

Investigating the Permeation of Methylphenidate and Rivastigmine using Various Enhancers

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Abstract

The stratum corneum serves as the most challenging obstacle to transdermal drug delivery. Chemical permeation enhancers assist with this limited drug delivery. In this study, improved permeation of methylphenidate and rivastigmine using various chemical enhancer groups was studied to determine the most effective group. Through a systematic review, previously published literature were analyzed. Results showed that the alcohol group resulted in the highest solubility average and the highest permeation coefficient, indicating that alcohol is a viable option for the improved permeation of these two drugs.

Introduction

Transdermal drug delivery is the transportation of drugs through the skin and into the bloodstream. These types of systems have many advantages, such as increased patient compliance and the avoidance of the first-pass effect. However, the range of drugs available to this system is restricted, as the stratum corneum, or the outermost layer of the skin, limits penetration to drugs with specific conditions. The application of chemical permeation enhancers temporarily improves this permeability by interacting with the skin through various mechanisms. These enhancers are classified into different groups based on their chemical structures. However, the effect of these chemical enhancers is limited by the possibility of causing skin irritation, such as erythema.

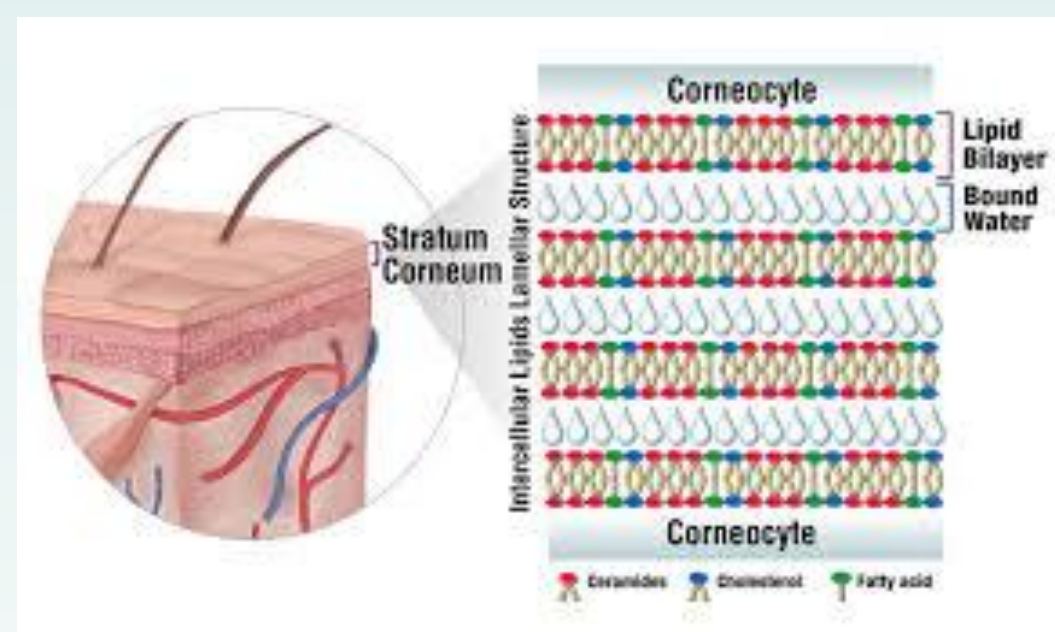


Fig 1. Stratum corneum structure

Purpose

1. To investigate the effect of various chemical enhancer groups on the permeation of methylphenidate and rivastigmine
2. To identify the most effective enhancer group for the diffusion of these two drugs

Hypothesis

The chemical permeation enhancer group of alcohol will result in the most enhanced diffusion of methylphenidate and rivastigmine.

Methods

The research study design is secondary data and systematic review. An extensive collection of previously published studies from various databases, such as PLoS ONE, ScienceDirect, PUBMED-NCBI, and Elsevier, was conducted. Gathered data was then analyzed and evaluated. Additionally, Excel was used to perform statistical analysis.

