In Vitro Evaluation of Topical Retinol Products Penetration into Skin

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BACKGROUND

Topical retinol cosmetic products have been widely marketed for anti-wrinkle and anti-photoaging purposes. While some retinol products declare a specified retinol content to attract consumers, but majority of those retinol product do not disclose their retinol content. Additionally, retinol is very sensitive to light and prone to oxidation. Rakusa et al. evaluated 12 topical retinol products and discovered that 2/3 of those products with retinol content fell well below 80% of its declared concentration after six months [1-2]. The retinol content in the product is important, but more importantly is the amount of retinol penetrated into the skin from those products, which would be directly related to the product efficacy [3]. However, no such information has been provided from those topical retinol products. In this study, we were to test a range of topical retinol products to evaluate whether there is a correlation between the retinol content in the product and the amount of retinol penetration into the skin, or it is more dependent on individual formulation. Additionally, we were also going to evaluate the stability of retinol in those products.

METHODS

Thirteen retinol Marketed Products (MPs) with different retinol content were purchased from Amazon. The retinol content of those products were determined with a HPLC method. Those products were stored at room temperature under dark and their retinol content was determined over 6 months. For the in vitro test of retinol penetration into skin, 10 µL of retinol products were applied to a 2 cm diameter circle of human cadaver skin (on a heating pad at 37 ^{o}C) for six hours. After that, the excessive product on the skin was removed with alcohol swab four times, then the circular skin area was tape striped with scotch tape 24 times and combined into four different groups (Tapes 1-6, Tapes 7-12, Tapes 13-18, and Tapes 19-24). After that, the underneath skin was punched out. The retinol content in the tape strips and in the skin was extracted with methanol and analyzed with a HPLC method. Two MPs with retinol content close to 1%, two MPs with retinol content within the range of 0.3% - 0.5%, and two MPs with retinol content in the range of 0.1% were evaluated for the in vitro retinol skin penetration. Additionally, retinol in isopropyl myristate (IPM) solutions (0.1%, 0.5%, and 1%) were prepared and the retinol penetration of those IPM retinol solutions into the skin was also evaluated.

RESULTS

Table 1. List of MPs and their Retinol content.

MP#	Formulation	Label Claim	Retinol Content Measured
1	Silicon gel	N/A	0.1355% ± 0.0045%
2	Silicon gel	N/A	0.0998% ± 0.0002%
3	Cream	1.000%	1.3391% ± 0.0042%
4	Cream	N/A	0.1391% ± 0.0006%
5	Cream	N/A	0.0299% ± 0.0002%
6*	Lotion	0.300%	0.0646% ± 0.0009%
7	Oil	N/A	0.0280% ± 0.0002%
8	Oil	8.000%	0.0001% ± 0.0002%
9	Oil	N/A	0.0181% ± 0.0002%
10	Cream	N/A	0.0017% ± 0.0001%
11	Oil	1.000%	1.0092% ± 0.0516%
12	Oil	0.300%	0.4355% ± 0.0017%
13*	Lotion	0.300%	0.2267% ± 0.0050%

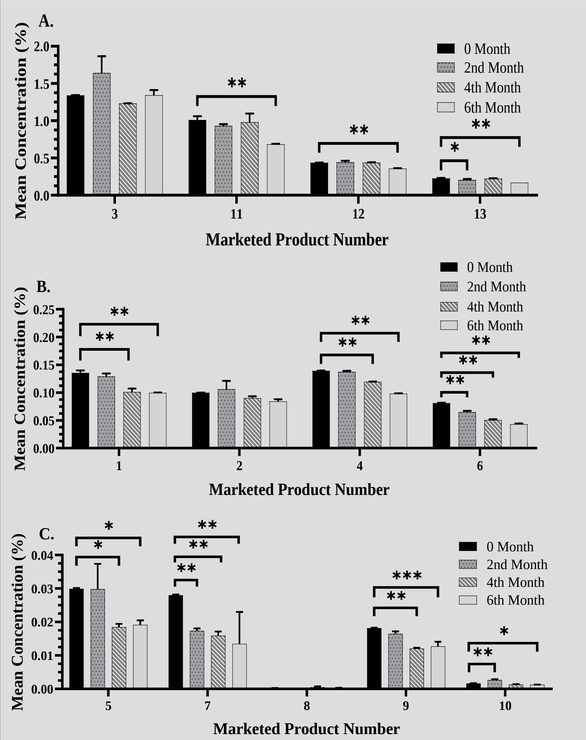

Fig 1 A, B, C: Retinol content in the 13 MPs over six months.

