Environmental Factors and Parkinson's Disease: A Case-Control Study in Belgrade, Serbia

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ABSTRACT

Objective: A case-control study was performed in Belgrade in order to investigate the association between Parkinson's disease (PD) and some environmental factors.
Methods: During the period 2001–2005, 110 new PD cases and 220 hospital controls were interviewed. Cases and controls were matched by sex, age (±2 years), and place of residence (urban/rural).
Results: According to multivariate conditional logistic regression analysis, PD was positively asssociated with exposure to insecticides (odds ratio (OR) 3.22, 95% confidence interval (95% CI) 1.32–7.87), dyes (OR 25.33; 95% CI, 2.89–222.0), and naphtha and its derivates (OR 9.53; 95% CI, 1.04–86.96), and with gardening (OR 5.51; 95% CI, 3.04–10.01), well water drinking (OR 2.62; 95% CI, 1.40–4.90), and spring water drinking (OR 2.19; 95% CI, 1.15–4.16). Negative association was found for service-sector working (OR 0.15; 95% CI, 0.04–0.59). The results obtained did not changed after adjustment for smoking
Conclusion: The findings of the present study support the role of environmental factors in the occurence of PD.

METHODS

Case-control study was conducted in Belgrade from January 2001 to November 2005. Case group comprised 110 subjects diagnosed for the first time as PD cases at the Institute of Neurology, School of Medicine, Belgrade University. Diagnosis was made by a neurologist and was based on the presence of at least two cardinal signs plus unequivocal response to L-Dopa: Unified PD Rating Scale (Fahn & the members of the UPDRS Development Committee, 1987). For each case, two controls were chosen among patients with degenerative joint disease (spondylosis, arthrosis and discus herniae) and some diseases of the digestive tract like cholelitiasis, haernia umbilicalis or inguinalis, pancreatitis chronica, echinocuccus hepatis and fistula rectovaginalis, which were treated at the University Clinical Center, Belgrade. Cases and controls were matched by sex, age (±2 years) and place of residence (urban/rural). PD and other patients were invited to participate in the study and none of them refused participation. The Institutional Ethics Committee approved this study. All participants were interviewed by the use of a structured questionnaire. Data were collected on demographic characteristics, occupational exposure to various factors, habits, diet, stressful life events, and personal and family histories. In the present paper, only data on occupation, occupational and residential exposure to pesticides, occupational exposure to various metals and chemicals, rural living, farming, and well and spring water drinking are presented. For the analysis of data, $\chi 2$ test, Fisher's exact test, and conditional univariate and multivariate logistic regression methods were used.

RESULTS

TABLE 1 Demographic characteristics of PD cases and their controls

Variable	Number of cases	Number of controls	*p* value[a]
Sex			
Male	63 (57.3%)	126 (57.3%)	
Female	47 (42.7%)	94 (42.7%)	Matched
Age			
<50	8 (7.3%)	20 (9.1%)	
50–59	48 (43.6%)	92 (41.8%)	
60–69	35 (31.8%)	71 (32.3%)	
≥70	19 (17.4%)	37 (16.8%)	Matched
Place of residence			
Urban	73 (66.4%)	146 (66.4%)	
Rural	37 (33.6%)	74 (33.6%)	Matched
Rural living (any time during life)	94 (85.5%)	137 (62.3%)	< 0.001
Nationality			
Serbian	104 (94.5%)	204 (92.7%)	
Other	6 (5.5%)	16 (7.3%)	.773
Marital status			
Single	4 (3.6%)	6 (2.7%)	
Married	91 (82.7%)	170 (77.3%)	
Divorced	4 (3.6%)	14 (6.4%)	
Widowed	11 (10.0%)	30 (13.6%)	.273
Education			
Incomplete primary	19 (17.2%)	34 (15.4%)	
Primary	27 (24.5%)	53 (24.1%)	
Secondary	38 (34.6%)	90 (40.9%)	
Higher	26 (23.6%)	43 (19.5%)	.961
Occupation[b]			
Agricultural worker	17 (15.4%)	27 (12.3%)	.424
Industrial worker	22 (20.0%)	51 (23.2%)	.512
Service-sector worker	4 (3.6%)	36 (16.4%)	.002
Administrative worker	16 (14.5%)	22 (10.0%)	.225
Professional	8 (7.3%)	8 (3.6%)	.155
Housewife	15 (13.6%)	21 (9.5%)	.263
Other	28 (25.4%)	x55 (25.0%)	.928

[a]According to univariate logistic regression analysis.
[b]Each occupation was compared with all others taken together.

