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Comparative Toxicodynamic Assessments of Traditional Medicines in Chronic Disease Models

Dr. Obaiah Jamakala[1], Dr. Hephzibah Rani Singh[2], Dr. B.Hemavathi[3], Dr. Sanjeeb Kumar Nath[4], Dr. Madhu[5*]

[1]Assistant Professor, Department of Zoology, Sri Venkateswara College, University of Delhi, New Delhi - 110021

[2]Sr. Assistant Professor, Department of Biotechnology Gayatri Vidya Parishad College for Degree and PG Courses (A) Visakhapatnam Andhra Pradesh

[3]Assistant Professor in Zoology (on contract) Department of Biosciences and Sericulture Padmavati Mahila Viswavidyalayam,Tirupati Andhra Pradesh

[4]Associate Professor & HOD Department of Botany Dhing College, Dhing Nagaon, Assam, 782123

[*5]Assistant Professor(Home Sci.) Deptt of Home Science Kashi Naresh Govt PG College,Gyanpur Bhadohi-221106

[*]**Corresponding author:**

Dr. Madhu

Assistant Professor (Home Sci.) Deptt of Home Science Kashi Naresh Govt PG College,Gyanpur Bhadohi-221106

Email ID: madhu.17june@gmail.com

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ABSTRACT

The increased use of traditional medicines (TMs) for the control of chronic diseases worldwide requires a scientific assessment of their safety and efficacy. Although they are thought to be safer because they come from natural sources, little is known about their pharmacokinetic and toxicodynamic characteristics, particularly in the context of chronic diseases. A comparative toxicodynamic analysis of a few common conventional medications used to treat chronic illnesses such as diabetes, cancer, heart disease, and neurological disorders is presented in this chapter.Based on both in vitro and in vivo chronic disease models, the research compares cytotoxicity, organ toxicity, markers of oxidative stress, apoptotic pathways, and alterations in gene expression caused by some selected herbal preparations. In addition, this chapter calls for regulation oversight and standardization safety profiling of TMs. The results advocate for an integrated plan for the integration of traditional medicines into evidence-based health systems.

Keywords: *Toxicodynamics, Chronic Disease Models, Herbal Safety, Phytotherapy, Cytotoxicity, Gene Expression, Herbal Pharmacovigilance*

1. INTRODUCTION

The traditional medicines (TMs) are an old part of the healthcare system and have provided a variety of therapeutic possibilities based on cultural and ethnobotanical experience (Mukherjee et al., 2021). Other systems include Ayurveda, Traditional Chinese Medicine (TCM), Unani, Siddha, Kampo and indigenous healthcare in Africa and Americas, which evolved over thousands of years and are still in practice especially in rural areas with lack of modern medicines (Ansari et al., 2021). According to the estimates of the World Health Organization (WHO), about 80 percent of world population depends on some kind of traditional medicine to meet their major demands on health (WHO, 2019). The increasing rate of chronic diseases, including diabetes mellitus (DM), cardiovascular disorders, neurodegenerative diseases, cancer, and autoimmune diseases has shown an active interest in natural and plant-based cure. The trend has caused a growth in the demand of herbal products, nutraceuticals and plant derived pharmaceuticals worldwide.

Chronic Diseases refer to long-term, progressive, and frequently irreversible type of illness, which needs constant care and management (Singh et al., 2025). These are long term illnesses that normally drive the patients towards alternative medicines such as complementary medicine that involve the use of traditional herbs that are considered as less hazardous compared to pharmaceutical drugs. This perception is however misguided. Quite a significant amount of TM bioactive substances have strong pharmacological effects, which in case not standardized and dosed properly may be life-threatening (El-Saadony et