Mediterranean Eating for Persons with Parkinson's Disease: An Evidence-Based Dietary Educational Intervention

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May 7, 2021

In Partial Fulfillment of the Doctor of Nursing Practice

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Abstract

Parkinson's disease requires holistic management to improve the quality of life in affected persons and prevent complications associated with other comorbidities such as cardiovascular disease. The purpose of this pilot, quasi-experimental, evidence-based improvement project was to assess if implementing a Mediterranean diet educational measure in patients 55 to 85 years of age with Parkinson's disease improves post-intervention Mediterranean Diet food intake questionnaire, and Patient Rated Outcomes for Parkinson's Disease scores compared to pre-intervention Mediterranean Diet food intake questionnaire and Patient Rated Outcomes for Parkinson's Disease scores over four weeks at a community center for Parkinson's disease. There were 11 total participants in the evidence-based dietary educational intervention. Post-intervention survey results revealed a greater adherence to Mediterranean style eating patterns and demonstrated improvements to Patient Rated Outcomes in Parkinson's Disease scores. This educational intervention aims to broaden the spectrum of evidence-based care to include the delivery of holistic dietary measures in a special patient population.

Keywords: Parkinson's disease, Mediterranean diet, cardiovascular health, self-efficacy, quality-of-life, holistic care, and gut microbiome.

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Project Significance

Parkinson's disease is a chronic, progressively-worsening neurologic disease characterized by non-motor and motor impairments that may include bradykinesia, tremors, ataxic gait, rigidity, altered speech, impaired swallowing, and mental and behavioral changes (National Institutes of Health, 2017). This disease is also associated with sleep disturbances, sexual dysfunction, constipation, depression, and fatigue and can severely impact the quality of life in affected patients (Dowding et al., 2012; Tysnes & Storstein, 2017). In addition to a considerable impact on quality-of-life, care for patients with Parkinson's disease totals $52 billion annually in the United States alone (Parkinson's Foundation, 2017).

Each year in America, nearly 60,000 people are diagnosed with Parkinson's disease, and approximately 10 million individuals live with the diagnosis worldwide (Parkinson's Foundation, 2017). The annual incidence rate is approximately 15 per 100,000, with a prevalence rate estimated to be between 100-200 per 100,000 (Tysnes & Storstein, 2017). Men are more likely than women to be diagnosed with the disease, and current incidence rates are likely to change in the near future due to evolving diagnostic criteria (Tysnes & Storstein, 2017). Additionally, those with Parkinson's disease face much higher rates of premature death due to cardiovascular and cerebrovascular disease compared to the general population (Scorza et al., 2018). Specifically, patients with Parkinson's are almost two times more likely to develop cardiovascular disease than the general population and have a 50% greater chance of mortality due to comorbidity (Downward, 2017).

Cardiovascular disease is the leading cause of death in the United States (American Heart Association, 2019). It may also lead to decreased quality of life through functional limitations and psychological distress (Thompson & Yu, 2003). The American Heart Association estimates that over 135 million adults will be diagnosed with some form of cardiovascular disease by 2035—approximately 45% of the population in the United States of America (2019). Additionally, the total cost of the disease may reach $1.1 trillion at that time, with direct medical costs potentially exceeding $748.7 billion with indirect costs reaching $368 billion (American Heart Association, 2019). Due to the increased likelihood of Parkinson's and cardiovascular disease occurring comorbidly, the need for patient-centered, holistic care and education is critical for the effective prevention and treatment of patients diagnosed (Tod et al., 2016).

Local Considerations

The local community center for persons with Parkinson's disease is a non-profit organization that offers free programs designed to address the effects of Parkinson's disease holistically, and was the site of project implementation. The center was founded in a medically underserved region with the aim of improving the quality of life in persons with Parkinson's disease. Prior to the creation of the center, patients had limited access to community support groups and modalities for holistic care— such as group exercise sessions explicitly created for those with Parkinson's disease. The site is currently based at the local shopping center for ease of accessibility by its visitors. It is used for exercise classes and other evidence-based therapies. Prior to implementing the evidence-based project, members of the community center had requested information regarding dietary recommendations. There are currently 56 members of the center.

Diversity Considerations

While more men are affected by the disease than women, every effort was made to include both sexes as equally as possible. The project leader included participants from a wide age range, between 55 and 85 years old. There was little ethnic diversity among members of the center, but every effort was made to include as many ethnically diverse members as possible.

Problem, Purpose

Parkinson's disease and cardiovascular disease can have a notable impact on patient quality of life. Swallow et al. (2016) note that over 60% of patients with recent-onset Parkinson's disease experience a medium to high cardiovascular risk simultaneously. The Mediterranean diet is a sustainable intervention that promotes overall patient health and lowers the risk of cardiac-related events (Cleveland Clinic, 2019). The purpose of implementing the Mediterranean diet educational intervention in patients aged 55 to 85 years of age with Parkinson's disease in this inquiry was to determine if the implementation of the evidence-based diet improved post-intervention Mediterranean Diet food intake questionnaire and Patient Rated Outcomes in Parkinson's Disease (PRO-PD) scores compared to pre-intervention Mediterranean Diet food intake questionnaire and PRO-PD scores over four weeks at the community center for Parkinson's disease. In this inquiry, cardiovascular health will be defined as normal fasting blood cholesterol levels (total cholesterol less than 200, high-density lipoproteins greater than 60, low-density lipoproteins less than 100, and triglycerides less than 150) and blood pressure readings (less than 130/80), as defined by the American Heart Association. The intention of this inquiry was to improve the intake of Mediterranean Diet-friendly foods and explore the diet's potential impact on quality-of-life measures and symptoms associated with Parkinson's disease through the implementation of the evidence-based diet.

Facilitators, Barriers

Project barriers included participant hesitation to complete surveys online and instead utilizing pen and paper surveys, which led to delays in final survey collection and follow-up. The COVID-19 pandemic also delayed contract approval with the project site, which shortened intervention time from the planned eight weeks to only four weeks. The pandemic also caused a decrease in community center attendance and the number of potential participants available for recruitment. The limited number of project participants ultimately affected the project's statistical outcomes and validity.

Facilitators of project implementation included the strong values for evidence-based practice adopted by the project site's founders and the evidence supporting the project's implementation. In addition to promoting cardiovascular health, the Mediterranean diet also fosters cerebrovascular, musculoskeletal, gut microbiome, and neurological health and is realistic and feasible to encourage balanced dietary practices (Kalampokini et al., 2019; Kessler, 2019). The costs associated with the project primarily involved printed materials (see budget table in Appendix A). The implementation of Mediterranean dietary education is a very sustainable practice for a relatively low cost (Cleveland Clinic, 2019). Printed materials and brief dietary counseling were provided and available for all visitors at the community center after presenting inquiry results at the center.

Inquiry

Does the implementation of a Mediterranean diet educational intervention in patients aged 55 to 85 years of age with Parkinson's disease improve post-intervention Mediterranean Diet food intake questionnaire and Patient Rated Outcomes in Parkinson's Disease (PRO-PD)

scores compared to pre-intervention Mediterranean Diet food intake questionnaire and PRO-PD scores over four weeks at a community center for Parkinson's disease?

Literature Search Strategies

PubMed, SAGE Journals, and CINAHL were utilized for literature searches, but PubMed served as the primary database for the inquiry. Google Scholar was a key search engine utilized for the inquiry as well. Keywords used in the search included Parkinson's disease, cardiovascular disease, heart-healthy diet, Mediterranean diet, gut microbiome-friendly diet, quality-of-life, holistic care, and self-efficacy (terms defined in Appendix B). With exception to landmark studies involving the Mediterranean diet, studies in English less than ten years old on non-pregnant adults were among the inclusion criteria. Exclusion criteria involved studies older than ten years, and those that were not in English did not involve non-pregnant adults or were outside of the inquiry's keywords or context (refer to Appendix C for PRISMA diagram). Utilizing the levels of evidence from Melnyk and Fineout-Overholt (2019), 17 articles were of level one evidence (largely systematic and integrative reviews), three were level two evidence (randomized controlled trials), five were level three (quasi-experimental), two were level four (cohort studies), two were level five (systematic reviews of descriptive and qualitative studies), five were level six (qualitative studies), and five were level seven evidence (expert opinion/expert committee) (Appendix D).

Synthesis of Evidence

The primary theme identified in the literature search involved the relationship between the Mediterranean diet and cardiovascular disease. Key aspects of the Mediterranean diet were

reviewed as well. Additionally, the provision of holistic care and the impact of the Mediterranean diet on patient quality of life were explored. Furthermore, the potential impact of the microbiome-friendly diet on Parkinson's symptoms related to gut microbiome modulation and the evaluation of patient outcomes were also themes investigated in the literature (Appendix E). Self-efficacy and the Patient Rated Outcomes in Parkinson's Disease (PRO-PD) scale were also themes explored during the literature search

The Mediterranean Diet: Impact on Cardiovascular Health

The dietary habits of people and cultures around the Mediterranean Sea were first recognized by American researcher Ancel Keys in 1961 when he noticed a correlation between the diet and lower rates of cardiovascular disease (Altomare et al., 2013). A cross sectional study was then done to compare multiple other countries across the globe to those near the Mediterranean (Holland, Finland, Italy, United States, Japan, Greece, and Yugoslavia) and found significantly lower blood cholesterol levels in correlation with a substantially smaller percentage of coronary heart disease in those who followed a Mediterranean-type diet, (Altomare et al., 2013).

Since 1961, the Mediterranean diet has become an evidence-based dietary intervention that has demonstrated a decreased clinical risk for cardiovascular disease and events in numerous observational studies and randomized clinical trials. In 2003, Trichopoulou et al. studied 22,043 Greek men and women and concluded that Mediterranean diet adherence resulted in significantly lower total, cardiovascular, and cancer mortality rates. In 2004, Knoops et al. noted that the diet was associated with a 23% decrease in the all-cause mortality rate after conducting an observational study on 2,339 European men and women between the ages of 70 and 90 years. Additionally, a Spanish cohort of 13,609 men and women studied by Martínez-González et al. in

2011 found a statistically significant relationship between Mediterranean diet adherence and decreased cardiovascular risk over an average of five years.

The first randomized, single-blinded clinical trial that supported the protective cardiovascular effects of the Mediterranean diet was conducted in 1994 on patients with established cardiovascular disease (de Lorgeril et al., 1994). The clinical trial included 605 post-myocardial infarction participants divided into a control (traditional post-infarction diet) and experimental group (Mediterranean diet) that was followed for an average of 27 months (de Lorgeril et al., 1994). Of the two groups, the overall mortality of the control group was 20, while the experimental group's overall mortality was eight (de Lorgeril et al., 1994). The trial was concluded early due to clinically significant results involving a 73% reduction in mortality due to coronary heart disease (Tosti et al., 2018).

A randomized trial by Estruch et al. (2018) assigned 7447 Spanish men and women at an increased risk for cardiovascular disease to one of three subtypes of the Mediterranean diet (one group supplemented their intake with extra-virgin olive oil, one group was assigned mixed nuts, and one control group was asked to follow a Mediterranean diet that reduced overall dietary fat). The participants were followed for seven years –between 2003 and 2010— and morbidity and mortality rates were analyzed during that time (Estruch et al., 2018). The results demonstrated a relative risk reduction of approximately 30% in major cardiovascular events with Mediterranean diet implementation (Estruch et al., 2018). Furthermore, the rates of major cardiac events were lower among the groups assigned supplementation with extra virgin olive oil or mixed nuts compared with the control group (Estruch et al., 2018).

A randomized clinical trial published in 2019 measured the effectiveness of Mediterranean diet implementation on blood pressure and arterial stiffness in 1142 European

participants 65-79 years of age (Jennings et al., 2019). The participants were followed for 12 months at multiple European centers and were broken into a control group (habitual diet) and experimental group (Mediterranean diet). The trial found clinically significant reductions in systolic blood pressure and arterial stiffness by the conclusion of the intervention.

Multiple systematic reviews and meta-analyses have also established a relationship between Mediterranean diet adherence and decreased risk of developing cardiovascular disease and its associated complications (Grosso et al., 2017; Martinez-Gonzalez & Martín-Calvo, 2016; Rosato et al., 2019; Tyrovolas & Panagiotakos, 2010). Utilizing meta-regression models and risk ratio calculation, Rosato et al. (2019) concluded that the Mediterranean diet is protective against cardiovascular disease— including coronary heart disease and ischemic stroke. Meta-analyses of multiple randomized controlled trials and observational studies examined the association between Mediterranean diet adherence and cardiovascular incidence and mortality. Grosso et al. (2017) determined that the average reduced risk of cardiovascular disease incidence and mortality—including coronary heart disease and ischemic stroke— was approximately 40%. In addition to concluding that the Mediterranean diet decreased cardiovascular risk, Tyrovolas and Panagiotakos (2010) also noted that the diet appeared to prevent premature mortality, prevent certain cancers, and improve the quality of life in older persons in an integrative review entailing a variety of international studies. Finally, a large integrative review by Martinez-Gonzalez and Martín-Calvo in 2016 suggests that the Mediterranean diet is the gold standard in preventive medicine.

The Mediterranean diet has also been well-accepted as an evidence-based, heart-healthy diet by the American Heart Association, World Health Association, Cleveland Clinic, Mayo Clinic, and the National Heart, Lung, and Blood Institute (American Heart Association, 2020;

Cleveland Clinic, 2019; Mayo Clinic, 2019; National Heart, Lung, and Blood Institute, 2018). It is also widely recognized for its long-term sustainability compared to other accepted diets and encouraged for the diet's support of general health (Cleveland Clinic, 2019; Harvard School of Public Health, 2018). While exact mechanisms have yet to be identified, potential factors of the Mediterranean diet that contribute to improved cardiovascular and overall health may include reduced saturated fatty acid, caloric, and amino acid intake increased phytonutrient intake, and the diet's modulation of microbiota-derived metabolites (Tosti et al., 2018). According to Tosti et al. (2018), these factors may work to lower lipids, protect against inflammation, reduce oxidative stress, affect platelet aggregation, modify cancer-associated growth factors and hormones, and modulate gut microbiota and the metabolites they produce.

Components of the Mediterranean Diet

The Cleveland Clinic (2019) describes the Mediterranean diet as a balance of plants, meats, and limited dairy. The recommendation is to consume three servings of fresh fruit and three servings of fresh vegetables daily. Additionally, legumes may be eaten three times per week, and whole grains and starchy vegetables may be consumed approximately three times per day. A daily intake of one to four tablespoons of extra virgin olive oil is also encouraged.

Meat and fish rich in omega three fatty acids is the most highly encouraged and should be consumed approximately three times per week. Skinless white meats (i.e., poultry) baked, broiled, or grilled are also recommended, but red meats (preferably lean meat) should only be consumed once weekly. Furthermore, intake of high-fat dairy and egg yolks should be limited, and baked goods and desserts should be avoided as much as possible. One glass of red wine daily is allotted on the Mediterranean diet.

The Mediterranean Diet: Impact on Quality-of-Life Measures

Parkinson's disease is often characterized by motor and non-motor impairments that may include bradykinesia, tremors, ataxic gait, rigidity, altered speech, impaired swallowing, and mental and behavioral changes (National Institutes of Health, 2017). Additional complications of the disorder that impact quality-of-life include depression, anxiety, sexual dysfunction, sleep disturbance, urinary problems, constipation, pain, and disruptions to a sense of smell, chewing, and swallowing abilities (Carteron, 2018). While no cure has been discovered for the disease, traditional management includes treatment with medications such as Carbidopa-Levodopa and may cost an average of $2,500 a year for a single patient (Parkinson's Foundation, 2017). Long-term use of the drug may also lead to secondary or "dopa-resistant" symptoms, including motor (i.e., abnormalities in posture, freezing spells, and impairment in speech) and non-motor (i.e., autonomic dysfunction and impairments in cognition and mood) signs and drug-related complications such as psychosis and dystonias that are often difficult to treat (Thanvi & Lo, 2004). The need for patient-centered, holistic care is critical for the effective treatment of patients suffering from this disease (Tod et al., 2016). Additionally, the involvement of a multidisciplinary team in patients with Parkinson's disease is essential and should include dietary considerations (Pretzer-Aboff & Prettyman, 2015).

A cross-sectional study of 16,937 Italian participants who followed the Mediterranean diet was assessed for the diet's potential impact on specific quality-of-life measures (Bonaccio et al., 2013). The participants were men and women over 35 years of age. The measures assessed included domains in physical functioning, limitations in roles related to physical health issues, general pain, perceptions about overall health, energy level, social functioning, and limitations in roles about mental health or emotional issues (Bonaccio et al., 2013). The study concluded a statistically significant correlation between Mediterranean diet adherence and an increase in

health-related quality-of-life measures (Bonaccio et al., 2013). The review completed by Tyrovolas and Panagiotakos (2010) also concluded that the Mediterranean diet demonstrated significant improvements in quality-of-life measures in the population studied.

