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Investigating the Hypoglycemic Effects of Plants used in Traditional Malaria Remedies

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ABSTRACT

The study examines the dual roles of plants traditionally used in malaria treatments, particularly their hypoglycemic effects and their mechanisms of action. Traditional remedies, such as those used in Madagascar, are deeply rooted in ethnomedical practices and show potential for treating drug-resistant malaria strains. However, these plants often exhibit significant hypoglycemic activity, posing risks of natural drug overdoses. The review synthesizes ethnobotanical data, biochemical pathways, and experimental studies to highlight the intersection of antimalarial and hypoglycemic properties. This understanding could inform safer applications of traditional remedies and foster collaboration between modern pharmacology and ethnomedicine. The findings underscore the importance of validating traditional practices through clinical trials and biochemical analysis, paving the way for integrative therapeutic approaches.

Keywords: Hypoglycemia, Traditional medicine, Antimalarial plants, Ethnobotany, Glucose metabolism.

INTRODUCTION

Malaria is an ancient disease on which humans have relied on plant remedies for centuries. One of the oldest reported texts contains several remedies for fever—the principal symptom of malaria. Traditional malaria remedies have recently attracted the attention of Western scientists mainly because of claims that some herbs can cure otherwise untreatable multi-drug-resistant strains of Plasmodium in animal studies. However, rather than seeking new herbal treatments for malaria, it is suggested that the focus should be on studying the mode of action of these antimalarial plants chemically to better understand their efficacy and potential side effects because there is an urgent need for a new understanding based on more clearly defined biological and potentially chemical parameters, such as understanding how these plants lower the body temperature. Hypoglycemia would certainly result in a lowered body temperature, so the study of hypoglycemia in rats fed antimalarial plants could help to elucidate this mechanism of action [1-3]. Much interest in the topic of hypoglycemia has been that of clinical hypoglycemia, primarily associated with diabetes; however, hypoglycemia can also occur from an overdose and/or interactions of prescription medications or ingestion of over-the-counter supplements and herbs such as bitter melon in what have been termed natural drug overdoses. In these cases, hypoglycemia results. In traditional Chinese medicine, bitter melon has been a remedy for diabetes and malaria. Data on hypoglycemia that occurs with the ingestion of herbal substances during traditional malaria therapy are scarce. Madagascar is a region known for its reliance on traditional medicinal practices. With a population of about 20 million people, Madagascar reports over 2 million cases of malaria per year. It is likely that Malagasy still uses medicinal plants in the treatment of malaria. The primary concerns of natural drug overdoses, such as hypoglycemia and food-drug interactions, are of interest due to the simultaneous use of prescribed medications and herbal remedies, which is expected to increase under the new legislation. Research into the use of antimalarial plants can be of major public health importance as many are potent suppressors of blood glucose levels [3-5].

Botanical Species Used in Traditional Malaria Remedies

Traditional antimalarial remedies and their ingredients are used in different cultures. Almost in every case, preparation of the remedy involves boiling at different times. Cases of species of medicinal plants traditionally given against malaria, which are also recognized for hypoglycemic effects, are reviewed in this report. From an ethnobotanical point of view, a little bit more is known about specimens used in the northern part of sub-Saharan Africa than in the south, and very little has been done in Asia and Latin America. The question is whether local uses and perceptions fit with pharmacological investigations [5-6]. According to Africans in Burkina Faso in the recent past, Tagetes erecta had depurative effects, and according to them, this did not prevent malaria but affected the healthfulness of fetuses. Although Curcuma longa is known in Africa for its anti-inflammatory and digestive properties, in Southeast Asia, it is officially recognized as an anti-inflammatory and anti-infertility remedy, and by African traditionalists who go along with this, it was used against malaria. Both of these species are unavailable on the European market, though Curcuma longa may be used as a spice to a certain extent. The use of Ficus racemosa for reducing blood sugar by Timor-Alor Islanders is officially unrecognized in Indonesia. As we have indicated in another section of this review, the inside bark of the rootstock of Inula helenium is drunk by Sudanese women for hypoglycemic effects. There may be other species with hypoglycemic effects used to treat specific diseases that we do not know about. Thus, ethnobotanical studies are crucial. Two out of three of the malariogenic botanical species indicated are common over a wide geographical area including the northern territories of sub-Saharan Africa. The Ficus species is commonly accessible to people, but Inula helenium and Tagetes erecta are not, given their restricted distribution. Bitter tonic herbs appear to be mechanisms of biocompetition affording specific knowledge to the traditional healer. Only a fraction of this biodiversity has been much exploited, and this in translation is richer in cultural items involving primitive drugs. Greater overlap is seen in traditional medical systems than in different systems of ethnobotanical plants. The African part of the family Asteraceae is recognized for malaria remedies more often than any other plant family. To date, none of the four plants treated in this report has been well-researched. It is crucial to validate plants through scientific experiments, ensuring that treatments are effective and safe. Evidence that Tagetes erecta has antimalarial effects appears robust, especially in West Africa [7-11].

