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Disease-Related Variables and Depression Among Iranian Patients with Parkinson Disease

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Abstract

Background: The factors affecting the correlation between Parkinson disease (PD) and depression have remained unclear.
Objectives: We assessed the prevalence of depression among patients with PD and the association between PD-related variables and depression severity.
Patients and Methods: This is a cross-sectional study performed in Kermanshah Province of Iran. Sampling was based on recruitment of subjects according to inclusion and exclusion criteria. Patients with confirmed Parkinson disease who were referred to clinics of Kermanshah University of Medical Sciences participated in this study. Depression was evaluated with Beck Depression Inventory-II (BDI-II). Clinical characteristics of PD, including tremor, rigidity, impaired posture, loss of autonomic movement, changes in speech and handwriting, masked face, and hyposmia were indexed. Anhedonia was assessed with Farsi version of Snaith-Hamilton Pleasure Scale. Data were collected between April 2010 and March 2014.
Results: A total of 350 patients (52.9% men and 47.1% women) participated in this investigation. Female gender (36.5% in women vs. 13.0% in men, $P < 0.0001$), impaired posture (27.2% in affected individuals vs. 18.8%, $P = 0.002$), masked face (39.0% vs. 5.2%, $P < 0.0001$), and hyposmia (48.7% vs. 21.0%, $P = 0.001$) were associated with higher susceptibility to profound depression. Lower scores of all domains of Farsi version of Snaith-Hamilton Pleasure Scale (including interest/pastimes, social interaction, sensory experience, and food/drink) were related to more severe depression ($P < 0.0001$ for all subscales). Severe and profound depression was found in 44% of the participants.
Conclusions: This study estimated that the prevalence of major depression among Iranian individuals with PD living in Kermanshah as 44%. Major determinants of depression were female gender, rigidity, impaired posture, masked face, hyposmia, and anhedonia.

Keywords: Depression, Parkinson Disease, Prevalence, Anhedonia

1. Background

Parkinson disease (PD) is a neurodegenerative disease which its prevalence varies by location and ethnicity (1, 2). The correlation between depression and Parkinson disease has remained unclear among Iranian population. The roles of demographic and disease-related variables are not fully described in the association between depression and PD. Depression is highly prevalent among patients with Parkinson disease (3, 4) and has been demonstrated to reduce quality of life among affected individuals (5, 6). Factors like male gender (7), cognitive impairment (8), motor symptoms (left-sided onset tremor) (9), and impulsivity (10) are shown to be associated with higher risk of developing depression among patients with PD. Studies have demonstrated that the association between depression and Parkinson disease is not merely a reaction to chronic disease, but a consequence of the neurodegenerative process (11, 12). Therefore, multifactorial disease-related variables along with non-PD specific components may affect the prevalence of depression in Parkinson disease (13). The prevalence of depression and related variables has not yet been described among Iranian patients with PD living in Kermanshah Province.

Since depression disruptively affect quality of life among patients with PD, determination of its prevalence and appropriate treatment are essential. There is some evidence indicating that depression has been underdiagnosed and undertreated in patients with PD (14). Studies have shown that depression in PD is more commonly accompanied with somatic and cognitive symptoms (15, 16) which may contribute to complexity and underdiagnoses of depression among this population. Determination of predictive factors for depression may help clinicians to cautiously consider susceptible patients for treatment.

2. Objectives

In this investigation, the prevalence of depression and the effect of demographic and disease-related variables were assessed in patients with PD living in Kermanshah Province, Iran.

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3. Patients and Methods

3.1. Study Design and Participants

Patients with confirmed Parkinson disease who were referred to clinics of Kermanshah University of Medical Sciences were invited to participate in this cross-sectional study. Patients were interviewed by an expert psychologist and an assistant. Written consents were obtained from each individual before enrollment. Exclusion criteria were as follows: history of depression or other psychiatric disorders before onset of PD, existence of other chronic medical conditions, including cancer, endocrinology disease, coronary vascular disease, history of myocardial infarct, and spinal cord injury. Patients under treatment with special medications such as glucocorticoid, thyroid hormones, anticonvulsive drugs, heparin, lithium, blood glucose reducing agents, and atorvastatin were also excluded. Those with the history of smoking, alcohol, or drug abuse were excluded as well. Participation was voluntarily and patients were assured about the confidentiality of their information. During interviews, private locations were provided to respect patient privacy. The study was approved by the Ethics Committee of Kermanshah University of Medical Sciences. Data were collected between April 2010 and March 2014. To avoid judgment bias, all interviews were performed with one single observer who was an psychologist. Although an assistant was present at the interviews, the final judgements of subjective assessment of depression were indexed according to the psychologist's interpretations.

