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Phytochemical analysis and Antioxidant activity of Medicinal Plants used in Traditional Medicine for Diabetes Management

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Abstract - The accumulation of harmful free radicals, which may be compared to oxidative stress, is a major contributor to several illnesses and a major concern for public health. The second kind of diabetes falls under this category. Cardiovascular problems account for 75% of diabetes fatalities in the Central African Republic, where an estimated 60,000 people have the disease. An alternative to synthetic antidiabetics is available in the traditional African pharmacopoeia. The first time, through cotton. The second time, using 3 mm wattman paper. Lastly, the filtrates are evaporated using a rotary evaporator. With this powder in hand, we were able to conduct experiments with phytochemicals and antioxidants. Following the sorting of phytochemicals, DPPH was used to evaluate the antiradical activity, and the ferric thiocyanate procedure was used to test the suppression of lipid peroxidation. Sterols, polyterpenes, polyphenols, flavonoids, and saponins were identified by phytochemical sorting as being present in these plants. It has been shown using thin-layer chromatography for methanol extracts that Millettia laurentii includes a reasonably high amount of polyphenols, however the concentration of sterols and polyterpenes is greater in the ethanol extract. In contrast, Khaya anthotheca and Desmodium tortuosum, which are rich in flavonoids and polyphenols, respectively, have antioxidant and antiradical important activity at 10.4 ± 0.3 and 9.5 ± 0.7, respectively.

Keywords: Diabetes, Antioxidant, Khaya, anthotheca, Desmodium, tortuosum, Millettia, laurentii.

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INTRODUCTION

The World Health Organization (WHO) classifies diabetes mellitus as a metabolic illness that may have many causes and is defined by long-term high blood sugar levels and changes in how the body uses carbohydrates, lipids, and proteins. Decreased insulin production or increasing resistance to its effect is the underlying cause of diabetes, a metabolic illness affecting glucose, lipid, and protein metabolism. Diabetic complications arise when either the body's insulin production is insufficient or its insulin use is impaired, leading to the chronic illness known as diabetes. Blood sugar levels are controlled by the hormone insulin. One potential component of diabetes mellitus is the overproduction and inadequate clearance of reactive oxygen species. Acidosis, low ascorbic acid levels, and changes in antioxidant enzymes are the major causes of antioxidant defense system disruption in diabetes. Along with cancer, heart disease, and stroke, it is quickly becoming the third leading cause of death worldwide. Over time, numerous bodily systems, particularly the nervous system and blood vessels, are damaged by hyperglycemia, or elevated blood sugar, which is a typical complication of uncontrolled diabetes. Diabetic complications may gradually harm the cardiovascular system, eyes, kidneys, and nerves.

Cardiovascular disease and stroke are more likely in those with diabetes. Death from cardiovascular disease accounts for half of all diabetic deaths. Foot ulcers, infections, and amputations are more likely to occur when neuropathy (nerve damage) and decreased blood supply to the feet are combined. Diabetes is responsible for 1% of blindness worldwide. Among the most common reasons for kidney failure, diabetes ranks high. Hypoglycemic medicines are those that reduce blood sugar levels or alleviate diabetes mellitus symptoms. Insulin and insulin preparations are the only ones that are used intravenously, whereas oral hypoglycemic drugs are those that are taken orally.

In the ethnobotanical literature, some 800 plants have been shown to offer potential anti-diabetic properties. Traditional medicine from various cultures has long relied on the healing properties of plants, and there is a mountain of data supporting this claim. Even though their actual uses and components were unknown, several plants were employed as food adjuvants and to cure a variety of illnesses. The high price and potential negative effects of synthetic hypoglycemic agents may explain this approach. Despite the development of many synthetic medicines, a safe and successful treatment paradigm for diabetes mellitus has not been reached yet. Because of their efficacy, lack of toxicity, and little or nonexistent adverse effects, traditional plant remedies for diabetes have been suggested for study by the World Health Organization (WHO).

