The Impact of Exercise on Sleep Quality in Individuals with Multiple Sclerosis

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Sleep Disturbances

- Approximately 50% of individuals with MS have a diagnosable sleep disorder, and 67% of individuals with MS report a sleep disturbance (Strober, 2015)
- Poor sleep quality has been associated with a reduction in (Lobentanz et al. 2004):
  - physical function
  - psychological well-being
  - self-care and ADL's
  - work ability
  - interpersonal relationships
- Poor sleep quality associated with fatigue (Stober, 2015)
- Poor sleep quality independent predictor of reduced quality of life in individuals with MS (Merlino et al. 2009)
- Sleep disorders often undiagnosed and untreated (Brass et al. 2014)

Benefits of Exercise

- Beneficial effects on physical and psychological symptoms of MS, including improvements in walking mobility, balance, fatigue, and depressive symptoms (Motl & Sandroff, 2015)
- Exercise has also been shown to have a moderate benefit in improving self-report sleep quality, shortening sleep latency, and reducing use of sleep aid medication in adults with sleep problems (Yang et al. 2012)
- A moderate improvement in sleep quality was demonstrated in individuals with MS who participated in a behavioral intervention to increase physical activity compared with the control group (Pilutti et al, 2014)
  - improvement approached statistical significance

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Purpose

- To examine the effectiveness of a supervised moderate-intensity aerobic exercise (AE) program and a home exercise program (HEP) on sleep quality in people with MS.

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Methods

Inclusion Criteria:

- ≥ 18 years old
- Relapsing remitting or secondary progressive MS
- Able to ambulate independently with or without an assistive device
- ≥ 24 on the Mini Mental Status Exam (MMSE)

Exclusion Criteria:

- History of alcohol/drug abuse or nervous system disorder other than MS
- Severe physical, neurological, or sensory impairments that would interfere significantly with testing
- Developmental history of learning disability or attention-deficit/hyperactivity disorder
- Relapse and/or corticosteroid use within four weeks
- Uncorrected vision loss that would interfere significantly with testing
- Known untreated sleep disorder
- Acute ischemic cardiovascular event or coronary artery bypass surgery less than 3 months ago
- Either unable to physically perform the exercise test using the recumbent stepper or demonstrate absolute indications for terminating exercise following American College of Sports Medicine's guidelines
- Uncontrolled blood pressure with medication (BP > 190/110mmHg)

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Methods

Baseline Assessment:

- Sleep assessments:
  - Pittsburgh Sleep Quality Index (PSQI)
  - Epworth Sleepiness Scale (ESS)
- Cardiorespiratory fitness
  - Total Body Recumbent Stepper (TBRS) submaximal exercise test to predict VO2 peak
- Other measures:
  - Beck Depression Index-Fast Screen (BDI)
  - State-Trait Anxiety Inventory (STAI)
  - Modified Fatigue Impact Scale (MFIS)
  - Multiple Sclerosis Quality of Life-54 Instrument (MSQOL)
  - Multiple Sclerosis Functional Composite (MSFC)

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Methods

- 28 individuals randomized into either the AE group or the HEP group
  - 6 individuals withdrew from AE intervention (5 change in work/travel schedule, 1 due to prior knee injury); replaced with individuals with same disease type and sex
  - AE group: supervised moderate-intensity aerobic exercise on recumbent stepper
    - 50-59% of hearth rate reserve (HRR) for 1.5 months; increased to 60-69% of HRR for remaining 1.5 months
    - Compliance assessed with exercise log
  - HEP: walking and stretching program
    - below 40% of HRR
    - Compliance assessed with exercise log and HR monitor
  - Both groups exercised 3x/week for 12 weeks
  - Motivational Interviewing via phone at 1 week, 1 month, and 2 months
- Reassessment conducted after 3 months

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Methods

AE

Time:	Exercise:
10-15 minute	Upper and lower body stretching
5 min warm-up	Comfortable intensity
30 minutes	Aerobic exercise
5 min cool-down	Comfortable intensity
10-15 minutes	Repeat stretching

