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The Antihyperglycemic Potentials of *Ocimum Gratissimum – A Review*

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ABSTRACT

Hyperglycemia, characterized by high blood glucose levels, is a key feature of diabetes mellitus. This review emphasizes on the potential of *Ocimum gratissimum* as a natural remedy for managing hyperglycemia and its associated complications. The study reviewed the pharmacological properties of *Ocimum gratissimum*, including its chemical composition and potential mechanisms of action. Preclinical studies exploring the antihyperglycemic effects of *Ocimum gratissimum* in animal models were examined. The findings indicated that *Ocimum gratissimum* demonstrated significant reductions in blood glucose levels and improvements in insulin sensitivity. However, further research, particularly well-designed clinical trials, is needed to validate its antihyperglycemic efficacy, determine optimal dosage, and assess long-term safety in humans. Overall, *Ocimum gratissimum* holds potential as a complementary therapy for managing hyperglycemia, offering new possibilities for diabetes management.

INTRODUCTION

One of the medicinal plants with the potential to be used as a novel medication source or as an alternative therapy for the treatment of a number of illnesses is *Ocimum gratissimum* L., also known as scent leaf. It is a common perennial herbaceous plant with a potent aroma that is also commercially viable. It can be found in Africa, Asia, and South America and is a member of the Lamiaceae family (Akara et al., 2021). Ocimum the plant has been reported to have numerous health benefits, including antimicrobial, anti-inflammatory, antioxidant, and anticancer properties. The leaves, stems, and essential oils of the plant are used in the treatment of various ailments including colds, headaches, stomach disorders, and infections (Okigbo & Mmeka, 2006).

Figure 1: *Ocimum gratissimum* plant

PHYTOCHEMICAL PROPERTIES

Ocimum Gratissimum is known to contain various bioactive compounds. These include:

Essential Oils: The plant is known for its strong aromatic properties, which are largely due to its essential oil content. The composition of the essential oil can vary depending on the plant's geographical location and other factors. However, common components of the essential oil include eugenol, thymol, and various terpenoids. Eugenol gives the plant its characteristic clove-like aroma (Santana et al., 2013).

The essential oil of *Ocimum gratissimum* is rich in eugenol, a compound that gives the plant its characteristic clove-like aroma and contributes to its antimicrobial properties (Santana et al., 2013).

Flavonoids: Flavonoids are a group of plant metabolites thought to provide health benefits through cell signaling pathways and antioxidant effects. These molecules are found in various fruits and vegetables, and *Ocimum gratissimum* is no exception (Oboh et al., 2016).

Phenols: These are another group of chemical compounds that often have antioxidant properties. The total phenolic content in *Ocimum gratissimum* leaves has been associated with its antioxidant activity (Oboh et al., 2016).

Tannins: Tannins are a class of astringent, polyphenolic biomolecules that bind to and precipitate proteins and various other organic compounds. They are found in many species of plants, including *Ocimum gratissimum*.

Saponins: These are phytochemicals that can produce a soap-like foaming when shaken in aqueous solutions. Saponins have been found in various parts of the *Ocimum gratissimum* plant (Okoli et al., 2007).

The presence and concentration of these components can however vary based on several factors, including the plant's growing conditions, harvest time, and the part of the plant used (leaf, stem, flower, etc.).

DIABETES MELLITUS

Diabetes mellitus, commonly known as diabetes, is a chronic metabolic disease characterized by high levels of glucose in the blood (hyperglycemia). This results from defects in insulin production, insulin action, or both. Insulin is a hormone produced by the pancreas that regulates the amount of glucose in the blood. Diabetes can lead to serious health complications if not managed properly, including heart disease, stroke, kidney disease, and nerve damage (Silva, 2018).
There are primarily two types of diabetes:

Type 1 Diabetes: Also known as insulin-dependent diabetes, this type typically develops in childhood or adolescence but can also occur in adulthood. In type 1 diabetes, the body's immune system destroys the insulin-producing cells in the pancreas, leading to insulin deficiency. People with type 1 diabetes need to take insulin daily to survive (Atkinson et al., 2014).

Type 2 Diabetes: This is the most common form of diabetes, accounting for about 90% of all cases. It mainly occurs in adults, but it's increasingly being

diagnosed in children and adolescents. Type 2 diabetes is characterized by insulin resistance, where the body's cells become less responsive to insulin. Over time, the pancreas may also produce less insulin. Type 2 diabetes is strongly associated with obesity, physical inactivity, poor diet, and a family history of diabetes (Chatterjee et al., 2017).

A third type, gestational diabetes, occurs in some pregnant women and typically resolves after childbirth. However, women with gestational diabetes have an increased risk of developing type 2 diabetes later in life.

PREVALENCE OF DIABETES

Diabetes mellitus is a significant global health concern, with the prevalence of the disease increasing dramatically in recent decades. The International Diabetes Federation (2021) estimated that approximately 463 million adults (20-79 years) were living with diabetes worldwide in 2019. This number is projected to rise to 700 million by 2045.
The prevalence of diabetes varies widely across different regions and populations. Factors contributing to these differences include age, genetic susceptibility, lifestyle, diet, and socio-economic factors.

