

SUPERSEEDS AS FUNCTIONAL FOOD- A REVIEW

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Abstract:

Diet has a vital role in human wellbeing. A healthy eating regimen relies upon its quality, which implies sound vitality balance, and an assortment of supplements. A simple method to achieve an assortment of supplements in the eating regimen is to look at a group of food that can be translated into a dietary suggestion. These days, individuals put together their eating regimen with respect to leafy foods. Seeds are turning into the most famous and healthy snack. As they are a decent source of different supplements like proteins, dietary fiber, vitamins, photochemical and they additionally show therapeutically value, such as cardio protective, anti-inflammatory, antioxidant, and anticancer properties. The developing interest for wholesome nourishment has been expanding lately and because of that, the food industry is reliably searching for new sources of wholesome and stimulating parts. In this manner, it would be a preferred position if waste portions of leafy greens would be described as far as solid mixes to be used as a source of characteristic food added substances and fixings.

KEYWORDS: Functional food; Dietary fibers; Food additives; Antioxidants; Anticancer; Seeds

1. INTRODUCTION

With rising health awareness among customer's the food industry is coordinating towards the improvement of new food items in the area of functional foods. The idea of functional foods includes foods or food components employing health advantages further on traditional supplements [1]. Customer inclinations towards plant-based food have moved considerably because of feasible and healthy reasons. Dairy items comprised of high Saturated Fatty Acid (SFA) and overconsumption of SFA could prompt cardiovascular ailments [2]. Customers favor plant-based eating regimens [3], which are more feasible [4] and ready to give better health benefit. The inclination towards plant-based eating regimens has essentially expanded [5], with the rise of millennial age who are progressively embracing vegetarian and lactose-free eating regimens. A few factors, for example, lactose intolerance, gastrointestinal distress, and sensitivities have become the main reasons for people avoiding dairy-based items [6].

Fitness is a challenge in the current lifestyle as the flow progress is afflicted by a few degenerative disorders associated with ways of living. With a quick changing global health situation and rapid realization of the bad impacts of uncontrolled food processing and overmedication; plant items have picked up the consideration. Developing awareness about the function of diet and mission for wellbeing has fuelled enthusiasm for nourishments that can work like medicine. 'Functional foods' or 'nutraceuticals' are foods or dietary segments that may give a health benefit beyond basic nutrition. Functional foods convey a wellbeing help past what is normal from their conventional supplement content [7]. Practical characteristics of numerous conventional nourishments are being revealed, while new food items are being created with gainful segments [8]. These days, there is a developing inversion of the recorded patterns and the commercial items made with consumable seeds are considered to have a potential and importance bigger than the utilizations for fiber. Seeds are progressively perceived as a genuine source of medicaments, cosmeceuticals, and nutraceuticals. Plant-inferred items contain different phytochemicals that have antibacterial, anticarcinogenic and vasodilatory activities [9].

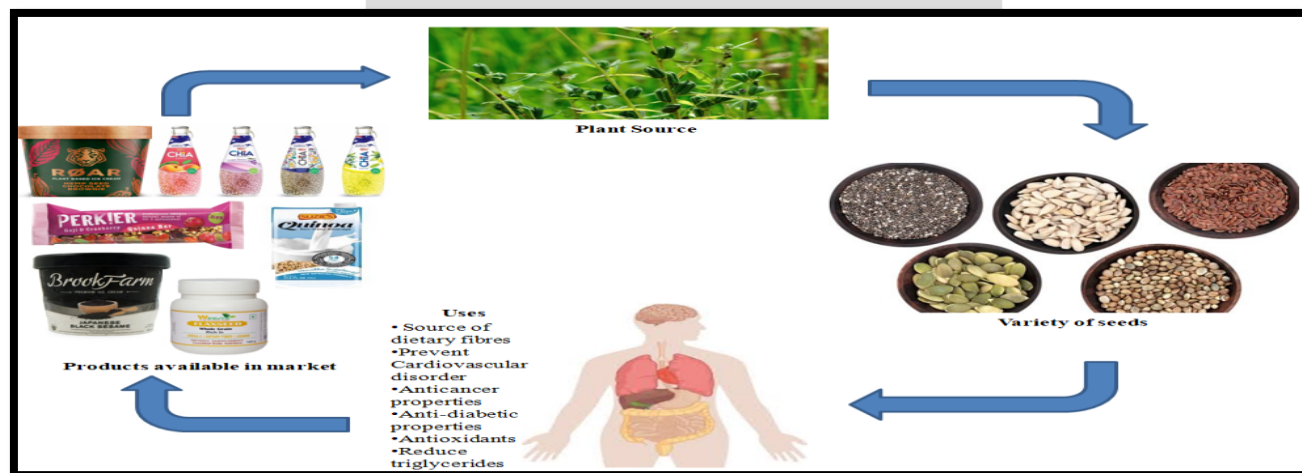


Fig. No. 1: Overview of supersedes obtained from plant sources and their uses.