Scientific confirmation of many plant species has shown botanicals' efficacy in lowering blood sugar. It is believed that phytochemicals have a significant role in diabetes treatment based on studies of their potential usefulness against the disease. This area requires more research to generate medications and nutraceuticals derived from natural resources. Nevertheless, a number of herbal therapies now in use have not been thoroughly tested by scientists, and a few of them may produce harmful side effects and significant interactions between other medications. Active moieties for the treatment of diverse illnesses are compounds with similar therapeutic action but differing structures, which are extracted from different species of plants. These plants and phytoconstituents have several potential uses, including regulating metabolic imbalances and delaying the onset of diabetes consequences. Furthermore, several plant phytochemicals with anti-diabetic characteristics have been isolated from plants in the last few years.

LITERATURE REVIEW

Giovannini, Peter et al. (2016). An estimated 387 million people worldwide are living with diabetes, , it will have risen to the position of seventh major cause of mortality. Compared to other Latin American nations, Central American countries have a higher incidence rate of 8.5%. This research intends to examine these plants. Various consequences and the largest number of reports of usage for diabetes control were considered when data was reviewed. Only 104 of the 535 species known to have any effect on diabetes or its complications are actually employed. For 16 out of the 20 species that were described, there was proof of a hypoglycemic impact in both in vitro and in vivo preclinical experiments. The traditional usage of medicinal plants in Central American diabetes management and related complications are summarized below, along with the contemporary scientific understanding that may shed light on these practices.

Bansode, Twinkle & Salalkar, B.K. (2015). Traditional herbal therapy makes extensive use of phytochemicals, which are bioactive substances derived from plants. This research set out to do just that by screening a subset of therapeutic plant extracts for these phytochemicals and mineral content. Trigonella foenum-graecum, Syzygium cumini, Terminalia chebula, and Salvadora persica were the four plants chosen for the analysis. It was discovered that all species contain flavonoids in high concentrations. Additionally, almost every species that has been investigated has saponins and tannins. At last, we determined that the Salvadora persica plant had the greatest mineral content (19%) out of the four plant species that were tested. The plants that were researched were found to have a wealth of phytochemicals that have important medicinal and pharmacological uses.

Gaikwad, Switi & Mohan, G. & Rani, M. (2014). The metabolic disease known as diabetes mellitus may be caused by either an inadequate amount of insulin or its dysfunction. Most individuals in both rich and poor nations have diabetes mellitus. There is a considerable risk of adverse effects and a high expense associated with treating diabetes using synthetic medications. In regions of the globe where conventional medical treatment is scarce, people have turned to phytomedicine for centuries. When it comes to managing diabetes mellitus, medicinal plants and phytoconstituents are invaluable, particularly in underdeveloped nations with limited resources. An intriguing prospect for the creation of novel diabetic mellitus treatments is the identification of phytochemicals from medicinal plants. Polysaccharides, alkaloids, glycosides, and phenolics including flavonoids, terpenoids, and steroids make up the bulk of phytochemicals. The creation of synthetic pharmaceuticals has made great strides, but phytomedicine is still a relatively new alternative treatment option. An comprehensive study of plant species and their components with shown hypoglycemic action is the goal of this article.

Attanayake, Anoja et al (2015). The antioxidant profile of several therapeutic plant extracts has been investigated extensively over the last 10 years, and a great deal of study has concentrated on the possible health advantages of antioxidants. The concentration of the plant extracts in water that were evaluated was 0.05 g/mL. The total polyphenol content and antioxidant activity were shown to be significantly correlated with each other ($P < 0.05$). Phytochemical research showed that the plant components included polyphenolic chemicals, alkaloids, and flavonoids, all of which showed antioxidant capacity in laboratory tests. Medicinal plant extracts' overall antioxidant capabilities are greatly enhanced by polyphenolic components.

