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Review Article

Exploring the Interplay of Medicinal Plants and Animal Physiology: Impact on Blood Sugar Regulation and Positive Effects

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ABSTRACT

With this review we attempt to investigate the interesting interaction between those medicinal plants and animal physiology, focusing in particular on their effects on blood sugar control related to diabetes. By examining the interplay between these plants and animals, we can begin to understand how certain bioactive compounds found in medicinal plants may positively influence blood sugar levels. The paper focuses on the possible benefits of introducing these plants in diabetic patients' diet or therapy, offering an available way for natural and integrative approaches to prevent development of this disease. The review is directed on expanding our knowledge about the combination of natural products.

INTRODUCTION

Linking animal physiology and phytochemistry in drug research: where is Darwin the apothecary?

How medicinal plants are related to animal physiology has been well investigated and documented - particularly, as far as blood sugar and diabetes control is concerned. Medicinal plants and herbs have always been a critically essential ingredient in healthcare system of most developing countries such as Zimbabwe. This is all the more consequent when dealing with care and management of diseases such as diabetes mellitus [1].

As a result of changes in life style, diabetes mellitus is now more common in Zimbabwe and this has led to the increased use of traditional remedies for its management and control particularly amongst urban dwellers. In rural Zimbabwe, a vast sector of the community is no longer using medical medicine but they have turned to herbal medicines because it is less costly and that local tradition uses herbs [1].

There have been extensive studies in identifying antidiabetic properties of indigenous plants from Zimbabwe. These studies are aimed to screen the new plant based drugs which are effective in diabetes mellitus. It is also important to understand the pharmacological actions of the various plant extracts so as to design diabetic drugs that can be effective. Medicinal herbs are used to lower blood sugar in treatment of diabetes not only in Zimbabwe, but the entire Africa. Plant-based drugs for diabetes mellitus are, in large extent known to traditional healers and herbalists. Nevertheless, it is necessary to enhance their understanding of the active compounds in plant extracts and how they work [2].

Natural plant products are extensively used, but there are some problems with them. Some of such plants can have complex endogenous metabolites which may not be used as a therapeutic agent Another reason that plant drug is rejected includes the presence of compounds capable of producing cancer etc. Attention is also being paid to medicinal plants as possible alternatives because of safety concerns and drug resistance made against modern drugs [3].

More attention has been given to the human clinical trials of medicinal plants for diabetes therapy. These trials, conducted in nations like Malaysia and Thailand, have turned up some promising data. For example, some medicinal plants like Rosella flower, bitter melon, turmeric and garlic have been found to be effective in the treatment of diabetes by controlling blood glucose.

While some medicinal plants have demonstrated the potential to reduce HbA1c levels in type 2 diabetics—a marker of blood sugar control—additional research is still needed to verify their long-term impacts. In order to evaluate the effectiveness and safety of these plant derived anti-diabetic remedies, adequate trials with long term follow-up were needed [4].

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In summary, the association between animal physiology and medicinal plants has significant implications in diabetes for blood sugar control. Zimbabwe is among other African countries with a tradition of using medicinal plants and herbs in traditional medicine for centuries. Study of indigenous plants found in Zimbabwe has further revealed their antidiabetic potential. Nevertheless, more research is needed in orderto understand the full mechanisms behindthis,ensure these plant-extracted remedywere safe andefficacious..

HARNESSING THE POTENTIAL OF MEDICINAL PLANTS: A PROMISING PATH FOR DIABETES MANAGEMENT

Metabolic disorder, diabetes mellitus, leads to hyperglycemia by insulin deficiency or resistance. This lethal medical condition afflicts millions of people world over. While existing drugs are often used to manage and reduce blood glucose levels, they tend to come with a variety of side effects. On the other hand, traditional drugs from herbal sources have been in popular use for centuries apart, are believed to be easily available, clinically efficient and causing comparatively lesser side effects [5].