3.2. Demographics and Parkinson Disease-Related Variables

Patients' age, gender, educational level, daily medication treatment schedules were asked directly from each individual and indexed in prepared forms during interviews. PD-related variables, including tremor, rigidity, impaired posture, loss of autonomic movement, mask face, speech and writing changes, excessive salvia, and urinary urgency were examined by a neurologist and also indexed. Anhedonia was assessed with Snaith-Hamilton Pleasure Scale (17). This assessment tool has been validated in Farsi (18). The Farsi version of Snaith-Hamilton Pleasure Scale has 14 items and each of the items has a set of 5 response categories (definitely agree, agree, no idea, disagree, and strongly disagree) which are scored from 1 to 5. Higher scores indicate lower level of anhedonia. The items are as follows: 1) I would enjoy my favorite television or radio program, 2) I would enjoy being with family or close friends, 3) I would find pleasure in my hobbies and pastimes, 4) I would be able to enjoy my favorite meal, 5) I would enjoy a warm bath or refreshing shower, 6) I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread, 7) I would enjoy seeing other people's smiling faces, 8) I would enjoy looking smart when I have made an effort with my appearance, 9) I would enjoy reading a book, magazine, or newspaper, 10) I would enjoy a cup of tea or coffee or my favorite drink, 11) I would find pleasure in small things; e.g., bright sunny day, telephone call from a friend, 12) I would be able to enjoy a beautiful landscape or view, 13) I would get pleasure from helping others, and 14) I would feel pleasure when I receive praise from other people (18). These items cover 4 domains of hedonic experience: interest/pastimes, social interaction, sensory experience, and food/drink.

Studies have demonstrated that Snaith-Hamilton Pleasure Scale has an internal consistency of 0.91 which shows its validity and reliability to assess hedonic capacity (19).

3.3. Beck Depression Inventory-II (BDI-II)

Beck Depression Inventory-II consists of 21 items and the score ranges from 0 to 63. Higher scores indicate more severe depressive moods. Interpretations of the scores are as follows: 1 - 10, normal; 11 - 16, mild mood disturbance; 17 -2 0, borderline clinical depression; 21 - 30, moderate depressive mood; 31 - 40, severe depressive mood; and over 40, extreme depression (20). The Persian version of BDI-II has been shown to have acceptable internal consistency (Cronbach $\alpha = 0.87$) and test-retest reliability ($r = 0.74$) (21). BDI-II was checked to be a valid and reliable instrument to assess depression among patients with Parkinson disease (22).

3.4. Laboratory Measurements

Because a weak association between diabetes mellitus type 2 and depression has been reported, the history of diabetes in all patients were recorded and blood samples were taken to measure fasting plasma glucose (FPG). These samples were centrifuged at 3000 rpm for 10 minutes at 4°C.

3.5. Sample Size Estimation

Cochran's formula was used to estimate sample size. According to Sadeghirad et al. (23), the approximate prevalence of major depression in Iran is 4.1%. By considering the total population of Kermanshah which is about 2000000, the approximate number of major depression in Kermanshah is estimated to be 82000. Using Cochran's sample size formula with a margin of error of 5% and confidence interval of 95, a sample of 382 patients were required. The formula was as follows:

$$n = \frac{Z_{1-\frac{\alpha}{2}} \times P_{1-p}}{d^2} \quad (1)$$

Similar sample size was determined using Morgan's table. We interviewed 412 patients with PD and 62 subjects were excluded according to exclusion criteria. Finally, a total of 350 patients participated in this study which is close to estimated sample size.

3.6. Statistical Analysis

All statistical analysis was performed using SPSS software version 21 (IBM Corporation, USA). Categorical variables were described by numbers and percentages whereas continuous variables by mean and standard

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deviation. Comparison of means between groups was done by t test and 1-way analysis of variance (ANOVA). Chi-square test was used to compare categorical variables between groups. Kolmogorov-Smirnov test was used to evaluate normal distribution in continuous variable. $P < 0.05$ was considered statistically significant.

