Which movement and muscular activity biomarkers to discriminate non-specific chronic low back pain patients from an asymptomatic population?

Florent Moissenet¹*, Kevin Rose-Dulcina¹, Stéphane Armand¹ and Stéphane Genevay²

¹ Kinesiology Laboratory, University of Geneva and Geneva University Hospitals, Geneva, Switzerland.
² Department of Rheumatology, Geneva University Hospitals, Geneva, Switzerland.

* florent.moissenet@unige.ch
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The identification of relevant and valid biomarkers to distinguish patients with non-specific chronic low back pain (NSCLBP) from an asymptomatic population could contribute to:

• a better patient follow-up
• evaluate therapeutic strategies

To date, NSCLBP is often described as a complex disorder where central and peripheral nociceptive processes are influenced by social, psychological and musculoskeletal factors. However, the role of musculoskeletal factors (related to movement and/or muscular activity) remains unclear.

The aim of this systematic review was then:

• To identify the primary biomarkers related to movement or muscular activity
• To report their reliability, validity, interpretability levels, when available
The research question, established using the PICO approach, was: “*In adults suffering non-specific chronic low back pain, what are the biomarkers that allow to discriminate them from an asymptomatic population in terms of movement or muscular activity?*”.

Systematic review details:
• PROSPERO registration number: CRD42020144877
• Conducted in Medline, Embase, and Web of Knowledge databases until July 2019
• Written following the Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) Statement
• The assessment of each reported movement and/or muscular activity parameter was inspired by the COSMIN checklist.
Results

In total, **92 studies were included.**

**Predominant parameters** were related to:

- Muscular activity in 70% of the included studies
- Primarily ICF 2\textsuperscript{nd} level cat. d410 “Changing basic body position” (43%)
- Spatial/intensity values (82%)
- The lumbar region (43%)

Included studies **come mainly from:**

- Occidental Europe including UK (32%)
- North America (28%)
- Asia (12%)

The mean **number of participants** across studies was:

- 29.0 ± 30.4 [min: 5, max: 218] for NSCLBP
- 23.1 ± 16.5 [min: 6, max: 130] for control
Results

Figure 1.
Included studies and related parameter types, ICF 2nd level categories, variable categories and regions of interest. The number of studies linked to each item is also reported.
Results

The construct validity of these parameters allowed to identify 121 movement biomarkers (BMo).

The measurement properties were assessed by only one study in 96% of BMo:

• **Reliability** was assessed in only 24% of BMo. When considering altogether intra- and inter-observer reliability results, the reported level was good in 73% of BMo.
• **Criterion validity** was never assessed.
• **Content validity** was good in 55% of BMo, but construct validity was mainly moderate in 48% of BMo.
• **Interpretability** (MDC) was only assessed for 17% of BMo.
• **Clinical applicability**, regarding the protocol used in the included studies, was moderate for 83% of BMo.

An **extensive measurement properties assessment** was found only in 31 BMo.
Results

The construct validity of these parameters allowed to identify 150 muscular activity biomarkers (BMu).

The measurement properties were assessed by only one study in 85% of Bmu:

- **Reliability** was assessed in only 14% of BMu. When considering altogether intra- and inter-observer reliability results, the reported level was good in 79% of BMu.
- **Criterion validity** was never assessed.
- **Content validity** was good in 53% of BMu, but construct validity was mainly moderate in 47% of BMu.
- **Interpretability** (MDC) was not assessed for BMu.
- **Clinical applicability**, regarding the protocol used in the included studies, was good for 62% of BMu.

An extensive measurement properties assessment was found only in 14 BMu.
This study highlights that, even if several relevant biomarkers related to movement and muscular activity have been proposed and their measurement properties partially assessed, there is currently a lack of consensus concerning a robust and standardised biomechanical approach to assess low back pain.

Prior to such a consensus, it is however crucial to increase the current knowledge on the biomarkers highlighted here (and on any other possible biomarker) to ascertain that all COSMIN domains (reliability, validity, responsiveness, interpretability) have been well explored.

For that, future studies should seriously consider reproducing existing protocols and measure parameters in the same conditions than in the original articles, but also in different countries, cultures and pain/disability levels on low back pain populations.
Summary points

• Reported biomarkers were related to various tasks mostly measuring spatial or intensity values targeted to the lower back;
• Biomarkers were mostly (90%) reported in only one study for each of them, and only 8% of them were assessed in terms of reliability, validity and interpretability;
• 31 movement biomarkers and 14 muscular activity biomarkers were identified for which an extensive measurement properties assessment is already available.

Further details about this study are available in Moissenet et al., 2021 (https://doi.org/10.1038/s41598-021-84034-x)