Grit Predicts Lower Cognitive Fatigue in Persons with Parkinson's Disease Independent of Cognitive Status

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INTRODUCTION

- **Fatigue** is a common and debilitating non-motor symptom in persons with Parkinson's Disease (PD).
- Fatigue is associated with poorer cognition in PD. With an estimated 27-40% of the PD population diagnosed with mild cognitive impairment (MCI; Litvan et al., Baiano et al., 2020), identifying protective factors to prevent or ameliorate fatigue in PD is critical.
- **Grit** is a personality trait that is defined as perseverance and passion towards achieving long-term goals (APA Dictionary of Psychology).
- Higher levels of grit are associated with multiple positive outcomes in healthy populations, including lower fatigue (Martinez-Moreno et al., 2021) and better cognition (Satz et al, 2011).
- However, little is known about grit in PD and how grit may relate to fatigue, or the role of cognition in this relationship.
- The purpose of this study was to investigate the relationship between grit and fatigue, including cognitive and physical fatigue. This study also aimed to explore how cognitive status (i.e., normal cognition vs. mild cognitively impaired) and global cognition (i.e., MoCA total scores) affect this relationship in persons with PD.

PARTICIPANTS & METHODS

Table 1: Clinical Characteristics & Demographic Information (N = 70)

Variables	Mean (SD)
Age (years)	69.44 (± 7.42)
Education (years)	16.13 (±2.28)
Gender	Male: n= 52 Female: n= 18
Disease Duration (months)	66.63 (±4.01)
Levodopa Equivalent Dosage (mg/day)	715.92 (±493.42)
Montreal Cognitive Assessment (MoCA) [range 0-30]	25.11 (±2.97)
Geriatric Depression Scale (GDS) [range 0-30]	8.89 (±6.00)
Geriatric Anxiety Inventory (GAI) [range 0-20]	3.62 (±4.44)

Notes: 1) One participant was missing data on disease duration and GAI (n=69) 2) Levodopa Equivalent Dosages were calculated using *Turner J. Parkinson's Measurement Graph Levodopa Equivalent Plasma Levels.* 3) Patients with PD Dementia were excluded. 4) Participants were encouraged to test in their "on" state after taking PD medications.

- Participants were administered the following questionnaires:
  - ❑ **Modified Fatigue Impact Scale (MFIS):** 21 items grouped into 2 subscales: Physical (range 0-36) and Cognitive Fatigue (range 0-48) and aggregated into a Total Fatigue score (range 0-84); all items are on a Likert Scale from 0-4; **higher scores = more fatigue**.
  - ❑ **Grit Scale (GS):** 17 items divided into 3 subgroups: ambition, perseverance, and consistency of interests; all items are on a Likert Scale from 1-5, with 1 = "not at all like me" and 5 = "very much like me"; range 0-60; **higher scores = higher grit**.

Table 2: Means and standard deviations of MFIS and Grit Scale scores (N = 70).

Variables	Mean (SD)
MFIS Total Fatigue	36.49 (±15.82)
MFIS Cognitive Fatigue	15.69 (±8.07)
MFIS Physical Fatigue	20.80 (±9.22)
Grit Scale Total	42.70 (±6.28)

Cognitive Status

- ❑ Participants: 20 cognitively normal (CN) and 50 participants with MCI based on Level II of the Movement Disorder Society PD-MCI criteria.

Statistical Analysis

- ❑ Pearson/Point Biserial correlations were conducted between fatigue variables and clinical characteristics/demographics to determine relevant covariates ($p \leq .10$) for the regressions. Correlations were also conducted between grit, fatigue, and cognition
- ❑ 3 hierarchical regressions were conducted with significant covariates entered in block 1 and grit entered in block 2. Each fatigue variable was entered separately as the criterion. Covariates were removed by backward elimination if $p > .05$.
- ❑ Additional analyses were conducted to determine whether the association of grit and fatigue was mediated or moderated by cognition (status and MoCA).

RESULTS

Table 3: Pearson/Point Biserial Correlations between each fatigue domain and clinical characteristics.