Biological Mechanisms of Hypoglycemic Effects

Several biochemical zinc-dependent isomerization and alcohol dehydrogenation reactions occur during glucose metabolism. Compound I, the enolate form of two glyceraldehyde-3-phosphate, forms pyruvate. This compound may also combine with dihydroxyacetone phosphate, in equilibrium with them, to form fructose-1,6-diphosphate via the activity of aldolase. This fructose is split by the enzyme fructose-1,6-diphosphatase into glyceraldehyde and dihydroxyacetone phosphate. This glyceraldehyde will proceed to form glycerol, while the other product is isomerized to glyceraldehyde-3-phosphate, which will continue to pyruvate. Alternatively, glucose is metabolized in the pentose cycle to form excessive glucose plus glyceraldehyde-3-phosphate to have a high gluconeogenic substrate from extra quantities of glucose. To ensure normal glucose metabolism or equilibrium in a state of hypoglycemia, this biochemical process must also be regulated through the inhibition of some of the already described biochemical activities and the stimulation of glycogenesis. The process of producing glucose, gluconeogenesis, is inhibited by insulin via the action of glucagon or glucocorticoids to produce hypoglycemia. These therapies may thus imply that these plants may enhance glucose metabolism and may not produce hypoglycemia in the body if the hypoglycemia is not caused by pancreatic dysfunction. The capability of these plants to cause the release of insulin is another way by which the biological mechanisms of hypoglycemia may manifest. Hence, these plants could perhaps stimulate insulin release from the pancreatic β-cells to produce this effect. There could also be inhibition of glucose absorption in the gastrointestinal tract in addition to the above-mentioned four mechanisms. This would prevent the uptake of glucose into the body. Many heterogeneous mechanisms could therefore result in the hypoglycemic effects of these plants. This has helped in understanding the scientific rationale for histological examination and the studies on antiplasmodium activities. Since there is a good reduction of glucose levels in both type 2 diabetic and normoglycemic mice at very low dosages of the extracts or isolated compounds, the mechanisms of action indicated will apply to affected diabetic patients [9-10].

Experimental Studies on Plant Extracts and Hypoglycemia

Several experimental studies have been conducted to verify whether extracts of plants that are used to treat malaria, when used alone, are hypoglycemic. The tests to determine hypoglycemia were carried out using different methods and many etiologies of diabetes mellitus and hypoglycemia. Both in vitro studies, which can be screening work or used to try to hypothesize the mode of action, and in vivo studies, using a

variety of very different types of animals in many tissues, have been used. It is very important to distinguish between those that used model systems to test pure substances and those that tested crude extracts. Both are reported in this review [11-12]. The majority of these studies have concluded that certain extracts of plants used in treating malaria also exhibited hypoglycemic activity when they were given in large amounts or to animals for a prolonged period. This information, coupled with the in vitro activity against phosphodiesterase exhibited by some extracts, strengthens the idea of a multi-action therapy for malaria if plants are to be used in combination. However, the design and intensity of these studies is such that the results need to be tested by suitably designed clinical trials. It also needs to be noted that widely differing results can be generated if multiple investigators use the same or even different types or species of animals and plants, but do so using different types of extract preparations, assay media, and dosages. Along with this goes the fact that experimental results need to be repeated for different kinds of preparations, including the fresh plant. Reproducibility, albeit an important requirement for validating herbal medicines within the framework of modern medicine, is not strictly required for a plant to be validly used as a medicine in traditional or ethnomedicine [13-18].

