Differences in WCST associated with chronic pain in aging: A VBM pilot study

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Introduction

It has been shown that older adults suffering from chronic pain present brain atrophy in addition to those manifested by normal aging (Cruz-Almeida, 2019). Moreover, both pain and aging, are causes of cognitive decline (Cohen, 2019; Higgins, 2018). Therefore, chronic pain older adults may be especially prone to cognitive deficits. This study aimed to analyze how neuropsychological performance in the Wisconsin Card Sorting Test (WCST) in musculoskeletal pain condition associates to brain regions showing alterations in both pain and aging, measured with voxel-based morphometry (VBM) analysis.

The objective was to examine the VBM in older adults with and without chronic pain and explore its association with WCST performance, to better understand how chronic pain affect to executive functions in aged population.

Materials and Methods

Participants. 30 older adults with musculoskeletal chronic pain (69,5±6.58 years; 14 males), 29 pain-free older adults (70.48±4.60 years; 15 males), and 30 pain-free younger adults (20.0 ±1.58 years; 15 males).

Experimental procedure: All participants completed the WCST (see Figure 1) and underwent a magnetic resonance imaging (MRI) scan (see Figure 2).

Data analysis. 1. WCST performance was analyzed with a univariate ANOVA (young vs. pain-free older vs. older with pain). **2.** Whole brain voxel-based morphometry (VBM) analysis was performed. **3.** Pearson's correlations were computed between WCST performance and brain regions showing significant density differences between groups.

Fig. 1. Wisconsin Card Sorting Test (WCST)

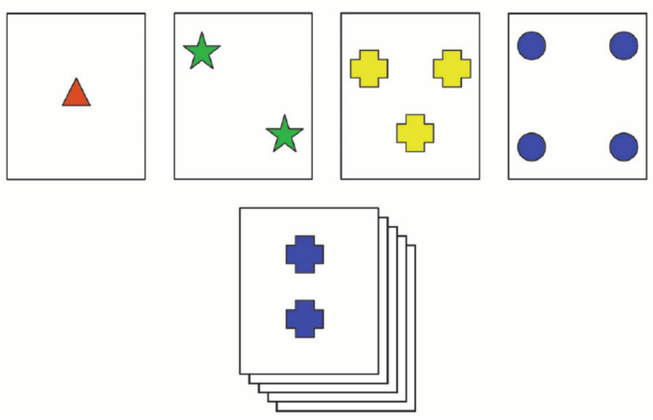


Fig. 2. MRI

Results

1. **WCST performance.** Older adults with chronic pain showed the highest percentage of errors and perseverative responses, followed by pain-free older and finally younger adults (all ps<0.05) (see Figure 3). No differences were found in completed categories, non-perseveratives errors and correct answers (all *p* >0.05).

2. **VBM analyisis.** In comparison to younger participants, both older adults groups showed a widespread brain atrophy involving frontal, parietal and temporal regions (all *p* >0.05). No differences between older adults with and without chronic pain were found (*p* > 0.05) (see Figure 4).

3. **Pearson correlations**. In chronic pain older adults, reduced grey matter density in orbitofrontal cortex (OFC) was associated to higher perseverative answers (medial OFC: r=-0.520; *p* = 0.009) and total errors (left OFC, r=-0,481; *p* = 0.005) (see Figure 5). No significant correlations were found in pain-free older and younger adults (all p>0.05).

Fig. 3. WCST performance.

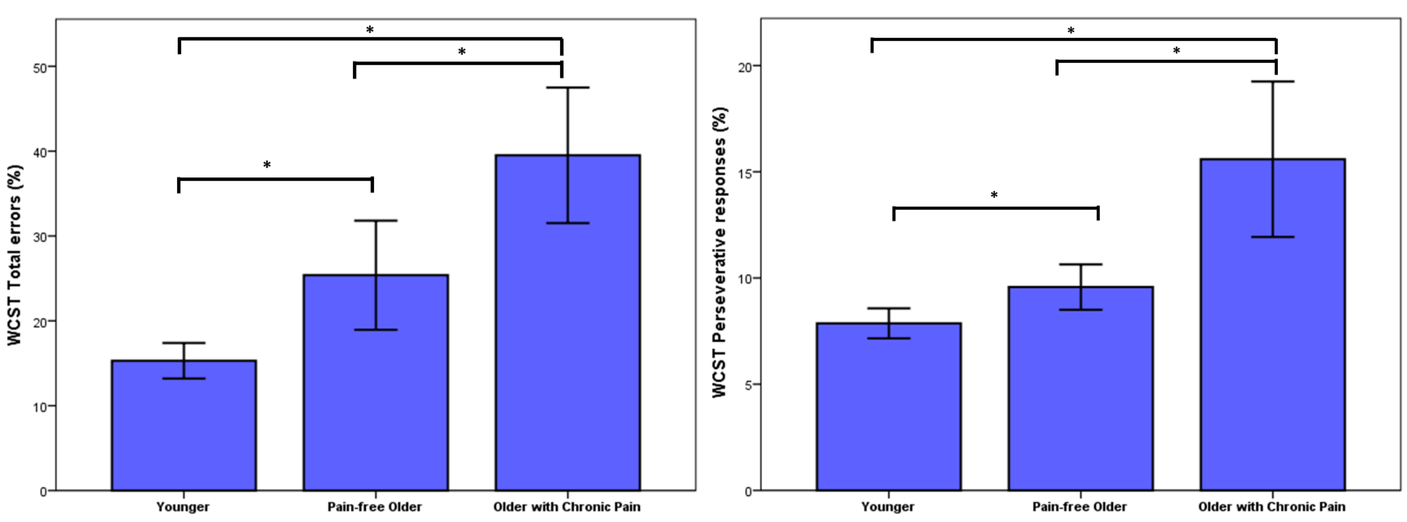


Fig. 4. VBM comparison between younger and both older adult groups.

