BEST:23

Assessing the Therapeutic Effects of Allopathic and Ayurvedic Medications in Parkinson's Disease: A Study of the Murine Gut Microbiome and Clinical Parameters

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ABSTRACT

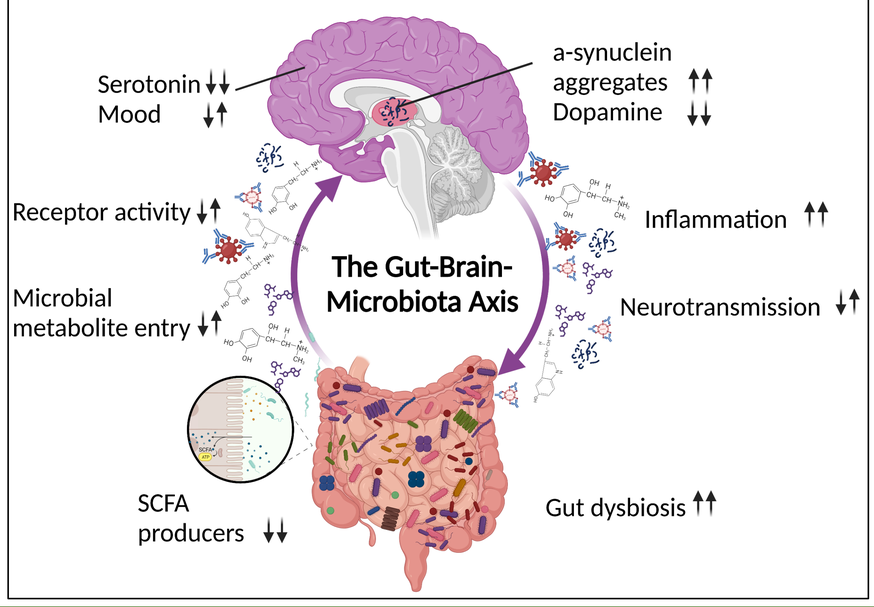
Parkinson's Disease (PD) pathology has been associated with gut dysbiosis suggesting a gut-brain-microbiota axis influencing disease progression. Ayurvedic formulations for PD, have no documentation of possible toxic effects on clinical parameters and gut microbiome. This study aims to test two widely prescribed Ayurvedic preparations, Suvarna Sameerapannaga Rasa (SSR) and Maha Kalyanaka Ghrita (MKG), against standard anti-Parkinson's allopathic treatment, Levodopa-Carbidopa. Ayurvedic preparations SSR and MKG, and allopathic medicine Syndopa-Plus, were administered in different dosages and assessed for in-vivo activity on the blood parameters and gut microbiome in normal female Swiss-albino mice. This was done using ALT/AST liver-function assay, post-mortem examination, biochemical tests for bacterial identification, and 16s rDNA metagenomic sequencing. Mice administered with 2X dosage SSR showed abnormal deviations in liver function, whereas those given 1X dosage showed abnormal morphological changes in organs. Biochemical characterization showed that Ayurveda-treated mice showed a different microbial diversity and abundance, as compared to levodopa-treated mice. 16s rDNA sequencing furthered showed that Levodopa-treated mice had lower species richness as compared to the control and Ayurveda-treated mice. MKG-treated mice showed a higher abundance of beneficial short chain fatty acid-producing bacteria. This study aims to compare the effect of Ayurvedic and allopathic treatments for PD, to assess their toxic/beneficial effects on normal mice and their microbiome.

OBJECTIVES

A) Exploring the comparative influence of Ayurveda treatment and standard Anti-Parkinson's treatment on the clinical outcomes and gut microbiome profile in Parkinson's Disease.

