

³Neurology Clinic and Policlinic, Departments of Head, Spine and Neuromedicine, Biomedicine and Clinical Research, Research Center for Clinical Neuroimmunology and Neuroscience (RC2NB), University Hospital Basel, University of Basel, Basel, Switzerland, ⁴Leiden University, Faculty of Social Sciences, Institute of Psychology, Health, Medical and Neuropsychology unit, Leiden, Netherlands, ⁵MS Center Amsterdam, Vrije Universiteit Amsterdam, Amsterdam Neuroscience, Amsterdam UMC location VUmc, Anatomy and Neuroscience, Amsterdam, Netherlands, ⁶MS Center Amsterdam, Vrije Universiteit Amsterdam, Amsterdam Neuroscience, Amsterdam UMC location VUmc, Neurology, Amsterdam, Netherlands

Background: Neuro-inflammation and neurodegeneration are pathological hallmarks of multiple sclerosis (MS). Exercise might have neuroprotective effects in MS but current literature is inconclusive. Brain derived neurotrophic factor (BDNF), neurofilament light (NfL), and glial fibrillary acidic protein (GFAP) are potential blood-based biomarkers for neurogenesis, axonal damage and astrogliosis, respectively. We hypothesize that exercise has a neuroprotective effect reflected by increased BDNF and decreased NfL and GFAP levels.

Objectives: To investigate the effect of aerobic training (AT) compared to a control intervention on neuro-specific blood-based biomarkers (i.e. BDNF, NfL, GFAP) in people with MS (pwMS).

Methods: In the TREFAMS-AT (Treating Fatigue in Multiple Sclerosis - Aerobic Training) trial, 89 pwMS were randomly allocated to either 16-week AT with 3 sessions/week or a control group (CG) (3 visits to an MS-nurse). In this secondary analysis, blood-based biomarker concentrations were measured using Simoa technology. Pre- and post-intervention concentrations between groups were compared, using an analysis of covariance (ANCOVA). Confounding effects of age, sex, MS severity measured by expanded disability status scale (EDSS), disease duration, use of disease modifying medication, and Body Mass Index were taken into account.

Results: Blood samples of 55 participants (mean age 45.6 years, 71% female, median disease duration 8 years, median Expanded Disability Status Scale 2.5) were available. Median [interquartile range (IQR)] baseline values for BDNF (ng/mL): AT 20.1 [15.6-25.0] and CG 21.4 [17.4-28.0], NfL (pg/mL): AT 8.8 [5.3-14.2] and CG 9.8 [7.6-12.2], and GFAP (pg/mL): AT 97.2 [72.8-137] and CG 98.3 [87.5-136]. ANCOVA demonstrated no significant between-group differences between AT and CG for BDNF ($\beta = 0.11$ ng/mL, 95%CI [-3.78 to 4.00]), NfL ($\beta = -0.10$ pg/mL, 95%CI [-0.71 to 0.50]), and GFAP ($\beta = 0.01$, 95%CI [-0.43 to 0.40]), adjusted for confounders.

Conclusion: Aerobic exercise therapy did not result in significant improvements of neuro-specific blood-based biomarkers in pwMS.

Disclosure Conflict of interest

Hannek Hulst receives research support from the ZonMW, NWO, ATARA, Biogen, Celgene/BMS, Merck and MedDay and serves as a consultant for Sanofi Genzyme, Merck BV, Biogen Idec, Roche and Novartis and received honorary from these parties paid

to her institution. She is on the editorial board of Multiple Sclerosis Journal. Charlotte Teunissen received funding from: National MS Society (Progressive MS alliance) and Innovative Medicines Initiatives 3TR (Horizon 2020, grant no 831434), has a research contract with Celgene, and she serves on editorial boards of Medidact Neurologie/Springer, Neurology: Neuroimmunology & Neuroinflammation, and is editor of a Neuromethods book Springer. Vincent de Groot, Heleen Beckerman, Brigit de Jong, Eline Willemsen en Arianne Gravesteijn: Nothing to disclose.

