7. SUMMARY, CONCLUSION AND RECOMMENDATIONS

The aim of the present research work was to select the best vesicular carrier system among niosomes, ethosomes and transfersomes (primary objective) for administration of drugs across the skin to produce systemic effect. Nystatin, a polyene antifungal agent, was used as model drug in the present study. The secondary objective of the study is enhancement of bioavailability of the nystatin and to decrease the adverse effects associated with higher doses of the nystatin by administering through skin.

Niosomal and transfersomal suspensions of nystatin prepared by using thin film hydration Technique whereas ethosomal suspensions of nystatin was prepared according to the method reported by Touitou et al. Totally 24 vesicular suspensions (eight formulations from each type of vesicular systems) were prepared. Eight niosomal suspensions were prepared by using two different non-ionic surfactants i.e span-80 and span-60 at four different concentrations. Eight transfersomal suspensions were prepared using two different edge activators i.e. span-60 and span-80 at four different concentrations. Eight ethosomal suspensions were prepared by changing the ethanol and lecithin concentrations (each at four different concentrations).

The prepared niosomal, ethosomal and transfersomal suspensions (24 formulations) were evaluated by vesicles morphology (size, shape and surface texture), entrapment efficiency and In vitro drug release. The drug release data was fitted in different
mathematical models such as Zero order, First order, Higuchi, Hixon-crowel, Korsmeyer-peppas to find out the order and mechanism of drug release from all formulations.

Based on the size, entrapment efficiency and invitro drug release results, one optimized vesicular suspension from each type of vesicular formulation was selected.

Elasticity and surface charge (Zeta potential) of the vesicles present in three optimized vesicular suspensions was studied.

After performing the zetapotential and elasticity studies, the optimized niosomal, ethosomal and transferosomal suspensions were formulated into gels having concentration of 0.01%w/w. Along with three vesicular nystatin gels, conventional nystatin gel having same concentration was also prepared with pure nystatin drug sample for comparative study.

The prepared gels were characterized for In vitro and ex vivo drug release, skin retention, stability studies.

In vitro, ex vivo drug release data showed a good correlation between each other. Transdermal flux, permeation coefficient and enhancement ratio was calculated from ex vivo drug release data of all three vesicular carrier gels. The data showed that the ethosomal gel is efficient than the transferosomal and niosomal gel in permeation of nystatin across the dialysis membrane and skin.

Skin retention study was performed to find out the quantity of nystatin that retained on and in the skin and reached systemic
circulation. The skin retention study also showed that ethosomes are efficient than other two vesicular carriers.

*In vivo* study was carried out in rabbits to find out the systemic effect of all vesicular gels and conventional gel. Highest $C_{\text{max}}$ and AUC were shown by the ethosomes than other two vesicular and conventional gels which revealed that ethosomes are effective carriers to produce systemic effect than other two carriers (primary objective).

Our findings contribute to the evidence base for enhancing the permeability of nystatin across the skin and to produce the systemic anti fungal activity (Secondary objective). The present study demonstrates the utility of ethosomes as a tool for administration of drugs across the skin to produce the systemic effect and further studies such as clinical trials are required to conclude the same.