4. Results

A total of 412 patients selected based on inclusion criteria were interviewed and 62 subjects were excluded according to exclusion criteria. Finally, 350 patients (52.9% men and 47.1% women) participated in this investigation. Mean age of the study sample and mean age by the time of PD onset were 64.07 ± 5.08 and 58.46 ± 4.47 years, respectively. Only 30 patients (8.6%) had familial history of PD. The majority of patients were illiterate (n = 183, 52.3%) and only 4.6% of participants had higher education. Tremor was observed in 325 (92.9%) patients and rigidity was detected in 291 (83.1%) patients. Impaired posture, loss of autonomic movements, changes in speech and handwriting were found in 217 (62.0%), 256 (73.1%), 217 (62.0%), and 163 (46.6%) patients, respectively. Table 1 illustrates the baseline and PD-related characteristics of participants. Only 10.6% of the patients had hyposmia whereas other PD-related variables, including masked face, excessive salvia, and urinary urgency were detected in a higher proportion of patients (55.7%, 48%, and 41.1%, respectively). Anhedonia was assessed by Farsi version of Snaith-Hamilton Pleasure Scale, which determines hedonic tone in 4 domains. Obtained scores in each domain were as follows: interest/pastimes (7.89 ± 2.01), social interaction (14.0 ± 3.94), sensory experience (11.53 ± 3.39), food/drink (5.47 ± 1.93) (Table 1).

Female patients were significantly more susceptible to severe and profound depression ($P < 0.0001$). High school educational level and academic educations were related to higher incidence of profound depression ($P < 0.0001$), whereas 12.5% of illiterate patients and 14.3% of patients with primary educational level had normal mood. Patients with familial history of PD experienced more severe depression ($P = 0.019$). Surprisingly, 40% of patients without tremor had profound depression whereas only 22.7% of individuals with tremor suffered from profound depression ($P = 0.004$). However, since only 7.1% of patients did not demonstrate tremor as a PD clinical sign, results on tremor should be interpreted cautiously. Rigidity was also a determinant of increased risk of depression ($P < 0.0001$). Similarly, patients with impaired posture were more likely to have profound depression whereas those with intact posture most commonly experienced borderline clinical depression. Furthermore, changes in speech and handwritings were not determinants of depression ($P = 0.095$ and 0.062, respectively). Profound depression was detected among 40% of patients with masked face whereas only 5% of individuals without masked face showed profound depressive mood. This finding demonstrates that masked face is a significant determinant of depression among patients with PD ($P < 0.0001$). Hyposmia was also related to higher susceptibility to depression and 50% of patients with hyposmia experienced profound depression ($P = 0.001$) (Table 2).

Table 1. Baseline Characteristics and Parkinson Disease-Related Variables in the Iranian Participants With Parkinson Disease[a]

Item	Frequency (%)
Gender	
Male	185 (52.9)
Female	165 (47.1)
Age, y	64.07 ± 5.08 [b]
Educational level	
Illiterate	183 (52.3)
Primary school	56 (16.0)
Middle school	63 (18.0)
High school	26 (7.4)
Diploma	6 (1.7)
Academic educations	16 (4.6)
Age by onset of PD, y	58.46 ± 4.47 [b]
Family history of PD	
Yes	30 (8.6)
No	320 (91.4)
Medication used for PD	
Levodopa	177 (50.6)
Benserazide	46 (13.1)
Pramipexole	57 (16.3)
Selegiline	70 (20.0)
Tremor	
Yes	325 (92.9)
No	25 (7.1)
Rigidity	
Yes	291 (83.1)
No	59 (16.9)
Impaired posture	
Yes	217 (62.0)
No	133 (38.0)
Loss of autonomic movement	
Yes	256 (73.1)
No	94 (26.9)
Change of speech	
Yes	217 (62.0)
No	133 (38.0)
Change of handwriting	
Yes	163 (46.6)
No	187 (53.4)
Masked face	
Yes	195 (55.7)
No	155 (44.3)
Excessive salvia	
Yes	168 (48.0)
No	182 (52.0)
Hyposmia	
Yes	37 (10.6)
No	313 (89.4)
Urinary urgency	
Yes	144 (41.1)
No	206 (58.9)
Snaith-Hamilton Pleasure Scale (Farsi version)	
Interest/pastimes	7.89 ± 2.01 [b]
Social interaction	14.0 ± 3.94 [b]
Sensory experience	11.53 ± 3.39 [b]
Food/drink	5.47 ± 1.93 [b]

[a] Abbreviation: PD: Parkinson disease.
[b] Values are presented as mean ± SD.