Regional variations: The Western Pacific region, which includes countries like China and Japan, had the highest number of people with diabetes in 2019, according to the IDF. However, the prevalence of diabetes was highest in the North America and Caribbean region.

Age: The IDF reports that the global prevalence of diabetes is higher in adults over 65 years, affecting over 136 million people in this age group in 2019.

Sex: The prevalence of type 2 diabetes mellitus is increasing in both sexes, but men are usually diagnosed at a younger age (Kautzky-Willer *et al*., 2023).

Education: In both genders, there is a clear educational gradient in the diabetes prevalence with the lower educated bearing the greater burden of disease. Therefore, the lower the education level, the greater the diabetes prevalence (Bartolini *et al*., 2020).

Type of diabetes: The vast majority of people with diabetes have type 2 diabetes, which is closely linked to obesity and physical inactivity. Type 1 diabetes, which is generally diagnosed in children and young adults and is not linked to lifestyle factors, is much less common.

It's important to note that a significant number of people with diabetes are undiagnosed. The IDF estimated that around 232 million people, or half of all people living with diabetes in 2019, were unaware of their condition.

TREATMENT OF DIABETES MELLITUS

Treatment for diabetes involves lifestyle modifications (healthy diet, regular exercise, weight management) and medication (Marín-Peñalver et al., 2016). People with type 1 diabetes require insulin therapy, while those with type 2 diabetes may be treated with oral medications, insulin, or other injectable medications. Blood glucose monitoring is crucial for managing diabetes. There is currently no cure for the condition.

STUDIES ON THE ANTIHYPERGLYCEMIC ROLES OF OCIMUM GRATISSIMUM

Several studies have shown that *Ocimum gratissimum* possesses various pharmacological properties which includes anti-anaemic, hepatoprotective (Akara et al., 2021), anti-hypertensive (Shaw et al., 2017), antifungal (Mohr et al., 2017), and anti-oxidative properties (Joshi, 2013), etc. Regarding its role in diabetes, some studies have also shown the anti-hyperglycaemic (Casanova et al., 2014) effect of *ocimum gratissimum;* though the majority of these studies have been conducted in animal models or in vitro, not in human clinical trials.

A study conducted by Okoli et al. (2007) showed that aqueous extracts of *Ocimum gratissimum* leaf reduced blood glucose levels in rats with induced diabetes. The study suggested that the plant could be beneficial in managing diabetes and its complications.

From a study by Mohammed et al., (2007), the hypoglycemic effects of the aqueous leaves extract of O. gratissimum were examined in streptozocin-induced diabetic rats, A single dose of 250, 500, or 1000 mg/kg body weight of the extract was given. After 24 hours of extract administration, the diabetic rats' blood glucose levels were considerably (P 0.05) reduced by 81.3% by the aqueous extract at a dose of 500 mg/kg. Reducing sugars, cardiac glycosides, resin, tannins, saponins, glycosides, flavonoids, glycerin, and steroids were all found during the preliminary phytochemical screening. The computed median lethal dose (LD50) for rats was 1264.9 mg/kg body weight. *O. gratissimum* leaf extract was found to have antidiabetic action in streptozocin-induced diabetic rats.

Another study by Oyedemi et al. (2012) showed that the aqueous leaf extract of *Ocimum gratissimum* has a protective effect on the pancreas of diabetic rats. This study suggested that the extract could be a potential source of natural antioxidants for the management and/or prevention of diabetes. Likewise, Adisa et al. (2013), found that *Ocimum gratissimum* leaf extracts exhibited anti-diabetic activity in diabetic rats, potentially through the regeneration of pancreatic beta

cells (which produce insulin) and the inhibition of glucose absorption in the intestines.

More recently, in a study by Shimada et al., (2019), mice subjects were co-administered with *O. gratissimum* leaf extract, and an oral starch and glucose treatment, the result showed that there was a prevention of the rise in postprandial blood glucose levels. This suggested that one of the potential mechanisms underlying the anti-hyperglycemic effects of the leaf extract of *O. gratissimum* could be the inhibitory action on sodium-dependent glucose transporter (SGLT1).

CONCLUSION

Several preclinical studies have explored the antihyperglycemic effects of *Ocimum gratissimum*. These studies have demonstrated promising results, showcasing the potential of the plant as a complementary therapy for diabetes management.

Despite these promising findings, the evidence regarding the antihyperglycemic effect of *Ocimum gratissimum* remains limited. Currently, there is a lack of clinical studies evaluating its efficacy and safety in humans. Therefore, further research is necessary to validate the potential of *Ocimum gratissimum* as a therapeutic agent for diabetes management. The future research should focus on conducting well-designed clinical trials to evaluate the antihyperglycemic efficacy, safety, and optimal dosage of *Ocimum gratissimum* in humans. These trials should include diverse populations, considering factors such as age, gender, and diabetes type.

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