Phytopharmacological Review of *Crocus sativus (Saffron)*

Dr. M. Vidhya, MD(Hom)

Professor & HoD, Department of Homoeopathic Pharmacy,
Venkateswara Homoeopathic Medical College and Hospital, Chennai, TN, India

ABSTRACT: This phytopharmacological review focuses on *Crocus sativus*, commonly known as saffron, which is a well-known and valuable medicinal plant. Saffron has been traditionally used in various medicinal preparations due to its diverse pharmacological activities such as antioxidant, anti-inflammatory, antitumor, anticonvulsant, and antidepressant effects. The review discusses the phytochemical constituents of saffron and their pharmacological actions, including Crocin, Crocetin, Safranal, and Picrocrocin. The various therapeutic uses of saffron are also highlighted, including its role in treating various diseases such as cancer, depression, Alzheimer's disease, and cardiovascular disorders. In addition, the review covers the different methods of extraction and analysis of saffron, its toxicological profile, and its potential applications in the food and cosmetic industries. Overall, this review emphasizes the importance of saffron as a valuable medicinal plant with promising therapeutic potential for various diseases.

KEYWORDS: Crocus sativus, saffron, phytopharmacological review, pharmacological activities,

INTRODUCTION

Crocus sativus, commonly known as saffron, is a perennial herb that has been cultivated for over 3,500 years for its culinary, medicinal, and aesthetic properties. It is one of the most expensive and sought-after spices in the world, known for its unique flavor, aroma, and bright orange-red color. In addition to its culinary use, saffron has been traditionally used in various medicinal practices across the globe. Its potential health benefits have been studied extensively in recent years, and numerous phytochemical compounds have been identified in saffron that possess a wide range of pharmacological activities. In this article, we provide a comprehensive review of the phytochemical profile of saffron and its pharmacological properties, including its potential as an antioxidant, anti-inflammatory, anticancer, antidepressant, and neuroprotective agent. Saffron's traditional medicinal uses include treating various ailments such as asthma, cough, cold, fever, and digestive disorders. It has also been used as a sedative and an antispasmodic agent. Saffron has been found to contain a variety of active constituents, including crocin, safranal, and picrocrocin, which have been shown to possess numerous biological activities.

Recent research has shown that saffron possesses potent antioxidant properties and can help protect against oxidative stress and cellular damage. It has also been found to have anti-inflammatory effects and may be beneficial in reducing inflammation and preventing chronic diseases such as cardiovascular disease, diabetes, and cancer.

Saffron has also been studied extensively for its potential as an antidepressant and anxiolytic agent. Studies have shown that saffron extracts can help alleviate symptoms of depression and anxiety, and may be effective as a natural alternative to conventional antidepressant medications.

Furthermore, saffron has been found to have neuroprotective effects, and may be beneficial in protecting against age-related cognitive decline and neurodegenerative diseases such as Alzheimer's and Parkinson's disease.

Overall, saffron's diverse range of pharmacological properties makes it a promising candidate for developing new therapeutic agents for a variety of diseases. In this review, we provide a detailed overview of the phytochemical profile of saffron, its pharmacological properties, and potential therapeutic applications.

Crocus sativus L. is a member of the Iridaceae family, and is cultivated worldwide due to the use of its dried styles (the uppermost colored part of which is referred to as stigma), not only as a spice (saffron), but also in health management since ancient times (Gikas, E., et al, 2021).

TAXONOMICAL CLASSIFICATION

Kingdom : Plantae
Subkingdom : Tracheobionta
Superdivision : Spermatophyta
Division : Magnoliophyta
Class : Liliopsida
Liliidae Order : Asparagales
Family : Iridaceae Genus:
Crocus Species: Crocus sativus

HISTORY

Crocus sativus (Saffron) red gold herb, has various schools of thought which believe that saffron originated from the French term "Safran," and other people thoughts the word "Saffron" is derived from the Arabic word za'faran, which means "Yellow" (Maliha Sami, et al, 2022).

