

Data Analysis for 16S rDNA

August 11th 2024

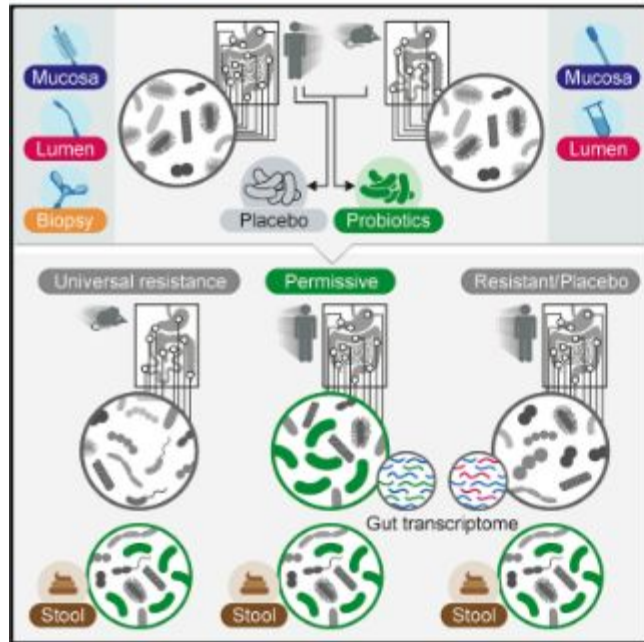
Hoang Son, Hoang Anh, Ngo Dai Phu

Bài báo và data:

https://drive.google.com/drive/folders/1ZqrvzDwhgYpLBWTcPwTHd_dUgJSwySCp?usp=sharing

Personalized Gut Mucosal Colonization Resistance to Empiric Probiotics Is Associated with Unique Host and Microbiome Features

Graphical Abstract



Authors

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In Brief

Probiotics transiently colonize the human gut mucosa in highly individualized patterns, thereby differentially impacting the indigenous microbiome and host gene-expression profile, a trait which is predictable by baseline host and microbiome features, but not by stool shedding.

Highlights

- The murine and human gut mucosal microbiome only partially correlates with the stool microbiome.
- Mice feature an indigenous microbiome-driven colonization resistance to probiotics.
- Humans feature a person-specific gut mucosal colonization resistance to probiotics.
- Probiotic colonization is predictable by pre-treatment microbiome and host features.

Probiotics



Source:

<https://files.nccih.nih.gov/files/probiotics-ThinkstockPhotos-477539840-square-edit3-medium.jpg>

UGI

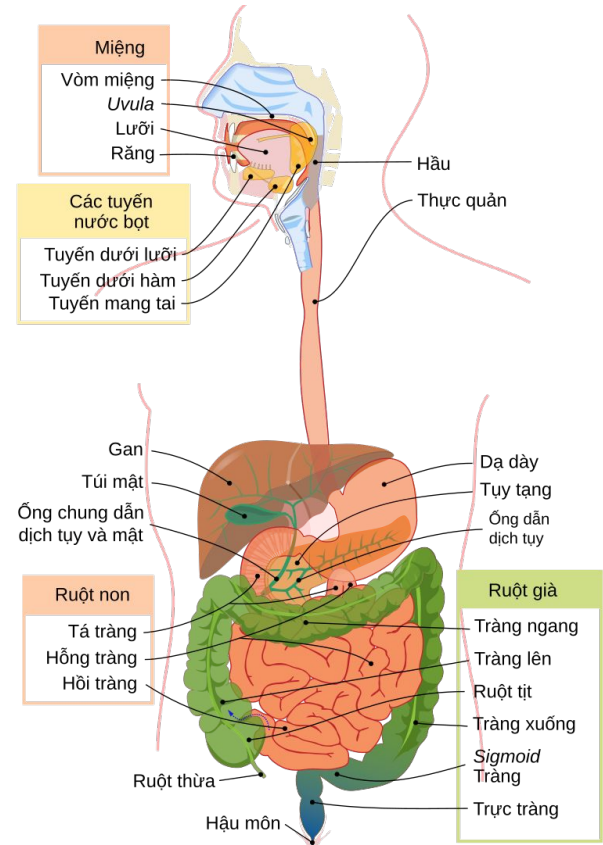
(Upper Gastrointestinal):

Các mẫu từ đoạn trên của ống tiêu hóa, thường bao gồm thực quản, dạ dày và tá tràng.

LGI

(Lower Gastrointestinal):

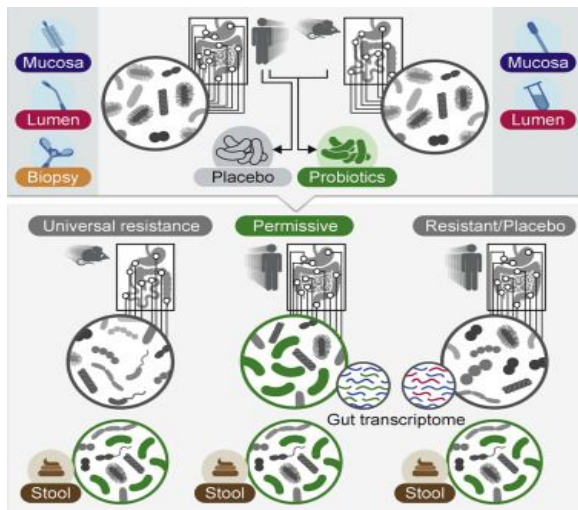
Các mẫu từ đoạn dưới của ống tiêu hóa, chủ yếu là ruột non (đoạn còn lại của ruột non ngoài tá tràng) và ruột già (kể cả đại tràng và trực tràng).



Source:

