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## Lipidome-based genome-wide association analysis in pigmented rice sprouts revealed higher antioxidant and anti-cancer properties

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### Abstract

The genetic wealth present in pigmented rice varieties offers abundant variation in different antioxidants to meet nutritional security targets among rice-consuming communities. Recently, germination has also gained much attention as a method to further enhance the dietary properties of rice. However, there is limited knowledge of the dynamic changes in the lipidome of rice during germination and the corresponding genes associated with the accumulating lipids. In this study, we profiled the lipidome of diverse pigmented rice collections of germinated sprouts. Genome-wide association studies (GWAS), gene-set analysis, and targeted association analysis revealed 72 candidate genes involved in the regulation of these accumulating lipids in pigmented rice sprouts (PRS), with a particular emphasis on lipase-related genes. The selected GDSL esterase/lipase (GELP) genes contribute to enhanced antioxidant and anti-cancer activities. By identifying the relatively high PVE contributing top five genes [(LOC\_Os02g40440, OsGELP40), (LOC\_Os10g05088, OsGELP102), (LOC\_Os10g30290, OsGELP107), (LOC\_Os01g52230, OsACP1), and (LOC\_Os09g27210 - lecithin-cholesterol acyltransferase)] we identified superior genome-wide identification of high-value marker-trait association (MTA) combinations GGTAAC/ACAAGCTGGGCC exhibiting higher antioxidant activity measured across three independent antioxidant methods ( $p < 0.05$ ). The superior MTA combinations possess effective inhibitory activity against HCT116 colon cancer and A549 lung cancer cell lines with an average  $1/IC_{50}$  of 0.03 and 0.02 (mL/ $\mu$ g) compared to the inferior MTA combination (AATGACACAGCCGGGCC), respectively. Evolutionary analysis revealed that GELP genes have been invoked by differential selection pressures experienced by *Indica* and *Japonica* subspecies. This study provides valuable insights into the potential health benefits of germination as a valuable dietary source of lipids for human health.

**Keywords:** Anticancer, antioxidant, gwas, lipid, pigmented rice