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SAFFRON: A GOLDEN CONDIMENT HAVING REPOSITORY USES – REVIEW

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ABSTRACT

From antiquity, saffron (*Crocus sativus* L.) had been used for various purposes throughout the world. Hence most of the uses are unremembered throughout the history. But nowadays synthetic drugs usage has been reduced people are preferred and demands the natural active components. The interest which is formed now in natural compounds brought back the consciousness for uses of saffron today. The global scenario is now heading towards the natural sources than the synthetic. In this study, we reviewed different uses of saffron including medicinal uses, cosmetic uses, health beneficial uses, culinary uses and perfumery use around the world.

KEYWORDS: Saffron, medicinal, cosmetic, health benefits.

INTRODUCTION

The word saffron aroused from 12th century Safran (an old French term), which was derives from the Latin word safranum. It is also associated with the Italian Zafferano and Spanish Azafran. Safranum is the Arabic word which has meaning of yellow color. Saffron is a perennial spice which is bulbous. Biological name of saffron is *Crocus sativus* L. It belongs to family Iridaceae. Also, popular as golden condiment. Propagation of the plant does not take place by seeds, the underground portion i.e. corms or bulbs are used which divides and produces new plant. Flowers springs up in autumn; the outstanding feature of the lilac to pale purple coloured flower is its three stigmas 25-30 mm long, which droop over the petals, that is what is collected as saffron. The stamens present on flower has very less amount of active compound which are not usually collected. 36000 flowers yield about 0.4535 Kg of stigmas. Saffron believed to have originated from Greece, Asia and Persia along with spreading eastwards to Kashmir and China. In “Tozaki-jahangari” some reference has been made

concerning saffron famous Kashmiri vaids namely Vagbhatta and sushtra used saffron as an element of fragrance, as dye and in herbal medicine. It is native medicine across the India. Saffron has property of strengthening the functioning of stomach and promotes its action. Saffron has good repute as a drug which strengthens the functioning of the stomach and aids its action. It also prevents spasmodic disorders and comforts involuntary muscle contraction. It is favorable in the treatment of various digestive disorders. It has given greater activity in treating the flatulent colic. It is also used for reducing the inflammation which acts as anti-inflammatory agent. Also used for treating fever condition, melancholia and enlargement of liver and spleen tissues. For diabetes also saffron is given along with ghee. It is also used for building up heart muscles and for calming action of brain. It has been found favorable in the treatment of urinary problems. It acts as a diuretic if soaked overnight in water & administered along with honey. The spice is useful in promotes and regulates menstrual periods. It calms lumbar pains, which accompany menstruation. Saffron is also advantageous in the treatment of other ailments concerning women such as leucorrhoea and hysteria. For treatment of uterine sores, saffron oil is beneficial. In modern pharmacopoeias, saffron is only used for coloring agent or as good additive. It is a rich source of carotenoids due to which it has anti-cancer and anti-tumour properties. Research has disclosed that saffron is to be rich in Vitamin-B_2 and Riboflavin. Using saffron as spice or condiment which is rich in carotenoid also plays vital role in traditional and folklore medicine of many cultures living on earth as drug to treat many disorders.[1]

Botanical Description

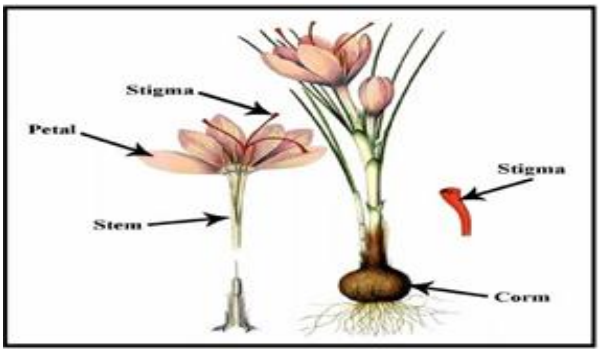

Figure 1: Different parts of saffron crocus plant.