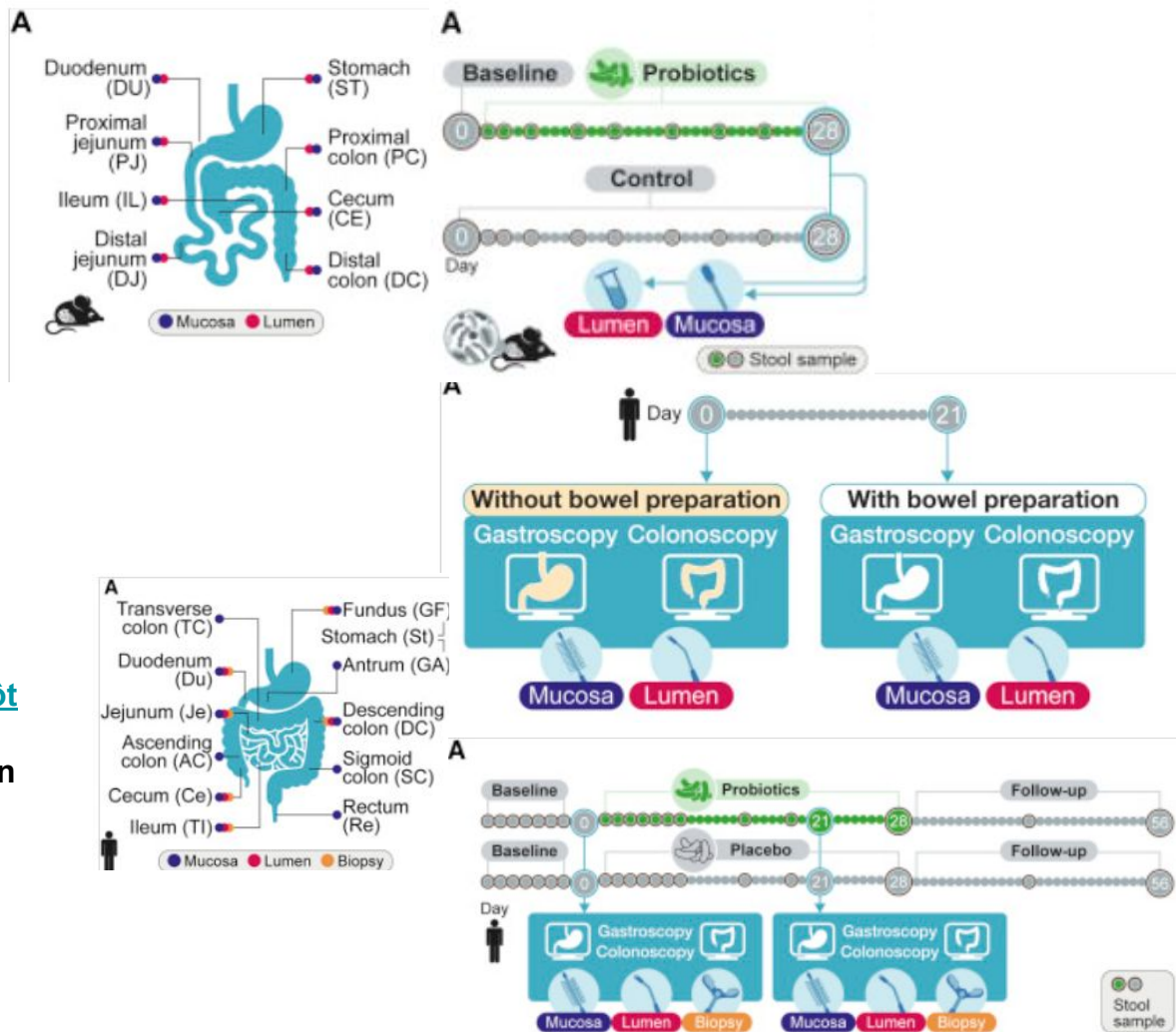
https://vi.wikipedia.org/wiki/H%E1%BB%87_t%C3%AAu_h%C3%B3a_n%C6%B0%E1%BB%9Di#/media/T%E1%BA%ADp_tin:Digestive_system_diagram_vi.svg

Thiết kế nghiên cứu



Thiết kế nghiên cứu - trên nhóm chuột
Thiết kế nghiên cứu - trên nhóm người tình nguyện (NC so sánh chuẩn bị ruột)

Thiết kế nghiên cứu - trên nhóm người tình nguyện (NC chung probiotics)

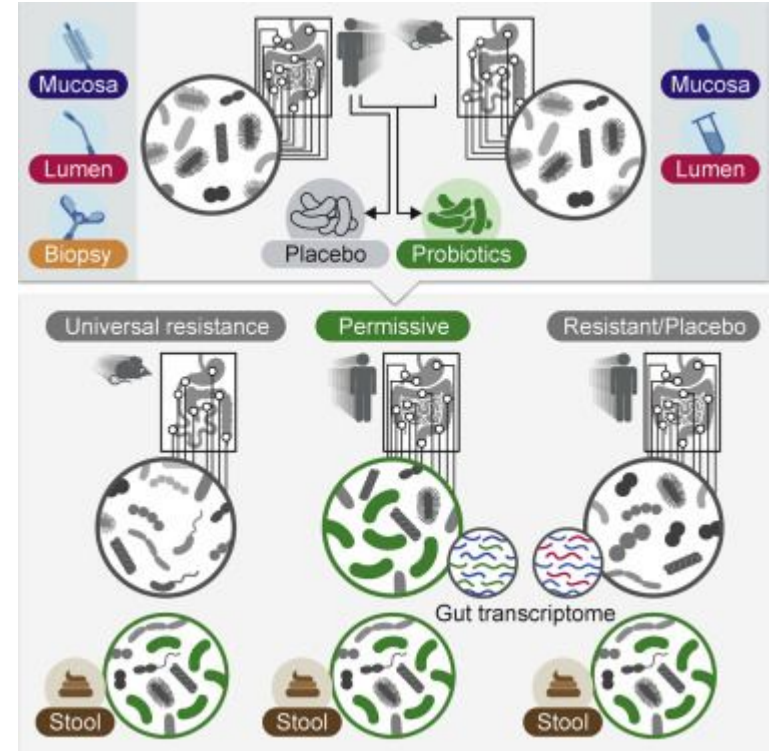


Probiotics:

1. *Lactobacillus acidophilus* (LAC)
2. *Lactobacillus casei* (LCA)
3. *Lactobacillus casei* sbsp. *paracasei* (LPA)
4. *Lactobacillus plantarum* (LPL)
5. *Lactobacillus rhamnosus* (LRH)
6. *Bifidobacterium longum* (BLO)
7. *Bifidobacterium bifidum* (BBI)
8. *Bifidobacterium breve* (BBR)
9. *Bifidobacterium longum* sbsp. *infantis* (BIN)
10. *Lactococcus lactis* (LLA)
11. *Streptococcus thermophilus* (STH)

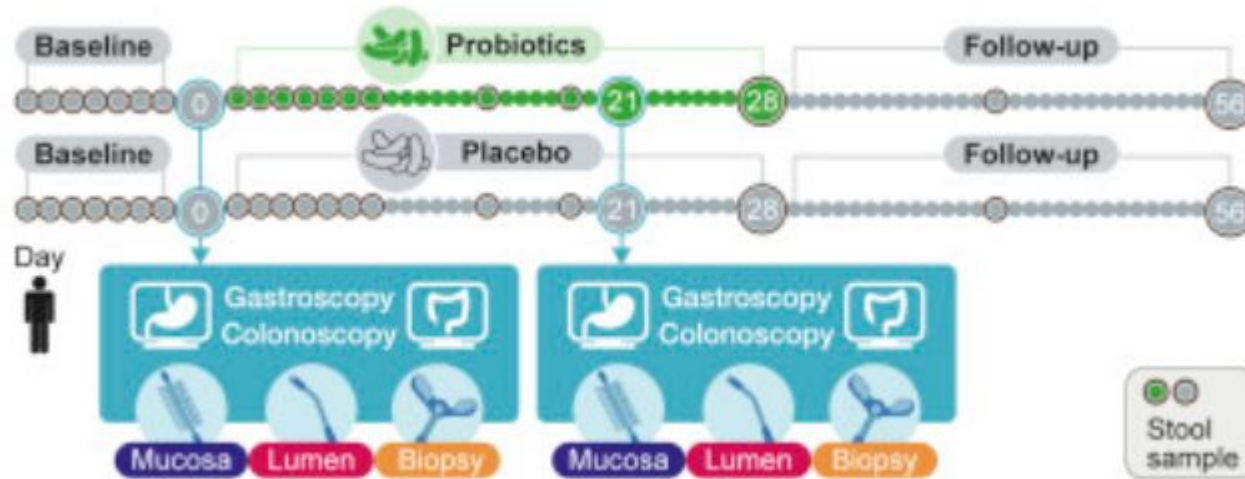
Four microbiome readouts:

- 16S rDNA
- MetaPhlan2
- KOs
- pathways



Source:


<https://www.cell.com/cms/attachment/4f14b634-40ab-4392-b85d-54c427166726/fx1.jpg>








A


Human participants were treated with probiotics pills or placebo bi-daily for a period of 28 days and were further followed for 1 month.