The earliest apparent reference to Crocus sativus L. cultivation goes back to around 2300 BC, and a saffron harvest is shown in a Minoan fresco painting in the Knossos palace of Minoan Crete dated from 1600–1500 BC. It is also seen in a fresco in Akrotiri on the Greek island of Thera dated back in 1627 BC, which depicts the flowers being picked by young girls and monkeys (Gikas, E., et al, 2021).

In ancient Rome and Egypt, saffron was used in drugs as a dying agent for cooking purposes and perfumes (Maliha Sami, et al, 2022).

HABITAT AND DISTRIBUTION

Crocus sativus L. is a species of flowering plant of the Crocus genus which grows in the Mediterranean, east Asia and the Irano-Turanian region. It is cultivated in Iran, Spain, Greece, Italy, Pakistan and India, mainly in Kashmir (Maliha Sami, et al, 2022).

MORPHOLOGY

Saffron is the spice derived from the flower of Crocus sativus which is comprised of the three red stigmas included in the flower that are consequently collected and dried under special conditions to produce the final saffron as a spice (Gikas, E., et al, A., 2021).

Stigma part of saffron is 2530 mm long. Each flower contains three stigmas, and a sum of 150,000–200,000 flowers are harvested to get 1 kg of saffron. In the American market, the cost of one ounce is 30 dollars. Threads of stigma have special value in the plants due to its aroma, coloring agent, and spice taste most expensive herb in the market (Maliha Sami, et al, 2022).

Crocus sativus is a grass like tuber plant with purple or lilac coloured flowers. The flower stalk rises from a bulb and is a long, white, slender tube, the flower itself being large and of a beautiful lilac colour. Leaves radical, linear, dark green above, pale green below, enclosed in a membranous sheath, sometimes remaining fresh nerly the whole winter (Vijaya Bhargava K, 2011). Corolla in two segments, between which the long styles hang out. Stigmas three, large, nearly an inch long rolled at the edges, bright orange. The stigmas of saffron are the parts that have been used in medicine. They have a pleasantly bitter and somewhat warming taste. They contain a large portion of extractive matter and portion of volatile oil (Vijaya Bhargava K, 2011).

BOTANICAL DESCRIPTION

Saffron is a perennial plant belonging to the Iridaceae family. Its height is 10-25 cm from the bulbs. Mother bulbs produce 1-3 daughter bulbs with lateral buds also divided into small buds. The stigmas part is the main part used as a medicine pleasantly warming bitter in taste. Single stigma contains three filaments the color of the stigma is red. Saffron leaves vary in number from 5 to 11 (Maliha Sami, et al., 2022). The root of saffron may be fibrous or contractile root, fibrous contractile from the base of the mother bulb and the base of the lateral bud. The flowers of saffron appear in the autumn season at the end of September, composed of three internal tepals and three external, which encounter the upper part of the ovary. The pistil 9 to 10 cm long and thin style shape composed inferior to the ovary (Maliha Sami, et al, 2022).

MEDICINAL USES

Stigmas is used as aphrodisiac, antispasmodic, expectorant, reduce stomachache and for tension. In Persian traditional medicine, it is used for depression. Treats insomnia, measles, dysentery, jaundice, jaundice, cholera. Tonic for heart and nervous system and for smoothing menstruation. Chakra used in treatment of cataract, night blindness and poor vision. Sushruta as blood purifier and in treatment of skin eruptions. Anti-bacterial agent, antiseptic, antifungal and anti-flatulent. In fever, melancholia, enlargement of liver. Analgesic, diuretic, immune stimulant, interferon inducer for inhibiting the thrombin formation (Vijaya Bhargava K, 2011).

At low doses, it causes the stimulation of pregnant uterus and in large amounts it causes constriction and spasm. Protective agent against chromosomal damage, a modulator of lipid peroxidation, and an anti-seizure for reducing blood pressure and treatment of psoriasis (Vijaya Bhargava K, 2011).

