

Some common medicinal plants used in protecting skin from Sun damage in district Tehri Garhwal, Uttarakhand, India

L.R. Dangwal¹ and Priyanka Uniyal²

^{1,2}Herbarium and Plant Systematics Laboratory, Department of Botany, H.N.B. Garhwal University (SRT Campus), Badshahithaul, Tehri Garhwal, Uttarakhand

(Received 24 February, 2020; accepted 12 June, 2020)

ABSTRACT

The present communication pertains to increasing UV radiation reaching the Earth due to the depletion of ozonosphere. These harmful UV rays are responsible for many skin problems, like tanning, sunburn, inflammation, redness or itchiness, hyperpigmentation (melasma), dryness, premature ageing and even skin cancer etc. Medicinal plants have tremendous properties to cure almost every skin disease known to mankind for ages. Authors have also collected information of some common medicinal plants used in treating a sun-damaged skin in the study area. These valuable information have been collected from neighbouring villages of study area *i.e.* Dharsal, Sondkot, Ranichauri, Sursingdhar, Dikhol gaun, Saabli etc., and enlisted ten common medicinal plants belonging to 9 families and 10 different genera - *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., *Lycopersicon esculentum* Mill., *Mallotus philippensis* (Lam.) Müll Arg., *Mentha arvensis* L. and *Ocimum basilicum* L.

Key words: Sun damage, Sunscreen, Medicinal plants, Skin problems, Traditional knowledge

Introduction

Due to the depletion of ozone layer, there is a general trend of increase in the global UV levels and now has become a matter of great concern. An increase in the ozone-depleting compounds, like halocarbons - CFCs and HCFCs, in the atmosphere due to human activities is majorly responsible for thinning of this stratospheric unit. There are various harmful skin health problems associated with prolonged and/or high dose exposure to ultraviolet radiation. Some of the common skin problems include dryness of skin, tanning, sunburn, redness or itchiness, inflammation, hyperpigmentation, premature wrinkling and skin cancer. Tanning and sunburn occur due to excessive accumulation of melanin, a

skin pigment, in response to long and repeated sun exposure to reduce the amount of UV rays penetrating the skin (https://www.medicinenet.com/sunburn_and_sun_poisoning/article.htm#7_tips_to_prevent_a_sunburn_and_skin_cancer). Prolonged UV exposure damages the skin fibre called elastin, which results in sagging and stretching leading to premature wrinkling of the skin (<https://www.webmd.com/beauty/sun-exposure-skin-cancer#1>). Exposure to UV rays causes oxidative stress which leads to the formation of free radicals. These free radicals pull electrons from other molecules, in turn destabilizing them and turning them to free radicals, which creates a free radical chain reaction. This causes damage to cells, proteins and DNA (Lobo *et al.*, 2010).

There are various chemical-based sunscreen products used by general folk around the world for sun protection. The commercially available chemical-based sunscreen lotions mainly contain chemicals like zinc oxide, titanium dioxide, avobenzone, octisalate, octocrylene, padimate O, octylmethoxy cinnamate etc. (<https://www.ewg.org/sunscreen/report/the-trouble-with-sunscreen-chemicals/>). Though these chemical-based sunscreens have faster action but they may impose risk to skin's health in the long run. For example, women with high levels of benzophenone-3 are more likely to give birth to underweight baby-girls, and continuous use of zinc oxide and titanium oxide may give rise to light-induced free radical formation which will further damage normal cells (Wolff *et al.*, 2008). There are various photo-allergic drugs that are commonly used in sunscreen products such as para-aminobenzoic acid (PABA), oxybenzone, cyclohexanol, benzophenones, salicylates and cinnamate. Even some of the drugs used in chemotherapy for skin cancer, like 5-fluorouracil, vinblastine and decarbazine, are photosensitive drugs that may result in severe skin reaction on sun exposure (https://www.medicinenet.com/sun-sensitive_drugs_photosensitivity_to_drugs/article.htm#sun-sensitizing_drugs_photosensitivity_definition_and_facts). Some moisturizing lotions or creams, especially those with benzocaine, also contain potential skin allergic chemicals (https://www.medicinenet.com/sunburn_and_sun_poisoning/article.htm#7_tips_to_prevent_a_sunburn_and_skin_cancer).