Additionally, constipation is a primary concern affecting the quality of life in many patients with Parkinson's disease (Dowding et al., 2012; Galland, 2014; Tysnes & Storstein, 2017; Uyar & Yildiran, 2019). In addition to lowering lipid levels, the Mediterranean diet's rich water-soluble fiber content may also help relieve this common complaint (Uyar & Yildiran, 2019). In this way, the dietary intervention works to lower cardiovascular risk while simultaneously improving quality-of-life measures.

The Mediterranean Diet and Parkinson's Disease: The Gut-Brain Connection

The adult human gastrointestinal tract (or "gut microbiome") is home to trillions of bacteria that direct the immune system, modify the human epigenome, and regulate host metabolism (Galland, 2014). Researchers have also discovered that hormones and neurotransmitters, including dopamine, norepinephrine, serotonin, and gamma-amino butyrate (GABA), are manufactured in the gut by bacteria that live there (Galland, 2014). A study conducted in 1997 discovered that nearly half of circulating dopamine was created in the gastrointestinal tract after careful measurement of blood and tissue samples (Eisenhofer et al., 1997). Furthermore, recent evidence has established that the gut microbiome and brain communicate through these neurotransmitters and foster the link between the gut (or enteric nervous system) and the central nervous system— otherwise known as the gut-brain axis (Mittal et al., 2017). New research is underway to understand Parkinson's disease and the contribution of the gut microbiome to pathophysiological effects within the gut-brain axis (Kalampokini et al., 2019; Mittal et al., 2017).

Dopamine is a central-acting catecholamine that is the most recognized neurotransmitter associated with Parkinson's disease (Mittal et al., 2017). Dopamine is a major catecholamine associated with gut homeostasis with receptors in the gastrointestinal tract located in the intestinal wall's mucosal and nerve ending layers (Mittal et al., 2017). Due to the extensive involvement of dopamine and other neurotransmitters in many physiologic processes, disruptions in appropriate levels or activities are associated with many diseases (Mittal et al., 2017). Gastrointestinal dysfunction is a key feature of Parkinson's disease and is recognized as the most prevalent autonomic disorder of the condition (Dowding et al., 2012; Galland, 2014; Mittal et al., 2017; Tysnes & Storstein, 2017; Uyar & Yildiran, 2019). Dopamine levels are decreased in the ascending colon of these patients, and dopaminergic myenteric neurons are found to be significantly fewer in number compared to control subjects as well (Mittal et al., 2017).

The gastrointestinal microbiome of patients with Parkinson's disease is significantly different than the microbiota of healthy members of the general population (Aho et al., 2019). Multiple studies have also concluded that specific microbiota may be identified as significantly over-or under-represented in the microbial composition of patients with the disease (Bedarf et al., 2019; Gorecki et al., 2019; Li et al., 2019). Research suggests that the enteric nervous system and central nervous system share a bi-directional relationship, meaning that changes to one system can potentially affect the other (Mittal et al., 2017). That gut microbiota are significant participants in the communication between the gut and brain that modulate the symptoms of Parkinson's disease (Felice et al., 2016).

Increasing evidence in preliminary human studies are beginning to show that gut microbiome-based interventions can alter neurotransmitter levels and impact host physiology (Felice et al., 2016; Jackson et al., 2019; Kalampokini et al., 2019; Singh et al., 2017; Strandwitz,

2018; Uyar & Yildiran, 2019). Kwon (2018) discussed evidence supporting the microbiome-related origins of Parkinson's disease and Santos et al. (2019) also addressed evidence regarding the protective or causative nature of gut microbiome health the development of Parkinson's disease later in life. Dutta et al. (2019), Jackson et al. (2019), and Alcalay et al. (2012) went further to discuss how certain foods and diets are considered protective against Parkinson's while other foods are becoming established as those that may contribute to it, or worsen symptoms. Research has demonstrated that an acute diet change alters microbial composition within 24 hours of induction and reverses almost as quickly— within 48 hours of discontinuation (Singh et al., 2017). Hegelmaier et al. (2020) demonstrated that dietary interventions and bowel cleansing with routine enemas improved Unified Parkinson's Disease Rating Scale (UPDRS) scores and reduced levodopa-equivalent daily dosing in patients. This intervention significantly improved the state of their gastrointestinal microbiota— including after a one-year follow-up.

Disruptive factors may include diet type, circadian rhythm disruption, and systemic stress and inflammation (Gubert et al., 2020; Singh et al., 2017). There have also been specific chemicals and compounds labeled as harmful to the healthy gut microbiome, including ammonia (Galland, 2014), diets high in animal protein, and low fiber levels (Singh et al., 2017). Canned foods, caffeinated and non-caffeinated sodas, fried foods, ice cream, yogurt, cheese, and iron supplementation have also been suggested to worsen the symptoms of Parkinson's disease (Dutta et al., 2019).

There are many evidence-based foods available that promote a healthy gut biome, reduce chronic inflammation, and perhaps most importantly for Parkinson's patients— the potential for increased dopamine, which is known to be produced by certain gut bacteria *Escherichia* and *Bacillus* species (Galland, 2014). Plant-based proteins (compared to animal proteins) have been

shown to increase beneficial bacteria while simultaneously decreasing different pathogenic microbes (Singh et al., 2017). Pea protein specifically promotes anti-inflammatory properties of the gut, which are essential for the integrity of the intestinal mucosal barrier (Singh et al., 2017). Diets high in saturated fats have demonstrated a decrease in ideal gut microbiota and an increase in inflammation. In contrast, diets high in unsaturated fats have manifested the opposite effect on the gut microbiome and inflammation (Singh et al., 2017). Dutta et al. (2019) name fresh vegetables and fruits, nuts, seeds, herbs, non-fried fish, olive and coconut oils, spices, polyphenols, and vitamin E foods that are protective against Parkinson's disease and as foods that also slow its progression.

Systematic and integrative reviews of microbiome-friendly diets recommend the Mediterranean diet as the most balanced diet that also improved the gut microbiome (Jackson et al., 2019; Kalampokini et al., 2019; Singh et al., 2017; Uyar & Yildiran, 2019). In addition to microbiome health, the Mediterranean diet also promotes cardiovascular, cerebrovascular, musculoskeletal, and neurological health (Kessler, 2019). Prebiotics, probiotics, and synbiotics are also being studied for clinical effect on the microbiome in patients with Parkinson's disease (Borzabadi et al., 2018). Still, specific strains and combinations of microbiota remain under intense study (Gazerani, 2019).

Evidence Discussion

Parkinson's disease requires holistic management to improve the quality of life in affected persons and prevent complications associated with other comorbidities such as cardiovascular disease (Pretzer-Aboff & Prettyman, 2015; Tod et al., 2016). The Mediterranean diet has demonstrated in many studies to reduce the risk of cardiovascular disease and improve the quality-of-life in persons to adhere to it (de Lorgeril et al., 1994; Estruch et al., 2018; Grosso

et al., 2017; Jennings et al., 2019; Martínez-González et al., 2011; Rosato et al., 2019; Tyrovolas & Panagiotakos, 2010). The diet emphasizes a daily intake of fresh fruit and vegetables, legumes, whole grains, olive oil, nuts, fish, and white meats (Cleveland Clinic, 2019). Furthermore, the Mediterranean diet has the potential to improve the symptoms associated with Parkinson's disease through gut microbiome modulation (Felice et al., 2016; Jackson et al., 2019; Kalampokini et al., 2019; Singh et al., 2017; Strandwitz, 2018; Uyar & Yildiran, 2019). The diet is well-accepted as an evidence-based diet and is recognized as the "gold standard" of preventive medicine in past research (American Heart Association, 2020; Cleveland Clinic, 2019; Martinez-Gonzalez & Martín-Calvo, 2016; Mayo Clinic, 2019; National Heart, Lung, and Blood Institute, 2018).

Evidence Strength, Limitations, and Gaps

The evidence supporting the inquiry spans from level one to level seven per Melnyk and Fineout-Overholt's levels of evidence (2019). Many systematic and integrative reviews support the inquiry, and the Mediterranean diet has been widely accepted as heart-healthy, well-balanced, and encouraged for general health (American Heart Association, 2020; Cleveland Clinic, 2019; Mayo Clinic, 2019; National Heart, Lung, and Blood Institute, 2018). Limitations to the evidence-primarily entail the older dates of many studies supporting the Mediterranean diet (i.e., older than ten years). For this inquiry, several were mentioned, but many more remain available through numerous search engines and databases. A prominent gap in evidence lies within symptom measurement after Mediterranean diet implementation in persons with Parkinson's disease.

Self-Efficacy and the Transtheoretical Model

Self-efficacy involves the confidence in one's ability to influence factors that affect daily life. In patients with Parkinson's disease, it encourages them to take a proactive role in managing their symptoms and disease (Cook, 2017). For this evidence-based project, participants were confident in implementing the Mediterranean diet. In similar studies, the self-efficacy theory has been used to predict outcomes with Mediterranean diet adherence. A 2018 study conducted by Greiner et al. discussed how self-efficacy was a direct predictor of dietary quality and outcomes in 337 cardiac patients. Furthermore, a different study created a Self-Efficacy Scale for Adherence to the Mediterranean Diet (SESAMeD) due to its integral role in diet adherence in 348 patients with established cardiovascular disease (Cuadrado et al., 2018). The researchers described the instrument as a helpful tool to assess users' confidence in implementing the appropriate dietary changes (Cuadrado et al., 2018).

The Transtheoretical Model (TTM) and its Stages of Change (Appendix F) demonstrates the process of implementing health-related changes (McEwen & Wills, 2019). Participants in the educational intervention had to utilize self-efficacy to pass through several stages of the TTM to implement the appropriate evidence-based changes. Initially, the participants were likely unaware of the need for evidence-based dietary education (i.e., the pre-contemplation stage) and required education to progress to the contemplation stage, where they began to weigh the risks and benefits and discuss the possibility of change (McEwen & Wills, 2019). Next, the participants advanced to the preparation stage, where they began to plan and prepare for the intervention if they chose to participate (McEwen & Wills, 2019). Finally, the participants progressed through the action and maintenance stages of the model if they implemented the evidence-based dietary changes and chose to continue the Mediterranean diet after the educational intervention (McEwen & Wills, 2019). Should the community center decide to

continue the dietary education after project completion, the Mediterranean diet is notably sustainable and promotes overall patient health while lowering the risk of cardiac-related events (Cleveland Clinic, 2019). For more information, please see the Logic Model (Appendix G).

Methods

Institutional Review Board Approval

The community center for Parkinson's disease did not have an institutional review board (IRB). Therefore, approval through the University of Missouri- Kansas City IRB was sought. The dietary educational intervention was classified and approved as category three exempt research (Appendix H). Faculty approval of the project occurred in July 2020 (Appendix H).

Ethical Considerations

A project information letter (Appendix H) approved by the UMKC IRB was distributed to all participants prior to the educational intervention. Participant privacy and confidentiality were ensured throughout the inquiry by coding surveys to protect the health and contact information from those outside of direct project involvement. The participants for the project consisted of a cohort of persons with Parkinson's disease who attend classes and activities at the community center and likely impacted the availability of sample diversity due to geographic location and a commonly shared participant culture. The lack of cultural diversity and specific inclusion criteria (i.e., English-speaking patients only) may have created a bias in the project that will need to be overcome in future inquiries. Implementing the Mediterranean diet in the desired patient population carried a low risk while simultaneously posing the possibility of great benefit. No known project leader conflicts of interest, and no funding was sought for the project.

Participants and Sampling

Inclusion criteria consisted of a medical diagnosis of Parkinson's disease and non-pregnant, English-speaking participants between 55 and 85 years of age. Exclusion criteria included children and those outside of the age range, those who are pregnant, those who do not speak English (due to availability of project written materials and translator access at this time), and those who had not been medically diagnosed with Parkinson's disease. Convenience and voluntary response sampling were utilized to select willing participants who met inclusion criteria from the intended project site due to the availability of qualified participants who frequently met in one pre-determined location. Of the 56 members at the community center, 11 participated in the educational intervention.

Definition: Evidence-Based Practice Intervention

The evidence-based educational intervention aimed to improve the Mediterranean Diet food intake questionnaire and PRO-PD scores. The intervention consisted of the project team leader presenting education regarding the significance and impact of cardiovascular disease on persons with Parkinson's and providing information regarding the evidence-based benefits of Mediterranean diet adherence. Participants also received written materials about the Mediterranean diet and were provided resources for shopping and beginning the diet successfully. Mediterranean Diet food intake questionnaire and PRO-PD scores were collected from participants prior to the educational intervention and again after four weeks to assess project outcomes (see Appendix I for original project timeline).

Intervention Protocol

Participants at the community center for Parkinson's disease were invited to participate in the evidence-based educational intervention beginning in December 2020 via announcements made by the organization's leadership and fliers posted throughout the center. Participants were

asked to sign up for the intervention by January 25, 2021 (see Appendix J for flow chart). In January, baseline information was collected- Mediterranean Diet food intake questionnaire and PRO-PD scores (see Appendix K for measurement tools). During the last week of January 2021, the project team leader met with participants to perform the evidence-based educational intervention and explain its potential pertinence to their overall health. Written materials were also provided to patients regarding the details of the diet and resources to assist with shopping for foods that meet the dietary requirements. Written materials for the Mediterranean diet were developed in July 2020 with guidelines from the United States Department of Agriculture, the American Heart Association, and the Mayo and Cleveland Clinics. A registered dietician was also consulted during material development and provided insight into shopping tips and recipes that could effectively assist participants with beginning the dietary intervention.

The participants attended the educational intervention online or in-person on January 29, 2021. The project leader followed up with the participants weekly at the community center to answer questions, troubleshoot potential problems, provide encouragement, and assess participant progress. Mediterranean Diet food intake questionnaire and PRO-PD scores were obtained once more at the end of four weeks. The intervention was completed during the week of March 22, 2020. After the final follow-up, the Mediterranean Diet food intake questionnaire and PRO-PD scores were analyzed and compared to baseline data. Of the 11 participants who completed the initial survey, 10 participants attended the intervention, and eight completed the follow-up surveys in their entirety. One participant did not complete the follow-up survey and another participant did not complete either survey in their entirety (or enough to allow for adequate statistical analysis and comparison).

Evidence-Based Practice Model and Organizational Change Process

The Stetler Model of Evidence-Based Practice allows for organizational and individual practice changes (Gawlinski & Rutledge, 2008). The stages of the model include preparing, validating, comparing results, making decisions, translating, applying, and evaluating changes (Gawlinski & Rutledge, 2008). In the preparation stage, the evidence for the dietary education was collected and evaluated to determine the need for the educational intervention, and the outcome measurements were established. During the validation phase, the evidence collected during intervention implementation was then synthesized and appraised for clinical and statistical significance. During the comparative evaluation phase of the Stetler Model, the findings of the educational intervention were assessed for usefulness and applicability in future clinical practice. The application of the intervention to future clinical practice was then appraised in the translation phase of the model. Finally, evaluation of the educational intervention and its future implementation may entail a cost-benefit analysis or other considerations that arise during the inquiry period.

The Stage Theory of Organizational Change involves four primary stages that organizations must undergo as they implement new approaches, as Glanz et al. (2008) described. Initially, the organization must be aware of a problem and explore potential solutions such as the inquiry at hand. Second, the organization must adopt the inquiry as a possible solution to the previously identified problem by allowing the inquiry to be implemented. Next, the organization modifies the inquiry or conflicting variables to accommodate if the inquiry had positive findings and if appropriate. Finally, the organization officially "institutionalizes" the inquiry as a routine part of a daily policy or activity (i.e., continue to provide or distribute materials regarding dietary changes).

Study Design

The inquiry utilized a quasi-experimental design. The study design was selected because quasi-experimental designs do not require randomization, include cohort study groups, and are meant to improve patient outcomes (Toulany et al., 2013). For the inquiry, one cohort was used with outcome evaluation through a Mediterranean Diet food intake questionnaire and PRO-PD scores before implementing the dietary intervention and again after four weeks—at the conclusion of the project.

Validity

The inquiry's participant population was specific to those with Parkinson's disease but would apply to similar community centers and patients living with the diagnosis in primary care settings. To improve external validity, great efforts were made by the project leader to recruit a variety of participants from different genders and ethnicities. The dietary educational intervention and printed materials are uncomplicated to reproduce and distribute at the community center long after the intervention and the evidence-based materials would also be pertinent and applicable to circulate within primary care settings. To ensure internal validity, the outcomes were measured on only one group consisting of the most diverse population possible in the given setting. Only two sets of Mediterranean Diet food intake questionnaire and Patient Rated Outcomes in Parkinson's Disease (PRO-PD) scores will be collected to minimize testing effects. Weekly follow-ups were intended to address concerns early—before participants dropped out of the project due to them. While 28 participants were needed, the 11 total project participants were not enough to achieve adequate statistical power, which was calculated using G-power.

