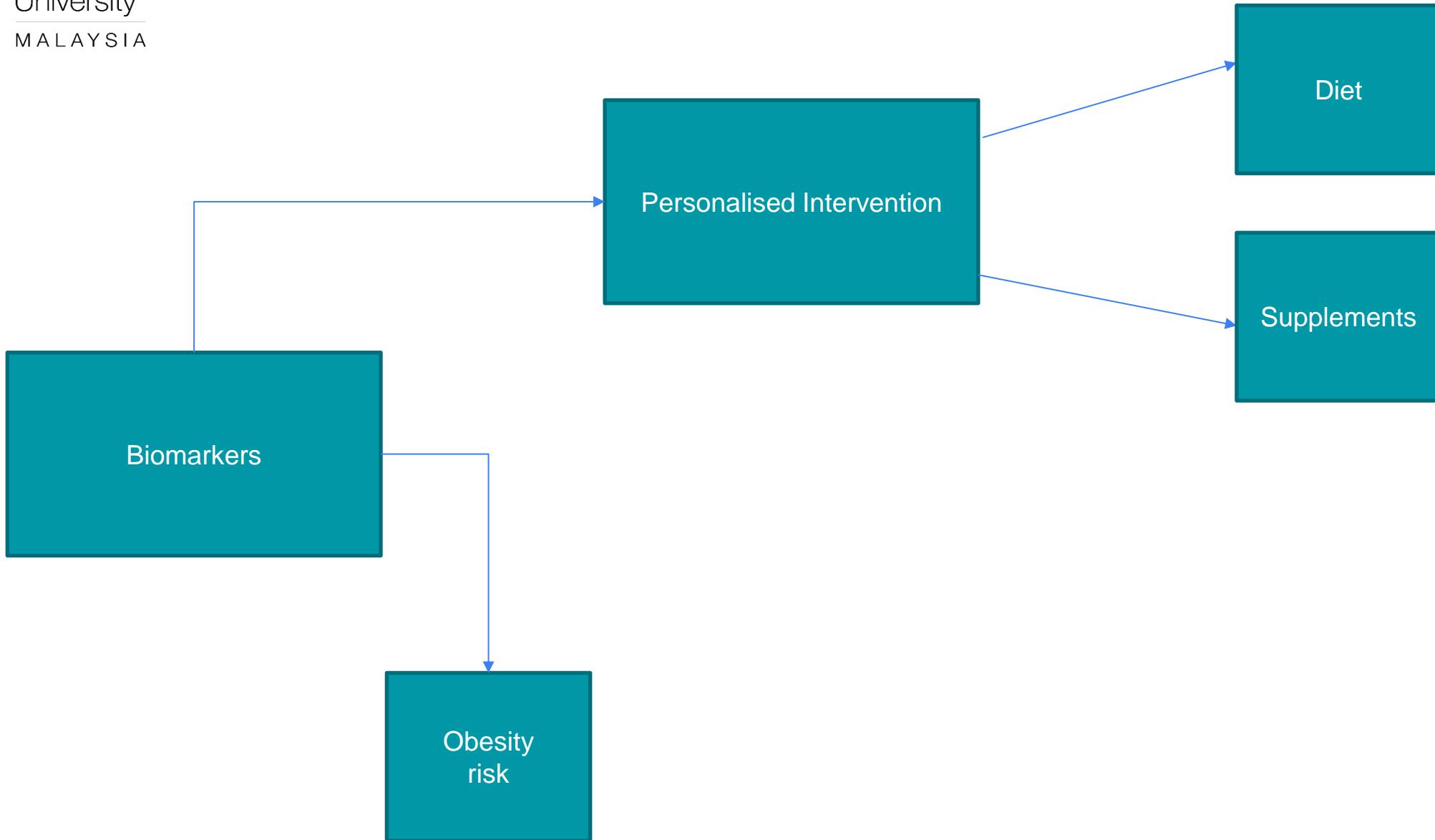


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Why understanding the obesogenic microbial signals are important?