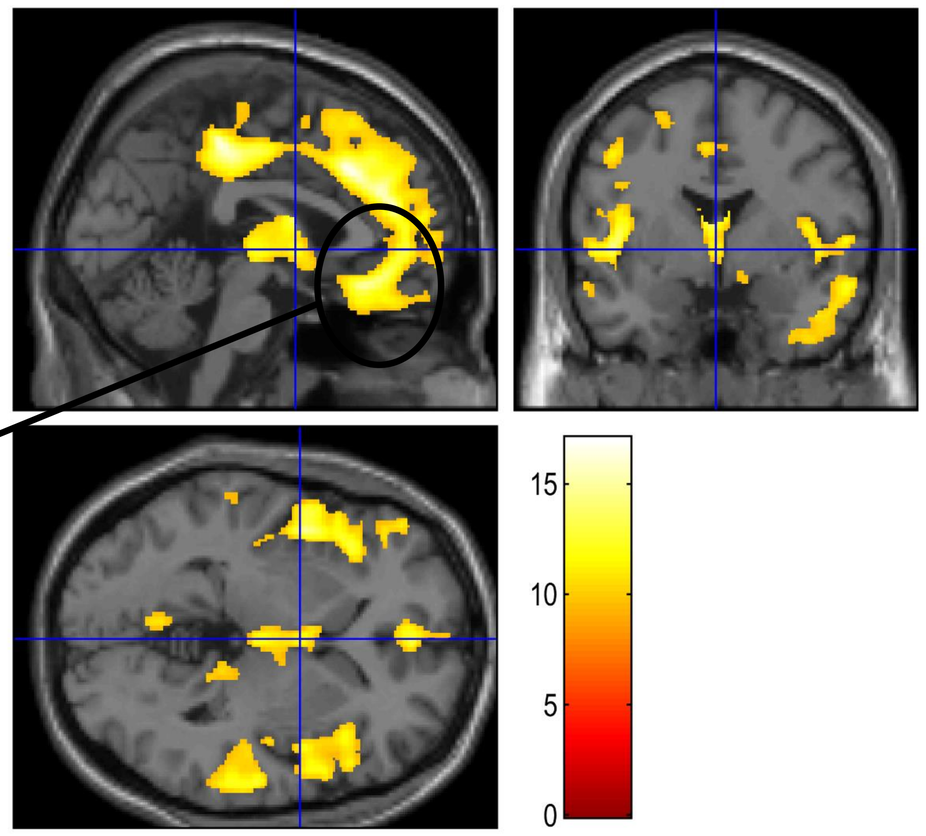
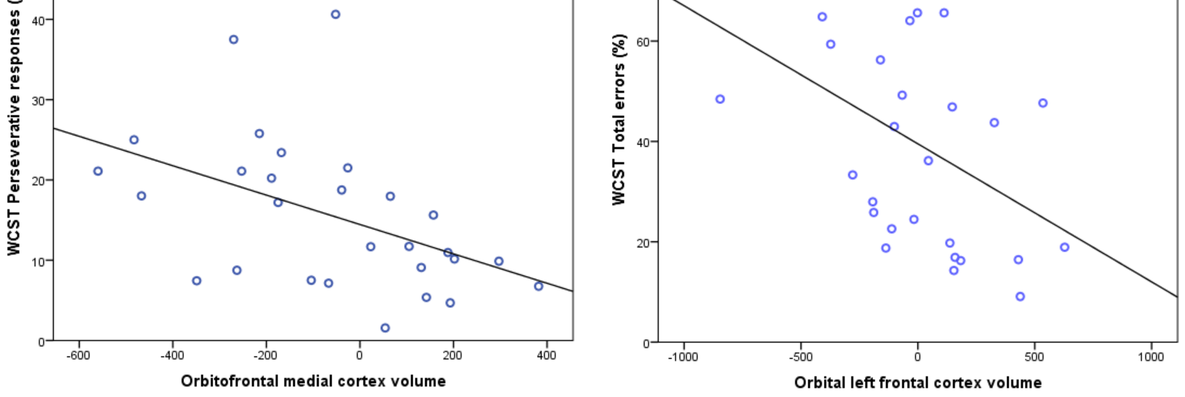


Fig. 5. Pearson correlation between VBM and WCST performance.



Conclusions

Older adults with chronic pain showed poorer performance in the WCST in comparison to pain-free older and younger adults, suggesting that chronic pain exacerbates age-related decline in executive functions. Although no structural alterations specifically related to chronic pain were found, correlational analyses showed that reduced density in OFC was associated with worst performance in the WCST only in the older adult with chronic pain group. Altogether, indicate that aging effects in brain morphometry have enhanced consequences in chronic pain population, suggesting that the cognitive load produced by pain may exceed the cognitive resources of an aged brain.

References

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