Outcomes

The project's primary outcome was to improve self-rated Mediterranean Diet adherence in the participants involved in the evidence-based project. This outcome was measured through Mediterranean Diet food intake questionnaire ratings of participants obtained at baseline pre-intervention and again four weeks after the educational intervention. A secondary outcome of the project intended to assess the symptoms of Parkinson's disease and quality-of-life measures in participants at baseline and again at post-intervention follow-up. The PRO-PD scale assessed symptoms and quality-of-life measures. The outcomes measured four weeks after the educational intervention were compared to the same baseline measures obtained prior to the intervention for analysis of the effect of the project's implementation (refer to an example of the data collection table Appendix L). Demographic data collected entailed age. Gender and ethnicity were left out to maintain participant confidentiality, as very few participants were not Caucasian males.

Measurement Instruments

The instruments for data collection included a Mediterranean Diet food intake questionnaire and the PRO-PD tool for symptom and quality-of-life measures. Mediterranean Diet food intake questionnaires have demonstrated accuracy and reliability in past research as predictors of Mediterranean Diet adherence (Papadaki et al., 2018). The Patient Rated Outcomes in Parkinson's Disease (PRO-PD) measure has been more recently developed and allows patients to self-rate the severity of both motor and non-motor symptoms associated with Parkinson's disease that impacts their quality of life (Mischley et al., 2017). The PRO-PD has demonstrated reasonable validity and reliability since its recent development; however, further testing of the tool will be required in the future to further establish the measure as both valid and reliable

(Mischley et al., 2017). The tool was selected for its patient-centered focus on symptoms and quality-of-life measures specific to Parkinson's disease. No permission was needed for the use of either tool— the creators of the PRO-PD only requested that they be cited appropriately (Mischley et al., 2017). The project participants unanimously elected to complete the food intake questionnaire and PRO-PD with pencils and paper and return them either by pre-stamped and addressed envelopes or via the community center's return box.

Quality of Data

The power analysis utilized for the project was made possible by G-Power. With an effect size of 0.5, an alpha of 0.05, and a power of 0.8, the sample size calculated for means with a difference from one constant sample case was 27. The actual sample size was 11. The measures of change included survey results from the Mediterranean Diet food intake questionnaire and PRO-PD questionnaire collected before the intervention and again four weeks after the intervention. Of the 11 total participants, eight surveys were completed before and after the intervention and used for analysis. A comprehensive review regarding the benefits of the Mediterranean diet published in 2016 by Martinez-Gonzalez and Martín-Calvo found statistical reductions in disability and improved quality-of-life measures in those who adhered to the diet.

Analysis

Descriptive statistics were used to analyze the demographic data obtained. Due to the small sample size, descriptive statistics including mean, median, mode, and frequency were analyzed through SPSS for the PRO-PD and food intake questionnaire results (Appendix M). The small sample size did not allow the project results to achieve adequate statistical power.

Results

Setting and Participants

The project took place over four weeks at the community center for persons with Parkinson's disease. Of the 11 total participants and eight participants completed both pre-intervention and post-intervention surveys in their entirety. The ages of the participants ranged from 55-85 years, with most participants between 66 and 75 years of age. Of the 11 total participants, 27% were female, and the rest were male. All participants were of Caucasian ethnicity.

Intervention Course, Actual

After receiving the contract and final institutional review board approval in November 2020, recruitment for the project began at the community center in December 2020 and continued into January of 2021. Potential participants interested in the project were asked to take home a packet that contained the IRB-approved project information letter and the initial survey. The participants were asked to complete the survey and return it by mail via the pre-stamped and addressed envelope included in the packet or in-person via the designated return area at the community center prior to January 29, 2021. The intervention took place on January 29, 2021, and eight participants attended in person while two participants watched the recorded session online.

The project leader followed up with the participants weekly at the community center to answer questions, troubleshoot potential problems, provide encouragement, and assess participant progress. Mediterranean Diet food intake questionnaire and PRO-PD scores were obtained once more at the end of four weeks. The intervention was completed during the week of March 22, 2020. After the final follow-up, the Mediterranean Diet food intake questionnaire and PRO-PD scores were analyzed and compared to baseline data. Of the 11 participants who completed the initial survey, 10 participants attended the intervention, and eight completed the

follow-up surveys in their entirety. One participant did not complete the follow-up survey, and another participant did not complete either survey in their entirety (or enough to allow for adequate statistical analysis and comparison).

Mediterranean Diet Food Intake Questionnaire: Outcome Data

While the educational intervention and food intake questionnaire included various foods, the primary food categories discussed were vegetables, fish, extra virgin olive oil, and red meat (Appendix N). Utilizing SPSS and a sample size of eight participants, the average daily intake of vegetables increased from 1.9 daily servings pre-intervention to 2.5 daily servings post-intervention. The daily intake of extra virgin olive oil increased from 1.1 tablespoons per day pre-intervention to 1.3 tablespoons per day post-intervention. Weekly servings of fish increased from 1.8 servings pre-intervention to 2.3 servings post-intervention. Finally, participants' average red meat intake decreased from 2.8 servings weekly to 2.5 servings.

Patient Rated Outcomes in Parkinson's Disease: Outcome Data

The PRO-PD survey consisted of 35 components— including constipation, depression, anxiety, cognition, fatigue, muscle pain, and motivation. The higher the score, the more severe the participant rated the symptom. The individual symptom scores could be totaled at the end of the survey for an overall score of symptom severity impacting participant quality-of-life. The average of the PRO-PD scores (n=8) pre-intervention was 107.6 with a standard deviation of 50.7. The average of the PRO-PD scores (n=8) post-intervention was 96.8 with a standard deviation of 44.7 (Appendix N). The highest overall PRO-PD score before the intervention was 171 compared to 167 after the intervention. Individual symptom scores (i.e., constipation, depression, anxiety, etc.) could also be analyzed statistically. Still, entry for this analysis through

SPSS would require time and labor that would remain statistically insignificant due to the small sample size. By final analysis, three of the initial surveys could not be used.

Discussion

Successes

The project's statistical analysis revealed improvements to Mediterranean dietary adherence post-intervention compared to pre-intervention. Additionally, PRO-PD scores demonstrated a reduction in patient-rated severity of their symptoms post-intervention compared to pre-intervention. The project met a need that members had previously requested of the community center for holistic, evidence-based dietary education.

Project Strengths

Setting strengths for project implementation included the strong values for evidence-based practice adopted by the project site's founders. Community members within the project setting were individuals who voluntarily committed their time to participate in evidence-based exercise and therapy classes for their diagnosis of Parkinson's disease. Therefore self-efficacy had already been well-adopted by many of them. The community center's technical communications coordinator assisted the project leader with attaining presentation equipment and its set-up at no cost— this included an overhead projector for the presentation and a camera recording for participants attending from home.

Despite initial project delays due to contract negotiations, project recruitment and implementation occurred with minimal disruption. Most participants attended the educational intervention in person (utilizing appropriate COVID-19 precautions set forth by the Centers for Disease Control and Prevention). Those who attended online commented that the video was

readily accessible and easy to watch. Participants utilized the availability of the project leader in the weeks following the intervention to ask for additional information and resources regarding dietary education. Most participants completed the project in its entirety.

Results Compared to Evidence in the Literature

A comprehensive review regarding the benefits of the Mediterranean diet published in 2016 by Martinez-Gonzalez and Martín-Calvo found statistical reductions in disability and improved quality-of-life measures in those who adhered to the diet. The findings of the project support the results of that review. In this dietary educational intervention, statistical analysis suggested that increased adherence to Mediterranean dietary eating patterns improved patient symptoms associated with quality-of-life measures.

Limitations

Internal Validity Effects

The project was initially intended to take place over eight weeks. Due to numerous factors associated with the COVID-19 pandemic and resulting delays, the project length had to be shortened to four weeks between the intervention and follow-up. This shortened length may have impacted the validity of the results regarding the implementation of a dietary eating pattern in the long term.

Participant hesitation to complete online surveys with a preference toward pen and paper surveys may have also impacted the internal validity. Participants were provided with paper surveys and a written request for a date to return the surveys. Several participants did not complete the follow-up surveys for one to two weeks after the requested deadline of Wednesday, March 10, 2021. While the intervention lasted four weeks for some participants, it may have potentially lasted for as long as six weeks for others before follow-up outcomes were assessed.

External Validity Effects

The cohort group consisted of members from the community center for Parkinson's Disease. Prior to the project, this group demonstrated the project's theoretical framework of self-efficacy by adopting proactive roles in managing their health and their diagnosis of Parkinson's disease through voluntary participation in exercise classes and evidence-based therapies available at the community center. While this attribute may be a common value among other members of similar community centers, persons diagnosed with Parkinson's disease may not share this value for evidence-based therapy in the family practice or clinical setting.

Utilizing G-Power analysis, 28 participants were needed for adequate statistical power of the project. Unfortunately, the 11 total project participants were insufficient to achieve adequate statistical power. While diversity among the participants was sought, the lack of diversity may have impacted external validity for other centers. Some females participated in the study, but the participants were predominately men. There was no ethnic diversity among participants in the study, as all participants were of Caucasian descent.

Sustainability of Effects and Plans to Maintain Effects

After project implementation, written materials (Appendix O) were placed in the educational area of the community center alongside information provided by the Parkinson's Foundation, the Michael J. Fox Foundation, etc. They will be free for interested participants to take with them. While written materials were provided in addition to the in-person or online education, the written materials distributed alone may not offer the same effective engagement as the project educational session. To maintain the project's strength, the online recorded session was intended to be made readily available to inquiring members of the center.

Efforts to Minimize the Study Limitations

Every effort was made to eliminate threats to project validity. Participant recruitment began nearly two months prior to the intervention, but the COVID-19 pandemic substantially impacted the community center's attendance and the availability of potential participants. The small sample size did not allow the project to reach adequate statistical power. Participant diversity was sought by the project leader, as well as the inclusion of community center members from different genders and ethnicities.

The project leader made an effort to preserve project length, but circumstances surrounding the COVID-19 pandemic and associated complications did not allow for the original eight-week intervention that had been planned initially. The project leader also provided clear verbal and written instructions regarding the requested return date for the survey by March 10, 2021. Participants who did not follow these instructions prolonged their project length for an extra one to two weeks, facilitating inconsistency within the planned and designated four-week project timeline.

Interpretation

Expected and Actual Outcomes

The statistical outcomes of the project were expected. After the dietary educational intervention, participants reported improved Mediterranean diet adherence in key areas—including vegetable, fish, olive oil, and red meat intake. The PRO-PD scores reported by participants demonstrated reductions in participant-rated symptom severity.

The outcomes of the project were affected by unforeseen problems. Of approximately 56 members of the community center for persons with Parkinson's Disease, only a fraction of members were available and only 11 members participated in the project due to lower attendance

during the COVID-19 pandemic. The small sample size and the shortened project length were unplanned barriers that affected the outcomes of the project.

Intervention Effectiveness

While statistically underpowered, the positive project findings were likely due in part to the cultural attitude among the community center members to seek and implement evidence-based therapies in their daily lives. Additionally, the project leader's weekly, in-person follow-up with participants may have facilitated participant adherence to the dietary education. Finally, assistance from the community center and the project preceptor with the dietary educational intervention enabled the project to be shared both in-person and online for project participants to attend. While the cohort participant group at the community center may be unique in many aspects, evidence-based dietary education would also be appropriate to implement in primary care settings and other similar community centers.

Intervention Revision

An intervention modification that may improve project outcomes might entail a greater availability of resources to participants, a list of recipes or a meal plan, and providing participants access to a registered dietician at a local grocery store (such as dieticians at Natural Grocers or HyVee) may improve the participant's experience and improved dietary adherence.

Expected and Actual Impact to Health System, Costs, and Policy

There is no measurable impact of the dietary educational intervention on the healthcare system or policy at the current time. Still, dietary changes that reduce constipation, anxiety, depression, and other commonly medicated symptoms would reduce healthcare costs.

The project's cost included the $25 cost of printing and an additional $20 for report covers to enclose the educational materials. The report covers were optional and selected by the

project leader to facilitate accessibility to the printed materials. With the $25 cost of printed materials, dietary education is easily sustainable from a financial standpoint. There were no sources of funding for the evidence-based dietary educational intervention.

Conclusion

Parkinson's disease is a complex, multi-faceted diagnosis that can substantially impair the function and quality of life in patients affected by it. Additionally, those with Parkinson's disease are at a considerably increased risk for cardiovascular disease and its associated complications. The Mediterranean diet is an evidence-based intervention for preventing cardiovascular disease and its complications; the American Heart Association, World Health Association, Cleveland Clinic, Mayo Clinic, and the National Heart, Lung, and Blood Institute recommend it. (American Heart Association, 2020; Cleveland Clinic, 2019; Mayo Clinic, 2019; National Heart, Lung, and Blood Institute, 2018). The diet is supported by numerous randomized clinical trials and systematic reviews. This inquiry intended to improve Mediterranean Diet adherence in persons with Parkinson's disease and to explore the diet's potential impact on quality-of-life measures (through PRO-PD assessment) associated with Parkinson's disease through improved adherence to the diet. Additionally, the dietary educational intervention can improve participant quality-of-life measures and symptoms affected by gastrointestinal microbiome modulation.

Future outcome studies of the evidence-based practice intervention should entail a larger sample size for statistical significance. Implementation of the evidence-based dietary education should also be directly evaluated in a primary care setting for those diagnosed with Parkinson's disease. In future studies, examination of symptoms affected by gastrointestinal microbiome modulation through Mediterranean diet adherence would be warranted.

Results of the inquiry were disseminated through the Midwest Nursing Research Society's annual conference in March 2021. The project will be submitted to the American Journal of Nurse Practitioners for publication and presented at the University of Missouri-Kansas City in May 2021. Ultimately, this evidence-based project aims to broaden the spectrum of holistic, evidence-based care delivered to those with Parkinson's disease.

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Uyar, G. Ö., & Yildiran, H. (2019). A nutritional approach to microbiota in Parkinson's disease. *Bioscience of Microbiota, Food and Health*, *38*(4), 115–127. https://doi.org/10.12938/bmfh.19-002

Appendix A

Budget Table

ITEM	ITEM DESCRIPTION	QUANTITY	UNIT COST	ANTICIPATED COST
PRINT MATERIALS	-Basic information about MD and a list of foods to eat and avoid. -Grocery shopping tips. -Survey materials	360 sheets	$0.07	$25.20
EQUIPMENT	-REDCap	1	$0	$0
	-SPSS	1	$0	$0
STUDENT TIME	165 clinical project hours	165 hours	$0	$0
TOTAL				$25.20

Appendix B

Definition of Terms

Parkinson's disease- A chronic, progressive neurologic disease characterized by motor and non-motor impairments that may include bradykinesia, tremors, ataxic gait, rigidity, altered speech, impaired swallowing, and mental and behavioral changes (National Institutes of Health, 2017).

Mediterranean diet- An ancient dietary pattern of people and cultures surrounding the Mediterranean sea that emphasizes a daily intake of fresh fruit and vegetables, legumes, whole grains, olive oil, nuts, fish, and white meats (Cleveland Clinic, 2019).

Cardiovascular health- Normal fasting blood cholesterol levels (total cholesterol less than 200, high density lipoproteins greater than 60, low density lipoproteins less than 100, and triglycerides less than 150) and blood pressure readings (less than 130/80), as defined by the American Heart Association.