Experimental outline in humans.

Data availability Sequence data have been deposited in the European Nucleotide Archive under accession number **ENA: PRJEB28097**.


 <https://www.ebi.ac.uk/ena/browser/home>

 EMBL-EBI home  Services  Research  Training  About us  


European Nucleotide Archive



Examples: histone, BN000065



Examples: Taxon:9606, BN000065, PRJEB402

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European Nucleotide Archive

The European Nucleotide Archive (ENA) provides a comprehensive record of the world's nucleotide sequencing information, covering raw sequencing data, sequence assembly information, functional annotation. [More about ENA](#).

Access to ENA data is provided through the browser, through search tools, through large scale file download and through the API.



Submit



Search



Rulespace

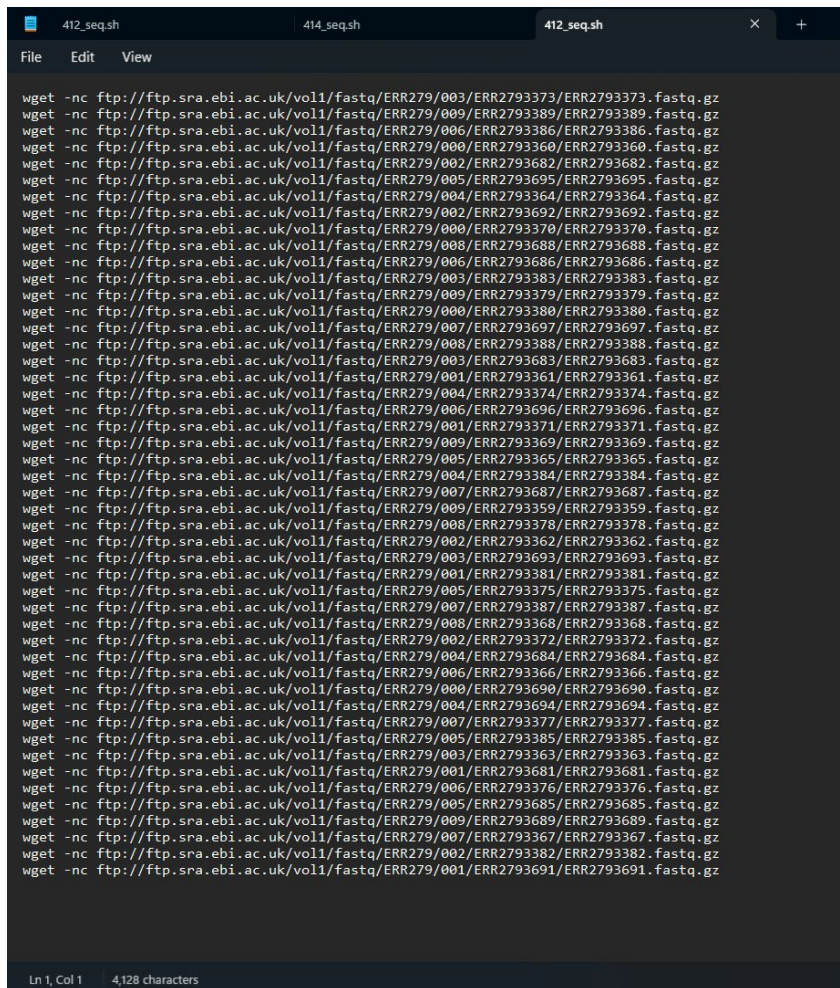


Support

Sau bước
chỉnh ENA và
xuất file thì
chúng ta có file
metadata này:

