# Metabolomics Unveils Novel Biomarkers for Early Diagnosis of Kidney Failure: Exploring the Therapeutic Effect of Naringenin and Cymbopogon proximus Essential Oil Combination

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Acute kidney failure (AKF) is a worldwide growing clinical problem affecting over 13 million people and resulting in 1.7 million deaths annually. AKF symptoms are not noticeable in the early stages. Early detection of KF phases can change its progression and lessen complications. Currently, AKF is diagnosed by serum creatinine and urea tests which lack high predictive values. This project aims to make use of the therapeutic effect of Naringenin and Cymbopogon proximus essential oil (CPO) combination against AKF, besides offering accurate diagnostic tools for AKF. This combination was chosen due to their demonstrated complementary properties. CPO, known for its antioxidant and anti-inflammatory effects, synergizes with naringenin activating the Nrf2 protein to boost the cell's antioxidant capacity besides potential anti-inflammatory effect. So, the efficacy of oxidative stress and inflammation reduction as well as symptom alleviation of AKF is maximized. Metabolites were then extracted from sera samples and analyzed by GC/MS. Multivariate analysis statistical analysis using PLS-DA model showed a clear distinction between the normal and AKF groups with an $R^2$ value of 0.99 and a $Q^2$ value of 0.98. ROC curve and the non-parametric Mann-Whitney test results indicated that Butanoic acid, Proline, and Iso-leucine are promising biomarkers for AKF diagnosis ($p=0.005$). Furthermore, the combination proved to restore normal levels of serum creatinine, urea, catalase, GSH, MDA, TNF-alpha, and TLR4. Meanwhile, it reduced renal injuries efficiently, restored normal renal cells, and facilitated the recovery of normal kidney metabolites. These findings could potentially enhance both AKF diagnosis and treatment while providing a path toward the formulation of the "NarPro pill".

**Awards Won:**