

Yoga-Based Modulation of Cognition and the Gut Microbiome in Mild Alzheimer's Disease: A 12-Week Exploratory Metagenomic Study



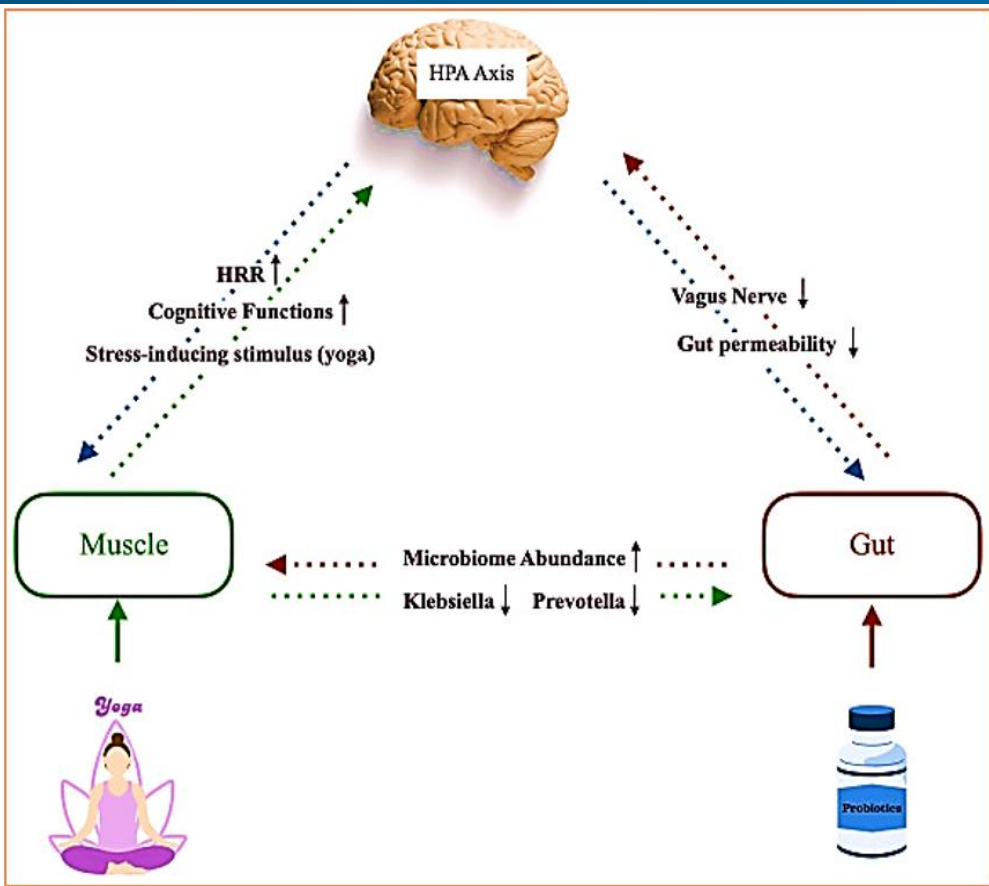
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Introduction

- ❖ Alzheimer's disease (AD) is the leading cause of dementia with limited disease-modifying therapies.
- ❖ Gut microbiome dysbiosis contributes to cognitive decline through the gut–brain axis.
- ❖ Targeting the gut microbiome is a promising therapeutic approach for AD.
- ❖ Yoga improves cognition and modulates immune and metabolic function.
- ❖ The impact of yoga on the gut microbiome in AD remains unclear.
- ❖ This study evaluated the effects of a 12-week yoga intervention on cognition and the gut microbiome in mild AD.



Yoga may modulate:
✓ Cognitive decline
✓ Gut dysbiosis
✓ Cardiovascular risk via vagal tone and inflammation

Aim of the study

- ❑ To evaluate the impact of a 12-week yoga intervention on cognitive function and gut microbiome composition in patients with mild Alzheimer's disease.

