

Study finds the frequency of alpha brain waves could be used to assess a person's predisposition to pain

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The personal experience of pain is highly variable among individuals, even in instances where the underlying injury is assessed to be identical. Credit: University of Birmingham

The frequency of alpha brain waves can be used as a measure of an individual's vulnerability to developing and experiencing pain, researchers at the University of Birmingham in the UK and University of Maryland in the US have discovered.

The personal experience of pain is highly variable among individuals, even in instances where the underlying injury is assessed to be identical.

Previous research has found some genetic factors influence pain susceptibility, but methods to accurately predict [pain level](#) consequent to [medical intervention](#) such as chemotherapy or surgery are lacking.

The objective of this study was to see if, from the resting brain activity of a healthy individual, it was possible to predict how much pain they would report once prolonged pain had been induced.

The researchers induced the pain using a

capsaicin paste – an ingredient found in hot chili peppers – to study participants' left forearm and then heated it. Topical capsaicin exposure induces 'robust thermal hyperalgesia' - a common symptom in chronic pain. All 21 participants in the study were induced in a state of prolonged pain for around an hour.

Using an electroencephalogram (EEG) - a non-invasive test used to find problems related to the electrical activity of the brain – the researchers found that across all 21 study participants, those who had a slower [frequency](#) of alpha brain waves recorded before the pain, reported being in much more pain than those who had a fast frequency of alpha brain waves.

The researchers also recorded the activity of alpha [brain](#) waves during the experience of pain, and if alpha frequency increased (relative to the no-pain condition) the individuals reported to be in less pain than when alpha pain decreased.

Co-senior author Dr. Ali Mazaheri, of the University of Birmingham's Center for Human Brain Health, said: "Here we observe that an individual's alpha frequency can be used as a measure of an individual's predisposition to developing pain.

"This has a direct relevance to understanding what makes an individual prone to chronic pain after a medical intervention, such as surgery or chemotherapy.

"Potentially this means we could be able to identify which individuals are more likely to develop pain as a result of a medical procedure and take steps early on in formulating treatment strategies in patients likely to be predisposed to developing chronic pain."

Dr. David Seminowicz and Andrew Furman, of the University of Maryland in the US, were also authors of the report.

Andrew Furman said: "Alpha frequency has been found to be slower in individuals who have experienced chronic pain. So the fact we observed that the slowing down of alpha activity as a result of pain correlated with the intensity of an individual's pain report was not that unexpected.

"What was very surprising though, was that prior to the pain—that is pain-free alpha frequency—could predict how much pain individuals would experience.

"This would suggest that it could be that the slowing of alpha [activity](#) in the [chronic pain](#) patients, isn't because of the pain, but rather these [individuals](#) had slow alpha frequency to begin with, and as such were more prone or vulnerable to developing [pain](#)."

More information: Andrew J. Furman et al.

Cerebral peak alpha frequency predicts individual differences in pain sensitivity, *NeuroImage* (2017).

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