RIMS - Physical exercise and lifestyle changes

P391

Psychometric properties of the modified reaching performance scale in persons with multiple sclerosis

J. Raats^{1,2,3}, P. Feys^{1,2}, G. Gysemberg^{1,4}, S. Ferdinand⁵, M.F. Levin⁶, I. Lamers^{1,2,4}

¹UMSC - University MS center, Hasselt - Pelt, Belgium, ²Hasselt University, REVAL Rehabilitation Research Centre, Hasselt, Belgium, ³AP Hogeschool Antwerpen, Ergotherapie, Antwerpen, Belgium, ⁴Noorderhart, Rehabilitation and MS Center, Pelt, Belgium, ⁵National MS Center, Melsbroek, Belgium, ⁶McGill University, School of Physical and Occupational Therapy, Montreal, Canada

Introduction: A valid and reliable assessment tool to describe the quality of a reach-to-grasp movement pattern can provide valuable insights into motor performance deficits in persons with MS (pwMS). The Reaching Performance Scale (RPS), developed for stroke, is an attractive scale to assess reaching movement patterns. Nevertheless, it has not been validated in pwMS.

Objectives: Firstly, to investigate the content and modify the RPS for application in patients with MS. Secondly, to investigate the psychometric properties (within- and between-session reliability and concurrent validity) of this modified Reaching Performance Scale (mRPS) for pwMS.

Methods: Forty-five pwMS executed the RPS that measured movement patterns and compensations during reach-to-grasp tasks. The content validity was determined by an expert panel based on observations of 45 subjects. The reliability of the mRPS was investigated based on five repetitions performed within one day, and between two days. For the concurrent validity, clinical measures at two levels of the International Classification of Functioning were correlated with the mRPS: Fugl-Meyer Assessment of the Upper Limb (FMA-UL), maximal isometric hand grip strength (HGS), Action Research Arm Test (ARAT), Box and Blocks Test (BBT), Nine Hole Peg Test (NHPT) and Trunk Impairment Scale 2.0 (TIS 2.0) and finally perceived performance by the Manual Ability Measure-36 (MAM-36).

Results: The subscale of trunk displacement of the original RPS was modified for its use in pwMS. The mRPS, specifically developed for pwMS, had excellent agreement scores for the within-session reliability (range of K between 0.85 and 0.98) and moderate-to-excellent agreement scores for between-session reliability (K: 0.66-1). Regarding validity, the mRPS was highly

correlated with the ARAT ($\rho=0.74$, $p<0.001$), and moderately correlated with the trunk performance (TIS 2.0, $\rho=0.61$, $p<0.001$), hand function: (BBT: $\rho=0.64$, $p<0.001$; NHPT: $\rho=-0.61$, $p<0.001$) and perceived performance (MAM36 $\rho=0.53$, $p<0.001$).

Conclusion: The mRPS is a reliable measurement tool to evaluate the movement pattern and motor compensations used during reaching in pwMS. Concerning concurrent validity, the mRPS measures different aspects of performance, namely compensation, that are not identified in other clinical measures that evaluate mostly task completion. Therefore mRPS fills a gap in clinical evaluation – that of quantifying movement quality during reaching.

Disclosure

Raats Joke: nothing to disclose

Feys Peter is editorial board member of NNR, MSJ and Frontiers in Rehabilitation Sciences-section strengthening health systems, provided consultancy to NeuroCompass and was board of advisory board meetings for BIOGEN.

Gysemberg Griet: nothing to disclose

Ferdinand Sofie: nothing to disclose

Levin Mindy F: nothing to disclose

Lamers Ilse received teaching honoraria from Sanofi Genzyme Europe

P392

Fear of falling impacts participation in instrumental activities of daily living, leisure activities and social activities in people with multiple sclerosis

H. Khalil¹, E. Allataifeh², A. Al-Sharman², M. Al-Qawasmeh³, K. El-Salem³

¹Qatar University, Department of Physical Therapy and Rehabilitation Sciences, Doha, Qatar, ²Jordan University of Science and Technology, Department of Rehabilitation Sciences, Irbid, Jordan, ³Jordan University of Science and Technology, Department of Neurology, Irbid, Jordan

Background: Fear of falling (FOF) is an important risk indicator for health related outcomes and quality of life in patients with multiple sclerosis (MS). However, its relationship with participation level in this population is not clear.

