Virgin Coconut Oil Protection Against UVB Induced Erythema and Pigmentation

(*Efek Proteksi Virgin Coconut Oil terhadap Eritema dan Pigmentasi yang Diinduksi Sinar UVB*)

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ABSTRACT
Skin naturally uses antioxidants (AOs) to protect against photo damage. Sun protection can be enhanced with effective formulations of topical antioxidant. Recently, consumer and media attention has focused on virgin coconut oil (VCO) as it was claimed having several beneficial effects for skin on its topical or systemic usage. We investigated the VCO protection against UVB induced erythema and pigmentation. The value of mean L*, a* and minimal erythema dose (MED) of 22 healthy volunteers were determined as the basic value. The next day, their back, which treated with VCO within 30 minutes and untreated one, were exposed to 1,2, and 3 times of MED of UVB irradiation. Erythema and pigmentary response were accessed 24, 72, and 144 hours after exposure for the value of L* and a*. The significance of mean L* and mean a* were analyzed by Independent T-test with p value < 0.05. The p value of mean L* and mean a* after 24, 72, and 144 hours of 1,2, and 3 times of MED of UVB irradiation were L*1MED: 0.387; 0.753; 0.587, 2MED: 0.823; 0.778; 0.997, 3MED: 0.667; 0.553; 0.760, a*1MED: 0.783; 0.148; 1.000, 2MED: 0.842; 0.786; 0.847, 3MED: 0.937; 0.631; 0.995. The claim that VCO having protection against UVB induced erythema and pigmentation was not proved.

Key words: UVB irradiation, erythema, pigmentation, virgin coconut oil

ABSTRAK
Kulit menggunakan antioksidan alami untuk memberikan perlindungan terhadap kerusakan akibat pajanan sinar Ultra Violet (UV). Antioksidan topikal diketahui efektif menghambat terjadinya kerusakan oksidatif akibat pajanan UV. Akhir-akhir ini penggunaan VCO (*Virgin Coconut Oil*) topikal diiklankan dapat berfungsi sebagai antioksidan alami yang bermanfaat untuk kulit. Efek proteksi pemberian VCO topikal terhadap eritema dan pigmentasi akibat pajanan sinar UVB. Duapuluh dua relawan diukur nilai L*, a*, dan *minimal erythema dose* (MED) sebagai data dasar, kemudian punggung relawan dioles VCO selama 30 menit. Kulit yang dioles VCO dan yang tidak dioles dipajan sinar *broad band* UVB (BB-UVB) dengan dosis 1, 2, dan 3 MED. Respon eritema dan pigmentasi diukur pada jam ke- 24, 72, dan 144. Perbedaan nilai rata-rata L* dan a* dianalisis secara statistik menggunakan Uji T-independen. Tidak terdapat perbedaan nilai L* dan nilai a* yang bermakna antara kelompok kontrol dan kelompok VCO baik di jam ke-24 (1MED L*0,387/a*0,783; 2MED L*0,823/a*0,842; 3MED L*0,667/a*0,937), jam ke-72 (1MED L*0,753/a*0,148; 2MED L*0,778/a*0,786; 3MED L*0,553/a*0,631) dan jam ke 144 (1MED L*0,587/a*1,000; 2MED L*0,997/a*0,847; 3MED L*0,760/a*0,995) pasca paparan UVB. VCO topikal tidak memiliki efek proteksi terhadap eritema dan pigmentasi akibat pajanan sinar UVB

Kata kunci: UVB, eritema, pigmentasi, *virgin coconut oil*

INTRODUCTION

Ultraviolet (UV) irradiation can be both beneficial and harmful to normal skin. The beneficial effects including vitamin D synthesis and treating certain skin disease, the harmful effect of UV irradiation is immune suppression, photo aging, and skin carcinogenesis. [1,2]

Protecting skin from photo damage from sun exposure is necessary. Sunscreens are useful, but their protection is not ideal because of inadequate use, incomplete spectral protection, and toxicity. Skin naturally uses antioxidants (AOs) to protect against photo damage, sun protection can be enhanced with effective formulations of topical antioxidant. [3,4]

Recently, consumer and media attention has focused specifically on products utilizing natural ingredients such as vitamins, minerals and botanical extracts. More recent claims focus on the antioxidant properties of these extracts and their ability to modulate

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certain types of environment damage, such as: the ginkgo biloba plant, greep seed extracts, lemon oil and lavender oil, ginseng, rosemary extract, soya protein, green tea and the newest one: virgin coconut oil (VCO) which is constantly being investigated, but only a few have been tested for their efficacy in human. VCO was claimed having several beneficial effects for skin on its topical or systemic usage. [5-7]

AIM OF STUDY

We investigated the VCO protection against UVB induced erythema and pigmentation.

MATERIAL AND METHOD

Participant selection

We included 22 healthy participants after they read and signed a written informed consent form. The group consists of 2 men and 20 women with ages ranging from 20 to 55 years. Participants were excluded when they had a history of abnormal photosensitivity, were taking any drug that might alter the response of skin to UVR, had a personal or family history of skin cancer, exposed to excessive sunlight or artificial UVR sources, consumed vitamin or food supplement in recent month, and pregnant, lactating or using hormonal contraception.