From ancient times, various herbs have been used traditionally by ethnic people to protect skin from the sun burn (Koræ and Khambholja, 2011). These herbs are applied either topically or taken orally. The sunscreen property of the plant extracts applied topically onto the skin surface is mainly due to reflection, scattering and absorption of the UV rays (D'Orazio *et al.*, 2013). There are many plants having higher antioxidant activity which helps to scavenge free radicals when taken orally. The naturally occurring compounds, such as anthocyanins, proanthocyanidin, carotenoids, vitamin E & C, resveratrol (*Vitis vinifera* L.), saffranol (*Crocus sativus* L.), boldine (*Peumas boldus* Molina), quercetin (*Vitis vinifera* L.), piperine (*Piper longum* L.), apigenin (*Matricaria chamomilla* L.), silymarin (*Silybum marianum* (L.) Gaertn.), curcumin (*Curcuma longa* L.), 4-nerolidylcathecol (*Pothomorphe umbellata* (L.) Miq.),

wheat germ oil (*Triticum aestivum* L.) and pumpkin seed oil (*Cucurbita maxima* Duchesne ex Lam.) provide photo-protective and anti-oxidant properties (Röpke *et al.*, 2003; Golmohammadzadeh *et al.*, 2010; Koræ and Khambholja, 2011; Saewan and Jimtaisong, 2013; Georgiev *et al.*, 2014; Choochana *et al.*, 2015).

Uttarakhand state is immensely rich in floral diversity of various medicinal plants that are useful in the treatment of a broad range of diseases. Though there has been a lot of extensive and intensive ethnobotanical surveys and research studies on the medicinal uses of many plant species in different health problems across the state (Badoni, 1987-88; Gaur, 1999; Rawat *et al.*, 2001; Dangwal *et al.*, 2010; Gangwar *et al.*, 2010; Singh and Rawat, 2011; Kumari *et al.*, 2012), yet there is comparatively very less information about the use of medicinal plant species for their sunscreen activity. The traditional knowledge of the medicinal plants useful in photoprotection is scarce since there are only a few old-aged people who carry such knowledge now-a-days. The young generation is leaning towards the chemical-based solutions rather than the traditional herbal-based knowledge. Thus, this traditional knowledge is getting lost slowly.

We want to revive the fading knowledge of important traditional herbal plants which are useful in curing the harmful effects of sun exposure on skin. We have carried out this research work in the area near the villages of University Campus, Tehri Garhwal. The aim of the present study is to document the traditional use of some important common medicinal plants with respect to sun damage protection. Data collected contains some important locally-available plants that have been traditionally used in the treatment of various skin health problems derived from prolonged sun exposure. We came to find 10 common plants that are known to have cooling, sun-blocking, anti-inflammatory, anti-cancerous and/or cell repairing effects on the sun-exposed and -damaged skin. Some of the listed plants also have anti-cancerous property.

Study Area

The present ethnobotanical study was carried out in some villages (Dharsal, Sondkoti, Ranichauri, Sursingdhar, Dikhol gaun, and Saabli) in and around Badshahithaul, Tehri Garhwal (30.0873° N, 78.61422° E) lying in the north-western Himalayan

region in Uttarakhand (www.indiamapia.com). The region is located at an elevational height of 1600-1800 m a.s.l. The climate is warm and temperate; the average annual temperature is 15.3°C (minimum temperature: 7.3 °C, in January; maximum temperature: 21.5 °C, in June); the annual rainfall averages 1934 mm (<https://en.climate-data.org/location/24771/>).

Methodology

Extensive and intensive field survey was conducted in the study area to collect information of the ethno-taxonomical plants used for their photo-protective properties. These informations were compiled through personal interviews with the local inhabitants, especially local *Vaidhyas* or medicinal practitioners, old-aged men and women, and shepherds. We have questioned 8-10 old-aged knowledgeable people from each village for the proper data collection. The collected data was thoroughly compiled with the help of available relevant literatures.

Results

From the collected data, we have enlisted 10 medicinal plants belonging to 9 families (Asphodelaceae, Asteraceae, Brassicaceae, Cannabaceae, Cucurbitaceae, Euphorbiaceae, Lamiaceae, Rutaceae and Solanaceae) and 10 genera of angiosperms. These plants are used in the treatment of skin problems related to sun damage since a very long time. The information of the plants with their botanical and vernacular names, morphological characters, plant part/s used, and medicinal uses in sun-protection is given below:

a) *Aloe barbadensis* Mill.

