Expression and production of recombinant frutalin in different expression systems and evaluation of its biomedical applications

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Frutalin is the α-D-galactose-binding lectin expressed in breadfruit seeds (Artocarpus incisa). This lectin may be used in cancer diagnostics/therapeutics due to its potential ability to recognise specific carbohydrates expressed in cancer cells membranes and/or cells surface receptors. However, frutalin extraction from plant seeds is a time-consuming process and typically results in a heterogeneous mixture of different natural isoforms. To overcome these limitations, frutalin was cloned and expressed in Pichia pastoris [1] and Escherichia coli [2]. Recombinant frutalin was detected in cultures of these microorganisms by SDS-PAGE and Western blot analysis. The higher recombinant frutalin yield was obtained in the P. pastoris expression system (up to 20 mg/L). Molecular and biological differences were found between each recombinant and native frutalin. Potential biomedical applications for native frutalin and recombinant frutalin produced in P. pastoris were studied. Recombinant frutalin demonstrated higher capacity than native frutalin to differentiate malign from benign human prostate diseases by immunohistochemistry (with a significant positive statistical correlation, \( P<0.00001 \)), in spite of its lower carbohydrate-binding affinity [3]. In addition, native and recombinant frutalin showed an identical magnitude of cytotoxicity on HeLa cervical cancer cells growth (\( IC_{50}=100 \mu g/mL, 24 \text{ h} \)), by inducing cell apoptosis and inhibiting cell proliferation and migration. Interaction studies conducted by confocal microscopy showed that native and recombinant frutalin were internalised and targeted to HeLa cell’s nucleus within 1 h of incubation. Therefore, frutalin with promising application in cancer diagnosis and therapy might be obtained from the recombinant P. pastoris expression system in alternative to its natural source.

References