In recent decades, the medicinal plants have been interested for treatment of diabetes. Which would have phytochemical compounds, also known as bioactive compounds, which continue to provide a range of human health benefits. anti-inflammatory, antibacterial, anti cancer, ant allergic, anti oxidant and antidiabetic activities are some of these characteristics. It is now well known that some herbal and natural remedies, prepared from medicinal plants, possess hypoglycemic or antidiabetic activities. The mechanisms through which these plants act as hypoglyceamiant have also been extensively studied. In contrast to synthetic drugs, the employs of PHM in the treatment of diabetes is an alternative approach that may less toxic [6].

There are several reports on the identification of certain medicinal plants for anti-diabetic property. Details of some medicinal plants with antidiabetic, anti-hyperglycemic, anti-lipidemic and insulin mimetic actions have been tabulated in these reports. A number of 81 plants, Medicinal in each medicinal plant used for diabetes in Asia that have lost been proved to cure the diabetes problem.

Plants offer easily accessible as well as affordable solution for management of diabetes both in developed and developing countries. These herbs can also boost the immune system and effectively regulate blood glucose levels7. We still have much to learn about the use of medicinal herbs for managing diabetes. "This is still better than taking toxic man-made chemicals but its not really medicine because we have no idea what the active ingredients are," Dr Ammit said, suggesting that future work would focus on identifying which parts of these plants and their mechanisms lead to these medicinal effects.

Conclusively, medicinal plants have great potential in the management of diabetes both as preventives and curative agents. They have become desired replacements for conventional drugs due to their reduced side effects, better therapeutic efficiency and cost-effectiveness. Further studies are warranted to investigate the active compounds and mechanisms of these plants in order to find more antidiabetic chemicals that may contribute to diabetes treatment all over the world.

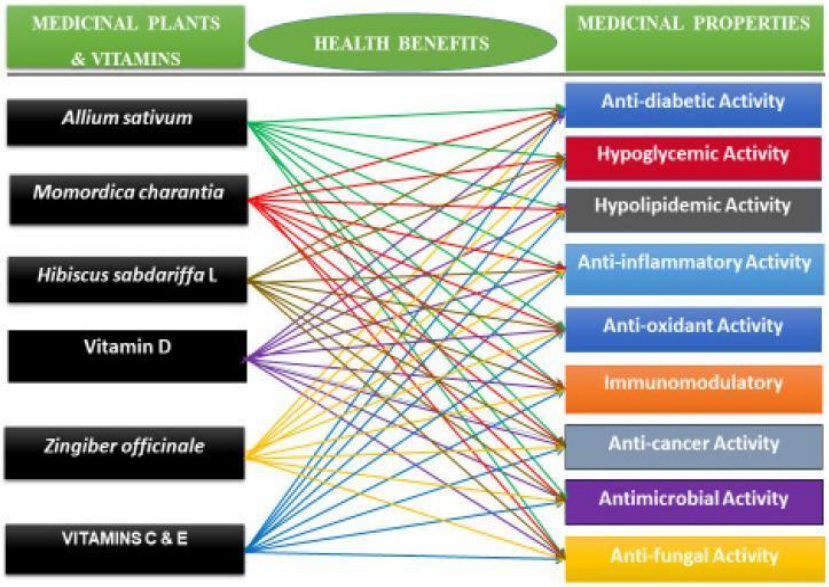

Figure 1. Allium sativum, Momordica charantia, Hibiscus sabdariffa L., Zingiber officinale, and Vitamins (C, D, and E) are listed in order of their medical value. The medicinal plants shown in Figure 2 include both traditional home medicines for diabetes prevention and/or treatment and common herbs that are used as functional foods all over the world [8].

