HIT THE PAIN AWAY

ACUTE EFFECTS OF HIGH INTENSITY TRAINING ON PAIN PROCESSING AND INFLAMMATION IN CHRONIC LOW BACK PAIN.

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Context

- Chronic nonspecific low back pain (CNSLBP) is a common musculoskeletal disorder with a highly disabling character affecting men and women worldwide(1).
- The prevalence of CNSLBP is still rising and increasingly burdens our healthcare systems.
- Optimized CNSLBP management through innovative research efforts is essential(2).

- exercise therapy (ET) has been proven to be an effective therapeutic modality for CNSLBP(3).
- In healthy subjects, exercise-induced hypoalgesia (EIH) is well documented. But, in persons with CNSLBP, acute pain responses to exercise are variable, especially in initial therapy stages(4). 'Flare-ups' of acute pain during exercise might be related to increased chronic pain sensitivity(5).
- Magnitude of the EIH response is believed to depend on several factors. There is currently only limited understanding of the optimal exercise intensity to produce hypoalgesic effects on different types of pain stimuli in persons with chronic pain. Nevertheless, several indications of a dose-response effect in exercise and the amount of EIH that can be expected have been found(6).

- effect sizes of ET on pain relief in general remain only modest(7).
- High intensity training (HIT) has been found to be an interesting modality to increase the effect size of pain reduction both acutely and long-term in several populations including chronic musculoskeletal pain(8).
- Working mechanisms of HIT remain unclear(9).

- Acute exercise can induce an extensive inflammatory response in persons with CNSLBP, which may heavily contribute to the disrupted production of EIH(10).
- Specifically, the effect of cytokines such as IL-6 and TNF-α during physical performance as potential local "pain triggers" are gaining more attention(11).
- in chronic pain disorders, EIH and related inflammatory responses to exercise are also said to be influenced by psychological factors such as anxiety and sleep disturbances, which merits their inclusion in multivariate analyses(12).

1) To evaluate differences in exercise induced hypoalgesia (EIH) after either a high intensity interval training (HIIT) or moderate intensity continuous training (MICT).
2) To investigate effects of inflammatory biomarkers, and psychological factors on initial pain perception and EIH.

➡ In persons with chronic nonspecific low back pain (n=20) and matched healthy controls (n=20).

Materials and methods

Design and participants. In this ongoing two-armed experimental cohort study, persons between 18-65 years with CNSLBP ('CNSLBP', n=20) and matched healthy controls ('HC', n=20) will participate in a cross-sectional assessment of different cardiorespiratory exercise protocols (i.e. HIIT and MICT) with a randomized assessment cross-over design to limit learning effects (Figure 1). A cardiopulmonary exercise test will be performed on beforehand to ensure correct training intensity during the execution of these assessments.

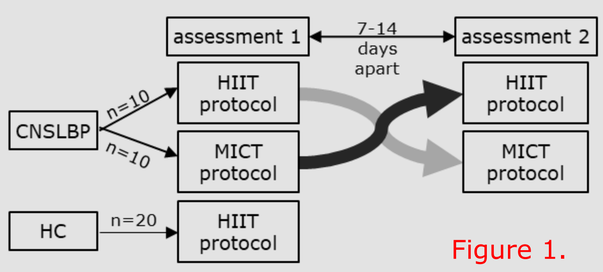
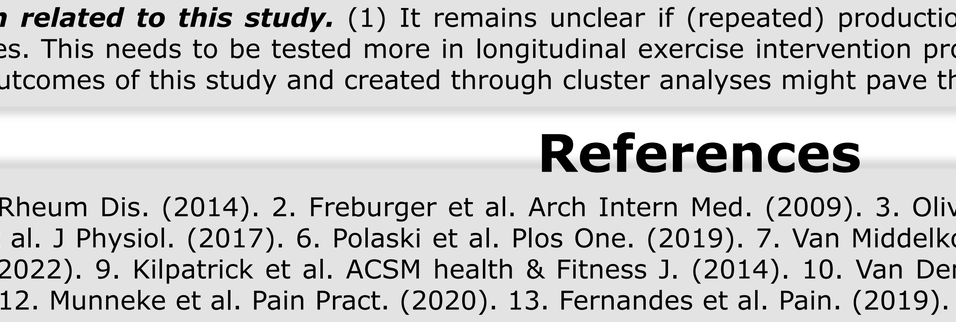


Figure 1.