Methodology

Inclusion criteria:

AD Group

- Age 45–75 years
- Clinical AD diagnosis (NIA-AA, McKhann et al., 2011)
- Cognitive impairment confirmed by MoCA
- MRI & FDG-PET support diagnosis

HC Group

- Age -matched
- MoCA normal
- No cognitive impairment

Exclusion Criteria:

- Major psychiatric/neurological disorders
- Vascular diseases, active malignancy
- Antibiotic use in past 3 months
- GI illness or surgery in past year

Subjects' recruitment & screening (n=16- AD, n=17-HCs)

Baseline measures

Cognitive tests, Metagenome sequencing, Biomarkers

12-week Yoga Intervention

60 min/day, 6 days/week- Follow up/loss

Post-intervention assessment (n=9)

Repeat cognitive tests, metagenome, biomarkers

Results

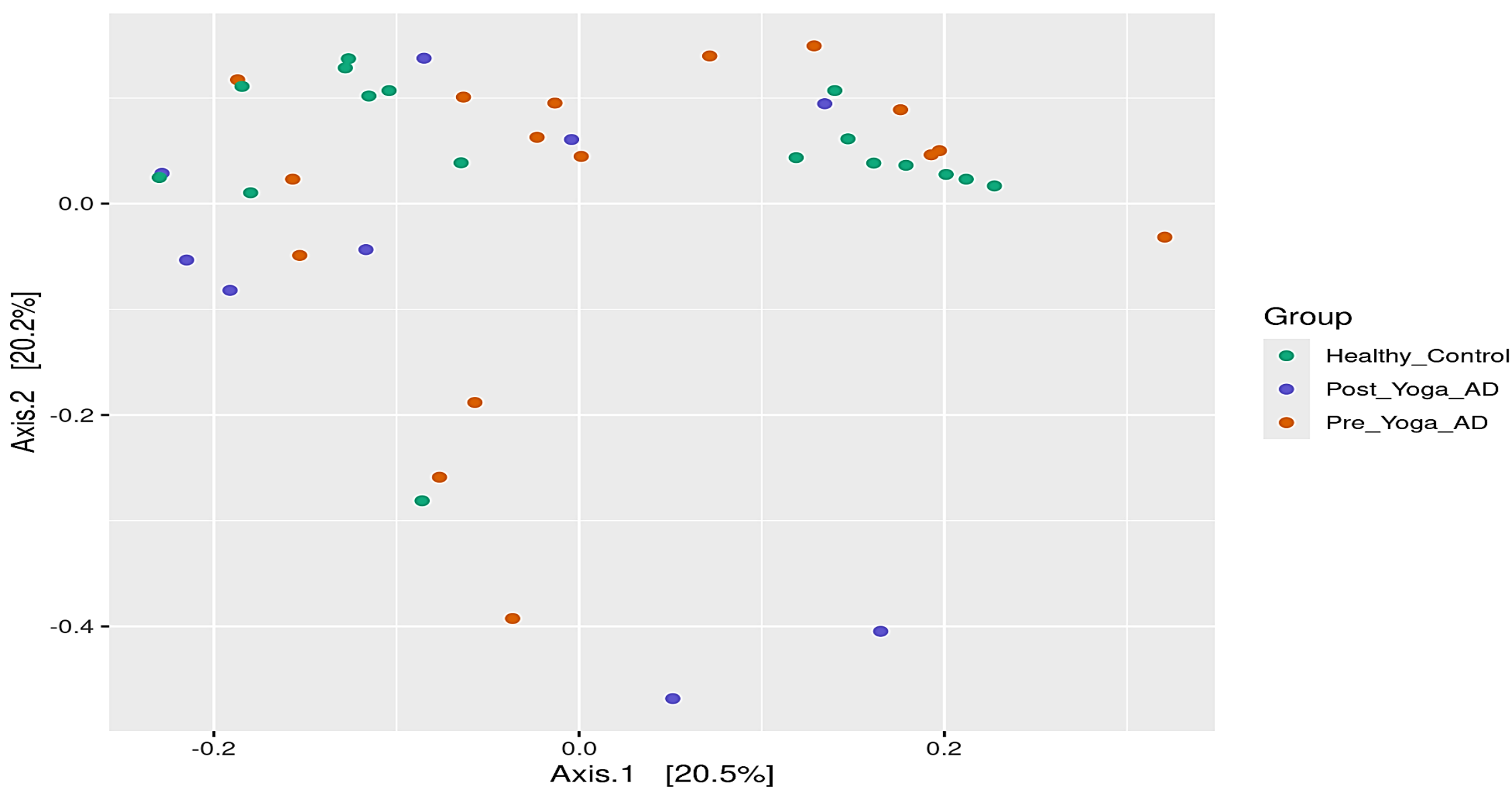
Demographic and clinical Characteristics