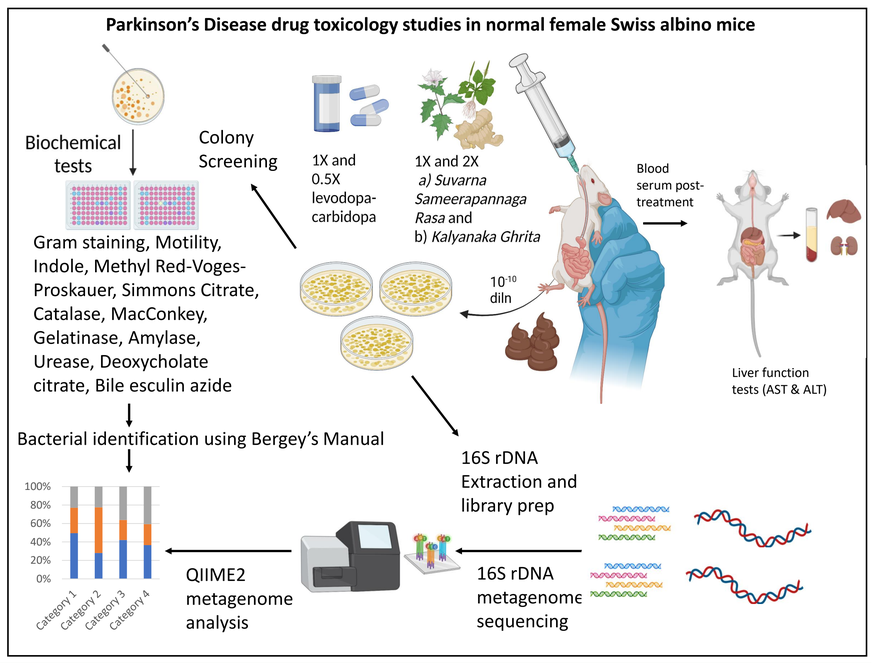
INTRODUCTION

Diagrammatic Representation of the Gut-Brain Microbiota Axis



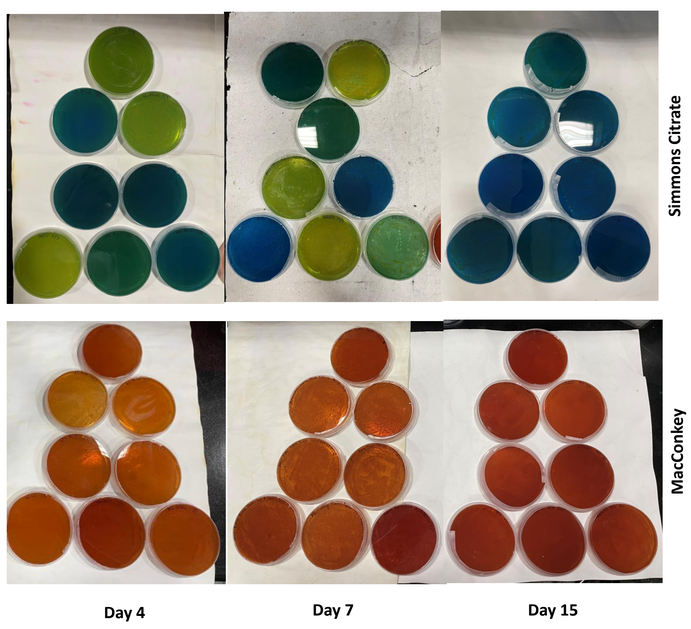
WORKFLOW

Parkinson's Disease drug toxicology studies in normal female Swiss albino mice



RESULTS

Shift Observed Towards Gram Negative, Citrate Positive, Lactose Positive Microflora with Increasing Drug Concentration and Duration of Treatment in mice

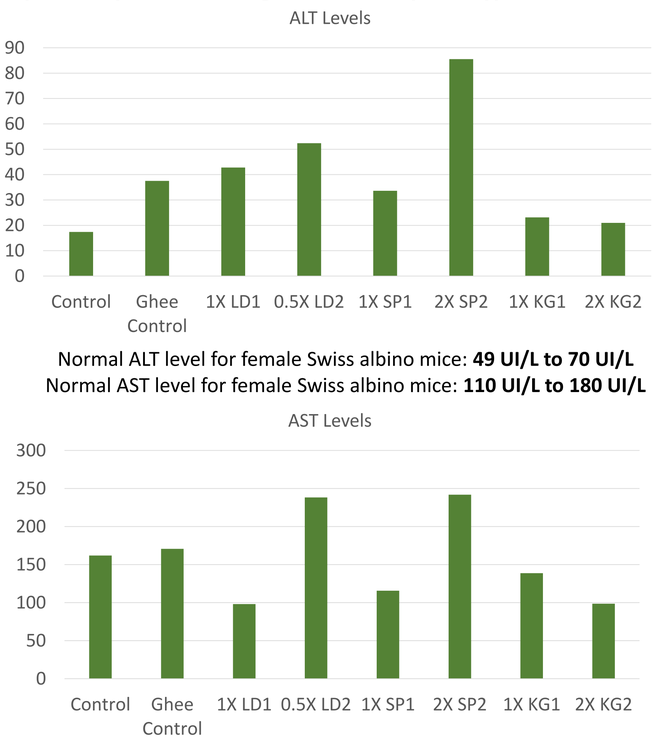


Phenotypic observation of mice post-treatment suggest possible abnormalities in liver, thymus and spleen in 2X Ayurvedic and 0.5X allopathic-medication.

