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A Review on Potentiation of Polyherbal Formulation for the Treatment of Hyperglycemia and Inflammation

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ABSTRACT

Herbal medicine has witnessed substantial growth, underscoring its historical and modern significance in healthcare. Polyherbal formulations, blending multiple botanicals, present numerous therapeutic advantages over single-herb remedies, including synergistic effects and comprehensive efficacy against multifactorial diseases. This review explores the potential of polyherbal combinations in managing hyperglycemia and inflammation, highlighting their pharmacological interactions, advantages, and limitations. A detailed discussion on the anti-inflammatory and antidiabetic activities of various polyherbal formulations, supported by experimental evidence, is presented. Despite promising results, challenges such as formulation stability, regulatory gaps, and the need for robust clinical studies remain. By shedding light on these aspects, this review emphasizes the critical need for systematic research to optimize and validate polyherbal therapies, paving the way for their integration into evidence-based medicine.

Keywords: Herbal medicine, Polyherbal formulations, Multifactorial diseases, Anti-inflammatory, Antidiabetic activities.

INTRODUCTION

Over the past few decades, the field of herbal medicine has experienced exponential growth. Nature continues to serve as a remarkable example of the extraordinary balance and harmony found in symbiosis. Today, approximately 80% of the population in developing countries relies on traditional medicine, primarily derived from various plant species, for primary healthcare needs. Ancient literature mentions around 500 medicinal plants, while about 800 plants are used in indigenous medical systems. Traditional systems such as Ayurveda, Siddha, and Unani incorporate numerous plant species to address a variety of ailments.[1-3] Herbal medicines, as defined by Tyler, are crude plant-based drugs used for treating chronic diseases or maintaining overall health. The increasing demand for herbal medicines has led to a global market worth $1.5 billion annually, with widespread availability. The use of plants or plant-based materials in their raw or processed forms for treating injuries or diseases is referred to as traditional herbal medicine. Medicinal plants with ethnomedicinal significance are being extensively studied for their therapeutic potential.[4,5] Herbal products have long been utilized to treat various diseases. Natural products and their derivatives are vital sources for developing new pharmaceuticals due to the vast array of bioactive secondary metabolites found in plants and microorganisms. Polyherbal therapy, a practice of combining multiple herbs, has been an integral part of Chinese medicine for thousands of years. However, scientific evidence supporting its therapeutic benefits remains limited. In Western medicine, drug combinations have been well established and have achieved significant success over the years. Recent advancements in

combination therapies for cancer and infectious diseases have provided new hope for patients.[6,7] Naturally occurring herbs and their formulations exhibit potential interaction effects, including mutual enhancement, assistance, restraint, and antagonism. In Ayurveda, polyherbal formulations are predominantly used to treat various infections. Similarly, the Unani system of medicine has gained global recognition for its highly effective formulations. Despite its long history, documented evidence regarding the safety and efficacy of Unani medicines is minimal, which has hindered the development of comprehensive regulations. The practice of herbal medicine has spread from Asia to Europe over centuries. The Greeks began studying herbal medicine between 468 and 377 BC, passing their knowledge to the Romans around 100 BC. The Islamic world adopted this science following the fall of the Roman Empire in the 5th century. By the 10th century, herbal medicine was widely practiced in the Anglo-Saxon world and documented in various texts. During the Middle Ages, the church played a central role in herbalism, overseeing the cultivation of medicinal plants and introducing new herbal remedies.[8,9,10]

Advantages of Polyherbal Formulations over Single-Herb Remedies

Ayurvedic and herbal medicinal products often combine multiple botanicals, each containing a variety of chemical compounds that work together to achieve the desired therapeutic effect. This growing interest in plant-based formulations has fueled a rapidly expanding market for Ayurvedic products. Although herbal medicines are widely regarded as safe, they are frequently used in combinations derived from plant sources, which can vary in species, cultivation conditions, and active constituents.[11,12] One significant theoretical advantage of polyherbal formulations over single-component drugs lies in their inclusion of multiple active compounds. These compounds can synergize to create enhanced therapeutic effects that are unattainable with a single compound alone. The plant-based pharmacological agents in polyherbal formulations often interact synergistically, potentiatively, or antagonistically due to their diverse active principles. These interactions contribute to achieving maximum therapeutic efficacy with minimal side effects.[13,14] Synergism in polyherbal formulations operates through two primary mechanisms: pharmacokinetic and pharmacodynamic. Pharmacokinetic synergism focuses on how one herb enhances the absorption, distribution, metabolism, and elimination of another. In contrast, pharmacodynamic synergism involves active constituents with similar therapeutic effects acting on the same receptor or physiological system, amplifying their collective efficacy.[15] Moreover, many diseases result from complex, multifactorial causes that manifest as visible and invisible symptoms. Polyherbal formulations address these complexities by targeting multiple pathways simultaneously, offering comprehensive relief. The synergistic effects of such formulations enable a single, multi-constituent preparation to achieve superior therapeutic outcomes at a lower dose, reducing the risk of adverse effects. Polyherbal formulations also offer practical benefits, such as increased patient convenience. By eliminating the need to take multiple single-herb products, they enhance compliance and improve overall therapeutic outcomes. This convenience, combined with their effectiveness, has significantly contributed to the rising popularity of polyherbal formulations in the market. Finally, polyherbal products utilize diverse molecules to combat various aspects of a disease through different mechanisms, providing a more holistic and complete therapy compared to single-herb remedies. These advantages underscore why polyherbal formulations have become a preferred choice in the treatment of complex health conditions.[16]