Variables	Pre-Yoga AD (n = 16)	Healthy Controls (n = 17)	p-value	Mean difference (95% CI)
Age (years), Mean ± SD	65.87±3.14	64.29±5.40	0.32	1.58 (-1.58- 4.74)
Sex (M/F), n	7/9	10/7	0.49	-
Age at onset (years), Mean ± SD	62.81±2.79	-	-	-
Education (years), Mean ± SD	12.37±2.25	13.29±4.79	0.49	-0.92(-3.60-1.77)
Family history of AD/dementia, n (%)	2(12.5%)	-	-	-
Smoking/drinking, n (%)	3(18.75)/4(25%)	-	-	-
MoCA score, Mean ± SD	21.56±2.55	27.59±1.42	0.001	-6.02(-7.48- -4.57)
PHQ-9 score, Mean ± SD	5.56±2.85	0.29±0.59	0.001	5.27(3.83- 6.71)

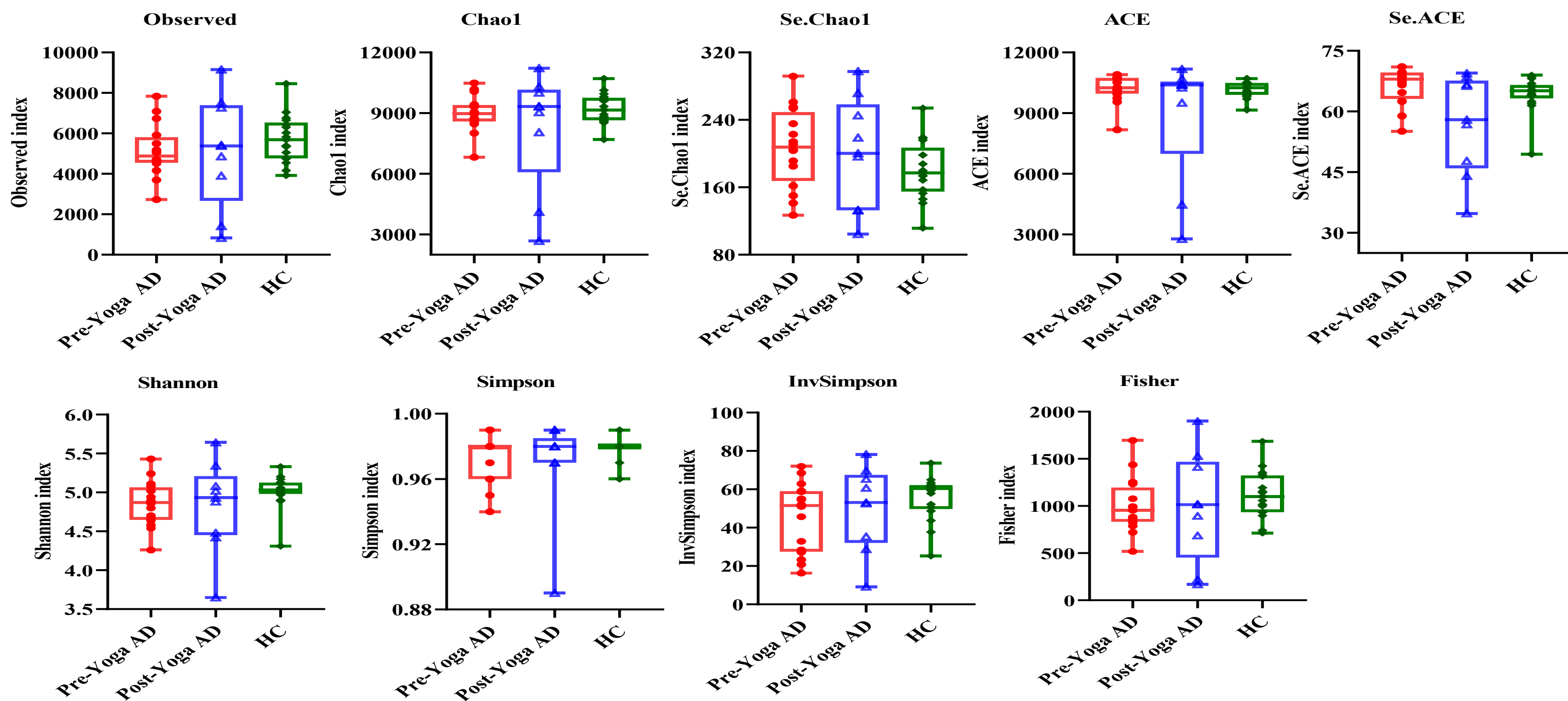
Cognitive and psychological outcomes in Alzheimer's disease (AD) participants pre- and post- yoga intervention

