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Dynamics of neuromuscular adjustments to the progressive reduction in external forces

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► **To cite this version:**

Camille Fazzari, Robin Macchi, Rémy Casanova, Caroline Nicol, Pascale Chavet. Dynamics of neuromuscular adjustments to the progressive reduction in external forces. 28th Annual Congress of the European College of Sport Science, Jul 2023, Paris, France. 2023, 10.13140/RG.2.2.28388.96642 . hal-04358566

HAL Id: hal-04358566

<https://hal.science/hal-04358566>

Submitted on 21 Dec 2023

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1 Introduction

- Runners are confronted with changing external forces [1]
- Only one study focused on the **neuromuscular adjustments to progressive reduction in external forces** [2]
- It reported **positive correlations during the braking phase**

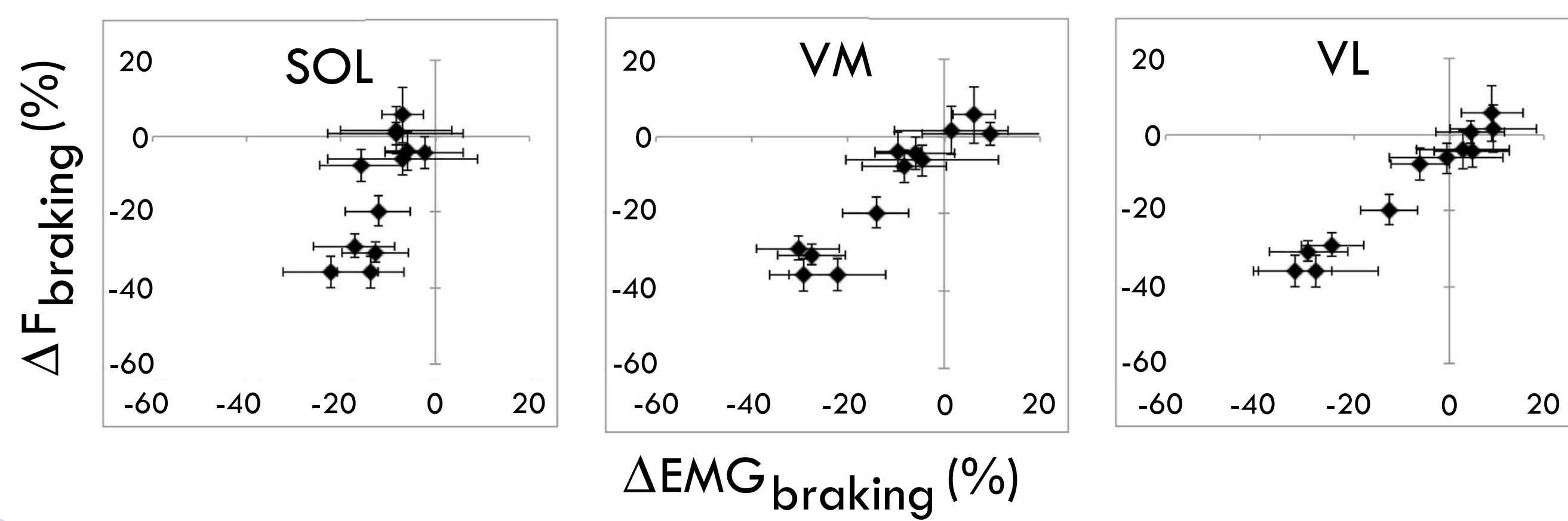


Fig. 1 Correlations between changes in mean force and mean muscle activity

- ...but **did not analyse them for each participant separately**

This study investigated the dynamics of neuromuscular adjustments to the progressive reduction in external forces, using an **individualised analysis**

2 Methods

- 40 male recreational runners (19 ± 1 yr) ran on a **Lower Body Positive Pressure treadmill** (AlterG®, 3.0 ± 0.2 m/s)

