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SESAME SEEDS: A PROMISING ANTI-DIABETIC AGENT

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Keywords:

Bioactive components, Lignans, Sesamin, Sisamol, Sesamolin, Sesaminol, Antidiabetic

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ABSTRACT: The day-by-day escalation of different diseases worldwide increases the demand for newer drugs with better therapeutic effects. Nature attracts researchers due to its rich herbal sources with potent effects against various diseases. Sesame seed acts as a reservoir for various bioactive components, exhibiting tremendous beneficial effects on human health. Sesame seed is not just only seeds that are consumed by the different parts of India but also plays an important into the lives of different communities, in their culture, and in the traditional system of medicine. Lignans are the major bioactive components of sesame seed reported to have many properties such as anti-diabetic, antioxidant, anticancer, and anti-inflammatory activities. Because of the oxidative coupling of β-hydroxyphenyl propane, different lignans are formed, such as Sesamin, Sisamol, Sesamolin, sesaminol. Due to the presence of multifarious bioactive components in sesame seeds, such as phenolic components, flavonoids sesame seeds bear a possibility to be an agent in controlling diabetes and hyperlipidemia by decreasing oxidative stress and inflammatory responses. This review focuses on the functional importance of lignans &in future scientific studies, clinical testing of the Sesame liganans in diabetic patients could provide plenty of opportunities and possibilities to the researchers.

INTRODUCTION: The day-by-day escalation of metabolic disorder such as Diabetics creates a global warning which leads to intensive research for the development of a magic bullet to produce the required therapeutic effect. The recent data expressed that by the year 2030, near about 366 million of the world population will suffer from type-2 diabetes. The current scenario of India is also in a state of bother due to the frequent rises in the case of diabetic people. In India, the estimated patient will be around 60.9 million by the end of year 2025 [1].

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The major complications of Diabetics, such as diabetic neuropathy, retinopathy, and foot ulcer, arise due to the abnormal metabolic pattern leading to increased blood-gluco-lipid profile (hyperglycemia). The chronic abnormal metabolic pattern occurs due to the insufficient production of Insulin (People with type-1 diabetes) and body resistance towards the action of insulin (type-2 Diabetics).

Nowadays, it's quite a challenge to manage diabetics and improve the life quality of the population. Changing the lifestyle habits of the population can be a way to manage Diabetics along with the medication. Herbal medicine always plays a phenomenal role in the treatment of various diseases. Different parts of the sesame plants are used for their ethnomedical importance worldwide. The current study mostly focuses on sesame components' use in managing diabetics.

Methodology: Selection of the topic and the related information was collected purely based on scientific research. The important keywords and the data were collected from the different research journals evaluating the activities of sesame against diabetes. The analysis and the discussion of the activities of the sesame to act against diabetes, is based on the results of the research journals.

Botanical Aspect:
Plant: *Sesamum indicum.*

Family: *Pedaliaceae.*

Genus: *Sesamum L.*

Species: *Sesamum indicum L.*

Synonyms: *Sesamum africanum Tod., Sesamum Orientale L., Dysosmum amoenum Raf.*

Local name: Tilmi, Til, Ellu, Woellu, Chitrallu.

Bioactive Components of Sesame Seeds: Earlier reports on *in-vivo* and *in-vitro* model, it was found that bioactive compounds abundant in plant seeds exhibited remarkable anti-proliferative, anti-diabetic potential. These components are available in black seeds, castor, citrus, cucurbita's, job's tear, grapes, cuscuta, givotia, passifloraa, sesame *etc*.

Lignanas such as Sesamin, Sesaminol, sesamol, sesamolin; flavonoids - naringin, hesperidin; tocopherols- α-tocopherol and β- tocopherol; linoleic acid, oleic acid, stearic acid, palmitic acid; phenolics such as ferulic acid, vanillic acid which are key components of sesame seeds exhibiting most potent anti-proliferative and anti-diabetic activity in *in-vitro* and *in-vivo* studies [3, 4].

