Nutritional evaluation in Parkinson's disease patients: a cross-sectional study.

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Background: Poor nutritional status results in a lower quality of life in the elderly and age related neurodegenerative disease such as Parkinson's disease (PD), where neurologic and nutritional elements may interact affecting each other ¹.

Objective: The aim of this study was to identify different nutritional and dietetic patterns in PD with respect to controls and within PD subtypes (motor and cognitive).

Methods: In a University-Hospital setting, we performed a cross-sectional study recruiting patients with PD and controls matched by age and sex. Nutritional status was evaluated by anthropometry (Body Mass Index; calf, upper arm, waist and hip circumferences), Mini Nutritional Assessment (MNA), bioelectrical impedance analysis variables (fat mass, fat-free mass, muscle mass, total body water); macronutrients intake by nutritional anamnesis (lipid, protein and carbohydrate intake), level of physical activity and total daily energy expenditure were also collected, as well as gait speed at 6-m course and handgrip strength by dynamometer. Polypharmacoterapy, comorbidity quantified by modified Cumulative Illness Rating Scale, the presence of depression at Geriatric Depression Scale and the number of falls in the last 6 months were also investigated. Clinical assessment of PD patients provided the following variables: hystory of disease (age of onset, years of disease), motor subtypes (non tremor and tremor dominant), motor assessment by Unified Parkinson's Disease Rating Scale (UPDRS) part III and IV, non motor assessment by Non-Motor Symptoms Scale (NMSS), Quality of life by short form 8-item Parkinson's Disease Questionnaire (PDQ-8), PD progression index (H&Y/ time and UPDRS III / time), antiparkinsonian drugs, Levodopa Equivalente Dose (LED), adherence to protein-redistribution diet.

Table 1: Demographic, clinical, antrophometric, nutritional, dietetic characteristics and motor performances of cases and controls.

