ABSTRACT

Nutrients, herbals and dietary supplements are major constituents of nutraceuticals which make them active in maintaining health, act against various disease conditions and thus promote the quality of life. Drug as dietary supplements play a major role to alleviate all type of disease. The sheer number and type of dietary supplements available is overwhelming, and it’s hard to know which offer health benefits and which are merely giving false promises - often the information about supplements is confusing or unclear. From ancient time globally the peoples were using the same oil as dietary source. Sesame oil is known dietary source having putative antioxidant property. In this review we summarized the medicinal value of sesame oil with respect to phytochemistry and pharmacological activity. This article must provide the data for the researcher to develop the molecule from sesame oil to treat many type life threatening diseases.

KEYWORDS: Sesame oil, Antioxidants, Dietary supplements, Sesamum indicum, Oxidative stress

INTRODUCTION

SESAME OIL

Sesame has been part of the human diet since ancient times. Sesame oil is one of the major dietary oils in Asian countries. Sesame seeds and oil contain several kinds of sesame lignans that may contribute to improved human health. Sesame oil, derived from the seeds of plant species of Sesamum indicum Family Pedaliaceae, consists of various fatty acids and nonfat antioxidants, including tocopherol, sesamin, sesamolin, and sesamol (1). Sesame seed believed to be indigenous to tropical Africa and cultivated in India, China and Nigeria (2). Sesame oil is obtained by refining the expressed or extracted oil from the seeds of Sesamum indicum. The oil consists of glycerides of oleic, linoleic, palmitic, stearic and myristic acids and also contains a crystalline substance, sesamine, and a phenolic substance sesamol, which gives the red colour with 1% solution sucrose in strong hydrochloric acid (2).

PHYTOCONSTITUENTS FROM SESAME OIL

Sesamum indicum seed has been an important oil seed since ancient times. It contains protein, oil & many other bioactive compounds. Lignans and lignin glycosides have been most intensively studied due to their antioxidative properties. On the other hand, naphthoquinones and anthraquinones have been isolated from the roots, an unutilized part of sesame. Chlorosesamone, hydroxyseasemone and 2, 3-epoxysesamone has been isolated from the roots and their antifungal activities reported. Anthrasesamones A-E has been isolated from the roots, and other two anthraquinone derivatives have been isolated from a hairy root culture of sesame (3). Sesamin and sesamolin are the most abundant lignans of sesame seeds and the major fat soluble lignans (4). Sesamin and sesamolin are comprised of benzene and furan rings. The structural difference between them is that sesamolin contains oxygen between its benzene and furan rings (5). Sesamin is absorbed via the lymph, incorporated into the liver, and then transported to the other tissues such as lung, heart, kidney, and brain (6). Sesamin is removed from serum and tissue within 24 hours after oral administration in rats (6), sesamin metabolite is mostly excreted and disappeared in urine within 24 hours (7). Sesamin is metabolized by cytochrome P450 in rat liver which results in conversion of the methylenedioxyphenyl to dihydrophenyl (catechol) moiety in structures. The dihydrophenyl (catechol) moiety has been reported to possess strong radical scavenging activities (8). A new chlorinated red naphthoquinone pigment having antifungal activity, named chlorosesamone, was isolated from the roots of Sesamum indicum. Its structure was characterized as 2-chloro-5, 8-dihydroxy-3-(3-methyl-2-butenyl)-1, 4-naphthoquinone (9). Two anthraquinone derivatives, named anthrax sesamone D and E, were isolated from the roots of Sesamum indicum. Their respective structures were determined to be 1, 2, 4-tetrahydroxy-3-(4-methylpent-3-enyl) anthrax quinone and 1, 2-dihydroxy-3- (4-methylpent-3-enyl) anthrax quinone (10). 2-Geranyl-1, 4-naphthoquinone was isolated from the hairy root culture of Sesamum indicum. The structure was determined to be 2-[(g)-3, 7-dimethylocta-2, 6-dienyl]-1, 4-naphthoquinone (11). A new anthraquinone derivative, named anthrasesamone F, was isolated from the seeds of Sesamum indicum. Its structure was determined to be (Z)-6, 7-dihydroxy-2-(6-hydroxy-4-methyl-3-pentenyl) anthraquinone (3).
Nutraceutical Value of Sesame Oil

Sesaminol

Sesamolin

Sesamol

Anthrasesamone A

Anthrasesamone B

Anthrasesamone C

Anthrasesamone D

Anthrasesamone E

Anthrasesamone F

Chlorosesamone

2-geranyl-1,4-naphthoquinone
MEDICINAL VALUE

*Sesamum indicum* is used as external poultice, emenagogue, lactagogue, diuretic, tonic and demulcent (12). Sesamin and sesaminol are the major phenolic constituents of sesame oil which have been reported to possess a broad spectrum of pharmacological effects including anti-mutagenic, antioxidant, antihypertensive, anti-inflammatory antithrombotic and cardio protective effects (13).

