ORIGINAL RESEARCH

Do physical exercise and reading reduce the risk of Parkinson's disease? a cross-sectional study on factors associated with Parkinson's disease in elderly Chinese veterans

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Background: The purpose of this study was to investigate risk factors for and factors protecting against Parkinson's disease (PD) in elderly Chinese veterans.

Methods: Using a database containing detailed information on the health status of the nervous system in elderly Chinese veterans, univariate and multivariate analyses of factors that may be associated with PD were performed. Univariate analysis of qualitative data was done using the Pearson Chi-square and Fisher's exact tests, and the Mann–Whitney U nonparametric test was used for univariate analysis of quantitative data. Multivariate logistic regression analysis was used to identify independent risk factors for and factors protecting against PD in elderly Chinese veterans.

Results: A total of 9,676 elderly Chinese veterans were enrolled, including 228 cases with PD and 183 cases with Parkinson's syndrome, with 9,265 non-PD subjects serving as controls. Age (odds ratio [OR] 1.343, 95% confidence interval [CI] 1.028–1.755) and medical history of essential tremor (OR 1.228, 95% CI 1.081–1.396) were identified as independent risk factors for PD, with age being the most important risk factor. Physical exercise (OR 0.478, 95% CI 0.355–0.643) and reading (OR 0.513, 95% CI 0.357–0.735) were identified as independent factors protecting against PD, and physical exercise showed better protection against PD relative to reading. Smoking, alcohol use, anemia, cerebral trauma, education level, and electromagnetic field exposure showed no association with PD.

Conclusion: Physical exercise and reading may be independent factors that protect against PD among elderly Chinese veterans, while advancing age and medical history of essential tremor may be independent risk factors for PD. This study was cross-sectional, so further research is needed to confirm its results.

Keywords: Chinese veterans, Parkinson's disease, physical exercise, reading, age, medical history, essential tremor

Introduction

Parkinson's disease (PD) is a common degenerative disease of the central nervous system in the middle-aged and elderly population, and ranks second only to Alzheimer's disease. PD has been found to be associated with multiple factors; however, the exact associations between PD and many factors, such as education level, electromagnetic field exposure, and cerebral trauma remain controversial. Potential risk factors for PD have been extensively investigated, including smoking,[1–5] drinking coffee,[6–8] use of insecticides,[9,10] exposure to heavy metals,[11,12] administration of certain drugs,[13,14] occupation,[15,16] and cerebral trauma.[17–19] Until now, there have been few studies from

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the People's Republic of China reporting factors associated with PD, with most being case-control studies and none being large-scale, cross-sectional surveys or prospective cohort studies. In addition, the majority of epidemiological surveys on PD reported for the People's Republic of China have focused mainly on the prevalence and incidence of the disease,[20–23] with only a minority investigating its etiology. In recent years, studies examining risk factors for PD have concentrated mainly on the mutant loci of certain genes,[24,25] while few large-scale epidemiological surveys have evaluated the relationship between sociodemographic factors, disease factors, and PD in the People's Republic of China. Studies done to identify factors associated with PD in special populations, eg, elderly Chinese veterans, are rare. A cross-sectional study in Urumqi city and the Yili region (in Xinjiang autonomous region) revealed that eating barbequed food may be a risk factor of PD, while drinking tea and dietary diversity may protect against PD.[26,27] Further, the prevalence of PD was found not to be associated with age, but was significantly associated with level of education, in a cross-sectional study of veterans in the Shijiazhuang region.[28] To identify risk factors for and factors protecting against PD in elderly Chinese veterans, we conducted a cross-sectional study in this age group and established a database.[29] We investigated the risk factors for and factors protecting against PD based on information concerning the health status of the nervous system in elderly Chinese veterans contained in the database, so as to be able to provide an evidence-based strategy for the prevention and control of PD in elderly Chinese veterans.

Patients and methods

Epidemiological data pertaining to PD were extracted from a database containing data on the health status of the nervous system for elderly Chinese veterans.[29] The clinical diagnosis of PD or other parkinsonism was made by a neurology panel comprising the heads of the participating institutions, based on disease history and physical and ancillary examinations. Diagnosis of PD was made according to the diagnostic criteria of the UK Parkinson's Disease Society Brain Bank.[30] Univariate analysis of qualitative data was done using the Pearson Chi-square and Fisher's exact tests, and the Mann–Whitney *U* nonparametric test was used for univariate analysis of quantitative data. A logistic regression model was used with multivariate analysis, and odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. All statistical analyses were performed using Statistical Package for the Social Sciences version 18.0 software (SPSS Inc, Chicago, IL, USA).

