

# POOR BACK MUSCLE ENDURANCE IS MEDIATED BY PAIN CATASTROPHIZING IN CHRONIC LOW BACK PAIN PATIENTS

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## INTRODUCTION

The study of the mediating effect of pain-related psychological characteristics (e.g.: pain catastrophizing, kinesiophobia) on the physical deconditioning (lower physical fitness) of chronic low back pain (CLBP) patients might be invalidated by the use of performance measures to assess physical fitness per se [1]. This might be mainly true when lumbar-specific assessments are applied to CLBP patients having fear of injury, namely the ones that are expected to show physical deconditioning [2]. The aim of this study was to unravel this problem with the use of an electromyographic (EMG)-based test of back muscle capacity designed to be free from motivation factors [3].

## METHODS

27 CLBP subjects (14 men) and 31 healthy controls (17 men) performed 3 maximal voluntary contractions (MVC) and a fatigue test (FT) in a static dynamometer measuring L5/S1 moments [3]. *Strength* was defined as the peak MVC. The FT, assessing absolute endurance, consisted of repeating intermittent static extension contractions (8-s cycles comprising a 5-s contraction) at a 90-Nm force level. The contractions were repeated until exhaustion in healthy subjects to get the corresponding fatigue criterion of time to exhaustion ( $Tend = 8 \text{ s} \times \text{number of cycles}$ ). In CLBP subjects, the FT was time-limited to 5 min. (38 cycles) in men and 10 min. (75 cycles) in women [3].

Surface EMG signals were collected from 4 pairs of back muscles (4 electrode sites: at L5, L3, L1, T10 vertebral levels) during the FT [3]. The EMG signals from the first 5 (women) and 10 (men) min of EMG data were processed in the frequency domain to compute EMG indices sensitive to muscle fatigue. In the temporal domain, EMG indices presumably sensitive to load sharing between back muscle synergists were calculated. Finally, gender-specific multiple regression equations were applied, using these "motivation-independent" EMG indices as input, to predict *Tend* (*PTend*) and *Strength* (*PStrength*) [3].

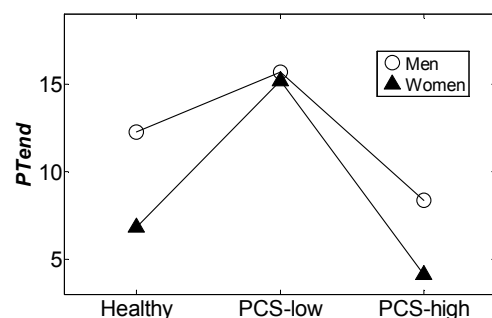
Three pain-related psychological variables were assessed in CLBP subjects before MVCs and FT: (1) pain intensity with a visual analog scale (VAS), (2) fear of movement or injury with the Tampa scale of kinesiophobia (TSK) and (3) pain catastrophizing with the Pain catastrophizing scale (PCS). CLBP patients were divided in two subgroups based on a median split of scores (low and high scores) on each of the three questionnaires, while ensuring that the subgroups have the same amount of men and women.

Two-way ANOVAs were carried out to compare sexes and the 3 groups (healthy subjects vs CLBP subgroups 1 and 2 defined using VAS, TSK or PCS median scores).

## RESULTS AND DISCUSSION

Healthy subjects were equal to both subgroups of CLBP patients (regardless of the subgrouping variable VAS, TSK or PCS), as regards to age, mass, height and percent fat. Both *Strength* and *PStrength* variables showed that men were stronger ( $P < 0.05$ ) than women and that CLBP subgroups were as strong as healthy controls. In healthy subjects, for whom *Tend* was measured, men showed higher values, which was expected knowing that absolute endurance (*Tend*) is partly determined by *Strength*.

Differences between healthy and CLBP subgroups were observed only when patients were divided using PCS scores. High-PCS patients showed lower *PTend* ( $P < 0.05$ ) than low-PCS patients (Figure 1). These results remained even when adjusting for pain intensity (VAS) in an ANCOVA. Moreover, some EMG indices showed comparable results to *PTend*. This partly supports the fear-avoidance model stating that patients showing more fear and pain catastrophizing decrease their physical activity and as a result, show more physical deconditioning [2]. Low catastrophizers (PCS-low) showed a trend, although not statistically significant, towards higher endurance than healthy controls (Figure 1). This would support a complementary model hypothesizing that other patients also do more physical activity than normal [4]. Interestingly, some EMG indices of muscle fatigue showed that healthy controls had significantly less and more fatigable back muscles than high- and low-PCS patients, respectively, which more clearly support both models.



**Figure 1:** Predicted time to exhaustion (*PTend*) between sexes and between healthy controls and CLBP subgroups divided on the basis of the median split of PCS scores.

## ACKNOWLEDGEMENTS

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## REFERENCES

1. Verbunt JA, et al., *Clin J Pain*. **21**: 232-240, 2005.
2. Vlaeyen JWS, et al., *Pain*. **85** :317-332, 2000.
3. Larivière C, et al., *Spine J*. **9**: 87-95, 2009.
4. Hasenbring MI, et al., *Eur J Pain*, **10**: 701-709, 2006.