Sample	Liver	Kidney	Heartbeat	Spleen	Thymus	Hair loss
Control	Normal	Normal	Normal	Normal	Normal	None
Ghee control	Slightly larger	Normal	Normal	Normal	Normal	None
1X LD1	Normal	Normal	Normal	Large	Normal	None
0.5X	Normal	Normal	Normal	Normal	Normal	None
1X SP1	Large	Normal	Slow	Normal	Large	None
2X SP2	Normal	Normal	Normal	Normal	Normal	Patchy
1X KG1	Normal	Normal	Normal	Normal	Normal	None
2X KG2	Normal	Normal	Slow	Normal	Normal	None

LD: Levodopa-Carbidopa SP: Suvarna Sameerapannaga Rasa KG: Kalyanaka Ghrita

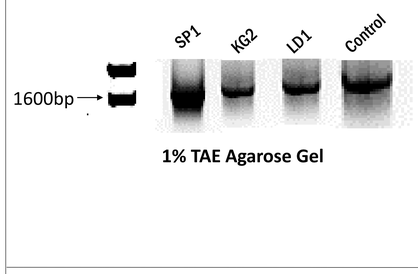
ALT and AST Levels show abnormal deviations, indicating the possibility of liver damage, in line with phenotypic observations



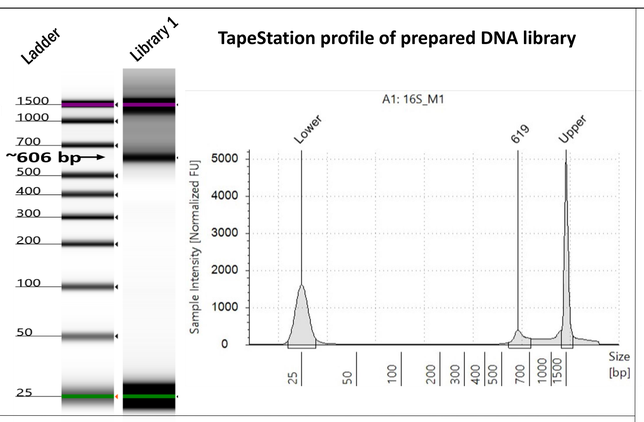
Normal ALT level for female Swiss albino mice: **49 UI/L to 70 UI/L**

