The Anti-Obesity and Anti-Depressant Effects Evaluation of Korean Red Ginseng Extract in High-Fat Diet with an Unpredictable Chronic Mild Stress-Induced Obesity and Depression Mice Model

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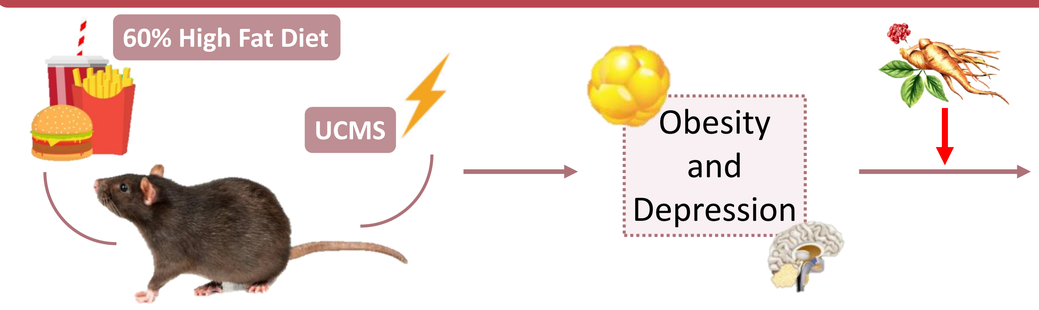
ABSTRACT

Depression is one of the important mental public health diseases and the leading cause of disability worldwide. It has been found to be associated with obesity because of chronic stress which changes eating habits and lifestyle. Besides, the increase of body mass index (BMI) is positively correlated to the proportion of the population with depression. Red ginseng, which derives from ginseng with high-temperature processing, has proven to possess multiple functions in health. Previous research shows that red ginseng has anti-obesity and anti-depressant effects respectively. However, the effect of red ginseng on obesity-related depression has not been investigated. Therefore, this study aims to investigate the anti-obesity and anti-depression effects of Korean red ginseng extract (KRGE) in the high-fat diet (HFD) with unpredictable chronic mild stress (UCMS)-induced obesity and depression mice model (HFD-UCMS model). Results demonstrated that the HFD-UCMS model successfully induced depressive-like behavior and obesity based on behavior and fat composition data. KRGE significantly increased the sucrose preference and maintained the normal locomotion activity ($p < 0.05$), indicating it has an anti-depression function. Moreover, the visceral adipose of KRGE-supplemented groups was decreased ($p < 0.05$), showing the anti-obesity ability of KRGE. I found that KRGE achieved both the anti-obesity and antidepressant-like effects in HFD-UCMS mice model through improving the fat composition, sucrose consumption, and locomotion. Therefore, I think it may use as a dietary supplement for obesity and depression prevention.

HYPOTHESIS & OBJECTIVE



To investigate the anti-obesity and anti-depression effects of Korean red ginseng extract (KRGE) in the high-fat diet (HFD) with unpredictable chronic mild stress (UCMS)-induced obesity and depression mice model (HFD-UCMS model)

EXPERIMENTAL DESIGN

8 weeks 60% high fat-diet induced obesity

4 weeks old
C57BL/6 male mice

N=8 for each group

Without UCMS				With UCMS			
OB Obesity group	N Negative obesity	P Obesity + Fluoxetine 20 mg/kg bw	NC Negative Chow diet	L Obesity + KRGE 200 mg/kg bw	M Obesity + KRGE 400 mg/kg bw	H Obesity + KRGE 800 mg/kg bw	

4 weeks UCMS treatment

Sucrose preference test & Open field test → Sacrifice → Visceral adipose tissue

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RESULTS

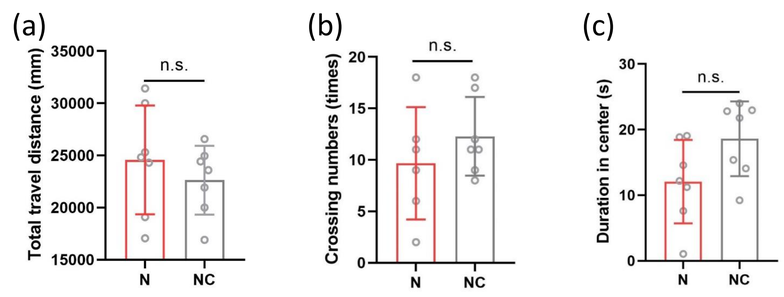

Figure 1a. Effects of the dietary factor on (a) total traveled distance, (b) crossing numbers and (c) duration in center induced by UCMS and/or DIO model. Data are presented as the mean ± SD (n=6-7) and analyzed with student's t test. n.s. means no difference. N, negative obesity group; NC, negative chow diet group.

