BIOLOGY

SUNBLOCK ACTIVITY POTENTIAL OF LEAF EXTRACT FROM *COLOCASIA ESCULENTA* (GABI) LEAVES

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Abstract. *Evaluation of sunblock activity is an important aspect nowadays, as exposure to sunlight is recognized as a major factor in the cause of the progressive unwanted changes in the skin appearance and physiology due to UV rays present in the sunlight. In this study, sunblock activity of Colocasia esculenta (gabi) leaf extract was determined by absorption spectroscopy using UV-vis spectrophotometry. The in-vitro SPF of the formulations was determined according to the UV Spectrophotometric method.*
The Colocasia esculenta (gabi) leaf extract under study produced high absorbance at 290-320 nm wavelength range and obtained an average SPF (Sun Protection Factor) of 7.39 in five trials. The study can positively conclude that Colocasia esculenta (gabi) leaf extract can considerably contribute in the preparation of sunblock product formulations which could prevent skin damaging effects of ultraviolet radiations.
Keywords*: sunblocks, in-vitro, sun protection factor (SPF), UV-Vis spectroscopy.*

Introduction. UV light has been classified by WHO as carcinogenic and produces several adverse effects including mutagenicity, immune depression of the skin, accelerated skin ageing and photo dermatoses (Nohynek and Schaefer, 2001). Sunlight composed of different wavelengths ranging from UV or ultraviolet light through (IR) infrared to visible light. Exposure to solar radiation is recognized to have negative effects on the human skin. Among all, ultraviolet light is the most harmful to the skin and causes sunburns, ageing of the skin and over the long term, skin cancer (Sudhahar et. al 2013).

The ultraviolet radiation or electromagnetic radiation produced principally by the sun is divided into infrared radiation (IR), visible light (VIS), and UV radiation. Heat not visible to the human eye is part of IR radiation and VIS accounts for the wavelength range of general illumination. Furthermore, UV radiation is divided into three bands in order of decreasing wavelength and increasing energy: UVA (320-400 nm), UVB (290-320 nm), and UVC (200-290 nm) (Korac and Khambholja 2011). Although UVC has the highest energy it was heavily absorbed in the upper atmosphere and thus not a major factor in causing human cancers. However, the major source of the damaging effects of sunlight striking the earth's surface are UVA in more than 90% and UVB less than 10% which comes from the UV spectrum between 290 and 400nm (Ortiz, et. al 2014).

Due to these specifics, sunblocks substances are now included into day-to-day products such as creams, ointment, moisturizers, lotions and other skin care products. The usual application of these products may help to avoid the harmful effects of ultraviolet radiation to some degree. However, it is essential that a very efficient sunblock substance is used in the cosmetic formulation.

Researches in cosmetics have been carried out by scientists because of its popularity and essentiality in our lives nowadays. As a result, more and more products are being developed and marketed. Body and beauty care product are likely to surpass the consumption of drugs in the future (Korac and Khambholja 2011). Hence, the result of this study will give information on the absorptive spectrum profile of Colocasia esculenta (gabi) leaf extract. Furthermore, this study assessed Colocasia esculenta (gabi) species having the potential for sunblock products that can be used as data base information for researchers in the future.

The effectiveness of a sunblock is usually expressed by sun protection factor (SPF) which is the ratio of UV energy required to produce a minimal erythemal dose (MED) in protected skin to unprotected skin (C. Malsawmtluangi et. al 2013).

The in-vitro approaches are generally two types. 1) Measurement of absorption or the transmission of UV radiation through sunblock product films in quartz plates or membranes 2) methods in which the absorption characteristics of the sunblock agents are determined based on

spectrophotometric analysis (Sudhahar et. al 2013). The major benefit of the in vitro test is that it is a fast, objective, cost-effective screening method.

Available marketed sunblock produces protection on the basis of active principles that provide protection through various mechanisms such as reflection or absorption of radiation by them. Studies have been performed on various plant (Helichrysum, Rrangula, Chamomole, Hamamelis virginiana, Cinnamomum zeylanicum and Rosa damascene etc.) (C. Malsawmtluangi et. al 2013). Most sunblock products contain ingredients that provide adequate protection only against UV-B rays.

It is of utmost importance to enrich the knowledge of the general public about the sunblock potential of plants hence the result of this study will benefit the manufacturers in formulating their natural based products. Thus, consumers will be protected from the harmful effects of UV light. Moreover, this study will help provide basic information for every family about common plants that can be used for home-made sunblock products in safeguarding the health of family members.

Results. The SPF is a quantitative measurement of the effectiveness of a sunblock formulation. In this study the leaf extract of Colocasia esculenta (Gabi) leaves was evaluated for sunblock activity using in-vitro SPF method.