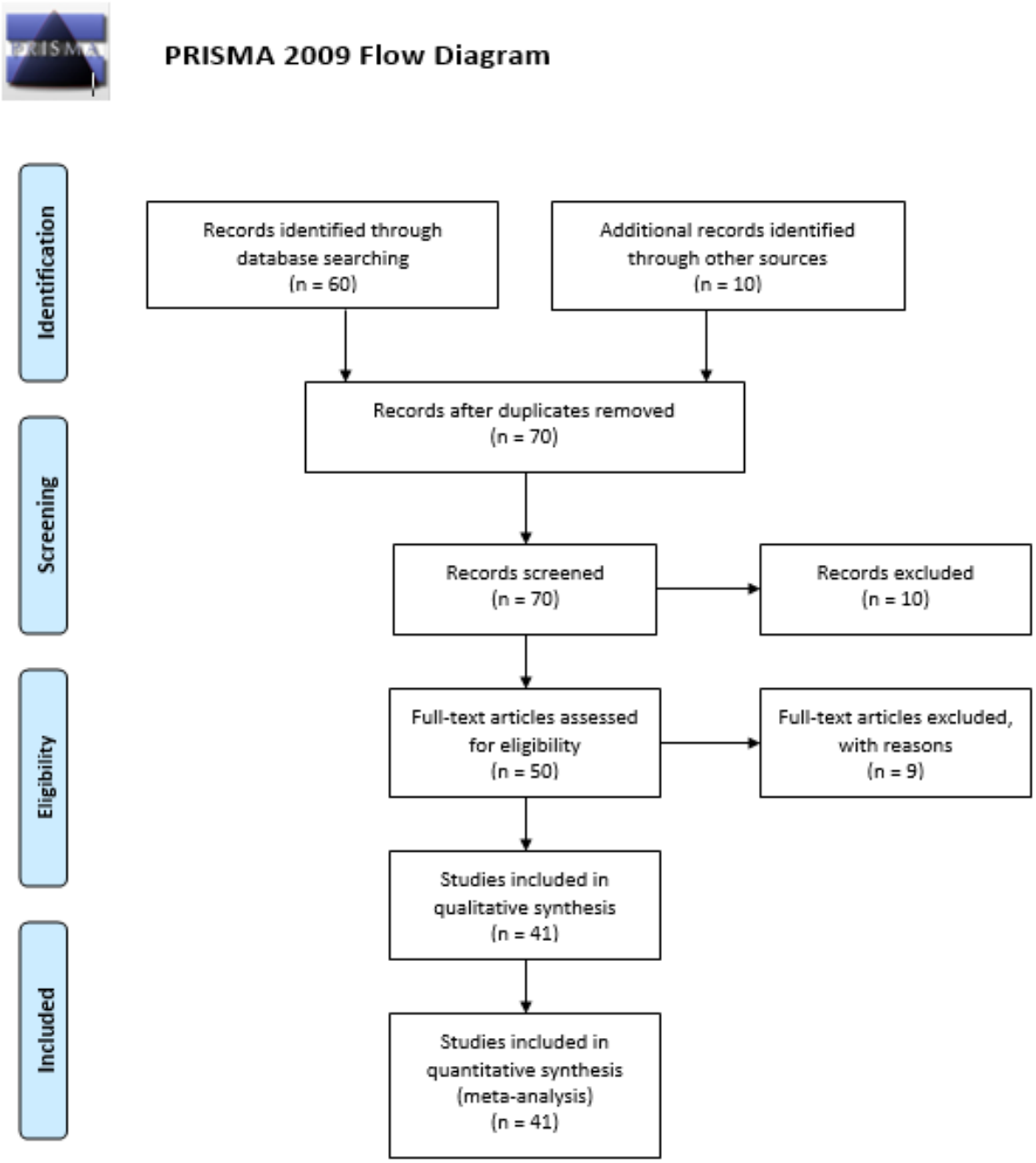
Self-efficacy- The belief in one's ability to influence factors that affect daily life and the confidence to take a proactive role in managing one's health (Cook, 2017).

Quality-of-life- A physical, mental, and social state of well-being.

Holistic care- Care that aims to treat the *whole* person and not just one body system or disease.

Gut microbiome- The trillions of bacteria that live in the gastrointestinal tract which regulate, direct, and modulate host physiology.

Appendix C



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Appendix D

Synthesis of Evidence Matrix

First author, Year, Title, Journal	Purpose	Research Design[1], Evidence Level[2] & Variables	Sample & Sampling, Setting	Measures & Reliability (if reported)	Results & Analysis Used	Limitations & Usefulness
Cardiovascular Benefits of the Mediterranean Diet						
Rosato, V., Temple, N. J., La Vecchia, C., Castellan, G., Tavani, A., & Guercio, V. (2019). Mediterranean diet and cardiovascular disease: A systematic review and meta-analysis of observational studies. *European Journal of Nutrition*, *58*(1), 173–191. https://doi.org/10.1007/s00394-017-1582-0	Systematic review and meta-analysis of observational studies to study effect of Mediterranean diet (MD) on cardiovascular health.	Level I evidence. Systematic review and meta-analysis.	29 articles examined.	Meta regression models were used and risk ratios were calculated using Dersimonian and Laird Random Effects Models.	Mediterranean diet is protective against cardiovascular disease- including coronary heart disease and ischemic stroke.	Supports Mediterranean diet protecting cardiovascular health.
Jennings, A., Berendsen, A., DeGroot, L., Feskens, E. J. M., Brzozowska, A., Sicinska Ewa, Pietruszka Barbara, Meunier Nathalie, Caumon Elodie, Malpuech-Brugère Corinne, Santoro Aurelia, Ostan Rita, Franceschi Claudio, Gillings Rachel, O' Neill Colette M., Fairweather-Tait Sue J., Minihane Anne-Marie, & Cassidy Aedín. (2019). Mediterranean-style diet improves systolic blood pressure and arterial stiffness in older adults. *Journal of the American Heart Association*, *73*(3), 578–586. https://doi.org/10.1161/HYPERTENSIONAHA.118.12259	RCT to determine if MD implementation effects arterial stiffness and blood pressure.	Level II: Well-designed RCT. IV: Arterial stiffness and SBP/DBP DV: Mediterranean diet adherence.	1142 European men and women from multiple healthcare centers in different regions.	Systolic blood pressure, diastolic blood pressure, and arterial stiffness	ANCOVA measures.	Significant reductions observed in systolic blood pressure and arterial stiffness. Reductions to diastolic blood pressure were not statistically significant.
Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M.-I., Corella, D., Arós, F., Gómez-Gracia, E., Ruiz-Gutiérrez, V., Fiol, M., Lapetra, J., Lamuela-Raventos, R. M., Serra-Majem, L., Pintó, X., Basora, J., Muñoz, M. A., Sorlí, J. V., Martínez, J. A., Fitó, M., Gea, A., … PREDIMED Study Investigators. (2018). Primary prevention of cardiovascular disease with a Mediterranean diet supplemented with extra-virgin olive oil or nuts. *The New England Journal of Medicine*, *378*(25), e34. https://doi.org/10.1056/NEJMoa1800389	Evaluate relative risk of cardiovascular mortality in post-MI patients after implementation of the Mediterranean diet	Level I: Well-designed RCT IV: Cardiovascular mortality relative risk DV: Implementation of Mediterranean diet	7447 Spanish men and women followed over 7 years.	Food frequency questionnaire, General medical questionnaire, and Minnesota Leisure Time Physical Activity Questionnaire Serum biomarkers	Kaplan–Meier cumulative-incidence curves for intervention groups and calculated hazard ratios on an intention-to-treat basis with the control group as the reference, using Cox model	30% relative risk reduction in major cardiac events found

Grosso, G., Marventano, S., Yang, J., Micek, A., Pajak, A., Scalfi, L., Galvano, F., & Kales, S. N. (2017). A comprehensive meta-analysis on evidence of Mediterranean diet and cardiovascular disease: Are individual components equal? *Critical Reviews in Food Science and Nutrition*, *57*(15), 3218–3232. https://doi.org/10.1080/10408398.2015.1107021	Meta-analysis to explore the association between MD adherence and CVD incidence and mortality	Level V: Meta-analysis of observational studies and RCTs	11 studies qualified for meta-analysis	Pooled analysis (unspecified)	40% reduced risk of cardiovascular incidence and mortality r/t MD adherence	MD adherence reduces risk of cardiovascular disease (including CHD and MI)
Martinez-Gonzalez, M. A., & Martín-Calvo, N. (2016). Mediterranean diet and life expectancy; beyond olive oil, fruits and vegetables. *Current Opinion in Clinical Nutrition and Metabolic Care*, *19*(6), 401–407. https://doi.org/10.1097/MCO.0000000000000316	Study association between MD adherence and preventable chronic diseases.	Level I: Integrative review	19 studies used.	Unknown	Nearly perfect consistency– Mediterranean diet reduces risk of MI, CVA, total mortality, CHF, and disability	Mediterranean diet is the "Gold Standard" in preventive medicine.
Martínez-González, M. A., García-López, M., Bes-Rastrollo, M., Toledo, E., Martínez-Lapiscina, E. H., Delgado-Rodriguez, M., Vazquez, Z., Benito, S., & Beunza, J. J. (2011). Mediterranean diet and the incidence of cardiovascular disease: A Spanish cohort. *Nutrition, Metabolism and Cardiovascular Diseases*, *21*(4), 237–244. https://doi.org/10.1016/j.numecd.2009.10.005	Study the association between adherence to the MD and the incidence of fatal and non-fatal cardiovascular events.	Level IV: Well-designed cohort study IV: Incidence of cardiac events DV: MD adherence	13,609 participants initially free of cardiovascular disease.	136 item food frequency questionnaire	Multivariate analyses.	Increased adherence to the Mediterranean diet led to decreased risk of cardiovascular events.
Tyrovolas, S., & Panagiotakos, D. B. (2010). The role of Mediterranean type of diet on the development of cancer and cardiovascular disease, in the elderly: A systematic review. *Maturitas*, *65*(2), 122–130. https://doi.org/10.1016/j.maturitas.2009.07.003	Study the association between the MD and cardiovascular health, quality of life, cancer.	Level I: Integrative review	10 studies were selected for analysis.	None provided	All studies demonstrated decreased cardiovascular risk with MD adherence and improved QOL in persons world-wide.	MD also reduces morbidity, premature mortality, and correlates with reductions in some types of cancer in older persons.
Knoops, K. T. B., de Groot, L. C. P. G. M., Kromhout, D., Perrin, A.-E., Moreiras-Varela, O., Menotti, A., & van Staveren, W. A. (2004). Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women: The HALE project. *JAMA*, *292*(12), 1433–1439. https://doi.org/10.1001/jama.292.12.1433	Study the association between MD adherence and morbidity/mortality rates.	Level VI: Single observational study.	2,339 European men and women.	Epidemiological statistics analyzed over 10 years.	23% decrease in all-causes mortality rates.	Became a foundational study that noted the association between MD adherence and decreased CV risk.

Trichopoulou, A., Costacou, T., Bamia, C., & Trichopoulos, D. (2003). Adherence to a Mediterranean diet and survival in a Greek population. *The New England Journal of Medicine*, *348*(26), 2599–2608. https://doi.org/10.1056/NEJMoa025039	Study the association between MD adherence and morbidity/mortality rates.	Level VI: Single observational study.	22,043 Greek men and women	Epidemiological statistics	Significant lower total, cardiovascular, and cancer mortality rates	Became another foundational study associating MD adherence with decreased CV risk.
de Lorgeril, M., Renaud, S., Mamelle, N., Salen, P., Martin, J. L., Monjaud, I., Guidollet, J., Touboul, P., & Delaye, J. (1994). Mediterranean alpha-linolenic acid-rich diet in secondary prevention of coronary heart disease. *Lancet (London, England)*, *343*(8911), 1454–1459. https://doi.org/10.1016/s0140-6736(94)92580-1	Study association between MD adherence and morbidity and mortality risk.	Level II: RCT IV: Morbidity and mortality rates DV: MD implementation	605 post-MI patients followed for an average of 27 months.	Epidemiological statistics.	Overall mortality of control group=20, vs MD group=8. 73% decrease in mortality related to coronary heart disease.	First RCT that demonstrated dramatic relationship between MD adherence and decreased CV, morbidity, and mortality risk.
Microbiome and PD: The Mediterranean Connection						
Aho, V. T. E., Pereira, P. A. B., Voutilainen, S., Paulin, L., Pekkonen, E., Auvinen, P., & Scheperjans, F. (2019). Gut microbiota in Parkinson's disease: Temporal stability and relations to disease progression. *EBioMedicine*, *44*, 691–707. https://doi.org/10.1016/j.ebiom.2019.05.064	To compare the gut microbiota in Parkinson's patients to those in a healthy adult population.	Level III Quasi-experimental design. IV: The gut microbiome composition of healthy persons vs those with PD. DV: Gut microbiota composition.	64 control subjects and 64 Parkinson's patients.	16S rRNA gene amplification sequencing of tool samples was used to analyze specimens twice, 2-25 years apart. UPDRS was used, as well as Levodopa Equivalent Dose measurements.	Significant differences detected between microbial composition of PD patients vs. control. Several microbes identified in specific difference between control vs. PD population biomes. Biome differed in pts. with faster vs. slower progression.	-Identified several target microbes of the biome that differed in the PD patients vs. the control population. -Specific microbe identified that is found in more quickly progressing PD vs slower- progressing.

Bedarf, J. R., Hildebrand, F., Goeser, F., Bork, P., & Wüllner, U. (2019). The gutmicrobiome in Parkinson's disease. *Der Nervenarzt*, *90*(2), 160–166. https://doi.org/10.1007/s00115-018-0601-6	Identify a specific PD gut microbiome composition.	Level III. Quasi-experimental design. IV- Gut microbiota DV- PD vs general population's biome composition.	Not provided.	Metagenomic sequencing procedures were utilized.	PD microbiota are easily distinguished from the biota of the general population even in clinically early cases. Specific microbiota can also be identified that are significantly over- or under-represented in the microbial composition of patients with PD.	Establishes a clear relationship between PD and the gastrointestinal microbiome.
Dutta, S. K., Verma, S., Jain, V., Surapaneni, B. K., Vinayek, R., Phillips, L., & Nair, P. P. (2019). Parkinson's disease: The emerging role of gut dysbiosis, antibiotics, probiotics, and fecal microbiota transplantation. *Journal of Neurogastroenterology and Motility*, *25*(3), 363–376. https://doi.org/10.5056/jnm19044	To investigate the relationship between the gut microbiome and PD. Additionally, investigate potential modulators of the gut microbiome and their impact on PD symptoms and microbiota.	Level I integrative review.	The specific number of studies utilized was not listed, nor were details provided regarding the literature searches performed.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Establishes link between PD and gut microbiome. -Fresh vegetables, fruits, nuts, seeds, herbs, non-fried fish, olive oil, coconut oil, spices, polyphenols, and vitamin E are considered protective against PD and slow progression ($p<0.05$). -Foods that worsen PD include canned foods, sodas, fried foods, beef, ice cream, yogurt, cheese, and iron supplementation ($p<0.05$).

Santos, S. F., de Oliveira, H. L., Yamada, E. S., Neves, B. C., & Pereira, A. J. (2019). The gut and Parkinson's disease: A bidirectional pathway. *Frontiers in Neurology*, *10*. https://doi.org/10.3389/fneur.2019.00574	To appraise evidence suggesting a bi-directional pathway between the gut microbiota and Parkinson's Disease.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Establishes relationship between PD and the gut microbiome. -The health of the gut microbiome can be protective or contribute to the development of PD later in life.
Li, C., Cui, L., Yang, Y., Miao, J., Zhao, X., Zhang, J., Cui, G., & Zhang, Y. (2019). Gut Microbiota Differs Between Parkinson's disease patients and healthy controls in northeast China. *Frontiers in Molecular Neuroscience*, *12*. https://doi.org/10.3389/fnmol.2019.00171	To investigate potential differences in gut microbiome composition in healthy persons vs those with PD	Level III. Quasi-experimental design. IV: Microbiome composition of healthy persons vs those with PD DV: Gut microbiota composition	51 PD patients 48 healthy controls. 16S-rRNA gene sequencing utilized.	Food frequency questionnaire utilized to control for dietary diversity.	Microbiota diversity was significantly different between PD patients and the healthy controls.	-Establishes relationship between PD and the gut microbiome. -Decreased species richness, phylogenetic diversity, beta diversity, and altered relative abundance noted in PD patient microbiota.
Kwon, D. (2018). Does Parkinson's begin in the gut? Scientific American. https://www.scientificamerican.com/article/does-parkinsons-begin-in-the-gut/	To investigate the relationship between the gut microbiome and PD.	Level VII-expert opinion/review of unspecified research.	Not applicable.	Not applicable.	Not applicable.	Evidence supports the microbiome-related origins of PD.
Strandwitz, P. (2018). Neurotransmitter modulation by the gut microbiota. *Brain Research*, *1693*(Pt B), 128–133. https://doi.org/10.1016/j.brainres.2018.03.015	To investigate the relationship between the gut microbiome and disease.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	Establishes the relationship between the gut microbiome and neurotransmitter modulation and neurologic disease.

Mittal, R., Debs, L. H., Patel, A. P., Nguyen, D., Patel, K., O'Connor, G., Grati, M., Mittal, J., Yan, D., Eshraghi, A. A., Deo, S. K., Daunert, S., & Liu, X. Z. (2017). Neurotransmitters: The critical modulators regulating gut-brain axis. *Journal of Cellular Physiology*, *232*(9), 2359–2372. https://doi.org/10.1002/jcp.25518	To investigate the relationship between the gut microbiome and disease.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-PD is an example of what happens when the gut microbiome jeopardizes the delicate balance of the enteric nervous system.
Felice, V. D., Quigley, E. M., Sullivan, A. M., O'Keeffe, G. W., & O'Mahony, S. M. (2016). Microbiota-gut-brain signalling in Parkinson's disease: Implications for non-motor symptoms. *Parkinsonism & Related Disorders*, *27*, 1–8. https://doi.org/10.1016/j.parkreldis.2016.03.012	To appraise evidence suggesting a bi-directional pathway between the gut microbiota and Parkinson's Disease and implications for non-motor symptoms	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Gut microbiota are significant participants in the communication between the gut and brain in patients with PD.
Galland, L. (2014). The gut microbiome and the brain. *Journal of Medicinal Food*, *17*(12), 1261–1272. https://doi.org/10.1089/jmf.2014.7000	To explain the complexities of the gut microbiome and its effect on neurological diseases like Parkinson's.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Gut microbiota are significant participants in the communication between the gut and brain in patients with PD.
Gubert, C., Kong, G., Renoir, T., & Hannan, A. J. (2020). Exercise, diet and stress as modulators of gut microbiota: Implications for neurodegenerative diseases. *Neurobiology of Disease*, *134*, 104621. https://doi.org/10.1016/j.nbd.2019.104621	To discuss the microbiome modulators of exercise, diet, and stress on neurological diseases like Parkinson's.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Dietary modulators found to improve the gut microbiome in PD patients include ketogenic and Mediterranean diets and Omega-3 supplementation.