	A	B	C	D	E	F	G	
1	sampleID	sample_title	scientific_name	Location	tissue_location	tissue_type	Group	sample_description
2	sample18	412.2.4_165	Homo sapiens	UGI	Jejunum mucosa	mucosa	Naive	endoscopic sample mucosa of UGI (naive) of part
3	sample45	412.2.2_165	Homo sapiens	UGI	Gastric antrum mucosa	mucosa	Naive	endoscopic sample mucosa of UGI (naive) of part
4	sample22	412.2.1_165	Homo sapiens	UGI	Gastric fundus mucosa	mucosa	Naive	endoscopic sample mucosa of UGI (naive) of part
5	sample48	412.2.3_165	Homo sapiens	UGI	Duodenal bulb mucosa	mucosa	Naive	endoscopic sample mucosa of UGI (naive) of part
6	sample1	412.1.1_165	Homo sapiens	UGI	Stomach lumen	lumen	Naive	endoscopic sample lumen of UGI (naive) of partic
7	sample33	412.1.2_165	Homo sapiens	UGI	Duodenum lumen	lumen	Naive	endoscopic sample lumen of UGI (naive) of partic
8	sample12	412.1.4_165	Homo sapiens	TI	Terminal ileum lumen	lumen	Naive	endoscopic sample lumen of TI (naive) of particip
9	sample44	412.2.17_165	Homo sapiens	TI	Terminal ileum mucosa	mucosa	Naive	endoscopic sample mucosa of TI (naive) of particip
10	sample28	412.1.5_165	Homo sapiens	LGI	Cecum lumen	lumen	Naive	endoscopic sample lumen of LGI (naive) of partici
11	sample47	412.1.6_165	Homo sapiens	LGI	Descending colon lumen	lumen	Naive	endoscopic sample lumen of LGI (naive) of partici
12	sample43	412.2.10_165	Homo sapiens	LGI	Transverse colon mucosa	mucosa	Naive	endoscopic sample mucosa of LGI (naive) of parti
13	sample5	412.2.12_165	Homo sapiens	LGI	Cecum mucosa	mucosa	Naive	endoscopic sample mucosa of LGI (naive) of parti
14	sample24	412.2.9_165	Homo sapiens	LGI	Descending colon mucosa	mucosa	Naive	endoscopic sample mucosa of LGI (naive) of parti
15	sample46	412.2.11_165	Homo sapiens	LGI	Ascending colon mucosa	mucosa	Naive	endoscopic sample mucosa of LGI (naive) of parti
16	sample36	412.2.7_165	Homo sapiens	LGI	Rectum mucosa	mucosa	Naive	endoscopic sample mucosa of LGI (naive) of parti
17	sample11	412.2.8_165	Homo sapiens	LGI	Sigmoid colon mucosa	mucosa	Naive	endoscopic sample mucosa of LGI (naive) of parti
18	sample7	512.1.6_165	Homo sapiens	LGI	Descending colon lumen	lumen	During probiotics	endoscopic sample lumen of LGI (during probiotic
19	sample41	512.1.5_165	Homo sapiens	LGI	Cecum lumen	lumen	During probiotics	endoscopic sample lumen of LGI (during probiotic
20	sample42	512.1.4_165	Homo sapiens	TI	Terminal ileum lumen	lumen	During probiotics	endoscopic sample lumen of TI (during probiotics
21	sample15	512.1.3_165	Homo sapiens	UGI	Jejunum lumen	lumen	During probiotics	endoscopic sample lumen of UGI (during probioti
22	sample26	512.1.1_165	Homo sapiens	UGI	Stomach lumen	lumen	During probiotics	endoscopic sample lumen of UGI (during probioti
23	sample37	512.1.2_165	Homo sapiens	UGI	Duodenum lumen	lumen	During probiotics	endoscopic sample lumen of UGI (during probioti
24	sample30	512.2.10_165	Homo sapiens	LGI	Transverse colon mucosa	mucosa	During probiotics	endoscopic sample mucosa of LGI (during probiot
25	sample19	512.2.9_165	Homo sapiens	LGI	Descending colon mucosa	mucosa	During probiotics	endoscopic sample mucosa of LGI (during probiot
26	sample34	512.2.11_165	Homo sapiens	LGI	Ascending colon mucosa	mucosa	During probiotics	endoscopic sample mucosa of LGI (during probiot
27	sample39	512.2.7_165	Homo sapiens	LGI	Rectum mucosa	mucosa	During probiotics	endoscopic sample mucosa of LGI (during probiot
28	sample25	512.2.8_165	Homo sapiens	LGI	Sigmoid colon mucosa	mucosa	During probiotics	endoscopic sample mucosa of LGI (during probiot
29	sample20	512.2.12_165	Homo sapiens	LGI	Cecum mucosa	mucosa	During probiotics	endoscopic sample mucosa of LGI (during probiot
30	sample23	512.2.17_165	Homo sapiens	TI	Terminal ileum mucosa	mucosa	During probiotics	endoscopic sample mucosa of TI (during probiotic
32	sample38	512.2.4_165	Homo sapiens	UGI	Jejunum mucosa	mucosa	During probiotics	endoscopic sample mucosa of UGI (during probio
33	sample13	512.2.1_165	Homo sapiens	UGI	Gastric fundus mucosa	mucosa	During probiotics	endoscopic sample mucosa of UGI (during probio
34	sample2	512.2.2_165	Homo sapiens	UGI	Gastric antrum mucosa	mucosa	During probiotics	endoscopic sample mucosa of UGI (during probio
35	sample8	412.0.1_165	Homo sapiens	Stool	Stool	Stool	Naive	stool sample (probiotics without antibiotics group
36	sample4	412.0.3_165	Homo sapiens	Stool	Stool	Stool	Naive	stool sample (probiotics without antibiotics group
37	sample29	412.0.4_165	Homo sapiens	Stool	Stool	Stool	Naive	stool sample (probiotics without antibiotics group
38	sample17	412.0.6_165	Homo sapiens	Stool	Stool	Stool	Naive	stool sample (probiotics without antibiotics group
39	sample10	412.0.7_165	Homo sapiens	Stool	Stool	Stool	Naive	stool sample (probiotics without antibiotics group
40	sample16	412.2_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
41	sample21	412.3_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
42	sample32	412.4_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
43	sample31	412.6_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
44	sample3	412.7_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
45	sample35	412.14_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
46	sample40	412.21_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
47	sample9	412.28_165	Homo sapiens	Stool	Stool	Stool	During probiotics	stool sample (probiotics without antibiotics group
48	sample14	412.42_165	Homo sapiens	Stool	Stool	Stool	Post probiotics	stool sample (probiotics without antibiotics group
49	sample6	412.56_165	Homo sapiens	Stool	Stool	Stool	Post probiotics	stool sample (probiotics without antibiotics group

Đây là file Shell Script để
download trình tự sequence:

