

# The antidepressant effects of Korean red ginseng water extract in unpredictable chronic mild stress

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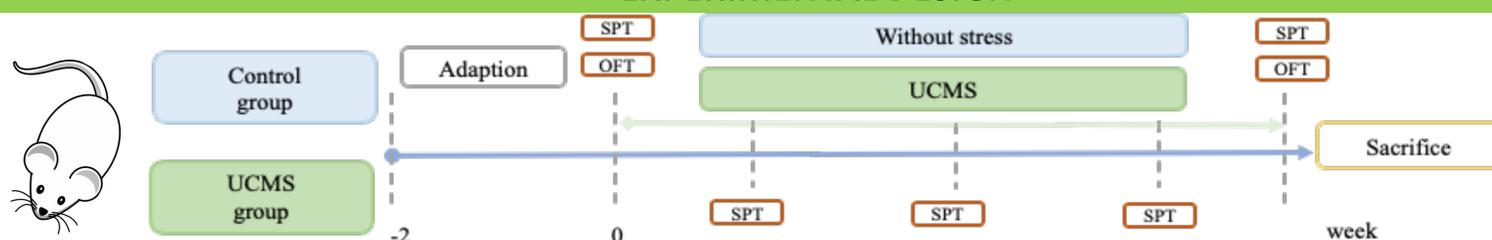
## ABSTRACT

Depression is a severe mental disease and a major public health issue worldwide. The previous study indicated that chronic stress could induce depression caused by neurotransmitter dysregulation in prefrontal cortex and hippocampus. Red ginseng has multi-functions to the health, include anti-oxidation, anti-inflammation, and so on, which may be an effective way for depression prevention. This study aims to use animal model for investigation the effectiveness of Korean red ginseng water extract (KGE) on anti-depression activity and to explore the mechanisms related to neurotransmitter modulation. Our results demonstrated that four weeks of UCMS induced depression-like behavior in rats, like the bodyweight change, decreased the water and food intake, also significantly reduced sucrose consumption ( $p < 0.05$ ). Furthermore, the monoamine neurotransmitters were checked by HPLC-ECD, and the data showed that four weeks of UCMS raised the turnover rates of dopamine and serotonin, which were related to depression symptoms. However, supplementation of KGE significantly improved sucrose preference and ameliorated the prefrontal cortex and hippocampus turnover rates of dopamine and serotonin ( $p < 0.05$ ). KGE possessed an antidepressant-like activity against the UCMS-induced rat model by improving sucrose consumption and modulating monoamine neurotransmitter levels in both the prefrontal cortex and the hippocampus. Our results indicated strong evidence that the KGE exhibited the depression preventive agent, and it may be applied as a dietary supplement.

## HYPOTHESES

- UCMS might resulting in depression-like phenotype in rats.
- Korean red ginseng water extract (KGE) might improve the depression-like behavior through modulating monoamine neurotransmitters level in the unpredictable chronic mild stress (UCMS) animal model.

## EXPERIMENTAL DESIGN



This work was supported by a grant from the Korea Ginseng Cooperation (KGC), funded by the Korean Society of Ginseng.

## RESULTS

UCMS significantly induced weight loss, and KGE didn't affect the body weight of the rats.

UCMS-treated rats drank the lower amount of water, and KGE didn't impact on the water intake.

UCMS significantly increased the turnover rates of the prefrontal cortex's 5-HT and DA, and KGE can ameliorated the prefrontal cortex turnover rate of monoamines.

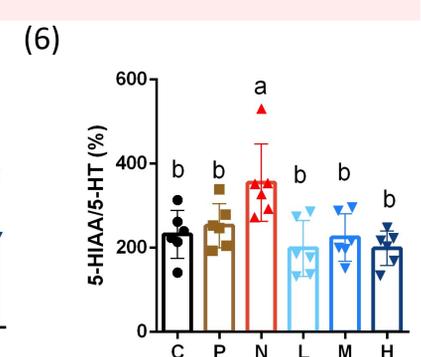
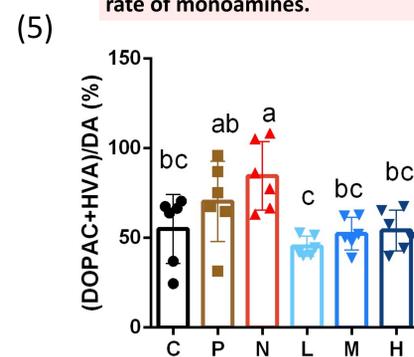
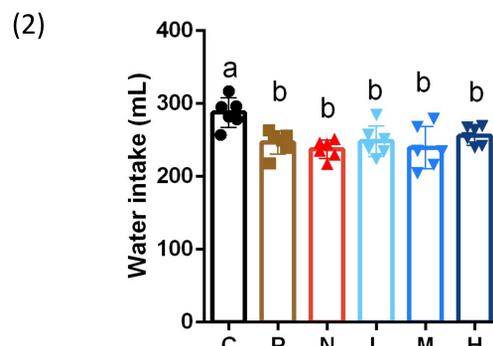
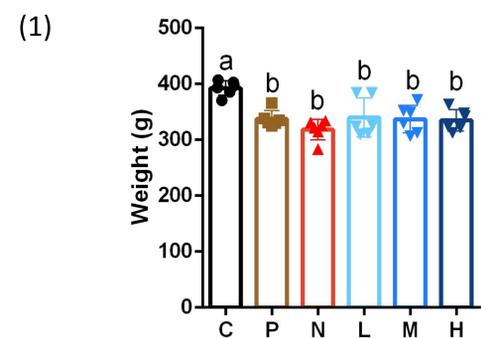


Figure (1). Body weight in unpredictable chronic mild stress-induced rats in week 4. Data were presented as mean  $\pm$  SD (n=6). Statistical analysis was performed using one-way ANOVA with Duncan's multiple comparison test. Different letters indicate significant differences among groups at the level of  $p < 0.05$ . C, control group; P, positive group; N, negative group; L, low dose; M, medium dose; H, high dose.