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Table 2. Association Between Depression Severity (Assessed by Beck Depression Inventory-II) and Parkinson Disease-Related Variables in Iranian Population[a]

Item	Normal Mood	Mild Mood Disturbance	Borderline Clinical Depression	Moderate Depression	Severe Depression	Profound Depression	P Value[b]
Gender							< 0.0001[c]
Male	27 (14.6)	27 (14.6)	52 (28.1)	29 (15.7)	26 (14.0)	24 (13.0)	
Female	16 (9.6)	9 (5.4)	18 (11.0)	18 (11.0)	44 (26.6)	60 (36.4)	
Educational level							< 0.0001[c]
Illiterate	23 (12.5)	21 (11.5)	40 (21.9)	16 (8.7)	40 (21.9)	43 (23.5)	
Primary school	8 (14.3)	0 (0)	7 (12.5)	15 (26.8)	17 (30.3)	9 (16.1)	
Middle school	11 (17.5)	10 (15.9)	3 (4.7)	12 (19.0)	10 (15.9)	17 (27.0)	
High school	1 (3.9)	1 (3.8)	11 (42.3)	1 (3.8)	2 (7.7)	10 (38.5)	
Diploma	0 (0)	4 (66.6)	1 (16.7)	0 (0)	1 (16.7)	0 (0)	
Academic educations	0 (0)	0 (0)	8 (50.0)	3 (18.7)	0 (0)	5 (31.3)	
Family history of PD							0.019[d]
Yes	0 (0)	0 (0)	5 (16.7)	7 (23.3)	6 (20.0)	12 (40.0)	
No	43 (13.4)	36 (11.3)	65 (20.3)	40 (12.5)	64 (20.0)	72 (22.5)	
Medications for PD							0.051
Levodopa	20 (11.3)	25 (14.1)	23 (13.0)	24 (13.6)	35 (19.8)	50 (28.2)	
Benserazide	4 (8.7)	5 (11.0)	24 (52.1)	1 (2.2)	0 (0.0)	12 (26.0)	
Pramipexole	8 (14.0)	2 (3.5)	12 (21.1)	9 (15.8)	16 (28.1)	10 (17.5)	
Selegiline	11 (15.7)	4 (5.8)	11 (15.7)	13 (18.6)	19 (27.1)	12 (17.1)	
Tremor							0.004[c]
Yes	36 (11.1)	36 (11.1)	68 (21.0)	42 (12.9)	69 (21.2)	74 (22.7)	
No	7 (28.0)	0 (0)	2 (8.0)	5 (20.0)	1(4.0)	10 (40)	
Rigidity							< 0.0001[c]
Yes	29 (10.0)	30 (10.3)	50 (17.2)	43 (14.8)	67 (23.0)	72 (24.7)	
No	14 (23.8)	6 (10.2)	20 (33.9)	4 (6.8)	3 (5.0)	12 (20.3)	
Impaired posture							0.002[c]
Yes	26 (12.0)	22 (10.1)	31 (14.3)	38 (17.5)	41 (18.9)	59 (27.2)	
No	17 (12.8)	14 (10.5)	39 (29.3)	9 (6.8)	29 (21.8)	25 (18.8)	
Loss of autonomic movement							0.053
Yes	34 (13.3)	20 (7.8)	48 (18.7)	45 (17.6)	54 (21.1)	55 (21.5)	
No	9 (9.6)	16 (17.0)	22 (23.4)	2 (2.1)	16 (17.0)	29 (30.9)	
Changes of speech							0.095
Yes	25 (11.6)	20 (9.2)	37 (17.0)	37 (17.0)	46 (21.2)	52 (24.0)	
No	18 (13.6)	16 (12.0)	33 (24.8)	10 (7.5)	24 (18.0)	32 (24.1)	
Changes of handwriting							0.062
Yes	21 (12.9)	11 (6.7)	42 (25.8)	19 (11.6)	29 (17.8)	41 (25.1)	
No	22 (11.7)	25 (13.3)	28 (15.0)	28 (15.0)	41 (22.0)	43 (23.0)	
Mask face							< 0.0001[c]
Yes	13 (6.7)	16 (8.2)	30 (15.4)	26 (13.3)	34 (17.4)	76 (39.0)	
No	30 (19.3)	20 (13.0)	40 (25.8)	21 (13.5)	36 (23.2)	8 (5.2)	
Excessive salvia							0.055
Yes	20 (12.0)	16 (9.5)	26 (15.5)	14 (8.3)	48 (28.6)	44 (26.1)	
No	23 (12.8)	20 (11.0)	44 (24.1)	33 (18.1)	22 (12.0)	40 (22.0)	
Urinary urgency							0.082
Yes	25 (17.3)	18 (12.5)	24 (16.7)	24 (16.7)	28 (19.4)	25 (17.4)	
No	18 (8.7)	18 (8.7)	46 (22.3)	23 (11.2)	42 (20.4)	59 (28.7)	
Hyposmia							0.001[c]
Yes	2 (5.4)	0 (0)	10 (27.0)	2 (5.4)	5 (13.5)	18 (48.7)	
No	41 (13.1)	36 (11.5)	60 (19.2)	45 (14.4)	65 (20.8)	66 (21.0)	
Diabetes mellitus							< 0.0001[c]
Yes	5 (7.6)	17 (25.7)	10 (15.2)	7 (10.6)	18 (27.3)	9 (13.6)	
No	38 (13.4)	19 (6.7)	60 (21.1)	40 (14.1)	52 (18.3)	75 (26.4)	