The absorption spectra of the leaf extract were obtained by scanning in the wavelength range of 200nm to 400nm using the UV- spectrophotometer. Thereafter, absorbance values of each aliquot prepared were determined from 290-320 nm at 5 nm interval, taking ethanol as a blank. The measurements were taken five times and the determinations were made at each point, followed by application of Mansur equation. Measurements were taken one by one after cleaning the cuvette before taking each sample.

The aliquots prepared were scanned between 290-320 nm and the obtained absorbance values were multiplied with the respective EE (λ) values. Then, their summation was taken and multiplied with the correction factor (10). Data was expressed as mean.

The absorption spectra of sample solution were obtained in the range of 290 to 320 nm using 1 cm quartz cell, and ethanol as blank.

The SPF number of aqueous extracts of the herbal sources was calculated by applying Mansur mathematical equation. The absorbance of different plant extracts was recorded as mean values of three readings. Calculation of Sun Protection Factor (SPF) of the plants will be performed according to Mansur et al. (1986) equation.

$$\text{SPF} = \text{CF} \times \sum_{290}^{320} EE\,(\lambda) \times \text{I}(\lambda) \times \text{Abs}(\lambda)$$

where EE(λ) is the erythemal effect spectrum, I(λ) is the solar intensity spectrum, Abs(λ) is the absorbance of sunblock product; CF is the correction factor (=10). (Mansur et al. 1986, as cited in Dutra et al. 2004).

Table 1: Absorbance of *Colocasia esculenta* (GABI) leaves on different wavelength

Wavelength	EE X I Value	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Mean
290	0.015	0.680	0.533	0.613	0.697	0.747	0.654
295	0.0817	0.550	0.487	0.547	0.560	0.597	0.548
300	0.2874	0.601	0.597	0.700	0.642	0.645	0.637
305	0.3278	0.713	0.733	0.771	0.808	0.775	0.760
310	0.1864	0.967	1.013	0.769	0.671	0.793	0.842
315	0.0839	1.119	0.953	0.907	1.103	0.910	0.998
320	0.018	0.333	0.533	0.663	1.060	0.563	0.631

Table 1 shows the absorbance of Colocasia esculenta (gabi) leaves extract at 290-320 nm which covers that wavelength of UVB. As seen on the table above, highest absorbance of the plant extract was recorded at 315 nm on the five trials.

Table 2: Determination of SPF value Colocasia esculenta (gabi) leaf extract

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Mean
Calculated SPF Value	7.41	7.38	7.39	7.42	7.34	**7.39**

Table 2 shows the SPF value of Colocasia esculenta (gabi) leaf extract on the five trials. As seen in the table, the computed value for the SPF or Sun Protection Factor is 7.39.

This value of SPF makes the plant extract a possible active ingredient for sunblock products in the market.

Table 3: SPF values of different plant samples

Sample		SPF Values
1	Mentha piperita (Leaves)	8.18
2	Azadirachta indica (Leaves)	4.37
3	Oscimum sanctum (Leaves)	2.9
4	Aloe vera (Leaves)	5.43
5	Lycopersicon esculantum (fruits)	6.08
6	Carica papaya (fruits)	2.31
Present Study	Colocasia esculenta (leaves)	7.39

* As presented by Gupta 2013

Table 3 shows the comparison of the different SPF values of different plant samples to the present study. As observed, the computed value of Colocasia esculenta (leaves) is comparable and even better to those of previously studied plants and fruits.

Conclusions. The main objective of the study is to analysed the sunblock potential of Colocasia esculenta (gabi) leaf extracts. It was found that Colocasia esculenta (gabi) leaf extracts has high UV protection capabilities.

The absorption spectrum profile of Colocasia esculenta (gabi) leaf extracts using UV-VIS spectrophotometer is also established by repeating trials and the SPF value was calculated.

The study shows that the Sun Protection Factor (SPF) of the plant extracts for potential sunblock agent is 7.39. The value calculated using the standard Calculation of Sun Protection Factor (SPF) of the plants according to Mansur et al. (1986) equation.

From the result obtained in the study, the researchers can positively conclude that Colocasia esculenta (gabi) leaf extracts have significant UV absorbing property. This will be a better, cheaper and safe alternative to harmful chemical sunblock that used nowadays in the industry.

The study shows that Colocasia esculenta (gabi) leaf extract sunblock has significant UV absorbing property and the proposed UV spectrophotometric method is simple, rapid, utilizes low-cost reagents and can be applied for in vitro determination of SPF values in many cosmetic formulations.

However, there are several aspects affecting the determination of SPF values. For future studies, the researchers suggest:

1. The formulation of a commercial cream using Colocasia esculenta (gabi) leaf extract as the main active ingredient.
2. Different factors may also be considered in the formulation of the cream like the use of different solvents in which the sunblock is dissolved; the combination and concentration of the ingredient.

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