As of late, organic product handling industries are coming to the utilization of basic ingredients got from vegetable crude materials, because of the developing pattern of supplanting substances from the manufactured source. Subsequently, an

exceptional consideration is paid to the utilization of profitable sources of a robust functional component, mainly the derivatives acquired from fruit and vegetable processing (e.g. jams, drinks, juices, etc.). Fruits processing by-products are composed of seeds, which are by and large disposed of regardless of their likely use as a source of supplements and bioactive mixes. These days, consideration has been centered on natural antioxidants such as phenolic compounds and vitamins that may likewise add to prohibit oxidative harm [10]. A few specialists have affirmed the advantageous convenience of such seeds like pumpkin, watermelon seeds and their possible use in food, pharmaceutical and cosmetic industries [11]. An ever-increasing industry these days is starting to focus to the exploration of common phenolic compounds from plants as a choice of supplanting engineered cancer prevention agents to keep up the nature of the foods from oxidative degradation. Likewise, polyphenols are frequently added to food items to prohibit off-flavor advancement and to settle them because of their possible part as functional agents [12]. Hence, seeds could be used as a dietary supplement for food industries. A large quantity of plant biomass wastes are generated yearly as leftover from the agro-food industries. These wastes are appealing sources of natural antioxidants. The high concentration of phenolic compounds present in peels, skins, and seeds assists the usage of this debris as a source of natural antioxidants. Phenolic compounds show a wide scope of physiological properties such as hostile to allergens, antiatherogenic, anti-inflammatory, anti-microbial, antioxidant, hostile to thermobiotic, cardio defensive and vasodilatory effects [13]. They work by prohibiting the development of new free radical species, changing over existing free radicals into less harmful molecules and preventing radical-chained responses [14]. For example, phenolic compounds such as, quercetin and ellagic acid, are acceptable cancer prevention agents that able to preserve body cells from injuries due to reactive oxygen and nitrogen species [15]. From a natural and conservative viewpoint, it is significant that plant by-products produced by the agro-food industry be utilized in food industry. Advancement of rancidity decreases the period of usability of the product, which at last influences customer acceptability [16, 17]. The utilization of synthetic antioxidants is less attractive because of current suggestions and customer preferences, so there is developing enthusiasm for discovering alternative solutions. Ever-increasing interest for healthy food has stimulated the manufacturing sectors to look for new basic sources of nutritional and healthful components to be utilized as food added substances or enhancements, with a high healthy benefit [18].

2. WHAT ARE SUPERSEEDS?

Seeds are small early-stage plants encased in a coat, the result of the aged ovule of flowering plants after pollination and the finishing of the cycle of generation. Seeds are made of complex frameworks in the external layer and the germ, rich in minerals, vitamins, and bioactive phytochemicals that protect the plant's DNA from oxidative pressure. The endosperm of seeds stores nutritive components to continue the future seedling with a variable blend of high-quality protein, complex carbohydrate, and fat contingent upon the kind of seed. Entire seeds give a wide range of bioactive particles liable to have remarkable health benefits. Edible seeds have a critical commitment to human nourishment. Super Seeds are plant-based sources of fundamental amino acids and give all the supplements and minerals, including calcium, zinc, copper and magnesium. Their benefits incorporate dietary fiber, vitamins and phytochemicals. Functional value and nutritional components of some supersedes have been discussed in Table 1 and Table 2.