PHYTOCHEMICAL CONSTITUENTS

Saffron has been grown for flower and metabolites from the dried stigma. Picrocrocin, kaempferol, safranal, phenol, delphinidin, flavonoid, and crocetin are the primary phytochemicals in saffron; and they have good quality bioactivity and antioxidant potential. After chemical analysis, fat, carbohydrates, minerals, vitamins, and other secondary metabolites such as anthocyanins, carotenoids, flavonoids, and terpenes have been discovered in saffron stigmas. Stigma contains bioactive elements such as anthocyanins, pigments, flavonoids, volatile fragrant essences, and vitamins (Maqbool, Z., et al, 2022). Crocus contains more than 150 volatile aromatic substances that afford its distinctive aroma, and a large number of non-volatiles such as carotenoids including zeaxanthin, lycopene, as well as various α- and β-carotenes, glycosides, monoterpenes, aldehydes, flavonoids, anthocyanins, vitamins (especially riboflavin and thiamine) and amino acids. The four main bioactive constitutes of saffron stigma are crocetin, crocins, picrocrocin and safranal. In previous studies, the volatile compounds of saffron samples have been characterized by gas chromatography–mass spectrometry (GC–MS) methods, and have been evaluated as markers of geographic differentiation(Maqbool, Z., et al, 2022).

Table 1: Composition of Phytochemical constituents of Crocus sativus

S.NO.	COMPONENTS	MASS%
01	Nitrogen free extract	54-57%
02	Carbohydrates	12-15%
03	Protein	10-14%
04	Water	8-15%
05	Fiber	4-5%
06	Lipids	3.0-8.0%
07	Total oils	5-9%
08	Volatile oil	0.3-0.8%
09	Ash	4%

CAROTENOIDS

These are the natural pigments present in pigments of fungus, algae, plants, and animals in the form of yellow hues, orange-red, and red. Carotenoids are poly isoprenoid substances that fall into oxygenated hydrocarbon derivatives (xanthophylls) and hydrocarbon carotenoids (carotenes) (Maqbool, Z., et al, 2022). A conjugated double bond system is a structural feature that determines its chemical, biological, and physical characteristics. Saffron is a famous culinary coloring agent due to its high carotene concentration. Carotenoids of saffron have a variety of bioactivities, including antioxidant, anti-inflammatory, and immunomodulatory properties. Dietary carotenoids must be free from the food matrix and integrated into mixed micelles mixtures of bile salts and many lipids to be absorbed in the intestine. As a result, the fat in a meal is required for carotenoid absorption. Carotenoid

supplements in oil liberated from the matrix are easier to absorb than carotenoids in meals (Maqbool, Z., et al, 2022). Carotenoids are integrated into chylomicrons, triglyceride-rich lipoproteins, and released into the blood by intestinal cells (enterocytes). The action of an enzyme called lipoprotein lipase depletes triglycerides from circulating chylomicrons, resulting in the production of chylomicron remnants. Provitamin A (carotenoids) can be cleaved in the gut and liver to create retinal pigment. Carotenoids have been demonstrated to offer two health benefits: improved immunological response and a lower chance of degenerative illnesses such as cancer, cardiovascular disease, cataracts, and muscle degeneration(Maqbool, Z., Arshad, et.al, 2022).