[a] Abbreviation: PD: Parkinson disease.
[b] P values stand for Pearson Chi-square test between categorical variables.
[c] Significance at the level of $P < 0.01$.
[d] Significance at the level of $P < 0.05$.

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Table 3. The Association Between Obtained Scores in Snaith-Hamilton Pleasure Scale and Depression (Assessed by Beck Depression Inventory-II) in Iranian Patients With Parkinson Disease

Item	Normal Mood	Mild Mood Disturbance	Borderline Clinical Depression	Moderate Depression	Severe Depression	Profound Depression	P Value [a]
Age, y	64.72 ± 5.85	60.61 ± 5.15	64.27 ± 4.70	62.74 ± 4.61	64.47 ± 4.48	65.46 ± 4.95	< 0.0001 [b]
Social interaction	21.02 ± 1.94	17.36 ± 1.64	15.34 ± 2.16	12.68 ± 2.08	11.71 ± 1.91	10.51 ± 1.82	< 0.0001 [b]
Interest/pastimes	11.25 ± 1.92	8.52 ± 1.38	7.75 ± 1.10	7.17 ± 1.59	7.75 ± 1.38	6.54 ± 1.44	< 0.0001 [b]
Sensory experience	17.48 ± 1.43	14.55 ± 1.42	12.44 ± 1.44	11.74 ± 1.78	9.15± 1.61	8.29 ± 1.61	< 0.0001 [b]
Food/drink	8.58 ± 1.23	7.36 ± 1.04	5.92 ± 1.05	5.27 ± 1.01	4.44 ± 1.22	3.65 ± 0.88	< 0.0001 [b]
Fasting plasma glucose	118.67 ± 16.14	130.83 ± 37.82	117.37 ± 27.56	119.43 ± 22.06	120.83 ± 20.76	113.01 ± 13.00	0.007 [b]

[a] P values stand for 1-way analysis of variance (ANOVA) for comparison of means between groups.
[b] Significance at the level of P < 0.01.

Patients with diabetes mellitus type 2 (DM II) were more likely to have mild disturbed mood compared with those individuals without history of DM II (25.7% vs. 6.7%; P < 0.0001). Similarly, patients with mild disturbed mood had the highest mean value for FPG (P = 0.007).

Mean age of the patients with mild mood disturbance was low compared to other groups (P < 0.0001). Lower scores of all domains of Farsi version of Snaith-Hamilton Pleasure Scale were related to more severe depression (P < 0.0001 for all subscales) (Table 3).

Forty-three patients (12.3%) had normal mood; however, mild disturbance mood was detected in 36 (10.3%) patients; 70 (20.0%) patients experienced borderline clinical depression; and 47 (13.4%) patients had moderate depression. Severe and profound depression was detected in 70 (20.0%) and 84 (24.0%) patients. The overall estimation of prevalence of severe and profound depression among Iranian individuals with PD was 44%.

5. Discussion

Although the association between depression and Parkinson disease (PD) has been described (11, 12), the role of PD-related variables on the severity of depression is yet unclear. Previously, Chagas et al. (8) demonstrated that increased severity of PD is associated with higher susceptibility to depression. In the present study, we assessed PD-related variables, including clinical features to identify major determinants of depression among Iranian individuals with PD. Our results show that rigidity, impaired posture, masked face, and hyposmia are commonly related to more severe depression. Anhedonia assessed by Farsi version of Snaith-Hamilton Pleasure Scale was also a major determinant of depression.