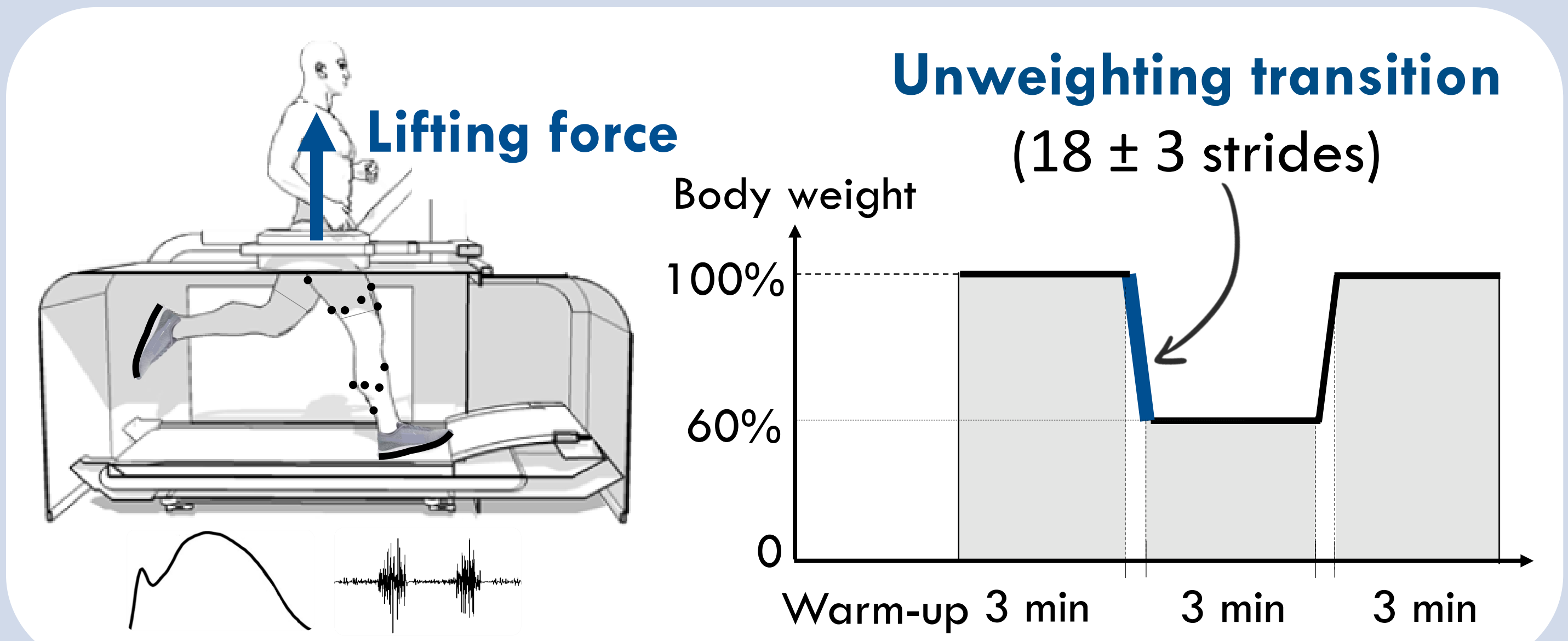
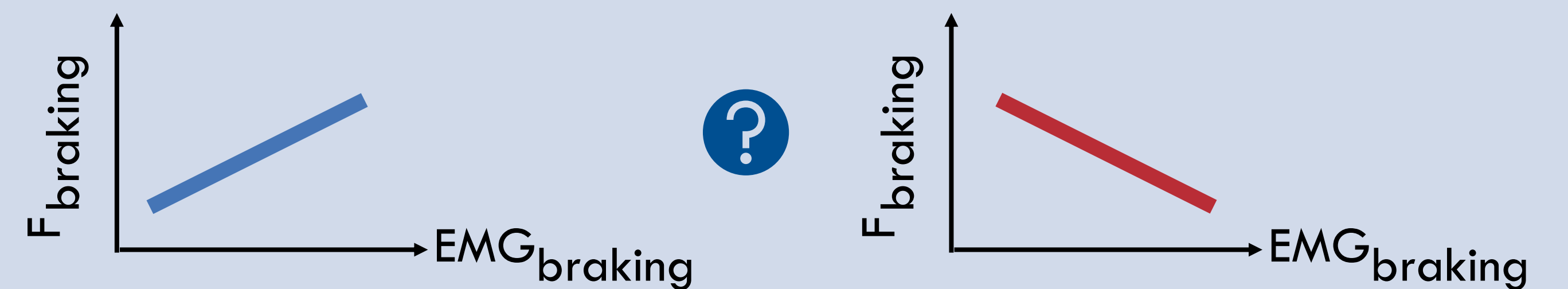


Fig. 2 Experimental design

- Spearman's correlation tests to quantify **the relationship between braking force and braking muscle activity**



