

Comparison of physical activity between persons with multiple sclerosis with lower limb weakness and normal strength

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Background

- Currently the recommended amount of physical activity for persons with multiple sclerosis (PwMS) is ≥ 150 minutes of exercise and/or lifestyle physical activity per week.¹
- Physical activity (PA) is lower in PwMS, and decreased PA is associated with increased risk of comorbidities and decreased function and quality of life.¹⁻³
- Muscle weakness is a common symptom that PwMS experience, which can cause impaired mobility.⁴
- There is a paucity of literature explaining the relationship between muscle weakness and PA in PwMS.

Objectives

- 1) To compare PA levels of PwMS with weakness of hip flexion (HF), hip extension (HE), knee extension (KE), knee flexion (KF), ankle plantarflexion (APF), and ankle dorsiflexion (ADF) to those with normal strength.

Methods

- Participants**
- A total of 175 PwMS were included in this secondary analysis of a larger study.
- Study Design**
- One-time research visit in which the following variables were captured:

Outcome Measure	Variables Collected:
Demographics and characteristics	Age, gender, disease duration, self-reported disability (Patient Determined Disease Steps: PDDS)
PA: International Physical Activity Questionnaire-Long Form (IPAQ-LF)	Total PA (MET/min/week)
Lower Limb Strength: Biodex Dynamometer	Isometric peak torque (Nm) of: <ul style="list-style-type: none"> • Hip Flexion (HF) and Extension (HE) • Knee Extension (KE) and Flexion (KF) • Ankle Plantarflexion (APF) and Dorsiflexion (ADF)

- Isometric peak torque was compared with normative data to determine weakness (>2 SD below the healthy peak torque).⁵

- Statistical Analysis**
- Descriptive statistics were performed, and Mann-Whitney U tests were used to compare Total PA for PwMS with weakness and normal strength for each muscle group.
 - A stepwise linear regression was performed to determine which muscle groups predicted Total PA while controlling for age and gender.
 - Analyses were performed using SPSS version 26 (SPSS, Chicago, IL).

Results

Table 1. Descriptive statistics of demographics, characteristics, and Lower Limb weakness

Gender (n, %)	Women: n=135 (77.1%) Men: n=40 (22.9%)	
Age (median, years)	53.0	
Disease duration (median, years)	12.3	
BMI (median kg/m ²)	28.6	
PDDS (median, score)	2.0 (moderate disability)	
Lower Limb Weakness		
Muscle Group	Weakness	Normal Strength
Hip Flexion	n=104	n=71
Hip Extension	n=156	n=19
Knee Extension	n=57	n=118
Knee Flexion	n=57	n=118
Ankle Plantarflexion	n=20	n=155
Ankle Dorsiflexion	n=170	n=5