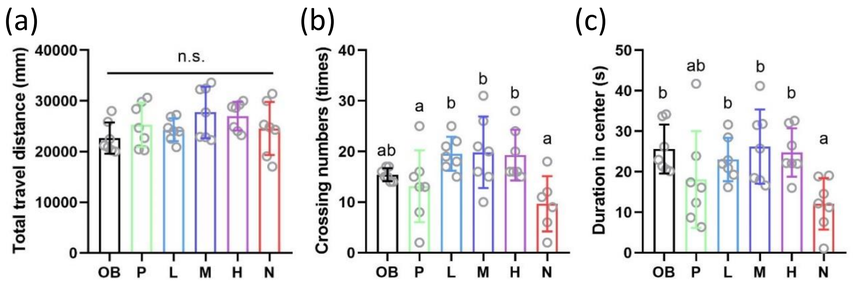

Figure 1b. Effects of the KRGE on (a) total traveled distance, (b) crossing numbers and (c) duration in center induced by UCMS and/or DIO model. Data are presented as the mean ± SD (n=6-7) and analyzed with one-way ANOVA with Duncan' s multiple-comparison test. Different letters indicate significant differences among groups at the level of $p < 0.05$. OB, obesity group; P, positive group; L, low dose group; M, medium dose group; H, high dose group; N, negative obesity group.

Both HFD and UCMS had no effects on the activity of mice. However, the exploratory and depressive-like behavior were alleviated by the KRGE

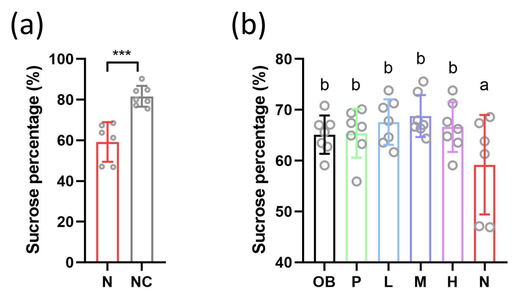

Figure 2. Effects of (a) the dietary factor and (b) the UCMS and/or KRGE on the sucrose preference on week four induced by UCMS and/or DIO model. Data are presented as the mean ± SD (n=6-7) and analyzed with student's t test. ***, $p < 0.005$. Different letters indicate significant differences among groups at the level of $p < 0.05$. OB, obesity group; P, positive group; L, low dose group; M, medium dose group; H, high dose group;N, negative obesity group; NC, negative chow diet group.

HFD-UCMS model induced the depressive-like behavior, and the degree of depression had positive correlation with obesity. The KRGE could improve the sucrose preference of mice.

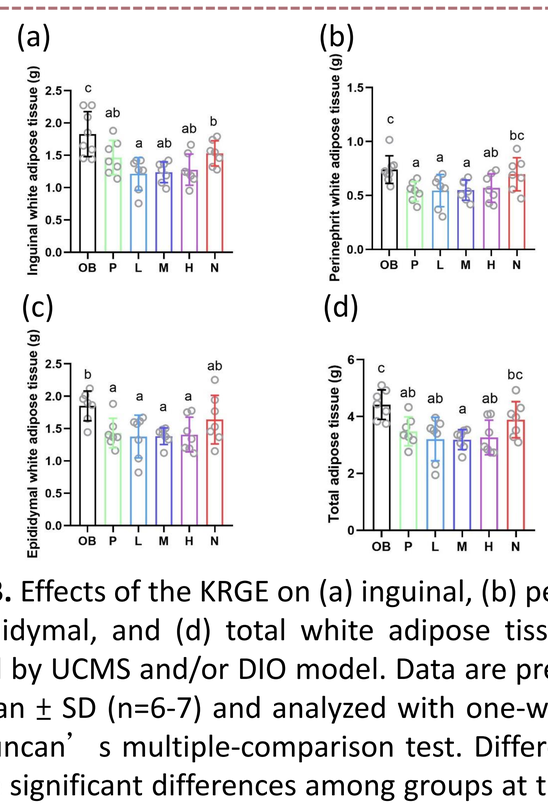

Figure 3. Effects of the KRGE on (a) inguinal, (b) perinephric, (c) epididymal, and (d) total white adipose tissue weight induced by UCMS and/or DIO model. Data are presented as the mean ± SD (n=6-7) and analyzed with one-way ANOVA with Duncan' s multiple-comparison test. Different letters indicate significant differences among groups at the level of $p < 0.05$. OB, obesity group; P, positive group; L, low dose group; M, medium dose group; H, high dose group; N, negative obesity group.

KRGE could reduce the accumulation of visceral adipocytes.

CONCLUSION

KRGE achieved both the anti-obesity and antidepressant-like effects in HFD-UCMS mice model through improving the fat composition, sucrose consumption, and locomotion. However, the underlying mechanisms of KRGE for anti-obesity and anti-depression are unclarified and need more experiments to confirm.