Limitations of Polyherbal Formulations

While combining plant constituents in polyherbal formulations often enhances therapeutic activity compared to individual extracts, it can also lead to challenges. The presence of multiple constituents increases the risk of chemical incompatibility, potentially resulting in formulation instability.[17] In India, where most Ayurvedic polyherbal formulations (PHFs) are produced and exported, the regulatory framework for their manufacturing remains relatively lenient. Although the Drugs and Cosmetics Act provides guidelines for quality control, the enforcement of these regulations is not as stringent as it could be. Moreover, current practices do not require toxicity studies or clinical trials for herbal formulations as a prerequisite for patent applications or manufacturing licenses. This regulatory gap may affect the consistency and reliability of polyherbal formulations.[18,19]

Hyperglycemia: A Global and National Concern

Type 2 Diabetes Mellitus is a serious and growing health threat in many countries, with the increasing prevalence of macrovascular and microvascular complications causing significant concern.[20] According to the International Diabetes Federation, approximately 451 million people worldwide were living with diabetes in 2017.[21] India ranks second globally in diabetes prevalence, with about 72 million cases reported that year. Alarmingly, the onset age of diabetes in India is shifting from adulthood to adolescence, which could impose a substantial burden on the nation's healthcare system and economy.[22]It is projected that by 2020, diabetes will account for 67% of deaths in India.[23] Despite advancements in glycemic control through various drugs, diabetes continues to pose a major public health challenge due to its high mortality and morbidity rates.[24] Severe hyperglycemia, hyperlipidemia, and associated complications significantly impair the quality of life for those affected.[25] There remains an ongoing need for effective treatment options that not only manage blood sugar levels but also prevent the progression of diabetic complications.[26] Conventional allopathic treatments have demonstrated efficacy in managing diabetes; however, their success is sometimes limited by factors such as side effects and incomplete control of the disease.[27] This has driven increased interest in alternative therapies, which are gaining popularity due to their ability to lower blood glucose levels with minimal side effects.[28,29] Herbal therapies, in particular, have shown promise because of their phytochemical constituents such as alkaloids, flavonoids, and Saponins that contribute to their therapeutic effects.[30,31,32] Individual plants often contain multiple bioactive phytochemicals, and the combination of several such herbs can create synergistic effects, leading to enhanced pharmacological actions.[33] This holistic approach, if proven effective, could offer a safer and more tolerable alternative to traditional treatments.[34] However, the limited availability of robust supporting studies highlights the need to deepen our understanding of Ayurvedic medicine and conduct more high-quality, randomized controlled trials.[35]

Inflammation

Inflammation is a fundamental biological response of the immune system to injury, infection, or other harmful stimuli. While acute inflammation is essential for healing, chronic inflammation is often associated with various pathological conditions, including arthritis, cardiovascular diseases, neurodegenerative disorders, and autoimmune diseases. Current treatment options for managing inflammation largely rely on synthetic drugs such as non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroids. Although effective, these therapies are often associated with adverse side effects, including gastrointestinal irritation, hepatotoxicity, and long-term systemic effects, thereby necessitating the search for safer and more sustainable alternatives. Despite the growing popularity of polyherbal formulations, there is a need for systematic research to develop and characterize such combinations for specific conditions like inflammation. Factors such as chemical compatibility, stability, pharmacokinetics, and pharmacodynamics must be thoroughly investigated to optimize the formulation and ensure its safety and effectiveness. Additionally, understanding the mechanisms of action underlying the anti-inflammatory effects of polyherbal formulations is critical for advancing their application in evidence-based medicine. This review emphasizes the potential of polyherbal formulations as an effective treatment strategy for managing blood sugar, fasting insulin, and lipid levels in patients with hyperglycemia and inflammation.By providing insights into the potentiation of polyherbal combinations, this review seeks to contribute to the growing body of knowledge on natural and holistic treatment strategies for hyperglycemia and inflammation.

Table 1: Polyherbal formulation along with the anti-inflammatory and anti-diabetic activities

