ABSTRACT

Lectins are carbohydrate-binding proteins of non-immune origin that reversibly bind to specific sugars and possesses the ability to agglutinate the red blood cells (RBCs). Jacalin is a dietary, Thomsen Friendenreich disaccharide (TFD) binding lectin, isolated from the seeds of jackfruit (*Artocarpus integrifolia*). It is a 66 kDa, tetrameric, β sheet protein that is known to undergo irreversible thermal denaturation, resulting in aggregation. Considering its potential applications, it is important to maintain the functional stability of jacalin during storage, transport and longer use; the effects of various additives on thermal stability of jacalin was investigated. Contrary to the common perception, sodium dodecyl sulfate (SDS), an anionic surfactant was shown to confer resistance to jacalin against thermal denaturation, by preventing aggregation.

Further, when the effects of jacalin on cancer cells belonging to different lineages were analyzed, jacalin was shown to exert antiproliferative effects on all the other cancer cells except K562 erythroleukemia cells. Jacalin induced dose-dependent increase in proliferation of K562 cells. Caveolin-1 (Cav-1) is proposed to play a central role in the sustained, mitogenic effects of jacalin on the K562 cells. The rationale behind is that the sequence of jacalin possesses a Cav-1-binding site and the mRNA, as well as protein expression of Cav-1 was found to be upregulated in the jacalin-treated K562 cells. Also, increased Extracellular Signal-regulated Kinase-1/2 (ERK1/2) and AKT (Thr 308) phosphorylation were observed in the jacalin-treated K562 cells. Further, we speculate Protein phosphatase 2A (PP2A) to be the potential downstream target of Cav-1. It is possible that, Cav-1, through the scaffold binding domain, binds to and hinders the normal catalytic functions of PP2A. As PP2A acts as a negative regulator and dephosphorylates various signaling phosphoproteins, hindering its functions may lead to incessant phosphorylation of its target proteins.
In addition to their direct impact on cancer cells, dietary lectins also modulate the immune functions and are capable of polarizing the immune response so as to inhibit or stimulate tumorigenesis. As cytokines, regardless of their source, can stimulate or inhibit tumor growth, the immunomodulatory effects of jacalin on peripheral blood mononuclear cells (PBMCs), the key cytokine-secreting immune cells were analyzed. While jacalin initially induced the mRNA expression of pro-inflammatory cytokine interferon-γ (IFN-γ), prolonged stimulation of PBMCs resulted in increased expression of anti-inflammatory cytokine, mainly transforming growth factor-β (TGF-β). Further, a significant decrease in cell proliferation was observed in HeLa cells that were directly cultured with the 6 h jacalin-stimulated PBMCs, while an increase in cell proliferation was observed when the HeLa cells were directly cultured with the 24 h jacalin-stimulated PBMCs. Besides, conditioned medium (CM) obtained from the jacalin-treated PBMCs had no substantial effect on the viability of cancer cells. This observation can have particular significance under in vivo condition.