

The Siddha Secret of Fluorescent Spices: Unveiling the Mysteries of Zesty Spices – A mini review

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Abstract

From the ancient period, medicinal plants have been preserved by sages to cure illness and diseases which have been mentioned in many Siddha books and Sangam literature by siddhars have been discussed. On account of that, this article explored the significance of Agathiyar's contributions and targeted three spices that play an important role in Siddha and allopathic medicines with some bioactive components. Those components have fluorescent properties individually and with other organic compounds which will be used to treat different cancer cells.

Keywords: Agathiyar, Fluorescence, Spices, Tumor, Therapeutic.

Introduction

“Siddhars” – The great ancient philosophers and doctors, who described the relation between nature and humans, and the techniques they used, called Siddha medicine preserved on palm leaves, stones, and other materials. With Agathiyar, Thirumoolar, and Bogar, 18 siddhars have been associated with the Siddha medicine. In the chapter ‘Marundhu Adhigaram’ from Thirukkural, a stanza discusses the diagnosis of illness by tracing the cause with proper remedy with the skill [1,2]

“நோய்நாடி நோய் முதல்நாடி அதுதணிக்கும்

வாய்நாடி வாய்ப்பச் செயல்.”

(குறள் 948)

Ancient Tamil literature has mentioned the medicinal plants, which the people still, preserve and have used those plants to treat diseases. [3]. Not only have the leaves played an important role in medicine and also the roots, and spices to cure illness. This review overviews the fluorescent (உடனொளிர்தல்) efficacy of some spices with health benefits. The bioactive compounds in those ingredients have enhanced the fluorescent which can be used for therapeutic applications [4]. A considerable amount of those bioactive compounds have less toxicity compared to drugs, and their cellular actions are beneficial for various chronic diseases and also to protect the other foreign micro-organisms. [5]

Turmeric

Turmeric (Botanical Name: *Curcuma longa*) is ubiquitously used as a spice and traditional medicine in the aspect of the biological activities and pharmacological actions of its extract. Curcumin is a pigment of turmeric shown in (Fig 1) that has various chemical and biological reactivity such as the production of reactive oxygen species (ROS), addition reactions, antioxidant, antibacterial, antifungal,

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and anticancer activities, and so on. [6,7]

Curcumin coordinates with metals and forms complexes with Aluminium, Zinc, Gallium, etc. Curcumin has fluorescent efficiency which is excited in 400 to 450 nm region; these metal complexes have shown a blue shift of absorption maximum. Due to this reason, it has been used to image cancer cells such as MCF-7 (Human breast cancer cell line) [8,9,10,11] bridged with the porphyrin complexes as potential photosensitizers in Photodynamic therapy. Both porphyrin and curcumin as bichromophore have high efficacy of singlet oxygen generation with an anticancer effect used to treat various oncological diseases [12,13]. When it is combined with other organic compounds like amino acids, 1,10 -phenanthroline, it doesn't reduce its efficiency but enhances its functionality more for therapeutic applications. [14,15].

The curcumin-bearing complexes are higher selectivity for tumor cells and have significant potential in imaging, which focuses on PET (Positron Emission Tomography), MRI (Magnetic Resonance Imaging), and SPECT (Single Photon Emission Computed Tomography). Curcumin inhibits cancer growth by inducing apoptosis or necrosis, with advanced imaging properties curcumin complexes lead a new generation of Photodynamic agents [16]. Curcumin based FluoroProbe injected has bound to amyloid beta (A β) plaques the in brain of Tg (Transgenic mice) and WT (wild-type) group mice has higher fluorescence to investigate Alzheimer's diseases.[17] From the ancient period, the medicinal values of turmeric have been mentioned by Agathiyar in 'Agathiyar Gunapadam'[3]that turmeric cures nausea, headache, infections, and inflammations as

“பொன்னிறமாம் மேனி புலனாற்றமும் போகும்
மூன்று புருட வசியமாம் - பின்னியெழும்
வாந்தி பித்து தோடமையம் வாதம் போதற் தீபனமாங்
கூர்ந்த மஞ்சளின் கிழங்குக்கு....
தலைவலிநீ ரேற்றஞ் சளையாத மேகம்
உலைவு தரு பிறசத்தினூட - வலிசுரப்பு
விஞ்சு கூடிவிருட்டும் வினுவிரணங்களும் போய்
மஞ்சள் கிழங்குக்கு மால்” (அகத்தியர் குணபாடம்)