Sesame oil has long been regarded as a daily nutritional supplement for increasing cell resistance to lipid peroxidation (LPO) (14). Sesame oil decreases LPO by inhibiting the generation of reactive oxygen free radicals and also it attenuates multiple organ failure triggered by endotoxin lipopolysaccharide in rats (8, 15-17). A single dose of sesame oil attenuates oxidative stress and hepatic injury in rats and also reduces iron initiated oxidative stress in rats & mice (15, 18-21). Sesame oil attenuated hepatic injury and decreased LPO, hydroxyl radical, and superoxide anion, but not nitric oxide, in acutely iron-intoxicated mice. Furthermore, inhibiting the activity of xanthine oxidase might be involved in the sesame oil-associated protection against acute iron-induced LPO and hepatic injury in mice. Although, circulating antioxidants have been associated with the depletion of superoxide anion during oxidative stress. More investigation is needed to confirm this, however (21, 22). Besides sesamin and sesaminol, sesaminol also demonstrated the antioxidant properties on the in vitro oxidative modification of human low-density lipoprotein (LDL); furthermore, it was a more effective scavenger than either α-tocopherol or prolucol in reducing the peroxy radicals derived from 2,2'-azobis (2-amidinopropane) dihydrochloride (23). The findings suggest the potential effect of sesame oil to protect LDL against lipid peroxidation.

Sesame oil increasing the alpha-tocopherol concentration in the blood and tissue it was observed in rats fed an alphatocopherol containing with sesame seed or its lignans (24). Additionally sesame oil showed the significant free radical scavenging capacity (RSC) in the methanolic fraction due to the presence of phenolic compounds (25). Hypoglycemic effect of a hot water extract from defatted sesame seed on the blood glucose level in genetically diabetic KK-Av mice has been reported earlier, the results indicate that the extracts had a reductive effect on the plasma glucose concentration of KK-Av mice, and this effect is suggested to have been caused by the delayed glucose absorption (26).

In addition to decrease lipid peroxidation and generation of reactive oxidative species, sesame oil increased the activities of antioxidative enzymes such as glutathione peroxidase (GPx), superoxide dismutase (SOD), and catalase in rodents under various conditions of oxidative stress (20, 21, 27, 28). A study in hypertensive patients indicated that sesame oil consumption remarkably reduced oxidative stress and simultaneously increased GPx, SOD, and catalase activities (29). These results support the hypothesis that sesame oil consumption may help to enhance antioxidant defense system in humans.

The potential antioxidant property and antihypertensive effect were reported earlier. The investigators suggested that sesamine is a useful prophylactic treatment in hypertension and cardiovascular hypertrophy (23, 30, 31). Administration of sesame oil at a dose of 5 ml/Kg before doxorubicin (DOX) treatment clearly attenuated the cardio toxicity. The oxidative damage to the heart contributes to the myocardial toxicity induced by DOX in male rats. These effects might be limited by the use of sesame oil. The protective effect of sesame oil may be due to its antioxidant properties (13).

Sesamin has been reported to inhibit desaturase activity, an enzyme that converts dihomo γ-linolenic acid (DGLA, 20:3, n-6) to arachidonic acid (AA, 20:4, n-6) (32). The inhibition of Δ5 desaturase activity results in accumulation of dihomo γ-linolenic acid whereas arachidonic acids are decreased, which also reduces the formation of pro-inflammatory mediators including prostaglandin PGE2, Tumor Necrosis Factor-α (TNF-α), Interleukin-6 and Interleukin-10 in mice (33). Thus, these studies imply that sesame lignans may affect the inflammatory pathway.

Animal studies have suggested that sesame lignans reduce cholesterol levels by both by inhibiting absorption and by decreasing synthesis of cholesterol (34, 35). Sesamin supplementation significantly reduced the concentration of serum cholesterol in rats fed a cholesterol-enriched diet; moreover, a significant reduction in the activity of liver microsomal 3-hydroxy-3-methylglutaryl Coenzyme A reductase (HMG-CoA reductase), the rate limiting enzyme of cholesterol synthesis in liver was observed (35). Additionally, sesamin can play a role as a transcriptional factor that regulates gene expression, sterol regulatory element binding proteins (SREBPs) which are membrane-bound transcriptional factors of the basic-helix-loop-helix-leucine zipper family, relating to cholesterol biosynthesis and LDL receptors, as well as fatty acid synthesis (34-36). SREBP-1 is mainly involved in the gene expression of enzymes in fatty acid synthesis and SREBP-2 regulates the gene expression of enzymes involved in cholesterol synthesis and the LDL receptor (36, 37). Dietary sesamin remarkably decreased not only mRNA of HMG-CoA reductase and LDL receptor, but also mRNA level and protein content of SREBP-1 in rat liver (34).