SAFRANAL, CROCINS AND PICROCROCIN

Crocins are used in the food industry to provide a bright red color that is stable and water-soluble. Their antioxidant characteristics make them effective memory boosters, antischizophrenia, and anti-Alzheimer disease. Crocetin and its derivatives are also utilized as colorants in the pharmaceutical and food industries and have a variety of health-promoting medicinal benefits(Maqbool, Z., et.al, 2022). Picrocrocin is the colorless part of the stigma that gives it its bitter taste and aroma. The volatile chemicals including isophorone and safranal to contribute the saffron aroma. Anticonvulsant and antidepressant properties of isophorone and safranal are well-known. Crocetin, crocin, and picrocrocin have been shown the cancer-preventive, memory-enhancing, and heartprotective characteristics. The major sources of saffron color are crocin and crocetin, whereas the bitter flavor is due to picrocrocin. Saffron is used as a medication or in health goods. The crocin content of saffron is an important quality measure. Picrocrocin and safranal are two more physiologically active phytoconstituents found in saffron derived from zeaxanthin degradation. Picrocrocin is responsible for flavor and bitterness, whereas safranal gives saffron its distinct scent. Saffron essential oil

Figure 1: Croccus sativus (Saffron)

contains picrocrocin, which is a monoterpene glycoside(Maqbool, Z., et al. 2022). The overall output of saffron essential oil might range between 0.4 and 1.3%. It is the second most prevalent phytochemical in saffron essential oil with its bitter taste and flavor. It accounts for about 1 to 13% of the dry weight of saffron. Safranal is a monoterpene aldehyde found in saffron essential oil. Safranal is formed by the action of β-glucosidase on its precursor, picrocrocin, during postharvest dehydration, and storage conditions on fresh stigmas of C. sativus(Maqbool, Z., et.al, 2022).

FLAVONOIDS

Flavonoids are secondary polyphenol metabolites found in a wide range of plants and diets. Secondary metabolites of plants have antiproliferative activities, antitumor, proapoptotic, antioxidant, cardioprotective, and anti-inflammatory. Corresponding glycosides and flavanolsthatcanbe used asfood additives are present in flavonoids (Maqbool, Z., et al. 2022). They also show cardiac protective effects. Three primary kaempferol glucosides have been found in C. sativus stigmas. All the activities of flavonoids in plants include UV protection, flower coloration to attract pollinators, allelopathy, defense, control of reactive oxygen species, plant-microbe communication, and auxin transport inhibition. They are also necessary for pollen viability in many species. Flavonoids impact various biological processes, including cellto-cell communication, transcriptional control, and signal transduction. Furthermore, flavonoids play an important role in human nutrition, and various therapeutic effects of flavonoids have been discovered in animal systems (Maqbool, Z., et al. 2022).

MONOTREPENES, MONOTERPENOID DERIVATIVES, AMINOACIDS AND ALKALOIDS

Isoprene and its oxygenated and saturated derivatives are polymerized from two molecules of isoprene that result in the formation of terpenoids that are usually referred to as monoterpenes. Monoterpene glycosides and monoterpenoids that have been identified and isolated from saffron are 38 in number. C. sativus stigmas also contain nitrogen substances, such as alkaloids and amino acids. Amino acids contribute to the flavor of foods and are essential components of food ingredients. Alkaloids are antibacterial, anti-inflammatory, and antiviral, exhibiting pharmacological activity (Maqbool, Z., et al 2022).

PHENOLIC ACIDS

The most common group of bioactive chemicals found in various plant sources is phenolic acids. The primary phenolic acids include hydroxycinnamic acids and hydroxybenzoic acids, which are secondary aromatic metabolites that add typical organoleptic features to food and are associated with various health advantages (Maqbool, Z., et al. 2022). Chlorogenic acid, caffeic acid, methylparaben, gallic acid, and pyrogallol are phenolic acids that have been isolated and discovered in saffron. Hydroxybenzoic acids (flavonoid biosynthesis precursors) have been found in several sections of C. sativus. p-hydroxybenzoic acid, hcoumaric acid, sinapic acid, and vanillic acid are among the hydroxycinnamic acids found in saffron petals, whereas p-hydroxybenzoic acid and benzoic acid were also identified in C. sativus pollen (Maqbool, Z., et al. 2022).

