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An Integrative Review of the Absorption of FDA-Approved Chemical Sunscreen Filters Into the Blood

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Background

Forms of skin cancer, are some of the most common types of cancer in the United States, with an estimated 1 million people currently living with melanoma. One of the most widely understood risk factors of skin cancer is excess exposure to UV radiation. In addition to other methods, the American Academy of Dermatology states that one of the most important prevention strategy for all skin cancers is applying broad spectrum, water resistant, SPF 30 or higher sunscreen to exposed skin. In the United States, sunscreens are available for purchase in various formats with key active ingredient being describes as chemical and physical components. The most common chemical ingredients include avobenzone and oxybenzone, and they act by absorbing UV radiation and converting into heat. The potential absorption of chemical sunscreen ingredients into the bloodstream has become a topic of interest in recent years, due to a 2019 FDA study finding certain chemical sunscreen ingredients absorb into the blood and exceed the FDA threshold for safety evaluation of .5 ng/ml.

Significance and Aim

Various studies have shown that chemical sunscreen ingredients are absorbed into the bloodstream, however there is disagreement on the long term implications of these results and the risks that United States sunscreen use guidelines may have due to systemic exposure. Although current studies do not suggest that sunscreen use is unsafe, it is important that investigation of chemical sunscreen exposure in the blood stream continues so we can understand the significance of absorption and its potential health impacts. The aim of this review is to compare the levels of absorption and potential health effects of systemic exposure of chemical sunscreen filters in the United States

Methods: Literature Search

Number of articles:
57 articles were searched and 15 were used for this review.
Inclusion Criteria:
Discussion of absorption levels of avobenzone, oxybenzone. Methods of absorption into the bloodstream for these filters
Exclusion Criteria:
Sunscreen ingredients not approved in the United States, not in English, studies on methods to determine absorption rather than actual absorption data, studies focused on animals with no human absorption conclusions or viewpoints, repeats, quantification methods
Analysis:
After reading the full text and extracting findings from these texts, relevant information was grouped based on the sunscreen filter: Avobenzone, Oxybenzone.

Database Searched	Date of Search	Keyword String	# of Results (used)
PubMed	11/18/23	Chemical Sunscreen Filters and Plasma Concentration and avobenzone and oxybenzone	2 (1)
PubMed	11/18/23	Avobenzone and Plasma	12 (5)
PubMed	11/18/23	Oxybenzone and Plasma	29 (4)
PubMed	11/18/23	Sunscreen filter absorption blood	6 (3)
PubMed	11/18/23	Chemical and blood and absorption and plasma and concentration and sunscreen	8 (2)

Results

Avobenzone (Butyl Methoxydibenzoylmethane)

- A plasma concentration of 7.1 ng/ml was reached after one application to 75% of the body surface. Avobenzone may also be a potential endocrine disruptor.[2]
- 11ug concentration was found in plasma and negligible levels in the urine following dermal sunscreen exposure. Concentrations peaked 10-16 hours after application and the application was based on 2mg of sunscreen per cm^2 body surface.[3]

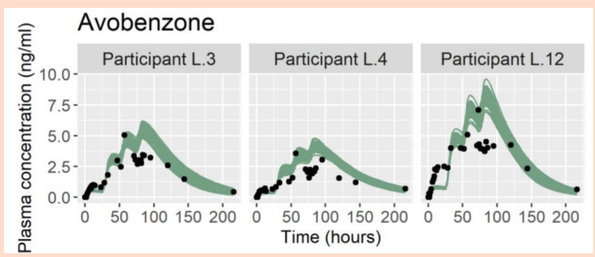

Figure 1. Plasma Concentration of Avobenzone[5]

Oxybenzone (benzophenone-3)

- May promote lung cancer metastasis. Caution in use of BP-3 in cancer patients.[10]
- Hormone levels changes were insignificant after application, suggesting BP-3 is incapable of disrupting homeostasis of reproductive hormones *in adults*.[9]
- A plasma concentration of 258.1 ng/ml was reached after one application to 75% of the body surface.[2]
- Affinity to stratum corneum

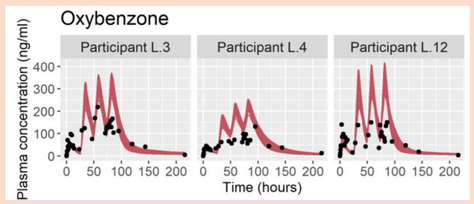

Figure 1. Plasma Concentration of Oxybenzone[5]

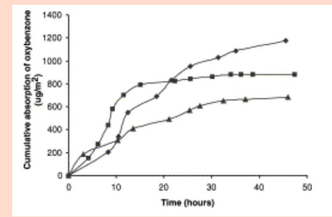

Figure 3: Systemic absorption of oxybenzone after topical application, result via urinary excretion. [8]

Discussion and Future Direction

- Oxybenzone showed higher concentrations in plasma of subjects in comparison to Avobenzone.
- Based on current studies available, systemic absorption of oxybenzone shows more potential health risks than Avobenzone.
- The FDA safety threshold of 0.5ng/ml was exceeded by both avobenzone and oxybenzone following 75% full body application every 2 hours for 8 hours.[2] This data suggests that FDA guidelines regarding systemic exposure to chemical UV filters needs to be altered, or other sunscreen agents should be encouraged for us.
- Overall, there are various studies on the absorption of avobenzone and oxybenzone into the blood and these studies show that oxybenzone is not only absorbed in larger quantities but also has a longer half life.
- It is clear that there is a need for more studies and trials on the potential health effects of these ingredients.
- Avobenzone and oxybenzone are the two sunscreen UV filters with the most research, however there are even more filters that are approved for use in the US with little to no research done on their absorption levels and health impacts.

References

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