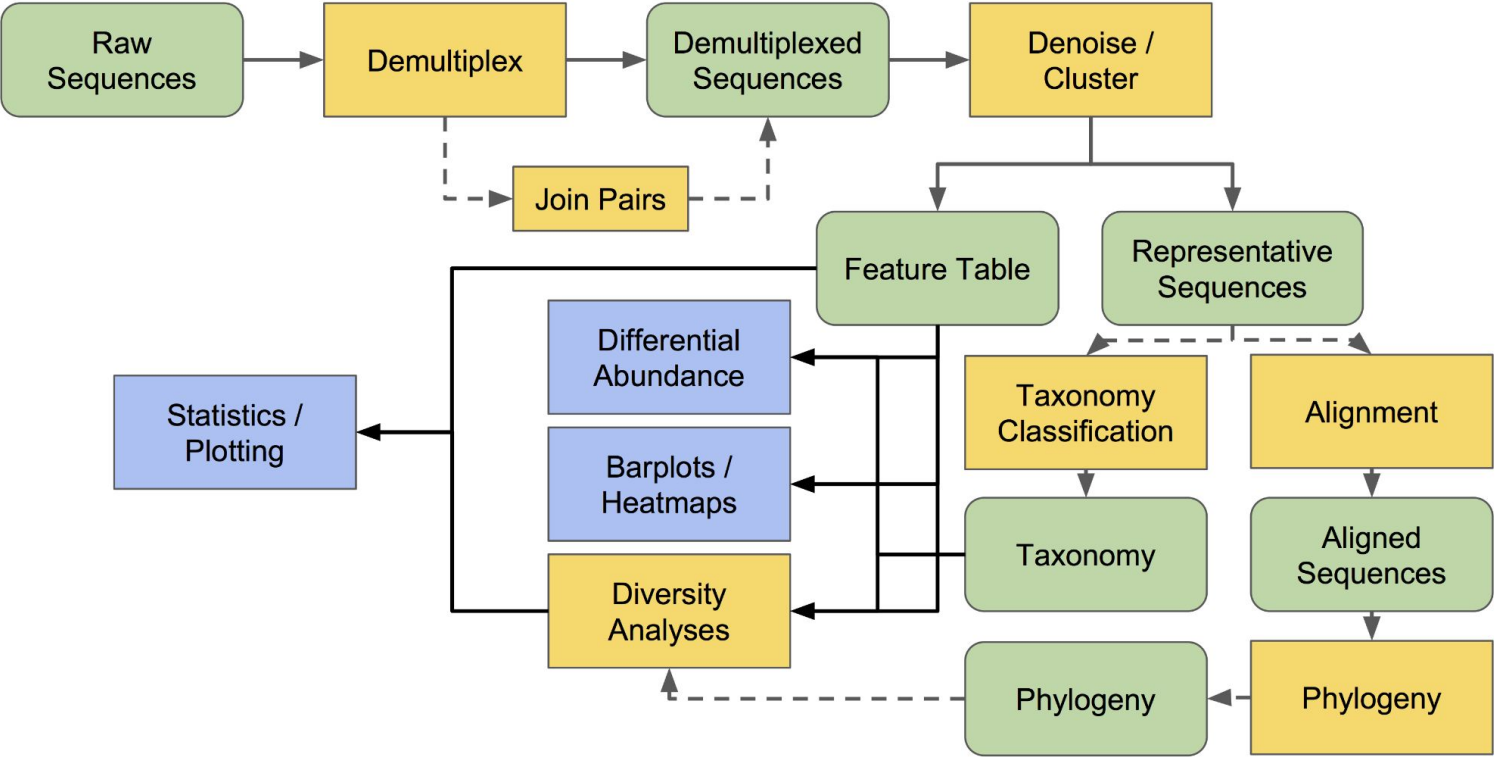


```
412_seq.sh 414_seq.sh 412_seq.sh
File Edit View

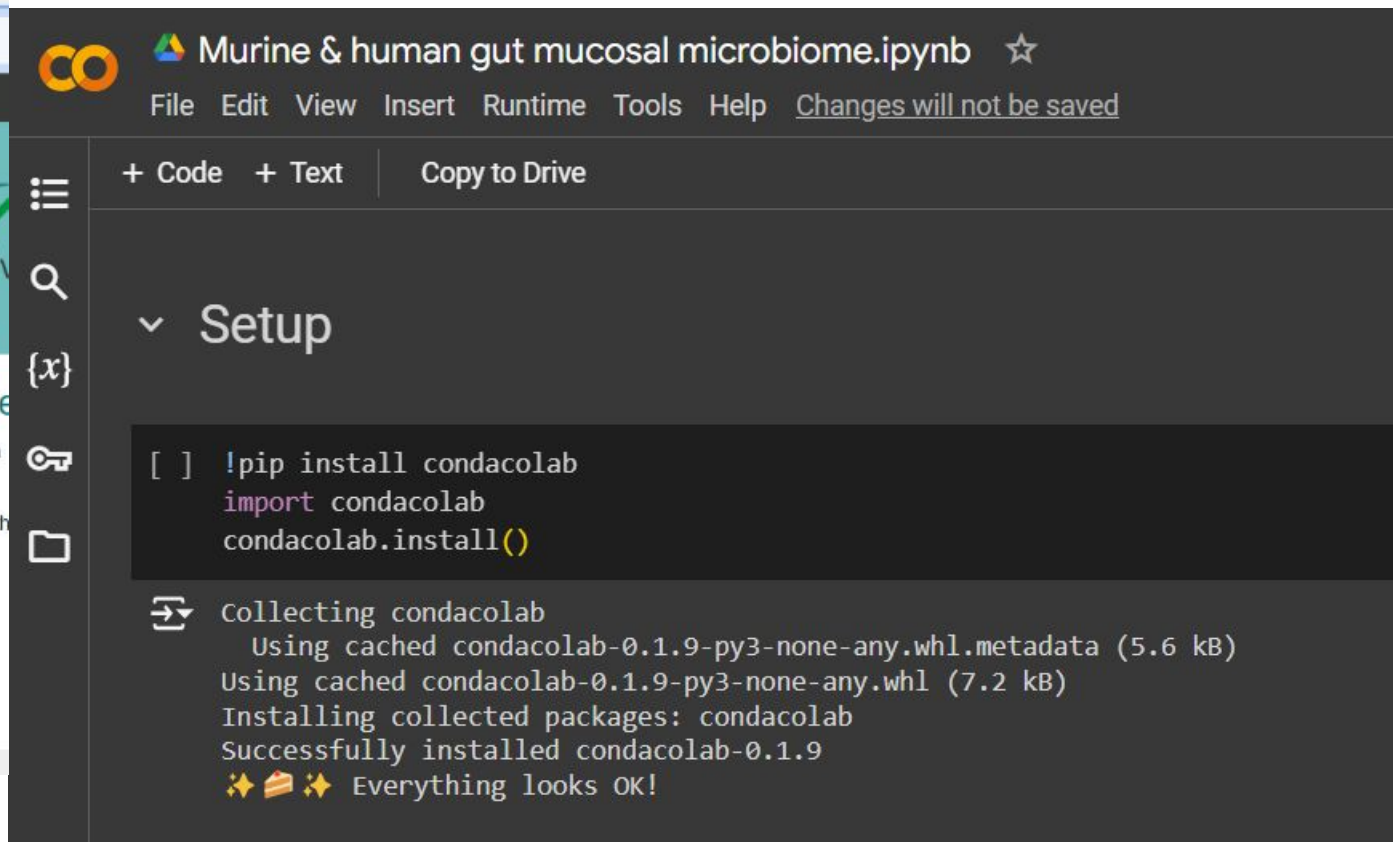
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```

Ln 1, Col 1 4,128 characters

Workflow:



Sau đây là phần trình bày các thao tác trên ENA và colab. **number ENA: PRJEB28097.**



Phân tích hình và kết quả. Dùng file taxa bar plots.qzv



File: taxa-bar-plots.qzv ✕

Visualization

Details

Provenance

Number of sample metadata columns provided: 7

Download

SVG (bars)

SVG (legend)

CSV

Taxonomic Level

Level 7

Color Palette

schemeAccent

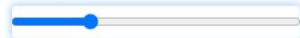
Sort Samples By

Location

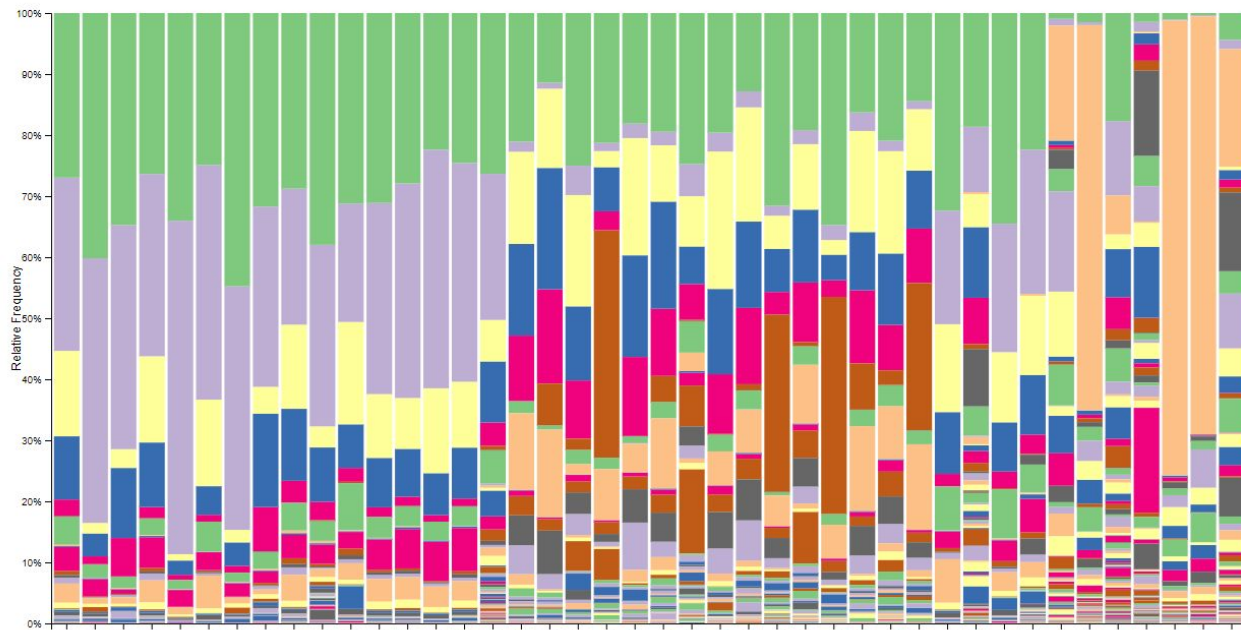
Ascending

Relabel X? ☒

Bar Width



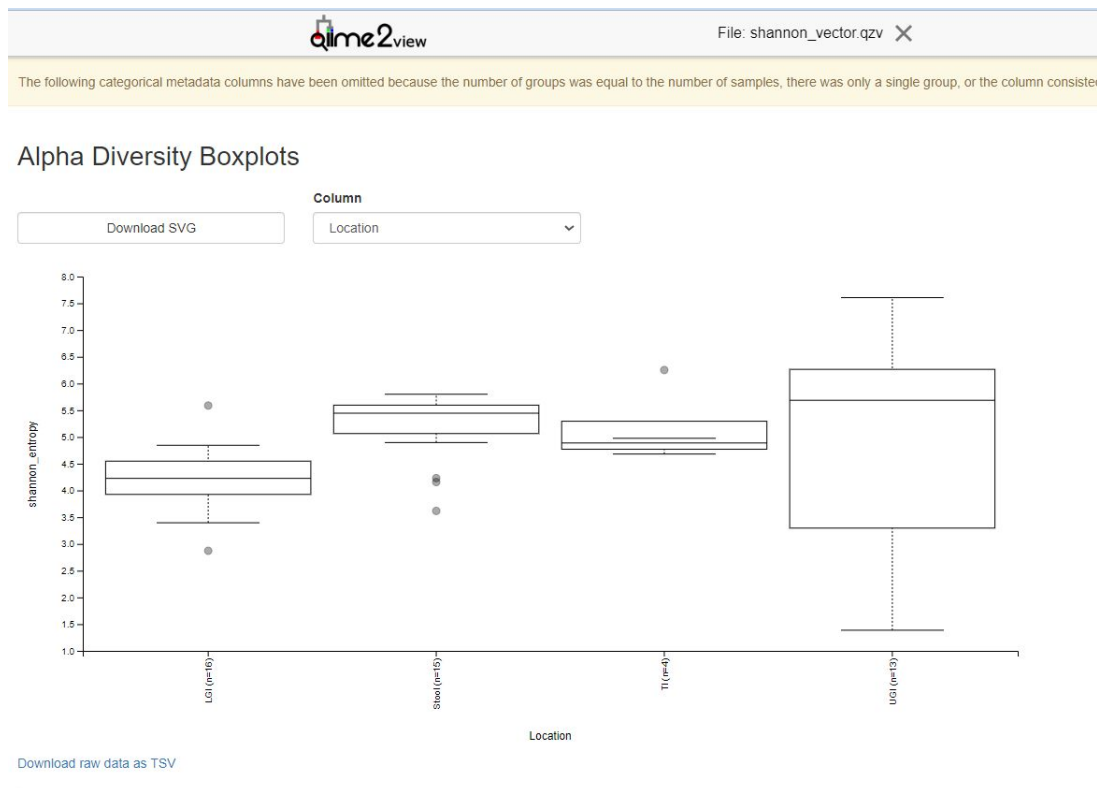
Hover over the plot to learn more



Legend:

- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;f__Bacteroidaceae;g__Bacteroides;s__uniformis
- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;f__Porphyromonadaceae;g__Parabacteroides;s__gordonii
- k__Bacteria;p__Proteobacteria;o__Epsilonproteobacteria;o__Campylobacteriales;f__Campylobacteraceae;g__s__
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Ruminococcaceae;g__Faecalibacterium;s__prausnitzii