Hegelmaier, T., Lebbing, M., Duscha, A., Tomaske, L., Tönges, L., Holm, J. B., Bjorn Nielsen, H., Gatermann, S. G., Przuntek, H., & Haghikia, A. (2020). Interventional influence of the intestinal microbiome through dietary intervention and bowel cleansing might improve motor symptoms in Parkinson's disease. *Cells*, *9*(2), 376. https://doi.org/10.3390/cells9020376	To investigate if dietary and bowel cleansing interventions improve motor symptoms in PD.	Level III. IV- Stool samples of patients who undergo dietary intervention and bowel cleansing vs control population. DV- UPDRS scores and microbiome diversity.	54 PD patients and 32 healthy controls. 16 patients put on well-balanced, ovo-laco vegetarian diet including STFAs for 2 weeks. 10 received additional treatment with daily fecal enemas over 8 days.	UPDRS rating scale, Levodopa-equivalent daily dosing, and stool testing were used to measure the outcomes.	Dietary intervention and daily bowel cleansing revealed significantly improved UPDRS scores and reduced the levodopa-equivalent daily dose, including after a one-year follow-up.	-Dietary intervention and bowel cleansing may provide significant non-pharmacologic therapy options for PD patients. -Would like to test the significance of diet alone without bowel cleansing.
Gazerani, P. (2019). Probiotics for Parkinson's disease. *International Journal of Molecular Sciences*, *20*(17). https://doi.org/10.3390/ijms20174121	To examine the use of probiotics with Parkinson's disease.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Probiotics, prebiotics, and synbiotics demonstrate potential for PD, but more studies are needed regarding individual strain types, combinations, etc. -Few studies address safety biomarkers and are recommended in the future.
Gorecki, A. M., Preskey, L., Bakeberg, M. C., Kenna, J. E., Gildenhuys, C., MacDougall, G., Dunlop, S. A., Mastaglia, F. L., Akkari, P. A., Koengten, F., & Anderton, R. S. (2019). Altered gut microbiome in Parkinson's diseae and the influence of lipopolysaccharide in a human a-synuclein over-expressing mouse model. *Frontiers in Neuroscience*, *13*. https://doi.org/10.3389/fnins.2019.00839	To investigate the gut microbiome in PD pathogenesis, and if the expression of a specific inflammatory lipopolysaccharide (LPS) contributes to development.	Level III IV: Microbiome composition of healthy persons vs those with PD DV: Gut microbiota composition	Mice were utilized for experimentation in Germany.	Stool samples were analyzed with 16S rRNA sequencing.	LPS found to contribute to early emergence of motor symptoms, compared to untreated mice still asymptomatic at that stage.	Bacterial diversity and abundance are altered in mice with the LPS.

Jackson, A., Forsyth, C. B., Shaikh, M., Voigt, R. M., Engen, P. A., Ramirez, V., & Keshavarzian, A. (2019). Diet in Parkinson's disease: Critical role for the microbiome. *Frontiers in Neurology*.	To investigate the intestinal microbiome in Parkinson's disease and how diet-associated changes in the microbiome may be a viable approach to prevent or modify disease progression	Integrative review. Level 1 Evidence, but not as reliable as a true systematic review. Researched the effect of multiple dietary variables and diets on Parkinson's disease prevention and symptom treatment.	The specific number of studies utilized was not listed, nor were details provided regarding the literature searches performed.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed under each new topic heading.	-Significant improvements to microbiota with Mediterranean diet, suggesting effective symptom treatment and halting of PD progression. -Now need clinical trials to test for beneficial clinical effects of Mediterranean diet in PD patients -future research aim.
Kalampokini, S., Becker, A., Fassbender, K., Lyros, E., & Unger, M. M. (2019). *Nonpharmacological modulation of chronic inflammation in Parkinson's disease: Role of diet interventions* [Research article]. Parkinson's Disease. https://doi.org/10.1155/2019/7535472	To explore the effect of dietary interventions on the PD patient's microbiome.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Diets rich in pre-and pro-biotics, polyunsaturated fatty acids, phenols, vitamins, and diets such as the Mediterranean diet attenuate inflammation and positively influence PD symptoms.
Kessler, A. (2019). Balanced diet to maintain optimal health in Parkinson's patients: A nutritionist's view. *Parkinson's News Today*. https://parkinsonsnewstoday.com/2019/07/03/diet-maintain-optimal-health-parkinsons-patients-nutritionists-view/	To discuss the impact of dietary interventions on Parkinson's disease.	Level VII expert opinion.	Not applicable.	Not applicable.	Not applicable.	-The Mediterranean diet is becoming the model for neuroprotection related to PD. -The diet includes fresh fruits and vegetables, nuts, seeds, non-fried fish, olive oil, coconut oil, wine, fresh herbs, and spices.

Uyar, G. Ö., & Yildiran, H. (2019). A nutritional approach to microbiota in Parkinson's disease. *Bioscience of Microbiota, Food and Health*, *38*(4), 115–127. https://doi.org/10.12938/bmfh.19-002	To explore potential benefits of prebiotics, probiotics, synbiotics, and diet on the gut microbiota in PD.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-The Mediterranean diet may have great protective impact on PD. -Increasing evidence supports that the amount, type, and balance of macronutrients and high intake of vegetables, fruits, and omega-3 fatty acids support the gut microbiome and can be neuroprotective against Parkinson's disease.
Borzabadi, S., Oryan, S., Eidi, A., Aghadavod, E., Daneshvar Kakhaki, R., Tamtaji, O. R., Taghizadeh, M., & Asemi, Z. (2018). The effects of probiotic supplementation on gene expression related to inflammation, insulin and lipids in patients with Parkinson's disease: A randomized, double-blind, placebo-controlled trial. *Archives of Iranian Medicine*, *21*(7), 289–295.	"…to evaluate the effects of probiotic supplementation on inflammation an oxidative stress biomarkers, and gene expression related to inflammation, insulin, and lipids in patients with PD"(Borzabadi et al., 2018, p. 290).	Level II- a randomized, double-blind, placebo-control trial. IV: The use of a probiotic in PD patients vs the control PD group. DV: Gut microbiota composition.	50 patients with PD were randomly assigned to control and experimental groups. A randomized clinical trial sample size formula was used with type one and type two errors at 0.05 and a power of 80% to calculate sample size.	Kolmogorov-Smirnov tests, ANCOVA, and Pearson Chi-Square tests were used in data analysis. The P value was set at <0.05 for statistical significance.	After 12 weeks, probiotic down-regulated gene regulation compared to the placebo group.	-Gene expression in the stool samples were significantly improved. -Researchers suggest symptom measurement in PD patients in future trials.

Perez-Pardo, P., Kliest, T., Dodiya, H. B., Broersen, L. M., Garssen, J., Keshavarzian, A., & Kraneveld, A. D. (2017). The gut-brain axis in Parkinson's disease: Possibilities for food-based therapies. *European Journal of Pharmacology*, *817*, 86–95. https://doi.org/10.1016/j.ejphar.2017.05.042	To explore how food-based interventions might impact PD pathology and symptoms.	Level I integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-No neuroprotective pharmacologic treatments currently exist. -Dietary interventions may decrease gastrointestinal inflammation and improve gut microbiome health, also allowing for improved uptake and availability of levodopa treatment and provide neuroprotection against the further progression of Parkinson's disease.
Singh, R. K., Chang, H.-W., Yan, D., Lee, K. M., Ucmak, D., Wong, K., Abrouk, M., Farahnik, B., Nakamura, M., Zhu, T. H., Bhutani, T., & Liao, W. (2017). Influence of diet on the gut microbiome and implications for human health. *Journal of Translational Medicine*, *15*.	To evaluate current data regarding the effects of several common dietary components on intestinal microbiota.	Level I Systematic literature review. Analyzed the effect of numerous dietary components on the intestinal microbiome.	Articles were reviewed independently by two investigators after searching the electronic MEDLINE database via PubMed. 188 total articles were selected for review. Majority of studies clustered around subject number n=20 to 70.	None stated, but studies consisted of primarily RCTs, cross-sectional studies, case–control studies, and in vitro studies. Animal studies also included to demonstrate dietary impact on the microbiome under controlled experimental conditions.	Review of the literature suggests that diet can modify the intestinal microbiome, which in turn has a profound impact on overall health. Mediterranean diet is the most balanced of available diet plans and conducive to a healthy gut microbiome.	-No statistical analysis provided. -Highly applicable to the DNP inquiry and with regard to the ethical dilemma of beneficence, the Mediterranean diet is helpful for a broad spectrum of issues, including heart disease, obesity, and dyslipidemia.

Alcalay, R., Gu, Y., Mejia-Santana, H., Cote, L., Marder, K., & Scarmeas, N. (2012). The association between Mediterranean Diet adherence and Parkinson's disease. *Movement Disorders*, *27*(6), 771–774. https://doi.org/10.1002/mds.24918	To assess the relationship between Mediterranean diet adherence and PD development/status.	Level VI- Qualitative study.	257 PD participants and 198 controls.	Willett semi-quantitative questionnaire that quantifies diet during the past year. Logistic regression models were then used and adjusted for caloric intake, age, gender, education, and ethnicity. Adjusted linear regression models were also used when assessing age-at-onset.	PD patients are less compliant than the control participants to the Mediterranean-type diet.	The Mediterranean diet may be neuroprotective.
Holistic Care, Quality of Life						
Tod, A. M., Kennedy, F., Stocks, A.-J., McDonnell, A., Ramaswamy, B., Wood, B., & Whitfield, M. (2016). Good-quality social care for people with Parkinson's disease: A qualitative study. *BMJ Open*, *6*(2). https://doi.org/10.1136/bmjopen-2014-006813	To explore the meaning of quality care to persons with PD and their caregivers and the impact of quality social care on health and well-being.	Level VI: Qualitative Study.	43 participants, including participants with PD, formal and informal caregivers, focus groups, and professionals.	Specific data analysis methodology was not provided.	Quality social care with timely delivery was reported to positively impact health.	Holistic care is a very important facet in the care of patients with PD.
Bonaccio, M., Castelnuovo, A. D., Bonanni, A., Costanzo, S., Lucia, F. D., Pounis, G., Zito, F., Donati, M. B., Gaetano, G. de, & Iacoviello, L. (2013). Adherence to a Mediterranean diet is associated with a better health-related quality of life: A possible role of high dietary antioxidant content. *BMJ Open*, *3*(8), e003003. https://doi.org/10.1136/bmjopen-2013-003003	Cross sectional study examining the relationship between the Mediterranean diet and health-related quality of life measures.	Level IV: Cohort study. IV: HRQOL measures DV: Patient adherence to Mediterranean diet.	16,937 Italian participants.	Italian Mediterranean diet analysis and a principal component analysis used.	The diet showed statistical correlation between Mediterranean diet adherence and quality of life scores.	-Possible interference of causality due to study design. -Mediterranean diet increases health-related quality of life scores.

Pretzer-Aboff, I., & Prettyman, A. (2015). Implementation of an Integrative Holistic Healthcare Model for people living with Parkinson's disease. *The Gerontologist*, *55*(Suppl_1), S146–S153. https://doi.org/10.1093/geront/gnv004	To develop an effective multidisciplinary care model for patients with PD.	Level VI: Qualitative study.	36 Participants with PD.	Specific data analysis not provided.	Implementation of a multidisciplinary care model was successful and patients received better quality care.	Involvement of a multidisciplinary team in patients with PD is important, and includes a dietician.
Thanvi, B., & Lo, T. (2004). Long term motor complications of levodopa: Clinical features, mechanisms, and management strategies. *Postgraduate Medical Journal*, *80*(946), 452–458. https://doi.org/10.1136/pgmj.2003.013912	To discuss the long-term complications of traditional pharmacologic therapy for PD.	Level I: Integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	-Long-term complications of traditional pharmacologic PD treatment includes "dopa-resistant" symptoms that impact quality of life.
Scheife, R. T., Schumock, G. T., Burstein, A., Gottwald, M. D., & Luer, M. S. (2000). Impact of Parkinson's disease and its pharmacologic treatment on quality of life and economic outcomes. *American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists*, *57*(10), 953–962. https://doi.org/10.1093/ajhp/57.10.953	To explore the impact of PD and its traditional pharmacologic treatments on the economy and patient QOL.	Level I: Integrative review.	A specific discussion regarding the literature search and the number of studies analyzed was not provided.	Measures and reliability were discussed within the context of individual studies.	Individual quantitative study analyses were addressed and discussed within the context of the integrative review.	The traditional pharmacologic treatment of PD with levodopa often leads to additional symptoms that impact quality of life and lead to financial burden for the patient and also at a national level.
Self-Efficacy						
Cook, D. G. (2017). The importance of self-efficacy. *Davis Phinney Foundation*. https://www.davisphinneyfoundation.org/blog/importance-of-self-efficacy/	To discuss the importance of the concept of self-efficacy for patients with PD.	Level VII-Expert opinion.	Not applicable.	Not applicable.	Not applicable.	Self-efficacy is a very important concept while caring for patients with PD.
Neuro-QOL Scale						
Cella, D., Lai, J.-S., Nowinski, C. J., Victorson, D., Peterman, A., Miller, D., Bethoux, F., Heinemann, A., Rubin, S., Cavazos, J. E., Reder, A. T., Sufit, R., Simuni, T., Holmes, G. L., Siderowf, A., Wojna, V., Bode, R., McKinney, N., Podrabsky, T., … Moy, C. (2012). Neuro-QOL. *Neurology*, *78*(23), 1860–1867. https://doi.org/10.1212/WNL.0b013e318258f744	Assess validity and reliability of the Neurological Quality of Life (Neuro-QOL) scale	Level V: Evidence from systematic review of descriptive or qualitative study.	13 short forms. 3,247 samples reviewed from numerous healthcare settings.	Short forms expressed as T scores	Internal consistency (Cronbach α) of 13 short forms ranged 0.85 to 0.97.	Neuro-QOL questionnaire demonstrated reliability and validity.

HealthMeasures. (2020). *Obtain and administer measures*. http://www.healthmeasures.net/explore-measurement-systems/neuro-qol/obtain-and-administer-measures	Discuss the Neuro-QOL scale	Level VII-Report from expert committee	Not applicable	Not applicable	Not applicable	-High internal consistency, test-retest reliability, and construct validity. -Accepted for use in PD. -Free, no permission required.
Ryan, S. (2019). *Neuro-QOL*. Shirley Ryan AbilityLab. https://www.sralab.org/rehabilitation-measures/neuro-qol	Discuss the Neuro-QOL scale	Level VII-Report from expert committee	Not applicable	Not applicable	Not applicable	-High internal consistency, interrater and test-retest reliability, criterion/construct validity, and accepted for use in PD. -Free, no permission required.

