ABSTRACT

Anxiety disorders represent a major global mental health concern. According to the Global Burden of Disease 2019, approximately 4.05% of the world's population is diagnosed with anxiety. In Indonesia, the Riskesdas national health survey reported a 6.8% increase during the COVID-19 pandemic. Due to the ethical and psychological risks of testing individuals with clinical anxiety, this study involved participants in a normal mental state, who were then exposed to controlled stimuli designed to induce discomfort.

Previous studies have utilized visual, auditory, or frustrating gameplay stimuli—such as misleading controls and deceptive challenges—to investigate emotional resilience and mental responses. However, most of these studies lacked an integrated real-time brain activity monitoring system.

EEG data were analyzed using MATLAB and EEGLAB to observe changes in the brain's frequency spectrum, particularly within the alpha (8–12 Hz), beta (12–30 Hz), and gamma (>30 Hz) bands. Results showed an increasing trend in the occurrence of high-frequency activity, from 5 times (Level 1) to 6.5 times (Level 2), and peaking at 9.5 times (Level 3), reflecting heightened brain activity as the game's difficulty progressed. Beta and gamma waves were dominant during gameplay, while alpha waves increased significantly following the audio stimulus. The game also elicited controlled discomfort, with an average subjective rating of 4.41 on a 5-point scale.

This research demonstrates that Turtle Trouble can serve as an effective interactive medium for objectively triggering and monitoring emotional changes. Additionally, the system shows potential as a prototype for future applications in light therapy, emotional regulation training, and neuropsychological research.

Keywords: Brainwave, EEG, Enhanced Alpha, Turtle Trouble, Neurofeedback, Frustration Game