Pain reduces rational responding to reasoning tasks

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Background

Every day we reason, make judgements and come to decisions. This often requires dedicating our attention to evaluating information or weighing up arguments. The primary function of pain is to capture attention, prioritise danger, and promote escape, avoidance, or repair1. Our reasoning and decision making may therefore suffer when we are in pain.

We examined the effect of acute pain on performance on two formal reasoning tasks. The tasks could be solved with either low-effort or high-effort processing, which would lead to different answers. We predicted that pain would reduce high-effort answers and increase low-effort answers.

Method

Sixty healthy participants (31 females) aged 18-58 years (M = 26.17, SD = 8.73) completed two reasoning tasks. The Cognitive Reflection Test2 (CRT) (Figure 1) prompts intuitive but incorrect responses, which can be corrected on reflection. This was completed once, with or without pain.

Belief Bias Syllogisms3 (BBS) (Figure 2) can be believable or unbelievable, and valid or invalid. Participants must not use prior beliefs (low-effort) to respond, but assess the logical validity (high-effort) of each item. This was completed twice, once with and once without pain.

Painful heat pulses were applied to the forearm with a Medoc Pathway Advanced Thermal Stimulator. Ethical approval was granted from the University of Bath Psychology and Health ethics committees.

Figures

A bat and a ball cost $1.10. The bat costs $1.00 more than the ball. How much does the ball cost?

Figure 1. Example item from the Cognitive Reflection Test. Intuitive answer: 10 cents, correct answer: 5 cents.

All things that are smoked are good for the health. Cigarettes are smoked.

Conclusion: cigarettes are good for the health. Is the conclusion logically valid or invalid?

Figure 2. Valid unbelievable item from the Belief Bias Syllogisms Task. Participants must overcome their beliefs in order to establish the validity of the syllogism. The low-effort answer is ‘invalid’ and the high-effort answer is ‘valid’.

Results

Within the pain group, there was a significant negative correlation between CRT scores and average pain intensity, \( r_c (-.385, p = .003) \). The more intense the pain, the less likely participants were to engage in the high-effort thinking required for correct answers.

For the BBS task, there was an interaction between Validity, Believability and Pain Intensity, \( F(2,74) = 4.54, p = .014, \eta^2_p = .109 \). Participants who rated their pain as high intensity gave fewer correct answers to unbelievable items (which require more high-effort thought than believable items) on the BBS task than participants with low intensity pain.

Discussion

On the CRT, engagement of effortful attention decreased as pain intensity increased. On the syllogisms task, high intensity pain was associated with fewer correct responses to unbelievable items. This is consistent with the selective scrutiny model4 of syllogistic reasoning, which suggests that believable items are endorsed with little thought, while unbelievable items are subjected to scrutiny. Our results suggest that pain may disrupt this scrutiny.

Conclusion

Our results suggest that pain could have a negative impact on rational thinking, potentially leading to worse life outcomes for individuals with frequent or chronic pain.

References


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