Benefits of a personalised and home-based training programme guided by a mobile application to reduce fatigue in people with a recent or longer standing diagnosis of multiple sclerosis

Manon Rojo*[1], Loïc Espeit[1], Léonard Féasson[1,2], Jean-Philippe Camdessanche[3], Guillaume Millet[1,4], and Angèle Merlet[1,2]

[1]Laboratoire Interuniversitaire de Biologie de la Motricité – Université Jean Monnet - Saint-Etienne, Université Claude Bernard - Lyon 1, Univ. Savoie Mont Blanc – France

[2]Service de Physiologie Clinique et de l'Exercice [CHU de Saint-Etienne] – Centre Hospitalier Universitaire de Saint-Etienne [CHU Saint-Etienne], Université Jean Monnet - Saint-Etienne – France

[3]Service de Neurologie [CHU de Saint-Étienne] – Centre Hospitalier Universitaire de Saint-Etienne [CHU Saint-Etienne], Université Jean Monnet - Saint-Etienne – France

[4]Institut Universitaire de France – Ministère de l'Education nationale, de l'Enseignement supérieur et de la Recherche, Ministère de l'Education nationale, de l'Enseignement supérieur et de la Recherche – France

Résumé

Introduction: Chronic fatigue affects 60-80% of people with multiple sclerosis (PwMS) and is considered the most disabling symptom by 60% of them (Krupp, 2006). Despite adapted physical activity is an effective strategy to reduce fatigue, and to improve physical capacities and quality of life, PwMS are less active than the general population (Macdonald et al., 2023). A home-based, personalised and early training programme could therefore be of interest. The aim of the study was to evaluate the effectiveness of a home-based, personalised training programme guided by a mobile application in fatigued PwMS with a recent or long-standing diagnosis.

Methods: Twenty-nine recently diagnosed PwMS (R-MS) (diagnosis $<$ 2 years and/or first symptoms $<$ 5 years) and 30 PwMS with a longer-standing diagnosis (LS-MS) (diagnosis $>$ 2 years and first symptoms $>$ 5 years) were included. They were fatigued (Fatigue Severity Scale (FSS) $\geq$ 4)) and had a mild disability (Expanded Disability Status Scale $\leq$ 4). They were randomised into two groups performing a 12-week training intervention at home. The control (CONTR) group followed the national recommendations (150 min/week) whereas the personalised (PERSO) group followed a programme guided by a mobile application and tailored to their physical abilities and fatigue levels (3 sessions of 30 to 50 min/week). Before and after the programme, participants completed a questionnaire assessing perceived fatigue (FSS). They also performed physical tests, including cardiopulmonary exercise testing (to assess maximal oxygen uptake (VOmax)) and quadriceps-intermittent-fatigue (QIF) test (to assess neuromuscular fatigue of the knee extensors: maximal voluntary contraction

*Intervenant

(MVC), twitch, voluntary activation and rating of perceived exertion (RPE)) (Doyle-Baker et al., 2018). A three-way mixed ANOVA was conducted to examine the effects of time (before vs after the programme), population (R-MS vs LS-MS) and training group (PERSO vs CONTR).

Results: The results are presented for the 20 R-MS and 20 LS-MS who completed the study to date. The data will be completed in July 2025. No significant difference between R-MS and LS-MS was observed for any variable. After the training programme, FSS significantly decreased (-30.5%, $p < 0.001$), regardless of the training group. VOmax increased in PERSO group (+19,7%; $p < 0.001$), no significant change was observed in CONTR group. After the training programme, attenuation of MVC decrease was observed at each participant's last common QIF stage (-5.9%, $p = 0.011$) regardless of the training group. The training group effect in terms of MVC decrease at this stage did not reach the level of significance (-26.7% vs +12.8%; $p = 0.079$, for PERSO and CONTR, respectively). In the PERSO group, a smaller RPE and smaller decrease in twitch amplitude were also observed at this stage (-25.8% and -42.7%; $p < 0.001$, respectively).

Discussion: This study shows that home-based training reduces perceived fatigue in PwMS. A personalised programme improves physical capacities (i.e,VOmax), the perception of effort (i.e.,RPE) and resistance to neuromuscular fatigue in PwMS. This latter result is highlighted by a smaller reduction in MVC and by less peripheral fatigue (i.e.,smaller decrease in twitch amplitude) for a given task. These benefits could be explained by the professional management of training, allowing for maximum effectiveness while avoiding excessive fatigue.
These results highlight the importance of physical activity in fatigued PwMS, including those recently diagnosed. Physical activity reduces fatigue and improves physical qualities from the onset of the disease. However, as the disease progresses, the response to physical activity does not decline, and the intervention remains as effective.

Conclusion: Home-based training reduces perceived fatigue and tailoring it to the patient's physical abilities and fatigue level further improves physical capacities and decreases neuromuscular fatigue in PwMS.

References:

Doyle-Baker, D., Temesi, J., Medysky, M. E., Holash, R. J., & Millet, G. Y. (2018). An Innovative Ergometer to Measure Neuromuscular Fatigue Immediately after Cycling. Medicine and Science in Sports and Exercise, 50(2), 375-387. https://doi.org/10.1249/MSS.0000000000001427

Krupp, L. (2006). Fatigue is intrinsic to multiple sclerosis (MS) and is the most commonly reported symptom of the disease. Multiple Sclerosis (Houndmills, Basingstoke, England), 12(4), 367-368. https://doi.org/10.1191/135248506ms1373ed

Macdonald, E., Buchan, D., Cerexhe, L., Renfrew, L., & Sculthorpe, N. (2023). Accelerometer measured physical activity and sedentary time in individuals with multiple sclerosis versus age matched controls: A systematic review and meta-analysis. Multiple Sclerosis and Related Disorders, 69. https://doi.org/10.1016/j.msard.2022.104462