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Review Article

REVIEW OF NUTRACEUTICAL USES OF AN ANTIOXIDANT SUNFLOWER SPROUT, *HELIANTHUS ANNUUS*

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ABSTRACT

The concept of "clean food or green food" is very popular in the present lifestyle. The green sprouts have been an increase in consumers' demands such as alfalfa (*Medicago sativa*), broccoli (*Brassica oleracea*), lentil (*Lens culinaris*), mung bean (*Phaseolus aureus*), radish (*Raphanus sativus*), soybean (*Glycine max*), sunflower (*Helianthus annuus*), and other seed sprouts that are usually eaten fresh or cooked for beverages, soups, appetizers, or main courses. Not only are the delicious menus but the sprouts also considered to provide health benefits. *H. annuus* is a folk remedy for chronic diseases such as bronchiectasis, cough, diarrhea, hypertension, infection, and rheumatism. Its phytochemical substances are alkaloids, carotenoids, flavonoid, minerals, oils, phenols, tannins, terpene compounds, and vitamins, which all of these contribute to its remedial properties. This review is an attempt to compile information on nutraceutical uses of sunflower sprout, *H. annuus* in the antioxidant property.

Keywords: Antioxidant, *Helianthus annuus,* Plant, Sprout, Sunflower.

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INTRODUCTION

Sprouts are shoots of germinated seeds, which are excellent sources of proteins, vitamins, and minerals [1]. They can be used the clean food in salads, soups, stews, and casseroles in the past few decades from Far Eastern countries to parts of the Western world [2]. The common types of seeds used for sprouting are alfalfa, amaranth, broccoli, cabbage, lentil, mung bean, radish, rice, rye, soybean, sunflower, and wheat seeds [3]. As the sprouts are consumed at the beginning of the growing phase, their nutrient concentration remains very high [4]. In naturopathy, sprouts have the medicinal benefits; they can be promoting health aspects and safety evaluation [5]. The U.S. Food and Drug Administration has published several recommendations to consumers regarding consumption of sprouts [6]. The sunflower *Helianthus annuus* is the core of medicinal values which is used as food and medicine worldwide [7].

TAXONOMICAL CLASSIFICATION OF *H. ANNUUS*

The generic name, *Helianthus*, is derived from Greek "helios" meaning the sun and "anthos" meaning a flower. The taxonomy of *H. annuus* is in the kingdom (*Plantae*); subkingdom (*Tracheobionta*); superdivision (*Spermatophyta*); division (*Angiospermae*); subdivision (*Eudicots*); class (*Magnoliopsida*); subclass (*Asteridae*); order (*Asterales*); family (*Asteroideae*); genus (*Helianthus*); species (*H. annuus*) [8,9].

NOMENCLATURE

H. annuus is commonly found to be grown in Africa, Australia, and Asia [10]. The vernacular name of *H. annuus* is also known as (English) sunflower, (Afrikaans) sonneblom, (Albanian) lule dielli, (Arabic) abbâd esh shams, azriyun (Brazil) girassol, (Catalan) corona de rei, heliantem, (Chinese) kui hua, xiang mu kui, zhang ju, (Corsican) girasole, (Croatian) džirasol, jednogodišnji suncokret, krumpir morski, (Czech) slunečnice roční, (Danish) almindelig solsikke, solsikke, (Dutch) engelse zonnebloem, (Esperanto) sunflora, (Estonian) harilik päevalill, (Finnish) auringonkukka, isoauringonkukka, (French) grand soleil, soleil, tournesol, (German) echte sonnenblume, sonnenblume, (Hawaiian) nānālā, pua nānālā, (Hungarian) napraforgó, (India) beliphul, surjmukhi, (Indonesia) bunga matahari, (Italian) corona del sole, girasole, (Japanese) himawari, koujitsuki, (Korean) hae ba ra gi, (Latvian) vasaras saulgrieze, (Lithuanian) tikroi saulėgrąža, (Malaysia) bunga matahari, (Niuean) matalā, (Norwegian) solsikke, solvendel, (Persian) aftabi, azriyun, (Philippines) mirasol, (Polish) slonecznik roczny, slonecznik zwyczajny, (Portuguese) giganta, gyrasol, (Russian) podsolnechnik, (Samoan) mata o le lā, (Slovašcina) navadna sonènica, (Spanish) alizet, copa de júpiter, (Swahili) alizeti, (Swedish) solros, (Thai) taan dtà-wan, (Turkish) ay ciç, gün ciç, (Vietnamese) hoa mặt trời [11].

