

Curcumin-loaded cockle shell-derived calcium carbonate nanoparticles: a novel strategy for the treatment of lead-induced hepato-renal toxicity in rats

ABSTRACT

Lead (Pb) toxicity affects the hepatic and renal systems resulting to homeostasis imbalance. Curcumin is a strong antioxidant but has restrained clinical applications due to its poor bioavailability. Nanomedicine showed promising potentials in drug delivery and has brought forth the use of cockle shell-derived aragonite calcium carbonate nanoparticles (CSCaCO₃NP) to enhance the effectiveness and targeted delivery of curcumin (Cur). Thus, this study aimed at evaluating the therapeutic effect of curcumin-loaded CSCaCO₃NP (Cur- CSCaCO₃NP) on lead-induced hepato-renal toxicity in rats. Thirty-six male adults Sprague-Dawley rats were randomly assigned into five groups. All groups contained six rats each except for group A, which contained 12 rats. All rats apart from the rats in group A (control) were orally administered a flat dose of 50 mg/kg of lead for four weeks. Six rats from group A and B were euthanized after four weeks of lead induction. Oral administration of curcumin (100 mg/kg) for group C and Cur-CSCaCO₃NP (50 and 100 mg/kg) for groups D and E respectively, commenced immediately after 4 weeks of lead induction which lasted for 4 weeks. All rats were euthanized at the 8th week of the experiment. Further, biochemical, histological and hematological analysis were performed. The findings revealed a biochemical, hematological and histological changes in lead-induced rats. However, treatments with the Cur-CSCaCO₃NP and free curcumin reversed the aforementioned changes. Although, Cur-CSCaCO₃NP presented better therapeutic effects on lead-induced toxicity in rats when compared to free curcumin as there was significant improvements in hematological, biochemical and histological changes which is parallel with attenuation of oxidative stress. The findings of the current study hold great prospects for Cur-CSCaCO₃NP as a novel approach for effective oral treatment of lead-induced hepato-renal impairments.

Keyword: Hepato-renal injuries; Lead-toxicity; Cockle shell; Curcumin; Nanoparticles; Oral therapeutics