3 Results & Discussion

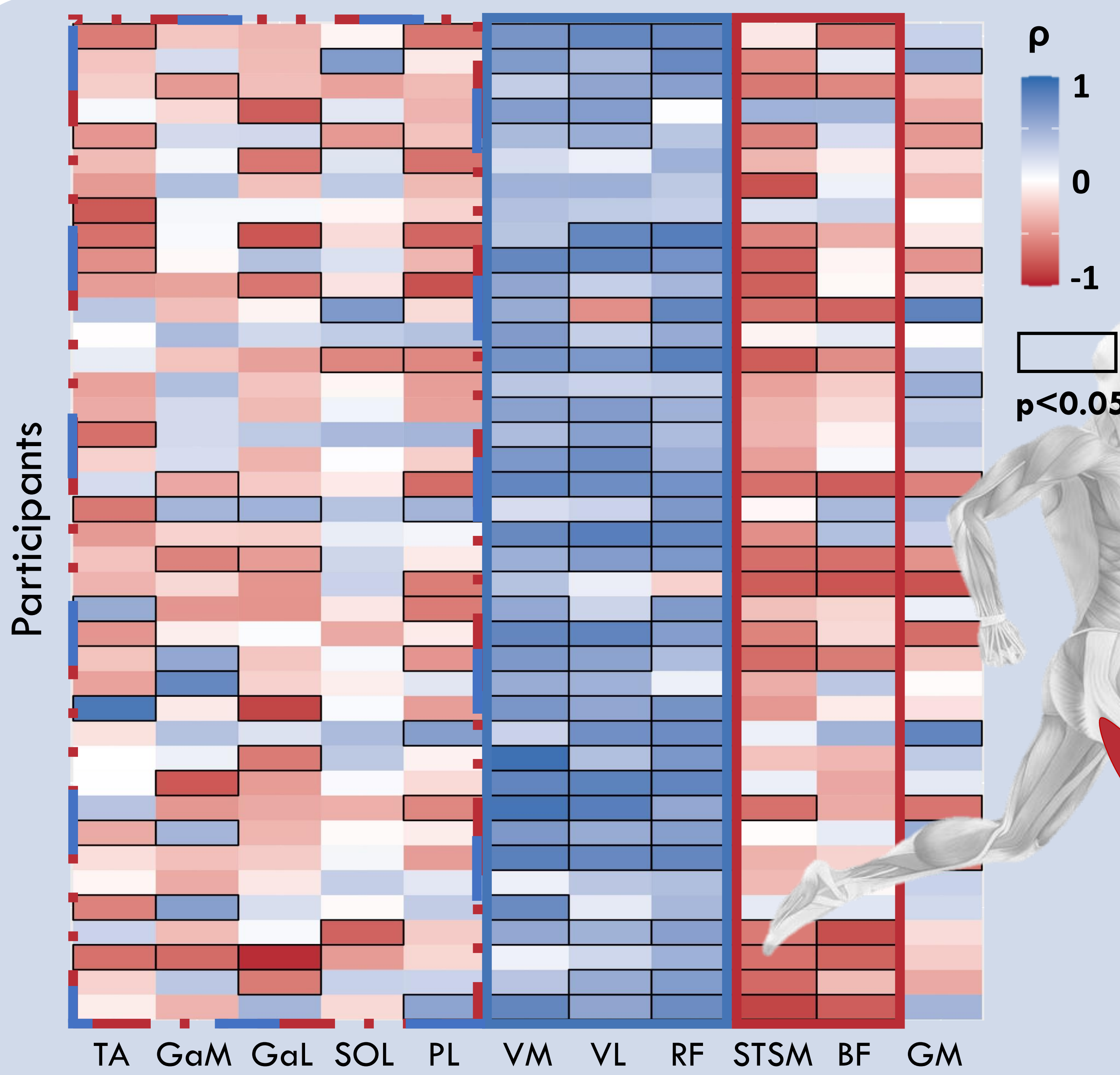


Fig. 3 Spearman's rank correlations coefficients (ρ) between mean braking force and muscle activity

During the **braking phase**, the progressive reduction in external forces was associated with:

- **Similar proximal neuromuscular adjustments**
 - ➔ **Quadriceps** activity
 - ➔ **Hamstring** activity
 - Reduces peak knee flexion during stance [3]
 - Accelerates the return of the free-leg [4]
- **Varied distal neuromuscular adjustments**
 - ➔ **Shank muscle** activity in some participants
 - ➔ **Shank muscle** activity in others
 - Ensures ankle stabilisation when shifting toward a forefoot strike [3]
 - No longer observed after 3 minutes of unweighted running [4]

4 Conclusion

- Neuromuscular adjustments differed between lower limb muscles
- They were **similar between participants for the proximal muscles, but varied for the distal muscles**
- They were not completed at the end of the unweighting transition

➔➔➔ **Further analysis should consider the transition and unweighted running phases as a continuum**

[1] Daley, in Understanding Mammalian Locomotion, 2016

[2] Sainton et al., PlosOne, 2016

[3] Fazzari et al., Front Physiol, 2023

[4] Neal et al., J Orthop Sports Phys Ther, 2016