Aim: The aim of this study is to explore the relationship between fear of fall and participation levels including participation in instrumental activities of daily living, leisure activities and social activities in people with MS.

Methods: One hundred patients with MS were evaluated. Fear of falling was assessed using the Fall Efficacy Scale-International (FES-I). Participation levels in instrumental activities of daily living, leisure activities and social activities were assessed using the Activities Card Sort (ACS). In addition, age, gender and the Patient-Determined Disease Step (PDDS) were collected from patients.

Results: Stepwise regression analysis demonstrated that fear of fall predicts participation in instrumental activities of daily living after adjusting for age, gender and PDDS ($R^2 = 0.353$, $P < 0.0001$), accounting for 35.5% of the variability of the fear of fall around its mean. Similarly, regression analysis showed that fear of fall predicts participation level in leisure and social activities after

adjusting for age, gender and PDDS ($R^2 = 0.273$, $P < 0.0001$ for leisure activities; $R^2 = 0.252$, $P < 0.0001$ for social activities).

Conclusions: Fear of fall can be an important determining factor affecting participation in instrumental activities of daily living, leisure activities and social activities.

Disclosure

All authors have nothing to disclose

P393

High-intensity resistance training in fatigued persons with multiple sclerosis - a randomized controlled trial

S. Englund¹, F. Piehl^{1,2}, M. Kierkegaard^{3,2}

¹Karolinska Institutet, Department of Clinical Neuroscience, Stockholm, Sweden, ²Academic Specialist Center, Center of Neurology, Stockholm, Sweden,

³Karolinska Institutet, Department of Neurobiology, Care Sciences and Society, Huddinge, Sweden

Introduction: Exercise studies among fatigued persons with multiple sclerosis (PwMS) with fatigue as primary endpoint are currently lacking.

Objectives/aims: The objective here was to explore effects on fatigue, mood, health-related quality of life and inflammatory markers of a high-intensity resistance training (HIRT) programme in fatigued PwMS.

Methods: A total of 71 PwMS scoring ≥ 53 (i.e., at least moderate fatigue) on the Fatigue Scale for Motor and Cognitive Functions (FSMC) were randomized to participate in supervised HIRT twice (group A, $n=35$) or once (group B, $n=36$) a week for 12 weeks. A non-randomized group ($n=69$) matched for FSMC score served as non-intervention control. Linear repeated-measurement intention-to-treat analyses were used for evaluating within-group (time) and between-group (time x group) effects, except for inflammatory markers where multivariable linear regression models were used. The study was registered at ClinicalTrials.gov (NCT04562376).

Results: Three of the 11 participants who dropped-out were lost to follow-up. Session and content adherence were fulfilled for 50 (70%) and 52 (73%) of participants, respectively. Between-group differences were non-significant for primary and most secondary endpoints, while the time effects were all significant. Mean difference in FSMC score (95% confidence intervals) was -10.9 (-14.8; -6.9) in group A and -9.8 (-13.2; -6.3) in group B. Corresponding values for combined intervention groups vs non-intervention control were -10.3 (-12.9; -7.7) and 1.5 (-0.6; 3.6), respectively, a significant between-group effect ($p<0.001$). Secondary endpoints also improved, but only Hospital Anxiety and Depression Scale anxiety and MS Impact Scale-29 psychological subscales favoured the twice weekly over once weekly HIRT group. As an exploratory endpoint, changes in plasma inflammatory protein markers were associated with reduced FSMC scores.

Conclusion: Once or twice weekly HIRT leads to clinically relevant reductions in self-reported fatigue scores among fatigued PwMS, with improved fatigue scores being associated with changes in plasma inflammatory protein levels. These findings provide evidence for recommending HIRT for fatigued PwMS.