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Investigating Sesame Seeds: Bioactive Potential and Therapeutic Advantages

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ABSTRACT

One of the first oilseed crops, (*Sesamum indicum L.*) sesame seeds are valued due to their beneficial bioactive compounds and high nutritional content. Sesame seeds are a significant component of human nutrition due to their high content of proteins, healthy fats, dietary fiber and vital minerals like magnesium, calcium and iron. Their phytochemicals have potent anti-inflammatory, antidiabetic, antioxidant and cardioprotective qualities, particularly lignans like sesamin, sesamolin, and sesamol. These substances help in better metabolic health overall, protect liver function and reduce cholesterol levels. Sesame seeds are becoming more and more acknowledged as a functional food because of their many therapeutic advantages, which include neuroprotection and anticancer potential. This review highlights the medicinal, phytochemical and content of nutrients in sesame seeds, along with their potential to improve health and regulating illness.

Keywords: Antioxidant properties, Sesame oil, Sesame seed, Bioactive compounds, Nutrition value

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Introduction

Sesamum Indicum L. sesame seeds are part of the genus Pedaliaceae Sesamum. Sesame was the first oilseed to be grown and used to produce edible oil. During the previous three years, there has been a notable surge in the production and growth of sesame seeds from 2.8 million tons (Mt) and 6.3 million hectares to 1 Mt and 6.2 Mt, in that order, between 2002 and 2016. Asia and Africa are the main growing regions for sesame 1.1 Mt and 0.8 Mt respectively, with Tanzania, India and Sudan producing the most, accordingly they are 0.7Mt [1]. The Asian food industry has long utilized sesame as a popular edible grain in a variety of products, including flour, cake batter, edible oil, and nut-based snacks [2]. Along with protein and fat, sesame seeds also contain lignans that contain phenolic compounds like sesamin and sesamolin, which are said to be beneficial to human health [3]. Because of their high concentrations of phenolics, including lignans, flavonoids, and phenolic acid (ferulic and p-coumaric 4-hydroxybenzoic acids), certain varieties of sesame such as black and white sesame, has grown in popularity. Furthermore, earlier studies have indicated that sesame seeds have a high nutritional value, including iron, phosphorus, calcium, copper, magnesium, zinc, dietary fiber and protein as well as vitamin B1. Accordingly, it is believed that sesame seeds have antioxidant properties, anti-diabetic and anti-cancer properties that are advantageous to human health [4]. Several bioactive substances present in seeds including sesamin, tocopherol and blood pressure benefits and other health benefits have been associated with sesamol and heart-related ailments. A new technique for assessing the possibility of various bioinformatics, bioactive substances as possible therapeutic goals and more particularly drug docking. The protein known as Targeting hemoglobin beta subunit (HBB) as the protein for bioactive substances found in sesame to determine whether they have the ability to avoid CVD [5].

Table 1: Nutritional Composition of Sesame seeds [6]

Dietary Components	**100g**
Carbohydrate	22-25g
Protein	15-18g
Dietary fiber	10-12g
Polyunsaturated Fat	19-21g
Thiamine	1-2mg
Riboflavin	1-3mg
Niacin	3-5mg
Pyridoxine	1-5mg
Folate	87-91mcg
Vitamin E	2-5mg
Vitamin A	9-15IU
Calcium	970-980mg
Potassium	240-250mg
Sodium	10-15mg
Iron	18-20mg
Copper	3-5mg
Magnesium	320-340
Phosphorus	500-700mg
Manganese	3-4mg
Zinc	9-11mg

Bioactive Components

The main oilseed crop, sesame, is well-known for its nutritional value, as well as phytochemical substances like lignans, aldehydes, phytosterols, naphthoquinones, phenols, polyphenols, triterpenoids and anthraquinones [7]. The increased concentration of sesamolin and sesamol in sesame seed oil is regarded as a naturally occurring antioxidant enhances the antidepressant, anticoagulant, anti-inflammatory, and activities that lower blood pressure [8]. This class of substances consist of carotenoids, phenolics, phytosterol and fatty acids with polyunsaturated chain [9,10] . The compounds listed above are frequently used as antioxidants and for a variety of additional goals like inhibiting the effects of bacterial toxins and avoiding the cholesterol absorption. [11]. Lignans, poly-unsaturated fatty acids,tocopherols, and phytosterols is one of the bioactive compounds and antioxidants which can be found in significant amount of sesame seeds. Sesame oil's high antioxidant content boost energy and aging resistance as compared to other edible oil [12].