Variables	Pre-Yoga AD (n = 16)	Post-Yoga AD (n = 9)	p-value	Mean difference (95% CI)
MoCA score, Mean ± SD	21.56±2.55	25.44±2.01	0.001	-3.88(-5.93—18.3)
PHQ-9 score, Mean ± SD	5.56±2.85	2.22±1.71	0.004	3.34 (1.17-5.51)

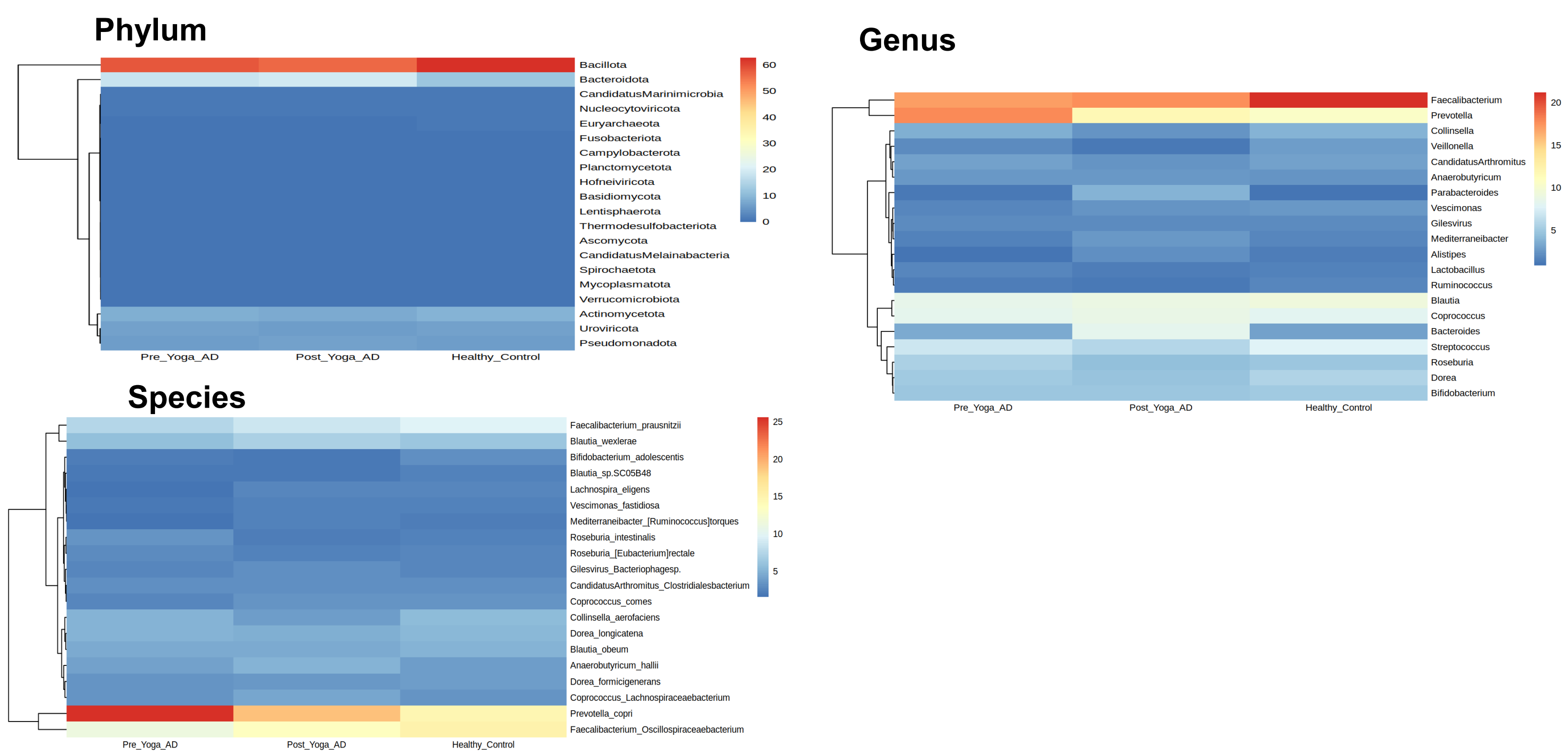
Principal Coordinate Analysis (PCoA) in pre-AD and 12-week post-Yoga AD compared with healthy controls