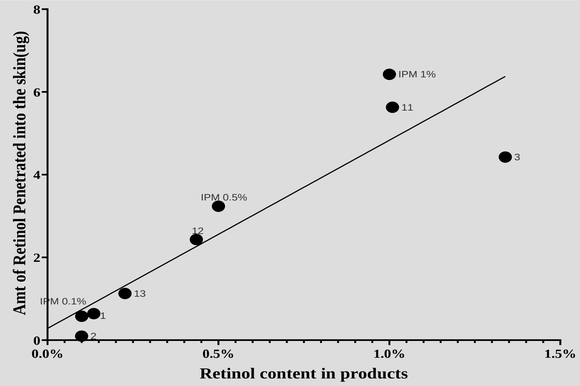

Fig 3. Correlation between the retinol content in products and the amount of retinol penetrated into the skin.

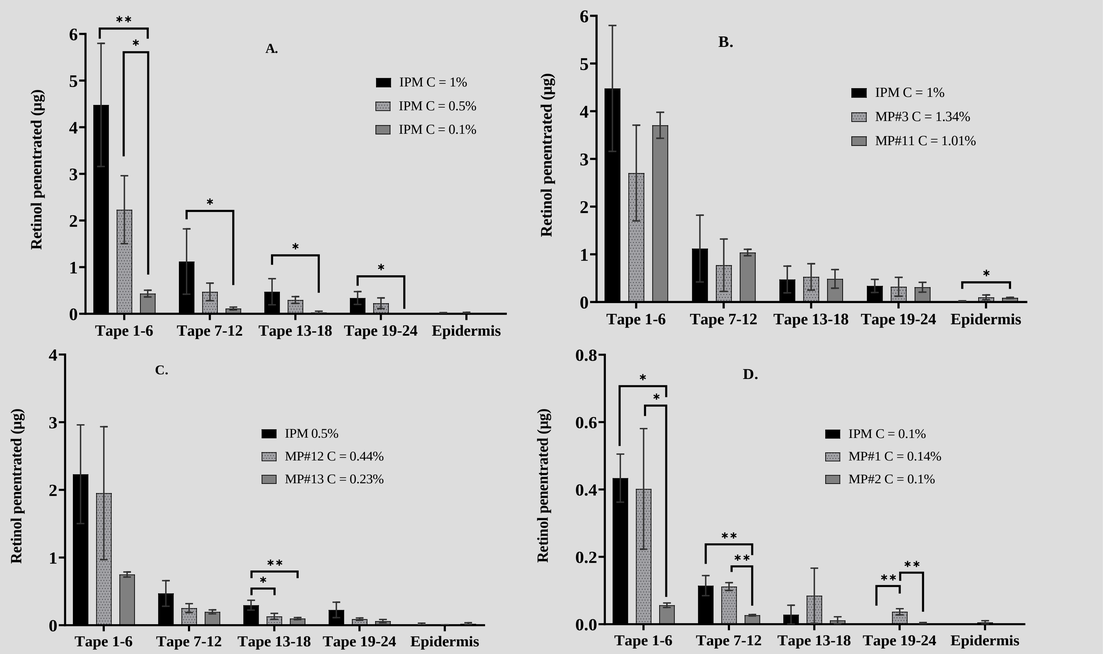

Fig 2 A, B, C, D: Retinol penetration into different layers in the stratum corneum and the epidermis from different retinol IPM solutions and marketed products.

CONCLUSION

There is a linear correlation between the retinol content in the product and the amount of retinol penetration into the skin, and this concentration related retinol penetration into the skin is relatively independent of the retinol product formulation.

There is very little retinol penetrated beyond the stratum corneum into to viable epidermis. Only retinol products with 0.3% or higher showed detectable retinol penetration into the viable epidermis.

Majority of the retinol products show significant degradation over the six month storage period, but a few products demonstrated quite stable over the time period. Thus the retinol product stability is formulation dependent.

REFERENCES

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