Normal AST level for female Swiss albino mice: **110 UI/L to 180 UI/L**

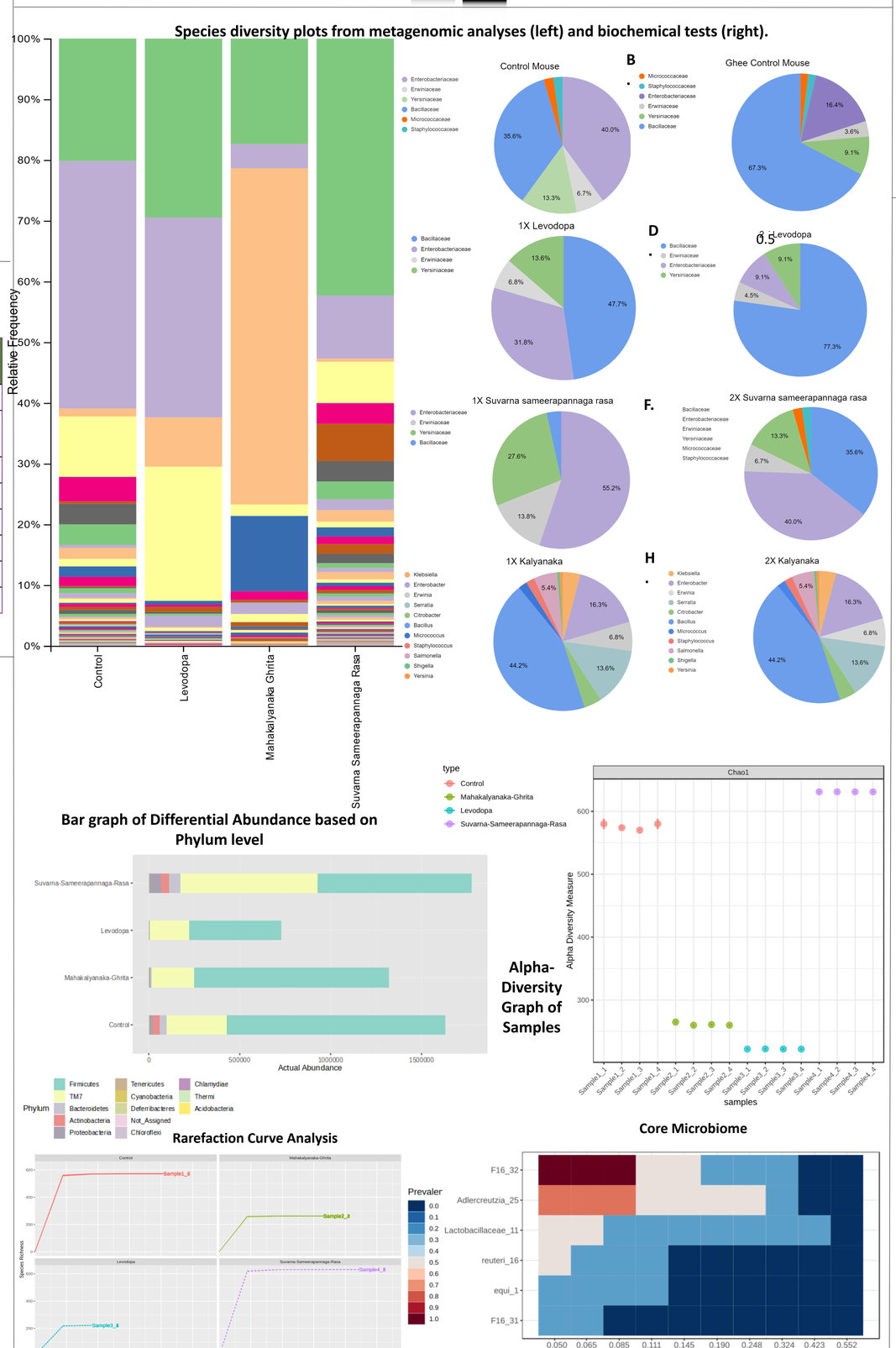
Gel image of microbial DNA amplified using VS1-VS2 primers, resolved with a *GeneDirex 1Kb ladder*



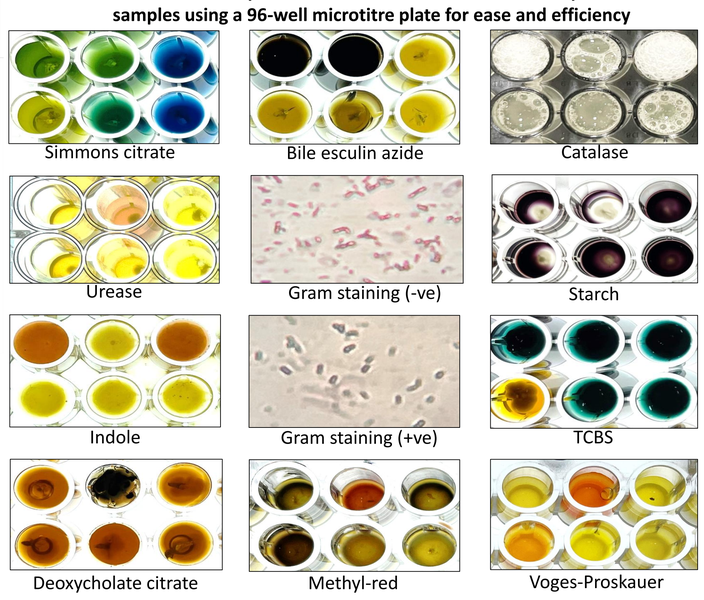
TapeStation profile of prepared DNA library



