Purpose
Curcumin is a natural compound with potential therapeutic benefits in various human diseases including cancer. The broad usefulness of curcumin is diminished due to its poor bioavailability. The primary goal of the study was to improve the pharmacokinetic profile of curcumin by formulating solid lipid nanoparticles of the drug.

Methods
An optimized curcumin loaded solid lipid nanoparticle formulation (C-SLN) was developed in our earlier study. It was prepared using solvent injection method and involved glyceryl monostearate (150 mg), curcumin (3 mg), and Poloxamer 407 (2% solution). The lyophilized formulation could be dispersed in water to obtain a mean particle size of 249.1 nm and a polydispersity index of 0.185. The pharmacokinetic profiles of curcumin in C-SLN and curcumin aqueous suspension (native curcumin) were compared after oral administration of a single dose of 50 mg/kg of curcumin in adult male Sprague-Dawley rats (n = 6 per formulation). The experimental protocol was approved by the Institutional Animal Care and Use Committee of Texas A&M University. The pharmacokinetics parameters were calculated using Kinetica™ (version 5).

Results
Complete plasma profile of the formulation and native curcumin can be seen in Figure 1. It is obvious that the bioavailability of the drug in the formulation has increased considerably. There was a significant increase (1.3 times, \( p < 0.01 \)) in curcumin absorption promptly after administration (in 60 min). The \( C_{\text{max}} \) and \( t_{\text{max}} \) of the drug from C-SLN have increased by 2.3 and 2 folds, respectively compared to the native curcumin. Increase in \( C_{\text{max}} \) indicates the ability of the nanoparticles to enhance drug absorption and delayed \( t_{\text{max}} \) demonstrates a sustained release of the drug. There was a significant increase in the \( AUC \) of C-SLN compared to the native curcumin (4 times, \( p < 0.01 \)). The elimination \( t_{\frac{1}{2}} \) of curcumin from the C-SLN was 6 hr, while it was 1.1 hr from the native curcumin. Curcumin is extensively metabolized in the body. Therefore, it is possible the drug was protected in the nanoparticles and hence, encountered reduced metabolism leading to extended \( t_{\frac{1}{2}} \) (Khalil et al., Colloids and Surfaces B: Biointerfaces 101: 353-360, 2013). Curcumin is also known for its poor bioavailability due to very low solubility in water (<0.1 mg/ml). Therefore, the significant improvement in all important pharmacokinetic parameters of the drug in C-SLN could be due to the inherent properties of colloidal nanoparticles in biological media, which prolong drug release and its \textit{in vivo} trajectory (Khalil et al., Colloids and Surfaces B: Biointerfaces 101: 353-360, 2013).

Conclusion
An optimized solid lipid nanoparticle formulation of curcumin was studied for the pharmacokinetic parameters in rats. The \( C_{\text{max}} \), \( t_{\text{max}} \), \( AUC \), and, \( t_{\frac{1}{2}} \) increased significantly compared to those in curcumin aqueous suspension. A 4-fold increase in bioavailability was observed. Decreased metabolism and increased solubility leading to improved absorption could be the possible reasons for such promising findings. The results demonstrate that C-SLN could be a potentially useful delivery system in treatment of diseases including cancer.