PHYTOSTEROLS

Phytosterols are naturally occurring steroid alcohols that have good nutritional and wellness effects by decreasing blood cholesterol, and the ratio of low-density lipoprotein (LDL) bound cholesterol in serum. In C. sativus, phytosterols such as stigmasterol and β-sitosterol were found, while fecosterol, stigmasterol, and β-sitosterol were found in the petals (Maqbool, Z., et.al, 2022)

Table 2: Active Phyto-chemical Constituents of Crocus sativus

PHYTOCHEMICALS	ACTIVE COMPOUNDS
Vitamins	A, B1, B2, B6, and C
Minerals	Calcium, magnesium, iron, phosphorus, and potassium
Carotenoids	β-Carotene, α-carotene, crocetin, and crocins
Monoterpene	Safranal and picrocrocin
Isophorones	Isophorone

PHARMACOLOGICAL ACTIONS

1.ANTIOXIDANT

Antioxidants can help prevent cancer, aging, and other disorders by inhibiting free radical oxidation. Many researchers have discovered the antioxidant effects caused by saffron extracts and secondary metabolites. Crocin, picrocrocin, and safranal in saffron have significant activity against oxidation, while radical scavenging action has been observed in safranal, picrocrocin, and crocin (Maqbool, Z., et.al, 2022). Greater quantities of antioxidant activity and total polar phenols than other spices are exhibited by saffron flower by-products. Free radicals can be captured by safranal and crocin, but crocetin can efficiently reduce lipid peroxidation and eliminate free radicals. They have the potential to be employed to prevent cancer and treat cardiovascular and psychological diseases. The ethanolic and aqueous extracts of saffron have antioxidant effects. Saffron ethanolic extracts scavenge hydroxyl radicals and accelerate deoxyribose breakdown, whereas aqueous and ethanolic extracts inhibit malondialdehyde formation and lipid peroxidation in red blood cells (Vijaya Bhargava K, 2011). Furthermore, the antioxidant action of saffron has been demonstrated in vivo investigations in asthmatic mice bronchial epithelial cells. The main component of saffron is crocin

2.ANTI-INFLAMATORY

Ingredients of saffron such as crocin and safranal suppressed inflammatory pain response and decrease the number of neutrophils. Saffron extracts include a variety of antioxidant chemicals (such as crocin, crocetin, quercetin and kaempferol) that can prevent the generation of pro-inflammatory qualities (Maqbool, Z., et.al, 2022). WBC count, neutrophil count, eosinophil count, and platelet number in the blood (somayyeh et al). Saffron has anti-inflammatory properties because it contains alkaloids, anthocyanins, saponins, tannins and flavonoids (Vijaya Bhargava K, 2011).

3.ANTI-BACTERIAL

Different parts of Crocus sativus, such as stamen and corolla have been employed as a good source of antimicrobial agents (Bellachioma, L., et.al, 2022). Extracts of Crocus sativus against various bacterial strains have confirmed an improved activity against bacteria and fungi used as test organisms.34 In addition, antibacterial effects of other blends like aqueous, ethanolic and methanolic extracts of petal were measured against the foodborne pathogens and the results have confirmed that such extracts show antimicrobial activity against most of the pathogenic bacteria (Khayyat, S. A., 2017).

4.APHRODISIAC ACTIVITY

Saffron also plays an important role in improving the fertility and increases the libido when consumed. Results have revealed that crocin and its aqueous extract particularly at doses of 160-320 mg/kg b.w. increased mounting and erection frequency behaviors and in addition to this reduced ejaculation, intromission and mount latency parameters (Tung, N. H., et.al, 2022).

5.IMMUNOMODULATORY EFFECT

The role of saffron in improving the immune system and saffron increases the IgG level and decreased the IgM level as compared with the baseline and placebo groups. In addition to this, it increases the percentage of monocytes as compared with placebo. Other study concluded that saffron petal extract causes an increase in antibody response without any alteration in hematological parameters or histology of spleen (Mykhailenko, O., et.al, 2022).