Clinical Implications and Future Directions

Several preparations and compounds used by African traditional healers for the treatment of malaria were shown in several different measures to have hypoglycemic-inducing effects. The possibility that these plants may indeed present with antihyperglycemic compounds inadvertently ingested with traditional medicine remedies has enormous clinical implications. Although it is doubtful that these results will contribute directly to the development of new anti-diabetic drugs, professionals must recognize the potential for hypoglycemic effects of these remedies, particularly when used by diabetics. In addition, some of these plants might possess a more general hypoglycemic effect and as such could be used to promote health and to prevent malaria-induced hypoglycemia [19-22]. However, traditional medicine should be tested for safety in large-scale, properly controlled studies before any form of utilization, as is warranted by numerous concerns regarding standardization, crude dosage determination, mutual suppression of actions, and toxicity. When utilizing medicinal plants, further practice of scientific validation of the dose and proper therapeutic and toxic effects should be applied. During the drug development process, dosage-response relationships will be determined, which are necessary for assessing the risk-benefit ratio [22-27]. Further scientific exploration recreating and validating the traditional hypothesis is not only desirable but essential to conserve scientific records of valuable medicinal plants in malaria therapy. In doing so, the collaboration and understanding of the wisdom accumulated over centuries by traditional healers in South Africa is a critical process. Although many indigenous plants have not been scientifically validated, the story of traditional use is pivotal to their potential future integration into modern malaria therapy methods, particularly in Africa. While additional studies are needed, specifically within the good clinical practice framework, results obtained here offer information on the further validation of traditional medicine and the synergy between modern and traditional medical systems. In addition, if effective, certain herbal remedies can be seen as an acceptable adjunct to the use of insecticides in integrated malaria vector control methods. As long as such research is performed within scientifically and ethically accepted norms, it is also a means of preservation of valuable medicinal information for future generations [28-32].

CONCLUSION

The exploration of traditional antimalarial plants reveals their complex interplay between therapeutic benefits and potential side effects, particularly hypoglycemia. Understanding these mechanisms not only enhances the safe use of these plants in traditional and modern medicine but also bridges the gap between ethnomedicine and contemporary pharmacological research. Future studies should prioritize clinical trials to validate safety and efficacy, as well as the preservation of traditional knowledge. By integrating these approaches, it is possible to optimize therapeutic strategies for malaria while minimizing adverse effects, thus fostering a synergistic relationship between traditional and modern medical systems. Additionally, further investigation into the biochemical pathways involved may yield insights into novel therapeutic agents for both malaria and diabetes management.

REFERENCES

1. Ma D, Wang S, Shi Y, Ni S, Tang M, Xu A. The development of traditional Chinese medicine. Journal of Traditional Chinese Medical Sciences. 2021 Nov 1;8:S1-9. sciencedirect.com
2. Chen SY, Qu K, Liu XJ, Chen Z. Historical medical exchanges following the confluence of traditional Chinese medicine and western medicine: coexistence and mutual development. Chinese Medicine and Culture. 2022 Sep 1;5(3):182-9.