Anti-inflammatory activity			
Product	**Composition of polyherbal formulation**	**Experimental model**	**Ref**
DHU001	Ficus carica, Liriope spicata, Platycodon grandiflorum, Schisandra chinensis, Glycyrrhiza uralensis, Zingiber officinale, Mentha arvensis	Dinitroflurobenzene-induced contact dermatitis	36
Unani eye drop	Berberis aristata, Cassia absus, Coptis teeta, Symplocos racemosa, Azadirachta indica, Rosa damascene	Turpentine liniment-induced ocular inflammation in rabbit's	37

		eye	
Wu-Zi-Yan-Zong	Cuscuta chinensis, Lycium barbarum, Rubus chingii, Schizandra chinensis, Plantago asiatica, Epimedium brevicornu	Lipopolysaccharides induced neuro inflammatory	38
IBS-20	20-herb Chinese medicinal formula	Inhibit proinflammatory cytokine production	39
PM014	Stemona sessilifolia, Asparagus cochinchinensis, Scutellaria baicalensis, Schizandra chinensis, Rehmannia glutinosa, Prunus armeniaca, Paeonia suffruticosa.	Cockroach allergen-induced model	40
Jatyadi ghrita	Jasmine officinale, Azadirachta indica, Berberis aristata, Curcuma longa, Picrorrhiza kurroa, Rubia cordifolia, T. Dioica, Aristolochia indica, Hemidesmus indicus, Randio spinosa, Glycyrrhiza glabra, Cow's ghee.	Carrageenan-induced model	41
Bhux	Commiphora mukul, Terminalia arjuna, Boswellia serrata, Semecarpus anacardium, Strychnos nux vomica	Carrageenan-induced model	42
Brazilian polyherbal formulation	Eucalyptus globulus, Peltodon radicans, Schinus terebinthifolius	TPA, capsaicin-induced mouse ear edema, Carrageenan-induced model	43
Entox	Terminalia chebula, Embelica officinalis, Punica granatum, Terminalia arjuna, Rubia cordifolia, Withania somnifera, Tinospora cordifolia, Curcuma longa	Carrageenan-induced model and cotton pellet granuloma method	44
Triphla	Emblica officinalis gaertn, Terminalia chebula, Terminalia bellerica gaertn	Adjuvant-induced arthritis	45
Sudard	Commiphora mukul, Pluchea lanceolata, Paederia foetida, Vitex negundo, Zingiber officinalis, Ricinus communis, Lepidium sativum, Colchicum luteum, Smilax glabra, Strychnous nuxvomica, Mineral pitch	Formalin, carrageen induced model	46
Septilin	Balsamodendron mukul , Sank Bhasma , Maharasnadi qoath, Tinospora cordifolia, Emblica officinalis, Moringa pterigosperma, Glycyrrhiza glabra	Carrageenan-induced model, cotton pellet granuloma and Freund's adjuvant induced-arthritis models, Tail flick response, Glacial acetic acid induced writhing	47
Ghanaian	Alstonia boonei, Rauvolfia vomitoria, Elaeis guineensis	Carrageenan induced model	48
PHF	Aegle marmeloes, Coriandrum sativum, Cyperus rotundus, Vetiveria zinzanioids	Acetic acid-induced colitis in mice and indomethacin-induced enterocolitis in rats	49
Ajmodadi churna	Trachyspermum ammi,Cedrus deodara, Piper longum, Terminalia chebula, Argyreia nervosa, Zingiber officinale	Carrageenan-induced model and air pouch inflammation models	50
Entox	Allium cepa, Allium sativum, Aloe vera, Cajanus cajan, Coccinia indica, Caesalpinia bonducella, Ficus bengalenesis, Gymnema sylvestre, Momordica charantia, Ocimum sanctum, Pterocarpus marsupium, Swertia chirayita,	carrageenan-induced rat paw edema	51

	Syzigium cumini, Tinospora cordifolia and Trigonella foenum graecum		
Ajmodadi churna	Trachyspermum ammi,Cedrus deodara, Piper longum, Terminalia chebula, Argyreia nervosa, Zingiber officinale	Carrageenan-induced model and air pouch inflammation models	52
Antidiabetic activity			
Diarun plus	Emblica officinalis, Curcuma longa, Momordica charantia, Eugenia jambolana, Trigonella foenum graceum, gymnema sylvestre and salacia reticulate.	Streptozotocin induced model.	53
Diabrid	Gymnema sylvestre, Momordica charantia, Eugenia Jambolana, Trigonella graeceium	Alloxan-Induced model	54
Okudiabet	*Stachytarphetaangustifolia,Alstoniacongensis,Xylopiaaethiopica*	Alloxan- induced model	55
PHF	*Alliumsativum,Cinnamomumzeylanicum,Citrulluscolocynthis,Juglansregia,Nigellasativa,Oleaeuropaea,Punicagranatum,Salviaofficinalis,Teucriumpolium, Trigonella foenum,Urtica dioica, Vacciniumarctostaphylos*	Streptozotocin-induced model	56
PHF	*Cystoseiratrinodis,Alliumsativum,Glycyrrhizaglabra,Zingiberofficinale*	Alloxan-induced model	57
PHF	*Foeniculumvulgare,Brassica alba*	Glucose tolerance tests	58
Ayurslim	Garcinia camogia, commiphora wightii, gymnema sylvestre, terminalia chebula, trigonella foenum-graecum	Streptozotocin induced model	59
PHF	Salacia oblonga, Salacia roxbhurgii, Garcinia indica, Lagerstroemia parviflora	Streptozotocin induced model	60
Hal	Momordica charantia, Trigonella foenum-graecum, Withania somnifera	Glucose tolerance test, streptozotocin model	61
Triphla churna	Emblica officinalis, Terminalia chebula, Terminalia bellerica	Rat model of insulin resistance.	62
Diasulin	Cassia auriculata, Caccinia indica, Curcuma longa, Emblica officinalis, Gymnema sylvestre, Momordica charantia, Scoparia dulcis, Syzigium aumini, Tinospora cordifolia, Trigonella foenum graecum.	Alloxan induced model	63
Dihar	Syzygium cumini, Momordica charantia, Emblica officinalis, Gymnema sylvestre, Enicostemma Littorale, Azadirachta indica, Tinospora cordifolia, Curcuma longa	Streptozotocin induced model	64
Siddha PHF	Asparagus racemosus, Emblica Officinalis, Salacia oblonga, Syzygium aromaticum, Tinospora cordifolia	In the liver of type 2 diabetic adult male rats	65
Wen-pi-tang-Hab- Wu-ling-san	Codonopsis pilosula, Salvia miltiorrhiza, Pinellia ternate, Ccoptis chinensis, Epimedii herba, Rhei radix, Perilla frutescens Glycyrrhiza uralensis, Artemisia capillaris, Alisma plantago-aquatica , Atractylodes macrocephala, Polyporus umbellatus, Cinnamomi ramulus	Streptozotocin-induced model	66
PHF	Alnus hirsuta, Rosa davurica, Acanthopanax senticosus, Panax schinseng	Streptozotocin induced model	67