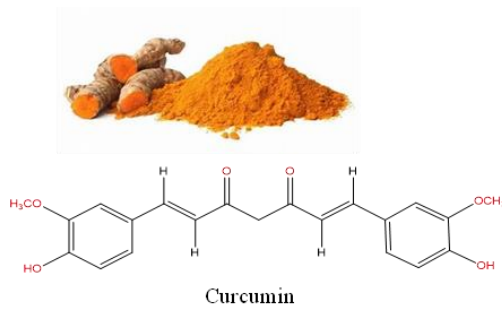


Fig 1: Bioactive component - curcumin of Turmeric

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Ginger

Ginger (Botanical Name: *Zingiber officinale*), used as a spice in India and China since ancient times, from 10th century England it for its medicinal properties. Ginger has been well known for GI (gastrointestinal) problems, chemotherapy for nausea, regulate menstruation heart-beat. According to the Indian Ayurvedic medicinal system, ginger is recommended to enhance food digestion, pain relief, and bronchitis. Agathiyar has remarked in 'Agathiyar Maruthuvam' [18] that ginger has medicinal properties as

“இஞ்சியைக் குத்தி நன்றா
யிருகண்ணில் பிழிய வேணும்
மிஞ்சிய மிளகிந் துப்பு
ஏலமும் கடுக்காய் சுக்கு
வஞ்சிசேர் சீனி முந்திரி
வகையும் பொடித்து வெல்லம்
தஞ்சமாய்த் தின்னும் போதே

தகர்ந்திடும் பித்தந் தானே” (அகத்தியர் மருத்துவம் 47)

The constituents present in ginger induce apoptosis and suppress various gastrointestinal cancers [19] also mentioned in 'Agathiyar Kuzhambu' [20]. Gingerol, a natural component of ginger, retains anti-tumor qualities and is effective against blood and lung cancers. 6-gingerol has luminescent properties used for various analytical assays, it has good fluorescent properties such as after irradiation at 350 nm reflecting yellowish fluorescent light [21]. There were three [6]-, [8]- and [10]-gingerol shown in (Fig 2) which binds with Bovine serum albumin to form stable gingerol complexes, while 10-gingerol has the highest binding affinity from fluorescence analysis. [22]. 6-Gingerol with calf thymus DNA, the absorption at 280 nm, and with ctDNA it emits at 344 nm with 2nm red shift.[23] Similarly, it has a potential radiosensitizer for gastric cancer and has been evaluated using Ionizing radiation(IR) which is sensitive towards it to capture the cancer cells.[24] 10-Gingerol is more potent than the other two gingerols for inhibition of triple-negative human (MDA-MB-231, MDA-MB-468) i.e., late stage and 51-year-old female breast cancer cell lines respectively, and mouse (4T1 – late-stage mouse breast cancer, E0771 - mammary carcinoma cell growth) and it suppressed the growth of estrogen receptor-bearing (MCF-7, T47D – human breast cancer cell line for progesterone's study) and HER2-overexpressing (SKBR3) human breast cancer cells.[25] The xanthine oxidase with three gingerols (6-,8-,10-gingerol), 10-gingerol has stronger inhibitory ability, higher binding affinity against XOD, and a fluorescence range of 300-500 nm with greater change in enzyme conformation.[26] Similar to gingerols, 6-Shogaol also has anticancer properties, the fluorescence spectra of 6-shogaol excites at 295 nm with BSA, without 6-Shagaol it excites at 280 nm which shows the shift due to fluorescent chromophore 6-Shogaol.[27] the 3-D fluorescence spectra of 6-Shogaol with HSA (Human Serum Albumin) excited at 338 nm and sodium phosphate buffer at 295 nm have been analyzed, which shows that 6-Shogaol therapeutic compounds have a strong binding affinity on HSA useful for therapeutic applications. [28] 6-Gingerol has anti-cancer properties by inducing apoptosis in A431 cells treated with 6-Gingerol for 48 h, which inhibits the growth and proliferation of skin carcinoma cells and induces apoptosis through mitochondrial functions modulation, revealing that this component can prevent several human cancers. [29]

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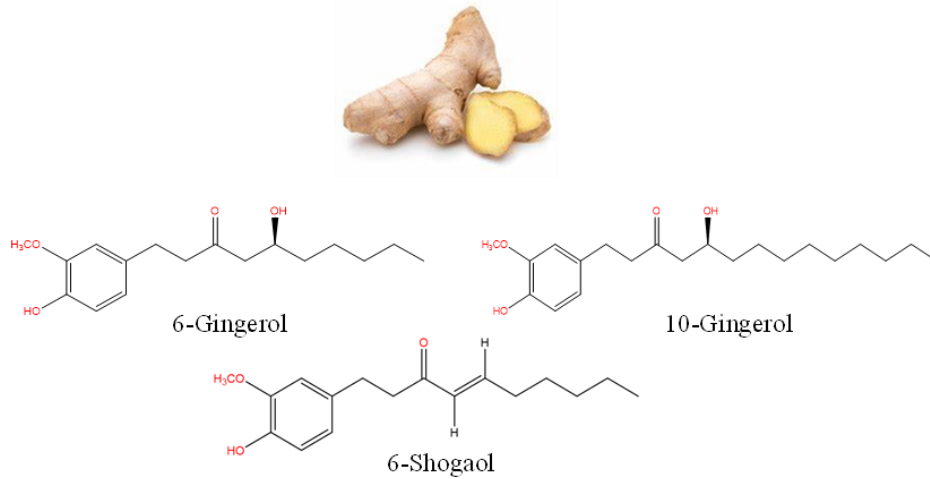