Outcomes. During each assessment, outcome measures will be analyzed before ('PRE') and directly after ('POST') the exercise protocols. EIH is assessed by cuff algometry through evaluating pain detection thresholds (PDTs). Questionnaires related to depression-anxiety-stress (Depression Anxiety Stress Scale (DASS21)), fear-avoidance behaviour (Fear Avoidance Behaviors Questionnaire (FABQ)), and sleep quality (Pittsburgh Sleep Quality Index (PSQI)) are inventoried. Venous blood samples (serum) are collected and will be assayed using standard ELISA protocols to evaluate inflammatory markers (i.e. interleukin-6 (IL-6) and tumornecrosis factor alpha (TNF-α)). An overview of the assessment flow is displayed in Figure 2.

Figure 2.



Data analysis. An independent t-test (or nonparametric variant) will be used to evaluate between group differences (CNSLBP vs HC). A paired t-test will be used to evaluate differences between assessment HIT and MICT (only in CNSLBP). In a later phase, more elaborate correlation/regression/cluster analyses will be used to estimate relationships between variables and make classifications of distinct profiles in this sample.

Preliminary results

Currently, 15 persons with CNSLBP and 11 healthy controls have been assessed and evaluated. Demographics with SD between brackets are displayed for both groups below.

CNSLBP ID		HC ID
46.3 (7.5)	Age (years)	46.3 (7.0)
8/7	Gender (F/M)	6/5
26.5 (5.1)	BMI (kg/m²)	27.2 (4.0)
29.6 (8.0)	VO_2max (ml/kg/min)	30.3 (5.7)
Moderate (73%)	Activity level (IPAQ)	Moderate (45%)
11.5/50 (5.1)	Disability (MODI)	-
5.8/10 (1.9)	Pain (NPRS)	-

PDTs PRE were not different between CNSLBP and HC (Figure 3A). When evaluating the dataset with matched samples (n=11x2), PDTs increased significantly after the protocols in HC ($p<0.05$, '*') but not in CNSLBP (Figure 3B). PDTs in CNSLBP were not different ('ns') between the HIIT and MICT protocol (Figure 3C). Moderate correlations were found between PDTs and patient reported questionnaires, but they were all non-significant. Inflammatory markers have not been evaluated yet.

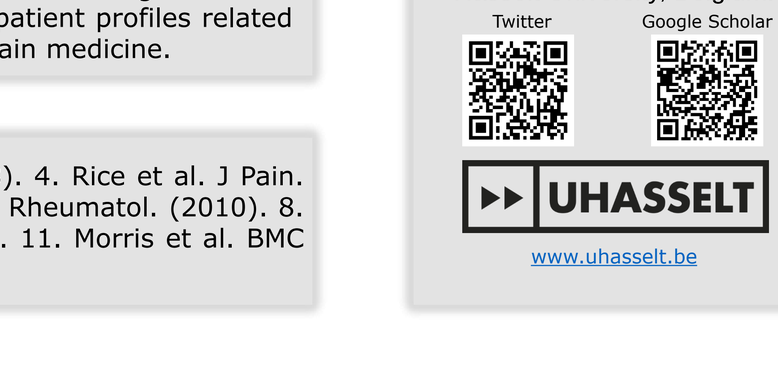


Figure 3.

Discussion

Preliminary conclusions. In this study sample, persons with CNSLBP do not have lowered baseline PDTs compared to matched healthy controls. One bout of a cardiorespiratory exercise protocol does not seem to affect PDTs acutely in persons with CNSLBP. A lack of increasing PDTs after either HIT or MICT might indicate EIH impairment that cannot be altered acutely by exercise regardless of intensity. With regard to the relationship of pain perception with both (patient reported) psychological variables and also inflammatory markers, higher power is needed to correctly evaluate if these outcomes are indeed associated with (impaired) EIH response. Recruitment of remaining participants and subsequent additional statistical analyses between PRE-POST PDTs and psychological factors and inflammatory markers are planned.

Additional hypotheses to be tested within the progression of this study. While static cuff algometry outcomes measures (i.e. PDTs) might not be distinctive at baseline or altered after exercise in persons with CNSLBP, other dynamic outcomes such as temporal summation and conditioned pain modulation (also inventoried in this study) might still be discriminative variables in this population(13).

(Potential) Limitations. (1) This study did not include a MICT protocol assessment in the HC group, limiting the evaluation of exercise intensity in persons without pain. (2) It remains to be seen if clustering analysis will produce a valid classification within this (small) dataset.

Future research related to this study. (1) It remains unclear if (repeated) production of EIH transfers to long term training results or clinical advantages. This needs to be tested more in longitudinal exercise intervention protocols. (2) More insights in patient profiles related to the depicted outcomes of this study and created through cluster analyses might pave the way for enriched RCTs in pain medicine.

References

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