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Comprative metabolomics of Dunaliella salina and Nannochloropsis salinamicroalgae speices under gibberellic acid and abscisic acid treatments

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Abstract

Due to the increasing importance of the use and development of microalgae as one of the main and economic sources of lipid production for biofuel extraction and the production of beta-carotene as a dietary supplement, the use of metabolomics methods to identify metabolites and other compounds can play a valuable role in the increasing their production. Therefore, an experiment was performed to investigate the effect of different concentrations of GA3 and ABA hormones in Gillard culture medium on some growth, physiological, biochemical, danmetabolic traits, analysis of metabolic data in relevant database, peptidomics studies, and electron imaging of *Dunaliella salina* and *Nannochloropsis salina*. Experimental treatments included different concentrations of GA_3 (zero (control), 0.5, 5, 10 and 20 mg/l) and ABA (zero (control), 0.5, 10 and 20 mg/l). Measured traits include growth rate, total chlorophyll, beta-carotene, carotenoids, dry biomass, total lipids, amount of GA3 and endogenous ABA, percentage of nitrogen and carbon, total protein, cell size, profile analysis of metabolites such as fatty acids, Pigments, carbohydrates, amino acids, and proteins included 14-3-3and HSP70. The results of variance analysis showed that the effect of different concentrations of GA_3 and ABA on all studied traits except beta-carotene and EPA in two microalgae species *D. Salina* and *N. Salina* was statistically significant at the level of 5%. Hormonal treatments applied to *D. salina* and *N. salina* microalgae showed a significant additive effect on fatty acids, total protein, carotenoids, amino acids, and proteins 14-3-3 and HSP70. Among the treatments applied on *D. salina* microalgae, the concentration of 20 mg/l ABA was the superior treatment in terms of total lipids, carbohydrates, omega-6, omega-9, beta-carotene, 14-3-3 proteins, and HSP70. While concentrations of 5 and 20 of mg/l GA_3 in *N. salina* microalgae were identified as the best treatments in terms of increasing amounts of dry biomass, total lipids, HSP70 protein, omega-6, and omega-3. Also, the results of bioinformatics studies and network analysis showed that the predicted three-dimensional structures, gene expression, and protein-protein interaction (PPI) in HSP70 microalgae protein were more than its 3-3-14 protein. According to the findings of this study, it is suggested that if the purpose of *D. salina* microalgae culture is to produce fatty acids, lipids, and carotenoids, a concentration of 20 mg/l of ABA in *D. salina* can be effective. However, if the goal is to produce dry biomass and total protein, the use of a concentration of 20 mg/l of GA_3 is effective. Also, if the purpose of cultivating *N.salina* microalgae is to produce carotenoids, protein 14-3-3 and total protein, a concentration of 0.5 mg/l of ABA can be effective, but if the goal is to produce biomass, total lipid and protein HSP70; concentration of 20 mg /l GA_3 can be effective.

Keywords: Network analysis, Protein 14-3-3, Plant growth regulator, Microalgae, Carotenoids, Lipids