



Review Article

THERAPEUTIC POTENTIAL OF SUNFLOWER SEEDS: AN OVERVIEW

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ABSTRACT

Sunflower plant (*Helianthus annuus*) is a miraculous oil seed crop which is cultivated globally for its seeds. Sunflower seeds, a nutrient dense food has been found to have a potential role in chronic inflammatory conditions, bacterial and fungal infections, cardiovascular diseases, skin diseases and even cancers. These benefits of sunflower seeds are attributed to the presence of phytosterols, unsaturated fatty acids, proteins, variety of vitamins and minerals. Various studies have demonstrated the therapeutic usefulness of sunflower seeds in multiple clinical conditions. This article is to give an overview about wide array of uses of sunflower seeds and to enlighten the therapeutic potential of cheap, accessible and easily available oil seed crop – 'Sunflower' in human beings.

Keywords: Sunflower seeds, *Helianthus annuus*, Oil seeds.

INTRODUCTION

Health is the topmost priority for every individual. In current scenario of rising number of health problems; one needs a remedy with multifaceted actions to keep a check on variety of factors responsible for causation of various ailments. Oil seed crops have been highlighted in recent years for their positive impact on disease prevention and health promotion. Sunflower seeds have also grabbed attention due to the substantial contribution in health [1]. Sunflower plant [*Helianthus annuus*], a leading oil seed crop which is cultivated primarily for its seeds, ranks second for edible oil production globally after soybean oil [2,3]. It is native to Middle American region later being commercially available

at global level [1]. Sunflower is cultivated globally for its oil and protein content predominantly. Proteins present in sunflower seeds have favourable amino acid distribution. Also in addition, tocopherols, minerals, and vitamins are provided by sunflower seeds in substantial amounts [4]. Half cup [64gm] of dry roasted sunflower seeds provide 370 kcal energy, 7gm of dietary fibres and 12 gm of proteins. Among vitamins, 17mg of vitamin E, 4.5gm of niacin, 0.5mg of pyridoxine, 4.5mg of pantothenic acid and 151mcg of folic acid are present in 64gm of dry roasted sunflower seeds. Sunflower seeds are also rich in minerals like calcium, copper, iron, magnesium, manganese, selenium, phosphorous,

potassium, sodium and zinc. 128 gm of sunflower seeds contains 89.6 mg calcium, 4.9 mg iron, 165 mg magnesium, 1478 mg phosphorus, 1088 mg potassium, 3.8 mg sodium, 6.8mg zinc, 2.3 mg copper, 2.7 manganese mg and 102 mcg selenium as given by USDA (2008).[1, 5].

Role of important constituents

Sunflower oil is high in oleic acid (C18:1) and linoleic acid(C18:1) .These fatty acids reduces the LDL cholesterol and total cholesterol decreasing the chances of coronary artery disease.[6] Phytosterols have been found in high amounts[270-289mg/100gm] in sunflower seeds which are efficient in reducing cholesterol ,increasing immunity and reducing the risk of colon cancer [7].

Sunflower oil is an excellent source of vitamin E /tocopherol which neutralizes free radicals, scavenge them and prevent oxidative damage to cellular and molecular components exhibiting anti inflammatory, cardio protective and anti tumour action. Due to anti inflammatory action of tocopherols, sunflower seeds seem to have a promising role to play in chronic inflammatory conditions like bronchial asthma ,osteoarthritis and rheumatoid arthritis. Also important impact of vitamin E on cardiovascular system makes sunflower seed oil beneficial in reducing atherosclerosis and hence complications like coronary artery disease and stroke [8,9].

Sunflower seeds possess antioxidant value 0.153, antioxidant activity 72.9, oxidation rate ratio 0.271 and antioxidant activity coefficient 279.7 which has no statistically significant correlation with total phenolic extracts [10].

Magnesium is important for maintenance of nerve and muscle tone in body .Sunflower seeds contain substantial amounts of magnesium hence predicting their potential usefulness in bronchial asthma, muscle cramps, hypertension, and migraine. Selenium, an another important constituents of sunflower seed is incorporated at the active site of many proteins, including glutathione peroxidase [antioxidant enzyme] .Due to its antioxidant action ,it has been found to decrease the risk of prostate cancer[11].

Sunflower seeds provide a rather significant source of zinc, a mineral which helps boost the immune system. Folate in sunflower seeds facilitates the formation of RNA, DNA and haemoglobin. Tryptophan and choline present in sunflower

seeds is useful in reducing stress, anxiety and depression and memory enhancement [5].Sunflower seeds because of being low in sodium and saturated fats and high in magnesium, potassium and fibre are included by the U.S. National Heart, Lung and Blood Institute in DASH eating plan [12].

