

# IMPACT OF NON-SKID SOCKS AND ANTERIOR WEIGHT ON POSTURAL RESPONSE AND STABILITY DURING PERTURBATION

Juaquin Acuna<sup>1</sup>, Briana Kiphen<sup>1</sup>, Alexander Lee<sup>1</sup>, Amanda MacKinnon<sup>1</sup>, Liz Manese<sup>1</sup>, Austin Ngo<sup>1</sup>, Nicole Oberhammer<sup>1</sup>, Tommy Tran<sup>1</sup>, Ethan Truong<sup>1</sup>, Michael Shiraishi<sup>1</sup>, Seong Hyun Moon<sup>2</sup>, Sivakumar Rajagopal<sup>3</sup>,

<sup>4</sup>Raj Kumar Chauhan, Rahul Soangra<sup>1&5</sup>

<sup>1</sup>Crean College of Health and Behavioral Sciences, Chapman University, Orange CA 92866 USA

<sup>2</sup>College of Engineering, Technology, and Architecture, University of Hartford, CT 06117 USA

<sup>3</sup>School of Electronics Engineering, Vellore Institute of Technology, Vellore, TN 632-014 India

<sup>4</sup>Lachoo Memorial College of Science and Technology, Pharmacy Wing, Jodhpur, Rajasthan 342003 India

<sup>5</sup>Fowler School of Engineering, Chapman University, Orange CA 92866 USA

**Corresponding Author: Rahul Soangra**

**Email:** [soangra@chapman.edu](mailto:soangra@chapman.edu)

**doi:** 10.34107/UKKK6693.016

## ABSTRACT

Non-skid socks and external weight are commonly utilized in healthcare and training to improve stability and simulate real-world conditions. However, their combined effects on postural response during perturbation remain unclear. This study examined how non-skid socks and added anterior weight affect latency and amplitude responses during postural perturbations. Ten healthy participants (mean age  $24.5 \pm 4.38$  years) underwent randomized perturbation conditions with and without non-skid socks and 10% body weight applied via weighted vests. Results from two-way ANOVA and mixed-effects models revealed no significant effects of socks, weight, or their interaction on latency ( $p > 0.05$ ). However, amplitude analysis showed a significant interaction ( $p < 0.001$ ), indicating that the combination of socks and weight increased postural instability. Specifically, conditions involving non-skid socks and weight resulted in higher amplitudes, suggesting greater deviations of the center of gravity and increased fall risk. Conversely, non-skid socks alone reduced amplitude, enhancing stability compared to barefoot conditions. These findings highlight the nuanced effects of non-skid socks and added weight on balance and stability. While socks alone may improve postural control, their combination with weight appears to elevate instability. Future research should include larger, diverse samples to confirm these findings and guide clinical practice regarding non-skid socks and weighted training protocols.

**Keywords:** Non-skid socks, postural stability, perturbation, weight training in healthcare

## INTRODUCTION

Reaction time is a fundamental aspect of human performance, influencing activities ranging from everyday tasks to specialized movements in sports and rehabilitation settings. Understanding the factors that impact reaction time, such as environmental conditions and individual physical attributes, is essential for optimizing performance and ensuring safety. Among these factors, sudden disturbances or alterations in stability, known as perturbations, play a critical role in determining how effectively individuals can respond to balance challenges. This issue is particularly relevant in fall prevention, as falls represent a significant health concern, especially among older adults and individuals with compromised balance. Each year, approximately 319,000 elderly individuals are hospitalized due to fall-induced hip fractures[1].

A common and cost-effective intervention aimed at reducing falls is the use of non-skid socks, which are marketed as enhancing balance, stability, and confidence during ambulation. However, empirical evidence supporting their effectiveness remains limited. Research indicates that non-skid socks do not significantly improve balance or stability in healthy individuals and offer minimal protection against falls[2]. Despite these findings, non-skid socks continue to be widely used in hospitals as an anti-fall measure[3] and are prominently sold by major retailers such as Lululemon ([shop.lululemon.com](http://shop.lululemon.com)) and Adidas ([adidas.com](http://adidas.com)). In addition to footwear, external anterior weight