Vernacular name: Ghrit-kumari, Patangwar

Family: Asphodelaceae

Botanical description: 60-100 cm tall, very short-stemmed plant, succulent leaves with serrated margin, flowers are produced on a spike upto 90 cm tall, each flower being pendulous, with yellow tubular corolla 2-3 cm; forms arbuscular mycorrhiza; fruit loculicidal capsule.

Plant part used: pulp of leaf

Ethnomedicinal uses: Pulp of leaf applied on sunburns; daily as a sunscreen; good for the dryness of

skin and preventing premature wrinkling, relieves skin rashes, pain and discomfort of excessive sun exposure.

b) *Artemisia nilagirica* (C.B. Clarke) Pamp.

Vernacular name: Kunja

Family: Asteraceae

Botanical description: Perennial, much branched herbs or under-shrubs, 1-2.5 m high, hairy-pubescent; stem ribbed, pubescent. Leaves ovate-elliptic, lobed or incised, densely tomentose. Heads discoid, 2-3 mm across, in leafy, panicle-racemes. Involucre bracts small, seriate. Florets tubular, bisexual, brownish-yellow, corolla 3 or 5-toothed. Achenes minute, glabrous.

Plant part used: Leaves, young twigs

Ethnomedicinal uses: Leaf paste or volatile oil is applied for cooling effect; applied for dryness, itchininess and redness of the skin; have anti-inflammatory properties.

c) *Brassica campestris* L.

Vernacular name: Sarson

Family: Brassicaceae

Botanical description: Annual herb upto 1m tall. Leaves cauline and ramal, simple, alternate, sessile, glabrous, upper leaves entire, lower leaves lyrate, exstipulate, unicostate reticulate venation; Inflorescence racemose. Flower pedicellate, hermaphrodite, actinomorphic, yellow, hypogynous. Ovary bicarpellary, syncarpous, septate longitudinally by a replum; fruit siliqua.

Plant part used: Seeds, leaves

Ethnomedicinal uses: Seed oil mixed with little amount of turmeric powder is applied externally on the sunburnt skin, and skin inflammation. It can be applied daily on the exposed skin for suncreening. Leaves used in cooking provide a good anti-oxidant source. It helps in preventing premature ageing and skin cancer. The seeds (powdered) have anti-cancerous property.

d) *Cannabis sativa* L.

Vernacular name: Bhaang, Ganja

Family: Cannabaceae

Botanical description: Annual-perennial, aromatic herbs or under-shrubs, to 2.5 m high. Leaves palmately 3-7 foliate or partite. Plant dioecious. Male

flower in lax terminal paniced-cyme. stamens 5. Female flowers solitary or clustered, axillary, sessile, forming leafy spikes. Fruit achene, with persistent perianth. Seeds globose or ovoid.

Plant part used: Seeds

Ethnomedicinal uses: Seed oil is applied externally as a sunscreen, protecting from tanning and sunburn; can also be used for hyperpigmentation.

e) *Citrus medica* L.

Vernacular name: Bada nimbu

Family: Rutaceae

Botanical description: An evergreen tree, 3-6 m tall, with sharp thorns on twigs; leaves elliptic or ovate, alternate, oblong, toothed, with winged petiole; fragrant. Flower solitary or in cluster, complete; fruit is a hesperidium, yellow in colour, oil glands present all over the surface; seeds pointed, smooth, elliptic or ovate, 9-10 mm long.

Plant part used: Fruit

Ethnomedicinal uses: Fruit juice is applied on the sun tanned skin (gives fast effect), drinking lemon juice prevents premature ageing, repairs dry skin, high anti-oxidant property helps in preventing skin cancer to occur; also used to treat dark spots or sunspots.

f) *Cucumis sativus* L.

Vernacular name: Khira

Family: Cucurbitaceae

Botanical description: Annual, scabrous, climbing herbs. Stem slender, sulcate, pubescent. Leaves broadly ovate or orbicular, palmately, 5-lobed; margins dentate, both surfaces hispid. Flowers yellow, unisexual, monoecious, mostly solitary axillary. Calyx tube adnate to ovary. Fruit elongate, berry.