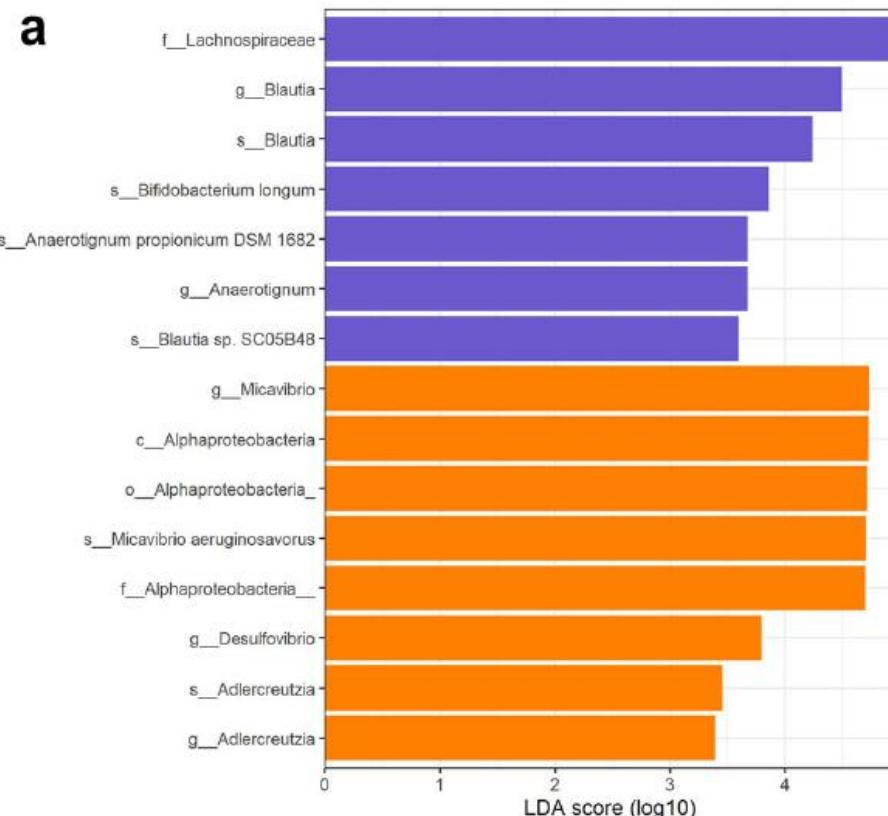




ORIGINAL ARTICLE - GASTROENTEROLOGY (CLINICAL)

The impact of diet and ethnicity on gut microbiota variation in irritable bowel syndrome: A multi-center study

Xin-Hui Khoo,* Chun-Wie Chong,[†] Abdul Malik Talha,* Koshy Philip,^{‡,§} Cindy Shuan-Ju Teh,[¶] Adib Mat Isa,^{*,**,+†}
Mung Seong Wong,^{**,††} Deborah Chia-Hsin Chew,^{##} Zhiqin Wong,^{##} Nor Syarahani Jusoh,^{§§}
Noorhuda Madihah Mohamed Maksum,^{¶¶} Norfilza Mohd Mokhtar,^{*,**,+††} Hazreen Abdul Majid,^{***,§§§}
Raja Affendi Raja Ali,^{##} Yeong-Yeh Lee^{*,††}  and Sanjiv Mahadeva* 



Responder at baseline

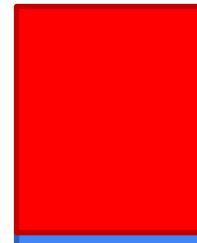
Note the presence of beneficial bacteria such as *Blautia* and *B.longum*