Figure 1. Comparison on Total PA between PwMS with weakness and without

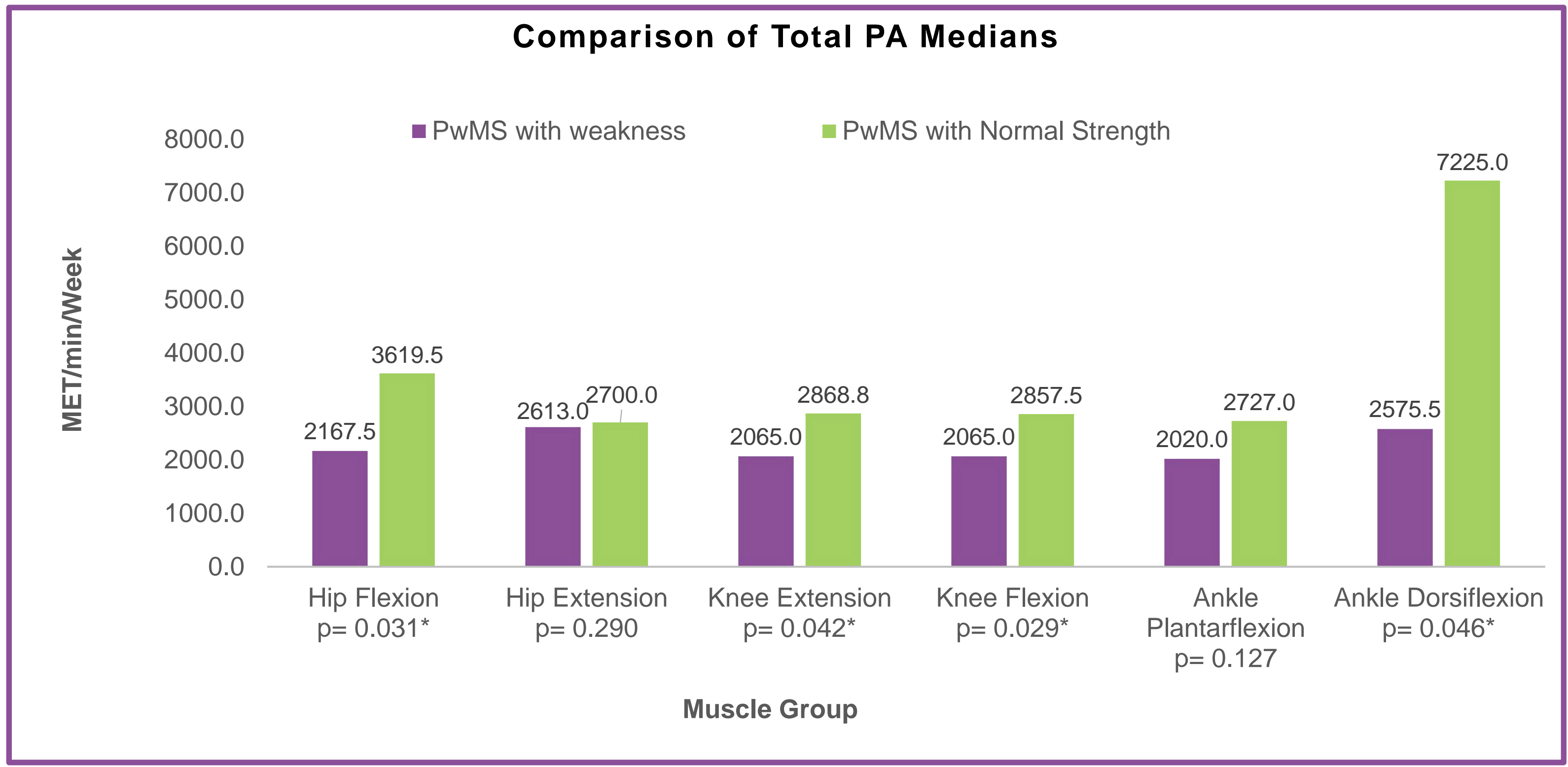


Table 2. Stepwise linear regression predicting Total PA from lower limb weakness

Step	Variable	B	SE	95% Confidence Interval		Significance
				Lower Bound	Upper Bound	
Step 1 R ² : 0.028	Age	-.009	.004	-.017	-.001	.030*
	Gender	-.062	.120	-.298	.174	.606
Step 2 R ² : 0.066	Age	-.007	.004	-.015	.001	.086
	Gender	-.051	.118	-.283	.182	.666
	KE weakness	-.282	.108	-.495	-.070	.009*

* Denotes significance p<0.05
 F(3, 173) = 4.01, P = .009

Discussion

- PwMS with muscle weakness in their hip flexion, knee extension and flexion, and ankle dorsiflexion had significantly different Total PA levels compared to those with normal strength.
- However, when added into the stepwise linear regression the only muscle group that was significant and remained in the model was knee extension weakness.
- KE weakness was a predictor of lower Total PA, after controlling for age and gender, and accounted for 3.8% of the variance.
- Additionally, PA was different for all of the flexion muscle groups, but only one extension muscle group (KE), indicating that when there is weakness in the flexors, there is more likely to be a disturbance in PA in PwMS.

Conclusion

- The findings demonstrate that PA was lower in PwMS with HF, KE, KF, and ADF weakness but not HE and APF weakness.
- PA was different for all of the flexion muscle groups, but only one extension muscle group (KE), indicating that weakness in flexors may cause a greater disturbance in PA.
- Furthermore, KE weakness was the only lower limb weakness found to be a significant predictor of Total PA after controlling for age and gender.
- These findings can help clinicians and research designing PA interventions by informing them that knee extension weakness is a predictor of lower Total PA and may be a focus point in order to improve Total PA in PwMS.

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