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Study on Medicinal Plants for Antidiabetic Effects in Cataract Patients

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Abstract:

This analytical study aims to investigate the potential antidiabetic effects of medicinal plants in the context of cataract development, comparing outcomes between diabetic and non-diabetic individuals. Diabetes is a known risk factor for cataract formation, and exploring the efficacy of medicinal plants in managing diabetes-associated cataracts is of significant interest. The research involves a comprehensive analysis of various medicinal plants with documented antidiabetic properties, assessing their impact on cataract progression in diabetic and non-diabetic subjects. The study employs both clinical and biochemical parameters to evaluate the effectiveness of these medicinal plants in mitigating cataract development, shedding light on their potential as adjunctive therapeutic interventions in diabetic eye complications.

Keywords: cataract, diabetes mellitus, oxidative stress, superoxide dismutase enzyme.

Introduction

Diabetes mellitus represents a global health concern, affecting millions of individuals and contributing to various complications, including ocular manifestations such as cataracts. Cataracts, characterized by the clouding of the eye's natural lens, are a prevalent cause of visual impairment and blindness, with diabetes being a well-established risk factor for their development. The intricate relationship between diabetes and cataracts necessitates a deeper understanding of potential interventions that can address both conditions simultaneously. In recent years, there has been a growing interest in exploring the therapeutic potential

of medicinal plants in managing diabetes and its associated complications. Numerous plants have been recognized for their antidiabetic properties, exhibiting effects such as improved glucose metabolism and enhanced insulin sensitivity. This analytical study seeks to investigate the impact of medicinal plants on cataract development in diabetic individuals, comparing their effects with non-diabetic counterparts.

Diabetes-induced cataracts result from the accumulation of sorbitol within the lens, oxidative stress, and inflammation. Managing diabetes is essential in preventing and slowing the progression of cataracts.

Medicinal plants, traditionally acclaimed for their diverse pharmacological properties, offer a promising avenue for integrated therapeutic approaches. Understanding the antidiabetic effects of medicinal plants and their influence on cataract progression is crucial for developing comprehensive strategies to manage diabetes-associated eye complications. This study aims to bridge the gap in current knowledge by conducting an analytical investigation into the efficacy of selected medicinal plants in both diabetic and non-diabetic cataract patients.

This study's findings could contribute to the development of novel therapeutic strategies for managing diabetes-associated cataracts. By elucidating the antidiabetic effects of medicinal plants and their impact on cataract progression, the research aims to provide valuable insights for clinicians, researchers, and individuals seeking holistic approaches to diabetes care. In summary, this analytical study endeavors to unravel the potential of medicinal plants as antidiabetic agents with implications for cataract management, offering a comprehensive perspective on the interplay between diabetes, medicinal plants, and ocular health.

Literature Review

Chintha Lankatillake (2019) Overeating and a lack of exercise have led to a worldwide pandemic of Type 2 Diabetes Mellitus. Although current treatments are helpful, they do have certain drawbacks. There is an urgent need for safer, more efficient, and more cost-effective alternative therapies because to these constraints, the alarming rise in diabetes prevalence, and the increasing expense of controlling diabetes and its consequences. There are about 1200 plant species that have been documented in ethnomedicine as being used to treat diabetes, making them a potentially valuable resource for the discovery of new antidiabetic chemicals. Analytical

biochemistry techniques for isolating and identifying lead chemicals are essential to the process of assessing medicinal plants for desired bioactivity. The purpose of this article is to serve as a reference for newcomers to the field of antidiabetic plant research by providing a detailed explanation of the current methodologies employed in this area. This review provides a concise summary of the current state of knowledge regarding blood glucose regulation and the general mechanisms of action of current antidiabetic medications, as well as a synthesis of information regarding common experimental approaches for screening plant extracts for antidiabetic activity and the current analytical methods and technologies for the separation and identification of bioactive natural products. approaches for assessing the antidiabetic benefits of plants are described, including cell-based bioassays for screening insulin secretagogues and insulinomimetics as well as more common in vivo animal models, in vitro models, in silico approaches, and biochemical tests. The use of molecular docking and enzyme inhibition tests are also emphasized. The importance of metabolomics, metabolite profiling, and data dereplication in the rapid identification of new diabetes treatments is discussed. Finally, the roles of nuclear magnetic resonance and high-resolution liquid chromatography-mass spectrometry in the dereplication, putative identification, and structure elucidation of natural compounds from evidence-based medicinal plants are summarized.

June Milind Wagh (2023) Diabetes-induced One possible cause of blindness in both developed and developing nations is cataract. Recent fundamental analyses have highlighted the polyol pathway's function in the disease process's early stages. Additionally, a cataract caused by diabetes has been documented. The risk factors for developing cataracts have been laid out

thanks in large part to demographic research, which have also expanded our knowledge of the correlation between polygenic illness and cataract genesis. Complications from phacoemulsification cataract surgery are more common in diabetic individuals than in the general population. Antioxidants and aldose-reductase inhibitors have shown promise in preventing or treating this potentially blinding disease in *in vitro* experiments. When it comes to treating and preventing diabetes complications, inhibitors of simple sugar enzymes are crucial. Natural, herbal, and naturopathic pharmaceuticals are increasingly being used since they have more therapeutic potential and less side effects compared to conventional medicine and ayurvedic medications. This study sheds light on the research and development of an ocular formulation (Eyedrop) that uses a standardized extract of a spice because it is simple, sterile, safe, and an alternative to phacoemulsification. Diabetic cataracts may be prevented and treated with the use of a newly developed eyedrop that has been standardized by *in vitro* testing of a spice extract.