Table No. 1 Functional value of different varieties of superseeds

| TYPE OF SEEDS | Antioxidant s | Anticancer | Heart Health | Anti-diabetic | Constipation | References |
|------------------------|--|--|---|---|------------------------------|------------|
| Pumpkin Seeds | Carotenoids, α -tocopherols | Phytosterols | phytosterols | paraaminobenzoic acid and sterols | --NA-- | [19] |
| Basil Seeds | Flavonoids | | | | | [20] |
| Sunflower Seeds | Tocopherols, flavonoids and phenolic acids | Phytosterols | Omega- 9 fatty acid | chlorogenic acid, glycosides, phytosterol | --NA-- | [21] |
| Flax Seeds | Lignans | scoisolariciresinol (SDG) gets converted into active mammalian lignans | α -linolenic acid (ALA) | Omega-3 and omega-6 fatty acids | Dietary fibers | [22] |
| Sesame Seeds | Sesamol, Sesamin | Tocopherols (β -sitosterol) | Phytosterols, phytic acid | | Sesamin | [23, 24] |
| Chia Seeds | Polyphenols | ALA | Dietary fibers | Omega-3 fatty acid | | [25] |
| Hemp Seeds | γ -tocopherol | Phenols and polyphenols | Oleic acid, linoleic acid, α -linolenic acid | | <i>Cannabis sativa</i> semen | |
| Muskmelon Seeds | Methionine, 9-cis-retinoic acid | Cucurbitacins | Dietary fibers | | --NA-- | [26] |

Table No. 2 Nutritional components of Plant-derived seeds

| Varieties of seeds | Fatty acids | Minerals | Vitamins and Bioactive compounds |
|------------------------|--|--|---|
| Pumpkin seeds | Linoleic acid, oleic acid, palmitic acid | Iron, manganese, magnesium, zinc, potassium, copper, phosphorous | Vitamin B, carotenoids, phenolic compounds, and tocopherols |
| Basil seeds | α -linolenic acid | Calcium, magnesium, iron, potassium, folic acid | Vitamin K, flavonoids, chicoric and rosamarinic acids |
| Sunflower seeds | Linolenic acid and oleic acid | Calcium, copper, iron, magnesium, manganese, selenium, phosphorous, potassium, sodium and zinc | Vitamin B complex, vitamin E, sesquiterpene lactones, flavonoids |
| Flax seeds | α -linolenic acid | Magnesium, manganese, molybdenum | Vitamin B1, lignans |
| Sesame seeds | Linoleic acid, oleic acid, palmitic acid and stearic acid | Phosphorous, iron, magnesium, calcium, manganese, copper and zinc | Vitamin B6, vitamin E, tocopherols, phytosterols |
| Chia seeds | α -linolenic acid (ALA), linoleic, oleic acid, palmitic acid and stearic acid | Manganese, phosphorus, copper, selenium, iron, magnesium, and calcium | Vitamin A, vitamin B1, B2 and B3, vitamin C, vitamin E, quercetin, myricetin, kaempferol, cholorogenic acid |
| Hemp seeds | Linoleic acid and α -linolenic acid | Phosphorus, potassium, magnesium, sulfur, calcium, iron, and zinc | Vitamin E, flavanones, isoflavones |
| Muskmelon seeds | Palmitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid | Magnesium, copper, zinc, iron, potassium, phosphorus, and manganese | Vitamin A, vitamin B6, vitamin C, vitamin E, flavonoids, lutein and zeaxanthin |

2.1. PUMPKIN SEEDS

Pumpkin (*Cucurbita pepo*.) is an annual creeping plant belongs to *Cucurbitaceae* family; pumpkin seeds are a significant source of nutrition [27]. The seeds are rich in phytonutrients that are affiliated with numerous health benefits. They are a prominent source of protein, vitamins, minerals, antioxidants, and polyunsaturated fatty acids (PUFA) [28]. Besides, pumpkin seed extract contains high quality and elevated levels of phytochemical sterols, which have significant benefits for the immune system, reproductive health and other areas of health [29]. It shows different health properties, like anticancer, antioxidant, antifungal, diuretic and antidiabetic activity. Studies revealed that peels and seeds, were treated waste before, however can be utilized in food industry and nutraceutical items. They are a source of polyphenols, including flavonoids capable for antioxidant activity and tannins qualified for antimutagenic and anticarcinogenic potentials [18]. The seeds contain phytosterols, which are fundamentally like cholesterol, thus compete with body's cholesterol for absorption, consequently involved in a critical role in the treatment of benign prostate hyperplasia and in bringing down cholesterol levels [30, 31]. The pumpkin is one of the well known consumable plants that are used as the cure of various disorders because of the event of many edible components and phytochemicals [32]. Its seeds are used for the curative of various infections, the herbal remedies separately or combine with medicines, and are utilized for the clinical treatment.