Lignans

The primary active component of sesame seeds, sesame lignans, has potent antioxidant qualities [13]. According to epidemiological research, sesame lignans help to improve liver function and control blood lipid levels. These characteristics also support the oxidative stability of sesame [14]. About half of the sesame lignans are composed of sesamin, with the remainder weight being made up of sesamolin, sesamol, and sesaminol. According to [14], sesame and sesamolin have mean values of 2.48mg/g (range 1.11-9.41mg/g) and 1.72mg/g (range 0.20-3.35mg/g), respectively. Sesame seeds have denaturing changes while being pressed and can convert the low polymeric structural unsaturated chemicals sesamol, sesaminol and sesamolin phenol from their constituent sesamin and sesamolin [15]. Black seeds have the largest quantities of sesamin, sesamol and total lignans, whereas white seeds have comparatively lower concentrations. It has been demonstrated that the lignan content of sesame seeds is closely correlated with the colour of their seed coat which shows concentrations of these compounds. Yellow, black, brown and white sesame seeds had total lignin levels of 2.52~5.94, 3.56~12.76, 2.66~6.68 and 2.83~5.66mg/g respectively [16].

Sesamol

A nutritional component and byproduct of the breakdown of the lignan obtain from the sesame seeds is sesamol. The importance of sesame oil as a quality stabilizer and essential aroma component has been brought to light by the discovery of a novel antioxidant compound in the oil [17,18]. Numerous recognised uses for sesamol include lowering cholesterol, acting as antioxidant, lowering depression and treating diabetic nephropathy and neuropathy [19].

Sesamin

One of the two best sources of lignin in the human diet is sesamin, the main lignin component present in sesame seeds. Sesamin is marketed as a dietary supplement with a number of purported benefits, including pro-apoptotic, anti-inflammatory, and antioxidant properties, antiproliferative, antimetastatic and proangiogenic qualities. It may also function as a fat

burner and oestrogen receptor modulator if sold to athletes or people trying to reduce weight, or it may have pro-antiphagocytic qualities. [20,21].

Sesamolin

One well-known lignan found in sesame oil is sesamolin has significant antioxidant, anti-aging and antimutagenic properties. Given its effectiveness in a wehi-3B-induced leukaemia model, the findings of a study conducted by [22] suggested that sesamolin might be a promising in vivo antileukemic medication. According to studies by [23] related sesame lignan derivatives might have higher antioxidant activity than the indigenous lignans present in sesame oil

Phytosterol

While consumed in sufficient quantities, the bioactive compounds found in plants lower blood cholesterol levels, which boosts immunity and lowers the risk of various types of cancer. Th chemical structure of these substances is similar to that of cholesterol. Both people and animals can benefit from these tri-terpenes' many biological effects which include anti-inflammatory, antibacterial, antioxidant and anti-cancerous qualities. Among the different kinds of phytosterol are sitosterol, campesterol, stigmasterol, sitostanol and campestanol.

Therapeutic Potential

Diarrhea, infant cholera, respiratory tract infections and other intestinal and bladder disorders are all commonly treated with sesame seeds. Additionally, hemorrhagic acne, ulcers, amenorrhoea and dysmenorrhea can all be treated with sesame powder [24]. Physiologically active components contain a number of health-promoting qualities such as lowering blood lipid and cholesterol levels and increasing hepatic fatty acid oxidase and neuroprotective effects on hypoxia or brain injury [25]. Because of its antioxidative, anti-inflammatory and free radical scavenging properties, sesame seed oil shows promise as a treatment for stress brought on by diazinon [26]. Bioactive components of sesame seed oil also improve blood pressure reduction and play a major role in electrolyte variation, antioxidant production, and lipid peroxidation reduction [27]. In addition to being a good source of plant protein, sesame seeds add fiber. Sesame seeds help with digestion, blood stimulation and nervous system circulation. Eating these seeds, which are among the best sources of iron and zinc would be fantastic. Since sesame seeds have a far higher calcium content than diary products, they are the best source of calcium. Constipation can be lessened by eating sesame seeds. Sesame oil is an effective remedy for cracked heels. One substance found in these seeds is sesamin, prevents oxidative damage to the liver. . Sesame seeds have a lot of polyunsaturated fatty acids, which help lower problems with lipid metabolism. These seeds have healthy fats called monounsaturated and polyunsaturated fatty acids that reduce cholesterol. They have a low level of saturated fat. Additionally, lignans and lecithin prevent the synthesis of cholesterol. Sesamin is one bioactive component that also has the ability to increase atheroprotective HDL levels while decreasing atherogenesis-triggering LDL, VLDL and TG levels [28].

Conclusion

A nutrient-dense functional food with both nutritional and medicinal uses is sesame seeds. Their bioactive substances, especially polyunsaturated fatty acids and lignans, have anti-inflammatory, antioxidant, and cardioprotective properties. Frequent consumption of sesame improves liver and cardiovascular health, promotes healthy lipid metabolism, and may lower the risk of developing chronic illnesses. Sesame seeds have a lot of potential uses in natural medicines and nutraceuticals because they are very healthy and have healing capabilities. Encouraging their consumption can bring better improvement in human health and nutrition security.

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