The saffron plant belongs to an Iridaceae family. This herbaceous perennial plant reaches 10 to 25 cm in height developing from its bulbs. The bulb is of sub-ovoid shape which varies in sizes and forms. It has a huge structure and is concealed by many concentric spathes. Mother bulb is produced from apical buds. Each mother bulb produces 1-3 daughter bulb. And several

smalls bulbs from lateral bulbs. Saffron has fibrous and thin both the roots. Number of leaves vary from 5-11 per bud. They are very narrow and measure between 1.5 and 2.5 mm of dark green colour. They are 20-60cm in length. In the beginning of the autumn, flowers of saffron begins to appear. Up till the end of September flowers turns to purple colour. Flower consists of six petals, from them three are internally and externally another three attached which meets up to the long tube that arises from the upper part of the ovary. Flowers are being protected by whitish membranous bracts by the appearance. Style arises from the pistil of about 9-10cm long. Pistil composed of an ovary and arising style. The style ends up with single stigma consisting three filaments with intense red colour whose length exceeds than the petals of flower, which is the most interesting part of the plant.[2]

Table 1: Saffron (*C. sativus*) nutritional value per 100 g.

PRINCIPAL	NUTRIENT VALUE	PERCENTAGE OF RDA%
Energy	310 Kcal	15.5
Carbohydrates	65.37 gm	50
Protein	11.43 gm	21
Total Fat	5.85gm	29
Cholesterol	0 gm	0
Dietary Fibre	3.9 gm	10
Vitamins		
Folates	93 mcg	23
Niacin	1.46 mg	9
Pyridoxine	1.010 mg	77
Riboflavin	0.267 mg	20
Thiamine	0.115 mg	10
Vitamin C	80.8 mg	90
Vitamin A	530 IU	18
Electrolytes		
Potassium	1724 mg	37
Sodium	148 mg	10
Minerals		
Calcium	111 mg	11
Copper	0.328 mg	37
Iron	11.10 mg	139
Magnesium	264 mg	66
Manganese	28.408 mg	1235
Phosphorus	252 mg	36
Zinc	1.09 mg	10

Source: USDA national nutrient database.

Main Phytochemical Components of Saffron

Chemical analysis of *C. sativus* stigmas contains about 150 volatile and non-volatile compounds. Fewer than 50 constituents, however, have been identified so far. The three main biologically active compounds are.

1) Crocin, a carotenoid pigment responsible for the yellow-orange colour of the spice;
2) Picrocrocin, bringing saffron flavour and bitter taste;
3) Safranal, a volatile oil, gives saffron much of its distinctive aroma.

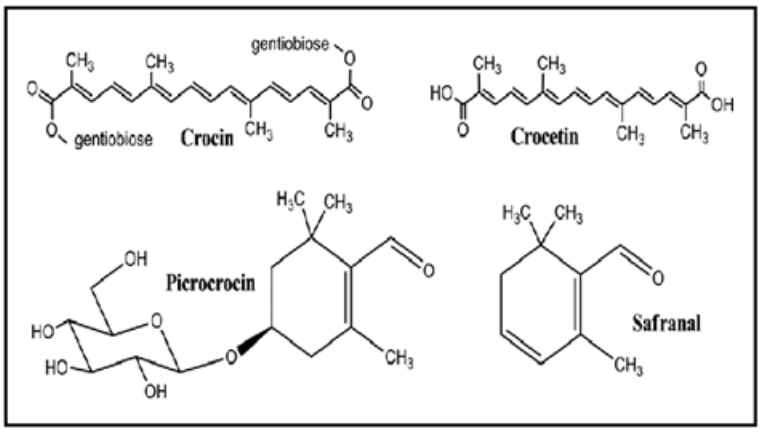

Figure 2: Biologically active components of saffron.