Appendix E

Themes of Evidence Table

	Theme	Theme	Theme	Theme	Theme	Theme
Article (last name of first author, date)	The association between the Mediterranean diet (MD) and the risk of cardiovascular disease	Patients with Parkinson's disease must be treated holistically.	Patients with Parkinson's Disease must take a proactive role in the management of their condition.	Key aspects of the MD	A microbiome-friendly diet (i.e. MD) may have an impact on the motor and non-motor characteristics of Parkinson's disease and quality of life measures.	Patient outcome evaluation will be assessed by blood pressure, fasting cholesterol, and the Neuro-QOL Scale
A nutritional approach to microbiota in Parkinson's disease (Uyar, 2019)		X			X	
The importance of self-efficacy (Cook, 2017)			X			
Clinical and metabolic response to probiotic administration in people with Parkinson's disease: A randomized, double-blind, placebo-controlled trial (Borzabadi, 2018)		X			X	
Diet in Parkinson's disease: Critical role for the microbiome (Jackson, 2019)					X	
Good-quality social care for people with Parkinson's disease: a qualitative study (Tod, 2015)		X				

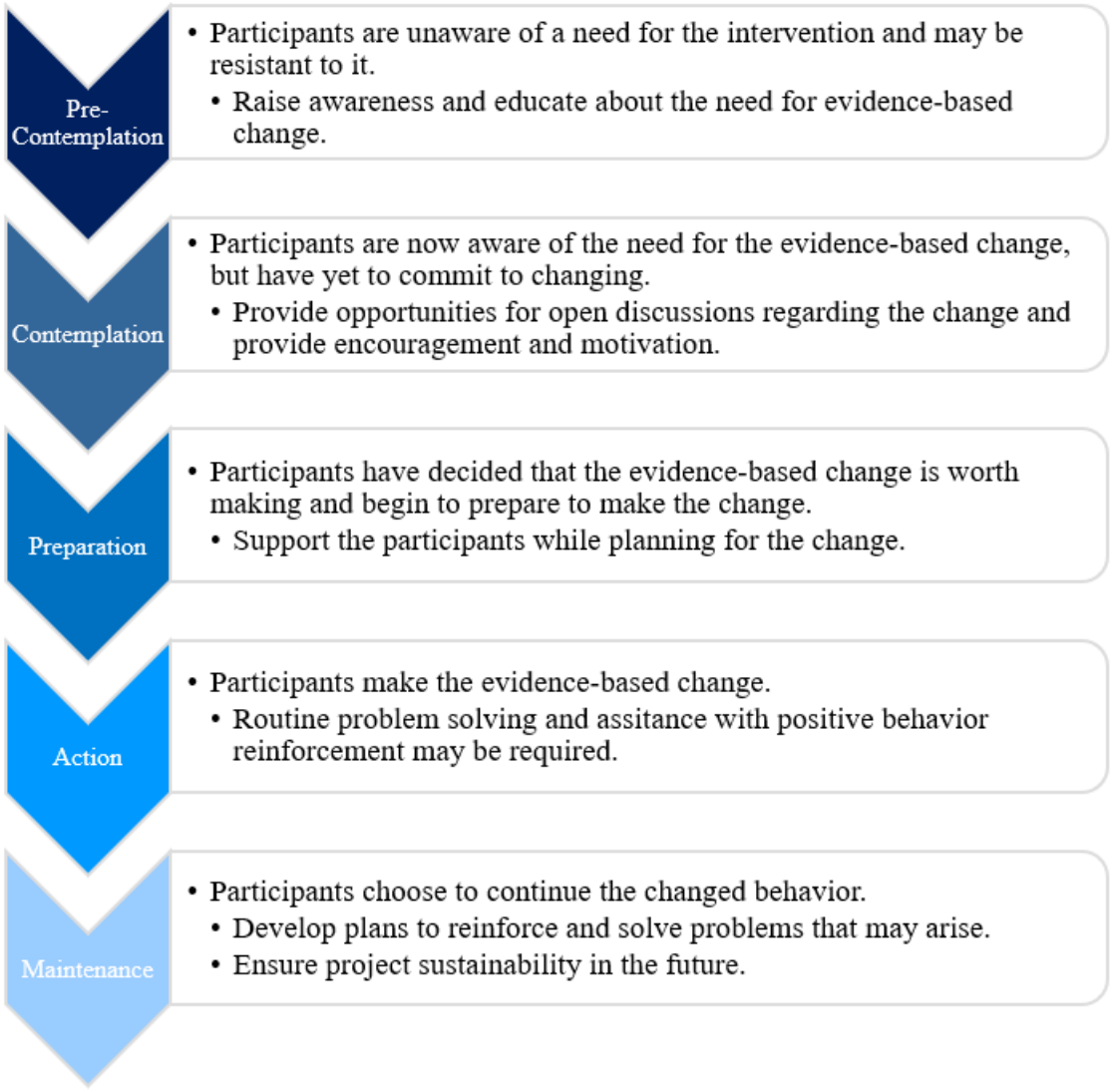
Adherence to a Mediterranean diet is associated with a better health-related quality of life: A possible role of high dietary antioxidant content (Bonnacio, 2013)		X		X		
Influence of diet on the gut microbiome and implications for human health (Singh, 2017)					X	
Microbiota-gut-brain signalling in Parkinson's disease: Implications for non-motor symptoms (Felice, 2016)		X			X	
Neurotransmitters: The critical modulators regulating gut-brain axis (Mittal, 2017)					X	
Nonpharmacological modulation of chronic inflammation in Parkinson's disease: Role of diet interventions (Kalampokini, 2019)		X			X	
Nutraceuticals in Parkinson's disease (Hang, 2016)		X			X	
Nutraceuticals and their preventive or potential therapeutic value in Parkinson's disease (Chao, 2012)		X			X	
The biochemical and cellular basis for nutraceutical strategies to attenuate neurodegeneration in Parkinson's disease (Mazzio, 2011)		X			X	

The gut microbiome and the brain (Galland, 2014)					X	
Treatment and medication (American Parkinson Disease Association, 2020)		X	X			
Neuro-QOL (Cella, 2012)						X
Neuro-QOL (Ryan, 2019)						X
Obtain and administer measures (HealthMeasures, 2020)						X
Mediterranean diet and cardiovascular disease: A systematic review and meta-analysis of observational studies (Rosato, 2019)	X			X		
Mediterranean-style diet improves systolic blood pressure and arterial stiffness in older adults (Jennings, 2019)	X			X		X
Primary prevention of cardiovascular disease with a Mediterranean diet supplemented with extra-virgin olive oil or nuts (Estruch, 2018)	X			X		
A comprehensive meta-analysis on evidence of Mediterranean diet and cardiovascular disease: Are individual components equal? (Grosso, 2017)	X			X		
Mediterranean diet and life expectancy; beyond olive oil, fruits and vegetables (Martinez-Gonzalez, 2016)	X			X		

Mediterranean diet and the incidence of cardiovascular disease: A Spanish cohort (Martinez-Gonzalez, 2011)	X			X		
The role of Mediterranean type of diet on the development of cancer and cardiovascular disease, in the elderly: A systematic review (Tyrovolas, 2010)	X			X		
Mediterranean diet, lifestyle factors, and 10-year mortality in elderly European men and women (Knoops, 2004)	X			X		
Adherence to a Mediterranean diet and survival in a Greek population (Trichopoulou, 2003)	X			X		
Mediterranean alpha-linolenic acid-rich diet in secondary prevention of coronary heart disease (de Lorgeril, 1994)	X			X		

Appendix F

Theory Application



Transtheoretical Model- Stages for Change (McEwen & Wills, 2019)

Appendix G

Logic Model

Logic Model for DNP Project					
Student: Claire Gregson					
Inquiry, PICOTS: **Does the implementation of a Mediterranean diet educational intervention in patients aged 55 to 85 years of age with Parkinson's disease improve post-intervention Mediterranean Diet food intake questionnaire and Patient Rated Outcomes in Parkinson's Disease (PRO-PD) scores compared to pre-intervention Mediterranean Diet food intake questionnaire and PRO-PD scores over two months at a community center for Parkinson's disease in Saint Joseph, Missouri?**					
Inputs	**Intervention(s)** *Activities*	**Outputs** *Participation*	**Outcomes -- Impact** *Short*	*Medium*	*Long*
Evidence sub-topics **1.** Impact of Parkinson's disease (PD) and cardiovascular disease- comorbid occurrence. **2.** Patients with PD must be treated holistically. **3.** Pathologic link between PD and the gut microbiome. **4.** Mediterranean diet positively impacts gut microbiota in patients with PD. **5.** Impact of PD on quality of life. **Major Facilitators or Contributors** **1.** Site value for EBP. **2.** Evidence supporting inquiry **3.** General benefits of Mediterranean diet **Major Barriers or Challenges** **1.** Existing knowledge **2.** Existing attitudes **3.** Limited number of participants	**Implementation of the Mediterranean diet will improve the cardiovascular health, symptoms, and quality of life measures in patients with Parkinson's disease.** **Major steps of the intervention** **1.** Receive site and IRB approval. **2.** Obtain pre-inquiry measures (Mediterranean Diet food intake questionnaire and PRO-PD scores). **3.** Initiate inquiry. **4.** Measure outcomes of inquiry at conclusion (two months) **5.** Complete analysis of results. **6.** Present results of the inquiry implementation.	**The participants** Patients 55-85 years of age with Parkinson's Disease **Site** Freudenthal Center for Parkinson's Disease **Time Frame** Two months. **Consent or assent Needed** Yes. **Other person(s) collecting data** No. **Others directly involved in consent or data collection** None known at this time.	**Outcome(s) to be measured** -Mediterranean diet food intake survey -PRO-PD Scoring **Measurement tool(s)** 1. Mediterranean Diet food intake questionnaire 2. Patient-Rated Outcomes in Parkinson's Disease (PRO-PD) **Statistical analysis to be used** **1.** Repeated measures ANOVA **2.** Descriptive statistics	**Continued improvements in patient cardiovascular health and potentially quality of life/symptoms while utilizing a balanced diet.**	**Improved patient quality of life with reduced risk of cardiovascular morbidity and mortality with potential relief of Parkinson's-associated symptoms.**

Appendix H

UMKC IRB Approval, Project Information Letter, and Faculty Approval Letter

UMKC Institutional Review Board
University of Missouri-Kansas City

5319 Rockhill Road
Kansas City, MO 64110
816-235-5927
umkcirb@umkc.edu

November 18, 2020

Principal Investigator: Lyla Jo Lindholm
Department: Nursing - General

Your Exempt Amendment Form to project entitled "Mediterranean Diet Implementation in Persons with Parkinson's Disease: A Dietary Educational Intervention" was reviewed and determined to qualify for IRB exemption according to the terms and conditions described below:

IRB Project Number	2026344
IRB Review Number	289204
Initial Application Approval Date	August 17, 2020
Approval Date of this Review	November 18, 2020
IRB Expiration Date	N/A Revised Common Rule
Level of Review	Administrative
Project Status	Active - Exempt
Risk Level	Minimal Risk

Approved Documents
PRO-PD Survey Page 2 (change from Neurological Quality of Life/Neuro-QOL survey)
PRO-PD Survey Page 1 (change from Neurological Quality of Life/Neuro-QOL survey)

The principal investigator (PI) is responsible for all aspects and conduct of this study. The PI must comply with the following conditions of the determination:

1. No subjects may be involved in any study procedure prior to the determination date.
2. Changes that may affect the exempt determination must be submitted for confirmation prior to implementation utilizing the Exempt Amendment Form.
3. The Annual Exempt Form must be submitted 30 days prior to the determination anniversary date to keep the study active or to close it.
4. Maintain all research records for a period of seven years from the project completion date.

If you are offering subject payments and would like more information about research participant payments, please click here to view the UM system Policy on Research Subject Payments: https://www.umsystem.edu/oei/sharedservices/apss/nonpo_vouchers/research_subject_payments

If you have any questions, please contact the IRB at 816-235-5927 or umkcirb@umkc.edu.

Thank you,
UMKC Institutional Review Board

Hello, my name is Claire Gregson, and I am a nurse practitioner student at the University of Missouri- Kansas City. I am conducting a study about how receiving education about the Mediterranean diet impacts your food choices and would love to share my knowledge with you! Furthermore, I am investigating if following aspects of the diet affects any of the symptoms that you experience with Parkinson's disease after four weeks.

If you choose to be in this study, you will be asked to complete a survey that would take about 20 minutes of your time. You will be asked to complete the survey before the educational session, and again four weeks after learning about the diet. The educational session about the Mediterranean diet is projected to take place during the week of January 25, and both online and in-person options will be offered.

Your participation is entirely voluntary; you may skip any questions that you do not want to answer or choose to stop participating at any time.

Any personally identifiable information collected during the survey will be kept strictly confidential and coded so that your answers cannot be identified. You will not be identified in any reports about this research.

Do you have any questions about the research study? Please contact Dr. Cheri Barber at the University of Missouri- Kansas City by phone at 816-235-6355 or by email at barberch@umkc.edu. If you have questions or concerns about your rights as a research participant, you can call the UMKC Research Compliance at 816-235-5927.

If you agree to take part in this study, please complete the survey packet that includes a self-addressed stamped envelope you can use to anonymously mail me the survey, or you may also return it to Stephanie Stewart or myself at the center at your convenience. Please feel free to reach out to Stephanie or myself if you have any other questions.
Thank you in advance for your time.

Kind regards,

Claire Gregson
UMKC BSN-DNP FNP Student

UMKC School of Nursing and Health Studies

July 8, 2020

Claire Gregson
UMKC DNP Student

Congratulations Claire. The UMKC Doctor of Nursing Practice (DNP) faculty has approved your DNP project proposal, *Mediterranean Diet Implementation in Persons with Parkinson's Disease: A Dietary Educational Intervention.*

You may proceed with IRB application

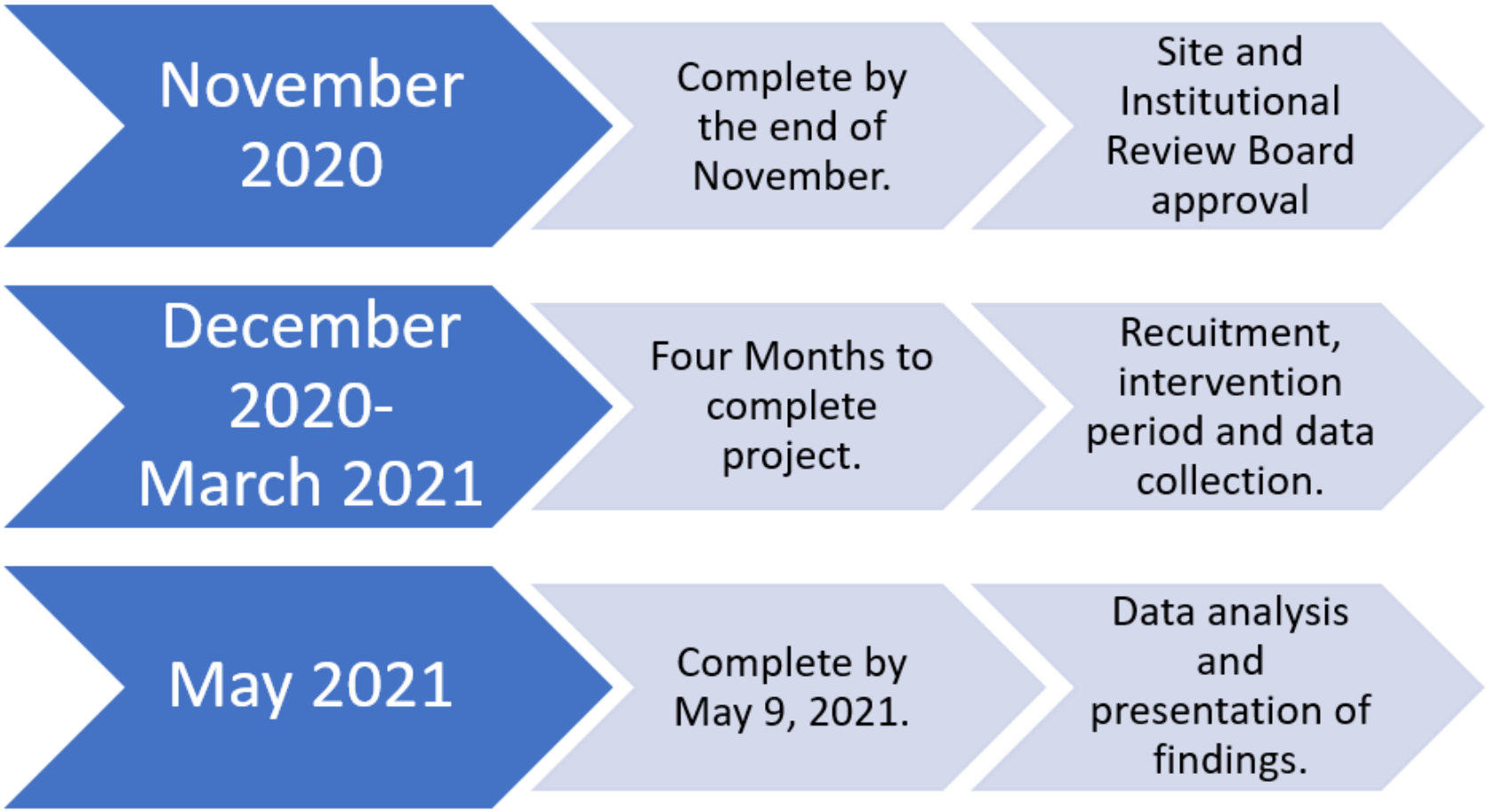
Sincerely,

Lyla Lindholm, DNP, RN, ACNS-BC
Clinical Assistant Professor, DNP Faculty
MSN-DNP Program Coordinator
UMKC School of Nursing and Health Studies
lindholml@umkc.edu

Cheri Barber, DNP, RN, PPCNP-BC, FAANP
Clinical Assistant Professor
DNP Program Director
UMKC School of Nursing and Health Studies
barberch@umkc.edu