Demographic variables Age 72.4 (\pm 8.8) 72.4 (\pm 8.6) n.s. Sex - women, n (%) 30 (52.6%) n.s. Education (y) 10.2 (\pm 4.1) 11.8 (\pm 4.6) n.s. Clinical variables MMSE score 27.0 (\pm 2.6) 27.5 (\pm 3.3) n.s. Falls in the previous 6 months (n) 0.1 (\pm 0.4) 0.5 (\pm 1.2) 0.03 CIRS total score 0.7 (\pm 1.6) 0.8 (\pm 1.2) 0.003 Depression, n (%) 6 (10%) 16 (22%) 0.002 Use of antidepressant drugs, n (%) 3 (5.2%) 10 (17%) 0.004 Anthropometric variables BMI (kg/m²) 25.5 (\pm 4.2) 26.1 (\pm 4.5) n.s. Calf circumference (cm) 24.7 (\pm 10.5) 97.6 (\pm 13.5) n.s. Aust circumference (cm) 94.2 (\pm 10.5) 97.6 (\pm 13.5) n.s. Nutritional and dietetic variables 100.9 (\pm 7.4) 100.3 (\pm 8.4) n.s. Fat mass 19.5 (\pm 8.3) 19.3 (\pm 7.8) n.s. Total body water 33.3 (\pm 6.8) 35.7 (\pm 7.8) n		Controls	PD	P
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InperiodInstructional and dietetic variablesNutritional and dietetic variablesFat free mass19.5 (\pm 8.3)19.3 (\pm 7.8)n.s.Fat free mass47.3 (\pm 10.7)51.5 (\pm 10.7)n.s.Muscle mass45.4 (\pm 8.8)48.8 (\pm 10.2)n.s.Total body water33.3 (\pm 6.8)35.7 (\pm 7.8)n.s.Total Daily Energy Expenditure (Kcal)2756.3 (\pm 434.2)2635.7 (\pm 482.3)n.s.Mini Nutritional Assessment score24.3 (\pm 4.2)24.1 (\pm 2.9)n.s.Total food energy intake (Kcal)1863.9 (\pm 485.6)1885.1 (\pm 499.1)n.s.Protein intake (g/kg)1.0 (\pm 0.3)1.0 (\pm 0.2)n.s.% of animal proteins58.4 (\pm 10.3)60.4 (\pm 9.4)n.s.Animal / vegetable protein1.5 (\pm 0.6)1.7 (\pm 0.9)n.s.% lipid intake32.2 (\pm 5.7)31.8 (\pm 4.5)n.s.% monounsatured fats16.4 (\pm 3.8)16.2 (\pm 2.9)n.s.% carbohydrates18.9 (\pm 5.2)20.6 (\pm 6.4)n.s.Fiber intake (g)23.1.5 (\pm 96.8)213.7 (\pm 85.3)n.s.% of alcoholic beverages3.3 (\pm 4.8)2.7 (\pm 4.3)n.s.% det rintake (ml)1150.9 (\pm 46.7)1124.5 (\pm 523.5)n.s.% carbohydrates18.9 (\pm 5.2)20.6 (\pm 6.4)n.s.% bip intake (ml)1150.9 (\pm 46.4.7)1124.5 (\pm 523.5)n.s.% of alcoholic beverages3.3 (\pm 4.8)2.7 (\pm 4.3)n.s.Motor performance variabl	Hip circumference (cm)	100.9(+7.4)	$\frac{97.0(\pm 13.3)}{100.3(\pm 8.4)}$	n s
Total for difference variablesFat mass19.5 (\pm 8.3)19.3 (\pm 7.8)n.s.Fat free mass47.3 (\pm 10.7)51.5 (\pm 10.7)n.s.Muscle mass45.4 (\pm 8.8)48.8 (\pm 10.2)n.s.Total body water33.3 (\pm 6.8)35.7 (\pm 7.8)n.s.Total Daily Energy Expenditure (Kcal)2756.3 (\pm 434.2)2635.7 (\pm 482.3)n.s.Mini Nutritional Assessment score24.3 (\pm 4.2)24.1 (\pm 2.9)n.s.Total food energy intake (Kcal)1863.9 (\pm 485.6)1885.1 (\pm 499.1)n.s.Protein intake (g/kg)1.0 (\pm 0.3)1.0 (\pm 0.2)n.s.% of animal proteins58.4 (\pm 10.3)60.4 (\pm 9.4)n.s.% of vegetable protein1.5 (\pm 0.6)1.7 (\pm 0.9)n.s.% nonounsatured fats16.4 (\pm 3.8)16.2 (\pm 2.9)n.s.% monounsatured fats16.4 (\pm 3.8)16.2 (\pm 2.9)n.s.% cholesterol (mg)231.5 (\pm 96.8)213.7 (\pm 85.3)n.s.% cholesterol (mg)231.5 (\pm 96.8)213.7 (\pm 85.3)n.s.Fiber intake (g)23.4 (\pm 6.9)23.3 (\pm 7.3)n.s.% of alcoholic beverages3.3 (\pm 4.8)2.7 (\pm 4.3)n.s.% of alcoholic beverages3.3 (\pm 4.8)2.7 (\pm 4.3)n.s.% date (ml)1150.9 (\pm 64.7)1124.5 (\pm 523.5)n.s.% of alcoholic beverages3.3 (\pm 4.8)2.7 (\pm 4.3)n.s.Motor performance variablesLevel of physical activity1.5 (\pm 0.1)	Nutritional and dietetic variables		100.3 (± 0.4)	11.3.
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Nuscie mass $0.13 (\pm 10.1)$ $0.13 (\pm 10.1)$ $0.13 (\pm 10.1)$ Muscie mass $45.4 (\pm 8.8)$ $48.8 (\pm 10.2)$ n.s.Total body water $33.3 (\pm 6.8)$ $35.7 (\pm 7.8)$ n.s.Total Daily Energy Expenditure (Kcal) $2756.3 (\pm 434.2)$ $2635.7 (\pm 482.3)$ n.s.Mini Nutritional Assessment score $24.3 (\pm 4.2)$ $24.1 (\pm 2.9)$ n.s.Total food energy intake (Kcal) $1863.9 (\pm 485.6)$ $1885.1 (\pm 499.1)$ n.s.Protein intake (g/kg) $1.0 (\pm 0.3)$ $1.0 (\pm 0.2)$ n.s.% of animal proteins $58.4 (\pm 10.3)$ $60.4 (\pm 9.4)$ n.s.% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables 44.8 $2.7 (\pm 4.3)$ n.s.Level of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s)<	Fat free mass	$47.3 (\pm 0.3)$	<u> </u>	n.s.
