



The Roles of Diet, Exercise, & Supplements in Parkinson's Disease Progression

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INTRODUCTION

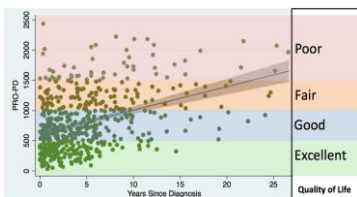
Epidemiological studies have demonstrated midlife nutrition as associated with risk of Parkinson's disease (PD) diagnosis, data irrelevant to individuals who have already been diagnosed. Clinical epidemiology is the study of the determinants and effects of decisions on disease outcomes following diagnosis. Improvements in remote access data collection, computer literacy, and outcome measures now enable evaluation in PD.

The goal of the "CAM Care in PD" study is to describe the association between lifestyle and PD symptom severity and rate of progression.

MATERIALS AND METHODS

The goal of this ongoing natural history study is to identify modifiable lifestyle variables associated with rate of PD progression. The Patient-Reported Outcomes in PD (PRO-PD) is the primary outcome measure, ranging from 0 (asymptomatic) to 2500 (severe) to assess PD severity.

PRO-PD Outcome Measure



The PRO-PD is correlated with the PDQ-39 ($r=0.763$, $P<0.000$), PROMIS Global quality of life ($r=-0.7293$, $P<0.000$), Hoehn & Yahr (HY) ($r=0.5922$, $P<0.000$), total Unified PD Rating Scale ($r=0.4724$, $P<0.000$), and the Timed-Up-&-Go ($r=0.4709$, $P<0.000$).¹

For this cross-sectional analysis, only baseline data were used. Food frequency questionnaires (FFQ) were used to quantify dietary intake. Participants were asked to identify supplements they had taken consistently over the prior 6 months. All analyses were adjusted for age, years since diagnosis, HY, and gender.

RESULTS

Food Choices

Food Item (Serving Size)	Estimate Change in PRO-PD Score (SD)	P-value (95% CI)
Fresh vegetables (1/2 cup)	-32 (7)	0.000 (-46, -19)
Non-fried fish (4 oz)	-24 (7)	0.002 (-39, -9)
Fresh fruit (1/2 cup)	-23 (7)	0.002 (-37, -8)
Olive oil (1 tsp)	-21 (6)	0.000 (-32, -10)
Nuts & seeds (1/4 cup or 2 Tbsp spread)	-20 (6)	0.002 (-32, -7)
Coconut oil (1 tsp)	-15 (5)	0.001 (-24, -5)
Turkey (4 oz)	-15 (15)	0.322 (-44, 15)
Spices (1/4 tsp)	-10 (5)	0.048 (-20, 3)
Fresh herbs (1 tsp)	-8 (5)	0.147 (-18, 3)
Legs (1 cup)	-6 (7)	0.389 (-21, 9)
Bread (1 slice)	-7 (6)	0.214 (-18, 4)
Wine (6 oz)	-6 (5)	0.175 (-15, -3)
Juice (8 oz)	-5 (5)	0.283 (-15, 4)
Protein fruit (1/2 cup)	-5 (5)	0.367 (-15, 5)
Beans (1/2 cup)	-4 (7)	0.605 (-18, 11)
Liquor (1 oz)	-2 (6)	0.787 (-14, 11)
Oatmeal (1 cup)	-1 (5)	0.880 (-11, 10)
Green tea (1 cup)	0 (6)	0.944 (-6, 10)
Eggs (1 egg)	0 (7)	0.979 (-15, 13)
Safflower oil (1 tsp)	2 (6)	0.787 (-18, 13)
Milk 1 cup (mammalian, e.g. cow)	3 (4)	0.489 (-5, 11)
Butter (1 tsp)	3 (5)	0.551 (-7, 13)
Pork (4 oz)	3 (7)	0.560 (-11, 17)
Coffee (8 oz)	5 (4)	0.209 (-5, 12)
Frozen vegetables (1/2 cup)	5 (6)	0.385 (-6, 16)
Tea (12 oz)	6 (7)	0.355 (-7, 19)
Cheese (1.5 oz)	7 (6)	0.334 (-6, 20)
Black tea (1 cup)	8 (5)	0.092 (-3, 17)
Eat food from a can	8 (7)	0.234 (-5, 21)
Beer (12 oz)	9 (6)	0.127 (-8, 32)
Legume (1/4 cup)	10 (6)	0.078 (-22)
Break from a plastic bottle	11 (5)	0.012 (-20, 30)
Ice cream (1/2 cup)	12 (6)	0.047 (0, 34)
Canned vegetables (1/2 cup)	12 (6)	0.036 (-1, 24)
Hot soda (12 oz)	13 (5)	0.012 (-3, 23)
Chicken (4 oz)	16 (9)	0.047 (-1, 31)
Pasta (1 cup)	16 (9)	0.039 (-1, 31)
Beef (4 oz)	18 (7)	0.008 (-5, 32)
Cheese 1 slice, 1/2 oz, 1 Tbsp	19 (6)	0.001 (-7, 30)
Canned fruit (1/2 cup)	19 (7)	0.004 (-6, 32)

Frequency Units

- Never
- <1 per month
- 1 per month
- 2-3x month
- 1 per week
- 2-4x week
- 5-6x week
- Once daily
- 2-4x day
- 4-6x day

Estimating Impact of Diet

PRO-PD Change Score $\times$
Frequency Units shifted

e.g. 1/2 oz. cheese 2-4 x per day vs. a similar individual that never eats cheese.