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Table 2: Allium sativum, Momordica charantia, Hibiscus sabdariffa L.[9]

Medicinal Plants & Vitamins	Systems of action	Clinical Studies
Allium Sativum	By upregulating the gene expression of Caspase 3 and Caspase 9, reducing the levels of IL-1, IL-6, and TNF-, and increasing IFN- in both in vitro and in vivo experiments, Allium sativum is believed to aid in the treatment of diabetes while avoiding exploitation.	In a double-blind clinical trial involving diabetic patients, the consumption of 750 mg of garlic three times a day for a duration of 12 weeks demonstrated potential effects in the treatment of diabetes. This was achieved by reducing fasting glucose levels and subsequently decreasing hemoglobin A1c (HbA1C) levels in the blood.
Vitamin C	Vitamin C enhances the immune system by stimulating IFN synthesis, boosting lymphocyte proliferation, and enhancing neutrophil phagocytic activity, as reported in reference. Additionally, vitamin C intake is associated with reduced insulin resistance and the regulation of fasting blood glucose (FBG) and glycosylated hemoglobin A1c (HbA1C) levels.	Further clinical trials are needed to ascertain whether vitamin C has the potential to serve as an effective therapeutic agent for diabetes mellitus.
Momordica charantia	Momordica charantia can exert a hypoglycemic effect by modulating the main enzymes within the hexose monophosphate pathway. It has the capacity to stimulate or inhibit these enzymes. This modulation results in increased utilization of glucose by peripheral and skeletal muscle, decreased gluconeogenesis and adipocyte development, reduced glucose absorption in the intestine, stimulation of key enzymes within the hexose monophosphate pathway, inhibition of glucose uptake by the intestine, and normalization of islet cells.	Clinical trials are required (there have been few and infrequent Momordica charantia research for the treatment of diabetes).
Hibiscus sabdariffa	Hibiscus sabdariffa's powerful capacity to delay the breakdown of complex sugars into simple sugars, lessen the absorption of simple sugar, and lower total blood glucose is the basis for its mode of action.	Clinical trials are needed.
Vitamin D	Studies showed that Vitamin D promotes the conversion of proinsulin to insulin, increases insulin output, and enhances insulin action through the regulation of the calcium pool.	A randomized control double-blind intervention research found that diabetes individuals receiving 4000 IU of Vitamin D daily for six months had significantly improved insulin sensitivity compared to those receiving a placebo.
Vitamin E	In animal models and human studies, vitamin E consumption has been shown to inhibit LDL lipid peroxidation, prevent the oxidative stress related to the abnormal metabolic patterns associated with T2DM (hyperglycemia, dyslipidemia, and elevated levels of FFAs), and subsequently attenuate cytokine gene expression.	A recent study examined the effects of a vitamin C and vitamin E supplement on insulin sensitivity in healthy young men who were both untrained and trained over the course of four weeks. The study's authors came to the conclusion that the supplement may prevent the exercise-induced improvement of insulin resistance in humans.

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Medicinal Plants & Vitamins	Systems of action	Clinical Studies
Zingiber Officinale	Patients with diabetes who consumed 2 g of ginger daily for two months showed a decrease in insulin, HOMA, and low-density lipoprotein (LDL), but no change in fasting plasma glucose (FPG), HbA1C, total cholesterol, or HDL levels.	Ginger powder increased glycemic indices as well as TAC and PON-1 activity in patients, according to a double-blinded placebo-controlled randomized clinical trial carried out on two groups of patients with type 2 diabetes [64]. But further scientific studies are required to determine whether ginger is useful for treating diabetes in people.

PHYSIOLOGICAL INTERACTIONS BETWEEN THERAPEUTIC PLANTS AND ANIMALS

EXAMINATION OF THE RELATIONSHIP BETWEEN BLOOD SUGAR LEVELS AND BIOACTIVE SUBSTANCES IDENTIFIED IN MEDICINAL PLANTS

Analysis of such relationship between bioactive compounds in medicinal plants and blood sugar in interaction between medicinal plants and animal physiology is vital to illustrate potentiality for medicine benefits from such plant on the management of diabetes. Diabetes is a serious metabolic disease, which has now reached epidemic proportions in the world and although there are many medications to control antidiabetic symptoms, they have limited use due to their high cost and side effects. Contrary to this, herbal drugs have been notable for cost-effective and better therapeutic response without having side-effects [7] [10].

