

**STUDIES ON MILK PROTEINS AS NANO
CARRIERS OF CURCUMIN**

By

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ABSTRACT

This study aimed to evaluate the efficacy of milk proteins (Sodium caseinate (SC), α -lactalbumin (α -la), β -lactoglobulin (β -lg), Whey protein concentrate (WPC) and Whey protein isolate (WPI) as curcumin nano-carriers and the functional properties of the formed nanoparticles (antioxidant, anticancer on human cancerous cell lines (HepG2 and MCF-7), antimicrobial, hepatoprotective against carbon tetrachloride (CCL₄) and antiviral activity against potato virus Y). Curcumin loaded milk proteins nanoparticles were prepared using the ionic gelation method. The physicochemical properties of the nanoparticles were determined. The average particle size of curcumin loaded milk proteins nanoparticles ranged from 274.80 to 462.80 nm and zeta potential values ranged from -12.63 to 27.73 mV. The entrapment efficiency (EE %) ranged from 72.27-77.27%. Radical scavenging activity (%) of the prepared nanoparticles was determined by DPPH assay. It was significantly higher than that of chitosan, curcumin, and all native proteins or its nanocomposite. As for the HepG2 and MCF-7 cancer cells, the anticancer activity of all tested materials increased significantly as their concentration increased. The IC₅₀ of curcumin/milk proteins nanoparticles were much lower as compared to curcumin or of milk proteins/chitosan nanocomposites. It ranged from 1.43 to 1.98 mg/ml in case of HepG2 and 1.55 to 1.84 mg/ml in case of MCF-7. All the tested materials displayed variable antibacterial and antiviral activity.

All native forms of milk proteins had approximately no effect on all tested strains except (SC). Its antibacterial effect was higher than that of both of chitosan or curcumin. The formation of nanoparticles (in most cases) significantly enhanced the inhibitory effect as compared to chitosan, curcumin, and native milk proteins. Hepatoprotective effect of curcumin/milk proteins nanoparticles against carbon tetrachloride (CCL₄) induced liver fibrosis in rats was examined. Administration of CCL₄ increased significantly (ALT, AST), the malondialdehyde (MDA) concentration, triglycerides, cholesterol, LDL while it significantly decreased body weight, GSH, and HDL . Formulation of curcumin loaded milk proteins nanoparticles led to more hepatoprotective effect as compared to all treatments (chitosan, curcumin, and native milk proteins). Both Cur-Cs/WPC NPs and Cur-Cs/WPINPs had the highest effect while Cur-Cs/ α -LaNPs had the lowest effect. Also, the histopathological examination showed marked improvements in the histological structure of the liver. The effect of all the tested materials against potato virus Y was examined. All the tested materials exhibited different levels of inhibitory effects against the virus and this effect was concentration dependent. All of the curcumin loaded milk proteins nanoparticles had higher activity as compared to the other native forms of the tested materials.

Key words : milk proteins, curcumin, curcumin nanoparticles, functional activities.

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