For instance, the significant level of unsaturation in the oil (>86%) [33] is connected to a decreased possibility for arteriosclerosis and cardiovascular disorders [34], although the antioxidants (tocopherols and tocotrienols) are related with decreased risk for gastric, breast, lung, and colorectal cancer [35-37]. Pumpkin seeds with reduced-hulls (naked-body) are favored for snacking and oil manufacturing because they eliminate the requirement for de-hulling prior to use [35]. Nowadays, pumpkin seeds are trading as fermented, sprouted, baked, concentrated form of protein from pumpkins and pumpkin protein isolate, as the seeds are rich in dietary fiber, the flour from pumpkin seeds is regularly added to bakery items to improve the texture and flavor. Dietary fiber improves gel formation, water and oil holding in bakery products. It likewise improves the nutritional quality of this product, because of its health benefits [38-40]. Pumpkin seeds are utilized for the control of depression because they contain the L-tryptophan which elevates the amount of serotonin in the brain. It's an alleged happy hormone [41]. It was utilized in the traditional medicine in nations like Mexico, Argentina, India, Brazil and China. In Africa, pumpkin seeds are utilized to treat tapeworm and in other folkloric medication, seeds are part of treatment for bladder and kidney diseases [38, 39, 42]. In southeastern Europe, *C. pepo* had recuperated prostate enlargement and irritable bladder [43]. Pumpkin shows CNS stimulant effect so it very well may be utilized for the folk treatment in conditions related with dizziness [38, 44]. Pumpkin has indicated substantial anti-diabetic effects. Protein-bound polysaccharides isolated from pumpkin seeds possessed hypoglycemic activity such as increasing insulin in plasma. Pumpkin consists of biologically active constituents such as paraaminobenzoic acid and sterols [45]. It is also rich in pectin, which manage glycemic levels and decreases the requirement of insulin in patients, who eat fiber-rich foods [38, 44].

2.2. BASIL (SABJA) SEEDS

Basil (*Ocimum basilicum* L.) belongs to *Lamiaceae* family, exceptionally fragrant with a wonderful taste utilized generally in culinary. Sweet Basil Seeds are an aid and are regarded as a superfood because of its enormous characteristics it has regarding therapeutical uses on account of its diverse chemical constituents. Seeds are a rich source of various polyphenolic flavonoids particularly Orientin and Vicenin; essential oils like eugenol, citronellol, linalool, limonene, citral and terpineol; High amount of beta carotene, lutein, zeaxanthin, Vitamins, minerals, and folates. Basil seeds contain $10.0 \pm 0.46\%$ protein, $33.0 \pm 0.61\%$ fat, and $43.9 \pm 0.22\%$ carbohydrates [46]. In addition, there have been different investigations to demonstrate that basil seeds possess properties like weight loss, healthy skin, cooling effect, prevention of acidity, anti-inflammatory, anticancer, and so on. Basil has a high content of magnesium, potassium and iron. Magnesium and potassium, as one of the seven basic macrominerals, improving the wellbeing of the cardiovascular system and the transmission of nerve impulses, likewise give assurance from various chronic diseases. It is digestive stimulant, and is utilized as diuretic. Basil contains significant levels of phenolic acids that add to its strong antioxidant capacity [47]. The main phenolic acids described in basil are rosmarinic, caffeic, caftaric and chicoric acids [48-50]. Rosmarinic acid, as predominant phenolic acid in basil extracts, is major phytochemical, because of their antioxidant and pharmacology properties. It has been discovered to be strong vital substance against human immunodeficiency virus type 1 (HIV-1) [51]. The major role of phenolic acids is as antioxidants. The antioxidative activity of phenolic acids is mostly because of their redox properties, which can play a vital role in neutralizing free radicals, quenching singlet and triplet oxygen or deteriorating peroxide [47]. Henceforth, they showed different advantages, might be defensive against cardiovascular ailments; act as anti-platelet and anti-inflammatory agents. The phenolic substances and antioxidant activity of basil were like red and black raspberry and higher than rosehips [52]. Sweet basil seeds have been utilized in ayurvedic medications to improve blood flow, anti-inflammatory, blood sugar management, and furthermore to improve immunity [53]. Basil seeds were utilized as the crude material and the antioxidative along with amylase inhibitory activities were utilized as markers for its bioactivities. Basil is economically significant crop for essential oil production. The EO of basil extracted by the means of steam distillation from the leaves and flowering tops are utilized to flavor foods, dental and oral items, in fragrance and medications [54]. Essential oils procured from *O. basilicum* have been conventionally grouped into four different chemotypes with various subtypes, based upon the crucial components in the oil: linalool-rich, methylchavicol-rich, methylcinnamate-rich and methyleugenol-rich [55]. The European basil EO, with linalool and methylchavicol as the major components, is frequently regarded to have the highest grade and the finest fragrance. This kind of oil is normally utilized in the cosmetic and scent industry. Scented basil (cinnamon, licorice, and lemon) are utilized in jams, nectars, vinegar and baked items [56].