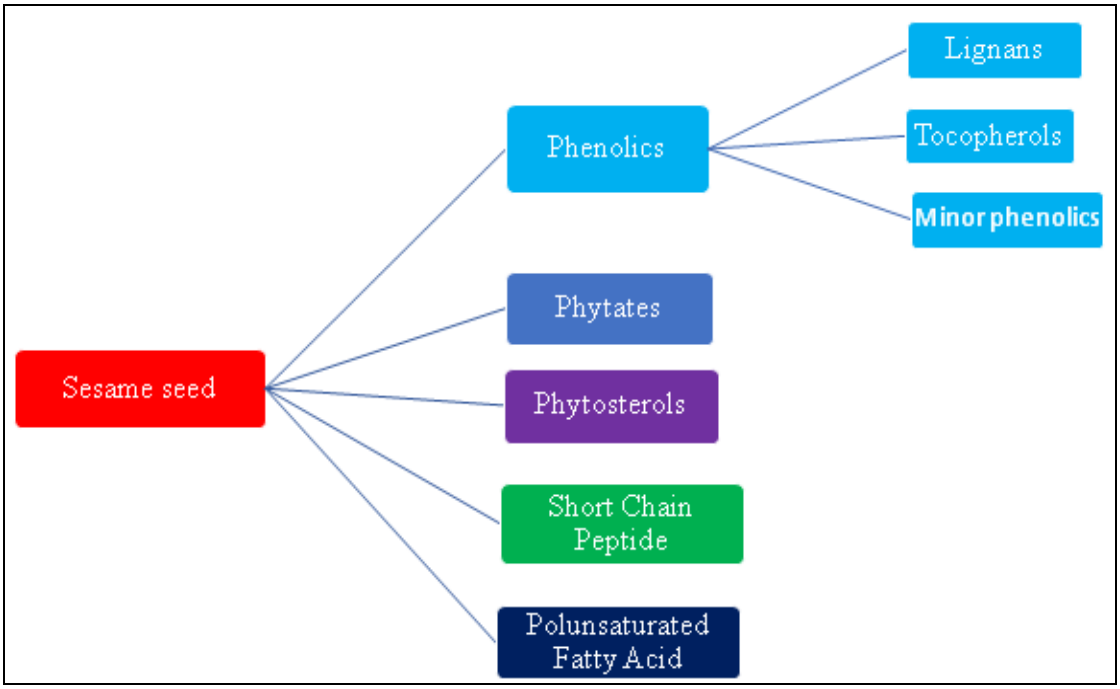

FIG. 1: COMPONENTS OF SESAME SEEDS

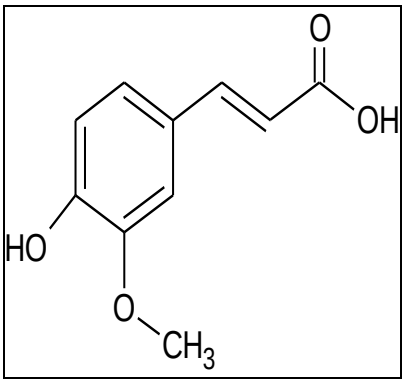

FIG. 2: FERULIC ACID

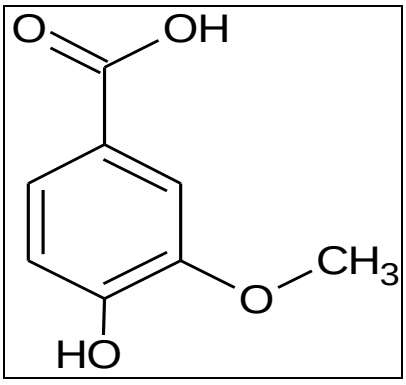

FIG. 3: VANILLIC ACID

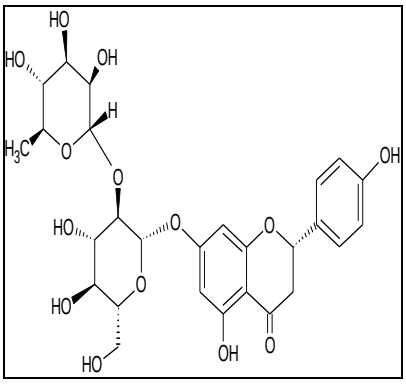

FIG. 4: NARINGIN

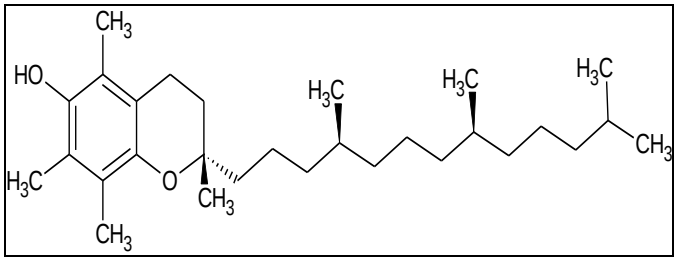

FIG. 5: A-TOCOPHEROL

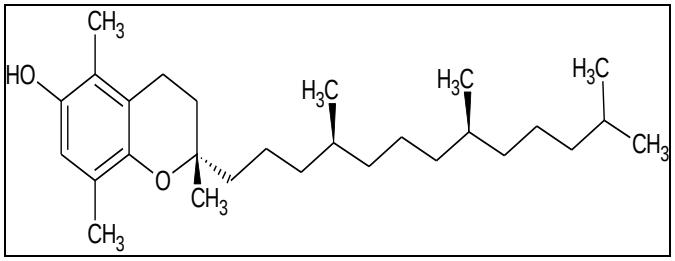

FIG. 6: B- TOCOPHEROL

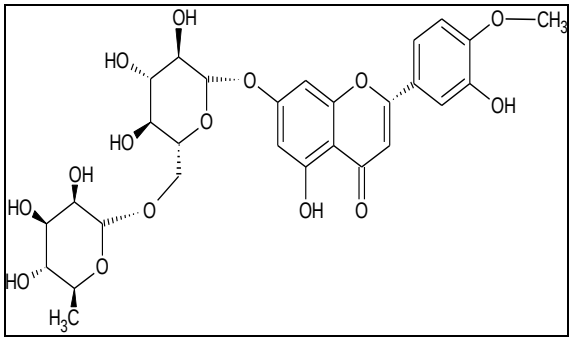

FIG. 7: HESPERIDIN

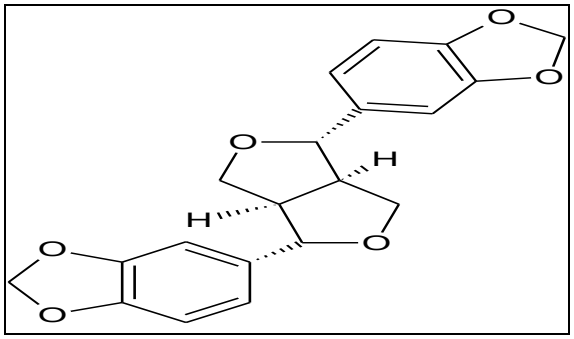

FIG. 8: SESAMIN

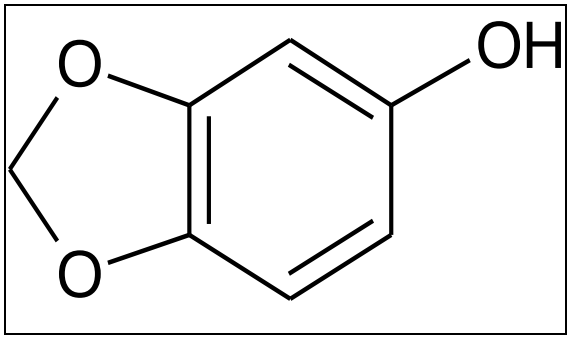

FIG. 9: SESAMOL

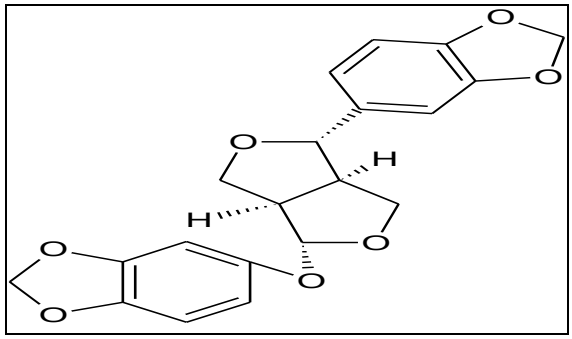

FIG. 10: SESAMOLIN

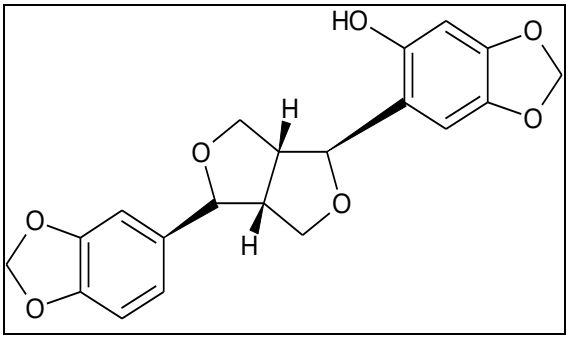

FIG. 11: SESAMINOL

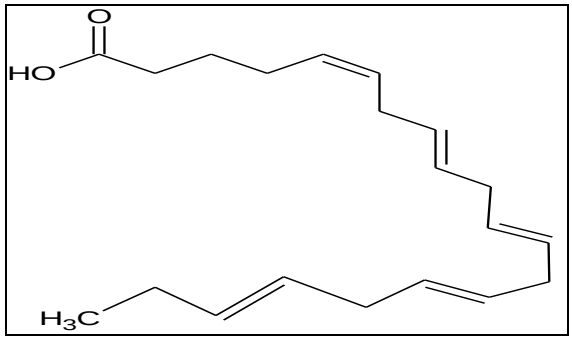

FIG. 12: LINOLEIC ACID

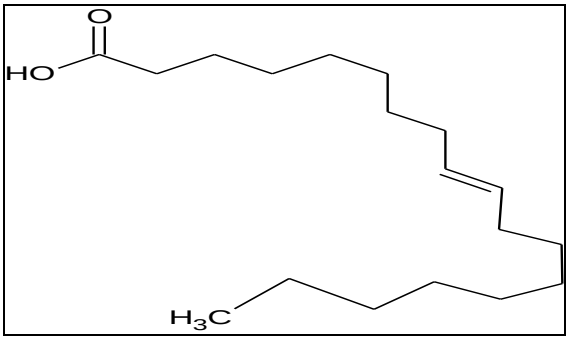

FIG. 13: OLEIC ACID

FIG. 2 TO 13: KEY BIOACTIVE COMPONENTS OF SESAME SEED

RESULTS:

