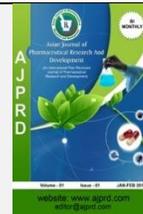


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Research Article

Determination of Sun Protection Factor of Blemish Balm Nanocream Containing Avobenzone, Octyl Methoxycinnamate, and Vitamin C

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ABSTRACT

Objective: The aim of this study was to determine sun protection factor of blemish balm nanocream (BB nanocream) containing avobenzone, octyl methoxycinnamate and vitamin C.

Method: The formulation of blemish balm nanocreams using a combination of a variety of concentrations of vitamin C (5, 7.5, and 9%), 3% avobenzone, and 7.5% octyl methoxycinnamate. The safety of the BB nanocream containing the highest concentration of vitamin C was examined using skin and eye irritation tests on the rabbit. SPF value of BB nanocreams determined by using UV-Vis Spectrophotometry method and compared with BB cream.

Results: All BB nanocream containing vitamin C, avobenzone, and octyl methoxycinnamate did not irritate the eyes and skin of rabbits. The SPF value of BB nanocream containing a combination of 3% avobenzone, 7.5% octyl methoxycinnamate and vitamin C of 5, 7 and 9% were 18.0497, 21.0857, and 21.5883 respectively. The SPF value of BB nanocream without avobenzone, octyl methoxycinnamate and vitamin C was 10.4798 and bb krim was 15,8515.

Conclusions: All BB nanocream formula containing 3% avobenzone, 7.5% octyl methoxycinnamate and Vitamin C (5%, 7%, and 9%) were not irritating the eyes and rabbit skin. The BB nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% vitamin C has the highest SPF value.

Keywords: BB Cream, Nanocream, Vitamin C, Avobenzone and Octyl methoxycinnamate

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INTRODUCTION

The short sun illumination of the skin may cause temporary damage to the epidermis, the symptoms are usually called mild erythema of the blood to burn in the worst cases. The old illumination will cause degenerative changes in the binding tissues in the corium. The condition causes the skin to

thicken, loss of elasticity so that the skin looks wrinkled, this is due to the skin loses its connective capacity-water¹. Sunscreen is a cosmetic dosage used to blend or effectively absorb sunlight, especially the ultraviolet and infrared wave emission areas to prevent the occurrence of skin disorders due to sunlight¹. The ability to determine the effectiveness of sunscreen is assessed in Sun Protection Factor (SPF).

BB cream known as Blemish Balm or Beauty Balm is a mild form of foundation with a series of moisturizing formulas and SPF with a medium spreadability level. Using moisturizers, skin care products, primarily, sunscreen, and foundation will surely take longer than just a single product².

Nanocream can be used as a topical preparation in the drug delivery system, among others: Absorption of active substances can increase due to smaller globule size to improve the delivery process of active substances through the skin, helping to solubilize the active substances that are hydrophobic, as well as having the rapid efficiency and penetration of the drug, and increase the bioavailability of active substances³.

Vitamin C serves as a depigmentation agent through its interactions with copper ions on the active part of tyrosinase thereby inhibiting the action of the enzyme tyrosinase oxidase and lowering the formation of melanin. The addition of vitamin C to the preparation of sunscreen can increase the value of SPF⁴. Therefore, in this research blemish balm cream will be developed in the form of Nano

cream preparations and conducted an evaluation of physical characteristics, evaluation of stability, the activity of sunscreen from the preparations.

MATERIALS AND METHOD

MATERIALS

The tools used in this study include: magnetic stirrer (BOECO Germany), hotplate (Fisons), analytical balance (Ohrus), Spectrophotometer UV-Vis (Shimadzu 1800).

The materials used in this study include: distilled water, pH buffer acid (Hanna), pH buffer neutral (Hanna), ethanol 96% (Brataco Medan), Glycerin (field Brataco), calcium hydroxide, calcium carbonate (CSPC), kaolin (Takehara), lanolin, magnesium carbonate, methylene blue, sodium metabisulfite (Merck, Germany), Nipagin (Medan Brataco), octyl methoxycinnamate (BTC), lemon perfume (Brataco medan), propylene glycol (Merck, Germany), cetyl alcohol (Brataco Medan), talcum (Galenova), Triethanolamine (TEA) (Petronas Chemicals), tween 80 (Merck, Germany), Vitamin C (CSPC), Yellow Iron Oxid (BTC), zinc oxide (Phar. Grade) and zinc stearate (CSPC).

