



# Effects of horticultural therapy versus handiwork on anterior cingulate cortex activity in people with chronic low back pain: a randomized, controlled, cross-over, pilot study

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## ABSTRACT

**Aim:** to assess the effects of horticultural therapy (HT) on anterior cingulate cortex (ACC) activity and rumination and catastrophizing scores in people with chronic low back pain (LBP)

**Materials and methods:** we conducted a randomized, controlled, cross-over, three-week pilot study (CT.gov identifier: NCT04656158). Participants were adults with non-specific chronic LBP. All participants underwent two 90-min HT sessions and two 90-min handiwork sessions per week. The two activities were separated by a wash-out period of one week. The activity sequence order was randomized. Each participant underwent three brain MRI: before, after the first and after the second activity. The primary outcome was mean change from baseline in ACC perfusion in ml (blood)/100g (tissue)/min using arterial spin labeling MRI. Secondary outcomes were mean changes from baseline in self-reported rumination and catastrophizing scores after each activity

**Results:** sixteen participants were included (Figure 1): 14 participants were women (88%), mean LBP intensity (numeric rating scale, 0-100) was 45.1 (27.2), and mean specific activity limitations (Roland-Morris disability questionnaire, 0-24) were 9.3 (4.1) (Table 1). Mean change in ACC perfusion was -0.1 (10.7) ml/100g/min after handiwork and -0.1 (8.7) after HT (Figure 2) (p=0.91). Mean change in rumination score was -0.5 (4.4) after handiwork and -0.3 (2.8) after HT and mean change in catastrophizing score was -2.0 (2.8) after handiwork and -1.4 (2.3) after HT (p=0.99 and 0.22, respectively) (Table 2)

**Conclusions/discussion:** we found no evidence of between-group differences for ACC activity and rumination and catastrophizing scores. The absence of a specific effect of HT on the prespecified outcomes may explain our results. One can also hypothesize that limited exposure to HT and participants' profile (moderately affected by pain) may have influenced outcomes

**References:** Bliss TVP et al. Synaptic plasticity in the anterior cingulate cortex in acute and chronic pain. *Nat Rev Neurosci* 2016;17:485-96. Bratman GN et al. Nature experience reduces rumination and subgenual prefrontal cortex activation. *Proc Natl Acad Sci USA* 2015;112:8567-72. Alsop DC et al. Recommended implementation of arterial spin-labeled perfusion MRI for clinical applications: A consensus of the ISMRM perfusion study group and the European consortium for ASL in dementia: Recommended Implementation of ASL for Clinical Applications. *Magn Reson Med* 2015;73:102-16