Plant part used: Fruit

Ethnomedicinal uses: Acts as a natural sunscreen. Juice is applied externally for faster cooling effect on sun-tans and sunburnt skin; prevents premature wrinkling of the skin, reduces dryness, redness and inflammation; lightens dark spots.

g) *Lycopersicon esculentum* Mill.

Vernacular name: Tamatar

Family: Solanaceae

Botanical description: Annual, erect or decumbent-

ascending herbs; stem somewhat angular or cylindrical, covered with glandular hairs. Leaves 1-2 pinatifid or partite, varied in shape and size; segments ovate-lanceolate, irregularly dentate, glandular - hairy on both sides. Flowers yellow, in 1-several flowered cymes. Fruits red, smooth, sometimes grooved, varies in shape and size, with green persistent calyx at the base.

Plant part used: Fruit

Ethnomedicinal uses: A natural sunscreen, removes tanning, hyperpigmentation and brightens skin (fruit juice alone is applied or with curd/honey); rich anti-oxidant property (eaten raw) helps in cell repairing preventing premature ageing and cancer.

h) *Mallotus philippensis* (Lam.) Müll Arg.

Vernacular name: Ruina

Family: Euphorbiaceae

Botanical description: Evergreen trees upto 12m high. Leaves alternate, ovate or ovate-oblong to lanceolate, acuminate, entire or serrate, red gland-dotted beneath; petioles rusty pubescent. Flowers yellowish, unisexual; clusters of male in terminal paniced racemes; female flowers solitary. Perianth 3 – lobed. Stamens 15-25. Capsules 3-lobed, 6-12 mm across, covered with crimson powder when ripe; seeds globose, smooth, black.

Plant part used: Leaves

Ethnomedicinal uses: Gives cooling relief to the sun-damaged skin; reduces inflammation; prevents premature ageing and promotes cell repairing; have anti-cancerous property.

i) *Mentha arvensis* L.

Vernacular name: Pudina

Family: Lamiaceae

Botanical description: Perennial, erect or prostrate-ascending herbs, to 90 cm high. Leaves ovate to lanceolate, toothed. Flowers white-lilac, in many, dense and distant whorls, forming slender, leafy inflorescence. Calyx almost equally 5-lobed. Corolla about 8 mm long, hairy outside, slightly larger than calyx; 4-lobed, equal. Stamens 4, usually exserted. Fruit nutlets.

Plant part used: Leaves, top shoot

Ethnomedicinal uses: Leaf extract or essential oil is

applied externally on the inflamed and sunburnt skin for cooling relief.

j) *Ocimum sanctum* L.

Vernacular name: Tulsi

Family: Lamiaceae

Botanical description: Perennial herb, aromatic, stem quadrangular, leaves opposite or whorled, serrate; Inflorescence verticillaster, flower zygomorphic, purple, hermaphrodite; corolla bilipped; stamens 4, didynamous, or 2; ovary 2-4 celled, gynobasic style; fruit schizocarpic, a group of 4 nutlets each with one seed.

Plant part used: Leaves, flowers

Ethnomedicinal uses: Leaf paste applied on the sunburned skin for cooling and healing purposes; essential oil can be applied on reddened, itchy and/or inflamed skin; also known to have good anti-cancerous potential.

Discussion

The present study has yielded less known uses of some locally available medicinal plants in photo-protection. We provided information about *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., *Lycopersicon esculentum* Mill., *Mallotus philippensis* (Lam.) Müll Arg., *Mentha arvensis* L. and *Ocimum basilicum* L.

Many of these plants, namely *Aloe barbadensis* Mill., *Brassica campestris* L., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L. and *Lycopersicon esculentum* Mill., are natural sunscreens helpful in curing sun-tanned and sunburnt skin. *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Cucumis sativus* L., *Mallotus philippensis* (Lam.) Müll Arg., *Mentha arvensis* L. and *Ocimum basilicum* L. provide cooling effect and relieve the pain and discomfort related to the sun-damaged skin. Dryness of the skin may be caused by prolonged sun exposure leading to scaling, itching and cracking of the skin. Also one of the side-effects of chemotherapy used to treat cancer is the dry skin. This can be treated using such plants as *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Citrus medica* L. and *Cucumis sativus* L. Some plants carry anti-inflammatory property which helps in case of redness, itchi-

ness and inflammations related to long sun exposure. These plants include *Aloe barbadensis* Mill., *Artemisia nilagirica* (C.B. Clarke) Pamp., *Brassica campestris* L., *Cucumis sativus* L., *Mallotus philippensis* (Lam.) Müll Arg., *Mentha arvensis* L. and *Ocimum basilicum* L.