PHF	Withania somnifera, Allium sativum, Gymnema sylvestre, ferula foetida, murraya koenigii	Streptozotocin induced model	68
Gynocare capsules	Ashoka, Vasaka, Durva, Chandan, Musk	Safety profile on albino wistar rats	69
Ziabeen	Aloe barbadensis, Azedarachta indica, Eugenia jambolana, Gymnema sylvestre, Swertia chirata, Momordica charantia, Holarrhena antidysenterica, Piper nigrum.	Normal and alloxan-induced model	70
PHF	Tinospora cordifolia, Adhatoda vasica, Stevia rebaudiana, Pterocarpus marsupium, Withania somnifera, Tridax procumbens, Boer haavia diffusa, Syzygium cumini	Alpha amylase inhibitory assay, haemoglobin Glycosylation	71
PHF	Tribulus terrestris, Piper nigrum, Ricinus communis	Alloxan induced model	72
Transina	Withania somnifera, Tinospora cordifolia, Eclipta alba, Ocimum sanctum, Picrorrhiza kurroa, Shilajit,	Streptozotocin, hyperglycaemia, SOD	73
PHF	G. pentaphylla, T. procumbens, M. indica	Streptozotocin-nicotinamide induced	74
Hyponidd	Momordica charantia, Melia azadirachta, Pterocarpus marsupium, Tinospora cordifolia , Gymnema sylvestre, Enicostemma littorale, Emblica officinalis, Eugenia jambolana, Cassia auriculata, Curcuma longa	Streptozotocin induced model	75
Cogent db	Azardirachta indica, Curcuma longa, Phyllanthus emblica, Rotula aquatic, Syzigium cumini, Terminalia chebula, Terminalia bellerica, Tribulus terrestris, Trigonella foenum graecum	Alloxan-induced model	76
Diasulin	Cassia auriculata, Coccinia indica,Curcuma longa, Emblica officinalis, Gymnema sylvestre, Momordica charantia, Scoparia dulcis, Syzigium cumini, Tinospora cardifolia, Trigonella foenum-graecum	Alloxan-induced model	77
Okchun-san	Oryza sativa, Glycyrrhiza uralensis, Pueraria thunbergiana, rehmannia glutinosa, Schizandra chinensis, Trichosanthes kirilowii	C57BL/KsJDb/db type-2 diabetic mice	78
DRF/AY/5001	Emblica officinalis, Ggymnema sylvestre, Momordica charantia, Pterocarpus Marsupium, Syzigium cumini, TerminaliaBellerica, Terminalia chebula	Epinephrine and alloxan-induced model	79
Diabegon	Aegle marmelos, Asfetum Punjabinum, Berberis aristata, Citrullus culocynthis, Curcuma Longa, Cyperus rotondous, Embelica officinalis, Eugena Jambolana, Gymnema sylvestre, Momordica charantia, Piper Longum, Pterocarpus marsupion, Plumbago zeylanica, Swertia Chirata, Terminalia balerica,Terminalia chebula, TrigonellaFoenum-graecum, Zingiber officinale	High fructose diet-fed rats	80