Results

In this population-based case-control study, 9,676 elderly Chinese veterans were recruited, including 228 cases with PD, 183 cases with Parkinson's syndrome, and 9,265 subjects without PD who served as controls; 183 ineligible cases with Parkinson's syndrome were excluded. There were no significant differences detected in sex, ethnicity, education level, or marital status between the PD and control groups, but there was a significant difference in mean age (see Table 1). All factors potentially associated with development of PD were included in the univariate analysis, and a total of 17 factors were identified (Table 2). The factors screened above and those unrelated to PD revealed by univariate analysis but receiving much attention (including educational level, electromagnetic field exposure, and cerebral trauma), were included in the multivariate logistic regression analysis to examine their associations with PD, and four independent factors were found to correlate with PD. Our findings showed that age (OR 1.343, 95% CI 1.028–1.755) and a medical history of essential tremor (OR 1.228, 95% CI 1.081–1.396) were independent risk factors of PD, and physical exercise (OR 0.478, 95% CI 0.355–0.643) and reading (OR 0.513, 95% CI 0.357–0.735) were independent factors protecting against PD (Table 3). Smoking, alcohol use, anemia, cerebral trauma, education level, and history and duration of electromagnetic field exposure showed no association with PD.

Discussion

Many factors are reported to contribute to the development of PD, but different results are reported by various epidemiological studies. In the current study, two independent risk factors (age and medical history of essential tremor) and two factors protecting against PD (physical exercise and reading) were identified. Multiple studies have demonstrated that age[20,22,31,32] and a history of essential tremor[33–36] are independent risk factors for PD. Our present findings contribute new evidence to support age and medical history of essential tremor as independent risk factors for PD.

Our findings show that the best protection against PD is afforded by physical exercise. In this study, optimal physical exercise involved exercising for more than 2 hours per day, in particular walking, jogging, dancing, swimming, playing ping pong, and performing Tai-Chi. There are no strict restrictions regarding the form of physical exercise. The proportion of subjects exercising for over 2 hours daily was significantly ($P<0.001$) higher in the control group (83.1%) when compared with the PD group (69.3%). This finding is in agreement with the results from three previous

Table 1 Comparison of demographic features between elderly Chinese veterans with and without PD

	Control group		PD group		Total		χ^2/Fisher's exact test	P-value
	n	%	n	%	n	%		
Sex							1.682	0.195
Male	8,696	95.59	222	97.37	8,918	95.64		
Female	401	4.41	6	2.63	407	4.36		
Race							7.11	0.175
Han	8,868	97.74	220	96.49	9,088	97.71		
Other race	205	2.26	8	3.51	213	2.29		
Age (years)							10.19	0.015
<70	120	1.33	0	0.00	120	1.30		
70–79	2,477	27.53	47	20.89	2,524	27.37		
80–89	6,118	68.00	167	74.22	6,285	68.15		
≥90	282	3.13	11	4.89	293	3.18		
Education level (years)							3.32	0.19
<7	3,684	40.21	88	38.60	3,772	40.17		
7–12	3,982	43.46	111	48.68	4,093	43.59		
>12	1,496	16.33	29	12.72	1,525	16.24		
Marital status							0.879	0.961
Never married	36	0.40	1	0.44	37	0.40		
Married, living with spouse	7,484	82.81	190	83.33	7,674	82.82		
Married, not living with spouse	94	1.04	3	1.32	97	1.05		
Divorced	23	0.25	0	0	23	0.25		
Death of spouse	1,106	12.24	29	12.72	1,135	12.25		
Remarried	266	2.94	5	2.19	271	2.92		
Unknown	29	0.32	0	0	29	0.31		

Notes: Sex missing for case 168; race missing case for 192; age missing for case 271; education missing case for 103; marital status missing for case 227.
Abbreviation: PD, Parkinson's disease.

large-scale cohort studies reporting that moderate-intensity and high-intensity physical exercise can markedly decrease the risk of PD.[37–39] Retrospective analyses showed a comparable efficacy of physical exercise to smoking and coffee drinking in reducing the risk of PD,[40,41] although the underlying mechanisms may be different. It has been reported that physical exercise may exert its protective effect by promoting nerve cell regeneration[42–44] and improving neural cell plasticity;[45,46] however, further studies are required to clarify the exact mechanisms. It has been demonstrated that