Mannan, Md et al. (2014). Medicinal plants have been around since prehistoric times. Almost every culture throughout the history of the human race has relied on some kind of plant medicine, either for food or to treat illness. The phytochemicals found in plants have the potential to improve human health in a number of ways, including by increasing the efficiency of different bodily organs, lowering inflammation, and providing essential nutrients. In terms of pharmacology, M. azedarach has a long list of useful properties, including those that deal with antinephrolithiasis, ulcers, bacteria, the liver, antioxidants, infertility, anthelmintics, fever, parasites, and cancer. The purpose of this study is to compile the most recent findings from a comprehensive literature search focusing on its phytochemical and pharmacological evaluations.

MATERIALS AND METHODS

Chemicals and finished goods Sigma-Aldrich-Fluka of Saint Quentin, France, supplies the products and reagents used in the different analyses.

Preparation of the ethanoic extracts of plants

Following the method described by Bidie et al., 100 milliliters of 100% ethanol and 5 grams of crushed plant organ product were mixed. At least seventy-two hours after manufacture, the mixture is stirred using a Heidolph MR Hei Tec type magnetic stirrer. The next step is to strain the mixture using a WATTMAN paper filter. A Heidolph HB Digital Laborota 4000 rotary evaporator is used to evaporate the filtrate at 40 °C at decreased pressure. The different tests made use of the powder that was collected. Examining Plant Chemicals: Ronchetti and Russo, Hegnauer, Bekro et al. outlined procedures that successfully proved the presence of several component groups in the extracts.

Phytochimical screening

Sterols and polyterpenes: We used the LIEBERMANN reagent, 5 ml of each extract until it was dry, 1 ml of acetic anhydride, and 0.5 ml of sulfuric acid in triturate to show the presence of sterols and polyterpenes.

Polyphenols : Two milliliters of each solution with a drop or two of an alcoholic solution containing two percent ferric chloride (Jeulin Evreux) will react with ferric chloride ($FeCl_3$).

Tannins : The STIASNY reagent's catechic tannins (30% Formol, 1 / 0.5 concentrated HCl) Add 15 milliliters of the STIASNY reagent to 5 milliliters of each solution that has evaporated to dryness; Stir the mixture for 30 minutes in a water bath set at 80 degrees Celsius. Gallic tannins / Suspend the filter from the preceding solution with sodium acetate (Fischer Scientific Elancourt) and add three drops of 2% $FeCl_3$.

Free or combined quinone substances: Each extract was dried to a dryness of 2 ml using the BORNTRAEGEN reagent. The 5 ml of 1/5 HCl is used to triturate the residue. After 30 minutes in the Marie bath, 20 milliliters of chloroform (Sigma Aldrich) are added to the triturate for extraction. The NH_3 was then added to the chloroform solution twice after diluting it.

Alkaloids: Six milliliters of each solution was evaporated to dryness using the DRAGENDORFF and MAYER reagent, and then six milliliters of alcohol was added at 60 ° C. DRAGENDORFF or MAYER reagents, each with 2 drops, added to the alcoholic solution.

RESULTS

Results of the extraction yields of the various plant components studied are shown in the histogram below. With 41.6% production, K. anthotheca is the most productive, followed by 8.8% from M. laurentii and 7% from D. tortuosum.

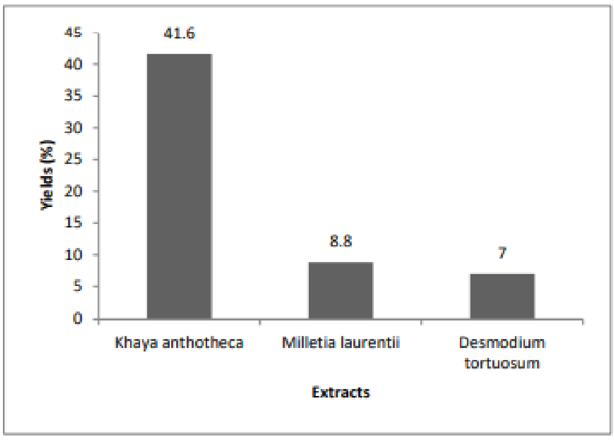

Figure 1: Yields of ethanoic extracts

K. anthotheca and D. tortuosum contain tannins and polyphenols, much as M. laurentii, according to the results. Unlike M. laurentii and D. tortuosum, which both had relatively low total phenol concentrations (26.41 ± 4.94 mg/g and 70.91 ± 3.07 mg/g, respectively), K. anthotheca contains over 103 mg/g EAG, according to the search for total phenols.