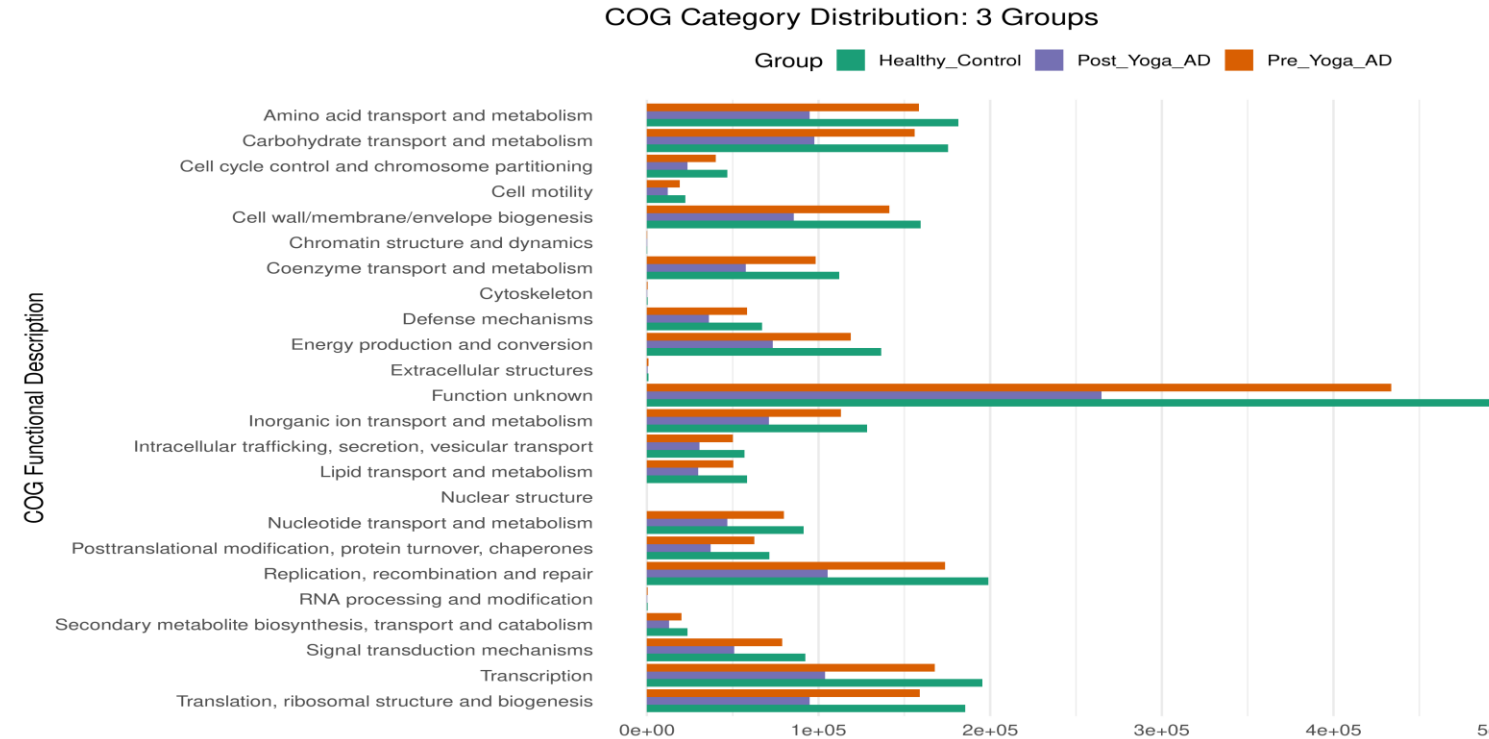
Alpha diversity index in Alzheimer's Disease (pre-Yoga AD, Post-Yoga AD) and healthy controls (HCs)