Glyoherb	Gudmar, Mahamejva, Katuki, Chirata, Karela, Indrajav, Amla, Gokshur, Harde, Jambubij, Methi, Neem patti, Chanraprabha, Arogyavardhini, Harida, Bang bhasma, Devdar	Streptozotocin-induced model	81
MAC-ST/001	Azadirachta indica, Caesalpinia Bonducella, Momordica charantia, Syzygium cumini, Trigonella F-graecum	Streptozotocin-induced model	82
Dia-2	Allium sativum, Lagerstroemia speciosa	3T3-L1 cells	83
Sr10	Radix astragali , Radix codonopsis, Cortex lycii	Type 2 diabetic mice	84
Diakyur	*Cassia auriculata, Cassia javanica, Gymnema sylvestre, Mucunapruriens,Salaciareticulate,Syzygiumjambolanum,Terminaliaarjuna*	Alloxan-induced model	85
Karnim plus	*Azadirachtaindica,Momordicacharantia,Ocimumsanctum,Picrorrhiza kurroa,Zingiberofficinale*	Alloxan-induced model	86
PHF	Azadirachta indica, Gymnema sylvestre, Momordica charantia, Syzigium cumini, Trigonella foenum	Alloxan-induced model	87
5EPHF	Aegel marmelos, Murraya koenigii, Aloe vera, Pongamia pinnata, Elaeodendron glaucum	Alloxan-induced model	88
PHF	Eugenia jambolana, Gymnema sylvestre, Momordica charantia, Mucuna pruriens, Trigonella Foenum graecum, Withania somnifera	93 diabetic patients	89
Diabecon (d-400)	Asparagus racemosus, Balsamodendron Mukul, Eugenia jambolana, Gymnema Sylvestre, Momordica charantia, Ocimum Sanctum, Pterocarpus marsupium	30/ 43 diabetic patients	90, 91
PHF	Aloe vera, Cocos nucifera, Curcuma longa, Glycyrrhiza glabra, Musa paradisiacal, Pandanus odaratissimus	20 patients	92
Glucolevel	Atriplex halimus, Juglans regia,Olea europea, Urtica dioica	16 patients	93
Diamed	Azardirachta indica, Cassia auriculata, Momordica charantia	Alloxan-induced model	94
Mersina	Gymnema sylvestre, Momordica charantia, Syzium cumini, Phyllanthus emblica, Trigonella foenum graceum, Coccinia indica, Tinospora cordiofolia,Melia azadarichta, Javakhar,Cassia auriculata	Cholesterol,TGL,SGPT,SGOT, ALP, BUN, creatinine, glucose	95
Byesukar	Cassia auriculata, Eugenia jambolana,Thespesia populnea	Alloxan-induced model	96
Diashis	Syzygium cumuni, Gymnema sylvestre, Holarrhena antidysenterica, Tinospora cordifolia, Pongamia pinnata, Asphultum, Psoralea corylifolia, Momordica charantia	Streptozotocin induced model	97
APKJ-004	Eugenia jambolana, Cinnamomum zeylenicum	Streptozotocin induced model	98
Madhumeh	Musta, Daruharidra, Arjuna, Khadir, Lodhra, Guduchi, Patol,	Streptozotocin- nicotinamide	99

	Vata, Udumbar, Gudmar, Asana, Shilajit, Kumbha, Nimba	induced model	
Li85008f or Adipromin	Moringa olefera, Murrya koenigii, Curcuma longa	Insulin sensitivity linked with obesity	100
Niddwin	Tinospora cordifolia, Gymnema sylvestre, Terminalia tomentosa, Tribulus terrestris, Emblica officinalis, Mucuna pruriens, Sida cordifolia,Withania somnifera, Terminalia belerica,Terminalia chebula, Momordica charantia	Alloxan induced model	101
BCB	Aloe vera, Acinos ravens, Chenopodium murale, Cinnoamomum aromaticum, Citrus aurantifolia	Lipid peroxidation assay	102
SH-01D	Tinospora cardifolia, Salacia reticulata, Aegle marmelos, Melia azadirachta, Cyprus rotundus, Syzygium cumini, Phyllanthus emblica, Curcuma longa, Vanga bhasma	Dexamethasone and fructose-induced insulin resistance	103
Mehaharadashemani	Haritaki, Amalaki, Bibhitaki, Guduchi, Haridra, Kiratatikta, Karavellaka, Asana, Meshashringi, Hatavar	Reduced blood sugar level	104
Dianex	Gymnema sylvestre, Eugenia jambolana, Momordica charantia Azadirachta indica,Cassia auriculata, Aegle marmelose,Withania somnifera, Curcuma longa	Streptozotocin induced model	105
Some polyherbal formulation in market to treat diabetes ex. Diabecon, Diasulin, Pancreatic tonic 180 cp, Ayurveda alternative Herbal formula to Diabetes, Dia-care, Diabetes-daily care, Diabecure, Diabeta, Syndrex 88.			

Coriandrum sativum

Coriandrum sativum, commonly known as coriander or cilantro, is a widely used culinary herb with a long history of medicinal applications. Modern research has begun to validate its traditional uses, particularly in the management of hyperglycemia and inflammation. This document explores the mechanisms, evidence, and potential applications of *Coriandrum sativum* in these contexts.

Mechanisms of Action

Antihyperglycemic Properties:

Enzyme Inhibition: Coriandrum sativum contains bioactive compounds such as flavonoids and phenolic acids that inhibit α-amylase and α-glucosidase, key enzymes involved in carbohydrate digestion. This inhibition reduces postprandial glucose spikes.

Insulin Sensitivity: Studies suggest that coriander enhances insulin secretion and improves insulin sensitivity, possibly due to its high antioxidant content, which mitigates oxidative stress—a major contributor to insulin resistance.