$8 \times 19 = +152$ additional points

Exercise

"On how many of the past 7 days did you do at least 30 minutes of exercise?"

Days per Week of Exercise	N=1072 (%)	Predicted Change in PRO-PD Score (SE)	P-value (95% CI)
0	67 (6.2%)	-	-
1	48 (4.5%)	-7 (73)	0.923 (-151, 137)
2	104 (9.7%)	-39 (60)	0.516 (-158, 79)
3	145 (13.5%)	-146 (57)	0.011 (-258, -34)
4	156 (14.6%)	-172 (56)	0.002 (-282, -62)
5	205 (19.1%)	-209 (55)	0.000 (-316, -101)
6	148 (13.8%)	-231 (56)	0.000 (-341, -122)
7	199 (18.6%)	-245 (54)	0.000 (-352, -138)

Does the Type of Exercise Matter?

Type of Exercise	N=1072 (%)	Predicted PRO-PD Impact Score (SE)	P-value (95% CI)
Silver Sneakers FLEX	11 (1.0%)	-304 (117)	0.009 (-533, -74)
Parkinson's Cycling Program	25 (2.3%)	-49 (28)	0.002 (-100, 30)
Tai chi	125 (10.9%)	-172 (140)	0.219 (-446, 102)
Other	562 (49%)	-109 (23)	0.000 (-155, 43)
Dance	118 (10.9%)	-48 (39)	0.214 (-125, 28)
Biking	279 (24.3%)	-37 (27)	0.175 (-91, 17)
Hiking	132 (11.5%)	-25 (36)	0.500 (-96, 47)
Swimming	128 (11.2%)	23 (37)	0.544 (-50, 95)
Walking	856 (74.6%)	-9 (28)	0.746 (-63, 45)

"Other" Exercise

Rowing
speedbagging, stretching
tabata mountain climbing and squats

Rowing
Parkinsons exercise class
Strength training, gyro-kinesis conducting (check it out!)

Exercise class for seniors
Rowing
pilates and stretching
tennis

elliptical trainer, weight machines
weight training, elliptical, treadmill
2 x 45 Min Parkinson exercise classes per wk
2 x 45 Min Parkinson exercise classes per wk
2 x 45 Min Parkinson exercise classes per wk
2 x 45 Min Parkinson exercise classes per wk
Middle age women's boot camp 2 x week
PMT - Parkinson Wellness Recovery program

Supplements

Nutritional Supplement	N=1148 (%)	Predicted Change in PRO-PD Score (SE)	P-value (95% CI)
Fish Oil	415 (36.2)	-77 (24)	0.002 (-125, -29)
CoQ10	323 (28.1)	-62 (26)	0.017 (-114, -11)
Vitamin D	679 (59.2)	-62 (24)	0.010 (-109, -15)
Coconut oil	213 (18.6)	-57 (30)	0.060 (-117, 2)
Turmeric/ curcumin	223 (19.4)	-46 (30)	0.118 (-104, 12)
Probiotics	277 (24.1)	-43 (27)	0.113 (-97, 10)
Calcium	349 (30.4)	-42 (26)	0.109 (-94, 10)
Vitamin C	351 (30.6)	-26 (26)	0.318 (-76, 25)
Multivitamin/ Mineral	365 (31.8)	-21 (25)	0.401 (-71, 28)
Vitamin B12	389 (33.9)	-9 (25)	0.705 (-58, 40)
Melatonin	164 (14.3)	81 (33)	0.014 (16, 146)
Melatonin, adjusted for insomnia		27 (28)	0.339 (-82, 82)
Iron (Fe)	60 (5.2)	123 (53)	0.020 (20, 226)

Pragmatic Results

After adjusting for age, income, Hoehn & Yahr, and gender, the mean score at diagnosis was 574, with an annual increase of 16 points per year.

The FFQ revealed an association between improved outcomes and intake of fresh vegetables, fruits, nuts & seeds, non-fried fish, olive and coconut oil. Canned fruits and vegetables, cheese, ice cream, beef, chicken, and pasta were associated with statistically worse outcomes over time.

There was a dose-dependent association between days per week of exercise and reduction in PRO-PD score over time, the benefit becoming statistically significant with three or more days per week. Of the activities listed, yoga was the most beneficial form of exercise. The data suggests individualized exercise programs may also be effective since "other" was also significant.

Supplements used by >10% of participants are listed here. After adjustments for age, income, HY, and gender, fish oil, coenzyme Q10, and vitamin D were the only three supplements found to be associated with fewer PD symptoms over time.

Iron and melatonin supplementation were associated with faster PD progression. Because poor sleep has been associated with PD progression, an exploratory analyses was performed to differentiate the impact of insomnia from melatonin, a common treatment for insomnia. The association with the melatonin went away after adjusting for insomnia.

CONCLUSIONS

The foods most protective against PD progression are staples of the Mediterranean diet. While previous studies have linked dairy and beef intake to PD incidence, this is the first study to demonstrate an association between dairy and beef intake and PD progression. Patients should be encouraged to exercise 30 minutes per day for maximum benefit. Whether yoga can be standardized and exploited to slow PD progression deserves further attention. Individuals reporting consistent supplementation with fish oil, coenzyme Q10, and vitamin D have improved outcomes in a naturalistic setting.

This pragmatic natural history study offers the first evidence base for prescribing a Mediterranean diet, daily exercise, and targeted nutritional supplementation to patients with PD.

ACKNOWLEDGEMENTS

National Institutes of Health NCCIH/ Bernard Osher K01 Career Transition Award, Noel Weiss, University of Washington School of Public Health, Department of Epidemiology, Fred Dowd.



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