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Total Daily Energy Expenditure (Kcal) $2756.3 (\pm 434.2)$ $2635.7 (\pm 482.3)$ n.s.Mini Nutritional Assessment score $24.3 (\pm 4.2)$ $24.1 (\pm 2.9)$ n.s.Total food energy intake (Kcal) $1863.9 (\pm 485.6)$ $1885.1 (\pm 499.1)$ n.s.Protein intake (g/kg) $1.0 (\pm 0.3)$ $1.0 (\pm 0.2)$ n.s.% of animal proteins $58.4 (\pm 10.3)$ $60.4 (\pm 9.4)$ n.s.% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.Fiber intake (ml) $1150.9 (\pm 464.7)$ $112.4 5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Level of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7.7)$ < 0.001 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7.7)$	Total body water	33.3 (± 6.8)	35.7 (± 7.8)	n.s.
Mini Nutritional Assessment score $24.3 (\pm 4.2)$ $24.1 (\pm 2.9)$ n.s.Total food energy intake (Kcal) $1863.9 (\pm 485.6)$ $1885.1 (\pm 499.1)$ n.s.Protein intake (g/kg) $1.0 (\pm 0.3)$ $1.0 (\pm 0.2)$ n.s.% of animal proteins $58.4 (\pm 10.3)$ $60.4 (\pm 9.4)$ n.s.% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	Total Daily Energy Expenditure (Kcal)	2756.3 (± 434.2)	2635.7 (± 482.3)	n.s.
Total food energy intake (Kcal) $1863.9 (\pm 485.6)$ $1885.1 (\pm 499.1)$ n.s.Protein intake (g/kg) $1.0 (\pm 0.3)$ $1.0 (\pm 0.2)$ n.s.% of animal proteins $58.4 (\pm 10.3)$ $60.4 (\pm 9.4)$ n.s.% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.1 (\pm 4.5)$ $12.7 (\pm 85.3)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Mini Nutritional Assessment score	24.3 (± 4.2)	24.1 (± 2.9)	n.s.
Protein intake (g/kg) $1.0 (\pm 0.3)$ $1.0 (\pm 0.2)$ n.s.% of animal proteins $58.4 (\pm 10.3)$ $60.4 (\pm 9.4)$ n.s.% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $234.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake / 1000 kcal $13.1 (\pm 4.5)$ $12.7 (\pm 4.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Total food energy intake (Kcal)	1863.9 (± 485.6)	1885.1 (± 499.1)	n.s.
% of animal proteins $58.4 (\pm 10.3)$ $60.4 (\pm 9.4)$ n.s.% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	Protein intake (g/kg)	1.0 (± 0.3)	1.0 (± 0.2)	n.s.
% of vegetable proteins $32.6 (\pm 10.3)$ $39.4 (\pm 10.2)$ n.s.Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.Cholesterol (mg) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables U U U U U Level of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	% of animal proteins	58.4 (± 10.3)	60.4 (± 9.4)	n.s.
Animal / vegetable protein $1.5 (\pm 0.6)$ $1.7 (\pm 0.9)$ n.s.% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.Cholesterol (mg) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake (g) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	% of vegetable proteins	32.6 (± 10.3)	39.4 (± 10.2)	n.s.
% lipid intake $32.2 (\pm 5.7)$ $31.8 (\pm 4.5)$ n.s.% monounsatured fats $16.4 (\pm 3.8)$ $16.2 (\pm 2.9)$ n.s.% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.Cholesterol (mg) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake / 1000 kcal $13.1 (\pm 4.5)$ $12.7 (\pm 4.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	Animal / vegetable protein	1.5 (± 0.6)	1.7 (± 0.9)	n.s.
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% polyunsatured fats $3.8 (\pm 1.2)$ $3.6 (\pm 1)$ n.s.Cholesterol (mg) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake / 1000 kcal $13.1 (\pm 4.5)$ $12.7 (\pm 4.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Level of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.003 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	% monounsatured fats	16.4 (± 3.8)	16.2 (± 2.9)	n.s.