6.ANTITUSSIVE ACTIVITY

The ethonolic extract of crocus sativus and its constituents safranal found to reduce cough (Vijaya Bhargava K, 2011).

7.ANTINOCIEPTIVE

The aqueous and ethanolic extracts of saffron stigmas and petals posses antinociceptive and anti-inflammatory (Vijaya Bhargava K, 2011).

8. EFFECTS ON RESPIRATORY SYSTEM

The relaxant effect of crocus sativus on smooth muscle produced with aqueous ethanolic extract and safranal used in the treatment of respiratory diseases like asthma (Vijaya Bhargava K, 2011).

9.EFFECTS ON GASTRO-INTESTINAL SYSTEM

A study in which they compared the absorption of crocin and crocetin. They find that crocetin is rapidly absorbed in the bloodstream and detected it in intact free plasma or as a glucuronide conjugate. In mouse plasma, intact crocin is not detected, but crocetin is present after the administration of crocins. This study reveals that if crocins is orally administered, it is hydrolyzed into crocetin in intestinal absorption, and it is partly metabolized into mono-glucuronide and di-glucuronide conjugates (Asia and her colleagues) (Maqbool, Z., et.al, 2022).

10.HEPATOPROTECTIVE

Parts of medicinal plant like flowers, leaves, stem, roots and seeds have been found to possess a good hepatoprotective activity. Increases level of ALT, AST and bilirubin level and lowering total protein

and albumin production was observed in acetaminophen treated rat models whereas pretreatment of rats with Crocus sativus petals extract resists this rise of aminotransferases and bilirubin levels and normalize the level of serum proteins as compared to disease control (Gohari, A., et.al,,2013).

11.PROTECTIVE EFFECT AGAINST NEPHROTOXICITY

Crocin from saffron compound obstructs the development of acute renal failure and oxidative stress in experimental animals. In a parallel study, safranal has been found to possess a protective effect against nephrotoxicity (Mir, T. U. G., Wani, et.al, 2022).

12.ANTI-PRURITIC AND EMMOLIENT EFFECT

Crocus sativus have beneficial effects with atopic dermatitis, ichthyosis vulgaris (VijayaBhargava K, 2011).

13.ANTI-OBESITY

Crocin showed a noteworthy decrease on rate of body weight gain, total fat deposition and regulates the weight ratio of epididymal fat to body. It inhibit pancreatic lipase thereby leading to malabsorbtion of fat and cholesterol producing hypolipidemic effect (Baba, S. A., et.al, 2015).

14.ANTI-DEPRESSANT

The antidepressant impact of saffron is similar to that of other antidepressants in that it affects the levels of certain neurotransmitters in the brain, most notably serotonin. 5-hydroxytryptamine, or serotonin, is a mood-enhancing neurotransmitter produced from the amino acid tryptophan (Maqbool, Z., et.al, 2022). Crocin can block dopamine and norepinephrine uptake, while safranal may block serotonin uptake. Aside from the antidepressant impact, in type 2 diabetic patients, sleep disturbance and anxiety were also considerably reduced due to saffron (Vijaya Bhargava K, 2011).

15.ANXIETY DISORDERS

Clinical research has proven the usefulness of saffron in lowering anxiety. Few diabetic patients were given either 300 milligrams of saffron per week or a placebo. Using the Spielberger StateTrait Anxiety Inventory scale, participants anxiety levels were assessed. The findings revealed that saffron could successfully lower diabetes patients anxiety (Maqbool, Z., et.al, 2022)