Figure 1: flow diagram

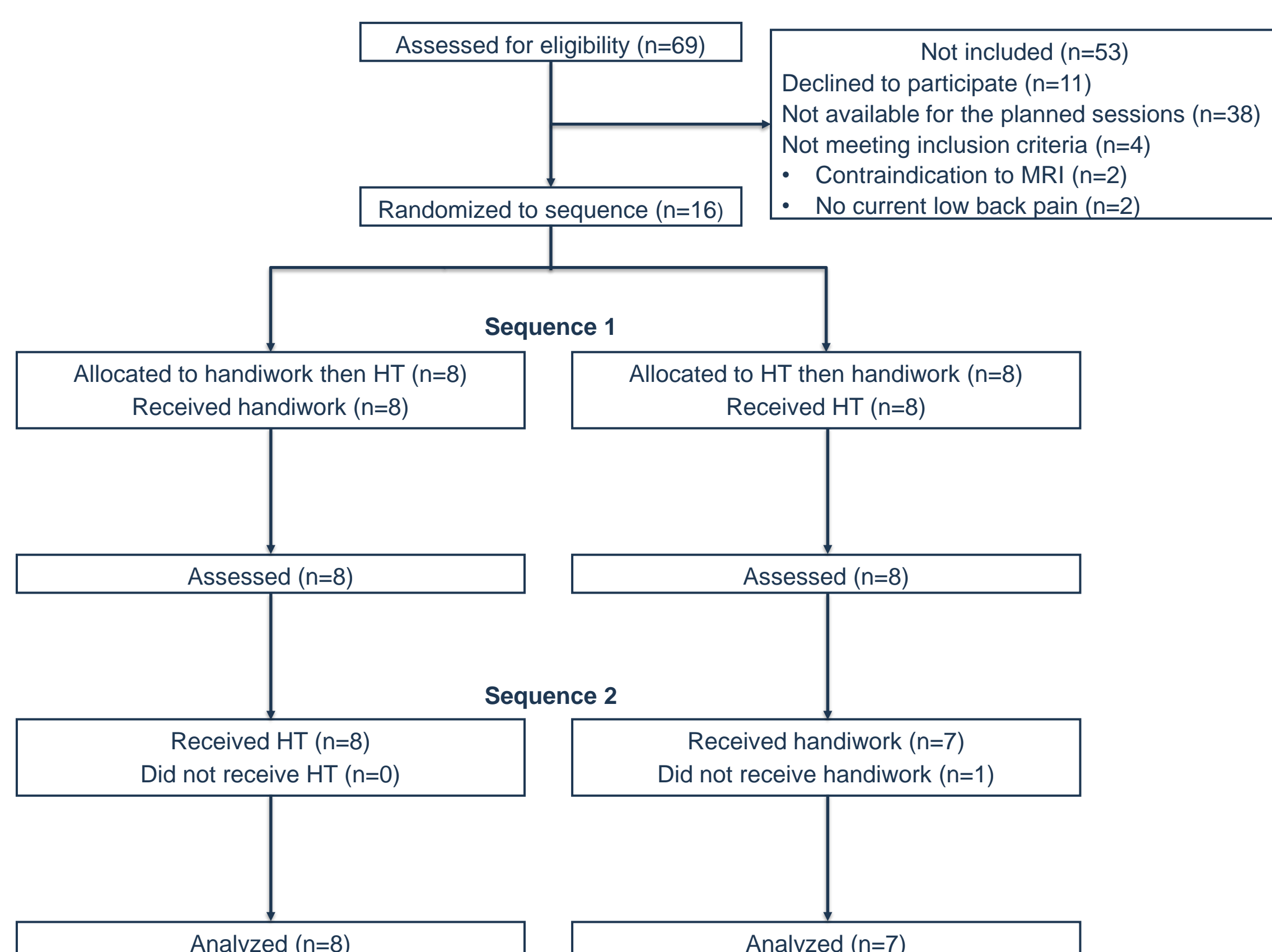


Table 1: participants' baseline characteristics

	Handiwork then horticultural therapy (n=8)	Horticultural therapy then handiwork (n=8)	All participants (n=16)
Current LBP episode duration (months), mean (SD)	35.3 (9.5)	67.0 (43.6)	58.4 (39.6)
LBP intensity on NRS (0-100), mean (SD)	32.8 (24.0)	57.5 (25.6)	45.1 (27.2)
Activity limitations on RMQD (0-24), mean (SD)	7.9 (5.1)	10.6 (2.2)	9.3 (4.1)
Catastrophizing on CSQ subscore (0-20), mean (SD)	12.9 (3.6)	13.6 (3.2)	13.3 (3.3)
Rumination on rumination score (0-60), mean (SD)	32.6 (6.7)	35.9 (6.4)	34.3 (6.5)
ACC perfusion (ml/100g/min), mean (SD)	48.2 (8.9)	51.0 (14.9)	49.5 (11.7)

Abbreviations: LBP: low back pain; NRS: numerical rating scale, higher scores indicate greater pain; RMQD: Roland-Morris Disability Questionnaire, higher scores indicate more limitation; CSQ: Coping Strategies Questionnaire (catastrophizing subscore), higher scores indicate greater catastrophizing; ACC: anterior cingulate cortex; \*n=15/16

