

In vitro evaluation of curcumin-encapsulated chitosan nanoparticles against feline infectious peritonitis virus and pharmacokinetics study in cats

ABSTRACT

Feline infectious peritonitis (FIP) is an important feline viral disease, causing an overridden inflammatory response that results in a high mortality rate, primarily in young cats. Curcumin is notable for its biological activities against various viral diseases; however, its poor bioavailability has hindered its potential in therapeutic application. In this study, curcumin was encapsulated in chitosan nanoparticles to improve its bioavailability. Curcumin-encapsulated chitosan (Cur-CS) nanoparticles were synthesised based on the ionic gelation technique and were spherical and cuboidal in shape, with an average particle size of 330 nm and +42 mV in zeta potential. The nanoparticles exerted lower toxicity in Crandell-Rees feline kidney (CrFK) cells and enhanced antiviral activities with a selective index (SI) value three times higher than that of curcumin. Feline-specific bead-based multiplex immunoassay and qPCR were used to examine their modulatory effects on proinflammatory cytokines, including tumour necrosis factor (TNF) α , interleukin- (IL-) 6, and IL-1 β . There were significant decrements in IL-1 β , IL-6, and TNF α expression in both curcumin and Cur-CS nanoparticles. Based on the multiplex immunoassay, curcumin and the Cur-CS nanoparticles could lower the immune-related proteins in FIP virus (FIPV) infection. The single- and multiple-dose pharmacokinetics profiles of curcumin and the Cur-CS nanoparticles were determined by high-performance liquid chromatography (HPLC). Oral delivery of the Cur-CS nanoparticles to cats showed enhanced bioavailability with a maximum plasma concentration (C_{max}) value of 621.5 ng/mL. Incorporating chitosan nanoparticles to deliver curcumin improved the oral bioavailability and antiviral effects of curcumin against FIPV infection. This study provides evidence for the potential of Cur-CS nanoparticles as a supplementary treatment of FIP.