Role of Phenolic Phytochemicals in Diabetes Management

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Phenolic Phytochemicals and Diabetes

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Preface

Diabetes is a major chronic disease characterized by hyperglycaemia, polyuria, polydipsia, and polyphagia. According to the seventh edition of the International Diabetes Federation (IDF) Atlas, approximately 415 million people between the ages of 20 and 79 around the globe have been estimated to suffer from diabetes in the year 2015. This count is further expected to rise to 642 million by the year 2040. The ever-changing lifestyle and dietary habits have immensely contributed to the development of not only chronic but also acute diabetic conditions. The current drugs in the market have their associated toxicity and side effects as well as become ineffective after a certain period of treatment.

Phytomedications are among the oldest remedies for diabetes that have been practiced around the world under various names including *Ayuveda* (Indian subcontinent), *Unani* (West Asia), and *Zhōngyī* (Central Asia). They are essentially mixtures of a variety of phytochemicals in various proportions. The concentrations of these phytochemicals may vary significantly, depending upon the plant source, or even in various organs within the same plant. As per the US Department of Agriculture (USDA) database, approximately 1200 phytochemicals have been reported to reverse/control diabetic conditions via a number of transcriptional, translational, and epigenetic modulations of major signaling molecules. Some of the limitations of phytomedicine include lack of validations of constituents' proportions and ambiguous mechanisms of action against diabetes.

Among the various types of phytochemicals, phenolic compounds have been of particular interest. It is among the major constituents and active principles in various plant extracts. Phenolic compounds are a group of simple and complex molecules, classified together based on the presence of at least one aromatic ring and a hydroxyl group attached to it. Herbs, fruits, and spices, including bitter gourd, java plum, and turmeric, are among the vast repository of natural resources from which a variety of phenolic compounds, including flavonoids, aromatic acids, phenylethanoids, alkylresorcinols, and capsaicin, have been identified and isolated. These phenolic phytochemicals have been studied for their therapeutic efficacy against various types of diseases, including cancer, diabetes, arthritis, cardiovascular diseases, and some neurodegenerative disorders.

This book summarizes the current research trends of phytophenolic therapy against diabetes. It lists the various phenolics reported to possess anti-diabetic activity and their plant sources. It also discusses the various mechanisms of actions of

these compounds. Each of these pathways may be targeted by the combination of multiple phytophenolics and synthetic drugs, such that their synergistic effects may result in lowering the diabetic conditions or simultaneous lowering of the dependence on synthetic drugs. Phytochemicals have certain shortcomings which include poor aqueous solubility, bioavailability, and shelf life. Nanotechnology-based approaches may overcome some of these problems. The pharmacokinetics, pharmacodynamics, and degradation of phytophenolics also need to be understood for their effective use which is also discussed here. The National Institutes of Health (NIH) and the USDA are among the many agencies that are funding intensive research in phytochemicals as dietary supplements in preventive medicine. The current trends of European markets evidently suggest that phytomedicines are increasingly being preferred as an alternative preventive medicine due to its mild adverse effects and reduced toxicity.

This book could be a useful reference to academicians, scientists working in government and industrial labs, dieticians, alternative therapy practitioners, and the common public. Some of the novel photochemicals reported here could also be a lead molecule for the design of novel anti-diabetic drug.

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Muddasarul Hoda Currently Assistant Professor, Department of Biological Sciences, Aliah University, Kolkata. His research interests include nanotechnology in drug targeting and therapeutics, and synergism of phytochemicals against glucose homeostasis imbalance and cancer. He received his PhD from Pondicherry University, and postdoctoral degree from the IIT Madras. He has 7 research publications to his credit.

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