Non-
Responder at baseline

WHAT IS

NORMAL

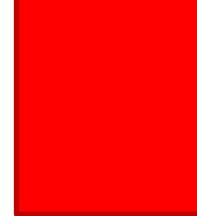
English Images Images



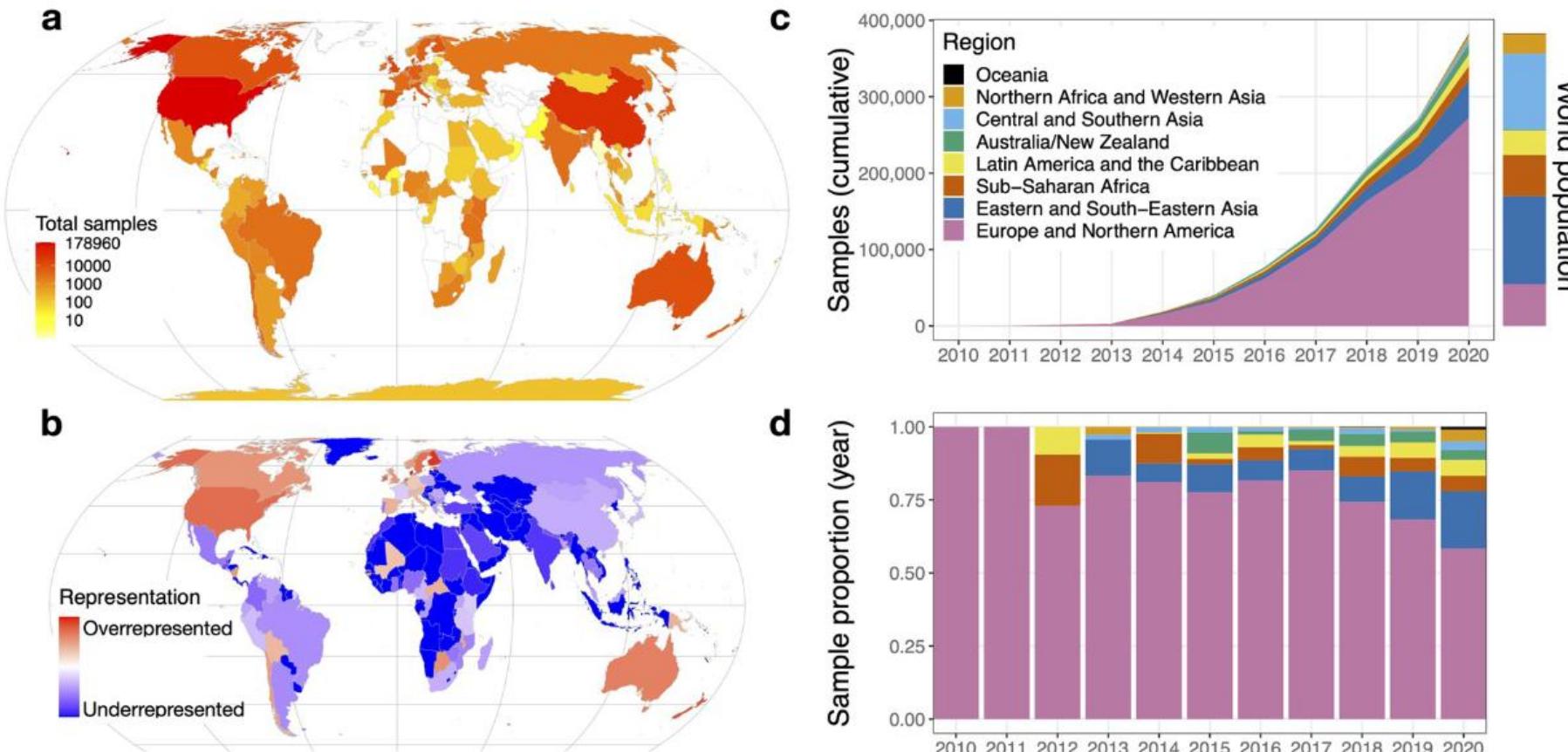
Too high



Normal



Too low



Abdill et al (2022) PLoS Biol 20: e3001536.

Summary

- Ethnicity-associated diet and lifestyle are the main determination factors of gut microbial composition
- A strong association between salivary amylase concentration, gut microbial composition and obesity was observed
- Ethnicity-specific obesogenic gut microbial signals were detected, potentially enabling the design of personalised intervention
- More research is required, especially the understanding of local microbial composition

Acknowledgement

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Dr Jacky Dwiyanto
Thiviya
Mok Chui Yang
Angel Wong
Emily Wong

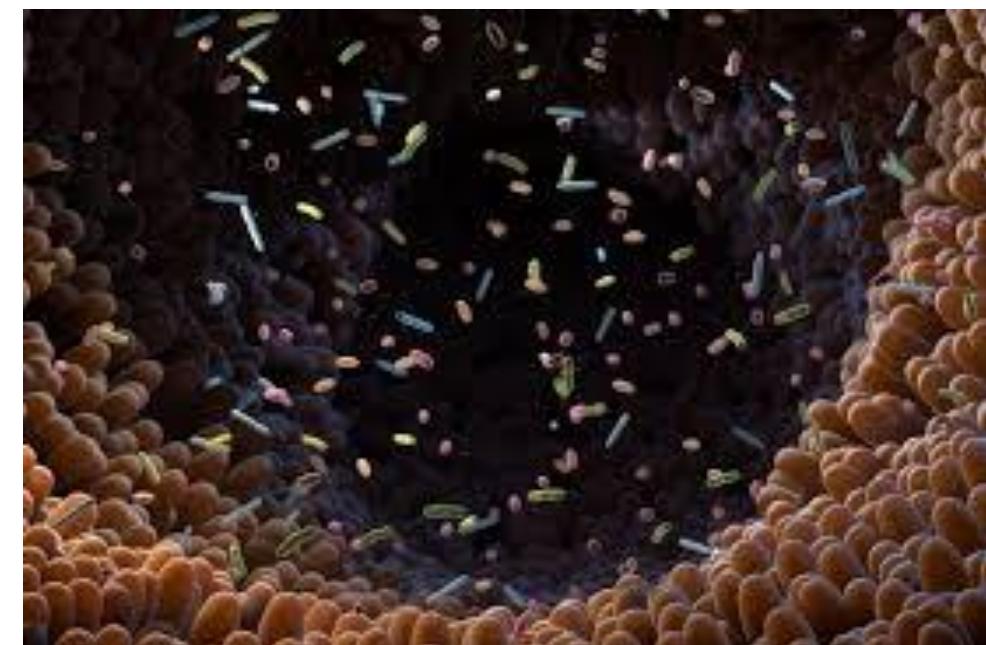
University of Malaya

AP Dr Cindy Teh
Dr Kong Zhi Xian

Monash Parkville

AP Darren Creek

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THANK YOU