Table: 1 Blemish Balm Nanocream composition

Ingredients	F0 (%b/b)	F1 (%b/b)	F2 (%b/b)	F3 (%b/b)
Vitamin C	0	5	7	9
Avobenzon	0	3	3	3
Octyl methoxycinnamate	0	7,5	7,5	7,5
Glycerin	20	20	20	20
Tween 80	20	20	20	20
BB nanocream base ad	100	100	100	100

Description: F0: BB Nanocream without avobenzon, octyl methoxycinnamate and vitamin C (blank)
 F1: BB Nanocream containing 3% avobenzon, 7.5% octyl methoxycinnamate and 5% Vitamin C;
 F2: BB Nanocream containing 3% avobenzon, 7.5% octyl methoxycinnamate and 7% Vitamin C;
 F3: BB Nanocream containing 3% avobenzon, 7.5% octyl methoxycinnamate and 9% Vitamin C.

Pre-clinical studies

Rabbit used is a rabbit that has healthy and normal eyes. This experiment was conducted on 6 rabbits by using the highest concentration formula of 9% to find out if the preparations made can cause opacity (clarity), erythema (redness), and lacrimation (out of the tears). Subsequently, as much as 0,1 g each test sample of BB Nanocream was placed in the conjunctiva pouch on one of the rabbit's eyes for each rabbit. Then, at the next test, the back area of each rabbit shaved before the experiment. The shaved skin parts of each rabbit are divided into three marked sections. Two areas marked in each animal are used for topical application BB Nanocream with different concentrations (0 and 9%). While other areas are marked as blank samples to test skin irritation as per the method^{5,6}.

Determination of the value of Sun Protection Factor Blemish Balm Nanocream Preparations

Sample absorption is obtained using a UV-Vis spectrophotometer at a wavelength of 290-400 nm using ethanol as a blank. The absorption value is recorded every 5 nm interval of 290-320 nm wavelength. The absorption value gained is multiplied by EE x I for each interval. The number of EE x I multiplied by the correction factor is finally obtained SPF value from the sample tested⁷.

$$SPF_{\text{spectrophotometric}} = CF \times \sum_{290}^{290} EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

Statistical analysis

All data were analyzed with regression analysis using SPSS 22. After the use of the data normalization test using the Kolmogorov method – Smirnov obtained that the data is distributed normally, then testing the SPF value statistically

followed by using the One-way ANOVA, obtained the value of sig. 0.001. It can then be concluded that there is a significant difference ($P < 0.05$) between each formula⁸.

RESULTS AND DISCUSSION

Preclinical testing results

Irritation of rabbit eye test results

Irritation Test Observation BB Nanocream has done to find out the irritated index caused by the BB Nanocream because BB Nanocream has substances that can potentially irritate the skin that can be seen in the Figure. 1.

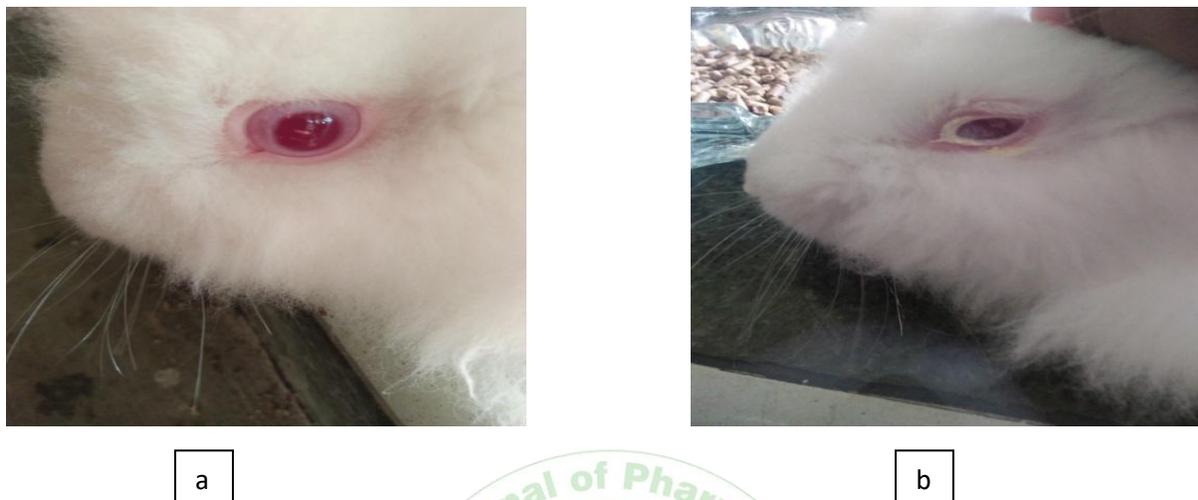


Figure: 1 Rabbit Eye irritation test (a) before applying BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C; (b) After applying BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C.

