

Steam-Processed *Panax vietnamensis* var. *fuscidiscus* Exhibits Anticancer Activity in Lung Cancer Organoids

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Abstract

Panax vietnamensis var. *fuscidiscus* (PVF), also known as Lai Chau ginseng in Vietnam, can be converted into red ginseng (RPVF) via steam processing, a method reported to enhance bioactivity. In this study, using a patient-derived lung cancer organoid (LCO) biobank as a clinically relevant screening platform, we found that RPVF extract, but not the raw PVF extract, induced potent LCO death, with complete organoid killing by 72 h. Next, HPLC analysis revealed that steaming transforms the ginsenoside profile from polar compounds toward less-polar forms, notably generating both epimers of G-Rg3, which are absent in PVF. Screening of nine purified ginsenosides identified 20(S)-G-Rg3 as the sole compound responsible for this anticancer activity, while its stereoisomer 20(R)-G-Rg3 was inactive, highlighting the pharmacological importance of Rg3 stereospecificity. These findings demonstrate that steam-processing converts PVF into a ginsenoside-enriched extract with anticancer activity in a physiologically relevant organoid model, supporting the development of RPVF into a standardized, 20(S)-G-Rg3-enriched functional food or nutraceutical ingredient for cancer-preventive applications, and underscoring the need for epimer-specific quality control in product development.

Keywords: *Panax vietnamensis* var. *fuscidiscus*; red ginseng; Rg3 stereoisomers; lung cancer organoids; anticancer activity.

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