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In vitro evaluation of sun protection factor of fruit extract of *Carica papaya L.* as a lotion formulation

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ABSTRACT

In the present study, to investigates the in vitro sun protection factor (SPF) of Carica papaya L fruit extract in a lotion formulation. Due to its antioxidant and photo protective properties, Carica papaya L is a promising candidate for use in cosmetic and pharmaceutical formulations. The sun protection factors were analyzed by ultraviolet (UV) spectrophotometry using samples irradiated with UVB lamp. It is screened for in vitro sun protection factor in the Carica papaya L extract and of its lotion formulation and determines Photo stability of the isolated Carica papaya L extract and SPF. This proved activity of plant showed its importance and prophylactic utility in anti- solar formulation. This will be a better, cheaper and safe alternative to harmful chemical sunscreens that used now a day in the industry.

Key words: UV protective, SPF and *Carica papaya L.* and lotion

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INTRODUCTION

Acute and chronic exposure to non-physiological doses of ultraviolet radiation leads to variety of changes of skin. For skin protection from deleterious effects of sunlight, sunscreen products are used in various form having chemical and physical filters. Nowadays, because of benefits of products containing natural compounds and compliance of user of these products, use of the natural compounds that can absorb ultraviolet radiation is of great interest.

The sunlight which also stimulates melanin and the pigment that acts as the skin natural sunscreen. But excessive radiations of sunrays are unprotected and leading to painful sunburn or other skin related complication. Skin, an architecturally marvelous structure has a surface area of 1.5 to 2 m^2. It is pliable yet tough, allowing it to take constant punishment from the external environment. Sunlight is one such factor that affects the skin constantly and in the process causing damage. Skin has the intrinsic properties to protect itself from the sun, in form of melanin.

Every year, more than one million people are diagnosed with skin cancer and about 10,000 die from malignant melanoma. Most skin cancers occur on the areas that are most frequently exposed to the sun, such as the face, neck, and the back of the hands. [1,2]

Direct exposure to UV-C for a length of time would destroy the skin. Fortunately, UV-C is completely absorbed by gases in the atmospheres before it reaches the ground. In any time the longer wavelength of UV-B and UV-A pass right through the atmosphere. The molecules in sunscreen absorb most of UV-Band prevent it from reaching the skin just as the molecules of the atmospheres absorbs UV-C and prevent it from reaching the ground [3-6].

The *CaricaPapaya L* (Caricaceae) is a powerhouse of nutrients and is available throughout the year. It is a rich source of threes powerful antioxidant vitamin C, vitamin A and vitamin E; the minerals, magnesium and potassium; the B vitamin pantothenic acid and folate and fiber. In addition to all this, it contains a digestive enzyme-papaintha effectively treats causes of trauma, allergies and sports injuries. All the nutrients of papaya as a whole improve cardiovascular system, protect against heart diseases, heart attacks, strokes and prevent colon cancer. The fruit is an excellent source of beta carotene that prevents damage caused by free radicals that may cause some forms of cancer. Ripe fruit consumed regularly helps in habitual constipation. It is also reported that papaya prevents premature aging. It may be that it works because a poor digestion does not provide enough nutrients to our body. The fruit is regarded as a remedy for abdominal disorders. The skin of papaya works as a best medicine for wounds. Even you can use the pulp left after extracting the juice from papaya as poultice on the wounds. The enzymes papain and chymopapain and antioxidant nutrients found in papaya have been found helpful in lowering inflammation and healing burns. The presence of vitamin A helps to restore and rebuild damaged skin. Applied papaya peel used as skin lightening agent. When peel mixed with honey and applied it can act as soothe and moisturizers the skin.[7]

The various herbal formulation and chemicals are available to block various ranges of UV rays which prevent all types of skin from various damages. Our investigation is to study and find out such fruit that are widely used as sunscreen from ancient time.

Therefore, we report here the promise of the *Carica Papaya L* fruit extract in cosmetic formulations; there are no prior data available about several aspects of the cosmetic formulation. The goals of this research are to evaluate, its stability at 2 to 3 months stored at 5, 25 and 45 ◦C; the in vitro sun protection factor; the Photostability of the isolated *Carica Papaya L* extract.

MATERIALS AND METHODS

Materials and extract preparation

Papaya fruit (*Carica Papaya L*) were obtained from a local market in Sangli Maharashtra, India, and they were botanical authenticated at Dept. of botany Y.C College, Karad (MS). Fruit were selected for uniform size, color, level of external ripeness, and divided into four ripeness stages: RS1 re- presents papaya with yellow area on 0% - 25% of the skin; RS2 with >25% - 50% color; RS3 with >50% - 75%, and RS4 with >75% - 100%. The papaya with yellow soft area of fruit flower were percolated ethanol: water(1:1) (100 ml/g of dried yellow soft area of fruit) and the extract was freeze-dried. The final concentration of the C. papaya L in the crude extract was 7.1% (w/w), as evaluated by HPLC with electrochemical detection.[8]

Formulations

For lotion formulation containing *Carica Papaya L* fruit extract with final concentration of 15% (w/w)glycerin prepared. All formulations were stored in well-closed dark glass flasks and were compounded fresh for all studies. The concentration was the minimal active antioxidant concentration. A formulation was prepared with the addition of active ingredient % (w/w) which is shown in Table 1.