Course of study

Subjects who met the inclusion and exclusion criteria underwent measurement of their back skin's color using Minolta CR-200 chromameter, measurement was performed three times on each location and the mean was recorded. In this study only a* data was taken as the inflammation measure (erythema) and L* as the pigmentation measure.

Afterwards, MED was measured on every volunteers, by using light-impermeable black plastics with 12 squares, sized 1 x 1 cm, attached on back skin, whereas other body parts were covered with black clothing, and the eyes were protected by UV-protection glasses.

The first square was exposed to UVB lamp with a distance of 80 cm for 45 minutes, equivalent to 45 mJ/cm^2, whereas other squares were covered. After exposure the first square were covered, the second square was opened for 50 minutes of exposure equivalent to 50 mJ/cm^2, this procedure was continued until the twelfth square exposed for 100 minutes equivalent to 100 mJ/cm^2. After 24 hours, the MED for each volunteer was determined.

After the MED was recorded, then the UVB exposure doses given were adjusted to 1 MED, 2 MED, and 3 MED. The back skin was covered by black plastic with 6 holes (3 columns, 2 rows), the first row was applied by VCO for 30 minutes to give time for the absorption of active substances. After 30 minutes and the VCO was cleaned, the hole in the first column was exposed with 1 MED, the other holes and body parts were covered with black clothing, the eyes were protected with UV protection glasses. Similarly, the hole on the second column was exposed with 2 MED, and the hole on the third column was exposed with 3 MED, with the same procedure.

After exposure, every predetermined square was applied with VCO 2 times daily until the final day of observation.

Clinical evaluation

Observation for differences in erythema and pigmentation responses were conducted by determining mean L* and a* from three measurements on each location with chromameter, on 24, 72, and 144 hours after UVB irradiation.

RESULTS

Twenty two healthy volunteers (20 females, 2 males) who met the inclusion criteria, and didn't meet the exclusion criteria, were included in this study. The subjects' age was 20 to 52 years, with an average of 33,09 ± 9,471 years. The subjects' MED was 45 to 90 mJ, with an average of 57,7273 ± 11,51885.

Homogeneity test for back skin's color before UVB irradiation was performed by using One Sample Kolmogorov-Smirnov Test, which resulted in normal data distribution (Table 1).

Table 1. Homogeneity test of skin color for treatment location

Treatment location	Mean	SD	Statistic test
L* (pigmentation)			
VCO	56.5894	4.31238	0.706
Control	57.2879	5.01797	0.595
a* (erythema)			
VCO	10.6736	1.46592	0.996
Control	10.0379	1.59155	0.984

From figure 1 to 6, it was clear that topical VCO didn't have protective effect towards erythema and pigmentation compared with control.

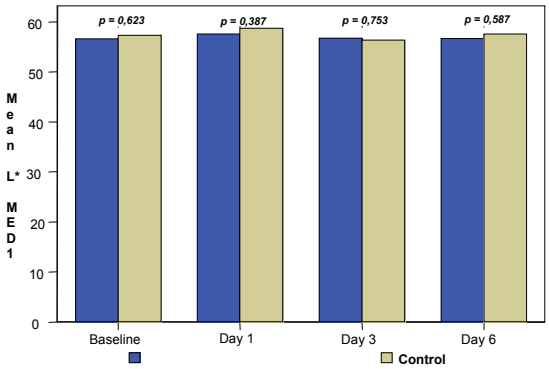

Figure 1. Differences of mean L* values between VCO and control 24, 72 and 144 hours after 1 MED UVB irradiation

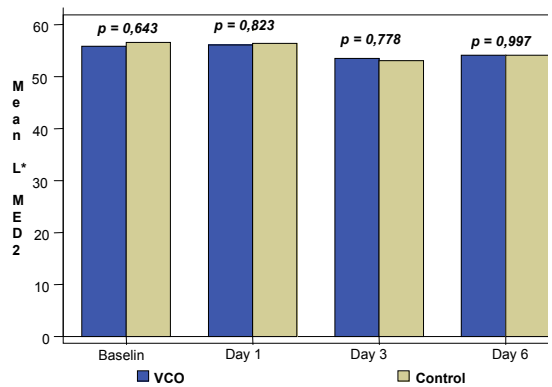

Figure 2. Differences of mean L* values between VCO and control 24, 72 and 144 hours after 2 MED UVB irradiation

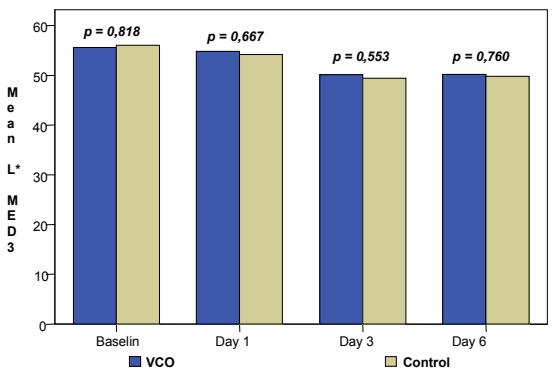

Figure 3. Differences of mean L* values between VCO and control 24, 72 and 144 hours after 3 MED UVB irradiation