3. Boakye-Yiadom M, Kumadoh D, Adase E, Woode E. Medicinal plants with prospective benefits in the management of peptic ulcer diseases in Ghana. BioMed Research International. 2021;2021(1):5574041. wiley.com
4. Mavondo GA, Mavondo J, Peresuh W, Dlodlo M, Moyo O. Malaria pathophysiology as a syndrome: focus on glucose homeostasis in severe malaria and phytotherapeutics management of the disease. Parasites and Parasitic Diseases IntechOpen. 2019 Apr 24;2:23-41.
5. Giri BR, Baral R, Bhatt H, Khadka A, Tamrakar R, Timalsina G, Gyawali R. Phytochemical screening, free-radical scavenging activity, in vitro alpha-amylase inhibitory activity, and in vivo hypoglycemic activity studies of several crude drug formulations based on selected medicinal plants of Nepal. Pharmaceutical Chemistry Journal. 2023 Jan;56(10):1369-78. researchgate.net
6. Benjamin MA, Mokhtar RA, Iqbal M, Abdullah A, Azizah R, Sulistyorini L, Mahfudh N, Zakaria ZA. Medicinal Plants of Southeast Asia with Anti-α-Glucosidase Activity as Potential Source for Type-2 Diabetes Mellitus Treatment. Journal of Ethnopharmacology. 2024 Apr 23:118239. [HTML]
7. Yashvardhini N, Samiksha S, Jha DK. Pharmacological intervention of various Indian medicinal plants in combating COVID-19 infection. Biomedical Research and Therapy. 2021 Jul 31;8(7):4461-75. biomedpress.org
8. Villarino NF, LeCleir GR, Denny JE, Dearth SP, Harding CL, Sloan SS, Gribble JL, Campagna SR, Wilhelm SW, Schmidt NW. Composition of the gut microbiota modulates the severity of malaria. Proceedings of the National Academy of Sciences. 2016 Feb 23;113(8):2235-40.
9. Camaya I, Donnelly S, O'Brien B. Targeting the PI3K/Akt signaling pathway in pancreatic β-cells to enhance their survival and function: an emerging therapeutic strategy for type 1 diabetes. Journal of Diabetes. 2022 Apr;14(4):247-60.
10. Kongthitilerd P, Thilavech T, Marnpae M, Rong W, Yao S, Adisakwattana S, Cheng H, Suantawee T. Cyanidin-3-rutinoside stimulated insulin secretion through activation of L-type voltage-dependent Ca2+ channels and the PLC-IP3 pathway in pancreatic β-cells. Biomedicine & Pharmacotherapy. 2022 Feb 1;146:112494. sciencedirect.com
11. Uddin Zim AI, Khatun J, Khan MF, Hossain MA, Haque MM. Evaluation of in vitro antioxidant activity of okra mucilage and its antidiabetic and antihyperlipidemic effect in alloxan-induced diabetic mice. Food Science & Nutrition. 2021 Dec;9(12):6854-65. wiley.com
12. Salleh NH, Zulkipli IN, Mohd Yasin H, Ja'afar F, Ahmad N, Wan Ahmad WA, Ahmad SR. Systematic review of medicinal plants used for treatment of diabetes in human clinical trials: An ASEAN perspective. Evidence-Based Complementary and Alternative Medicine. 2021;2021(1):5570939. wiley.com
13. Muema FW, Nanjala C, Oulo MA, Wangchuk P. Phytochemical content and antidiabetic properties of most commonly used antidiabetic medicinal plants of Kenya. Molecules. 2023 Oct 20;28(20):7202.
14. Gang R, Matsabisa M, Okello D, Kang Y. Ethnomedicine and ethnopharmacology of medicinal plants used in the treatment of diabetes mellitus in Uganda. Applied Biological Chemistry. 2023 Jul 6;66(1):39.
15. Aslam B, Hussain A, Sindhu ZU, Nigar S, Jan IU, Alrefaei AF, Albeshr MF, Tufarelli V, Khan RU. Polyphenols-rich polyherbal mixture attenuates hepatorenal impairment, dyslipidaemia, oxidative stress and inflammation in alloxan-induced diabetic rats. Journal of Applied Animal Research. 2023 Dec 31;51(1):515-23.
16. Nigussie G, Wale M. Medicinal plants used in traditional treatment of malaria in Ethiopia: a review of ethnomedicine, anti-malarial and toxicity studies. Malaria Journal. 2022 Sep 10;21(1):262.
17. Ceravolo IP, Aguiar AC, Adebayo JO, Krettli AU. Studies on activities and chemical characterization of medicinal plants in search for new Antimalarials: a ten year review on Ethnopharmacology. Frontiers in Pharmacology. 2021 Sep 22;12:734263.
18. Obeagu, E. I., Alum, E. U. and Ugwu, O. P. C. Hepcidin's Antimalarial Arsenal: Safeguarding the Host. NEWPORT INTERNATIONAL JOURNAL OF PUBLIC HEALTH AND PHARMACY. 2023; 4(2):1-8. https://doi.org/10.59298/NIJPP/2023/10.1.1100
19. Okechukwu PC Ugwu, Okwesili FC Nwodo, Parker E Joshua, Christian E Odo, Abubakar Bawa, EC Ossai, CC Adonu Anti-malaria and hematological analyses of ethanol leaf extract of Moringa

oleifera on malaria infected mice *International Journal of Pharmacy and Biological Science* 2013. *3(1) 360-371.*