2.3. SUNFLOWER SEEDS

Sunflower (*Helianthus annuus* L.) is a species of the *Asteraceae* family grown commercially round the world offering an assorted variety of nutritive and health benefits. Sunflower seeds have likewise caught eye because of their remarkable beneficence in health. Despite the fact that, sunflower seeds are utilized as a snack, salad garnish, and in some bakery items, are generally cultivated for oil production. The basic sunflower seeds developed and ingested worldwide, supplies a plenty of nutritive components including protein, unsaturated fats, fiber, vitamins, and minerals [57]. These seeds are made of around 20% protein, seed storage proteins give the sulfur and nitrogen needed for seedling growth after germination [58]. These sulfur-rich proteins are excellent for some human metabiological needs, including muscular and skeletal cell growth, insulin production, and as an antioxidant. It is likewise favourable source of glutamine/glutamic acid, asparagine/aspartic acid, arginine, and cysteine, and is protein-rich with both well adjusted amino acid content and low anti-nutritional properties [59]. Seeds contains 35–42% oil and are commonly rich in linoleic acid (55–70%) and in this manner low in oleic acid (20–25%) [60]. Examination shows that sunflower oil may bring down both complete cholesterol and low-density lipoprotein (LDL) and give antioxidant properties [61]. Oleic acid is a monounsaturated omega-9 fatty acid, which can lower triacylglycerides and low density lipoprotein levels, expanding high density lipoprotein (HDL), and thereby lower the risk of cardiovascular failure. Oleic acid likewise shows a powerful relationship with breast cancer. Sunflower seeds when mixed with wheat-based bread also notably raise the amount and nature of protein in bread [62]. Half cup (64gm) of dry cooked sunflower seeds gives 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 available in 64gm of dry roasted sunflower seeds. 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 specified by USDA (2008) [63]. Phytosterols have been found in high amounts [270-289mg/100gm] in sunflower seeds which are equipped for reducing cholesterol, increasing immunity and bringing down the risk of colon cancer [64]. It is a brilliant source of vitamin E /tocopherol which kills free radicals, scavenge them and prevent oxidative harm to cellular and molecular components showing anti-inflammatory, cardio-defensive and anti-tumour activity. Because of anti inflammatory activity of tocopherols, sunflower seeds appear to have a favourable role to play in chronic inflammatory conditions like bronchial asthma, osteoarthritis and rheumatoid arthritis. Additionally, the significant effect of vitamin E on cardiovascular system makes sunflower seed gainful in decreasing atherosclerosis and hence complications like coronary artery disease and stroke [65, 66]. Sunflower seeds contain generous amount of magnesium consequently predicting their probable benefits in bronchial asthma, muscle cramps, hypertension, and migraine. Selenium, another major constituent of sunflower seed is integrated at the active site of numerous proteins, including glutathione peroxidase [antioxidant enzyme]. Because of its antioxidant activity, it has been found to bring down the risk of prostate malignancy [67]. Sunflower seeds give a fairly critical source of zinc, a mineral that helps in boosting immunity. Folate in sunflower seeds helps in the development of RNA, DNA, and hemoglobin. Tryptophan and choline present in the seeds are viable in diminishing stress, anxiety and depression and memory improvement.