Bahare Salehi (2019) The prevalence and death rate from diabetes mellitus continue to rise, making it one of the world's leading health concerns. The health risks associated with improper blood sugar management are substantial. Traditional antidiabetic medications work, but they always come with some unwanted side effects. However, there is a possibility that medicinal plants might provide an additional supply of antidiabetic chemicals. Preclinical and clinical research on medicinal plants with antidiabetic potential are discussed. Each plant matrix's potential benefits are determined by the synergistic interaction of its unique profile of bioactive chemicals.

Ngan Tran (2020) Natural goods, such as those derived from living things, have been

found to be beneficial to animal and human health. The World Health Organization estimates that in underdeveloped countries, 80% of the population still relies on traditional medicines or folk medicines, most of which are produced from the plant, for illness prevention and treatment. Compared to current pharmaceuticals, traditional medicine made from plant extracts is safer, has fewer side effects, and is less expensive. There has been a lot of recent writing on how the pharmaceutical business may benefit from using the phytochemical components of medicinal plants. A wide variety of beneficial biological properties, such as antiallergic, anticancer, antimicrobial, anti-inflammatory, antidiabetic, and antioxidant, are attributed to plant-derived secondary metabolites, which are small molecules or macromolecules biosynthesized in plants and include steroids, alkaloids, phenolic, lignans, carbohydrates, and glycosides, etc. Hyperglycemia caused by metabolic abnormalities in pancreatic β -cells is the root cause of diabetes mellitus, a lifelong condition. Both insulin resistance and a lack of insulin synthesis in the pancreas may lead to hyperglycemia, although Type 1 diabetes mellitus is the more common form of the disease. Current diabetic mellitus treatments aim to normalize blood glucose levels in the vasculature by regulation and reduction of glucose production. However, most contemporary medications come with a plethora of side effects that may lead to major health issues while being treated. So, traditional medicines have been around for a while and serve a vital purpose as complementary therapies. Some of the novel bioactive compounds derived from plants in recent years have shown antidiabetic action with greater effectiveness than oral hypoglycemic medications used in clinical treatment. The clinical practice of traditional medicine has been successful, and it seems

to have a promising future in the treatment of diabetes mellitus. The World Health Organization has called attention to the importance of preventing diabetes and its consequences as a crucial step toward achieving universal health coverage. Therefore, the purpose of this study is to provide a short overview of the active chemicals and pharmacological effects of a selection of often used plants for the treatment of diabetes. Each species' morphological details from the V-herb database were also added.

Bioactive Compounds from Plants Having Type 2 Antidiabetic Activity

Momordica charantia (MC) is a popular vegetable across the tropics, especially in countries like Vietnam, India, China, East Africa, South and North Asia, and Central and South America. Known as bitter melon or bitter gourd, this plant belongs to the family Cucurbitaceae (Figure 3). MC is often eaten as a vegetable, but it also has medicinal properties and is utilized in traditional medicine. Its anti-inflammatory, anti-oxidant, anti-viral, anti-cancer, anti-bacterial, anti-fungal, and, most notably, anti-diabetic properties. When tested on rats, gerbils, langurs, and humans, *Momordica charantia* consistently caused a hypoglycemic effect due to the presence of insulin-like proteins that are similar to human insulin in the plant's fruits, seeds, and callus. For hundreds of years, people in India and China relied on the idea that MC could cure diabetes mellitus. In recent years, several studies have been conducted on its hypoglycemic effects. Numerous studies have revealed that its bioactivities bring about a significant drop in blood sugar levels (Figure 4). The results of these studies showed that bitter melon may improve glucose tolerance not only in normal and diabetic mice, but also in people. Numerous studies demonstrated the significant

antidiabetic properties of MC's bioactive components.

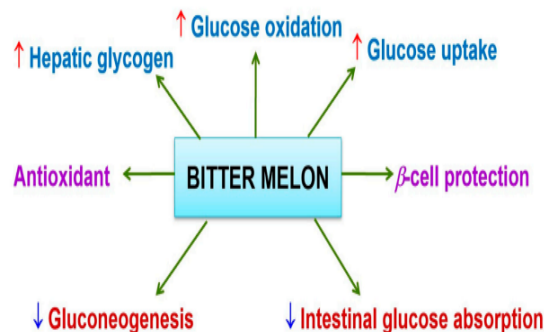


Figure 4: The mechanism in decreasing blood glucose levels of *M. charantia*.