Cholesterol (mg) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake / 1000 kcal $13.1 (\pm 4.5)$ $12.7 (\pm 4.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.001 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001	% polyunsatured fats	3.8 (± 1.2)	3.6 (± 1)	n.s.
Choresterol (mg) $231.5 (\pm 96.8)$ $213.7 (\pm 85.3)$ n.s.% carbohydrates $18.9 (\pm 5.2)$ $20.6 (\pm 6.4)$ n.s.Fiber intake (g) $23.4 (\pm 6.9)$ $23.3 (\pm 7.3)$ n.s.Fiber intake / 1000 kcal $13.1 (\pm 4.5)$ $12.7 (\pm 4.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variables $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Level of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Chalastaral (mm)			
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Fiber intake (g) $23.4 (\pm 0.9)$ $23.3 (\pm 7.3)$ fl.s.Fiber intake / 1000 kcal $13.1 (\pm 4.5)$ $12.7 (\pm 4.3)$ n.s.Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ n.s.% of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ n.s.Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Fiber intako (g)	$10.7 (\pm 0.2)$	<u> </u>	n.s.
Water intake (ml) $13.1 (\pm 4.3)$ $12.7 (\pm 4.3)$ $11.3.1 (\pm 4.3)$ Water intake (ml) $1150.9 (\pm 464.7)$ $1124.5 (\pm 523.5)$ $n.s.$ % of alcoholic beverages $3.3 (\pm 4.8)$ $2.7 (\pm 4.3)$ $n.s.$ Motor performance variablesLevel of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ $n.s.$ Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Fiber intake (g)	$\begin{array}{c c} 23.4 (\pm 0.7) \\ 13.1 (\pm 1.5) \end{array}$	$\begin{array}{c} 23.3 (\pm 1.3) \\ 17.7 (\pm 1.3) \end{array}$	n s
Nucce interve (m)1130.7 (\pm 404.7)1124.3 (\pm 323.3)11.3.% of alcoholic beverages3.3 (\pm 4.8)2.7 (\pm 4.3)n.s.Motor performance variablesLevel of physical activity1.5 (\pm 0.1)1.5 (\pm 0.2)0.007Handgrip strength(kg)26.1 (\pm 9)26.9 (\pm 8.6)n.s.Gait speed at 6-m course (m/s)6.5 (\pm 1.6)5.6 (\pm 2)0.03Steps at gait speed at 6-m course(n)11.0 (\pm 2.5)12.5 (\pm 7)< 0.001	Water intake (ml)	$1150 \ 0 \ (\pm 4.5)$	$12.7 (\pm 4.3)$ $1174 5 (\pm 573 5)$	n c
Motor performance variables $1.5 (\pm 0.1)$ $2.7 (\pm 4.5)$ $1.5.$ Level of physical activity $1.5 (\pm 0.1)$ $1.5 (\pm 0.2)$ 0.007 Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ $n.s.$ Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	% of alcoholic beverages	1130.7 (± 404.7) 3 3 (+ Δ 8)	77(+ 12)	n s
Level of physical activity 1.5 (± 0.1) 1.5 (± 0.2) 0.007 Handgrip strength(kg) 26.1 (± 9) 26.9 (± 8.6) n.s. Gait speed at 6-m course (m/s) 6.5 (± 1.6) 5.6 (± 2) 0.03 Steps at gait speed at 6-m course(n) 11.0 (± 2.5) 12.5 (± 7) < 0.001 Step width (m) 0.56 (± 0.1) 0.48 (± 0.1) < 0.001	Motor performance variables	J.J (<u>+</u> 7.0)		11.3.
Handgrip strength(kg) $26.1 (\pm 9)$ $26.9 (\pm 8.6)$ n.s.Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	level of physical activity	1 5 (+ 0 1)	15(+02)	0 007
Gait speed at 6-m course (m/s) $6.5 (\pm 1.6)$ $5.6 (\pm 2)$ 0.03 Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001 Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Handgrip strength(kg)	26,1 (+ 9)	76.9 (+ 8.6)	n.s
Steps at gait speed at 6-m course(n) $11.0 (\pm 2.5)$ $12.5 (\pm 7)$ < 0.001Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Gait speed at 6-m course (m/s)	6.5 (+ 1.6)	5.6 (+ 7)	0.03
Step width (m) $0.56 (\pm 0.1)$ $0.48 (\pm 0.1)$ < 0.001	Steps at gait speed at 6-m course(n)	11.0 (± 2.5)	12.5 (± 7)	< 0.001
	Step width (m)	0.56 (± 0.1)	0.48 (± 0.1)	< 0.001