2.4. FLAX SEEDS

Flaxseeds are scientifically known as *Linum usitatissimum* L. It is a broadened crop [68] and is developed either for the manufacturing of oil or fiber [69-71]. The major wholesome components of flaxseed include oil, viscous lignan-rich fibres (mucilage), protein and minerals. A 100g part of flaxseed gives 534Kcal energy and contains around 7% carbohydrates, 10% protein, 53% total fat and 21% dietary fat. It is high in maximum of the vitamin B [72] and is low in saturated fatty acids, for instance cholesterol. About 73% of the unsaturated fatty acids present in flaxseeds are polyunsaturated fatty acids [73]. Muir, Westcott, & Aubin (1996) and Muir & Westcott (2003) announced that flaxseed contains 40-50% oil and meal, comprised of 23-34% protein, 4% ash, 5% viscous fiber (mucilage) and lignan precursors (9-30 mg/g of defatted meal) [74, 75]. It is a source of good-quality protein and albumins and globulins are the storage proteins of flaxseed with globulins forming the highest portion (58-66% of the total seed protein) [76]. Flaxseed is rich in omega-3 unsaturated fat (α -linoleic acid) content. It accommodates around 48% of all the lipids and is preferable to be incorporated in the diet [77]. It contains both insoluble and soluble fiber [78]. These dietary fibers help to improve laxation and prohibit constipation by increasing fecal mass and reducing bowel transit time [79]. The soluble fiber fraction of flax makes around one-third of total dietary fiber and helps to control blood glucose levels and reduce blood cholesterol levels. The fundamental soluble fiber in flax is mucilage gum. Integration of flax mucilage and α -linolenic acid into the eating regimen lessens the cholesterol level of body and manages the blood sugar levels [80] and prevent from diabetes [81]. Polysaccharides in flaxseed reduce the risk of different infections such as lupus, nephritis, arteriosclerosis and hormone-dependent types of malignancy [81, 82, 83]. Flaxseed contains diverse phytochemicals such as phenolic acids, cinnamic acids, flavonoids and lignins, which are antioxidants and influence cell development and viability. These agents defend against cancer and cardiovascular ailments [84]. Flaxseed is considered as a complete functional food because of the presence of α -linolenic acid [85]. It is rich in the fundamental omega-3 unsaturated fat, α -linolenic acid. The omega-3 fatty acids have biologic effects that make them valuable in preventing and managing chronic conditions namely diabetes mellitus, kidney ailments, rheumatoid arthritis, hypertension, atherosclerosis, cerebrovascular accident, alzheimer's disease, alcoholism and various types of cancers [86]. The amino acid arrangement of flax reveals that it is one of the most nutritious of the plant proteins. It is gluten-free, which protects from celiac disease. These seeds are low in carbohydrates; it adds to the low carbohydrate intake. Alpha linolenic acid, the omega-3 unsaturated fat present in flaxseed promotes bone health by assisting with forestalling excessive bone turnover-when utilization of foods rich in these omega-3 fat results in a lower proportion of omega-6 to omega-3 fats in the dietary regimen [87].

2.5. SESAME SEEDS

Sesame (*Sesamum indicum* L.) is a member of the *Pedaliaceae* family, mainly harvested for its palatable oil and food source. Sesame seed is a source of nutritive components with numerous health-promoting properties in people. These are regarded as advantageous food as they improve diet with the pleasant fragrance and flavor and hence give wholesome and physiological advantages. Sesame seeds are rich in protein, vitamin, carbohydrates, dietary fiber, and also a brilliant source of different minerals. Sesame seeds contain 25% protein and 50% oil. Sesame protein is somewhat low in lysine however rich in various amino acids particularly methionine, cystine, arginine and leucine. Sesame seed is rich in oil, contains high quantity of unsaturated fatty acids (83-90%), chiefly linoleic acid (37-47%), oleic acid (35-43%), palmitic (9-11%) and stearic acid (5-10%) with very low amount of linolenic acid [88]. The seeds are a rich source of antioxidants and bioactive compounds including phenolics, phytosterols, phytates, PUFA, short chain peptides, and a unique class of lignans such as sesamin and sesamol. Both of these substances related to a group of specific beneficial fibers called lignans and have a cholesterol-lowering effect in humans and prevent hypertension and increase vitamin E supplies in animals. Sesame seeds have certain importance for human nutrition because of its elevated level of sulfur amino acids and phytosterols [89]. The antioxidative factors (sesamin, sesamol, sesamol, their glucosylated structures sesaminol glucosides and tocopherol make the oil truly steady, and thus it has a long lifetime [90, 91]. The presence of phenylpropanoid compounds such as lignans alongside tocopherols and phytosterols give protection against reactive oxygen species and increases keeping quality of oil by exhibiting oxidative rancidity. Sesame seed also contains lignan aglycones in oil and lignan glucosides. Among the vitamins in the sesame seed, the appearance of vitamin E is captivating with the efficacy of sesame seed as a nutritious food. Foods of plant origin are well known to supply a complex mixture of natural substances with antioxidative effects. Such antioxidative activity seems to be associated with the prevention of degenerative disorders such as cancer, heart diseases, atherosclerosis and senescence. Sesame lignans have different pharmacological properties, e.g. antioxidant activity [91], antiproliferative activity [92] and responsible for improving antioxidant activity of vitamin E in the lipid peroxidation systems [93], lowering cholesterol levels [94], increasing hepatic fatty acid oxidation enzymes [95], and show antihypertensive effects [96, 97]. Sesame seeds are utilized in the formation of various food items. In the Far East, sesame seeds are baked (180-200°C) and their oil is extracted and sold as roasted sesame oil in the market. The usage of sesame into diet can assist with having better flavor in our daily ingested meal. The sesame seeds have a refreshing flavor and taste that looks like the nuts and its use is basic in various items. It can be pour over soups, salad greens, oats, or yoghurt. The baked items can be fortified with complete sesame grains to attain a pleasant form that enhances the quality of the end product.