Anti-diabetic Property of Sesame Seeds: Nature always holds the key to everything. Most of the abundant bioactive components of sesame seeds expressed anti-diabetic activity. Amongst them, the lignans are the most potent ones. A study carried out by a researcher at 2019, reported that some of the newly synthesized flavonolignans inhibit the α-glucosidase in diabetic rats [10]. The dark and white sesame seed extracts lower the blood glucose levels in diabetic rats. By giving 12% of white sesame oil for a period of time the blood glucose levels of rat's decrease. Another study also revealed that sesame oil consumption for 3 months leads to the decrease in both HbA1c & blood glucose levels in patients suffering from type-2 diabetes [7]. The different bioactive components such as sesamin and sesaminol are expected to decrease blood glucose levels in in-vitro anti-diabetic activities significantly.

Linoleic acid, oleic acid, palmitic acid present in sesame oil reduces blood glucose levels [9]. Another study reported that synthesized furofuran lignans reduced blood glucose levels & also act as potent anti-oxidants [6]. Sesamin & episesamin modulates the body cholesterol levels by interfering in the absorption & metabolism of cholesterol [11]. A component of defatted sesame +-Pinoresinol exhibits α-golucosidase inhibition in diabetic rat [12]. Sesame oil as a constituent of edible oil for hypertensive diabetic patients reduced sodium levels, increased potassium levels & also reduced plasma glucose levels. The combination therapy of sesame oil and glibencamide in type-2 diabetes patients shows better therapeutic effects with 36% reduction in blood glucose levels [13]. n-butanol extract of the black sesame seeds inhibits the α-golucosidase enzyme in the *in-vitro* study [15]. Another study expressed that combination therapy of synthetic agents and sesame seeds components proves therapeutically more beneficial [16].