20. Okechukwu PC Ugwu, OFC Nwodo, PE Joshua, CE Odo, EC Ossai, B Aburbakar.Ameliorative effects of ethanol leaf extract of *Moringa oleifera* on the liver and kidney markers of malaria infected mice. 2013.*2(2) 43-52.*
21. Okechukwu PC Ugwu, Okwesili FC Nwodo, Parker E Joshua, Christian E Odo, Emmanuel C Ossai The effect of ethanol leaf extract of *Moringa oleifera* on the lipid profile of malaria infected mice *Journal of applied science* 2013. *4(1) 1324-1332.*
22. Enechi OC, CC Okpe, GN Ibe, KO Omeje, PC Ugwu Okechukwu. Effect of Buchholzia coriacea methanol extract on haematological indices and liver function parameters in Plasmodium berghei-infected mice Global Veterinaria 2016. 16(1) 57-66.
23. Okechukwu Paul-Chima Ugwu Anti-Malaria Effect of Ethanol Extract of Moringa Oleifera (Agbaji) Leaves on Malaria Induced Mice. *University of Nigeria Nsukka*, 2011. *39.*
24. Aja PM, IO Igwenyi, PU Okechukwu, OU Orji, EU Alum. Evaluation of anti-diabetic effect and liver function indices of ethanol extracts of Moringa oleifera and Cajanus cajan leaves in alloxan induced diabetic albino rats Global Veterinaria 14(3) 439-447 (2015).
25. Offor CE, OPC Ugwu, EU Alum. The anti-diabetic effect of ethanol leaf-extract of Allium sativum on Albino rats. International Journal of Pharmacy and Medical Sciences, 4, (1), 01-03 (2014).
26. Enechi OC, H Ikenna Oluka, PC Okechukwu Ugwu. Acute toxicity, lipid peroxidation and ameliorative properties of Alstonia boonei ethanol leaf extract on the kidney markers of alloxan induced diabetic rats. African journal of biotechnology, 13, 5 (2014).
27. Adonu CC, OP Ugwu, A Bawa, EC Ossai, AC Nwaka. Intrinsic blood coagulation studies in patients suffering from both diabetes and hypertension. Int Journal of Pharmaceutical Medicine and Bio Science, 2 (2), 36-45 (2013).
28. Okechukwu Paul-Chima Ugwu, Esther Ugo Alum, Michael Ben Okon, Patrick M Aja, Emmanuel Ifeanyi Obeagu, EC Onyeneke Ethanol root extract and fractions of Sphenocentrum jollyanum abrogate hyperglycaemia and low body weight in streptozotocin-induced diabetic Wistar albino rats Oxford University Press 2(2) 10 (2023).
29. Mariam Oyedeji Amusa and Adeyinka Olufemi Adepoju Okechukwu P. C. Ugwu, Esther Ugo Alum, Emmanuel I. Obeagu, Michael Ben Okon, Patrick M. Aja , Awotunde Oluwasegun Samson Effect of Ethanol leaf extract of Chromolaena odorata on lipid profile of streptozotocin induced diabetic wistar albino rats. IAA Journal of Biological Sciences, 10, (1), 109-117 (2023).
30. Alum EU, GU Umoru, DE Uti, PM Aja, OP Ugwu, OU Orji, BU Nwali, NN Ezeani, N Edwin, FO Orinya HEPATO-PROTECTIVE EFFECT OF ETHANOL LEAF EXTRACT OF Datura stramonium in ALLOXAN-INDUCED DIABETIC ALBINO RATS. Journal of Chemical Society of Nigeria, 47, 5 (2022)..
31. Ugwu Okechukwu P.C. and Amasiorah V.I. The effects of the crude ethanol root extract and fractions of Sphenocentrum jollyanum on hematological indices and glycosylated haemoglobin of streptozotocin-induced diabetic. INOSR Scientific Research, 6, (1), 61-74 (2020).
32. Enechi OC, IH Oluka, OPC Ugwu, YS Omeh Effect of ethanol leaf extract of Alstonia boonei on the lipid profile of alloxan induced diabetic rats. World Journal of Pharmacy and Pharmaceutical Sciences (WJPPS), 2013, Vol. 2, No. 3, 782-795(2012).

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