Due to presence of wide variety of nutritional components, Sunflower seeds possess wide therapeutic dimensions with multifaceted actions. This article is to give an overview about wide array of uses of sunflower seeds as anti inflammatory, anti bacterial, antifungal, anticancer, cardio protective and dermoprotective in human beings and to enlighten the therapeutic potential of the cheap and easily available seed crop-Sunflower.

Anti bacterial activity

Antibacterial efficacy of sunflower seeds has been highlighted in clinical studies .One study was conducted in Egypt on preterm infants <34 weeks gestational age where topical application of sunflower seed oil 3 times daily (n = 51) resulted in a significant improvement in skin condition (P = 0.037) and a highly significant reduction in the incidence of nosocomial infections (P = 0.007) compared with infants not receiving topical prophylaxis (n = 52) .No adverse events was reported as a result of topical therapy[13].

Another animal study witnessed significant antimicrobial activity, anti-inflammatory and wound-healing properties for Bioperoxoil [ozonised sunflower oil] as compared to other commercially available antimicrobial agents. Bioperoxoil, was tested for its antimicrobial activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans*, *Staphylococcus typhimurium* and *Escherichia coli* in vitro, together with its healing potential against *Staphylococcus aureus* in vivo. Healing experiments were carried through topical application of 3.5 mg/ml of the ozonised oil up to the 7th day after inoculation with *S. Aureus* on Wistar rat. Bioperoxoil showed anti-inflammatory effects against all strains tested; with MIC values ranging from 2.0 to 3.5 mg/ml. Protective effects on skin connective tissue and enhanced wound healing were also observed during the treatment, as compared to neomycin [14].

Antifungal activity

Another ozonised sunflower oil, Oleozon, twice a day for 6 weeks , has been found to be safe, efficacious and cost effective alternative to ketoconazole for tenia pedis infection

in a controlled randomized phase III trial in 200 patients. Comparison between topical Oleozon with Ketoconazole cream recorded no statistical difference in clinical and mycological cure as demonstrated in 75% and 81% for Oleozon and ketoconazole patients respectively and no recurrence was observed when patients were evaluated 6 months after the end of the treatment in the Oleozon group [15].

Sunflower not only possess antifungal activity but Sunflower oil cake meal has also been found to be a useful substitute of full value for soybean meal and corn-steep liquor in the fermentation media for production of antifungal antibiotics such as levorin, mycoheptin, amphotericin. The studies showed that replacement of soybean meal by sunflower oil cake meal with simultaneous increasing of the amount of carbohydrates in the medium increased the levorin levels by 60-70 per cent as compared to the conventional media. When soybean meal and corn-steep liquor were simultaneously replaced by sunflower oil cake meal in amounts of 3-4 per cent, the levels of mycoheptin in the fermentation broth increased by 30--65 per cent respectively. Replacement of soybean meal and corn-steep liquor by 3 per cent of sunflower oil cake meal in the medium increased the amphotericin levels by 27 percent as compared to the control [16].

Anti-inflammatory activity

Anti inflammatory action with Sunflower oil has been reported in a rat study where indomethacin given with sunflower reduced paw edema induced by carrageenan by 79.5%, where as individually indomethacin and diclofenac reduced paw edema by 56.2% and 50.7%, respectively without producing statistically significant gastric damage in rats when compared with untreated rats ($P > 0.05$). However, indomethacin caused statistically significant gastric lesions as compared with untreated rats ($P < 0.05$). Moreover, it was also found to improve the levels of antioxidant defence systems in rat stomach tissues against oxidative damage [17].

Triterpene glycosides, helianthosides 1 (1), 2 (2), 3 (3), 4 (4), 5 (5), and B (6) isolated from sunflower petals were found to possess significant inhibitory activity [InhR (inhibitory ratio) 1.0 mg/ ear] with percentage Inh R 71,77,73,75,63 and 80 respectively, against 12- O-tetradecanoylphorbol-13-

acetate (TPA)-induced inflammation (1.7 nmol/ear) in mice. All of the triterpene glycosides tested showed potent inhibitory effects, with ID50 (50% inhibitory dose) values of 65-262 nmol/ ear which was more than indomethacin (ID50 - 838 nmol/ear) and same as that of hydrocortisone (ID50 - 83 nmol/ear) [18].

Anticancer activity

Sunflower seeds are rich source of phytoesterol which may serve as a preventive measure for breast cancer. It has been observed that beta-Sitosterol, most abundant phytosterol inhibits the growth of several specific types of tumour cells in vitro and decreases the size and the extent of tumour metastases in vivo too [19]. A study reported reduced postmenopausal breast cancer risk associated with increased consumption of sunflower and pumpkin seeds compared to no consumption [OR = 0.66, 95% CI = 0.77-0.97][20]. Chemoprotective potential of sunflower seed oil has also been reported in the mouse skin tumour model where 40% protection was demonstrated with sunflower oil [21].