Crocin ($C_{44}H_{64}O_{24}$) is a rare carotenoid in nature, easily soluble in water. In comparison with other carotenoids, crocin has a wider application as a dye in foods and medicines, mainly because of its high solubility. Picrocrocin ($C_{16}H_{26}O_7$) is the main factor influencing the bitter taste of saffron, which can be crystallized by hydrolysis.[3] Safranal ($C_{10}H_{14}O$), responsible for the aroma (it accounts for 70% of the volatile fraction), has little or no presence in fresh stigmas, its concentration depends on the conditions of drying and preservation of saffron. In addition to crocin and picrocrocin, the major compounds in saffron are anthocyanins, flavonoids (such as kaempferol) but it is also rich in vitamins, amino acids, proteins, starch, mineral matter and gums. Its various non-volatile active components, many of them are carotenoids. It includes zeaxanthin, lycopene, and varied α- and β-carotenes. The volatiles, which have a very strong odour, are consistent of more than 34 components, which are mainly terpenes, terpene alcohols, and their esters.[4] The quality of saffron depends on the concentration of these three main metabolites providing the unique colour and flavour of stigmas. Their contents depend on the environment and cultural practices.[5] The chemical composition of saffron samples from many countries indicates that the reported values strongly depend on the methods used for drying, extraction and stigma analysis.[6,7] Many methods of

analyzing saffron components have been described.[8] The quality of saffron is thus regulated by ISO 3632 standards, aimed at standardizing the classification of saffron worldwide; these are updated every three years. Phytochemical investigations have revealed that the stigmas of the saffron flower contain a number of chemical substances including carbohydrates, minerals, mucilage, vitamins B1 & B2 and pigments, crocin, crocetin, carotene, lycopene and zigzantin. In addition, it contains small amounts of the pigment anthocyanin, oil soluble pigments including α-carotene, β-carotene and zegxantin.[9] The colour is mainly due to the degraded carotenoid compounds, crocin. The flavour is because of carotenoid oxidation products, safranal and the distinctive flavour due to glucoside, picrocrocin.[10] Saffron has a strong aroma, which is produced by specific essential oils. Safranal, the major principle of *C. sativus* is a carboxaldehyde volatile compound constituting around 70% of total essential oil is formed by de-glucosylation of picrocrocin.[10] Several terpene aldehydes and ketones are also found in the essential oil. The most abundant constituent is safranal, 2,6,6-trimethyl 1,3-cyclohexadiene-1-carboxaldehyd (>50%); another olfactorily important compound is 2-hydroxy-4,4,6-trimethyl 2,5-cyclohexadien-1-one. There is presence of flavonoids such as rutin, luteolin, quercetin, bioflavonoids, hesperidin, tannins and anthocyanins in flower petals may be responsible for its antinociceptive[11] and anti-inflammatory[12] and blood pressure lowering[13] effects. Active constituents present in the saffron such as safranal, picrocrocin and crocin gives aroma, flavor and colour respectively. The main colouring compound, crocin which imparts strong colour of saffron and its highly soluble in water amongst naturally occurring carotenoids. This is why saffron is preferred mostly as a colourant in food and medicines majorly.[14] The principal element giving saffron its special flavour is picrocrocin which is stable in fresh saffron but as a result of heat and the passage of time it decomposes thereby releasing the volatile aldehyde safranal. Food processing industry uses saffron as a colourant and flavouring agent in sausages, margarine, butter, ice-cream, sauces, dressings, cheese and beverages.[15]

Cosmetology and Perfumery Uses of Saffron

Anti-UV Agent

Long-time exposure to the sun is extremely harmful because it puts the skin in contact with UV rays, known to cause serious abrasion to the skin. Saffron is known to have sun protective effects that can protect the skin from harmful Ultra-Violet rays. Studies show that saffron containing lotion may be better sunscreen than homosalate having sunscreens. Saffron can act as a natural Ultra Violet rays absorbing agent.[16,17]

Redness of Dark Spots

Saffron is used to decrease the pigment melanin which gives the better skin lightening effect. Tyrosinase is the main catalyst for this phenomenon.[18] Antioxidant activity is mainly because of monoterpenoids, crocin, quercetin, kaempferol, and phenolic components present in saffron. The mode of action of these compounds to decrease melanin present in skin by inhibiting the activity of tyrosinase.[19]

Anti-Aging Effect and Diseases of the Skin

Traditionally, saffron is soaked with a few basil leaves to treat blemishes such as acne. A mixture of soaked saffron strands along with coconut oil, or olive oil, and a little amount of raw milk is an effectual way to exfoliate and enhance blood circulation face skin.