2.6. CHIA SEEDS

Chia seeds (*Salvia hispanica* L.), belong to the *Lamiaceae* (mint) family; an annual herb, endemic to Mexico which blooms in the summer season [98, 99]. It was utilized as a staple crop by Aztecs and was offered to Gods in religious practices. Due to the high

content of omega-3 fatty acids, these seeds have been well known for their therapeutical and nutritive qualities and their oil was utilized in cosmetics and portraits by Aztecs [100]. It is an ideal source of fatty acids, soluble dietary fiber, minerals, and contains a significant amount of proteins and phytochemicals, they can be considered as functional food [101]. Antioxidants and phenolic compounds have been found to have health-promoting properties and also give protection from degenerative ailments such as heart diseases, cancers, diabetes, hypertension, obesity, and diverticulosis [102]. Chia seeds can be ingested as a whole, granulated or grounded. These seeds (per 100g) contain large amount of protein (16.54 g) in comparison to other cereal crops like wheat (11.8 g), oats (13.6 g), barley (11.5 g), rice (6.8 g) and corn (11.1 g) [100, 103, 104]. Chia seeds are particularly rich in mucilage. The mucilage of chia seeds contains about 71.22% polysaccharides which are practically identical to the polysaccharides in mucilage of flaxseeds (75%). Chia seeds have the extraordinary property of forming a gelatinous mass when absorbed in water. This is a direct result of the presence of high amount of mucilages and gums. Studies demonstrate that chia seeds can soak water up to 12 times their weight [105]. This property makes it valuable in the food industry. Chia seeds could hence likewise be favourable for the gastrointestinal health because soluble fiber prolongs the gastro-intestinal transit time that helps in improved metabolism [95].

2.7. HEMP SEEDS

Hemp (*Cannabis sativa* L.) is an annual herbaceous plant which is a member of the *Cannabaceae* family, has been a significant source of food, fiber, medicine, and a psychotropic/religious drug [106]. In ancient times, the cultivation of hemp has been restricted because of the presence of the psychotropic substance tetrahydrocannabinol (THC). The new proteomic description of hempseed featured that it is an under-exploited protein-rich seed with beneficial nutritive components [107]. Whole hempseeds contain 25%-35% oil, 20%-25% protein, 20%-30% carbohydrates, 10%-15% insoluble fibers, vitamins and minerals [108, 109]. Hemp seed is exceptionally high in amino acid, arginine. This essential metabolite, as metabolic precursor for the production of nitric oxide (NO), acts as a significant signalling messenger in the cardiovascular system. It contributes in the control of hemostasis, fibrinolysis, platelet and leukocyte interactions with the arterial wall, regulation of vascular tone, proliferation of vascular smooth muscle cells, and homeostasis of blood pressure [110]. In hemp seed, the content of phytic acid (inositol hexaphosphate, IP6) and trypsin inhibitors appeared relatively high contrasted with a few other antinutritional compounds examined [111]. Plant-based oils contain high amounts of unsaturated fatty acids; LA and ALA are the prevalent unsaturated fat in hempseeds summing up to 80–90 g/100 g of their total fatty acids [112]. The proper ratio of fatty acids and the higher intake of omega-3 fatty acids could provide suitable amounts of prostanoids and leukotrienes with hostile to thrombotic, anti-vasoconstrictive and anti-inflammatory properties, hence reducing the risk of coronary artery disease and other cardiovascular disorders [113]. The seeds of hemp have been a significant source of nutrition for thousands of years in Chinese and European cultures however, these days, regardless of the various clinical evidence, which features their enormous health advancing properties, people are as yet unconscious of their nutritional as well as therapeutical benefits. Hemp seeds have been utilized to treat blood problems and constipation. “Ma Zi Ren Pill”, a conventional Chinese medication also known as hemp seed pill, containing six herbs, among which *Cannabis sativa* semen, has demonstrated to be healthy and efficacious in relieving constipation as it increased complete spontaneous bowel movement and decreased straining at evacuation with no serious adverse effects noted [114, 115]. Hempseed has significant therapeutic-nutritional properties; they have been utilized as a pain relieving, for bruises and skin diseases, for cough, jaundice and colic. In the mid twentieth century a formula drink with hemp seeds, Maltos-cannabis, was famous in Scandinavia as an outstanding medication against lung infections, anaemia, acute gastritis (gastric catarrh), scrofula (tuberculous adenitis), neurasthenia, asthenia. New discoveries are in accordance with the potential involvement of β -sitosterol in the suppression of obesity-related chronic inflammation [116].