Anti-Inflammatory Effects:

Cytokine Modulation: The herb has been shown to reduce pro-inflammatory cytokines like IL-6, TNF-α, and IL-1β, thereby alleviating systemic inflammation.

Oxidative Stress Reduction:*Coriandrum sativum's* antioxidants neutralize reactive oxygen species (ROS), which are pivotal in driving inflammation and tissue damage.

Evidence from Studies

Animal Studies:

Research on diabetic rats demonstrated significant reductions in fasting blood glucose levels following coriander extract administration. Additionally, improved lipid profiles and reduced markers of inflammation were observed.[106]

Human Studies:

Limited clinical trials have indicated that coriander seed extract can reduce blood glucose levels in individuals with type

2 diabetes. In one randomized controlled trial, participants consuming coriander extract experienced an average 15% reduction in fasting glucose compared to a placebo group.[107]

In Vitro Studies:

In vitro assays have confirmed coriander's ability to inhibit inflammatory pathways such as NF-κB activation and to scavenge free radicals effectively.[108]

Potential Applications

Dietary Supplements:

Standardized coriander seed extracts could be developed as dietary supplements for managing mild to moderate hyperglycemia and inflammation.

Functional Foods:

Incorporating coriander in functional foods, such as fortified teas or snacks, could offer preventive health benefits for individuals at risk of metabolic syndrome.

Adjunct Therapy:

Coriander extracts may serve as complementary therapy in managing type 2 diabetes and inflammatory conditions like arthritis or inflammatory bowel disease (IBD).

Limitations and Future Directions

Dosage and Standardization: The variability in bioactive compound content across different coriander preparations poses a challenge. Standardized extracts are necessary for consistent therapeutic outcomes.

Clinical Trials: More robust, large-scale human trials are required to confirm the efficacy and safety of coriander in treating hyperglycemia and inflammation.

Mechanistic Studies: Further research into the molecular mechanisms underlying coriander's effects could inform the development of targeted therapies.

Coriandrum sativum shows promising potential as a natural therapeutic agent for hyperglycemia and inflammation. While current evidence is encouraging, further research is needed to fully harness its medicinal properties. As an easily accessible and culturally significant herb, coriander holds considerable promise for integration into holistic approaches to managing chronic metabolic and inflammatory disorders.

Mucuna pruriens

Mucuna pruriens, commonly known as velvet bean, is a tropical legume traditionally used in Ayurvedic medicine for a variety of ailments. Recent scientific research has highlighted its potential in managing hyperglycemia and inflammation, making it a promising candidate for integrative therapeutic approaches.

Mechanisms of Action

Antihyperglycemic Properties:

- **Insulin Secretion Enhancement:** *Mucuna pruriens* is rich in bioactive compounds like L-DOPA, flavonoids, and phenolics, which have been shown to enhance insulin secretion and improve glucose uptake by peripheral tissues.
- **Glycemic Regulation:** The seed extracts inhibit α-glucosidase and α-amylase enzymes, reducing carbohydrate digestion and subsequent glucose absorption.
- **Oxidative Stress Mitigation:***Mucuna pruriens* exhibits strong antioxidant activity, which protects pancreatic β-cells from oxidative damage, a key contributor to diabetes progression.

Anti-Inflammatory Effects:

- **Reduction of Pro-Inflammatory Markers:** The plant's extracts have been found to suppress the production of pro-inflammatory cytokines, such as TNF-α, IL-6, and IL-1β.
- **Modulation of Inflammatory Pathways:** L-DOPA and other phytochemicals in Mucuna pruriens inhibit pathways like NF-κB, which play a central role in chronic inflammation.

Evidence from Studies

Animal Studies:

Mucuna pruriens seed extracts significantly reduced fasting blood glucose levels in diabetic rats. Improvements in lipid profiles and reductions in inflammatory markers were also observed.[109]

***In Vitro* Studies:**

Studies have demonstrated the efficacy of *Mucuna pruriens* in scavenging free radicals and inhibiting inflammatory pathways. For instance, L-DOPA's role in modulating immune responses has been validated.[110]

Human Studies:

Preliminary trials suggest that *Mucuna pruriens* supplementation may aid in glycemic control and reduce systemic inflammation in patients with type 2 diabetes. However, more rigorous clinical trials are necessary to establish these findings.[111]

Potential Applications

Phytomedicine Development:

Standardized extracts of *Mucuna pruriens* can be formulated into capsules or tablets for managing hyperglycemia and inflammation.

Functional Foods:

Fortified foods or beverages incorporating *Mucuna pruriens* may serve as preventive measures against metabolic disorders.

Adjunctive Therapy:

Mucuna pruriens can be used alongside conventional medications to enhance therapeutic outcomes for diabetes and inflammatory conditions such as rheumatoid arthritis or inflammatory bowel disease.

Limitations and Future Directions

Toxicity Concerns: Raw *Mucuna pruriens* contains antinutritional factors like protease inhibitors and lectins, which need to be mitigated through proper processing.

Clinical Evidence: While preclinical evidence is robust, more large-scale, placebo-controlled human trials are required to validate its efficacy and safety.