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Lachnospiraceae;g__Epulopiscium;s__
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Lachnospiraceae;s__
- k__Bacteria;p__Verrucomicrobia;o__Verrucomicrobiales;f__Verrucomicrobiales;g__Akkermansia;s__
- k__Bacteria;p__Firmicutes;o__Bacilli;o__Lactobacillales;f__Streptococcaceae;g__Streptococcus;s__
- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;s__
- k__Bacteria;p__Proteobacteria;o__Gammaproteobacteria;o__Pasteurellales;f__Pasteurellaceae;g__Gallibacterium;s__
- k__Bacteria;p__Actinobacteria;o__Actinobacteria;o__Bifidobacteriales;f__Bifidobacteriaceae;g__Bifidobacterium;s__longum
- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;f__Prevotellaceae;g__Prevotella;s__copri
- k__Bacteria;p__Proteobacteria;s__
- k__Bacteria;p__Proteobacteria;o__Betaproteobacteria;o__Burkholderiales;f__Alcaligenaceae;g__Sutterella;s__
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;s__
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Ruminococcaceae;s__
- k__Bacteria;p__Proteobacteria;o__Betaproteobacteria;s__
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Lachnospiraceae;g__Lachnospira;s__
- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;f__([Paraprevotellaceae]);g__Paraprevotella;s__