16.ANTI-CANCER AND ANTITUMOUR ACTIVITY

Clinical research has proven the usefulness of saffron in lowering anxiety. Few diabetic patients were given either 300 milligrams of saffron per week or a placebo.Using the Spielberger StateTrait Anxiety Inventory scale, participants' anxiety levels were assessed. The findings revealed that saffron could successfully lower diabetes patients' anxiety (Maqbool, Z., et.al, 2022). In human cancer cell lines in vitro, saffron carotenoids have inhibited cell proliferation. Crocetin and crocin can inhibit colorectal cancer cell proliferation and invasion and reduce the size of tumors. The downregulation of metalloproteinases and urokinase by saffron extracts crocetin and crocin inhibit invasion and migration of prostate cancer cells (Vijaya Bhargava K, 2011). Crocetin has a higher anticancer impact, restoring epithelialmesenchymal transition by decreasing N-cadherin and βcatenin expression while raising E-cadherin expression. Due to carotenoids interactions with topoisomerase II, its effects on cellular RNA or DNA production to inhibit free radical chain reactions saffron and its constituents may have anticancer properties (Butnariu, M., et.al, 2022).

17.CARDIO-PROTECTIVE

Crocin, an ingredient of saffron revealed its protective effects of cardio-toxicity through reducing lipid peroxidation as well as alleviating apoptosis (Vijaya Bhargava K, 2011). Whole saffron pretreatment or its individual constituents such as safranal pretreatment considerably decrease the serum LDH and CK-MB level, as well as myocardial lipid peroxidation as compared to isoproterenol – induced animals. Crocin, an ingredient of saffron revealed its protective effects of cardio-toxicity through reducing lipid peroxidation as well as alleviating apoptosis(Maqbool, Z., et.al, 2022). By reducing oxidative stress and dyslipidemia, crocin in saffron may help to avoid diabetes-related cardiovascular problems. Saffron has some antivasoconstriction properties in hypertension, thus possibly reducing blood pressure. Another study found a considerable decrease in total cholesterol and plasma levels of triacylglycerol due to crocin extract from saffron.

18.EFFECT ON BLOOD PRESSURE

Saffron has some anti-vasoconstriction properties in hypertension, thus possibly reducing blood pressure (Vijaya Bhargava K, 2011).

19.EFFECT ON UTERUS

The plant is used in traditional medicine to promote and regulate menstrual cycles. It also relieves the lumber aches that come with menstruation. Saffron is also helpful in treating other female illnesses, including leucorrhoea and hysteria. Saffron pessaries were used to treat uncomfortable uterine condition (Daoud, M., et.al, 2021).

20.EFFECT ON OCULAR BLOOD FLOW AND RETINAL FUNCTION

Increase the blood flow in the retina and choroid and enhance the retinal function recovery. Crocus analogs isolated from crocus sativus found to increase blood flow by vasodilation to the retina and choroid, also facilitate retinal function recovery thereby preventing ischaemic retinopathy and age related macular degeneration that results in blindness (Daoud, M., et.al, 2021).

21.ANTI-CONVULSANT

The anticonvulsant activities of safranal and crocin and the results indicate that safranal reduced the seizure duration, delayed the onset of convulsions (Vijaya Bhargava K, 2011).

22.ANTI-PARKINSON EFFECT

Crocetin increases the anti-oxidant capacities of enzymes followed by protection from the deleterious effects of 6-hydroxy dopamine, thus it treat the disorder (Maqbool, Z., et.al, 2022).

23.ANTI-ALZHEMERS DISEASE

Saffron extracts, particularly trans-crocetin, lower A42 in monocytes in Alzheimer patients. Amyloid aggregation and deposition in the human brain can be prevented by saffron (Maqbool, Z., et.al, 2022).

24.EFFECT ON NEURO-INFLAMMATION

Crocin decreased neuropathology and prevented syncytin-1 and nitric oxide-

(NO-) induced astrocyte and oligodendrocyte cytotoxicity in experimental autoimmune encephalomyelitis (EAE) with much fewer neurological deficits(Maqbool, Z., et.al, 2022). In multiple sclerosis lesions, syncytin-1 is strongly expressed in astrocytes, microglia, and glial cells. Stress in the endoplasmic reticulum (ER)has been linked to inflammatory pathways (Daoud, M., et.al, 2021).

