The relationship between the ability to detect ascending sensory signals, and the emotions and beliefs in expectations of pain reduction - an experimental conditioning task

Mariana Agostinho[2], Duarte Santos[1], Adriana Gutierrez[1], Miguel Réfega[1], Rita Canaipa[2]*

[1]Institute of Health Sciences, Universidade Católica Portuguesa, Lisbon, Portugal

[2]CIIS, Centre for Interdisciplinary Health Research, Institute of Health Sciences, Universidade Católica Portuguesa, Lisbon, Portugal

Background

The Bayesian Brain Hypothesis has been proposed to explain the construction of pain perception. According to this approach, pain results from the interaction of individuals' certainty in the priors, encompassing emotions, expectations, and conditioning responses from previous experiences and the certainty in the ascending sensory signals [1].

The certainty of the expectations and conditioning have been consistently assessed by an experimental placebo paradigm developed by Colloca et al. (2010) [2]

The certainty of the ascending sensory signals is difficult to measure directly, but the Focused Analgesia Selection Test (FAST) has recently been proposed as a potential proxy for this factor. This paradigm assesses within-subject variability in reports of pain intensity in response to noxious stimuli of different experimentally induced intensities [3].Psychological factors contributing to this equation were also assessed in this research [4,5].

In this study, we aimed to assess factors contributing to these certainties and possible associations between these two components in healthy individuals.

Methods

Questionnaires

Hospital Anxiety and Depression Scale (HADS): Total 14 items, 4 item Likert-scale; subscales of anxiety and depression (each max. score 21)[4].

Pain Catastrophizing Scale (PCS): Total 13 items, 5 item Likert-scale; subscales of rumination, magnification and helplessness (máx. score 52) [5].

FAST

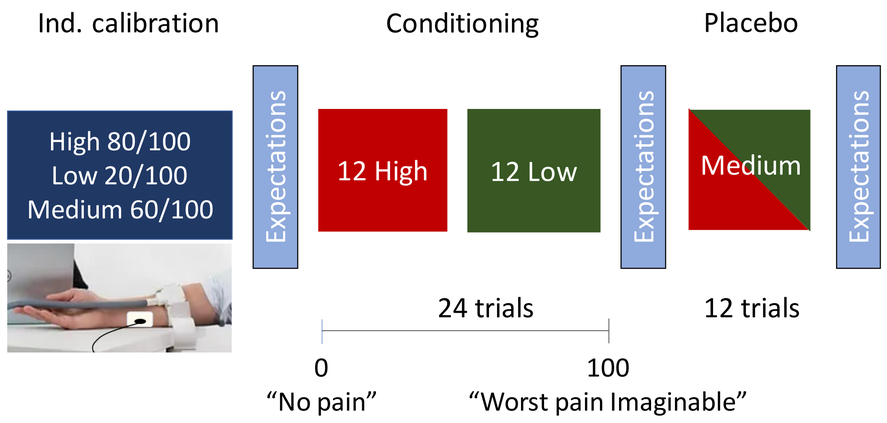
Total of 49 stimuli: 7 trials X 7 stimuli intensities (44°, 45°, 46°, 47°, 48°, 49°, 50°) applied with Medoc TSA-II thermode (30×30 mm).

Pain reports in NRS: 0 – "no pain" to 100 – "worst pain imaginable".

Outcomes: R^2 - linear regression model of stimuli intensity x pain reports;

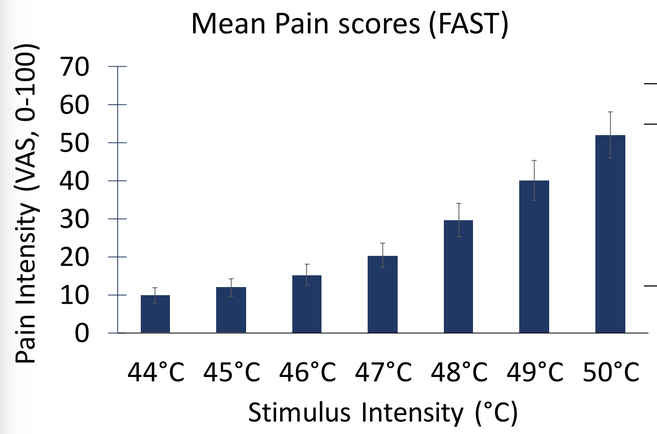
ICC - 2-way mixed model for the 7 trials of each of the 7 stimuli intensity.