Fig 2: Bioactive components – [6]-, [10]- Gingerol and 6-Shogaol of Ginger

Pepper

The most widely used spice in the world ‘Black pepper’ (Botanical Name: *Capsicum Annuum*), is also renowned for its medicinal value due to the presence of piperine, shown in (fig 3) an active ingredient that exerts antipyretic, antifungal, antibacterial, and antioxidant properties. According to the ancient Ayurvedic system of Indian medicine pepper is used as a drug with a combination of dry ginger called ‘*thrikatu*’. [30] Piperine-bound HSA was examined for fluorescent activity with the addition of hemin resulting in a red shift of emission maxima from 440 to 480 nm, this bioactive compound targeted tissues which elicits its pharmacological effect, it has weak fluorescent properties but it enhances its fluorescence by increasing the serum albumin concentrations, comparing the piperine bound with BSA and HSA, from BSA piperine quenches its fluorescence greater. [31] Likewise, piperine bound with α , β , γ -cyclodextrin, observed emission at 463, 472, and 469 nm, which piperine changes the fluorescence of cyclodextrin by molecular behavior by overwhelming the mobility of aromatic CH center of methylenedioxyphenyl group. [32] Piperine and its derivatives were examined for depigmenting disease vitiligo against pigmented mice with or without UV irradiation 3 days a week which provided information that piperine has the potential to vitiligo and that evidence pepper has potential against skin diseases. [33]. Piperine evidence that it is efficient as a therapeutic agent and enhances cell death in UV-B-irradiated against *B16F10* mouse melanoma cells through elevation of ROS formation acts as a potent UVB photosensitizer for *B16F10* murine melanoma cells. [34] Piperine inhibits the proliferation and viability of various kinds of cancer cells through activation of apoptotic signaling, inhibition of cell cycle progression, and also cancer stem cells. [35]

Pepper has been used as a spice, fragrance, and medicine by ancient period people which has been mentioned in ‘*Natrinai*’[3] as

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“மிளகு பெய்தனைய சுவைய புன்காய்
உலறு தலை உகாய்ச் சிதர் சிதிர்ந்து உண்ட
என்றும் நற்றிணைப் பாடலடிகளால் அறியலாம்” நற்றிணை 66 (1-2)

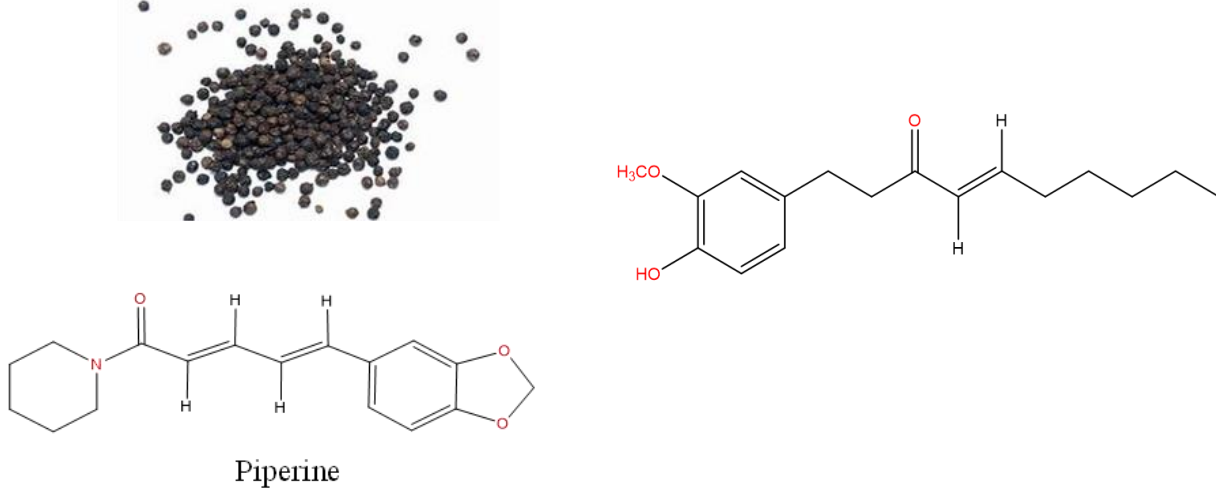


Fig 3: Bioactive component - Piperine of Pepper

Conclusion:

The fluorescent-enhanced spices unknowingly used by ancient people offer a promising potential against many medicinal practices, from the Agathiyar wisdom, which scientists have scientifically proven its medicinal values. To navigate the complexities, we face in modern health care, it is important to preserve and integrate traditional knowledge with advanced modern techniques. Doing so may uncover new and innovative solutions for chronological diseases, this concludes that fluorescent-enhanced spices revolutionize our approach to curing many health problems, especially cancer cells.

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