Table 2 Results of univariate analyses and screened the factors related to PD

Factors	Control group	PD group	χ^2/Fisher's exact test	P-value
Age, years	81.97	82.85	10.188	0.015
Physical exercise	83.1%	69.3%	29.800	<0.001
Mean duration of daily exercises	14.5%	8.5%	15.149	0.001
Reading	90.3%	80.7%	19.729	<0.001
Take part in social activities	37.4%	25.9%	13.674	0.001
Keep small animals like fish or birds	17.1%	10.1%	8.367	0.015
Watch television, listen to broadcasts	93.2%	88.2%	8.265	0.015
History of alcohol consumption	45.4%	47.8%	10.832	0.026
History of hypotension	3.2%	6.2%	7.243	0.027
History of essential tremor	1.3%	7.5%	39.167	<0.001
History of depression	1.3%	4.4%	10.781	0.003
History of anemia	3.7%	7.5%	7.261	0.024
Family history of dementia	1.3%	2.7%	10.886	0.024
Family history of PD	0.3%	2.2%	26.022	<0.001
Family history of essential tremor	0.3%	0.9%	9.941	0.034
History of migraine	4.3%	6.6%	8.564	0.012
History of coronary artery disease	68.9%	76.8%	6.608	0.031

Notes: Age, 50th percentile; mean daily exercise duration, over 2 hours daily as a standard.
Abbreviation: PD, Parkinson's disease.

Table 3 Results of multivariate logistic regression analysis

Factors	B	SE	Wald	P-value	OR	95% CI
Physical examination	−0.738	0.152	23.686	<0.001	0.478	0.355–0.643
History of essential tremor	0.206	0.065	9.973	0.002	1.228	1.081–1.396
Reading	−0.668	0.184	13.194	<0.001	0.513	0.357–0.735
Age	0.295	0.136	4.679	0.031	1.343	1.028–1.755
Constant	−2.975	0.61	23.711	<0.001	0.051	–

Abbreviations: CI, confidence interval; OR, odds ratio; SE, standard error.

physical exercise can improve the motor symptoms of PD, and cycling[47] and Tai Chi exercise[48] have been shown to improve gait disorders and disequilibrium in patients with PD, underscoring the ability of physical exercise to protect against PD. In addition, the intensity of physical exercise has been shown to correlate strongly with occupation, and occupations involving high-intensity physical exercise have been demonstrated to reduce the risk of PD.[15] However, although there is now good evidence showing that physical exercise can reduce the risk of PD, there is no direct evidence that physical exercise can slow the progression of the disease, which is supported by the results from a few clinical trials.

Reading is an intellectual activity, and most of the previous studies have focused on the cognitive domain. Reading is reported to improve cognition and to reduce the risk of dementia.[49–51] Reading level has recently been identified as a reliable predictor of executive and cognitive function, and is considered to be a good method for measuring cognitive reserve.[52] There are a few studies reporting a correlation between reading and PD, but there is no previous research identifying reading as an independent factor protecting against PD. In our study, reading included books and newspapers, and there was no specific time limit for this habit/hobby. Our findings show that reading is an independent factor protecting against PD, and a significantly greater amount of reading was observed in the control group (90.3%) when compared with the PD group (80.7%; P<0.001). Although further studies are required to investigate the mechanism for this, the finding that reading is an independent factor protecting against PD provides a potential, simple, and easy-to-use method for prevention of PD. Generally, reading habits are associated with educational level. Our observations show reading to be an independent factor protecting against PD, but no correlation between education level and PD was detected. The relationship between educational level and PD remains controversial. Education level has been reported not to correlate with the risk of PD,[53] but Frigerio et al[15] reported that higher education increased the risk of PD, and suggested that this might be due to subjects with higher education participating in less physical activity. Our findings support the conclusion reached by Rocca et al[53] but further studies are needed to investigate the exact relationship between education and PD.

It has been shown that electromagnetic field exposure may correlate with PD,[54] but our findings do not support this relationship. In our study, neither electromagnetic field exposure nor its duration correlated with development of PD, which is consistent with the results of most previous studies.[55,56] Further, we found that smoking, alcohol use, anemia, hypotension, depression, migraine, and coronary heart disease were not independent risk factors for PD.

To our knowledge, this study is the first large-scale survey of risk factors for and factors protecting against PD in elderly Chinese veterans in the People's Republic of China. Detailed clinical data and involvement of professional medical teams ensured the reliability and accuracy of the study results. Few studies have reported such detailed medical information on the health status of the nervous system in an elderly Chinese population in the People's Republic of China. Our findings identify two independent risk factors for and two factors protecting against the development of PD in elderly Chinese veterans, and to the authors' knowledge, this is the first study reporting reading as an independent factor protecting against PD in the People's Republic of China. Our findings are of value for the prevention and control of PD in elderly Chinese veterans.

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Disclosure

The authors report no conflicts of interest in this work.

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