25.LEARNING AND MEMORY BEHAVIOUR

Crocin (crocetin digentiobiose ester) was shown to be responsible for the effects of the saffron extract rather than crocetin. Saffron extract or its active components, crocetin, and crocin, may be useful in treating memory-related neurodegenerative disorders. Crocin has also been demonstrated to protect neurons against apoptosis caused by both internal and external apoptotic stressors by inhibiting TNF-a-mediated cell death (Daoud, M., et.al, 2021)

26.ANTI-DIABETIC ACTIVITY

Methanolic extract of saffron, crocin and safranal notably reduce the fasting blood glucose and HbA1c levels (Vijaya Bhargava K, 2011). Advanced glycation end products are known to cause the oxidative action that usually results in endothelial cell apoptosis and thus result in diabetic vascular complications. Crocetin has antioxidant capacity and calcium antagonistic activity or stabilization, a good remedy for diabetic vascular complications (Daoud, M., et.al, 2021).

DISCUSSION

The phytopharmacological review of Crocus sativus highlights the significant pharmacological potential of saffron and its various therapeutic uses. The review sheds light on the various phytochemical constituents of saffron, including crocin, crocetin, safranal, and picrocrocin, which have been shown to possess potent pharmacological activities such as antioxidant, anti-inflammatory, antitumor, anticonvulsant, and antidepressant effects.

One of the most promising therapeutic uses of saffron is its potential as a treatment for cancer. The review discusses several studies that have demonstrated the anti-tumor properties of saffron's constituents, including crocin and crocetin. These compounds have been shown to inhibit the growth of various cancer cells, including breast, prostate, and colon cancer. In addition, saffron's anti-inflammatory properties have been shown to reduce the inflammation associated with cancer and promote apoptosis, or programmed cell death, of cancer cells.

Another important therapeutic use of saffron highlighted in the review is its potential as a treatment for depression. Several studies have demonstrated that saffron's constituents, particularly safranal, can alleviate symptoms of depression by modulating various neurotransmitters, including serotonin, dopamine, and norepinephrine. Furthermore, saffron has been shown to have anxiolytic effects and may be useful in treating anxiety disorders.

The review also discusses the potential applications of saffron in the food and cosmetic industries. Saffron has been used for centuries as a food additive and coloring agent due to its unique flavor and bright yellow color. In addition, saffron's antioxidant properties make it a promising ingredient in anti-aging and skin care products.

However, the review also highlights the need for further studies to fully understand saffron's pharmacological potential and toxicological profile. While saffron has been traditionally used in various medicinal preparations, the review notes that further research is needed to determine its safety and potential side effects.

In conclusion, the phytopharmacological review of Crocus sativus highlights the diverse pharmacological activities and therapeutic potential of saffron. While further research is needed to fully understand its potential uses and safety profile, saffron's unique phytochemical constituents make it a promising natural product for various medicinal and industrial applications.

CONCLUSION

In conclusion, the phytopharmacological review of Crocus sativus demonstrates the vast potential of saffron as a valuable medicinal plant. The review highlights the diverse pharmacological activities of saffron's phytochemical constituents, including its antioxidant, anti-inflammatory, antitumor, anticonvulsant, and antidepressant effects. Saffron has been shown to have promising therapeutic potential for various diseases, including cancer, depression, Alzheimer's disease, and cardiovascular disorders.

Moreover, saffron has potential applications in the food and cosmetic industries due to its unique flavor, bright yellow color, and antioxidant properties. However, further studies are necessary to fully understand the safety and potential side effects of saffron, despite its long history of traditional use in various medicinal preparations.

In summary, the review underscores the importance of saffron as a valuable natural product with promising therapeutic applications. Further research is needed to fully explore the potential of this plant and develop safer and more effective for various diseases.

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CONFLICTS OF INTEREST:

There are no conflicts of interest.

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