

# CAN ALTERING THE GUT MICROBIOME VIA DIET TREAT SYMPTOMS OF MAJOR DEPRESSIVE DISORDER?



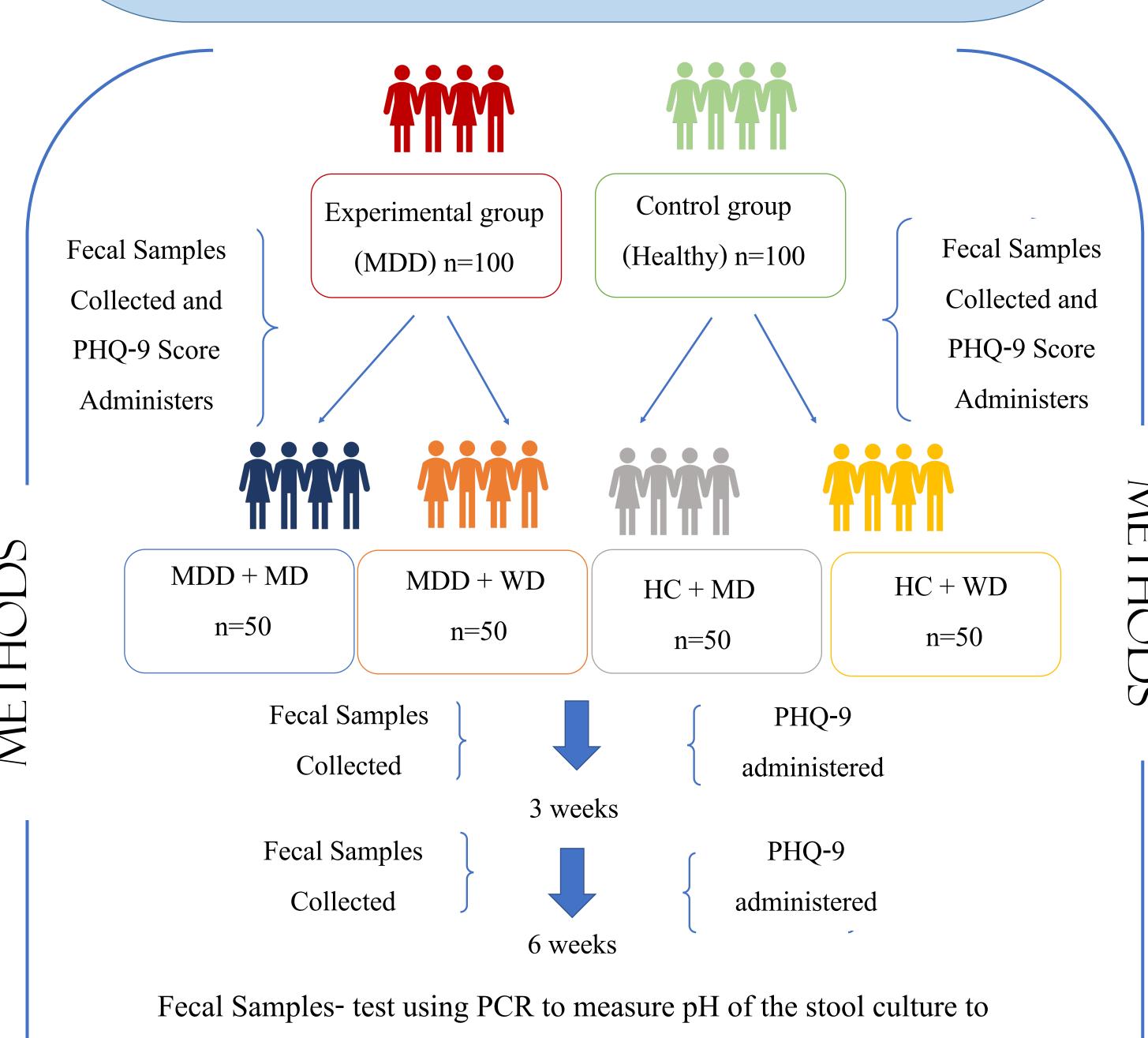
JULIA DEGROOTH
DEPARTMENT OF PSYCHOLOGY, PROVIDENCE COLLEGE

# BACKGROUND

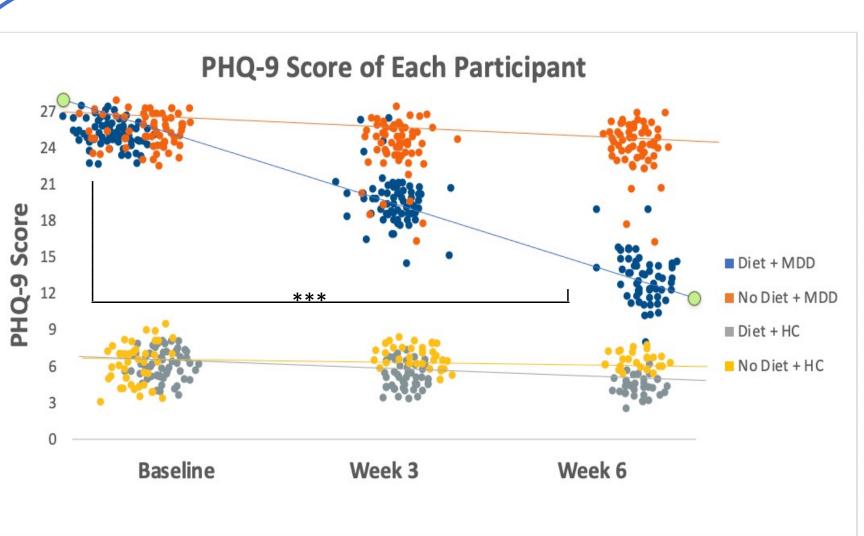
**Problem:** Worldwide, 350 million people suffer from Major Depressive Disorder (MDD), yet antidepressant medications do not work for 30 - 40 % of MDD patients.

**Objective:** Identify alternative ways to treat MDD using the gut-microbiome and Mediterranean diet (MD) and Western diet (WD). Based on previous research, if a bidirectional relationship exists between depression and the gut-microbiome, the abundance of gut bacteria will increase for Bacteroidetes, but decrease Firmicutes and Lactobacillus upon eating the MD or WD (Jiang et al., 2019).

Based on the gut-brain axis, I expect to see a more diverse microbiome when eating a Mediterranean diet than a Western diet as it improves symptoms of MDD as measured in the PHQ-9 scale.