Figure (2). Water intake in unpredictable chronic mild stress-induced rats in week 4. Data were presented as mean  $\pm$  SD (n=6). Statistical analysis was performed using one-way ANOVA with Duncan's multiple comparison test. Different letters indicate significant differences among groups at the level of  $p < 0.05$ . C, control group; P, positive group; N, negative group; L, low dose; M, medium dose; H, high dose.

Figure (5). DOPAC+HVA/DA (%), (6). 5-HIAA/5-HT (%) in prefrontal cortex. Data were presented as mean  $\pm$  SD (n=6). Statistical analysis was performed using one-way ANOVA with Duncan's multiple comparison test. Different letters indicate significant differences among groups at the level of  $p < 0.05$ . C, control group; P, positive group; N, negative group; L, low dose; M, medium dose; H, high dose.

UCMS-treated rats reduced food intake, supplementation with a high dosage of KGE improved the food intake.

UCMS induced depression-like behavior in rats, treated with 50, 100, 200 mg/kg bw KGE significantly increased sucrose intake.

UCMS significantly increased the turnover rates of the hippocampus's 5-HT and DA, and KGE has an antidepressant-like effect by modulating the turnover rate of monoamine neurotransmitter levels in the hippocampus.

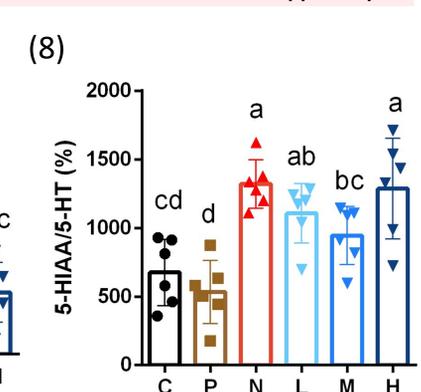
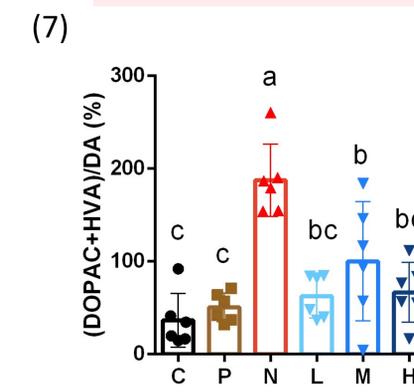
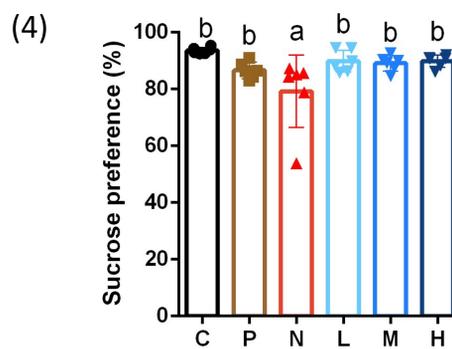
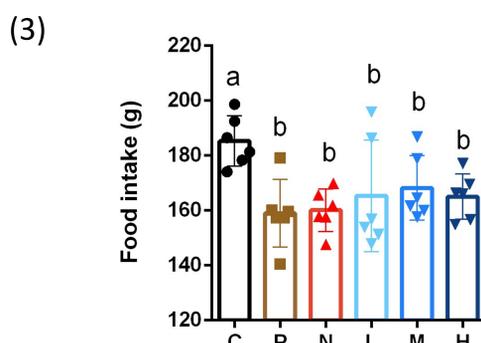


Figure (3). Food intake in unpredictable chronic mild stress-induced rats in week 4. Data were presented as mean  $\pm$  SD (n=6). Statistical analysis was performed using one-way ANOVA with Duncan's multiple comparison test. Different letters indicate significant differences among groups at the level of  $p < 0.05$ . C, control group; P, positive group; N, negative group; L, low dose; M, medium dose; H, high dose.

Figure (4). Sucrose preference in week 4. Data were presented as mean  $\pm$  SD (n=6). Statistical analysis was performed using one-way ANOVA with Duncan's multiple comparison test. Different letters indicate significant differences among groups at the level of  $p < 0.05$ . C, control group; P, positive group; N, negative group; L, low dose; M, medium dose; H, high dose.

Figure (7). DOPAC+HVA/DA (%), (8). 5-HIAA/5-HT (%) in hippocampus. Data were presented as mean  $\pm$  SD (n=6). Statistical analysis was performed using one-way ANOVA with Duncan's multiple comparison test. Different letters indicate significant differences among groups at the level of  $p < 0.05$ . C, control group; P, positive group; N, negative group; L, low dose; M, medium dose; H, high dose.

## CONCLUSION

**KGE demonstrated a potential impact on preventing depression by modulating monoamine neurotransmitters in the prefrontal cortex and hippocampus. Taken together, KGE considered a potential food extract for the prevention of depression.**