Variable		Age	Education	Gender	GDS	GAI	Disease Duration	Levodopa Dosage	MoCA
Total Fatigue	*r*	-.13	**-.24**	-.06	**.56**	**.35**	**.38**	**.33**	**-.37**
	p	.301	**.041**	.635	**<.001**	**.003**	**.001**	**.005**	**.002**
Cognitive Fatigue	*r*	-.16	**-.21**	.01	**.59**	**.45**	**.29**	**.23**	**-.40**
	p	.186	**.076**	.929	**<.001**	**<.001**	**.015**	**.053**	**<.001**
Physical Fatigue	*r*	-.08	**-.23**	-.11	**.44**	**.21**	**.39**	**.37**	**-.29**
	p	.536	**.052**	.371	**<.001**	**.085**	**<.001**	**.002**	**.017**

Table 4: Final Regression Model with Total Fatigue as Criterion

Predictor	Standardized Beta	T	P-Value	Overall F-Statistic	R^2
GDS	.42	4.24	**<.001**	**F (4, 65) = 17.09**	.51
LED	.27	2.93	**.005**		
MoCA	-.235	-2.66	**.010**		
Grit	-.29	-2.97	**.004**	***p* < .001**	

Covariates excluded in the final model: GAI ($p = .987$), education ($p = .224$), disease duration ($p = .084$)

Table 5: Final Regression Model with Cognitive Fatigue as Criterion

Predictor	Standardized Beta	T	P-Value	Overall F-Statistic	R^2
GDS	.41	4.42	**<.001**	**F (3, 66) = 24.01**	.52
MoCA	-.27	-3.14	**.003**		
Grit	-.35	-3.51	**<.001**	***p* < .001**	

Covariates excluded in the final model : education ($p = .599$), LED ($p = .239$), GAI ($p = .154$), disease duration ($p = .083$)

Table 6: Final Regression Model with Physical Fatigue as Criterion

Predictor	Standardized Beta	T	P-Value	Overall F-Statistic	R^2
GDS	.33	3.00	**.004**	**F (3, 66) = 10.99**	.33
LED	.32	3.21	**.002**		
Grit	-.20	-1.85	.069	***p* < .001**	

Covariates excluded in the final model : GAI ($p = .314$), education ($p = .222$), MoCA total score ($p = .190$), disease duration ($p = .070$)

- There was no significant interaction between grit and cognitive status for total fatigue (p= .189) or cognitive fatigue (p= .175).
- There was no significant interaction between grit and MoCA total scores for total fatigue (p= .189) or cognitive fatigue (p= .119).
- There were no significant correlations between grit and cognitive status (p = .336) or MoCA total scores (p = .275); thus, mediation analyses were not conducted.

DISCUSSION

- Higher grit significantly predicted lower overall fatigue in persons with PD above and beyond demographics, PD characteristics, and mood symptoms, which is consistent with previous research in healthy individuals.
  - Specifically, higher levels of grit predicted lower cognitive fatigue, but not physical fatigue.
  - While one may argue that greater commitment of mental resources to a long-term goal should result in *more* cognitive fatigue, our results indicate that persons with PD who have *less* fatigue may be able to devote greater time and commitment to the pursuit of goals and tasks.
  - Greater depressive symptoms and higher levels of LED were also related to increased levels of fatigue, which is consistent with previous findings (Friedman et al, 2006; Siciliano et al, 2018).
- While better global cognition (MoCA) was associated with less (cognitive) fatigue, neither cognitive status nor global cognition was related to grit, nor moderated the relationship between fatigue and grit, in PD.
  - These findings have clinical relevance, such that grit is an important factor to consider in all non-demented PD patients regardless of cognitive status.
- The findings of this study suggest that grit may be a beneficial treatment target for fatigue in non-demented individuals with PD, including those with mild cognitive impairment.
- Future research should aim to investigate the relevance of grit in the treatment of PD-related fatigue and other non-motor symptoms. Moreover, additional studies are needed to better understand the contribution of other relevant factors, such as sleep, in the relationship between grit and fatigue in PD.

ACKNOWLEDGEMENTS

We would like to thank Dr. Dawn Schiehser and Marina Nakhla for their wonderful mentorship and support. This project was supported by VA Merit Award **1 I01 RX001691-01A1** to Dawn M. Schiehser, Ph.D. by the Department of Veterans Affairs, VHA, Office of R&D, RR&D.

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