A systematic search was performed for medicinally important plants bearing anti-diabetic potential through different search engines and online journals. The review compiled together 81 medicinal plants having antidiabetic, anti-hyperglycemic, anti-hypoglycemic, anti-lipidemic and insulin mimic activities which are indigenous to Asian countries. These plants have been widely used by the traditional healers for treating different diseases [4].

Medicinal plants seem to enjoy special favour in the control of diabetes because of their availability, cost and lack of side effects as opposed to the synthetic drugs. Most of undeveloped countries in the world depend 100% on plants for their medical needs. Furthermore, many remedies in current use are based on natural products derived from traditional medicinal plants. For example, the historical use of Galega officinalis may be related to the anti-hyperglycemic drug metformin [11].

Some commonly used hypoglycemic medicinal herbs are: Allium sativum ((garlic), Momordica charantia (bitter Melon), and Hibiscus sabdariffa L. (roselle plant), Zingiber officinale Rosc (ginger) along with vitamins C, D and E. These are medicinal plants that enhance the performance of the immune system and regulate blood sugar levels.

To gain a deeper insight into these medicinal plants the ingredients and mechanisms they use to regulate glucose level, will need more research. Novel anti-diabetic drugs can be elaborated by taking the advantageous knowledge regarding bioactive substances and their interactions within animal system. In addition, bioactive phytochemicals isolated from these plants may contribute to the development of functional meals and antidiabetic drugs [11].

Medicinal plants are highly promising in antidiabetic drug discovery due to the presence of metabolites and phytochemicals. In order to better appreciate their value as diabetic alternative medicine, their bioactive compounds as well as blood sugar controlling effect might justify the ‘super’ criteria. In comparison to traditional drugs, the use of medicinal plants is cost effective and available and with less side effects. Deciphering the active compounds and mechanisms of these plants might contribute to the development of new anti-diabetic drugs. [12].

STUDY OF THE METHODS VIA WHICH CERTAIN PLANTS HAVE BENEFICIAL BENEFITS

An examination of how herbs control blood sugar in diabetes explains how herbs impact animal physiology. As the medicinal properties of these herbs have been extensively used with no adverse side effects in folk medicine, much research has centered on their efficacy and effectiveness to treat diabetes. Many of the Diabetes treatments on today's market in fact come from these plants. The core objectives of this systematic review are to ascertain the diverse diabetic treatments that exist, particularly herbal therapy [13].

Database searches including Science Direct, PubMed, Wiley online library, Scopus and Springer were carried out in order to find relevant studies about diabetes and effective medicinal plants. A total of 490 articles were generated following the recovery of selected articles published between 1995 and 2015. 450 papers were excluded from the review after removing irrelevant or unavailable papers.

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Oxidative stress and ROS overproduction, which may have significant impacts on the body, are known as main reasons to induce diabetes. Among the natural antioxidants present in various medicinal plants, flavonoids, tannins, as well as vitamins C and E have been shown to be effective at preserving beta-cell function and reducing blood glucose levels [14].

Unlike synthetic drugs, medicinal plants offer several advantages for the management of diabetes mellitus. They are cheaper and have fewer harmful side effects. Furthermore, it has been demonstrated that they outperform existing OTC drugs in handling diabetes related symptoms. There have been many studies into the mechanisms that underlie hypoglycemic and anti-diabetic effects of plants used in traditional medicines. Medicinal activities of the active components from these plants have been extensively studied. As an illustration, the anti-hyperglycemic drug metformin widely used nowadays has its origin in the traditional diabetic drug Galega officinalis [15].

Some commonly used medicinal plants such as garlic (Allium sativum), bitter melon (Momordica charantia), roselle plant (Hibiscus sabdariffa L.), and ginger (Zingiber officinale Rosc) have hypoglycaemic activity. And there have been similar benefits for blood sugar and immune system support from the vitamins C, D, E in addition to these plants.

Medicinal plants are increasingly used in developed and developing countries for their cheapness, availability and use in diabetes management. They have great promise for the treatment of complications related to diabetes, and further study might be carried out on the active constituents and underlying mechanisms of action [16].