HEP

Time:	Exercise:
10-15 minute	Upper and lower body stretching
30 minutes	Aerobic exercise
10-15 minutes	Repeat stretching

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Statistical Analysis

- Mixed model ANOVAs (Time as within-subject measure, Group as between-subject measure)
- Effect size for the F-statistic (partial eta; η_p^2) is reported and interpreted as small= .01, moderate=.06, and large=.14 (Cohen, 1988)
- Percent change scores
- Cohen's d effect size and interpreted as small *d* = .2, medium *d* = .5, and large *d* = .8 (Cohen, 1988)
- Spearman correlations

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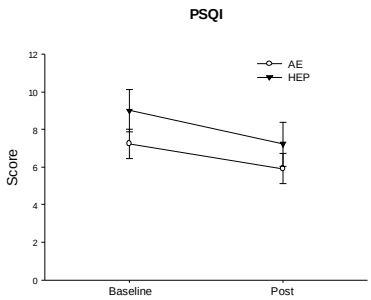
Results

Group	Sex	MS Type	Age (years)	MSFC	Disease Duration (Years)	MMSE	BDI
AE	11 females 1 male	10 RR 2 SP	48.9 (13.6)	7.4 (3.9)	10.8 (8.4)	29.3 (0.9)	2.3 (2.1)
HEP	8 females 2 males	9 RR 1 SP	50.9 (12.2)	9.2 (3.1)	9.0 (5.6)	28.6 (1.4)	4.6 (3.7)
P-value	N/A	N/A	.726	.254	.562	.171	.089

*Only participants who were at least 70% compliant with program were included in the analysis (2 from AE and 4 from HEP removed)

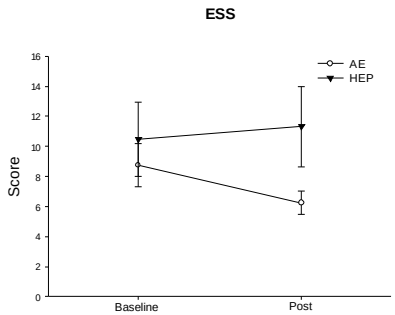
Results



	%change	Cohen's d
AE	-18.4	.49
HEP	-19.8	.51

	F-statistic	p-value	Partial Eta η_p^2
Time	9.634	.006	.336
Time*group	.602	.447	.031
Group	2.044	.169	.097

Results



	%change	Cohen's d
AE	-28.6	.63
HEP	7.9	.11

	F-statistic	p-value	Partial Eta η_p^2
Time	3.297	.085	.148
Time*Group	6.765	.018*	.263
Group	1.912	.183	.091

Results

		SubMaxV02 baseline	SubMaxVo2 %change	MSFC	BDI %change	STAY (State) % change	STAY (Trait) % change	MFIS % change
PQSI %change	r	-.065	-.017	-.062	-.055	.567	.345	.300
	p	.779	.942	.790	.824	.007*	.137	.187
ESS %change	r	.145	-.141	.443	-.386	.272	.169	.051
	p	.521	.532	.039*	.093	.221	.463	.826

Results

AE

		MSFC	STAY (State) % change
PQSI %change	r	.000	.782
	p	1.000	.003*
ESS %change	r	.018	.205
	p	.957	.522

HEP

		MSFC	STAY (State) % change
PQSI %change	r	-.109	.343
	p	.781	.366
ESS %change	r	.657	.395
	p	.039*	.258

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Discussion

- Both the AE and the HEP intervention produced a moderate effect on sleep quality
- AE group experienced a moderate effect on daytime sleepiness
- Exercise may be a non-pharmacological and an inexpensive method to address sleep symptoms

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Discussion

- Mechanism of change?
  - Does not appear to be cardiorespiratory fitness
- Supervision may have contributed
  - Interaction with research personnel and other participants
  - Schedule
- Mode may have contributed (recumbent stepper vs walking)
  - Feeling safe while exercising
- Medication or disease severity

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