- k__Bacteria;p__Bacteroidetes;s__
- k__Bacteria;p__Proteobacteria;o__Betaproteobacteria;o__Burkholderiales;f__Comamonadaceae;s__
- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;f__Prevotellaceae;g__Prevotella;s__nigrescens
- k__Bacteria;p__Proteobacteria;o__Gammaproteobacteria;o__Enterobacteriales;f__Enterobacteriaceae;g__Escherichia;s__
- k__Bacteria;p__Proteobacteria;o__Gammaproteobacteria;o__Pasteurellales;f__Pasteurellaceae;g__Aggregatibacter;s__seq
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Vellionellaceae;g__Dialister;s__
- k__Bacteria;s__
- k__Bacteria;p__Bacteroidetes;o__Bacteroidia;o__Bacteroidales;f__([Paraprevotellaceae]);g__([Prevotella]);s__tannerae
- k__Bacteria;p__Fusobacteria;o__Fusobacteria;o__Fusobacteriales;f__Fusobacteriaceae;s__
- k__Bacteria;p__Firmicutes;o__Clostridia;o__Clostridiales;f__Vellionellaceae;g__Acidaminococcus;s__
- k__Bacteria;p__Deferribacteres;o__Deferribacteres;o__Deferribacteriales;f__Deferribacteraceae;g__Mucispirillum;s__
- k__Bacteria;p__Proteobacteria;o__Bacteroidia;o__Bacteroidales;f__Burkholderiales;g__Burkholderia;s__

Phân tích hình và kết quả. Dùng file shannon_vector.qzv theo location



Phân tích hình và kết quả. Dùng file shannon vector.qzv theo group

Alpha Diversity Boxplots