Table 1: Phytochemical screening

Extracts	Sterols and polyterpenes	Polyphenols	Flavonoïds	Tanins	Quinones	Alcaloïdes	Saponins	Total Phenols
K. anthotheca	-	+	±	±	-	-	+	103±1.1
M. laurentii	+	+	-	-	-	-	+	26.43±4.9
D. tortuosum	-	+	-	+	-	-	+	70.43±3

Anti-radical activity by DPPH

The DPPH-detected anti-radical activity shows that the IC50 for K. anthotheca and D. tortuosum is attained at extract concentrations of < 10mg / L, while for M. laurentii it is > 10mg / L. In comparison, the IC50 for complex quercetin in the reference sample is 6.3 mg / L.

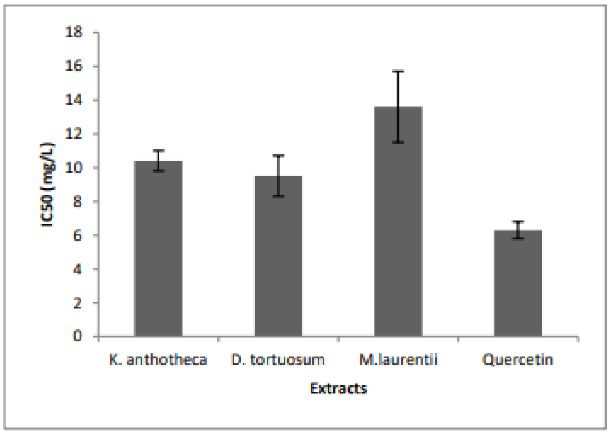

Figure 2: Antioxidant activity

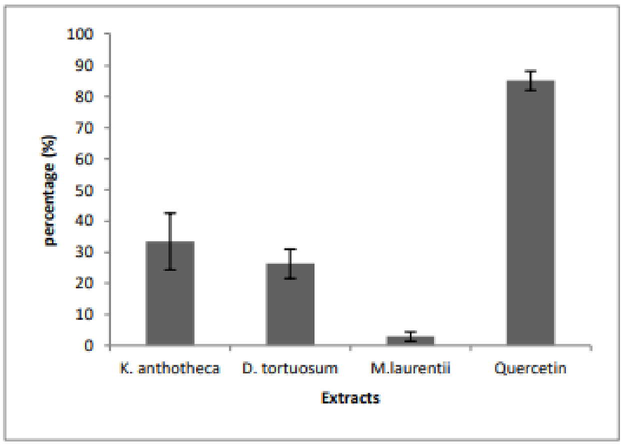

Figure 3: Lipid peroxidation by the FTC method

M. laurentii has a very low inhibition percentage (± 1.5) of lipid peroxidation compared to K. anthotheca (33.43 ± 9.17) and D. tortuosum (26.32 ± 29.17). Another research found that K. ahthotheca, which is a type of K. anthotheca, had limited antioxidant activity and a higher IC50 value of 176.40 ± / ml. Protection against lipid peroxidation.

CONCLUSION

This study concludes that the three samples examined, namely K. anthotheca, D. tortuosum, and M. laurentii, possess antioxidant activity due to their high concentrations of polyphenols, polyterpenes, flavonoids, and secondary antioxidants, saponins, and tannins. Flavones, rutin, and catechin are some of the secondary metabolites found in these plants at the amounts used in this research; they may have a significant influence in the plants' antidiabetic effect. But even at these dosages, the activity is noticeably lower than quercetin, the reference molecule. The existence of secondary metabolites, which regulate the pharmacological characteristics of plants used in traditional medicine, is established by careful manipulation of the solvent and solute concentration.

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