In short, medicinal herbs play a large role in regulating blood sugar levels in diabetes. They have been shown to be safe and effective with minimal side effects, in conventional medicine. These foods contain natural antioxidants that keep beta cells healthy and maintain your blood sugar. Herbal medicine is the best approach in treating diabetes mellitus and it's cost-effective than other chemical drugs. In order to develop new anti-diabetic drugs, more studies should focus on identifying the bioactive components from these plants and investigating their action mechanisms. [17].

POTENTIAL ADVANTAGES OF USING MEDICINAL HERBS TO MANAGE DIABETES

Discov.Day The Prospective Role of Medicinal Plants in Diabetes via the Modification of Oxidatively Induced Injury and Ultrastructural Evidence: A Review.

Potential benefits of medicinal plants for control of diabetes The use of medicinal plants in controlling diabetes is associated with numerous potential advantages. Medicinal plants have been widely used in the treatment of diabetes, a life-threatening metabolic disorder, since antiquity. Currently-available medications are based on these plants and have been shown to be safe. One (151) sieved out data specifically on the herbal medicine while reviewing in detail on the already known diabetic treatment. The researchers found that a lot of the plants were sources of natural antioxidants, like tannins, flavonoids and vitamins C and E which when ingested can help keep pancreatic beta cells working well and lower blood glucose. This is crucial as oxidative stress and the increment of reactive oxygen species (ROS) are common factors that can lead to diabetes [18].

In addition to being anti-oxidants, natural drugs are more beneficial compared to synthetic drugs. They are generally more acceptable to diabetics, due to their less cost and fewer side-effects. Furthermore, these herbs are found to be more effective in controlling diabetes mellitus than conventional medications.

The use of medicinal plants in the management of diabetes is receiving significant attention, and not only in developing but also developed countries. Clinical trials have confirmed the therapeutic effects of traditional medicine using plant extracts and also it has less adverse side-effects than modern drugs. Indeed, several of the medicines universally used today are derived from organic components found in herbal medicinal plants frequently utilized [19].

Examples of such promising antidiabetic medicinal plants are the Allium sativum (garlic), Momordica charantia (bitter melon), Hibiscus sabdariffa L. (roselle plant) and Zingiber officinale Rosc (ginger). These are plants possessing hypoglycemic properties which aid in the strengthening of immune system and control on blood sugar. In sum, there could be several possible benefits for medicinal herbs in the control of diabetes. They are cheaper, therapeutically potent and with minimal side effects than synthetic drugs. In order to make these plants contribute their most as medication, more research is needed to establish the active constituent and mechanism that might lead them successful. In low-income countries and marginalized rural communities, we can manage diabetes better if patients have access to medicinal plants We can also cure it completely. [20].

EXPLORING THE POTENTIAL OF MEDICINAL PLANTS IN DIABETES MANAGEMENT: NATURAL ALTERNATIVES WITH PROMISING BENEFITS

There has been much attention in recent years paid to the role of medicinal plants on diabetes patients' ability to control their blood sugar level. That's largely because the chemically synthesized diabetes drugs have unpleasant side effects, including weight gain, digestive issues and heart failure. The option for relatively effective anti-diabetic medications without or less side effects is an open question and the use of medicinal plants could be advantageous. Researches have indicated that to include medicinal herbs in diet/treatments is effective for the control of diabetes. Active compounds from these plants, tannins, flavonoids and

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vitamins C and E also have anti-diabetic effect. Such factors would also facilitate efficient beta-cell treatment of diabetes and contribute to the optimization both of blood glucose levels and functionality [21].

Moreover, medicinal plants are cheaper than synthetic drugs and have a long history in traditional medicine systems over thousands of years. These plants form material basis for numerous current drugs, and bear testimony to their efficacy and safety. For example the fact that Galega officinalis has traditionally been employed medicinally directly relates to modern medicine in that it calls on metformin - a common medication for diabetes. It has been found that some herbs have anti-diabetic effects. Some of the most commonly used are Allium sativum (garlic), Momordica charantia (bitter melon), Hibiscus sabdariffa L. (roselle plant), Zingiber officinale Rosc (ginger) and vitamins C, D and E. These herbs also supercharge the immune system, as well as promote blood sugar regulation.