Results

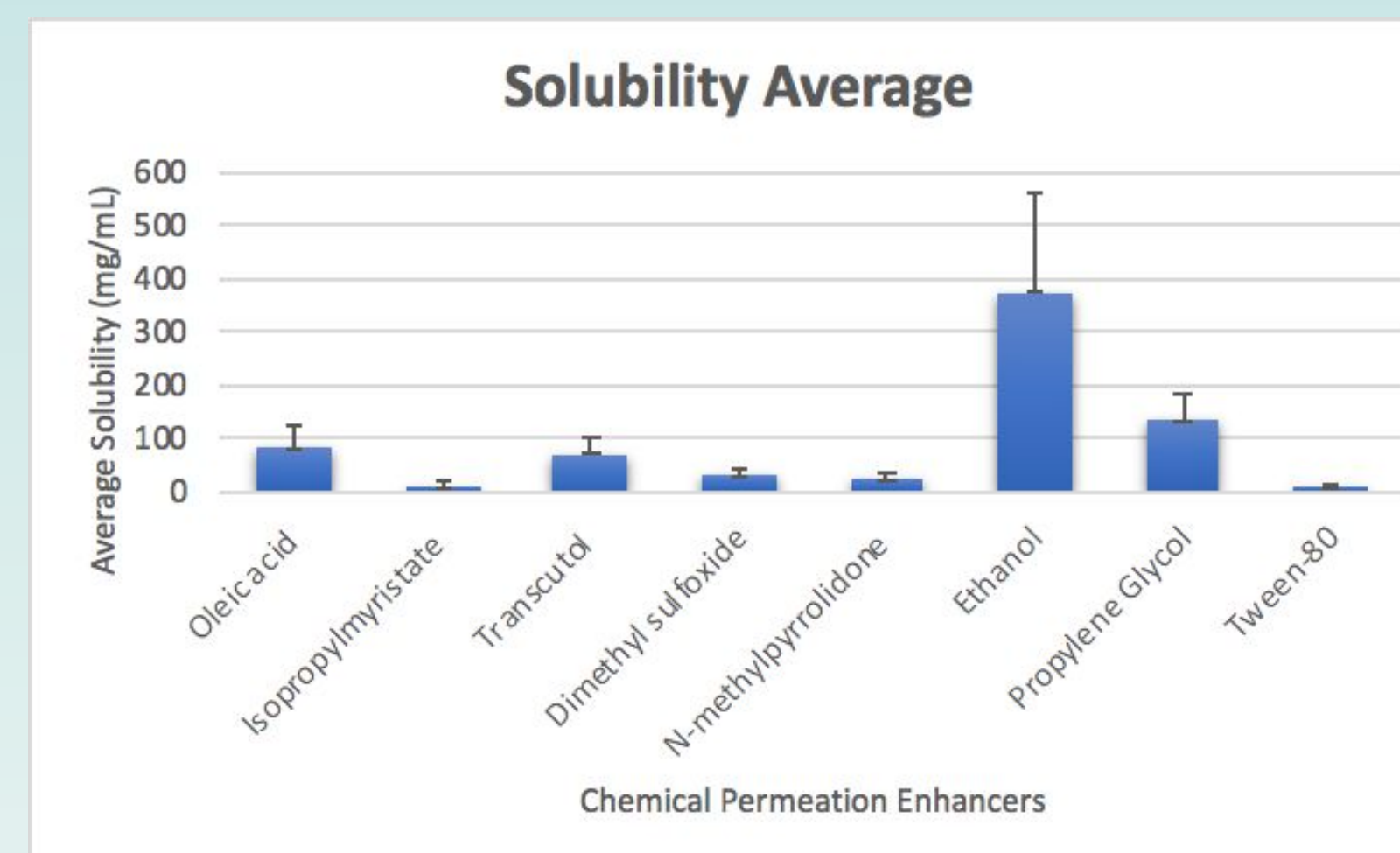


Fig 3. Solubility averages (mg/mL) as of drug formulations with various chemical enhancers as reported by several researchers