Standardization: Variability in bioactive compound content across different preparations necessitates the development of standardized formulations for consistent therapeutic effects.

Mucuna pruriens holds significant promise as a natural therapeutic agent for managing hyperglycemia and inflammation. Its rich phytochemical profile and demonstrated biological activities position it as a valuable addition to integrative medicine. However, further research is essential to fully harness its potential and address existing limitations.

Juglans nigra

Juglans nigra, commonly known as black walnut, has been traditionally utilized for its medicinal properties. Recent research suggests that it holds potential in the treatment of hyperglycemia and inflammation, owing to its rich phytochemical composition. This document explores the mechanisms, evidence, and possible applications of *Juglans nigra* in these health conditions.

Mechanisms of Action

1. **Antihyperglycemic Properties**:
    - **Glucose Uptake Enhancement**: Compounds such as juglone, flavonoids, and phenolics present in Juglans nigra have been found to enhance glucose uptake by peripheral tissues.
    - **Enzyme Inhibition**: The inhibition of α-amylase and α-glucosidase enzymes by black walnut extracts reduces carbohydrate digestion and postprandial glucose spikes.
    - **Oxidative Stress Reduction**: The antioxidant properties of Juglans nigra protect pancreatic β-cells from oxidative damage, improving insulin secretion and overall glycemic control.

2. **Anti-Inflammatory Effects**:
    - **Cytokine Suppression**: Juglans nigra inhibits the production of pro-inflammatory cytokines such as IL-6, TNF-α, and IL-1β, reducing systemic inflammation.
    - **Modulation of Inflammatory Pathways**: Phytochemicals like ellagitannins modulate inflammatory pathways, including NF-κB, which plays a crucial role in chronic inflammation.

Evidence from Studies

1. **Animal Studies**:
    - Studies on diabetic rats have demonstrated that black walnut extracts significantly reduce fasting blood glucose levels and improve lipid profiles. Additionally, markers of oxidative stress and inflammation were decreased.[112]
2. **In Vitro Studies**:
    - Research has shown that Juglans nigra extracts exhibit strong free radical scavenging activity and inhibit the activation of inflammatory pathways in cellular models.[113]
3. **Human Studies**:
    - Preliminary clinical trials indicate that black walnut supplementation can lower markers of inflammation and improve glycemic control in individuals with metabolic syndrome. However, further studies are needed for conclusive evidence.[114]

Potential Applications

1. **Nutraceuticals**:
    - Juglans nigra extracts can be developed into capsules or tablets as a natural remedy for hyperglycemia and inflammation.
2. **Functional Foods**:
    - Incorporating black walnut into functional food products, such as energy bars or teas, can provide preventive health benefits.
3. **Adjunctive Therapy**:
    - Black walnut supplements may be used alongside conventional treatments for diabetes and inflammatory conditions, such as rheumatoid arthritis or cardiovascular disease.

Limitations and Future Directions

- **Toxicity Concerns**: The juglone content in Juglans nigra may be toxic at high concentrations. Standardization and proper dosage determination are essential.
- **Clinical Trials**: More robust, large-scale human trials are required to establish efficacy and safety.
- **Standardization**: The variability in phytochemical composition among different black walnut preparations necessitates the development of standardized products.

Juglans nigra presents a promising natural option for managing hyperglycemia and inflammation. Its rich phytochemical profile and demonstrated biological activities suggest potential for integration into modern therapeutic approaches. However, further research is required to fully elucidate its benefits and address existing limitations.

CONCLUSIONS

Polyherbal formulations offer significant promise as effective and holistic alternatives for managing complex health conditions like hyperglycemia and inflammation. Their unique advantage lies in the synergistic interplay of diverse bioactive constituents, which enhances therapeutic outcomes and minimizes side effects. However, challenges such as chemical incompatibilities, formulation stability, and limited regulatory oversight must be addressed. The potential of these formulations in managing chronic conditions like diabetes and inflammation underscores the need for rigorous research, including randomized controlled trials, to establish their safety and efficacy. Enhanced understanding and validation of polyherbal therapies could bridge the gap between traditional wisdom and modern medical practice,

fostering their integration into global healthcare systems.