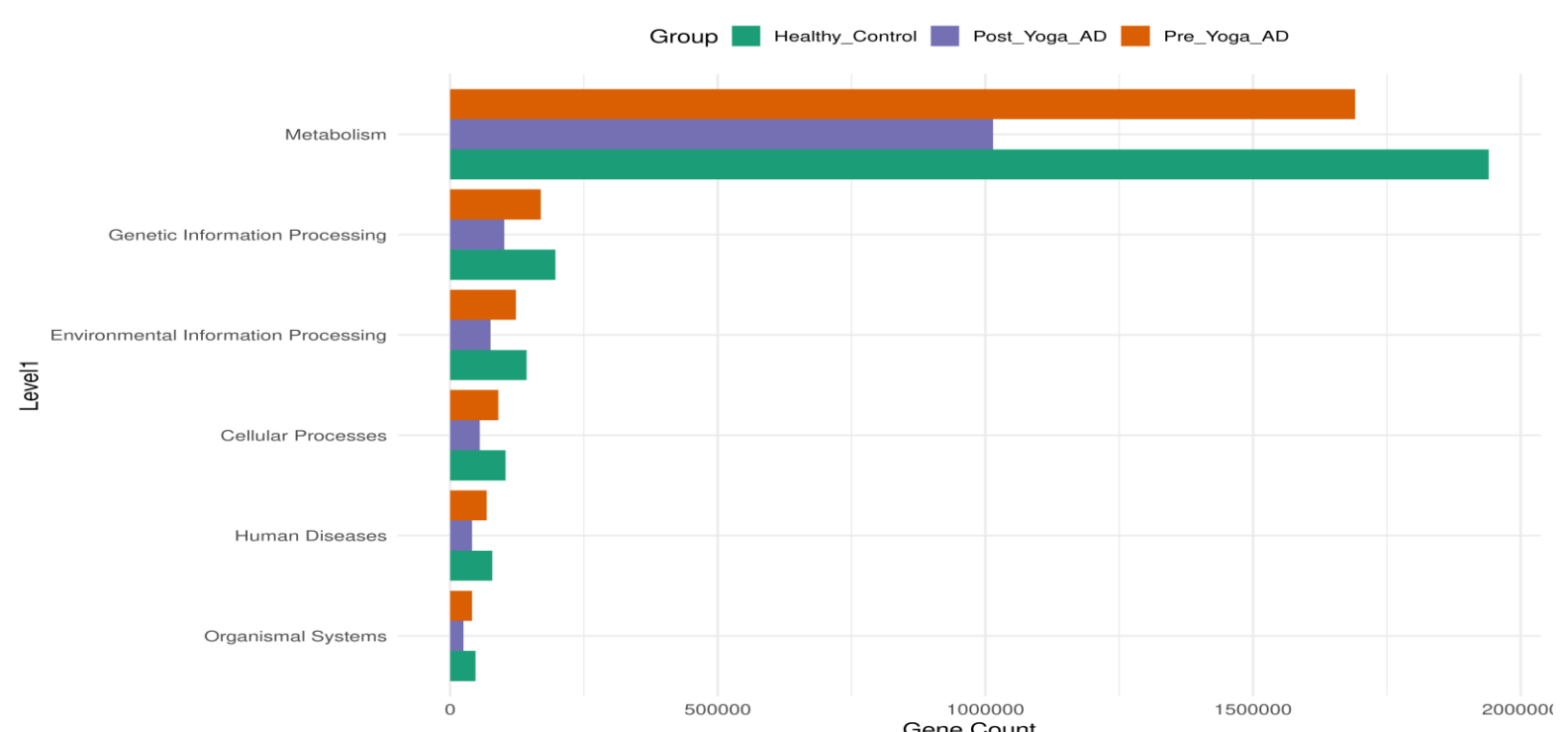
Heatmaps (Top 20) and functional distribution : (Pre-AD, Post-Yoga AD, and Healthy controls)