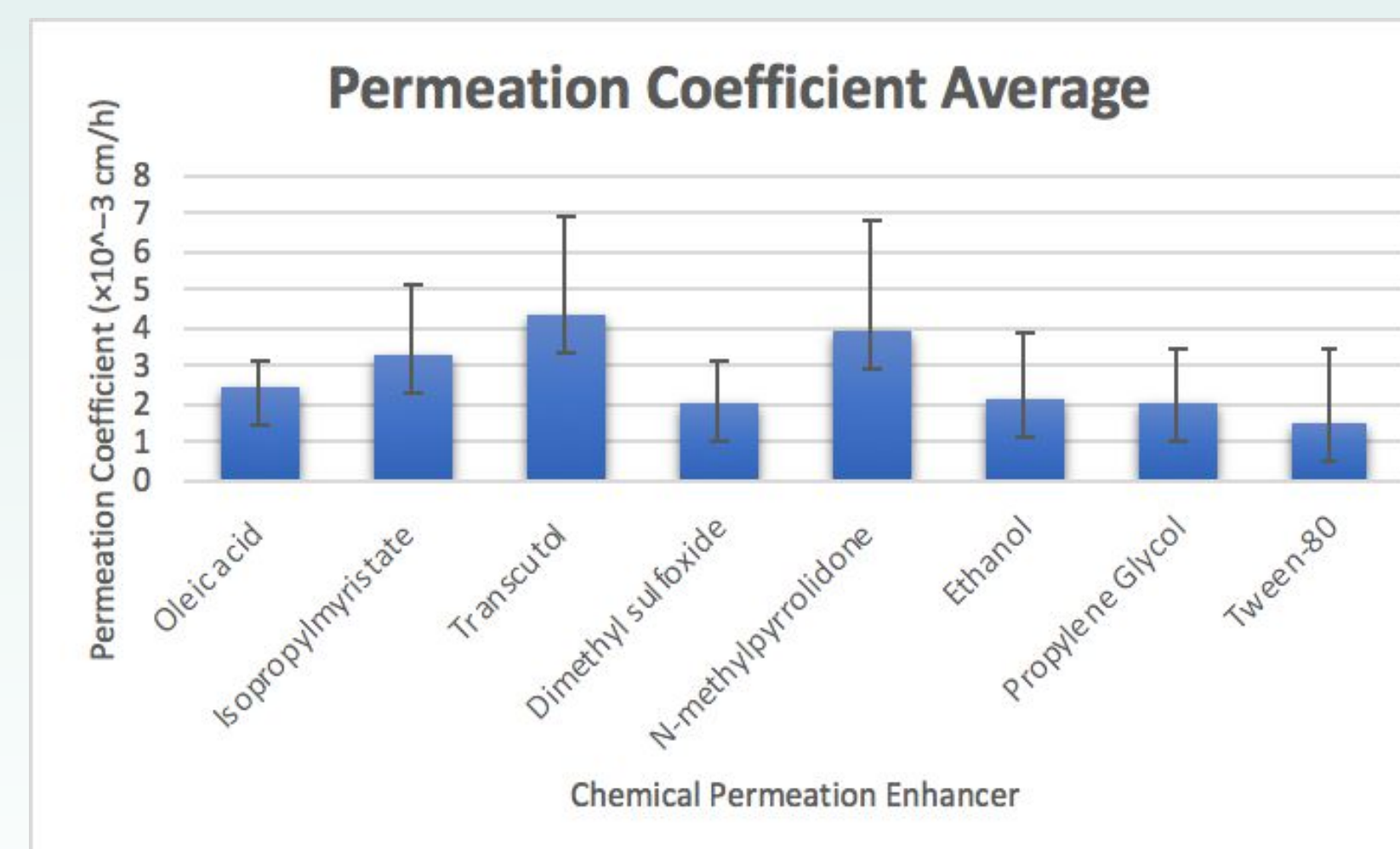


Fig 4. Permeation coefficient averages (x10⁻² cm/hr) of sample drug formulations with chemical enhancers as reported by several researchers

Discussion

The inconsistency in the results implies that other mechanisms significantly impact diffusion. It also conveys that some mechanisms more heavily affect permeation than others, as shown by ethanol's solubility average being significantly higher than the other chemical enhancers', but permeation coefficient being two times less than Transcutol's.

Despite the discrepancy between the two data sets, both support the hypothesis that alcohol will result in the most improved permeation of rivastigmine and methylphenidate. This is due to the fact that enhancers part of the alcohol group resulted in the highest solubility and permeation coefficient averages. This conclusion also establishes that the alcohol group's various mechanisms, effects, and characteristics allow for its effectiveness in improving permeation.

Furthermore, there have been no reports of skin irritation with this group, suggesting that possesses a balance between improved permeation and safety.

Conclusion

The results of this research support the hypothesis and lead to the conclusion that the chemical enhancer group of alcohol results in the most improved permeation of rivastigmine and methylphenidate.

Further Work

Further research on the mechanisms of chemical enhancers must be conducted, as drug solubility is just one of many. This will allow for a deeper understanding of the correlation between the effects of chemical enhancers and permeation and explain why some mechanisms have more influence on increased diffusion than others. Furthermore, a larger range of chemical enhancers should be examined in order to produce a more thorough study and thus, a more reliable conclusion. To further investigate enhanced permeation of methylphenidate and rivastigmine, combinations of chemical enhancers and their possible synergistic effects should be researched as well.

References

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- * Further references in paper

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