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Bioavailability and antihyperglycemic effect of metformin transfersome vesicles in transdermal patch delivery system

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Metformin, a prominently prescribed antihyperglycemic agent has been proven to increase life span of both diabetic and non-diabetic individuals. It decreases glucose production and absorption and increases body's response to insulin. However, it is slowly and incompletely absorbed in the gastrointestinal tract and it has a low permeability. It is available in oral tablet and it takes 6 hours for the drug to be completely absorbed. It is taken 2 to 3 times a day as a maintenance drug, depending on patient's condition. Gastrointestinal side effects have also been reported in nearly 30% of patients. With these impediments, different drug delivery systems have been developed. The use of transfersomes in transdermal patch offers the potential advantage of improving the bioavailability of the drug. Metformin transfersome vesicles were prepared using sodium cholate and phosphatidylcholine 50% and its particle size was 168 nm. Drug entrapment efficiency was determined using HPLC and it was found to be 94.96%. Plasma concentration of metformin in hyperglycemic-induced rabbits treated with metformin transfersome patch was significantly higher than controls ($p=0.001$). The post treatment glucose level of hyperglycemia-induced rabbits applied with metformin transfersome patch ($p=0.002$) showed significant decrease in glucose level relative to untreated alloxan-induced hyperglycemic rabbits. The study showed that metformin transfersome vesicles in transdermal patch delivery provide enhanced antihyperglycemic effect and bioavailability over metformin transdermal patch.

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Controlled delivery of drugs adsorbed onto porous Fe_3O_4 structures by application of AC/DC magnetic fields

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In this research we demonstrate that porous Fe_3O_4 structures can be used as a vehicle for the transport of drugs adsorbed onto their porous surface. We used methyl blue as a surrogate drug. It adsorbs onto the Fe_3O_4 surface and its release into the surrounding water via application of a magnetic field. Controlled release of the methyl blue to water was then achieved by application of a magnetic field. Application of a pure AC field caused released of the methyl blue. However, a combination of both DC and AC fields resulted in much faster release. This study demonstrates a concept for controlled drug delivery, where pharmaceutical molecules, similar to methyl blue, would be adsorbed onto porous Fe_3O_4 structure and the released at a target by application of appropriately localized magnetic fields. Furthermore, we developed super paramagnetic nanoparticles for activation of the MscL nano-valves incorporate in liposome by magnetic field. Synthesized $CoFe_2O_4$ nanoparticles were labeled by -SH groups for attachment to MscL channels. Activation of MscL by magnetic field with the nanoparticles attached was examined by the patch clamp technique showing that the number of activated channels under ramp pressure increased upon application of the magnetic field. A combination of MscL channels and the magnetic nanoparticles generated for this study holds promise for use in the development of "smart liposomes", a new generation of liposome drug delivery system.

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