Saffron is rich in antioxidants anticipates to inhibit the expression of markers of inflammation such as TNF and interleukin. An application of the formulation containing 3% saffron extract to human skin may be useful in controlling of melanoma.[20]

Perfumery

Once dried, the spice releases a pleasant aroma. Saffron contains mainly safranal, which is the main odoriferous compound that we obtain. In ancient Greece, saffron was used as royal dye. Also was used as perfume in salons, courts, theatre's and bathrooms.[21-22] Additionally, during the Parthian Dynasty, they used saffron among the ingredients of a royal scent.[23]

SOME MEDICINAL PROPERTIES OF SAFFRON

Antidepression effect

A number of preclinical and clinical studies indicate that stigma and petals of saffron have shown antidepressant activity. The constituents mainly in saffron such as safranal and crocin have shown good antidepressant activity in study.[24] The effectual effect of constituents in petals of saffron have shown good treatment of mild to moderate depression. Petals of saffron contains kaempferol which act as antidepressant.[25]

Effect on learning behaviour and long-term potentiation

Traditionally herbal drugs are commonly used improve cognitive functions and to relieve other functions associate with the Alzheimer's Disorder. Saffron is one of the potent drugs yielding as herb. Saffron extract mainly includes crocin and crocetin which helps to improve memory and learning skills. For treatment of neurogenerative disorders and related memory impairment

orally saffron can be administered in formulation form.[26]

Effect on blood flow in eyes and retinal function

Crocin analogues isolated from saffron enhances the blood flow through retina and choroid. It gives regaining of retinal functions and it can be used for treatment of ischemic retinopathy and age-related macular degeneration.[27]

Effect on coronary artery disease

50 mg of saffron in 100 ml of milk was administered twice a day to human subjects and it shown remarkable decrease in lipoprotein oxidation susceptibility in patients with coronary artery disease (CAD) specifies the potential of saffron as an antioxidant.[28]

Effect on blood pressure

Aqueous and ethanol extracts of saffron decreases the blood pressure in a dose dependent manner.[29]

Antinociceptive and anti-inflammatory effects

Extract of stigma and petals from saffron exhibited antinociceptive effects. It also showed anti-inflammatory both acute and chronic. The effects may be due to components such as flavonoids, tannins, anthocyanins, alkaloids and saponins.[30]

Anticonvulsant effect

Saffron has been reported to give some behavioural effects on CNS. It has been reported that an alcoholic extract of saffron decreased the motor activity. The study indicates that extract prepared from ethanol produces a sedative effect which is apparently seems to be responsible for anti-convulsant activity.[31] In Iranian traditional medicine, the saffron had been used as an anticonvulsant remedy.

Anti-gastric effects

Saffron suspension has antiulcerogenic principles which protect against gastric mucosal damage through inhibition of gastric acid and stimulation of mucus secretion.[32]

Antiparkinsonian effect

Crocetin one of the main component present in saffron helps in preventing parkinsonian disorder.[33]

Mutagenic or antimutagenic effects

The compounds isolated from saffron, crocin and dimethyl-crocin were found to be non-mutagenic.[34,35] Using the Ames/Salmonella test system, saffron extract in concentration of 1500 mg/plate was observed to be non-toxic, nonmutagenic and non-antimutagenic. Strains used were TA97; TA98; TA100; TA102 and TA1538.[36,37,38,39]

Tumoricidal effect

The oral administration of extract of saffron enhances the life span of Swiss albino mice intraperitoneally.[40] In an animal model (frog embryos), crocetin, from saffron was productive in treating many types of cancer.[41] An growth in the levels of β-carotene and Vitamin A in the serum of laboratory animals under oral administration of saffron extracts was detected and suggested that conversion to retinal due to carotenoids supports the anticancer effects of carotenoids were referred to be carotene.[42,43]

