formation. While the second oily component added was diacylglycerol (DAG). DAG increases membrane permeability during nanoparticle absorption (Yi et al., 2013). Moreover, DAG was found to be capable of filling the gaps between the surfactant/cosurfactant and solidifying the dispersion system (Fatouros et al., 2007). Therefore, adding DAG would be expected to increase the physical stability of insulin-loaded nanoparticles formula. DAGs dissolved in oleic acid during formulation.

Insulin was protected from gastric enzymes by incorporation into lipid-based formulation because oleic acid is not affected neither by the acidic media of the stomach nor proteolytic enzymes of the GIT. By this efficient technique, the insulin in the formula had good protection against the GIT enzymes with nanosize structure that might enhance its permeability across intestinal mucosa.

The first part of the current research involved synthesizing different grades of LMWC with average M.W. of 7, 10, 13, 16 and 24 KDa and quantitatively and qualitatively characterize the different grades of chitosan using Infrared Spectroscopy (FT-IR), Differential Scanning Calorimetry (DSC) and Viscometer. Furthermore, the construction of insulin-loaded nanoparticles and measuring its diameter in the dispersion system was carried out. The current formula was found to have significant reduction in the particle size of the nanoparticles (85 ± 2.53 nm) when compared with the old formula (108 ± 9 nm). This reduction in the particle size is due to the addition DAGs.

After that, *in vivo* evaluation was required to validate the true performance of an oral delivery system. The hypoglycemic studies on oral insulin-loaded nanoparticles revealed significant hypoglycemic effect in the glucose level of STZ-induced diabetic