Cardioprotection

Sunflower seeds oil [rich in oleic and linoleic acid] also demonstrated cardioprotective effect reported by reduction in occurrence of life-threatening arrhythmias in an animal study. Addition of 12% sunflower seed oil in rat food pellet for 4 weeks, decreased the incidence of reperfusion-induced ventricular fibrillation both after 6 min (2/15 vs. 7/11) and 12 min (0/11 vs. 2/8) of myocardial ischemia and the incidence of other arrhythmias was also decreased. The number of animals developing no arrhythmias during reperfusion was increased (8/15 after 6 min of ischemia, 4/11 after 12 min of ischemia vs. 0/11 and 0/8 in controls, respectively)[22].

Dermoprotection

Sunflower seed oil provides an extra option in treatment of atopic dermatitis where therapeutic agents which increase relipidization and inhibit inflammation are conventionally used [23]. In vitro and in animal studies data demonstrated role of sunflower oleodistillate (SOD) in atopic dermatitis due to enhancement of epidermal lipid synthesis and reduction of inflammation. In vitro mechanism attributed to activation of peroxisome proliferative-activated receptor-alpha (PPAR-alpha) which stimulates keratinocyte differentiation, improve barrier function, and enhance lipid metabolism in the skin.

2% SOD was found to possess a strong steroid-sparing effect and a positive effect on quality-of-life parameters [24].

Sunflower seed oil has been studied for its protective effect on biophysical properties of skin in humans. 19 adult volunteers with and without a history of atopic dermatitis were recruited into two randomized forearm-controlled mechanistic studies. Olive oil [6 drops] was applied to first cohort twice daily for 5 weeks whereas to second cohort was applied six drops of olive oil to one forearm and six drops of sunflower seed oil to the other twice daily for 4 weeks. Topical application of olive oil led to significant decrease in stratum corneum integrity and induction of mild erythema in volunteers. In contrast Sunflower seed oil preserved stratum corneum integrity, did not cause erythema, and improved hydration in the same volunteers [25]. Not only efficacious, but topical sunflower oil therapy is highly cost-effective in reducing deaths from infection among the preterm neonates [26].

Another animal study, 18 normal dogs were given supplementation of flax seeds and sunflower seeds. 1-month supplementation with either reported temporary improvement in skin and hair coat [using a numeric scoring system and serum PUFA concentrations [27].

Hybrid varieties of sunflower

Genetics has led to the production of hybrid sunflower able to generate different oil profiles in terms of fatty acid composition and tocopherol type and amount. Hybrids seem to improve human nutrition. Standard sunflower oil is rich in linoleic acid but the hybrids generated by induced mutations provide better genotypes which are rich in oleic acid, palmitic and stearic acid [4].

Novel recombinant line of sunflower lines; CAS 29, CAS -30, CAS 15, CAS-33, CAS-19 and CAS -20 have been generated by crossing high stearic acid lines between themselves or by crossing them with standard and high-oleic sunflower lines. The stearic acid contents of lines CAS -29/ CAS -30, CAS- 15, CAS-33, CAS-19 and CAS -20 as estimated are 34.5%,24.9%,17.4%,10% and 21.5%, respectively[28].

Among all tocopherols, standard sunflower oil has predominantly alpha one tocopherol where as hybrids generated by induced mutations are rich in beta, gamma,

and delta tocopherols [29]. Alpha-tocopherol may significantly reduce the risk of developing bladder cancer where as gamma tocopherol may help protect against colon and prostate cancers [30,31]. Hybrids are also physically better than the standards in being more stable to heat and oxidation too [4].

Allergy

Strong hypersensitivity has been observed with sunflower seeds [32]. High prevalence of Helianthus pollen in the atmosphere during harvesting has considered as an allergenic source [33]. Sensitization has been probably through inhalant route when using these seeds to feed birds [34]. Just keeping cage birds fed on sunflower oil seeds can cause sensitization as shown in a report [n=4 where 3 of the participants developed anaphylaxis and one chronic bronchial asthma predicting the route of sensitization being inhalation of airborne sunflower seed allergens[35].

In a study done on sunflower processing factory workers, very high rate (23.5%) of sensitization to sunflower was recorded in the study group compared to subjects who were not exposed to sunflower pollen in the workplace. The study group had a higher rate of allergic rhinitis and conjunctivitis ($P<0.05$) where as no difference was observed in asthmatic symptoms and allergic skin diseases [36]. Allergenicity to sunflower seeds does not confer sensitization to sunflower oil as observed in a study where Sunflower oil ingestion in the patients who were highly sensitive to the parent material proved safe [37].

In conclusion, use of sunflower seeds in our day today life can provide us much of the recommended level of phenolic anti-oxidants, minerals, vitamins, and proteins. Sunflower seeds are cheap, easily available, accessible and intensely nutritious food which possess promising role in variety of infections, inflammations, cancers and cardiac diseases. Multidimensional role of miraculous sunflower seeds in health promotion and disease prevention necessitates their use in our diets to assure healthy living.

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