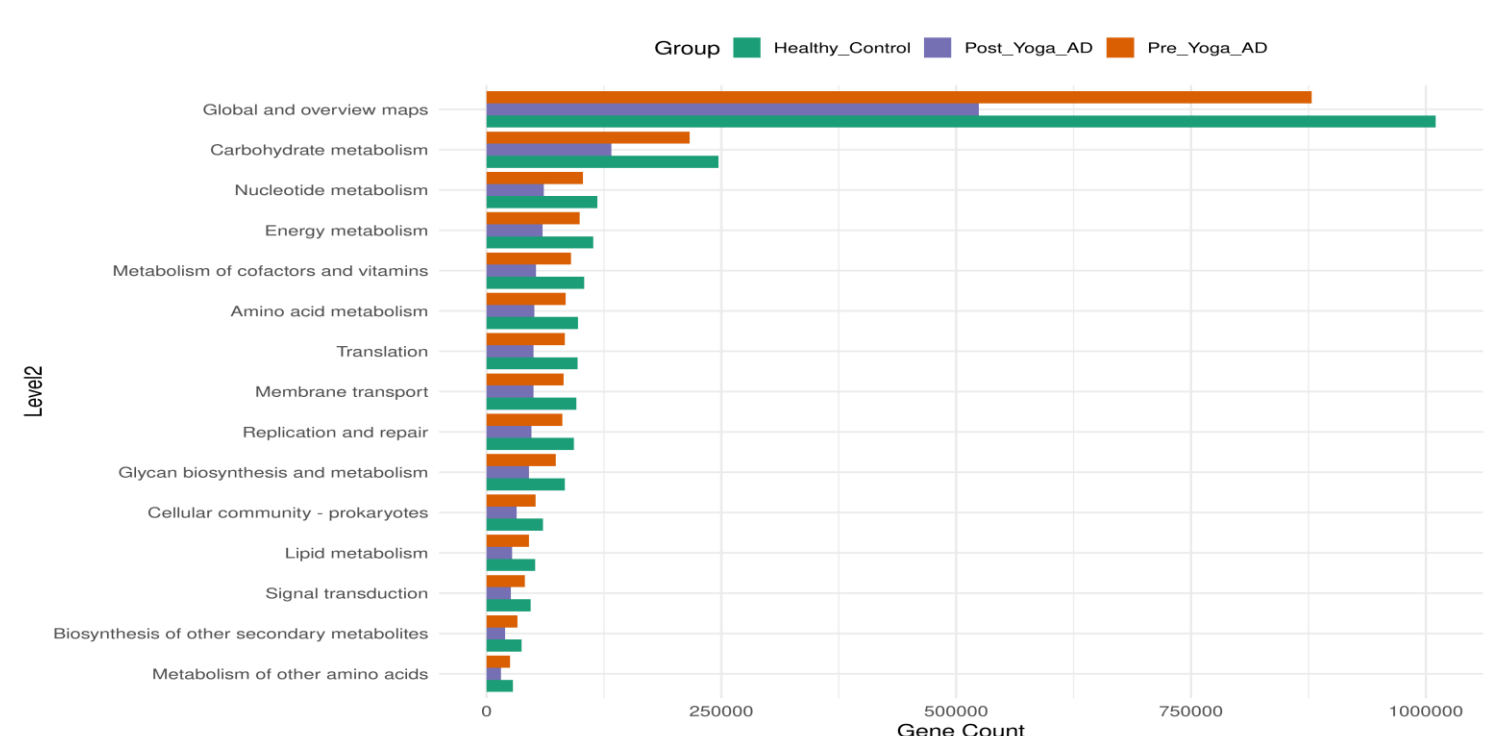
COG distributions across the group



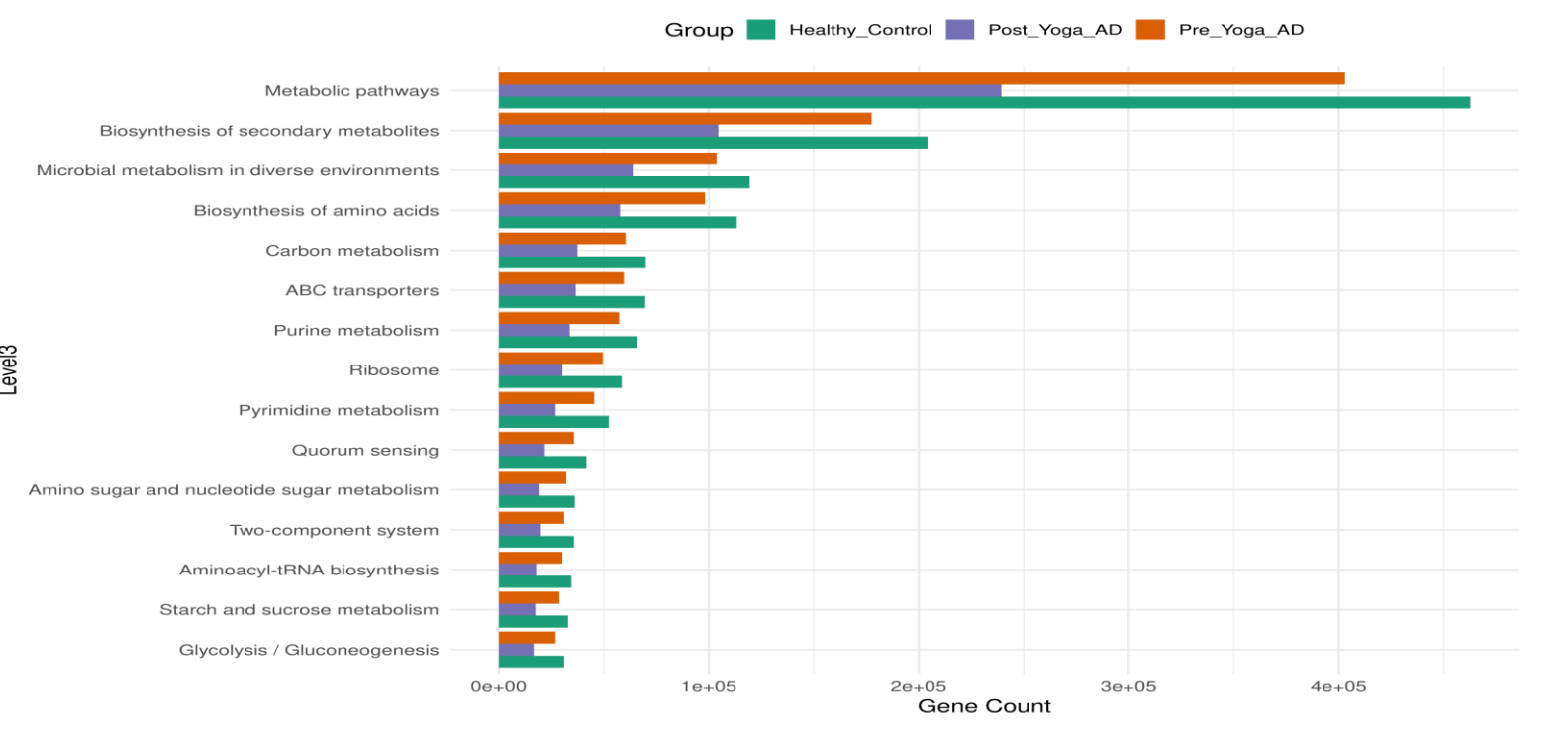
KEGG level 1 functional domains



KEGG level 2 pathway



KEGG level 3 pathway



Conclusion

- ✓ Yoga intervention improved cognitive performance (MoCA ↑) and reduced depressive symptoms (PHQ-9 ↓) in mild AD.
- ✓ Gut microbial composition showed distinct post-yoga shifts, as demonstrated by PCoA and taxonomic heatmaps.
- ✓ Functional metagenomic profiles were altered following the 12-week yoga intervention.
- ✓ Alpha diversity showed no significant overall change following yoga.
- ✓ These findings suggest that yoga may beneficially modulate the gut microbiome while improving cognitive outcomes in mild Alzheimer's disease.
- ✓ Larger controlled studies are required to validate these exploratory findings.

References

1. Tiwari P, Gupta A, Kaushik M, Dwivedi R, Tripathi M, Dada R. Association of yoga with cognitive and gut microbiome changes in Alzheimer's disease: An exploratory case-control study. J Alzheimers Dis. 2026 Mar;110(2):562-575. doi: 10.1177/13872877261415612. Epub 2026 Jan 28. PMID: 41603333.
2. Kaushik M, Yadav A, Upadhyay A, Gupta A, Tiwari P, Tripathi M, Dada R. Yoga an integrated mind body intervention for improvement in quality of life in individuals with Alzheimer's disease and their caregivers. Front Aging. 2025 Mar 21;6:1449485. doi: 10.3389/fragi.2025.1449485. PMID: 40191145; PMCID: PMC11968721.

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