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Examining fatty acid interactions with *Arthrospira platensis*-derived C-phycocyanin

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Cultured meat requires less land and water and is less polluting, but still costly. The critical challenge in cultivated meat science is identifying and developing bovine serum albumin alternatives as the key component in cell media. Phycobiliproteins (PBPs) from micro- and macroalgae are promising candidates for albumin replacement due to their high abundance and well-known excellent antioxidative and metal-binding activities of covalently attached tetrapyrrole chromophores. Considering the importance of fatty acids (FA) binding by albumin for cell cultivation, the additional prerequisites for developing PBPs as albumin replacement components is their validation for the ability to bind FA. This study aims to examine the ability of C-phycocyanin (C-PC), the major PBP of microalgae *Arthrospira platensis*, to bind seven fatty acids (stearic, palmitic, oleic, elaidic, linoleic, linolenic and docosahexaenoic acid). For this purpose, we employed various optical spectroscopy techniques (fluorescence, CD, and VIS absorption spectroscopy). The protein fluorescence quenching approach demonstrated FA binding affinities ranging from 0.42 to 2.4 x 10^5 M^{-1}, with the ability of FA to bind at different sites on C-PC. Fatty acid binding induces substantial changes in the VIS absorption spectra of C-PC, indicating the FA are attached in the vicinity of C-PC chromophores. On the other hand, CD spectroscopy did not show significant effects of FA binding on C-PC secondary structure content. Overall, this study revealed C-PC's significant potential in binding FA, the critical prerequisite to replacing albumin for developing animal-free cell media for meat cultivation.