Figure 2: average CBF maps (n=16) before and after horticultural therapy

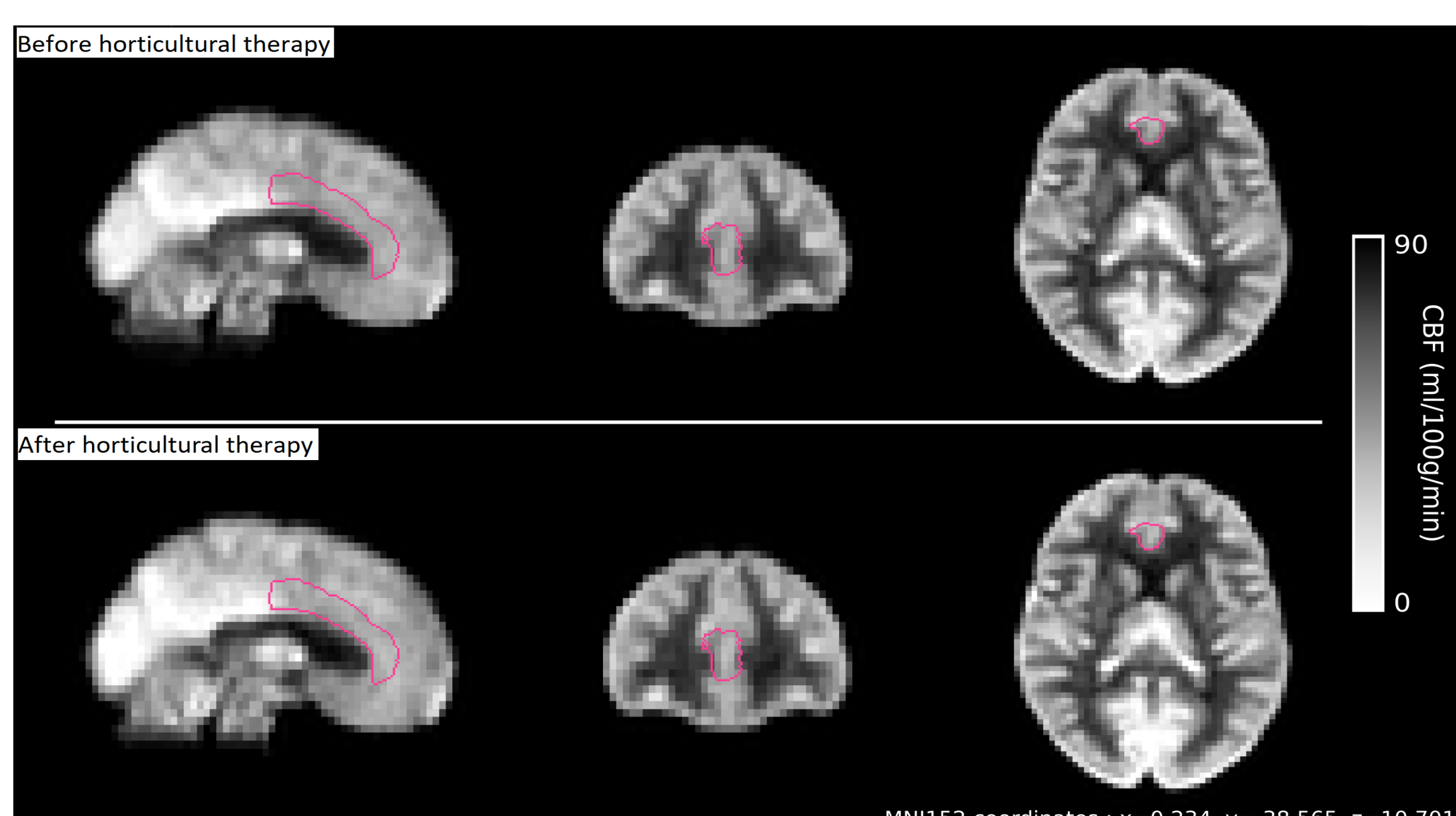


Table 2: primary and secondary outcomes

	Handiwork (n=15)	Horticultural therapy (n=15)	p-value
Change in ACC perfusion (ml/100g/min), mean (SD)	-0.1 (10.7)	-0.1 (8.7)	0.91
Change in catastrophizing score, mean (SD)	-2.0 (2.8)	-1.4 (2.3)	0.22
Change in rumination score, mean (SD)	-0.5 (4.4)	-0.3 (2.8)	0.99