GROWING SPROUTS

The morphology of sunflower seed is black tear-dropped shape or conical pericarp, or hull, smooth surface, and gray strips. Although there are several ways to sprout seeds, the most common starts with seed measurements (Fig. 1a): This is the amount of seeds to use per jar or blanket or tray and varies from seed to seed as they differ in size; soaking time (Fig. 1b): Most all sprouts, need to be soaked at least 8 hrs in advance before the actual sprouting process can take place; damp towel (Fig. 1c): Place the seeds in the damp towel and fold the towel up so that they are covered and place the towel in a resealable plastic bag 24 hrs at least. During this period, the seeds should begin to sprout (Fig. 1d). Sprouting time (Fig. 1e): Spread the seeds across the tray with either a soil medium, coconut coir or vermiculite, place the second tray on the top of the soil, and place both the trays in a cool dark place about 3 days but check and water on them every day. Remove the upper tray when they grow up about an inch height (Fig. 1f) and place the sprouts in a sunny location (Fig. 1g). Seeds germinate quickly and will be ready to cut, at soil level (Fig. 1h), in 6-9 days. Seedling, at their two-leaf stage (Fig. 1i), is referred to as sunflower lettuce. If left to grow any older, they are bitter and rather unpalatable.

FACTORS INDUCED SPROUTING

Xing *et al*. [12] study the effects of light spectral energy distribution of the light emitting diode on the growth and quality of *H. annuus* sprouts. Fluorescent light was used as the control. The results showed that on the condition of light intensity 23 μmol m^{-2} s^{-1}, photoperiod 14 hrs/day, and temperature 25 ± 2°C, red light could significantly increase the cotyledon area, the hypocotyl diameter, the starch content and the chlorophyll to carotenoid ratio of sunflower sprouts. Besides, compared with other treatments, red light could improve the content of chlorophyll a, total chlorophyll, and carotenoid remarkably. Blue light obviously increased the accumulated amount of dry weight, soluble protein, and the activity of antioxidant enzymes. Yellow light could

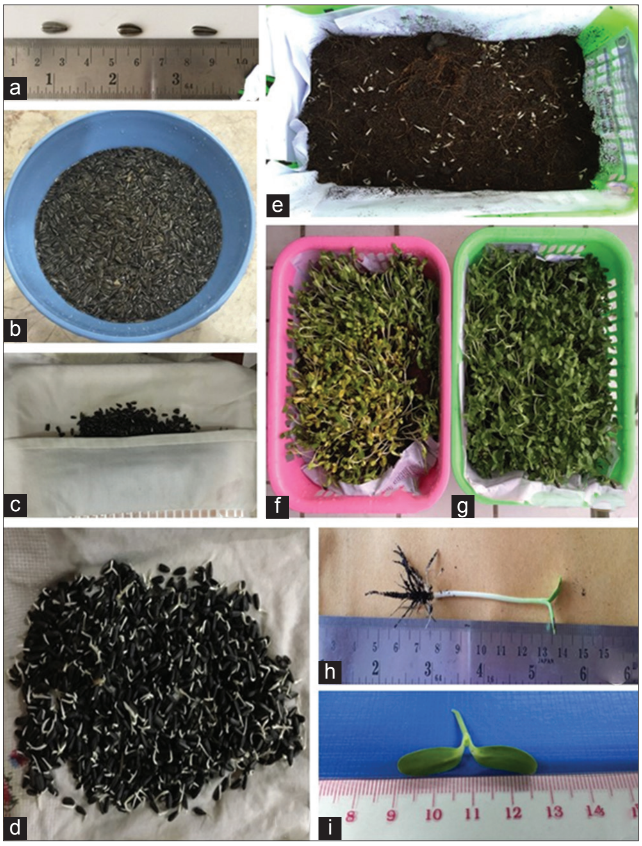

Fig. 1: How to grow the *Helianthus annuus* sprout (a) seed measurements; (b) soaking time; (c) damp towel; (d) germination; (e) sprouting tray; (f) before sun exposure; (g) after sun exposure; (h) grow-up sprout; (i) two-leaf stage

inhibit the elongation of roots and promote the accumulation of free amino acid. Under the light of ultraviolet B, hypocotyl length, and the activity of antioxidant enzymes were improved significantly. Overall, red light was more beneficial for the culture of sunflower sprouts.

