

## TIME-FREQUENCY ANALYSIS OF EVENT-RELATED PAIN POTENTIALS IN MEDITATORS

Vasil Kolev<sup>1</sup>, Juliana Yordanova<sup>1</sup>, Valentina Nicolardi<sup>2</sup>, Luca Simone<sup>3</sup>, Peter Malinowski<sup>4</sup> & Antonino Raffone<sup>2</sup>

<sup>1</sup>Institute of Neurobiology, Bulgarian Academy of Sciences, Sofia, Bulgaria;

<sup>2</sup>Department of Psychology, Sapienza University of Rome, Italy; <sup>3</sup>Institute of Cognitive Sciences and Technologies, CNR, Rome, Italy; <sup>4</sup>School of Psychology, Research Centre for Brain and Behaviour, Liverpool John Moores University (LJMU), UK

### Grant 272/20

**Background:** Several studies in the last two decades have shown the effects of meditation and mindfulness interventions on pain experiences. A few recent studies have found that meditation affects in particular the emotional component of pain.

**Aims:** To evaluate the effects of meditation states and traits on time-frequency components of pain Event-Related Potentials (ERPs). Focused Attention Meditation (FAM), Open Monitoring Meditation (OMM), and Loving Kindness Meditation (LKM) were investigated. We studied fast and slow time-frequency (TF) components of pain ERPs to evaluate whether long-term meditators process painful information differentially by modulating early sensory or late stages of pain processing.

**Method:** Participants: Twenty monastics from a Thai Forest Theravada Buddhist tradition were included in the group of long-term meditators (LTM; 3 females; mean age = 46, mean of years in monastery =  $18 \pm 12.7$ ), with an average of 100 hours of meditation practice per month. Another group of 15 short-term meditators (STM) with less than 250 hours of meditation experience (6 females, mean age = 46) was involved. Time-frequency ERP components: The following main pain-related time-frequency ERP components were identified:

Low-frequency

- Theta-Alpha (5-10 Hz)
- Delta (1-4.5 Hz)

High-frequency

- Beta (17-25 Hz)
- Slow Gamma or Gamma 1 (30-35 Hz)
- Fast Gamma or Gamma 2 (38-45 Hz)

**Procedure:** The whole experimental procedure consisted of three phases: 1) determination of the absolute pain threshold; 2) stimulus intensity calibration; 3) task and stimulation blocks. The third experimental phase consisted in a series of nociceptive stimuli during a non-meditative Rest condition, FAM, OMM and LKM. Participants had to rate three dimensions of experience related to the nociceptive stimulation in each trial: pain, aversion, and identification with pain experience.

**Preliminary results:** Major observations of significant suppression of the synchronization of theta-alpha, beta, fast gamma and slow gamma TF components of pain ERPs at the hemisphere contra-lateral to the side of painful stimulation in LTM as compared to STM demonstrates that LTM, in contrast to STM, do not process efficiently sensory painful information in the early stages of information processing.

The finding that synchronization is suppressed within 150 ms after stimulus implies the presence of early sensory blocking or filtering of painful information flow in LTM. Thus, it

is suggested that long-term meditation practice may affect not only the emotional component of pain but also the earlier sensory component.

**Keywords:** Pain, Meditation, Event-related potentials, EEG, Synchronization

**E-mail contact:** [antonino.raffone@uniroma1.it](mailto:antonino.raffone@uniroma1.it)