## INFLUENCE OF GUT DIVERSITY AND DIET ON BEHAVIOR

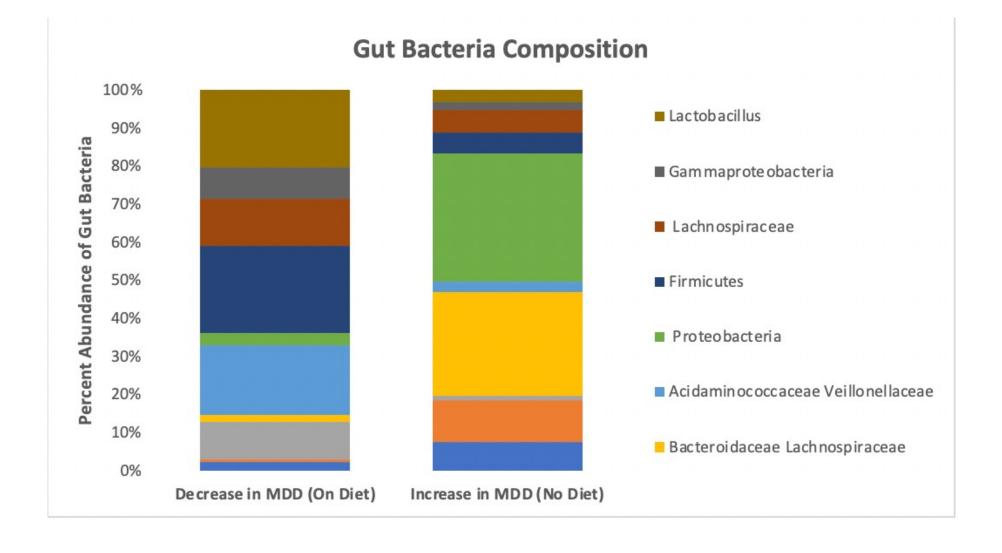


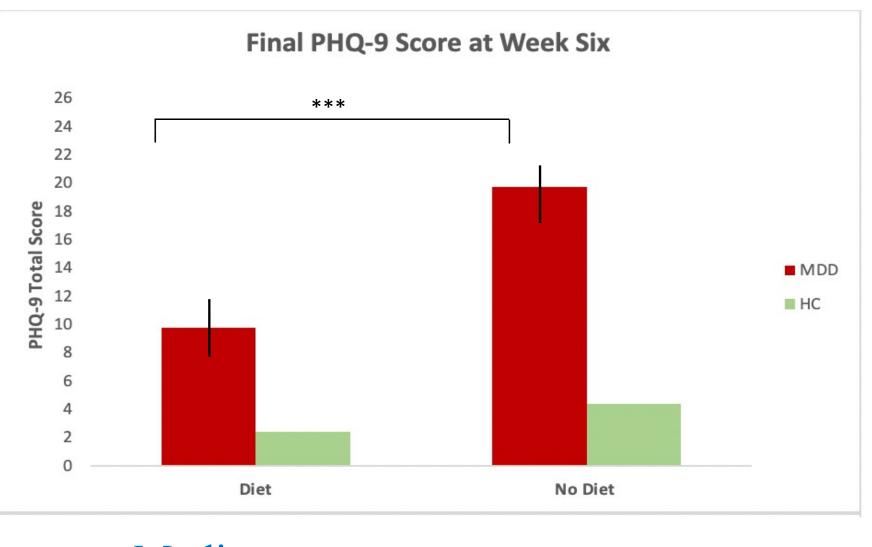
MDD patients on a Mediterranean diet showed

significant decline of depression improvements

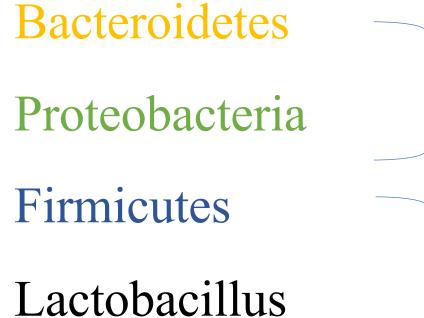
to the severity of their depression compared to

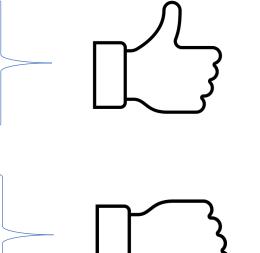
the control group.











