Anti-Obesity and Inhibitory Effect of Lipid Accumulation of The Cone of *Pinus rigida × Pinus taeda* in 3T3-L1 Cells

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With the COVID-19 pandemic, there is increasing interest in anti-obesity strategies. According to the National Statistical Office, the obesity rate in Korea was 38.3% in 2020 and 37.1% in 2021. Obesity is a risk factor for several severe diseases, including stroke, heart disease, type 2 diabetes, and certain types of cancer. *Pinus rigida × Pinus taeda* is a hybrid of *Pinus rigida* Mill and *Pinus taeda* Linn, and its cones are considered a by-product. Although previous studies have investigated their pharmacological effects on antioxidant activity and protection against oxidative DNA damage, few researchers have explored their potential as functional natural materials. Therefore, we evaluated the anti-obesity effects of the cone of ethyl acetate fraction of *P. rigida × P. taeda* (ERT), specifically its ability to inhibit lipid accumulation. Our analysis showed that ERT contains phytochemicals (catechin and caffeic acid) which are known to improve immune function and inhibit cell damage. ERT inhibited lipid droplet accumulation at the cellular levels through Oil Red O staining. Furthermore, ERT suppressed the expression of adipogenic transcription factors (PPARγ and CEBP/α) as well as downstream lipogenic target genes (FAS and SREBP-1) thereby inhibiting adipogenesis. ERT also down-regulated key adipogenic markers, including aP2α, while inducing the phosphorylation of AMPK. It has been reported that PPARγ and CEBP/α are expressed in the early stages of adipose differentiation, while SREBP-1 is expressed in the late stage. Therefore, our findings suggest that ERT activates AMPK signaling pathways, which inhibits adipogenic transcription factors (PPARγ, C/EBPα, and SREBP1) and lipogenic genes (FAS and aP2α), thereby blocking lipid accumulation and preventing obesity and related disorders. ERT showed potential as a new resource for developing a functional material for anti-obesity agents.

Key words: *Pinus rigida × Pinus taeda*, Lipid accumulation, Catechin, Caffeic acid, Anti-obesity

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