Furthermore, sesame lignans increase peroxisomal and microsomal hepatic fatty acid oxidation through increased gene expression of hepatic fatty acid oxidation enzymes in vivo in animal models (38-42). The mechanism of peroxisome proliferators-activated receptor (PPARα) regulation of gene transcription has been proposed (36, 43), which is that PPAR binds DNA at direct repeats as a heterodimer with retinoid X receptor (RXR). In the unliganded state, this complex binds co-repressor proteins while in the liganded state, the co-repressor complex is replaced by a co-activator complex. This leads to a conformational change and promotes gene activation. These findings indicate that sesamin or other sesame lignans may act as a ligand for SREBP and PPARs.

PHYSIOLOGIC EFFECTS OF SESAME OIL

The consumption of sesame seed or pure sesame lignans has been shown in vitro and in vivo to have diverse physiological functions, which may include antihyperpertensive and hypcholesterolemic effects. Consumption of sesame lignans
Nutraceutical Value of Sesame Oil

or sesame oil has been shown to lower blood pressure in several types of hypertensive animals and humans. A clinical trial in hypertension patients on treatment with nifedipine, an antihypertensive drug has demonstrated that the group that consumed dietary sesame oil had significantly lowered blood pressure compared with a group with nifedipine alone or other dietary oils (29). This study indicates that sesame oil may have potential effects on drug metabolism in humans. Sesamin metabolites containing a dihydroxyphenyl (catechol) structures have potent radical scavenging activities in vitro (8). It has been suggested that sesamin metabolites modulate the vascular tone and contribute to the in vivo antihypertensive effect of sesamin by inducing an endothelial nitric oxide-dependent vasorelaxation (22). The study suggests that the enhancement of endothelium-dependent vasorelaxation induced by sesamin metabolites is one of the possible mechanisms of antihypertensive effects of sesamin (22).

Sesame lignans may affect blood lipids as well as lipid metabolism, acting as a hypocholesterolemic agent. The absorption of lymphatic cholesterol and fatty acids was highly inhibited and liver cholesterol levels were significantly lower in rats fed sesame oil diet (44, 45). Furthermore, the sesame oil diet significantly decreased levels of serum total cholesterol and LDL-cholesterol in rats (44). Sesamin supplements had similar effects on reducing the absorption of lymphatic and serum cholesterol in rats; moreover, a significant reduction in the activity of liver microsomal HMG-CoA reductase was observed (8). It has been suggested that sesamin metabolites modulate the vascular tone and contribute to the in vivo antihypertensive effect of sesamin by inducing an endothelial nitric oxide-dependent vasorelaxation (22). The study suggests that the enhancement of endothelium-dependent vasorelaxation induced by sesamin metabolites is one of the possible mechanisms of antihypertensive effects of sesamin (22).

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3,4-Methylenedioxyxenol (sesamolin) is one of the sesame oil lignans with a high anti-LPO effect. Sesamol dose-dependently reduced serum LPO endotoxin-challenged rats, decreased hydroxyl radical and peroxynitrite, but not superoxide anion counts, increased the activities of superoxide dismutase, catalase, and glutathione peroxidase in endotoxin-treated rats, reduced nitric oxide (NO) production and inducible NO synthase expression, and attenuated hepatic and renal injuries induced by endotoxin in rats. We concluded that sesamol might protect against organ injury by decreasing NO-associated LPO in endotoxemic rats (66).

CONCLUSION

Sesame seed oil, which is low in saturated fat and high in polyunsaturated and monounsaturated fats, is an ideal cooking medium for a heart saving diet plant. The antioxidants in sesame seed oil, viz., sesaminol, sesamolin and sesamolinol protect fats from being oxidized. Sesaminol maintains the so-called bad cholesterol low-density lipoproteins in an unutilized state which prevents arteriosclerosis. Sesamin also helps maintain Normal Blood Pressure. It helps regulate the body's immune and auto immune system balance. It inhibits a set of regulating compounds, which cause inflammation, clotting and other immune imbalances that contribute to disorders such as heart disease and autoimmune joint disorders. This review shows the evidence that the sesame oil was useful in the treatment of all acute and chronic diseases as dietary supplement. With the present evidence further research work is required to bring the sesame oil as nutraceutical drug.

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LPO-Lipid Peroxidation, LDL-Low Density Lipoprotein, RSC-Radical Scavenging Capacity, GPx-Glutathione Peroxidase, SOD-Superoxide Dismutase, DOX-Doxorubicin, TNF-α-Tumor Necrosis Factor-α, SREBPs-Sterol Regulatory Element Binding Proteins, HMG CoA-3-Hydroxy 3-Methyl Glutaryl Coenzyme, PPAR-Peroxisome Proliferator Activated Receptor, RXR-Retinoid X Receptor, HDL-High Density Lipoproteins, CYP-Cytochrome P450, APHP-Acyctaminophen, Pb + LPS-Lead blus Lopolysaccharide, NO-Nitric Oxide REFERENCES

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