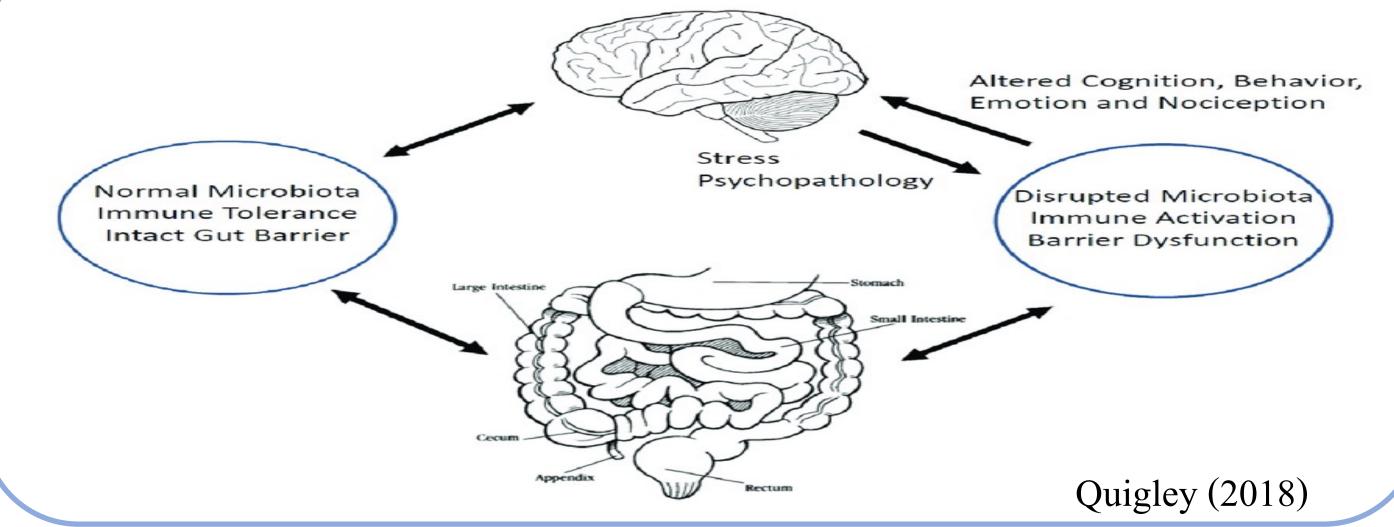
Mediterranean

Western Diet

Diet

Diet alters the gut microbiome via the brain-gut axis and improves behavior compared to the healthy and non- diet control groups.

# GUT-BRAIN AXIS



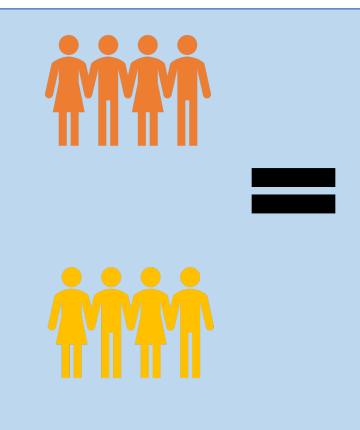
.. .. .. ..

# NULL HYPOTHESIS Final PHQ-9 Score at Week Six No change was identified between the experimental (MDD and MD) and the Control group (HC and WD) Diet No Diet

# HOW MEDITERRANEAN & WESTERN DIET AFFECTS THE BRAIN

Monday	whole-grain oats with cinnamon, dates, and maple syrup, top with low-sugar fruits, such as raspberries or blackberries	stewed zucchini, yellow squash, onion, and potato in a tomato and herb sauce	oven-roasted vegetables, such as: artichoke, carrot, zucchini, eggplant, sweet potato, tomato, toss in olive oil and heavy herbs before roasting, 1 cup of whole-grain couscous
Tuesday Wednesday Thursday	Breakfast	Lunch	Dinner
	one pan-fried egg, whole- wheat toast, grilled tomatoes	2 cups of mixed salad greens with cherry tomatoes and olives on top and a dressing of olive oil and vinegar, whole-grain pita bread, 2 ounces (oz) of hummus	whole-grain pizza with tomato sauce, grilled vegetables, and low-fat cheese as toppings
	Breakfast	Lunch	Dinner
	1 cup of Greek yogurt, half a cup of raspberries, or chopped nectarines	whole-grain sandwich with grilled vegetables, such as eggplant, zucchini, bell pepper, and onion	one portion of baked cod or salmon with garlic and black pepper to add flavor, one roasted potato with olive oil
	Breakfast	Lunch	Dinner
	1 cup of whole-grain oats with cinnamon, dates, and honey, top with low-sugar fruits, such as raspberries, 1 oz of shredded almonds	boiled white beans with spices, such as laurel, garlic, and cumin, 1 cup of arugula with an olive oil dressing and toppings of tomato, cucumber, and feta cheese	one-half of a cup of whole-grain pasta with tomato sauce, olive oil, and grilled vegetables, 1 tablespoon of Parmesan cheese
Friday Saturday	Breakfast	Lunch	Dinner
	two-egg scramble with bell peppers, onions, and tomatoes, top with 1 oz of queso fresco or one-quarter of an avocado	roasted anchovies in olive oil on whole- grain toast with a sprinkling of lemon juice, a warm salad comprising 2 cups of steamed kale and tomatoes	2 cups of steamed spinach with a sprinkling of lemon juice and herbs, one boiled artichoke with olive oil, garlic powder, and salt
	Breakfast	Lunch	Dinner
	1 cup of Greek yogurt with cinnamon and honey on top, mix in a chopped apple and shredded almonds	1 cup of quinoa with bell peppers, sun- dried tomatoes, and olives, roasted garbanzo beans with oregano and thyme, top with feta cheese crumbles or avocado	2 cups of steamed kale with tomato, cucumber, olives, lemon juice, and Parmesan cheese, a portion of grilled sardines with a slice of lemon
	Breakfast	Lunch	Dinner
Sunday	two slices of whole-grain toast with soft cheese, such as ricotta, queso fresco, or goat cheese, add chopped blueberries or figs for sweetness	2 cups of mixed greens with tomato and cucumber, a small portion of roasted chicken with a sprinkling of olive oil and lemon juice	2 cups of greens, such as arugula or spinach, with tomato, olives, and olive oil, a small portion of white fish

