

## Protective Effect of Essential Oil from *Chamaecyparis obtusa* on Anxiety-Related Behaviors and Cytokine Abnormalities Induced by Early Life Stress

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**Abstract :** In this study, the effect of essential oil from *Chamaecyparis obtusa* (EOCO) on early life stress using maternal separation (MS) rats was investigated. Anxiety-related behaviors were examined in MS rats using the elevated plus-maze (EPM) test. The changes of gene expressions by EOCO in the hippocampus of MS rats were analyzed using a microarray method. Rats in the MS groups were separated from their respective mothers from postnatal day (pnd) 14 to 28. Rats in the EOCO-treated groups were exposed to EOCO for 1 h or 2 h by inhalation from pnd 21 to 28. The EOCO-treated MS rats showed decreased anxiety-related behaviors compared to the MS rats in the EPM test. In the microarray analysis, EOCO downregulated the expressions of cytokine genes such as *Ccl2*, *Il6*, *Cxcl10*, *Ccl19*, and *Il1rl* in the hippocampus of MS rats, and it was also confirmed through RT-PCR. In particular, the expressions of *Ccl2* and *Il6* were predominantly decreased by EOCO in the hippocampus of MS rats. Interestingly, their protein expressions were also reduced by EOCO in MS rats. These results indicate that EOCO decreases MS-induced anxiety-related behaviors, and modulate cytokines, particularly *Ccl2* and *Il6*, in the hippocampus of MS rats.

**Keywords :** anxiety-related behavior, *Chamaecyparis obtusa*, cytokine gene, early-life stress, maternal separation

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