TABLE 2 Environmental exposure and its duration in PD cases and their controls

Variable	Cases No. (%)	Controls No. (%)	*p* value
Type of occupational agriculture work[a]:			
Cattle farming	27 (24.5)	17 (7.7)	< 0.001[b]
Fruit farming	22 (20.0)	14 (6.4)	< 0.001[b]
Vegetable farming	26 (23.6)	21 (9.5)	0.001[b]
Crop farming	20 (18.2)	23 (10.5)	0.052[b]
Other plants farming	4 (3.6)	3 (1.4)	0.194[b]
Duration of any occupational agriculture work			
Years: < 20	2 (7.4)	1 (2.9)	
20–39	12 (44.4)	9 (26.5)	
≥ 40	13 (48.1)	24 (70.6)	0.224[c]
Type of non-occupational agricultural work at any time during life:			
Crop farming	52 (47.3)	54 (24.5)	< 0.001[b]
Years: ≥ 20 years	28 (53.8)	39 (72.2)	0.049[c]
Gardening	72 (65.5)	38 (17.3)	< 0.001[b]
Years: ≥ 20 years	43 (57.7)	30 (78.9)	0.042[c]
Cattle farming	43 (39.1)	65 (29.5)	0.082[b]
Years: ≥ 20 years	20 (46.5)	45 (69.2)	0.018[c]
Exposure to pesticides:			
Any	27 (24.5)	19 (8.6)	0.001[b]
Insecticides	27 (24.5)	11 (5.0)	< 0.001[b]
Years: < 10	4 (14.8)	2 (18.2)	
10–29	14 (51.8)	4 (36.4)	
≥ 30	9 (33.3)	5 (45.4)	0.630[c]
Herbicides	12 (10.9)	14 (6.4)	0.153[b]
Years: < 10	2 (16.7)	3 (21.4)	
10–29	6 (50.0)	8 (57.1)	
≥ 30	4 (33.3)	3 (21.4)0.876[c]	
Phungicides	3 (2.7)	3 (1.4)	0.391[b]
Years: ≥ 10	2 (66.7)	2 (66.7)	1.00[c]
Well water drinking (ever)	76 (69.1)	102 (46.4)	< 0.001[b]
Years: ≤ 10	10 (13.2)	14 (13.7)	
11–39	47 (61.8)	64 (62.7)	
≥ 40	19 (25.0)	24 (23.5)	0.973[c]
Spring water drinking (ever)	47 (42.7)	57 (25.9)	0.002[b]
Years: ≤ 10	10 (21.3)	8 (14.0)	
11–39	28 (59.6)	34 (59.6)	
≥ 40	9 (19.1)	15 (26.3)	0.508[c]

[a]Some women who declared themselves as housewifes, actually acted as agricultural workers.
[b]According to univariate logistic regression analysis.
[c]According to χ^2 test or Fisher's exact test.

TABLE 3 Occupational exposure of PD cases and their controls to various chemicals and metals[a]

Variable	Cases No. (%)	Controls No. (%)	*p* value[b]
Dyes	17 (15.4)	–	< 0.001
Lacquers	15 (13.6)	–	< 0.001
Organic dissolvents	9 (8.2)	1 (0.4)	0.005
Mineral oils	4 (3.6)	–	0.060
Naphtha and its derivates	13 (11.8)	1 (0.4)	0.001
Carbon monoxide	5 (4.5)	–	0.033
Aluminium	3 (2.7)	1 (0.4)	0.225
Copper	6 (5.4)	–	0.020
Nickel	3 (2.7)	–	0.118
Iron	8 (7.3)	1 (0.4)	0.008
Zinc	6 (5.4)	–	0.020
Lead	9 (8.2)	–	0.005
Coal dust	4 (3.6)	–	0.060
Asbestos	6 (5.4)	1 (0.4)	0.026

[a]Duration of exposure to listed chemicals and metals was ≥ 20 years in all cases and controls with the exception of naphta and its derivates, iron and lead to which 84.6%, 75.0% and 88.9% of cases recpectively were exposed ≥ 20 years.
[b]According to univariate logistic regression analysis.
None of cases and controls were exposed to carbone disulphide, cyanide, manganese, amalgam and molybdenum.

TABLE 4 Risk factors for PD according to multivariate logistic regression analysis

Variable	OR	95% CIs
Gardening (ever)	5.51	3.04–10.01
Exposure to insecticides (occupational and residential)	3.22	1.32–7.87
Occupational exposure to dyes	25.33	2.89–222.0
Occupational exposure to naphtha and its derivates	9.53	1.04–86.96
Well water drinking (ever)	2.62	1.40–4.90
Spring water drinking (ever)	2.19	1.15–4.16
Service-sector worker	0.15	0.04–0.59

CONCLUSIONS

The results obtained are in line with hypothesis that some pesticides and nonmetallic toxins may increase risk for PD, and that some other occupational exposures (gardening and sector-service working) and environmental exposures (well and spring water drinking) may be related to PD occurrence.