Anti-hyperglycaemic and pancreas-protective effects

Ethanolic extract of *C. sativus* L. stigmas when administered orally and intraperitoneally at different doses (20, 40, 80 mg Kg-1) caused a notable decrease of plasma glucose levels in diabetic rats. It confirms that administration of saffron extract containing chiefly stigma act as protective barrier for vital organs including pancreas, which in turn reduces the cause of diabetes in animals.[44]

Historical uses of Saffron.[45]

Major medicinal application of saffron in ancient time	
Immune system and infections	Immunostimulatory Anti-inflammatory Rheumatoid arthritis Anti-bacterial Anti-fungal
Skin	Its topical use, healing wounds
	To refresh facial skin To increase brightness of the body To treat acne To treat erysipelas To treat eczema
Vision and eye	Local using strengthen eyesight Useful in day blindness To cure purulent eye infection To treat corneal disease Lacrimating Anti-cataract To treat keratitis
Reproductive system	Aphrodisiac To treat impotency and as activator of sperms To facilitate hard delivery and delivery of placenta To regulate menstrual cycle and dysmenorrhea To cure uterus pain Useful for uterus ulcers As an emmenagogue

Urinary tract and kidney	Diuretic Purifier of kidney and bladder To cure infection of urinary tract With honey facilitates passage of renal stone
Gastrointestinal tract	Strengthening liver and stomach To cure obstructions inside liver and spleen To decrease appetite To treat enlarged liver and enlarged spleen To cure splenic disorders Carminative To treat vomiting To treat dyspepsia To cure rectal prolapse To tonify stomach
Respiratory system	Strengthening respiratory system To treat dyspnea Anti-asthma To treat cough Anti-pertussis To treat sore To treat measles Its odor and oil are good for diaphragmatis and pleuritis
Cardiovascular system	Cardiotonic Improving circulation Preventing coagulation To decrease the resistance of coronary arteries To help nutrient's and drugs reach the heart
Cycological disorders	Relaxant anti-stress Anti-depressant To elevate mood Anti-anxiety Its topical use in boiled water is good for severe insomnia
Central nervous system	To cure obstructions inside brain To protect brain from oxygen deprivation To treat neurasthenia To treat apoplexy Its topical use in boiled water is good for severe headaches
General effects	Anti-spasmodic To cure broken bones To treat earache To treat toothache To invigorate the body To strengthen senses Sedative and febrifuge To improve swellings and edema To cure edema Ant poisonous
	To treat alcoholism To treat insect bites and stings Anti-diabetic To decrease lipids Against cold

Other Uses of Saffron

Culinary Use

From ancient times till now all over the world, saffron was and is still used while cooking. Its aroma is similar as honey but with metallic notes as described by chefs and saffron specialist.[46] In countries like India, Iran, Spain and also some saffron is used as a condiment for rice. In Spanish cuisine, dishes such as Paella Valenciana, made from rice, & zarzuela, made from fish. National dish of Iran uses saffron, chelow kabab. In Indian cuisines saffron is mostly used while making traditional dishes made from rice, also for sweets and specially for biryanis. Also, while making sweets such as Gulab jamun and kulfi.[47] In Moroccan cuisine, saffron is central

ingredient in the blend of chermoula herbs which gives special aroma to the dish.[48]

Coloring Power

The use of saffron as much as substitute dye which is excellent in the field of agro-food due to the higher water solubility of crocin.[49] Thus, the strong dyeing property of saffron can be used in cosmetic preparations and for coloring of butter, pasta, cheeses. It is also used in paint and textiles industry for coloring. Saffron solution remains stable in alkaline as well as acidic medium. Buddhist monks had been used saffron as dye for coloring silk, wool and oriental carpets. Natural dyes have greater biodegradability and compatibility, have low toxicity and less allergic than synthetic dyes.

CONCLUSION

Saffron is the worthiest medicinal food which can be consumed as food as well as medicine. This study has reviewed the forgotten uses of this valuable plant. Saffron has shown optimistic results for treating almost all the diseases and disorders. It has shown the results from curing mild fever to treatment of cancer and DNA repair. It is not only used in medicine also in textiles, cosmetics and many more.

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