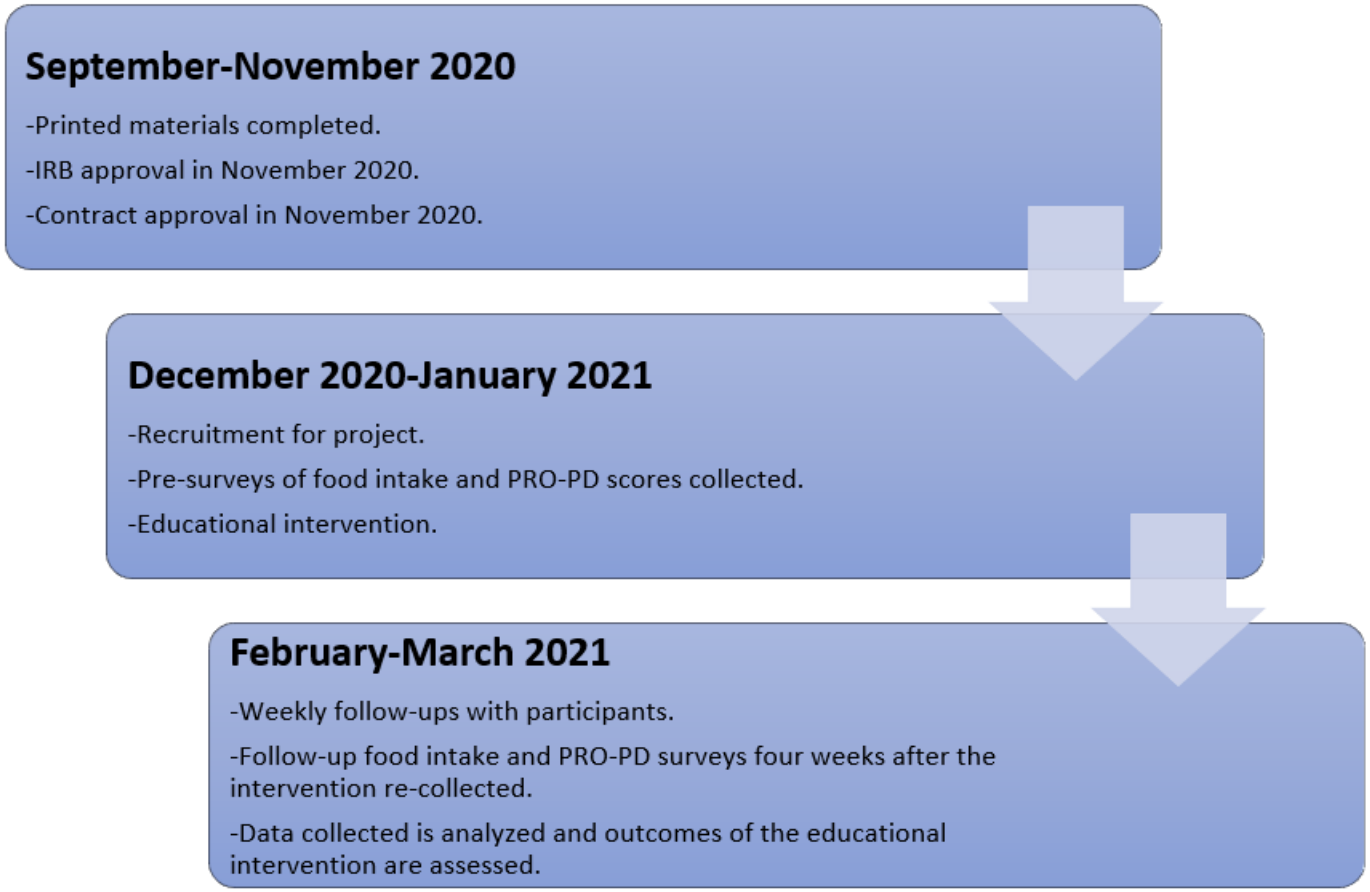
Appendix I

Projected Intervention Timeline



Appendix J

Intervention Flow Diagram



Appendix K

Food Intake Questionnaire

Record ID	_____
How many servings of fresh vegetables do you eat in a day? (1 serving= 1/2 cup to 1 cup)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How many servings of fresh fruit do you eat in a day? (1 serving= 1/2 cup to 1 cup)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How many tablespoons of extra virgin olive oil do you consume each day?	○ Less than 1 ○ 1-2 tablespoons ○ 3-4 tablespoons ○ 5+ servings
How many servings of fish do you consume in a week? (1 serving= 3-4 ounces or about the size of a deck of cards)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How many servings of red meat do you consume in a week? (1 serving= 3 ounces or about the size of a deck of cards)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How many servings of nuts do you consume in a week? (1 serving= one ounce, 1/4 a cup, or 2 tablespoons of nut butter)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How many servings of starchy vegetables (i.e. peas, potatoes, corn) and whole grains do you consume each day? (1 serving= 1/2 cup cooked, 1 ounce of dry cereal, or 1 slice of bread)	○ Less than 1 ○ 2-4 servings ○ 3-5 servings ○ 6 or more servings
How many servings of legumes (i.e. peanuts, beans, lentils) do you consume each week? (1 serving= 1/2 cup)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How many servings of dairy do you consume in a week? (1 serving= 1 cup of milk, 1 cup of low-fat yogurt, 1/3 cup of shredded cheese, or 2 slices of cheese)	○ Less than 1 ○ 1-2 servings ○ 3-4 servings ○ 5+ servings
How often do you consume processed foods (i.e. lunch meats, microwave dinners, etc.) in a week?	○ Less than once ○ 1-3 times ○ 4-5 times ○ 6 or more times
How often do you consume baked goods and desserts in a week?	○ Less than once ○ 1-3 times ○ 4-5 times ○ 6 or more times

Patient-Reported Outcomes in PD (PRO-PD)

Please rate the severity of your symptoms over the past 7 days, on average.
The more severe and debilitating the symptom, the higher the score.
If you're not having that symptom, the score is zero.
You must answer every question.

	Circle one number or enter score to right											Score
Slowness	0	1	2	3	4	5	6	7	8	9	10	
Constipation (incomplete bowel emptying)	0 = Healthy, daily bowel movements				5 = Requires medication				10 = Severe constipation			
	0	1	2	3	4	5	6	7	8	9	10	
Walking	0 = I move freely, with ease										10 = Unable to move	
	0	1	2	3	4	5	6	7	8	9	10	
Freezing of gait	0 = None										10 = Severe, debilitating	
	0	1	2	3	4	5	6	7	8	9	10	
Falling	0 = None					5 = Occasionally					10 = Daily	
	0	1	2	3	4	5	6	7	8	9	10	
Rising from Seated Position	0 = With ease					5 = With effort					10 = Unable to rise	
	0	1	2	3	4	5	6	7	8	9	10	
Dressing, Eating, & Grooming	0 = With ease					5 = With effort					10 = Unable	
	0	1	2	3	4	5	6	7	8	9	10	
Motivation / Initiative	0 = Engaged, active								10 = Withdrawn, detached, or isolated			
	0	1	2	3	4	5	6	7	8	9	10	
Handwriting or Typing	0 = Great, with ease					5 = Slow or small					10 = Completely illegible	
	0	1	2	3	4	5	6	7	8	9	10	
Depression (feeling sad, blues)	0 = Mentally healthy					5 = Persistent sorrow					10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Loss of Interest	0 = Active, engaged										10 = Severely withdrawn	
	0	1	2	3	4	5	6	7	8	9	10	
Anxiety	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Fatigue	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Daytime Sleepiness	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Dyskinesia (rocking, writhing, twisting, squirming movements associated with medication.)	0 = None					5 = Sometimes, mild				10 = Severe, debilitating		
	0	1	2	3	4	5	6	7	8	9	10	
Tremor (How it has been, on average, over the past week)	0 = None				5 = Slight & infrequently present				10 = Severe, debilitating			
	0	1	2	3	4	5	6	7	8	9	10	
Balance	0 = sturdy, steady				5 = Occasional falls			10 = Lose balance spontaneously				
	0	1	2	3	4	5	6	7	8	9	10	
Control of Body Temperature (symptoms may include cold hands and feet or sweating)	0 = No Problem								10 = Severe dysregulation			
	0	1	2	3	4	5	6	7	8	9	10	
Dizzy on standing	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	

Patient-Reported Outcomes in PD (PRO-PD)

Visual Disturbance	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Insomnia (inability to sleep)	0 = Not a problem									10 = Severe problem.		
	0	1	2	3	4	5	6	7	8	9	10	
REM Sleep Behavior Disorder (acting out dreams)	0 = None				5 = Vivid dreams, talking in sleep					10 = Yelling, kicking, interferes with sleep		
	0	1	2	3	4	5	6	7	8	9	10	
Restless Leg Syndrome (urge to move legs in order to stop unpleasant sensations.)	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Muscle cramping, pain, or aching (most common in the morning or as medications wear off)	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Speech	0 = Normal				5 = Sometimes asked to repeat statements					10 = Not understandable most of the time		
	0	1	2	3	4	5	6	7	8	9	10	
Drooling	0 = None					5 = Night time only					10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Stooped posture	0 = Stand tall				5 = Rounded shoulders				10 = Severely stooped			
	0	1	2	3	4	5	6	7	8	9	10	
Memory / Forgetfulness	0 = Sharp				5 = Occasional forgetfulness				10 = Severe lapses			
	0	1	2	3	4	5	6	7	8	9	10	
Comprehension	0 = Sharp								10 = Frequent confusion			
	0	1	2	3	4	5	6	7	8	9	10	
Sense of smell	0 = No problem				5 = Not as good as others				10 = I can't smell a thing			
	0	1	2	3	4	5	6	7	8	9	10	
Medication Side Effects (err of', nausea, dyskinesia, etc.)	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Sexual Dysfunction (loss of libdo, erectile dysfunction, difficulty with orgasm)	0 = Healthy										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Urinary symptoms (dribbling, urgency, incontinence)	0 = Healthy										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Hallucinations or Delusions (seeing things that aren't there)	0 = None					5 = Mild					10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	
Nausea	0 = None										10 = Severe	
	0	1	2	3	4	5	6	7	8	9	10	

Appendix L

Data Collection Table in SPSS

	Age	Veg.Pre	Fruit.Pre	EVOO.Pre	Fish.Pre	RedMeat.Pre	Nuts.Pre	Starch.Pre	Legumes.Pre	Dairy.Pre	Processed.Pre	Baked.Pre	PROPD.Pre
1	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	.	.	.	.	.	.	.	.	.
7	.	.	.	.	.	.	.	.	.	.	.	.	.
8	.	.	.	.	.	.	.	.	.	.	.	.	.

	).	Veg.Post	Fruit.Post	EVOO.Post	Fish.Post	RedMeat.Post	Nuts.Post	Starch.Post	Legumes.Post	Dairy.Post	Processed.Post	Baked.Post	PROPD.Post
1	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	.	.	.	.	.	.	.	.	.
7	.	.	.	.	.	.	.	.	.	.	.	.	.
8	.	.	.	.	.	.	.	.	.	.	.	.	.

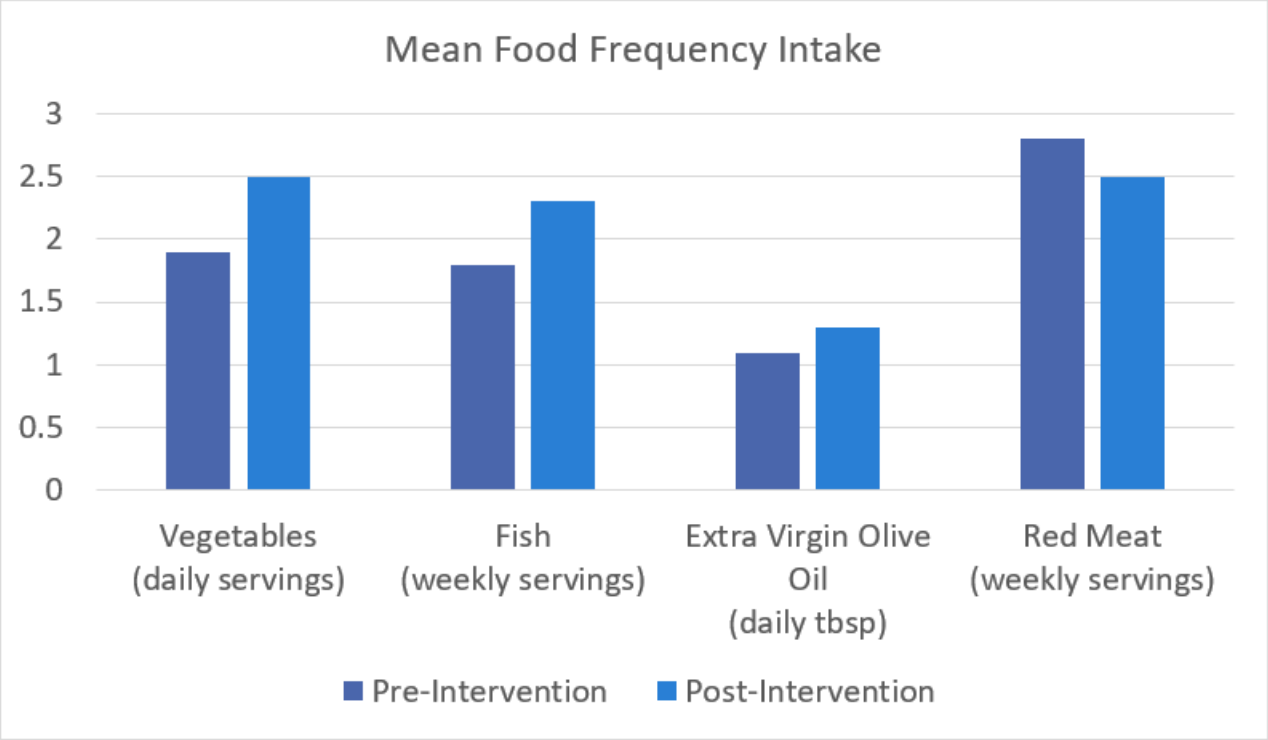
Appendix M

Statistical Analysis Template

Outcome Measure with Tool	Tool Validity and Reliability	Statistical Analysis and Plan
-Mediterranean Diet Food Intake Questionnaire with Mediterranean dietary choices and common dietary choices harmful to cardiovascular and gastrointestinal microbiome health.	-Items listed in the questionnaire will be based on those from the MEPA tool, which is valid and reliable (Cerwinske et al., 2017; Ribbens et al., 2019).	-Descriptive Statistics
-PRO-PD measures	-PRO-PD tool is also valid and reliable in initial testing (Mischley et. al., 2017). Both tools are free and do not require permission for use.	-Descriptive statistics.

Appendix N

Statistical Findings: Mediterranean Diet Food Intake Questionnaire and PRO-PD Results



Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Veg.Pre	8	1.00	3.00	1.8750	.64087
Veg.Post	8	2.00	4.00	2.5000	.75593
Fish.Pre	8	1.00	2.00	1.7500	.46291
Fish.Post	8	2.00	3.00	2.2500	.46291
EVOO.Pre	8	1.00	2.00	1.1250	.35355
EVOO.Post	8	1.00	2.00	1.2500	.46291
RedMeat.Pre	8	1.00	4.00	2.7500	.88641
RedMeat.Post	8	1.00	3.00	2.5000	.75593
PROPD.Pre	8	20.00	171.00	107.6250	50.71471
PROPD.Post	8	30.00	167.00	96.7500	44.69819
Valid N (listwise)	8				

Appendix O

Educational Materials (slides with speaker notes printed)

The Mediterranean diet is one of the most widely known and well-accepted patterns of eating for overall health and wellness (American Heart Association, 2020; Cleveland Clinic, 2019; Mayo Clinic, 2019; National Heart, Lung, and Blood Institute, 2018).

Those diagnosed with Parkinson's disease can be twice as likely to die from a cardiovascular event such as heart attack or stroke compared to the general population (Downward, 2017). There is lots of speculation about why this is, but one primary theory involves a lack of lifestyle and dietary coaching in healthcare settings for those diagnosed with Parkinson's disease.
However, since the first study conducted in the 1960s, many researchers and studies have since concluded that populations who follow the Mediterranean diet face significantly less risk for cardiovascular events compared to the general population (Grosso et al., 2017; Martinez-Gonzalez & Martín-Calvo, 2016; Rosato et al., 2019; Tyrovolas & Panagiotakos, 2010).
The Mediterranean diet has demonstrated in past studies to improve the risk factors for cardiovascular disease that include unhealthy cholesterol levels, obesity, and measurable markers of inflammation within the body and cardiovascular system (Widmer et al., 2015).

Quality of life can be impacted by issues associated with Parkinson's disease, including GI symptoms such as constipation and memory problems. The high fiber content and intake of omega 3 fatty acids associated with the Mediterranean diet can

work to improve both of these issues (Dowding et al., 2012; Galland, 2014; Tysnes & Storstein, 2017; Uyar & Yildiran, 2019). Additionally, past surveys and studies of populations who follow the Mediterranean diet have shown higher quality of life ratings than other populations who follow different eating patterns (Bonaccio et al., 2013).
Finally, following the Mediterranean diet has also been associated with preventing or reducing the risk of depression, diabetes, breast and colorectal cancers, asthma, and cognitive decline (Widmer et al., 2015).

The Mediterranean diet has also been well-accepted as an evidence-based, heart-healthy diet by the American Heart Association, World Health Association, Cleveland Clinic, Mayo Clinic and the National Heart, Lung, and Blood Institute (American Heart Association, 2020; Cleveland Clinic, 2019; Mayo Clinic, 2019; National Heart, Lung, and Blood Institute, 2018).