2.8. MUSKMELON SEEDS

Muskmelon (*Cucumis melo* L.), belongs to the *Cucurbitaceae* family; it is one of the most ingested fruit crop worldwide. It is a delicious and juicy fruit known for its nutritive and medicinal properties. Melon is an important source of minerals and antioxidant compounds. Besides, it contains polyphenols, organic acids, lignans and other polar compounds which give possible health benefits [117]. As indicated by Lester, melons should be incorporated into the diet, just as five to eight servings per day, to ensure appropriate nutrition and to diminish the risk of cancer and chronic ailments [117]. It is an acceptable source of vitamins, minerals, fatty acids, and polyphenol. Usually, seeds are discarded and treated as waste item, after consuming the muskmelon fruit. Seeds of musk melon are generally dried and used to add flavor to Indian cuisines and desserts. They are additionally utilized as snacks after roasting and salting. These seeds are exceptional source of protein, packed with phenolic and flavonoids compounds having antioxidant and antibacterial properties and omega-3 unsaturated fat. Apart from being a good source of protein, seeds are a rich in vegetable oil ranging from 35 to 49% depending on diversities from different area [118]. Melon seeds support immune system, lower the risk of cardiovascular diseases, help in maintaining blood-fat levels and contain basic supplements for the healing of wounds [119]. It also combats against osteoporosis and facilitates healthy teeth and bone development. Lately, it has been appeared to have useful therapeutic properties such as pain relieving, anti-inflammatory, antioxidant, antiulcer, anticancer, antimicrobial, diuretic, and antidiabetic properties [120-122]. Besides, it indicated a hepatoprotective activity against hypothyroidism and immune-modulator action [121]. The methanolic extract of melon seeds has strong pain relieving quality. *Cucumis melo* seeds displayed anti-ulcerogenic activity, presence of triterpenoids and sterols are reliable for these actions [123]. Cucurbitacins are profoundly oxygenated tetracyclic-triterpenes, primarily found in the *cucurbitaceae* family. Cucurbitacin B is an organic anti-cancer agent separated from the stems of *Cucumis melo*. The anti-cancer activity of

cucurbitacin B in human leukemia cells has been stated. Cucurbitacin B prevents STAT3 operation and the Raf/MEK/ERK pathway in leukemia cell line K562. Cucurbitacin A and cucurbitacin E also have important anti-tumour activity [124, 125]. It is utilized for the treatment of toxic and chronic hepatitis, jaundice and cirrhosis of the liver [124]. The seeds have demonstrated great antimicrobial, and anthelmintic property [126]. Musk melon seeds are valuable in painful discharges and dysuria, dyspepsia, help in maintaining kidney functions, lower blood pressure and inhibit cardiac dysfunction, having anti-rheumatic and anti-gout properties [121]. The muskmelon seeds are generally discarded as an agro-waste and can economically be utilized to extract muskmelon oil thus reducing the overall cost of muskmelon oil biodiesel production when compared with conventional vegetable oils.

3. CONCLUSION

The modern civilization, which due to technological advances, developed medicines which are quick acting, potent and capable to treat & provide symptomatic relief, has now started to feel the need for longer lasting & more fundamental cures for their problems of health. Attention now being shifted from relief to prevention & cure. The intention is to go back to nature & use natural materials & methods of ancient times. Plant-based foods as medications are assuming more significance in the essential health care of individuals and communities in different nations. Functional foods and nutraceuticals may give a way to lessen the increasing burden on the health care system by a non-stop preventive mechanism. Both nutraceuticals and functional foods contain the active ingredients with physiological activities with healthier and more joyful way of living. Countless phytochemicals and bioactives are found in photogenic foods. The synergistic effects delivered by a mixture of bioactives present in source materials and the complementary nature of phytochemicals from various sources are significant elements to consider in the preparation of functional foods and in the range of a healthy diet.

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