Even though medicinal plants are promising for controlling diabetes, additional research is required to acquire a deeper understanding of their mechanisms and discover effective bioactive compounds. In order to confirm efficacy and show the therapeutic index, studies should focus on conducting well-designed clinical trials [22].

Finally, it is important to consider the possible advantages of medicinal herbs in DM therapy. These plants are less expensive and possess fewer side effects than synthetic drugs. It is necessary to be careful against combination of natural herbs with conventional antidiabetic medications in order to avoid adverse drug-herb interactions. It is essential to investigate the effects, mechanisms and possible adverse effects of bioactive compounds in foods from medicinal plants. This will help to develop new, safer plant-based drugs to tackle the epidemic of diabetes in developing countries, where it is on the increase..

EXPLORING THE POTENTIAL OF MEDICINAL PLANTS IN REVOLUTIONIZING DIABETES TREATMENT:

A NATURAL AND AFFORDABLE APPROACH WITH PROMISING BENEFITS AND LIMITED SIDE EFFECTS:

A novel medical but not a medicine: use medicinal plants to treat diabetes and resurrect sydrome x! Medicinal plants can provide natural-holistic remedy and generally lack side effects as seen with conventional drugs which have numerous harmful side effects. Moreover, these plants are less expensive and are accessible to those in emerging countries. Certain commonly used drugs derive from traditionally used medicinal plants, thus reinforcing the rationale of their efficacy against diabetes [23].

Various plants and vitamins are known to have anti-diabetic and blood glucose lowering potential. Garlic, bitter melon, roselle plants, ginger and vitamins C, D and E are some examples. Scientists are scouring these plans and their bioactive compounds for more clues to how they work, although that could lead eventually to a more simplified approach to diabetes treatment. Pharmacological application of indigenous plants in Zimbabwe for diabetes has been given less consideration. Exploratory thoughts on the therapeutic potentials of medicinal plants in management of type 2 diabetes mellitus and problems are described in studies conducted in Zimbabwe and elsewhere [24].

Through clinical studies, medicinal plants have bioactive compounds that can act as antihyperglycemic or antidiabetic. Yet clinical study data is limited on their efficacy. The antidiabetes potency and safety of these plants need to be further researched with specific clinical studies. The simultaneous treatment diabetes and hypertension with herbal drugs there's also some possibility but additional investigation is needed to confirm, its efficacy validity and pratical benefits. Some of these food plants from the other families have been found to possess antidiabetic properties and may supplement modern drugs for diabetes. Further scientific research is needed to fully understand the prophylactic effect of medicinal foods against human diseases [25].

In general, medicinal plants offer a natural and low-cost approach for treating diabetes, especially in developing countries. A further study and clinical trials will be necessary in order to make the best use of medicinal plants at their full for treating diabetes..

UNLOCKING THE POTENTIAL OF MEDICINAL PLANTS: EXPLORING COMPLEMENTARY TREATMENTS FOR DIABETES

Conventional drugs have been widely used for the management and control of diabetes for a long time but not without its negative effects which include liver toxicity. Therefore, the study of medicinal plants that may act as adjuncts to FD treatment has become a topic of considerable interest. Certain bioactive compounds from these plants have been found to possess antihyperglycemic / antidiabetic effect. They're very promising as a way to treat diabetes in model animals, but it's not clear from clinical trials how well plants work on people. COMMENT Various medicinal plants have been investigated in clinical trials to address this void and their effectiveness assessed. Nevertheless, other factors should be considered that may influence the results of these studies (e.g., geographic areas and extraction procedures) [26] .

Studying plants with known anti-diabetic and antihypertensive activity may represent one approach to obtaining more reliable results for the potential use of medicinal plants in diabetes. We can have a better idea regarding comparative effectiveness of each plant in treatment of two diseases by studying these dual effective drugs.