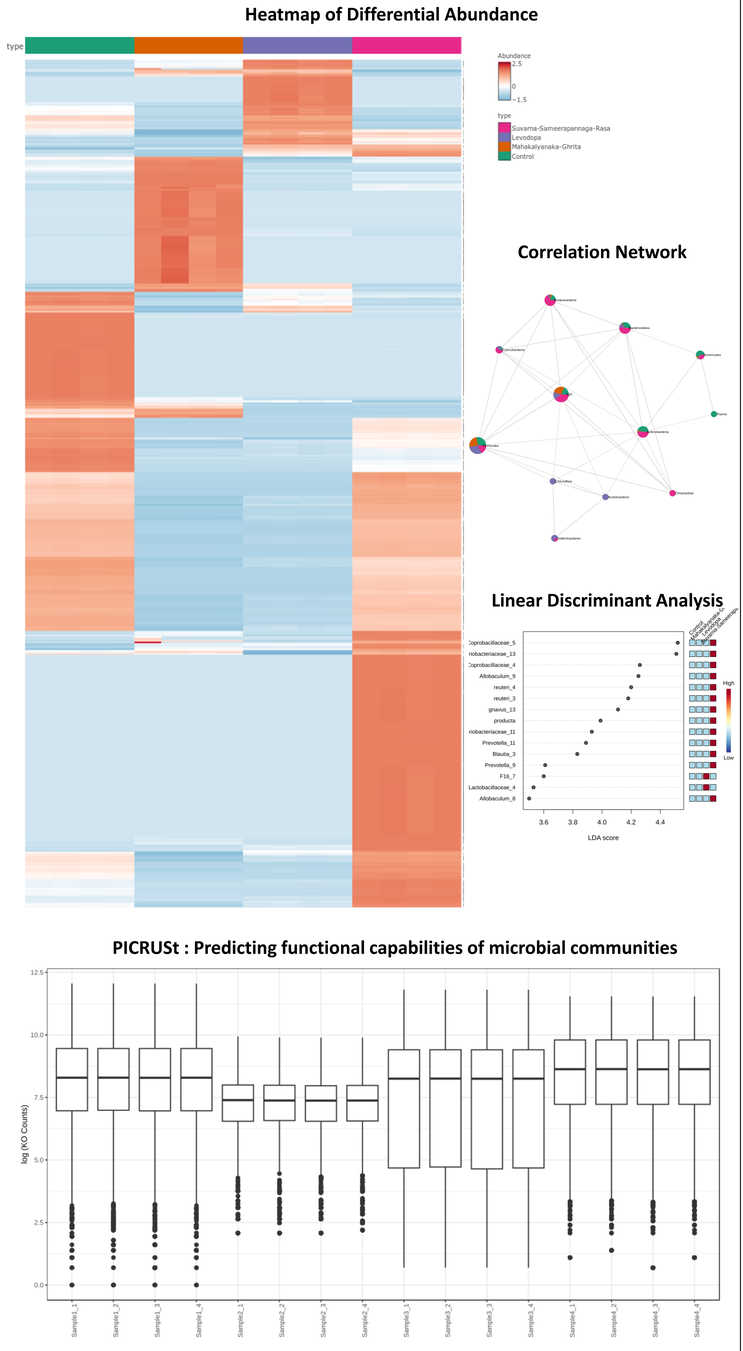
Species diversity plots from metagenomic analyses (left) and biochemical tests (right).



13 Biochemical tests were performed to characterise the bacteria present in mouse samples using a 96-well microtitre plate for ease and efficiency



Heatmap of Differential Abundance



Correlation Network

Linear Discriminant Analysis

Bar graph of Differential Abundance based on Phylum level

Alpha-Diversity Graph of Samples

Rarefaction Curve Analysis

Core Microbiome

PICRUSt : Predicting functional capabilities of microbial communities

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SUMMARY

Suvarna Sameerapannaga Rasa has shown signs of liver toxicity, but it has also retained a higher diversity of gut bacteria as compared to the other treatment groups. Relatively, it is very evident that the control and MKG groups show mutually exclusive abundances, whereas control and SSR show similar abundances. Levodopa-treated mice show an overall decrease in diversity and abundance of the microbial populations, suggesting a possible dampening effect on the gut microbial influence on the brain.

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