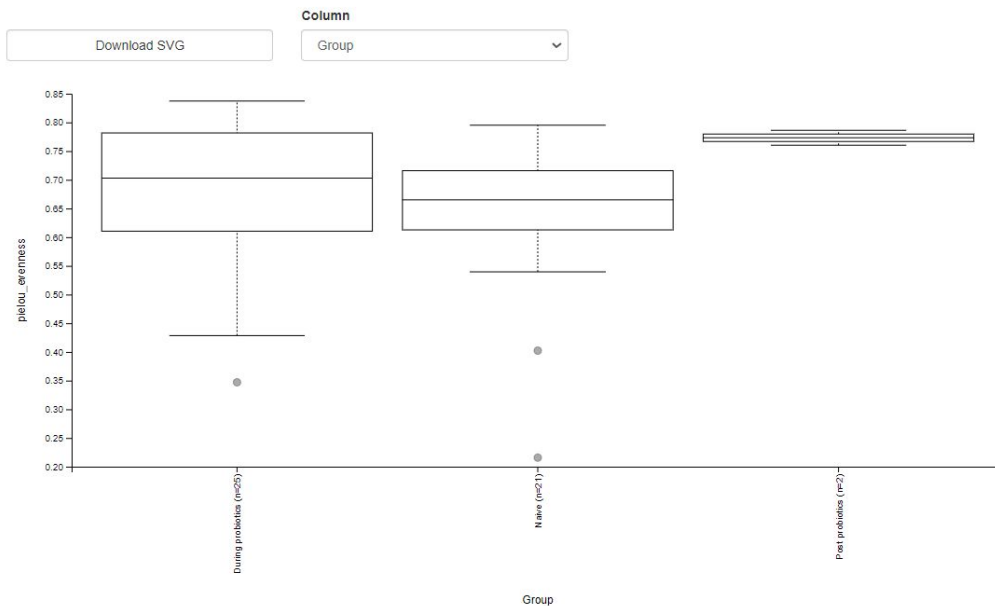


Phân tích hình và kết quả. Dùng file evenness_vector.qzv theo group

qime2view File: evenness_vector.qzv Visualiz

The following categorical metadata columns have been omitted because the number of groups was equal to the number of samples, there was only a single group, or the column consisted only of missing data: **sample**.

Alpha Diversity Boxplots

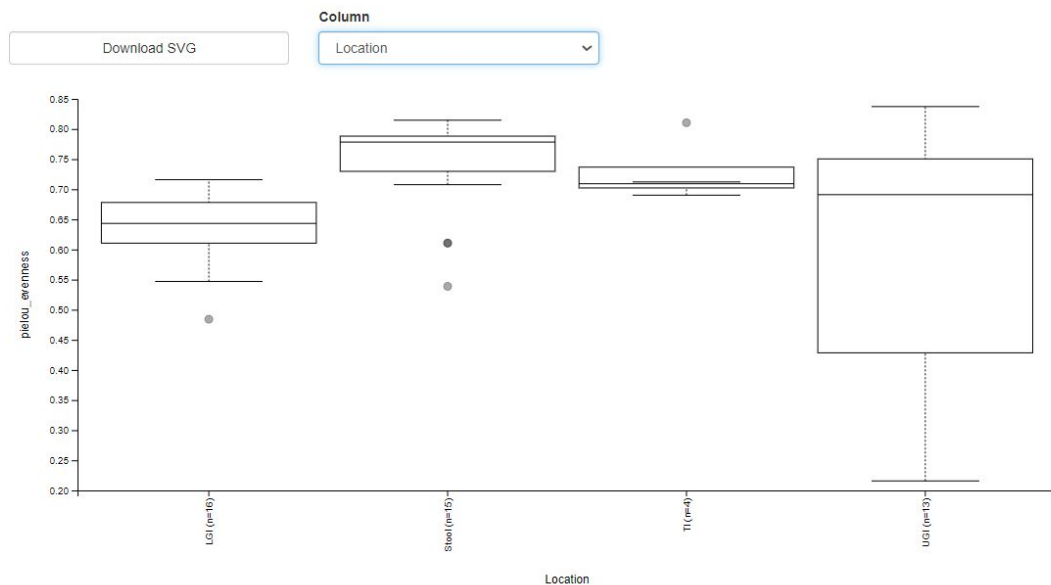


Phân tích hình và kết quả. Dùng file evenness_vector.qzv theo location

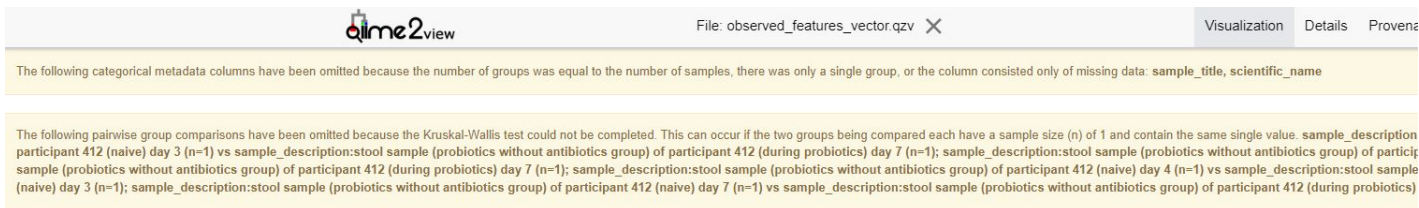
qime2view File: evenness_vector.qzv X

The following categorical metadata columns have been omitted because the number of groups was equal to the number of samples, there was only a single group, or the column

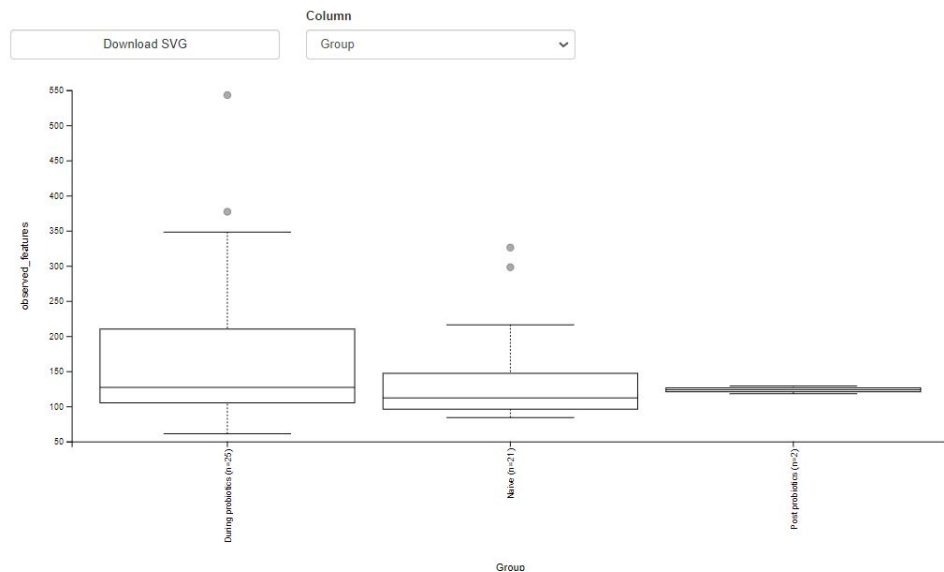
Alpha Diversity Boxplots



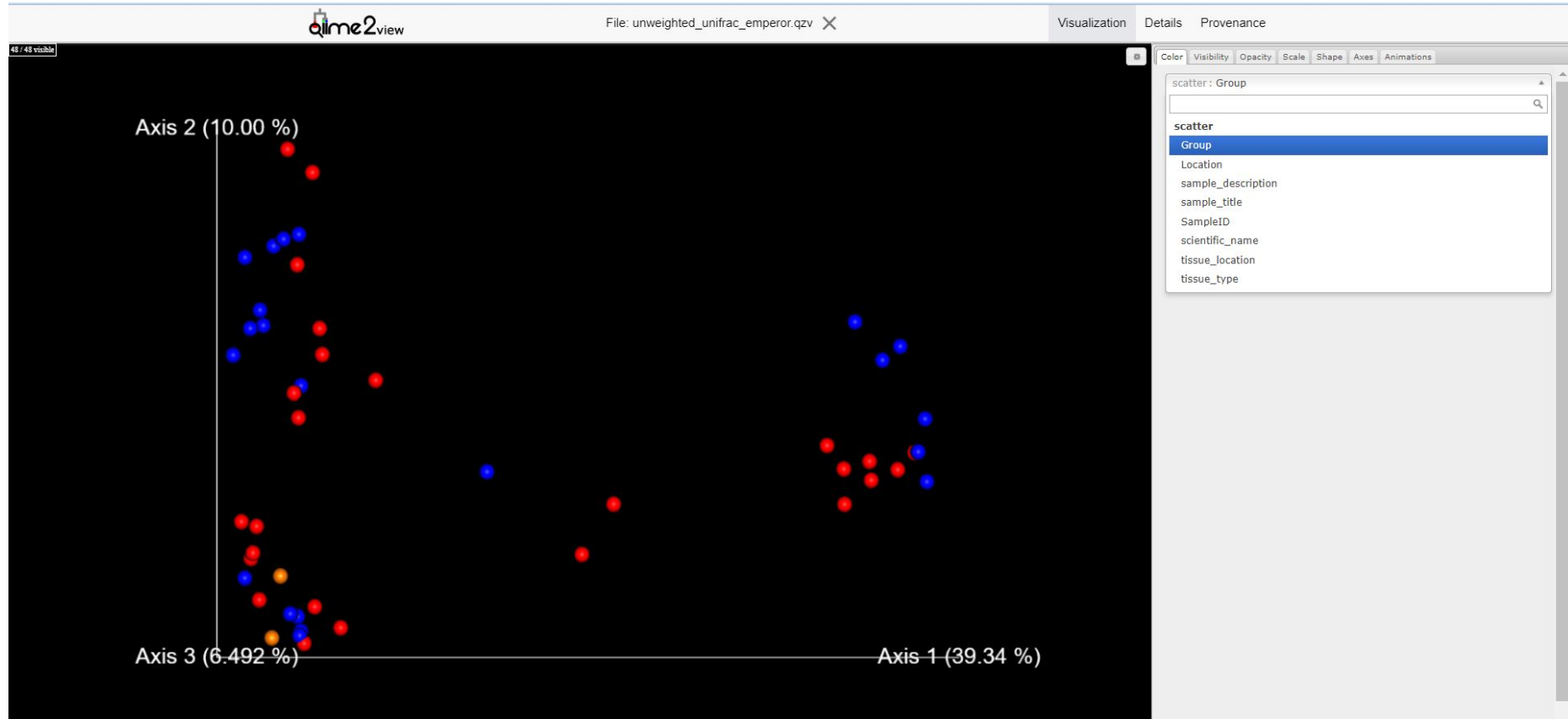
Phân tích hình và kết quả. Dùng file



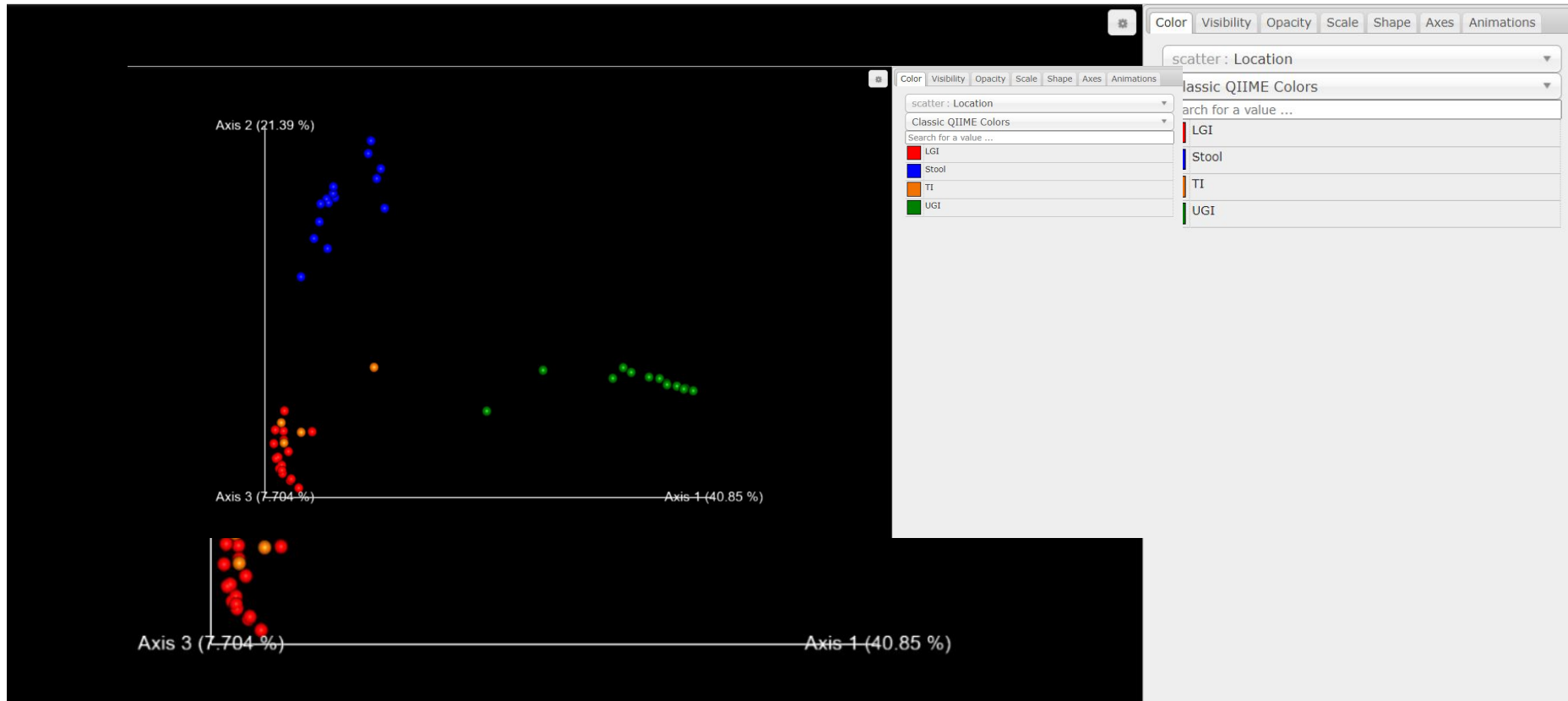
Alpha Diversity Boxplots



Phân tích hình và kết quả. Dùng file unweited_unifrac_emperor.qzv



Phân tích hình và kết quả từ file bray curtis emperor.



Kết luận - người số 412

1. Theo quá trình: trước khi dùng probiotics - trong khi dùng probiotics - sau khi dùng probiotics
2. Theo vị trí: UGI - TI - LGI - Stool