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It is interesting to remark that although many therapeutic fruiting species have been safely consumed for thousands of years in numerous areas of the world, their potential beneficial effects on human beings lack scientific basis. In addition, the high-dose and long term effects of these plants should be understood alongside any likely interactions with conventional anti-diabetic drugs [27].

It is also important to note that future work will need to focus on conducting high-quality clinical trials for the assessment of efficacy and determination of the therapeutic index of phytochemicals derived from medicinal plant-based diets in order to bridge these information gaps. The efficacy and mechanisms of action, the pharmacokinetics, as well as potential adverse effects for the respective active compounds will be better recognized by these evaluations. Finally, a better understanding of the relationship between animal physiology and traditional plant-based medicine will bring new avenues for nature-friendly and holistic approaches for diabetes. We can work towards developing new and safer plant-based drugs for the management of diabetes, particularly in resource-poor nations by studying the pharmacological activities of the medicinal plants that have therapeutic potentiality against this ailment as well as their combination effect with other available treatments [28].

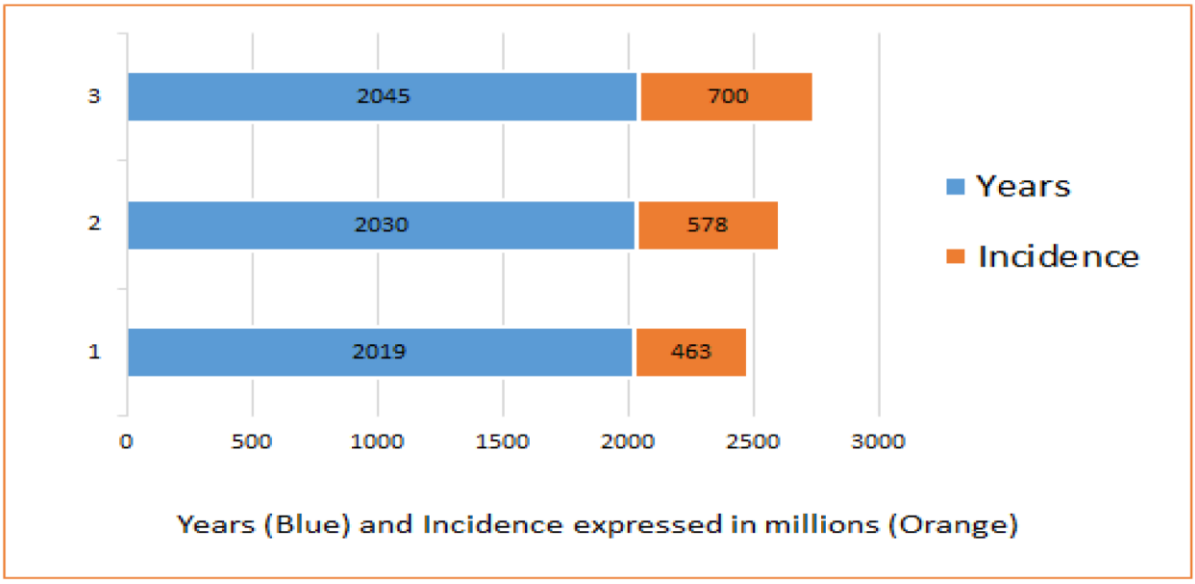

Figure 5. Projection of an increased incidence of diabetes patients worldwide [29].

CONCLUSION

Summary of the main points covered in the analysis

Indeed, during this review it transpired how paramount are the medicinal plants in treating and managing diabetes mellitus. It is found that the traditional plants contain natural anti-diabetic properties and are safe for use. These plants are rich in constituents such as alkaloids, phenolics, flavonoids and tannins which augment the potency of pancreatic tissues by stimulating insulin secretion or decreasing gastrointestinal glucose uptake.

More than 410 anti-diabetic medicinal plants have been exper- imentally shown, but there are only 109 plants whose whole mechanisms have been explored. The modulation of a number of metabolic pathways concerned in glucose metabolism by these medicinal plant extracts (e.g. glycolysis, gluconeogenesis, Krebs cycle, glycogen synthesis and degradation, insulin production and secretion, cholesterol synthesis as well as carbohydrate metabolism and absorption.