One of the common skin problems related to sun damage includes hyperpigmentation (melasma) of exposed skin area. It can be treated naturally with the help of *Aloe barbadensis* Mill., *Cannabis sativa* L., *Citrus medica* L., *Cucumis sativus* L., and *Lycopersicon esculentum* Mill. Plants that are rich in anti-oxidants, like *Aloe barbadensis* Mill., *Brassica campestris* L., *Citrus medica* L., *Cucumis sativus* L., *Lycopersicon esculentum* Mill., and *Mallotus philippensis* (Lam.) Müll Arg., are very helpful in preventing premature ageing and cancer, and helps in cell repairing process which heals the damaged skin. *Brassica campestris* L., *Mallotus philippensis* (Lam.) Müll Arg., and *Ocimum basilicum* L. have good anti-cancerous property and thus are potential alternatives to chemotherapy for skin cancer.

Conclusion

With the advancement in the field of medicine, scientists have developed many allopathic formulations for several diseases, ranging from normal cold and flu to the life-dangering cancer. But these medicines also incur economic loss and health-related problems at the same time. Long exposure to the Sun causes tanning, early ageing, and sunburns, ultimately leading to skin cancer. Nowadays, we use chemotherapy for treating skin cancer, which involves the use of chemo drugs (such as cisplatin, doxorubicin, 5-FU, topotecan, etc.). These drugs results in many side effects, commonly – hair loss, mouth sores, loss of appetite, nausea and vomiting, increased risk of infection, fatigue and so on. On the other hand, use of herbal plants omits the chances of such side-effects to a great extent and thus are safe to approach. The local medical practitioners or *Vaidhyas*, shepherds and other old knowledgeable people have been carrying forward the traditional knowledge of important medicinal plants that can be used in photo-protection. But all these traditional healers are now old and newer generation seems unaware of this knowledge. From our study we found that there is less knowledge of the use of these plants for sun damage protection and treatment among people in the study area. If not prop-

erly investigated and documented soon, this traditional knowledge will be lost forever. There is still a great scope of finding some more very helpful medicinal plants, through ethnobotanical research approach, that carry miraculous sun-screening and/or sun-protecting properties in them. This knowledge can be further analyzed practically for the production of better herbal sunscreen products, which we can cater easily to the general public worldwide. We are looking forward to revive the traditional knowledge of medicinal plants and make use of such knowledge to the fullest for the benefit of mankind.

Recommendations

The present study reveals some of the important medicinal uses of locally available wild-grown plants with respect to photoprotection. Some of these plants are unconventionally cultivated plants. With the growing demand for herb-based medicinal and cosmetic products nowadays, the scope of herb-based industries is on rise. With this, requirement of such useful plants is inevitable and thus farmers will surely benefit economically by cultivating such medicinal plants in future. These plants can be grown as border-crop, intercrop or can be rotated seasonally with the conventional crops following crop rotation pattern. Most of the above mentioned plants does not require much attention or care and thus are easy to cultivate.

Acknowledgement

We are thankful to the villagers of the study area for sharing their valuable ethno-medico taxonomical knowledge and co-operation. It is their effort for the conservation of this traditional treasure.