Previous studies indicate that diet influences the gut microbiome as a bidirectional relationship exists between the gut and brain because it regulates the HPA-axis, inflammation, produces and controls neurotransmitters, like GABA and short-chain fatty acids, and influence the immune system and gut barrier



	Breakiast	Lunch	Dinner
Monday	Cup of Honey-Nut cheerios cereal with one glass of 2 percent milk and an orange	Turkey sandwich with mayonnaise, lettuce and tomato. Served with whole wheat chips.	Serving of Pasta with shrimp and two pieces of garlic bread.
	Breakfast	Lunch	Dinner
Tuesday	Scrambled eggs with American cheese on a whole- wheat English muffin with whole milk	A 93 percent lean ground beef burger on a sesame seed bun with tomato, mayo, ketchup and lettuce. Served with a Caesar salad.	whole-grain pizza with tomato sauce with mozzarella cheese.
	Breakfast	Lunch	Dinner
Wednesday	1 cup of yogurt, half a cup of granola with a chocolate chip granola bar.	White bread sandwich with steak, onion, and cheese. Served with fries.	one portion of baked chicken with garlic and black pepper to add flavor, asparagus and white rice.
	Breakfast	Lunch	Dinner
Thursday	2 Blueberry buttermilk muffins with a glass of orange juice	Pasta salad with a glass of whole milk.	Four cheese lasagna with an Italian salad. Served with shaved parmigiana.
	Breakfast	Lunch	Dinner
Friday	Three Buttermilk pancakes with syrup and butter.	Oven BBQ chicken wings with carrots and celery. Served with ranch.	Sloppy joes with ground beef, slopping joe seasoning packet and tomato paste on a hamburger bun. Served with water and potatoes.
	Breakfast	Lunch	Dinner
Saturday	One whole wheat cinnamon roll with icing.	Serving of Turkey potpie filled with carrots, peas, potatoes.	A T-bone steak served with green beans and mashed potatoes.
	Breakfast	Lunch	Dinner
Sunday	Two Apple- raisin bran muffins	Beef Stroganoff with egg noddle's, onions, sour cream, and cheese.	Serving of chicken parmigiana with angle hair spaghetti. Served with broccoli.

# EXPECTED CONCLUSION

I expect to see that the bacterial composition in MDD is significantly more diverse after six weeks on the Mediterranean diet than the Western diet and Healthy group, indicating that diet and amount of bacteria affect MDD severity and vary as a function of diet. Specifically, an increase in the abundance of Bacteroidetes and Proteobacteria, while a decrease in levels of Lactobacillus and Firmicutes led to lower rates of depression for MDD participants. Future studies should look at a causal relationship between the gut microbiome and the brain.

identify the participants bacteria composition.

PHQ-9 Score- 9-item scale to measure presence and severity of MDD

and used as an operational definition for all participants.