PHYTOCHEMICAL SUBSTANCES

The sprout of *H. annuus* consists of the important constituents of pharmacological activities. Phenolic compounds: The phenolic compounds are caffeic acid, chlorogenic acid, caffeoylquinic acid, glucoside, glucopyranoside, cynarine, gallic acid, protocatechuic, coumaric, ferulic acid, and sinapic acids [13-15]. Flavonoids: Various flavonoids isolated from this plant are heliannone, quercetin, kaempferol, luteolin, apigenin [16]. Pigments: The pigments in sunflower are chlorophyll, carotene, and xanthophyll [17]. Fatty acids: The fatty acids composition in cotyledons are linoleic, palmitic, stearic acid, and oleic acids [18-20]. Vitamins: It contains a high concentration of vitamin A, B, C, and E and also niacin. Minerals: The minerals isolated from this plant are calcium, iron, magnesium, phosphorus, potassium, selenium, and zinc [21].

TRADITIONAL USES

In a review, Saini and Sharma [8] described the traditional uses of *H. annuus* like food and source of different disease treatment. It is used for antiaging [17], antidiabetic [22-24], antimicrobial activity [25,26], and antioxidant [19,27]. It also uses the other parts of this plant in the prevention of hepatic disease [28], nephrolithiasis [29], and heart disease [30]. Besides of the medicinal uses, the environmental protection by biodegradation [31] and phytoremediation was studied by this plant [32,33] and also in biodiesel production plant [34,35].

ANTIOXIDANT ACTIVITY

The process of germination of edible seeds to produce sprouts increases their nutritive value [4]. Several studies have reported higher levels of nutrients in sprouts compared to the un-germinated seeds [15,36-38]. Moreover, the sprouts are valuable dietary components as the sources of antioxidative phytochemicals [19,39], however, information that of sunflower sprout is scarce. A comprehensive search of major databases included Sciencedirect, Springerlink, PubMed, and Google Scholar was conducted during the period 2005-2015 to retrieve available information about the antioxidant property of sunflower, *H. annuus* sprout. Different combinations of keywords as well as synonyms for keywords were used during the searches. Information on phytochemical activities was also retrieved and may be of interest; however, the primary focus of this review is not on those activities.

In 2009, Pasko *et al*. [39] reported higher total phenolic and flavonoid content in sprouts compared to seeds, suggesting that synthesis of antioxidants during germination may occur. It is thought that seeds mainly act as a reservoir for the development of the sprouts [40]. Next year, Casals and Zevallos [37] evaluated the 13 edible seeds for the level of phenolic compounds and the antioxidant activity at different germination states (dormant, imbibed, and 7d sprouts). Selected seeds included alfalfa, broccoli, fava, fenugreek, kale, lentil, mung bean, mustard, onion, radish, soybean, sunflower, and wheat. The authors reported the phenolic and total antiradical capacity showed the general trend distribution of 7d sprouts > dormant seeds > imbibed seeds. In addition, 7d sunflower sprouts had the higher total antiradical capacity (40,202 μg Trolox g^{-1}) compared to other seeds (1456-25,991 μg Trolox g^{-1}). Moreover, in 2012, Baczek-Kwinta and Sala [19] reported the antioxidant activities of sunflower sprout were 1.2 chlorogenic acid equivalent g^{-1} of free radical scavenging activity, 0.3 chlorogenic acid equivalent g^{-1} of ferric reducing antioxidant power, 2.49 mg g^{-1} of chlorophyll, 4.75 g^{-1} of flavonoid, and 130 μg g^{-1} of anthocyanin. In recent year, 2014, Pajak *et al*. [15] reported total phenolic content in the seeds and sprouts of sunflower were 4 and 9 mg g^{-1} gallic acid equivalent. They also reported the flavonoids content in the seeds and sprouts of sunflower were 25 and 45 mg g^{-1} quercetin equivalent. *H. annuus* contains several kinds of the phenolic profile.

CONCLUSION

Why you need to add the sprouts in your daily meal because they are a lot of benefits. They contain fewer calories but are excellent sources of nutrients, easily grow so you can do by yourself without any soil or sunlight. Recent researches were found that sprouts have essential therapeutic benefits and have the ability to protect consumers from diseases. *H. annuus* is the source of various chemical constituents which are used for the treatment of many fatal or life-threatening diseases. Sunflower sprouts are a quintessential seed sprouting variety because of their large size, tasty, chlorophyll-rich leaves and succulent white stems. Sunflower sprouts are not only delicious but they are also quite nutritious and are rich in a number of vitamins and minerals as well as amino acid, fatty acid and fiber.

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