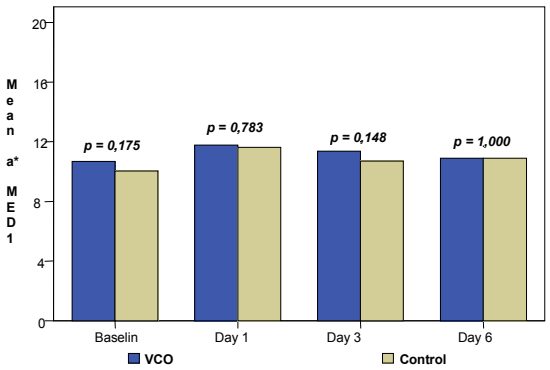

Figure 4. Differences of mean a* values between VCO and control 24, 72 and 144 hours after 1 MED UVB irradiation

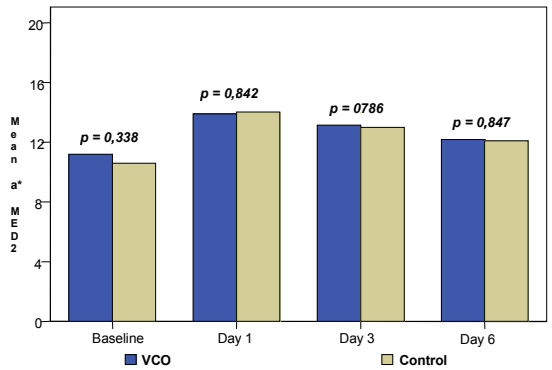

Figure 5. Differences of mean a* values between VCO and control 24, 72 and 144 hours after 2 MED UVB irradiation

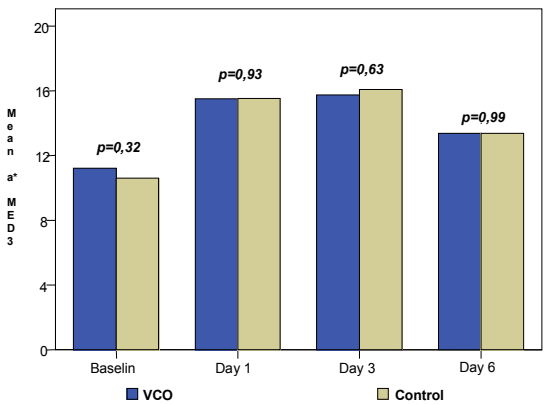

Figure 6. Differences of mean a* values between VCO and control 24, 72 and 144 hours after 3 MED UVB irradiation

DISCUSSION

VCO contains 64% medium chain saturated fatty acid (MCSFA). It consists of 50% lauric acid, 6–7% capric acid, 8% caprylic acid, and natural vitamins, especially vitamin E, which serves as antioxidant. VCO is a polysaturated fatty acid and it doesn't have double carbon binding, which consists of 8 to 12 carbons. VCO's content includes 92% saturated fatty acid, 6% monounsaturated, and 2% polyunsaturated fatty acid. With its minimal content of polyunsaturated fatty acid then VCO is classified as a saturated oil, therefore it is very stable and can endure oxidation process, hence it seldom becomes foul smelling, and it will not release free radicals because it is hard to be oxidized.[7] The lauric acid and tocoferol content of plant's oil are known to have antioxidant effect and can reduce oxidative stress due to UVB exposure. [6,8]

The study by Sharma et al found that lauric acid and other antioxidants content in plant's extract had antioxidant and antiproliferative effect which prevent the promotion of carcinogenesis in mice after application of benzoil peroxide and UVB radiation exposure.[8] Vitamin E which contained in plant's oil is alpha-tocoferol, gamma-tocoferol and tocotrienols which can prevent damage by preventing the formaton of thymidine dimers and cyclobutane pyrimidine dimers.[6]

Vitamin E is a lypophilic antioxidant mostly found in plasma, membranes, and tissues, which acts to disrupt oxidation chain and prevent oxidative damage. Vitamin E in the skin is easily depleted due to UVB exposure, because its level is lower than the other antioxidants.[5,9,10] Application of 1% alpha-tocoferol cream on mice had not been proved to prevent the formation of tyhmidine dimers after UVB exposure.[6] Lin et al found that vitamin E on the skin works synergistically with other antioxidants to increase its protective effect against UVB.[11] In this study, VCO was not shown to have protective effect towards erythema and pigmentation as topically applied antioxidant after exposure with 1, 2 and 3 MED UVB. This was maybe explained by the fact that VCO didn't have various antioxidant combinations that can work synergistically, and its lauric acid and vitamin E content were also inadequate. A number of literatures didn't mention the level of tocoferol contained in VCO.

VCO's protective property was assumed to be better if used orally, therefore, currently we are undergoing research on the effect of systemic VCO to prevent erythema and pigmentation after single UVB exposure.

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