

# INVESTIGATION OF OPTIMAL LUMBAR SPINE POSTURE DURING A SIMULATED LANDING TASK IN ELITE GYMNASTS

Lawrence Sonvico, MSc<sup>1</sup>

Simon M Spencer, MSc<sup>2</sup>

Louise Fawcett, MSc<sup>2</sup>

Jonathan Bucke, MSc<sup>2</sup>

Nicola R Heneghan, PhD<sup>3</sup>

Alison Rushton, PhD<sup>3</sup>

## ABSTRACT

**Background:** Lumbar spine range of motion (ROM) is a key component of injury prevention and normative data has not currently been determined for an elite gymnastics population. In current clinical practice, it is commonplace to measure sagittal spinal alignment, during 'high-load, low-dynamic' control tasks, subjectively, while also only considering the lumbar spine as a single segment

**Purpose:** To develop normative data for total lumbar spine ROM and ROM during a simulated landing task (SLT) in an elite gymnastics population, evaluating findings in the context of the existing biomechanical literature.

**Study Design:** Repeated measures, cross sectional design

**Methods:** Lumbar spine and low lumbar spine (LLS) ROM during a SLT were measured, using the Dorsa Vi: Vi Perform™ system in asymptomatic male and female elite gymnasts. Values for maximal ROM and LLS angle during the SLT were collated and descriptively analyzed. Lumbar ROM and posture was evaluated in relation to the current biomechanical literature and a proposed Conceptual Compressive Lumbar Load Distribution Model (CCLLDM).

**Results:** Thirty elite gymnasts (15 male, 15 female), participated. Participants were members of the British Artistic Gymnastics elite senior and junior training program and were between the ages of 16 to 30 years. Mean (SD) maximal lumbar spinal movements were 64.23° (6.34°) for flexion and 25.89° (11.14°) for extension. During the SLT, participants performed lumbar spine flexion of 15.96° (8.80°), when considered as a single segment. When considering the lumbar spine as a two segment model the LLS position during the SLT was towards end range anterior pelvic tilt, suggesting LLS extension.

**Conclusion:** These data provide a baseline for asymptomatic lumbar spine movements in an elite gymnastics population and provides insight into upper and lower lumbar spine movement during a SLT. The data and newly developed CCLLDM provide clinicians with a potential framework to identify sporting skills that may be associated with increased spinal tissue load.

**Levels of Evidence:** 3b

**Keywords:** Gymnastics, normative data, range of motion, spinal neutral

<sup>1</sup> The English Institute of Sport, Bisham Abbey National Sports Centre, Marlow, United Kingdom.

<sup>2</sup> The English Institute of Sport, Lilleshall National Sport Centre, Nr Newport, Shropshire, United Kingdom

<sup>3</sup> School of Sport, Exercise & Rehabilitation Sciences, The University of Birmingham, Edgbaston, Birmingham, West Midlands, United Kingdom

The authors declare no funding sources and no conflict of interests.

**Acknowledgements:** The assistance and knowledge throughout this process from Andrew Powell, Michael A. Adams and The British Gymnastics team has been much appreciated. The authors declare the results of the study are presented clearly, honestly, and without fabrication, falsification or inappropriate data manipulation.

## CORRESPONDING AUTHOR

Lawrence Sonvico

The English Institute of Sport, Bisham Abbey National Sports Centre, Marlow, SL7 1RR, United Kingdom

E-mail: lawrence.sonvico@eis2win.co.uk