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# Effects of Personalized vs. Standardized Training in Patients with Chronic Fatigue on Fatigue and Neuromuscular Function

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## Résumé

### INTRODUCTION:

Chronic fatigue (CF) is defined as pathological fatigue lasting over six months, unrelieved by rest, and impairing daily activities. It is typically assessed using questionnaires such as the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F; cut-off  $\leq 34$ ). While physical activity is an intervention leading to reductions of fatigue in CF, individual responses remain highly variable. This variability highlights the need for personalized approaches (1). Tailoring training based on individual fatigue levels could thus enhance its efficacy (2). This study aimed to compare the effects of a personalized training program (PERSO), adapted weekly according to fatigue, with a standardized program (RECO) following World Health Organization recommendations, on fatigue, neuromuscular function and fatigability.

### METHODS:

The presented data were collected from 51 CF patients (20 males; mean age:  $46.2 \pm 12.5$

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\*Intervenant

years; baseline FACIT-F:  $20 \pm 7.2$ ) who completed a 12-week supervised training program ( $3 \times 90$  min/week), combining aerobic and resistance exercises. The RECO group ( $n = 27$ ) followed a fixed-intensity protocol with a progressive increase of volume over the weeks. The PERSO group ( $n = 24$ ) followed the same volume progression, but intensity was adjusted weekly using principles adapted from elite endurance training, based on four fatigue measurements: subjective fatigue, heart rate variability, muscle pain, and low-frequency fatigue of the knee extensors. Pre- and post-intervention assessments included fatigue (FACIT-F), neuromuscular parameters at rest (maximal voluntary contraction torque (MVC), twitch torque (Tw), and voluntary activation (VA)), and performance in isometric (ISO) and cycling (BIKE) incremental and standardized fatiguing tasks. Fatigability was determined by calculating decrease in MVC (MVC) relative to baseline after three fatiguing stages and at exhaustion. Tw and VA were further calculated to inform on associated peripheral and central exercise-induced alterations, respectively.

## RESULTS:

Mixed-model ANOVAs (time  $\times$  group) revealed significant improvements over time ( $p \leq 0.05$ ) for FACIT-F scores (post-training:  $25.7 \pm 10.6$ ), performance in ISO and BIKE, MVC at rest in BIKE and VA after stage 3 in ISO, with no significant group or interaction effects. Notably, 71% of the patients in the PERSO group achieved a minimally clinically important difference ( $\geq 3$  points on FACIT-F (3)) in fatigue scores, compared to 59% in the RECO group. Additionally, when RECO and PERSO groups were pooled, significant correlations ( $p \leq 0.05$ ) were found between ISO and BIKE performance and MVC at rest in their respective tasks (ISO:  $r = 0.6$ ; BIKE:  $r = 0.378$ ).

## DISCUSSION:

These preliminary results (80 patients scheduled in the study) show that both personalized and standardized training programs led to improvements in fatigue, performance and neuromuscular function in patients with CF. The observed improvements in ISO and BIKE performance suggest enhanced exercise tolerance, regardless of training modality, and the increase in MVC at rest in the BIKE condition further reflects a gain in maximal neuromuscular capacity. Moreover, performance improvements were positively associated with gains in maximal voluntary torque, highlighting the importance of neuromuscular capacity in exercise tolerance. The attenuated loss of VA during the fatiguing isometric task suggests better preservation of central motor drive post-training, regardless of training modality. While no significant interactions were observed, a greater proportion of patients in the PERSO group showed improvements in fatigue, supporting the potential benefit of adjusting training intensity to individual fatigue levels. Yet, no time  $\times$  group interaction was found on FACIT-F.

## CONCLUSION/PERSPECTIVES:

This study tested the feasibility and potential added value of a personalized training approach in the management of CF. Adapting exercise intensity based on individual fatigue levels did not lead to better fatigue improvement, despite the fact that a greater proportion of patients had fatigue improvements in the PERSO group. Such strategies may be particularly relevant in CF patients characterized by high variability in symptoms and response to training. Future analysis with the full study cohort will be essential to refine these findings and explore whether specific patient profiles (e.g. fatigue due to specific diseases) present particular characteristics and respond better to personalized approaches. Identifying such responder profiles could contribute to more targeted and effective exercise prescriptions in clinical fatigue management.

## REFERENCES

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