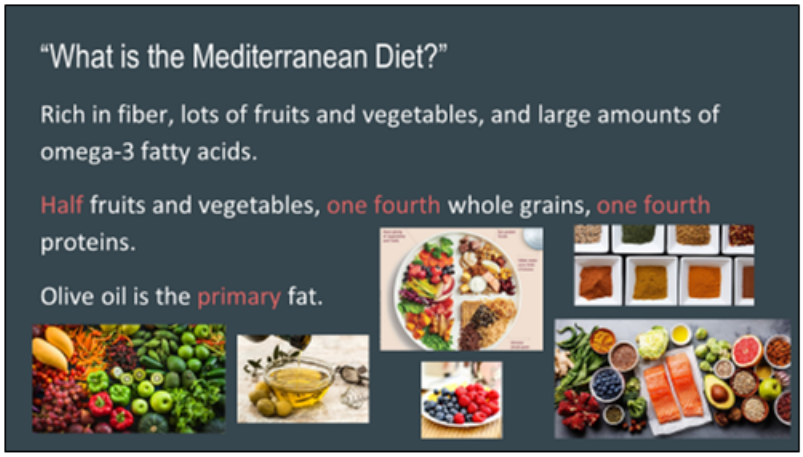
Let's pause for a moment and explore how your diet can affect overall health in an interesting way.

New research is emerging every day that studies the connection between the gut (or GI tract) and the brain. It is known that the gastrointestinal tract and the nervous system communicate through something called the gut-brain axis. This communication likely occurs through chemicals messengers like dopamine being released, which are in part created by the population of healthy bacteria living within your gut.
This population of healthy bacteria is often called the gut microbiome, and new research is establishing how it affects everything from depression and anxiety to the development of chronic illnesses such as Parkinson's disease (Felice et al., 2016; Widmer et al., 2015). Changing the gut microbiome has been associated with improvements to thinking and mood in emerging research, and an inflamed gut environment and its altered microbiome has even been suggested as a trigger for the development Parkinson's disease in individuals (Dutta et al., 2019; Gorecki et al., 2019).

Signs of an unhappy gut microbiome and GI tract (such as constipation) can often appear years before Parkinson's disease is diagnosed (Maraki et al., 2018), and the tiny bacteria living in the GI tract of someone diagnosed with Parkinson's disease are very different under a microscope than the gut bacteria living in the GI tract of someone in the general population (Jackson et al., 2019).

Unbalanced nutrition is a primary cause of GI tract inflammation and the gut microbiome becoming less healthy and diverse (Kalampokini et al., 2019; Uyar & Yildiran, 2019).

The high-fiber component of the MD provides a rich source of nourishment to the gut microbiota in your GI tract. Furthermore, the polyphenols, antioxidants, and anti-inflammatory properties of the foods encouraged by the MD are also considered neuro-protective (Kalampokini et al., 2019; Uyar & Yildiran, 2019). Additionally, emerging studies have suggested that adherence to the MD could potentially slow the progression of Parkinson's Disease (Kalampokini et al., 2019; Uyar & Yildiran, 2019).



A review of the Mediterranean diet per the Cleveland Clinic, 2019.

Over the years, studies have shown that dietary choices made over a lifetime strongly and consistently correlate with PD diagnosis later in life and can also affect the speed of PD progression (PD Active Resources, 2021).

Dr. Laura Mischley has been conducting a study for the past seven years known as the "CamCare Study." Her research investigates what eating behaviors and foods that people diagnosed with PD are following who are either experiencing slowed or no progression of the disease or rapid progression. Her results for 2020 were just announced, and behaviors of people who experienced slowed or no disease progression included cooking most of their meals, avoiding artificial sweeteners/colors/flavors, eating organically-grown foods when possible to avoid pesticides, and buying from local farmers when they are able (PD Active Resources, 2021). Furthermore, persons with slowed or no disease progression often ingested two to four servings per week of fresh vegetables, fruits, nuts, seeds, fish, olive oil, coconut oil, fresh herbs, green/black tea, and wine (PD Active Resources, 2021). On the other hand, persons with rapid PD progression more commonly consumed canned fruits and vegetables, frozen vegetables, beef, pork, dairy, fried foods, pasta, bread, chicken, soda, butter, and drinks from plastic bottles (PD Active Resources, 2021).

I wanted to provide you with an example of a Mediterranean diet food pyramid and take a moment to discuss the people at the bottom of the pyramid.
Other aspects of the Mediterranean lifestyle include socialization when possible, daily physical activity, and getting adequate sleep. Another item to consider when discussing eating patterns is eating within a 10- or 12-hour window each day (i.e. 7 am to 7 pm) and avoiding calories for three hours before bedtime (this excludes drinks). Following this pattern of eating has been shown in past studies to provide the benefits of the ketogenic diet without the side effects that include poor appetite and psychosocial stressors (PD Active Resources, 2021).

Vegetables

- 3 or more servings of vegetables each day
  - 1 "serving"= ½ to 1 cup
- May be a variety of *fresh, frozen,* or *canned* vegetables
  - Monitor sodium intake
- Vegetables may include (but are not limited to)
  - Spinach
  - Kale
  - Green and red peppers
  - Eggplant
  - Squash
  - Onions
  - Garlic
  - Rhubarb
  - Carrots
  - Broccoli

Serving recommendations per the Cleveland Clinic (2019)

I still included canned or frozen vegetables on this slide despite recent study findings, but that decision is yours to make.

**Ask your provider before eating green leafy vegetables if you are taking coumadin/warfarin.

Fruit

- 3 servings per day of fruit
  - 1 serving= ½ to 1 cup
- May be a variety of fresh, frozen, canned, or dried fruits
  - Monitor nutritional labels for added sugars (including corn syrups, etc.)
  - Dried fruits contain more sugar.

Fruit may include (but is not limited to):

Blueberries, strawberries, raspberries, pomegranate, apples, oranges, bananas, grapes, kiwi, lemon, lime, elderberry, and apricots

Whole Grains and Starchy Vegetables

- 3 to 6 servings per day
  - 1 serving = 1/2 cup cooked; 1 slice of bread; or 1 ounce of dry cereal
- When selecting starchy vegetables, try a baked or roasted red skin or sweet potato.

Choose whole grain bread, cereal, and pasta.
Other grains include
Rolled oats
Barley
Quinoa
Brown rice
Polenta
Millet
Farro

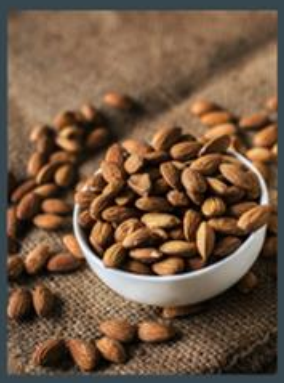
Legumes

- 3 servings per week
  - 1 serving= ½ cup
- Add to salad, soups and pasta dishes.
- Try hummus or bean dip for veggies or a veggie or bean burger.

Legumes include
Peas
Chickpeas
Beans
Peanuts

Nuts

- 3 or more servings per week
  - 1 serving = 1 ounce or 1/4 cup or 2 tablespoons of nut butter
- Choose raw, unsalted and dry roasted varieties
- Try them alone or with dried fruit as a snack.
- Add to hot or cold cereal, salad or yogurt.



One study supported by the American Heart Association showed that substituting walnuts, peanuts, almonds, or other nuts for a serving of carbohydrates or saturated fats reduced blood lipids by 30% and reduced the risk for cardiovascular disease by as much as 45% (Widmer et al., 2015).

Includes walnuts, hazelnuts, and almonds.

Fish and Seafood

- 3 or more servings per week
  - 1 serving = 3 to 4 ounces or about the size of a deck of cards
- Choose fish that are rich in omega 3 fatty acids, including:
  - Salmon
  - Tuna
  - Sardines
  - Mackerel
  - Herring

Other fish and seafood include:
Cod
Crab
Calamari
Shrimp

Meat

- White meat
  - Choose white meat instead of dark meat.
  - Try skinless white meat poultry that is baked, broiled or grilled.
- Red meat
  - One (or less) servings per week.
    - 1 serving = 3 ounces or about the size of a deck of cards

In 2018, the Cleveland Clinic established a relationship between red meat consumption and the gut microbiome releasing a byproduct during its digestion that significantly contributes to the link between cardiovascular disease risk (including for heart attacks and strokes) and regular red meat ingestion (Cleveland Clinic, 2018).
Red meat includes beef, veal, pork, lamb, etc.
When eating red meat, try to choose lean cuts such as sirloin, tenderloin, and flank steak.

Eggs and Dairy

- Dairy
  - Choose fat-free or low fat dairy products.
  - Avoid whole-milk dairy, cream, and cream-based sauces and dressings.
- Eggs
  - Unlimited egg whites
    - Limit yolks for high cholesterol.

There is currently debate between several studies regarding whether or not dairy products contribute to gut microbiome changes.
Please keep in mind that any food sensitivities that you may have to dairy products contributes to gastrointestinal inflammation and harm to the gut microbiome.
Dairy has been connected to the diagnosis and progression of PD (PD Active Resources, 2021). There are several theories regarding why this is- it may be due to pesticides ingested by dairy cows that are passed through milk, the microbiota of a cow's biome interfering with the human microbiome that leads to inflammation, and a possible link between PD and chronic inflammation from lactose intolerance (PD Active Resources, 2021). Regardless, the choice to completely eliminate dairy is yours to make.

Dairy may include
Fat-free or 1% milk, yogurt, and cottage cheese
Natural, light, or part-skim cheese
While egg whites are unlimited on the MD, limit yolks to no more than one per day or four per week if you have issues with cholesterol.

Extra Virgin Olive Oil

- Use 1-4 tablespoons per day
- Use as your primary source of fat/oil.
  - Use instead of vegetable oil and animal fats (i.e. butter, sour cream, mayonnaise).
  - Try drizzling on salads, using it to cook vegetables and pasta, or using it as a dip for bread.

Omega-3 fatty acids such as fish and olive oil are crucial for brain health. Studies are demonstrating that a healthy intake of olive oil can actually protect against memory decline and dementia.

You could also try
Avocado oil
Flax oil
Grapeseed oil
Walnut oil

Limit saturated fats and avoid trans fats!
They increase risk for heart disease and some cancers.
Cause gut inflammation and limit microbiome diversity.
Saturated fats= typically solid at room temperature.

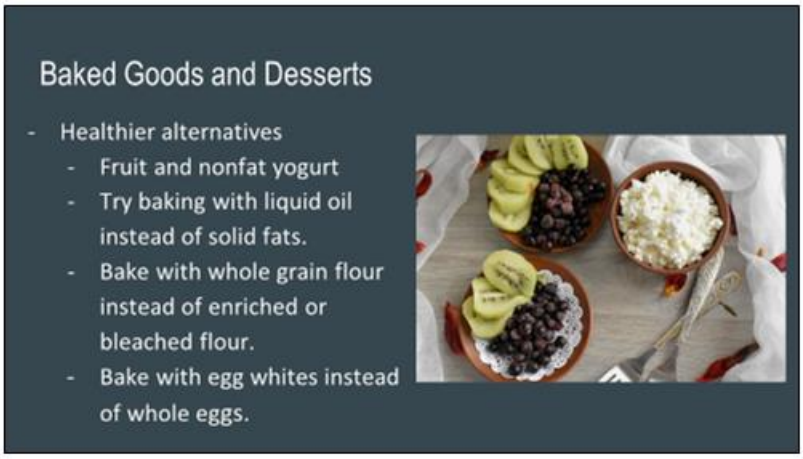
Beverages

- Water is the primary beverage of choice for those on the Mediterranean diet.
- Not a water drinker? Try...
  - Sparkling/seltzer water
  - Adding fresh/frozen fruits (lemon, lime, strawberries, etc.)
  - Black/green tea

Water intake also addresses concerns with constipation, which is an issue that many people with PD encounter. Aim for 64-100 ounces per day (about 7 plastic water bottles or 4 reusable water bottles)

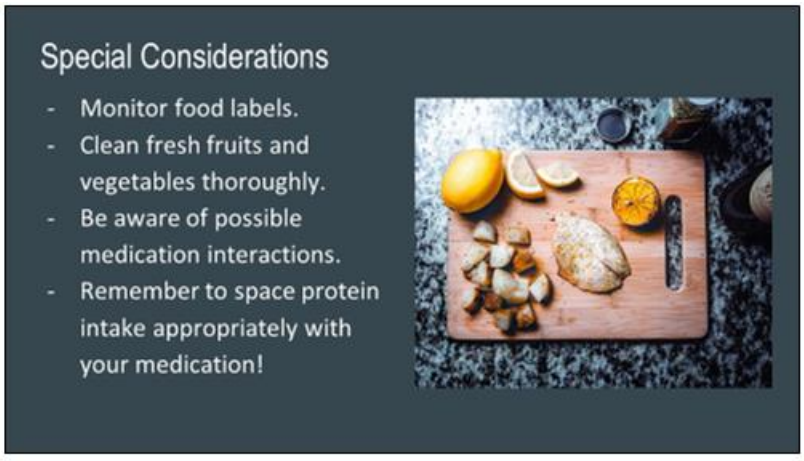
60% of persons with PD do not have enough stomach acid, which may present with symptoms that include eating small meals before feeling full, weight loss, and inconsistent responses to your carbidopa-levodopa (PD Active Resources, 2021). Juice from one whole lemon or one ounce of lemon juice in your drink can increase the uptake of your carbidopa-levodopa by as much as 25% (PD Active Resources, 2021). This information is meant to educate you- please do not make this change without first consulting your provider.

Coffee and red wine are also allowed in moderation, and their intake is associated with a slow in PD progression (PD Active Resources, 2021).
Please consult your physician first regarding potential interactions between wine and your medications.



AVOID commercial or processed baked goods/desserts/sweets.
Limit intake of homemade goods to less than 3 times per week.

Sugar intake can substantially reduce the amount of good bacteria in your gut (Cleveland Clinic, 2018). When this happens, you develop more intense sugar cravings and therefore worsen the repeating cycle of sugar intake and its effect (Cleveland Clinic, 2018). Certain refined sugars such as high fructose corn syrup and even artificial sweeteners can cause gut inflammation that leads to inflammation in your body overall as well (Cleveland Clinic, 2018).



Appraise food labels for sodium content, corn syrup, trans fats, etc.

Clean fresh fruits and vegetables thoroughly.

Ensure that your medications do not interact with certain foods or drinks (i.e. wine, cheese, etc.) before consuming them.

Remember to space protein intake appropriately with your medication!
Take carbidopa/levodopa at least 45 minutes before or one hour after protein in meals.
Keep in mind that certain proteins- i.e. eggs, meat, etc. will take much longer than a plant protein such as hummus to digest. Therefore, allow extra time for these proteins that digest and move through the gut more slowly (PD Active Resources, 2021).

"Where do I start?"

- Meal planning
  - Add snacks to your list
  - Keep the protein/sinemet spacing in mind.
- Shop for in-season fruits and vegetables if possible.
- Read food labels- especially searching for sodium and corn syrup in canned goods.
- Regularly inventory your food supply in your pantry and refrigerator (i.e. weekly, etc.)
- Utilize the registered dietitian services available at some grocery store chains.

Remember- space your sinemet to take at least 45 minutes before or one hour after ingesting proteins.

If you enjoy gardening, consider starting an herb garden.

In Summary...

- Evidence-based, well-balanced diet that reduces cardiovascular risk and may improve quality of life in people who follow it.
- Reduces gut inflammation and promotes a happy and diverse microbiome for overall health.
- The diet is ½ fresh fruit and vegetables, ¼ whole grains and fiber, and ¼ proteins.
- Avoid sweets, white flour products, red meat, and fried foods.
- Plan meals and time medications so that they do not interact with your protein intake.
- Drink water.
- Try cookbooks, Pinterest, and internet recipes.

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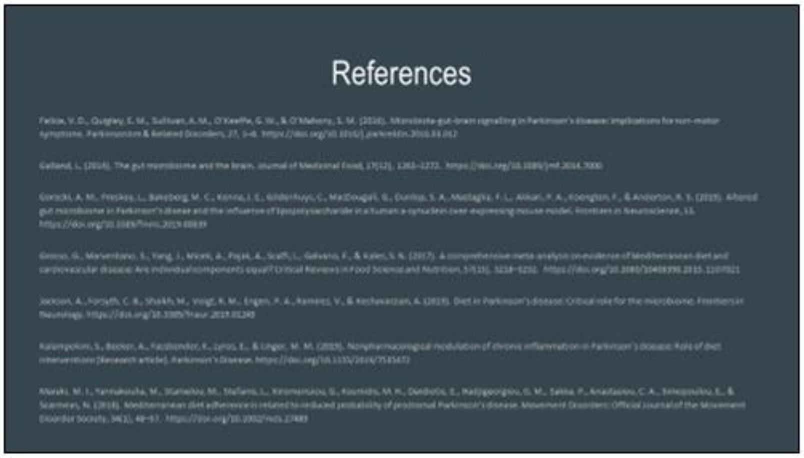
References


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