References

- Amaro-Ortiz, A., Yan, B. and D'Orazio, J.A. 2014. Ultraviolet radiation, aging and the skin: prevention of damage by topical cAMP manipulation. *Molecules (Basel, Switzerland)*. 19(5) : 6202-6219.
- Badoni, A.K. 1987-88. Ethnobotany of hill tribes of Uttarkashi, Plants used in rituals and phythomedicinal practices. *Journals of Himalayan Studies and Regional Development*. 11&12: 103-115.
- Choochana, P., Mounjaroen, J., Jongkon, N., Gritsanapan W. 2015. Tanguyenyongwatana, P. Development of piperic acid derivatives from *Piper nigrum* as UV protection agents. *Pharm. Biol.* 53(4): 477-482.
- Dangwal, L.R., Sharma, A. and Rana, C.S. 2010. Ethno-medicinal plants of the Garhwal Himalaya used to cure various diseases. A case study. *New York Science Journal*. 3(12): 28-31.
- D'Orazio, J., Jarrett, S., Amaro-Ortiz, A. and Scott, T. 2013. UV radiation and the skin. *International Journal of Molecular Sciences*. 14(6): 12222-12248.
- Gangwar, K.K., Deepali and Gangwar, R.S. 2010. Ethnomedicinal Plant Diversity in Kumaun Himalaya of Uttarakhand, India. *Nature and Science*. 8(5): 66-78.
- Gaur, R.D. Flora of the District Garhwal North West Himalaya (with ethnobotanical notes). Transmedia, Srinagar Garhwal, Uttaranchal. India; 1999. 811 p.
- Georgiev, V., Ananga, A. and Tsolova, V. 2014. Recent advances and uses of grape flavonoids as nutraceuticals. *Nutrients*. 6(1) : 391-415.
- Golmohammadzadeh, S., Jaafari, M.R. and Hosseinzadeh, H. 2010. Does saffron have antisolar and moisturizing effects? *Iranian Journal of Pharmaceutical Research: IJPR*. 9(2): 133-140.
- Korac, R.R. and Khambholja, K.M. 2011. Potential of herbs in skin protection from ultraviolet radiation. *Pharmacognosy Reviews*. 5(10): 164-173.
- Kumari, P., Joshi, G.C. and Tewari, L.M. 2012. Indigenous uses of threatened Ethno-medicinal plants used to cure different diseases by Ethnic people of Almora District of Western Himalaya. *International Journal of Ayurvedic & Herbal Medicine*. 2: 4.
- Lobo, V., Patil, A., Phatak, A. and Chandra, N. 2010. Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacogn. Rev.* 4(8): 118-126.
- Rawat, D.S., Bhandari, B.S. and Gaur, R.D. 2010. *Vegetational Wealth*. In: (eds. O.P. Kandari and O.P. Gusain) Garhwal Himalaya Nature, Culture and Society Pub. Co., Trans media House Srinagar (Garhwal); 2010. 70-92.
- Röpke, C.D., Kaneko, T., Rodrigues, R.M., da Silva, V.V., Barros, S., Sawada, T.C.H., Kato, M. and Barros, S. Evaluation of percutaneous absorption of 4-nerolidylcathecol from four topical formulations. *International Journal of Pharmaceutics*. 249: 109-116.
- Saewan, N. and Jimtaisong, A. 2013. Photoprotection of natural flavonoids. *Journal of Applied Pharmaceutical Science*. 3 (9): 129-141.
- Singh, G. and Rawat, G.S. 2011. Ethnomedicinal Survey of Kedarnath Wildlife Sanctuary in Western Himalaya, India. *Indian Journal of Fundamental and Applied Life Sciences*. 1(1) : 35-46.
- Wolff, M.S., Engel, S.M., Berkowitz, G.S., Ye, X., Silva, M.J., Zhu, C., Wetmur, J. and Calafat, A.M. 2008. Prenatal phenol and phthalate exposures and birth outcomes. *Environ. Health Perspect.* 116(8): 1092-1097.
- Website
[Internet] Badshahithaul, (Uttarakhand) Map. http://www.indiamapia.com/Tehri_Garhwal/Badshahithaul.html.

[Internet] New Tehri Climate. <https://en.climate-data.org/location/24771/>.

[Internet] The trouble with ingredients in Sunscreens. <https://www.ewg.org/sunscreen/report/the-trouble-with-sunscreen-chemicals/>.

[Internet] Sunburn (Sun Poisoning). https://www.medicinenet.com/sunburn_and_sun_poisoning/article.htm#7_tips_to_prevent_a_sunburn_and_skin_cancer.

[Internet] Sun-sensitive drugs (Photosensitivity to drugs). https://www.medicinenet.com/sun-sensitive_drugs_photosensitivity_to_drugs/article.htm#sensitizing_drugs_photosensitivity_definition_and_facts.