Placebo paradigm



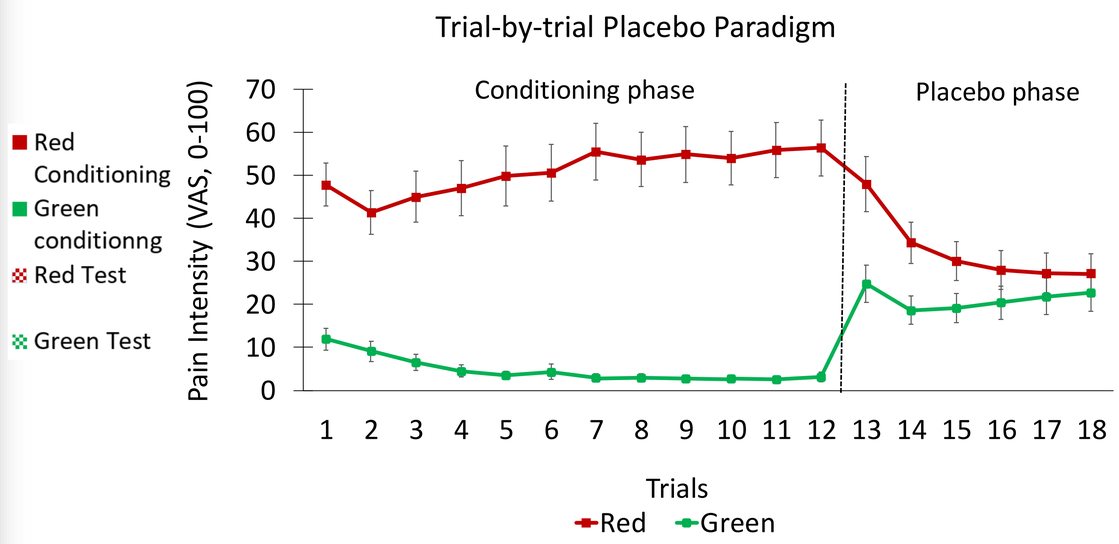
Results

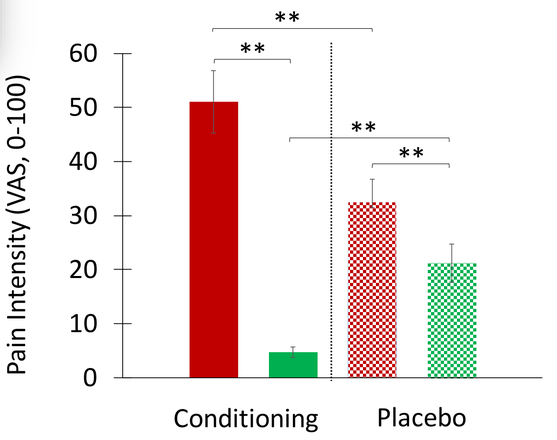
26 participants were recruited. HADS (M=9.96 ± 5.16 SD) and PCS (M=18.65 ± 8.85 SD).

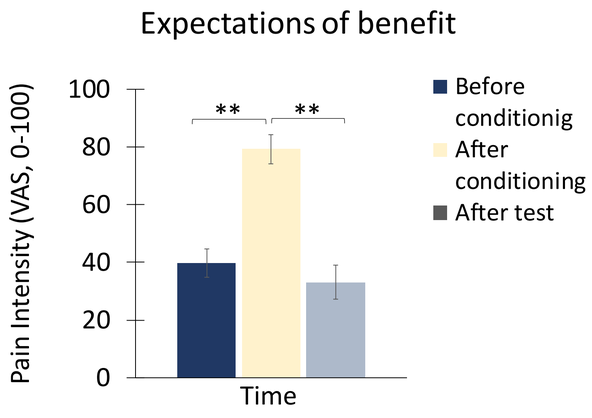


FAST Outcomes

	R2	ICC
Mean (±SD)	0.536 (0.161)	0.623 (0.178)
Median	0.536	0.638
Min	0.023	-0.043
Máx	0.788	0.874







No correlations were found between the FAST outcomes, the conditioning, the test phase, or expectations.

Correlations were found between the HADS anxiety and the placebo (Spearman's r=-.606, p<.001).

Expectations before the conditioning (Rumination Spearman's r= .402 e p= .042) and after (Spearman's r= .443, p= .023) the placebo were positively correlated with the PCS.

Discussion

The ability to perceive ascending sensory signals was not correlated to conditioning or placebo response intensity. Emotional factors may be more relevant to conditioning, and beliefs may have a more direct role in expectations of pain reduction - individuals with higher anxiety levels were less vulnerable to the placebo effect, and catastrophization may have a critical role in expectations of pain reduction during the conditioning by considering the treatment to be more effective. Future studies should recruit chronic pain patients to assess the possibility of the two experimental tasks being related.

Funding

FCT Project CIIS I&D – UIDB/04279/2020 – Base. MA was also supported by the FCT with an individual research grant [Award number(s): 2020.09061.BD]

References

[1] Büchel, C., Geuter, S., Sprenger, C., & Eippert, F. (2014). Placebo analgesia: A predictive coding perspective. Neuron, 81(6), 1223–1239. doi:10.1016/j.neuron.2014.02.042

[2] Colloca, L., Petrovic, P., Wager, T. D., Ingvar, M., & Benedetti, F. (2010). How the number of learning trials affects placebo and nocebo responses. Pain, 151(2), 430–439. doi:10.1016/j.pain.2010.08.007

[3] Treister, R., Eaton, T., Trudeau, J. J., Elder, H., & P Katz, N. (2017). Development and preliminary validation of the focused analgesia selection test to identify accurate pain reporters. Journal of Pain Research, Volume 10, 319–326. doi:10.2147/jpr.s121455

[4] Zigmond, A. S., & Snaith, R. P. (1983). Hospital anxiety and depression scale. PsycTESTS Dataset. doi:10.1037/t03589-000

[5] Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: Development and validation. Psychological Assessment, 7(4), 524–532. doi:10.1037/1040-3590.7.4.524