2. Sesame Seed against COVID-19: In the development of a new drug for COVID-19, *In-sillico* studies of sesame against the different proteins of COVID-19 produces some promising results. Screening of the sesame's bioactive components using the *In-sillico* method results in a potent property against COVID-19. By preventing viral replication by forming a drug-protein complex, sesame phytoconstituents such as sesamin, sesamol, sesaminol, sesamolin, and sesamolinol emerge as the potential inhibitor of SARS-CoV-2. The M^{Pro} protein of SARS-CoV-2 inhibition leads to a way of controlling COVID-19 [18]. Sesame seed is an important constituent of the diet that boosts the patient's immune system during the COVID-19 infection.

In *in-sillico* study, it's proved that viral activity is inhibited by sesamin after interaction with the active site's residue Cys 145 of the SARS-CoV-2 virus. Also, the oil, after application decreases the risk of infection by entrapping the virus during breathing. In India, the Ministry of Ayush 2020 released some guidelines that advise that sesame oil decreases the infection risk& hence can be used during the infection (3). Zn, a mineral abundant in sesame, is important for inhibiting SARS coronavirus RNA-dependent RNA polymerase (RdRp) [17]. M^{Pro}, PL^{Pro}& RdRp are the important sites for viral replication, but sesame binds with these sites and forms a stable complex resulting in the inhibition of viral infection [19]. According to the *in-sillico* studies reports of the sesame components, it can be said that it has great potential to be a new lead against COVID-19, but further advanced research is required to establish the drug.

TABLE 1: OTHER POTENT ACTIVITIES OF SESAME SEED

Other activities of Sesame Seed				
Plant	**Component Category**	**Component**	**Activity**	**Reference**
Sesame (*Sesamum Indicum*)	Lignans	Sesamin	Promote Lipid & glucose Metabolism Anti-hypertensive Free-radical scavenging Inhibition of cholesterol biosynthesis & absorption Neuroprotection Decrease the cardio-vascular risk	4,12,17,20,21
		Sesamolin	Anti-proliferative Suppress the ROS (Reactive Oxygen Species) generation	

	Sesamol	Anti-oxidant Inhibit LDL oxidation Inhibit Lipid peroxidation
	Sesaminol	Inhibit Oxidative damage
	Pinoresinol & other minor phenolics	Inhibit LDL oxidation Inhibit Lipid peroxidation

DISCUSSION: The demands for herbal drugs increase day by day around the world. This includes low toxic effects, low cost, patients' acceptability, greater therapeutic effects etc. With this increase in demand, sesame bears the possibility to evolve as an important therapeutic applicator with so much of potential to act against different disease conditions.

Advanced studies such as *in-vitro, in-vivo,* and clinical trials with the sesame are required to formulate the dosage form of the sesame in the near future. Hence, this area provides lots of challenges and opportunities for further future research of sesame seeds as anti-diabetic drug.

CONCLUSION: Tailoring the new drugs along with the daily demanding circumstances is a continuous process. Traditionally, *Sesamum indicum was* used from earlier days in the management of haemorrhoids, diuretic, ulcer, amenorrhoea, for inducing labour, asthma. Combining the traditional knowledge of sesame with the modern pharmacological investigation could be a promising way to manage several diseases, including diabetes. This review mainly emphasizes the therapeutic properties of the sesame seeds components in diabetes and the possibility against COVID-19.

Also, the bioactive compounds exhibit antioxidant effects on various conditions caused by oxidative stress. The advanced study such as structure-activity relationship (SAR), pharmacokinetics, bioavailability & MOA of compounds presented in the extracted samples could provide insights into the reported pharmacological activities. The anti-diabetic effects of sesame showed *in-vitro;* however, clinical trials & more precautionary safety measures are required to determine the toxic effects on long-term human application.

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CONFLICT OF INTEREST: The author declares no conflict of interest, financial or otherwise.

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