Statistics: Data distribution was investigated by means of Kolmogorov-Smirnov (K-S) test to determine the appropriate use of parametric (K-S, $p \ge 0.05$) or non-parametric (K-S, p < 0.05) procedures; descriptive statistics were used for the characterization of the sample.

Differences in demographic, clinical, anthropometric, nutritional and dietetic features as weel as motor performance and strengh were explored between case and controls and within PD subtypes (motor and cognitive) by appropriate statistics. A Spearman correlation test was applied between nutritional and dietetic parameters and scores of clinical scales in PD.

Results: Our sample was composed by 114 people (60 women, 54 man): 39 healthy controls (HC), 18 affected by essential tremor (ET), 57 affected by PD.

HC and TE resulted similar in terms of demographic, nutritional and dietetic features, so they have been merged to form the control group. Demographic, clinical, antrophometric, nutritional and dietetic characteristic and motor performaces have been shown in table 1. Clinical characteristics of cases have been illustrated in table 2.

No significative differences emerged in nutritional assessment between case and controls. PD at risk of malnutrion (with MNA < 24) demostrated a significant higher burden of NMS (at NMSS) (81.6 \pm 40.0 vs. 51.3 \pm 29.7, p= 0.007) and a worse quality of life (at PDQ-8) (11.4 \pm 5.8 vs. 6.8 ± 4.7 , p= 0.003); even MNA scores resulted inversely related to NMSS (Rs = 0.322, p=0.017) and PDQ-8 scores. (Rs= 0.396, p=0.001),

Within PD, rigid-akinetic subtype resulted more frequently at risk of malnutrition with respect to tremorigen subtype (MNA < 24: 19 vs. 6; MNA \geq 24: 14 vs.18, p= 0.015).

PD with a MMSE score < 26 consumed more animal derived protein with respect of PD with a MMSE \geq 26 (62.3 ± 9.4 vs. 58.1 ± 10.1 p = 0.001).

An inverse correlation resulted between dairy products (Rs -0.384, p<0.001) as well as meat (Rs -0.371, p<0.001) consumption and cognitive performance at MMSE, whereas no correlation emerged between egg or fish consumption and MMSE scores.

PD with a slower progression of disease (HY/t and UPRDSIII/t) showed a higher intake of monoinsatured fats in their diet (Rs =-0.297, p=0.03 and Rs = - 0.284, p= 0.03 respectively) and in particular with olive oil (R -0.334, p < 0.001 and R -0.313, p< 0.001 respectively).

Conclusion: To our knowledge, this is the first study showing a possible role of olive oil in delaying the progression of PD; furthermore, a worse cognitive status in PD resulted correlated to the consumption of dairy products and meat. Our findings, which should be verified with a longitudinal study, set the basis to support a targeted nutritional intervention in PD patients.

Table 2: Clinical characteristics of cases

	N		%		
Subtypes					
Non tremor dominant	33		57.9		
Tremor dominant	24	1	42	2.1	
Antiparkinsonian drugs					
Levodopa users	49		85.9		
Dopamine agonists users	31		54.4		
Protein-redistribution diet	13		22.8		
	Mean	SD	Min	Мах	
Hystory of PD					
Age of onset	65.3	8.8	47	87	
Years of disease	7	4.3	1	19	
PD progression index					
H&Y/ time	0.32	0.28	0.05	1.5	
UPDRS III / time	3.77	3.0	0.05	1.5	
Motor scales					
UPDRS III	18	11.3	1	52	
UPDRS III - hypertonus	3.2	2.6	0	11	
UPDRS IV - dyskinesias	0.6	1.2	0	5	
UPDRS IV - fluctuations	0.6	0.8	0	4	
UPDRS IV - dystonia	0.1	0.3	0	1	
Non motor scale					
NMSS	64	37.2	1	178	
Quality of life					
PDQ8	8.8	5.7	0	22	
IFDD	502 6	374 9	0	1230	





1. Barichella M, Cereda E, Pezzoli G. Major nutritional issues in the management of Parkinson's disease. Mov Disord. 2009;24: 1881-1892. doi:10.1002/mds.22705