Table 1. Composition (%, w/w) of lotion formulations used for the determination of SPF

Active Ingredients	Quantity
C. papaya L fruit extract	1.42 mg
Glycerin	15% w/w
Cream base	q.s

Table 2- Physicochemical parameters of the extract lotion

Parameters	%w/w (±) S.D.
Foreign organic matter	0.084 % ± 0.244
Ethanol soluble extractive	13.23 % ± 0.434
Water soluble extractive	39.15 % ± 1.487
Total ash	6.88 % ± 0.245
Acid-soluble ash	2.34 % ± 0.233
Acid-insoluble ash	8.98 % ± 0.954
Loss on drying	6.235 % ± 0.284
Moisture content	9.88 % ± 0.244

Physiochemical parameters of the extract lotion
Physicochemical parameters of the extract lotion were determined according to the standard method which is shown in Table 2.

Flavonoid identification test
The general flavonoid identification test was performed on the extract as,

Test 1: To dry extract, add 5ml of 95% ethanol, few drop of concentrated hydrochloric acid and 0.5 g of magnesium turning. The finally pink color observed. (Shinoda test)

Test 2: To a small quantity of extract, add lead acetate solution, it shows yellow colored precipitate is formed. [9]

Determination of the in vitro sun protection factor
The crude *Carica Papaya L* fruit extract, the lotion formulation (15% w/w glycerin) containing *Carica Papaya L* fruit extract were analyzed for the in vitro SPF. The crude *Carica Papaya L*fruit extract lotion formulation was dissolved in methanol UV solv: water (6:4). Scans of the samples in solution were run from 320 to 290 nm using 1 cm quartz cuvettes in a Jascco UV-1700 spectrophotometer. The commercial sunscreens, Himalaya®SPF 15, were used for the calculation of the correction factor and a solution of 8% homosalate (v/v) diluted to 0.2 mg/ml was used as standard. The SPF model used in this study was based on the following equation proposed by Mansur et al. [10]

The SPF model used in this study was based on the following equation proposed by Mansur et al.

$$SPF = CFX \sum_{290}^{320} EE\lambda\ X\ I(\lambda) X\ abs\ (\lambda) \quad (1)$$

where CF is correction factor, determined by sunscreens with known SPF, so that a solution containing 8% of homosalate gives SPF = 8; EE (λ) the erythemal efficiency spectrum; I (λ) the solar simulator spectrum as measured with a calibrated spectroradiometer;

$$\sum_{290}^{320} EE(\lambda) X I(\lambda) = 290\text{–}320\ \text{nm} \quad (2)$$

Where, 290–320 nm in 5 nm increments; abs(λ) is the spectroradiometer measure of sunscreen product absorbance. Table 2 shows the normalized values of the product function used in these studies and were calculated. [10,11]

RESULTS AND DISCUSSION

Determination of the correction factor
The correction factor was calculated for commercial sunscreen (Himalaya® SPF 15) using Eq. (1) data given in Table 2 and the total SPF given in Table 3.

Table 3- The normalized product function used in the calculation of SPF data

λ (nm)	EE×I (normalized)
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180
	=1.000

EE: erythemal efficiency spectrum; I: solar simulator intensity spectrum

Determination of SPF in the Carica Papaya L extract and of its lotion formulation
According to Table 4 summarizes the SPF values determined for each solution described. As expected in vitro SPF value for the *Carica Papaya L* extract was 16.047±0.05. When 1.42% *Carica Papaya L* extract was added to the glycerin and cream base formulation, the SPF value was 2.90±0.01.

Table 4- SPF calculated for commercial sunscreens (Himalaya® SPF 15) using Eq. (1) and data given in Table 2

λ (nm)	EE×*I* (normalized)	Himalaya® SPF 15	
		Absorbance	SPF
290	0.0150	0.7943	0.0198
295	0.0817	0.7723	0.0676
300	0.2874	0.7625	0.2145
305	0.3278	0.7443	0.2434
310	0.1864	0.7167	0.1356
315	0.0839	0.6906	0.0578
320	0.0180	0.6688	0.0199
Total			0.7586

EE: erythemal efficiency spectrum; I: solar simulator intensity spectrum.

Table 5- Results expressed as the average and S.D. of three determinations replicated of the SPF values

Sample	**SPF**
Carica Papaya L *fruit* extract lotion	2.90±0.01.
Crude Carica Papaya Lextract	16.047±0.05

CONCLUSION

The result obtained were showed that ability of extract to absorb UV radiation and hence proved UV protection ability. Further, isolated extract have, the major antioxidant of *Carica Papaya L,* is also stable when exposed to UVB irradiation. It is essential for collection of similar data for different plant and there flowers, as well as other parts. This proved activity of plant showed its importance and prophylactic utility in anti-solar formulation. This will be a better, cheaper and safe alternative to harmful chemical sunscreens that used now a day in the industry. Besides its antisolar activity and effects, making it a useful sun care as well as skin care product.

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