Medicinal Plants as an Alternative Source of Antidiabetic Agents

In the future of medicine development, natural goods, especially those derived from plants, will be mined for their potentially useful active ingredients. Plant-based preparations are the major essential player of all current medicines, particularly in rural regions, due to their ease of availability, cheap cost, and least negative effects. The bioactive compounds found in many plants have potent pharmacological effects without the risk of unwanted side effects. Many of the medications that are presently accessible, including those that are prescribed by doctors, were originally derived from plants. By providing a brief overview of botanicals' characteristics, a definition of the study, some examples of novel and a description of existing databases and highlighting the need for categorization of botanicals as useful tools for health research, Durazzo *et al.*'s recent review provides a current snapshot of the strict interaction between the main biologically active compounds in plants and botanicals.

Because of the high expense of standard diabetic medications, medicinal plants are increasingly being utilized to treat the disease, especially in underdeveloped nations. Flavonoids, terpenoids, saponins,

carotenoids, alkaloids, and glycosides are only some of the phytoconstituents found in medicinal plants that may have antidiabetic effects and are thus suggested for use in the treatment of diabetes and other disorders. This may be the first step toward comprehending the biological actions and beneficial activities of plants, as noted by Durazzo *et al.*, who also noted that the combined action of biologically active substances leads to the possible beneficial qualities of each plant matrix. Current methods for investigating phytochemical interactions may be broken down into three broad categories: (i) the creation of interaction model systems; (ii) the investigation of extractable and non-extractable compounds; and (iii) the characterization of extracts rich in biologically active compounds.

The rising prevalence of diabetes is a serious cause for worry in both the medical and general communities. Diabetic patients might sometimes find relief from their condition by using medicinal herbs rather than conventional antidiabetic medications. Therapeutic alternatives for the treatment of diabetes are limited but include herbal medications and plant components with low toxicity and no adverse effects. Studies consistently show that medicinal herbs with hypoglycemic qualities help diabetics control their condition. The mechanisms of natural products as antidiabetic agents were discussed, and compounds of high interest were highlighted, including fukugetin, palmatine, berberine, honokiol, amorfrutins, trigonelline, gymnemic acids, gurmarin, and phlorizin. Anti-diabetic, anti-hyperglycemic, hypoglycemic, anti-lipidemic, and insulin-mimetic activities have been identified in 81 plants native to Asian nations, and these plants have been classified and discussed in the present study by Bindu and Narendhirakannan.

Phytochemicals with Antidiabetic Potential

Since hundreds of millions of people throughout the world are looking for improved ways to control their diabetes, the discovery of novel natural antidiabetic medications might hold significant potential. In this context, the past several decades have seen development in the study of phytochemicals responsible for antidiabetic actions. Plant extracts, in either their combined or isolated form, have been studied for their potential anti-diabetic effects. Many different types of phytochemicals found in medicinal plants are being studied for their potential anti-diabetic properties. These include alkaloids, phenolic acids, flavonoids, glycosides, saponins, polysaccharides, stilbenes, and tannin. Phytochemicals' positive effects may be brought about in a number of ways. These include, but are not limited to, modulating glucose and lipid metabolism, increasing insulin secretion, activating cells, blocking the gluconeogenic enzymes, and protecting cells from reactive oxygen species (ROS).

Pharmacological Agents for the Treatment of Macular Edema Following Cataract Surgery

Leakage of fluid from perifoveal capillaries into the macular region's extracellular space is thought to be facilitated by proinflammatory prostaglandins. Topical nonsteroidal anti-inflammatory drugs (NSAIDs) have been shown to reduce the incidence, duration, and severity of cystoid macular edema by blocking the cyclooxygenase enzymes responsible for prostaglandin production. This is accomplished by preventing the release and breakdown of the blood-retina barrier.

Clinical studies have been performed lately to investigate the effectiveness of the topical NSAID nepafenac in lowering the

occurrence of macular edema after cataract surgery. Amfenac, the active metabolite, is formed from the prodrug by intraocular hydrolases in the retina, ciliary body epithelium, and choroid, and is then quickly absorbed through the cornea.

In a retrospective research, 240 patients treated with topical prednisolone for 4 weeks and 210 patients treated with prednisolone and nepafenac for the same time period were compared for the incidence of macular edema after uneventful phacoemulsification. Macular edema was more common in individuals given topical prednisolone alone, the investigators found, compared to those given nepafenac in combination.

Conclusion

Patients', families', and society's financial well-being are all thought to be negatively impacted by diabetes mellitus. In addition, diabetes may cause permanent vision loss, kidney failure, and heart failure if it is not managed properly. Studies on novel antidiabetic drugs are being conducted to address this issue. Traditional remedies have come to light as a result of the unintended consequences of contemporary therapy. Additionally, modern herbal extracts may be used with conventional medications to provide synergistic therapeutic effects. The active components in several herbs have been shown to reduce blood sugar levels and prevent diabetic complications. The separation, purification, and characterization of plant bioactive compounds will be the focus of future studies. With any luck, the data gathered in this review will be useful in diabetes care. In this article, we provide a comprehensive catalog of anti-diabetic plants culled from the Vietherb database. Anti-diabetic functional food and medication development may benefit greatly from the isolation and identification of bioactive phytochemicals from these plants.

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