Previously, Reijnders et al. (24) showed that prevalence of major depression among patients with PD is about 8.1%. However other investigations, including Chagas et al. (8) showed a much higher prevalence of depression (28.5%). Estimation of prevalence of depression in patients with PD varies among different populations according to study methodology, assessment tool, and community characteristics (24). Our estimation of depression prevalence among Iranian patients with PD in Kermanshah Province is about 44%. Using different assessment instrument to assess depression may also contribute to different estimations of depression prevalence in patients with PD. In this regard, Williams et al. (25) compared scales for detection of depression in patients with PD (Beck Depression Inventory-II, Center for Epidemiologic Studies Depression Rating Scale-Revised, 30-item Geriatric Depression Scale, Inventory of Depressive Symptoms-Patient, Patient Health Questionnaire-9, and Unified Parkinson Disease Rating Scale-Part I). Their results showed that all mentioned instruments, except for the Unified Parkinson Disease Rating Scale-Part I, were valid screening tools (25). However, it seems that proper comparison of depression among nations requires utilization of similar methods.

Our results demonstrated impaired posture as a determinant of depression. Among PD-related variables, Hassan et al. (26) showed that postural instability was correlated with depression among patients with PD which was in line with our findings. Furthermore, Letvinenko et al. (27) showed that back pain was correlated with the extent of posture disturbances. Since the relationship between pain and depression is also well-documented (27), we concluded that impaired posture increases the risk of depression through raising the level of pain.

According to recent NINDS recommendation (28), anhedonia is a specific component of depression in PD. Our study illustrates that anhedonia is significantly correlated with more severe depression among patients with PD which is consistent with NINDS recommendations (28). Similarly, the close relationship between anhedonia and depression has been reported in general population (29) and in adolescents with major depression disease (30). This evidence, in line with our study, supports the predictive value of anhedonia in determining depression. On the other hand, there is evidence demonstrating weak discriminating value of anhedonia compared to negative affect and apathy in determining depression in patients with PD (16, 31). In the present

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study, apathy was not assessed and further investigations are required to compare the discriminating value of apathy and anhedonia as determinants of depression in Iranian population with PD in Kermanshah. Anhedonia reflects deficits in the processes of reward valuation and motivation (32). Studies have shown that involvement of ventral striatum and prefrontal cortical regions may contribute to the development of anhedonia in depression (32). Deficits in dopamine generating cells in the substantia nigra of the brain are the underlying pathophysiology of PD. Further studies are required to determine whether coincidental involvement of ventral striatum and substantia nigra in PD results in anhedonia among affected individuals.

Our investigation showed that women with PD are more susceptible to major depression compared to men which is contrary to the results of Hsu et al. study (7). On the other hand, Becker et al. (33) reported that depression is more prominent among women with PD in the United Kingdom which supports our results. Since multifactorial components, including community characteristics should be considered when addressing depression based on gender distribution, further investigations with controlling social and environmental factors are required to clarify the role of gender in the incidence of depression among Iranian people with PD.

Some studies have demonstrated the association of depression with diabetes mellitus (34-37). However, Riederer et al. (38) showed the association between depression and diabetes mellitus (DM) is relatively week among patients with PD. Our study did not approve higher severity of depression in patients with coexistence of PD and diabetes. However, mild mood disturbance was more frequently observed among patients with DM. Similarly, highest mean of FPG was detected among patients with mild disturbance mood. These findings show that DM and FPG may not be direct determinant of depression in PD but they have predictive value in determining a specific subgroup of mild depressive mood.

This study determines the variables associated with depression severity in patients with PD. Identification of these variables can help give priorities to each patient based on their vulnerability to depression which is the strong point of this study. However, the weak point of this study is the lack of follow-up process. Therefore, patients could not be assessed with regard to changes in depressive mood through time.

In this study, the prevalence of depression among Iranian patients with PD in Kermanshah Province and the association between depression severity and PD-related variables were assessed. It is estimated that 44% of patients with PD suffer from severe and profound depression. Major determinants of depression were female gender, rigidity, impaired posture, masked face, hyposmia, and anhedonia.

This study identified the probable risk factors of depression among patients with Parkinson disease. However, the findings of this study should be approved by future cohort investigations.

Footnotes

Authors' Contributions: Jalal Shakeri contributed to study design, interpretation of data, and obtained the ethical approval. Seyed Davood Hoseini contributed to study design and intellectual editing of the first draft. Maryam Chaghazardi contributed to data collection and interpretation of data. Nasrin Abdoli contributed to data collection and manuscript writing. Farid Arman contributed to statistical analysis, interpretation of data, and editing the manuscript. Hania Shakeri contributed to statistical analysis, intellectual editing of the paper, and data collection.

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