

# ABSTRACT

**Introduction:** Low back pain is a multi-factorial and multi-consequential pathology, both in human and economic terms. With the current tools for categorizing and quantifying it clinically and objectively, its diagnosis is currently based on subjective or expensive methods.

**Objectives:** This study tends to support the hypothesis that people with low back pain (LBP) tend to stereotype their movements in contrast to asymptomatic people (NLBP) who would show greater variability. The sample entropy (SampEn) will aim to quantify this variability and potentially serve as a discriminating factor. It will also discuss the results of previous studies that have been able to discriminate between these two populations using other parameters.

**Material & methods:** 39 volunteer participants ( $45.6 \pm 9.8$  years old) divided into 2 groups participated in the study: 19 subjects with low back pain and 20 others “healthy”. All of them performed a b&r test at a preferential pace for 70s (10s of warm-up followed by 60s of measurement) while being equipped with 3 DYSKIMOT inertial sensors placed on Th12, S2 & at 10cm below the greater trochanter. Calculations of SampEn, movement time, symmetry ratio and peak and extension velocity were performed on the raw gyroscope values on the Y axis (rad/s).

**Results:** The mean SampEn values allowed to significantly ( $p\text{-value} < 0.05$ ) differentiate the LBP population to the NLBP from the 8<sup>th</sup> to the 19<sup>th</sup> cycle. A Pearson’s correlation calculated from the SampEn value at the 19<sup>th</sup> cycle showed that NLBP subjects converge faster ( $r^2 > 0.95$  at the 3<sup>rd</sup> cycle) than LBP subjects ( $r^2 > 0.95$  at the 7<sup>th</sup> cycle). Regarding the other parameters, all of them made it possible to distinguish these 2 populations, but not in a significant way.

**Discussion:** The SampEn, like other parameters, is effective in differentiating the population with and without low back pain. However, the reasons for the movement strategies used remain unclear.

**Conclusion:** The sample entropy was able to significantly discriminate a LBP population from an NLBP. Contrary to the speed of extension or peak, the symmetry ratio, the time of movement or its amplitude. But at the level of the individual, this remains illusory. A Pearson correlation showed that NLBPs converged faster than LBPs to a predictable, stereotypes movement.

**Keywords:** sample entropy, lumbar back pain, inertial sensors, repetitiveness