Diabetes mellitus, a chronic endocrine disease resulting in high blood glucose levels, can disrupt the metabolism of carbohydratess proteins and fats. It results from insulin deficiency and poor peripheral tissue utilization of insulin. The liver's metabolism of glucose and the withdrawal of the substance from circulation by muscle cells and fat depend on insulin. But the pancreas of those with diabetes churns out insulin ina usually insufficient or ineffective manner.

In India, there is a high prevalence of diabetes with approximately 61 million diabetics. The country lack of appropriate health infrastructures and facilities makes it difficult for effectively management of diabetes. Use of natural drugs is more preferred than synthetic one due to their low cost with lesser side effects.

And lastly, as a result of change in diet and the costly nature of modern medicine, diabetes mellitus is on the increase in Zimbabwe. While modern African medicine has made use of medicinal plants and herbs to manage diabetes mellitus and its complications.

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This is therefore necessary to evaluate these plants for the bioactivity as more than 1200 plant species are known worldwide to cure diabetes according to ethnobotanic. Modern analy tical biochem istry methods rec ognize and differentiate individual lead compounds from medicinal plants. In in vitro models such as cell-based bioassays and enzyme inhibition assays, and in silico methods including molecular docking are used to screen plant extracts against antidiabetic activity.

To summarize diabetes mellitus is a major chronic disease requiring efficient therapeutic strategies. Medicinal plants such as A. sativum, M. charantia, H. sabdariffa L., Z.officinale and vit C, D, E have been shown potential as anti- diabetic The herbs contain various bioactive phytoconstituents that aid in reducing blood sugar levels for people with diabetes is useful for general healthiness.

The benefits of vitamins and herbal cure should be promoted especially in developing world where access to modern medicine is expensive. These natural remedies are less expensive for the prevention and treatment of DM than traditional medicine, at less side effects than drug preparations.

Implications for future diabetes research and application

In conclusion, employing medicinal plants for diabetes therapy has potential importance in research and application. The therapeutic interventions of diabetes have advanced during the last decades, though anti-diabetic drugs usually have serious side effects. The World Health Organization has suggested the consumption of medicinal plants in food as an approach for diabetes therapy due to their proven hypoglycemic effect both under pre-clinical and clinical studies.

Several studies have substantiated the hypoglycemic activities of medicinal herbs such as Allium sativum, Momordica charantia, Hibiscus sabdariffa L., Zingiber officinale as well as vitamins C, D and E presence of coumarins, flavonoids, polyphenols and terpenoids etc., are believed to be related with a number of potential benefits. These agents reduce blood glucose and improve insulin sensitivity.

Moreover, anti-diabetic agents such as flavonoids, alkaloids, phenolics and tannins are highly present in traditional medicinal plants. Such agents have been observed to increase insulin release or decrease glucose absorption through the gut to improve pancreatic tissue sensitivity. It has also been shown that medicinal plant extracts may modify the metabolic routes related to glucose metabolism.

It is also proved that vitamins and medicinal plants in the appropriate doses can help to control diabetes. They assist diabetics in reducing not only their fasting blood sugar but also their blood flow and wound healing. Moreover, these natural remedies can also help in relieving diabetes issues.

In view of the low cost of herbal and vitamin preparations, the prophylactic and therapeutic effects should attract particularly in impoverished countries with limited access to modern medication. The awareness of the health benefits of these natural remedies has to be created.

The mechanism of action of some phytochemicals associated with the antidiabetic effect of medicinal plants should be further explored. Knowledge of the active constituents and their modes of action will facilitate development of more specific and efficacious therapies for diabetes.

Herbal drugs play a crucial role in management of blood sugar in diabetic patients. They are safe, inexpensive alternatives to the conventional medicines and they have the ability to prevent diabetic complications. Certainly, the continued investigation and practice of medicinal plants in the management of diabetes will lead to better medical outcomes for people with this chronic metabolic disease.

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