The eye irritation test indicates that the dosage of BB Nanocream did not irritate the eye. Eye irritation test results have also been supported by the degree of acidity (pH) test, where the pH of the BB Nanocream preparations between 4.5-7.5. This suggests that the constituent ingredients of BB Nanocream have not given a noticeable effect on the onset of eye irritation.

Rabbit skin irritation test result

This observation was done using the animal test rabbit before applying BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C and after applying BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C can be seen in the Figure. 2



Figure: 2 Test irritation of the skin of rabbits (a) Before applying BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C; (b) After applying BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C

Value of Sun Protection Factor preparations

Blemish Balm Nanocream that has dissolved in the dissolving was further measured using a UV-Vis

spectrophotometer with a repetition of three times at a wavelength of 290 – 400 nm and its absorption⁹ it can be seen in Figure 3 and Table 2.

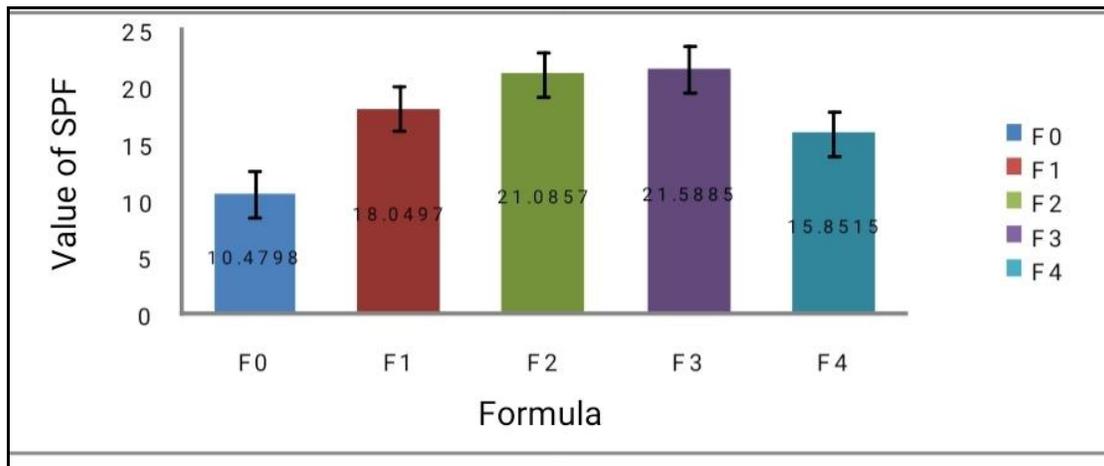


Figure 3. SPF value of BB nanocream and BB cream formulation

(F0) BB Nanocream without vitamin C, avobenzone and octyl methoxycinnamate (Blank); (F1) BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 5% Vitamin C; (F2) BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 7% Vitamin C; (F3) BB Nanocream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C; (F4) BB cream containing 3% avobenzone, 7.5% octyl methoxycinnamate and 9% Vitamin C.

Table 2 Category effectiveness of SPF value preparations

No	Formula	Average SPF value	Category Effectiveness
1	F0	10.4798	Maximum
2	F1	18.0497 ^{*#}	Ultra
3	F2	21.0857 ^{*#}	Ultra
4	F3	21.5885 ^{*#}	Ultra
5	F4	15.8515	Ultra

Description: Tukey post hoc test results, $\alpha < 0,05$, ^{*} $P < 0,05$: there are significant differences with the control, [#] $P < 0,05$: there are significant differences with the comparison

Based on the Figure. 3 can be seen that the higher the concentration of vitamin C added, the higher the SPF value given the dosage, the higher the level of protection given by the sunscreen^{10,11,12}.

From the results of Table. 2 category effectiveness of the SPF value of the BB nanocream and BB cream, which contains variations in the concentration of vitamin C, 3% avobenzone and 7.5% octyl methoxycinnamate had the effectiveness of the Ultra on F1, F2, F3 and F4 formulas while at F0 formula had maximum effectiveness. Sunscreen cosmetic preparations that provide a better protection effect on UV rays have a minimum SPF value of 15 or more that could provide a longer protection effect against UV rays¹³.

CONCLUSIONS

All BB Nanocream formula contains 3% avobenzone, 7.5% octyl methoxycinnamate and Vitamin C (5%, 7%, and 9%) were not irritating the eyes and rabbit skin. BB Nanocream contains 3% avobenzone, 7.5% octyl methoxycinnamate and 9% vitamin C has the highest SPF value.

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