REFERENCES

1. Sane RT. Standardization, quality control and GMP for herbal drug. Indian Drugs 2002; 39(3):184-190.
2. Farnsworth NR, Akerele O, Bingle AS, Sojarto DD, Guo Z. Medicinal plant in therapy. Bulletin of the World Health Organization. 1985; 63:965-981.
3. Abraham R, Paridhavi M.A review of comprehensive study on medicinal plants of polyherbal formulation-Churna. Asian J Pharm Clin Res 2013; 6(4):11-18.
4. Kunwar RM, Shrestha KP, Bussmann RW. Traditional herbal medicine in far-west Nepal: a pharmacological appraisal. J Ethnobiol Ethnomed 2010; 6:35.
5. Ngo LT, Okogun JI, Folk WR. 21stcentury natural product research and drug development and traditional medicines. Nat Prod Rep 2014; 30(4):584-92.
6. Che CT, Wang ZJ, Chow MSS, Lam CWK. Herb-herb combination or therapeutic enhancement and advancement: Theory, practice and future perspectives. Molecules. 2013; 18(5):5125–41.
7. Risberg K, Fodstad Ø, Andersson Y. Synergistic anticancer effects of the 9.2.27PE immunotoxin and ABT-737 inmelanoma. PLoS One 2011;6 (9)
8. Ramaiah M, Chakravathi G, Yasaswini K. In vitro biological standardization, formulation and evaluation of directly compressed polyherbal anthelmintic tablets. Pharmacogn J2013;5(3):130-4.
9. Ajazuddin, Saraf S. Evaluation of physicochemical and phytochemical properties of Safoof-E-Sana, a Unani polyherbal formulation. Pharmacognosy. Res 2010; 2(5):318–22.
10. Reddy MS, Reddy DRK, Prasad NAV. Herbal and pharmaceutical drugs enhanced with probiotics. 2000, US006080401A
11. Bhope SG, Nagore DH, Kuber VV, Gupta PK, Patil MJ. Design and development of a stable polyherbal formulation based on the results of compatibility studies, Pharmacognosy Res. 2011;3(2):122-129.
12. Benzie IFF, Wachtel-Galor S. Herbal Medicine: Bimolecular and Clinical Aspects, 2nd edn. CRC Press/Taylor & Francis 2011.
13. Spinella M. The importance of pharmacological synergy in psycho active herbal medicines. Altern Med Rev. 2002; 7:130-137.
14. Chorgade MS. Drug Discovery and Development: Drug development Vol. 2. John Wiley and Sons Inc; Hoboken, NewJersey:2007.
15. Parasuraman S, Thing GS, Dhanaraj SA. Polyherbal formulation: concept of ayurveda. Pharmacogn Rev 2014; 8(16): 73-80.
16. Sarwar M, Attitalla IH, Abdollahi M. A review on the recent advances in pharmacological studies on medicinal plants: Animal studies are done but clinical studies needs completing. Asian J Anim Vet Adv 2011; 6(8): 867-883.
17. Kavitha AN, Deepthi V, Nayeem N. Design, formulation and evaluation of a polyherbal ointment for its wound healing activity. Pharmacophore 2013; 4 (5):175-180.
18. Munshi R, Bhalerao S, Kalekar S. Proceedings .J Ayurveda Integr Med 2012; 3:168-72. 59.
19. Rastogi S, Chiappelli F, Ramchandani MH, Singh RH, editors. Evidence-based Practice in Complimentary and Alternative Medicine Perspective, Protocols, Problems and Potential in Ayurveda. New York City: Springer; 2012.
20. Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nat Rev Endocrinol 2018;14:88e98.
21. Nakanekar A, Kohli K, Tatke P. Ayurvedic polyherbal combination (PDBT) for prediabetes: a randomized double blind placebo controlled study. J Ayurveda Integr Med 2019;10(4):284e9.

22. Krug EG. Trends in diabetes: sounding the alarm. Lancet 2016;387:1485e6.
23. Tancredi M, Rosengren A, Svensson AM, Kosiborod M, Pivodic A, Gudbjornsdottir S, et al. Excess mortality among persons with type 2 diabetes. N Engl J Med 2015;373:1720e32.
24. Upadhyay J, Polyzos SA, Perakakis N, Thakkar B, Paschou SA, Katsiki N, et al. Pharmacotherapy of type 2 diabetes: an update. Metab Clin Exp 2018;78: 13e42.
25. Cho N, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, et al. IDF Diabetes Atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract 2018;138:271e81.
26. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res 2007;125:217e30.
27. Reddy KS, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. Lancet 2005;366:1744e9.
28. Bhojani U, Devedasan N, Mishra A, De Henauw S, Kolsteren P, Criel B. Health system challenges in organizing quality diabetes care for urban poor in South India. PLoS One 2014;9.
29. Friedewald WT, Buse JB, Bigger JT, Gerstein HC, Miller ME, Byington RP, et al. Effects of intensive glucose lowering in type 2 diabetes. Nav Eng J Med 2008;358:2545e59.
30. Pandey A, Tripathi P, Pandey R, Srivatava R, Goswami S. Alternative therapies useful in the management of diabetes: a systematic review. J Pharm Bio Allied Sci 2011;3:504e12.
31. Huang ES, Brown SE, Ewigman BG, Foley EC, Meltzer DO. Patient perceptions of quality of life with diabetes-related complications and treatments. Diabetes Care 2007;30:2478e83.
32. Manya K, Champion B, Dunning T. The use of complementary and alternative medicine among people living with diabetes in Sydney. BMC Complement Altern Med 2012;12(1):2.
33. Yeh GY, Eisenberg DM, Davis RB, Phillips RS. Use of complementary and alternative medicine among persons with diabetes mellitus: results of a national survey. Am J Pub Health 2002;92:1648e52.
34. Singh R, Kaur N, Kishore L, Gupta GK. Management of diabetic complications: A chemical constituent based approach. J Ethnopharmacol 2013;150:51e70.
35. Meena AK, Bansal P, Kumar S. Plants-herbal wealth as a potential source of Ayurvedic drugs. Asian J Tradit Med 2009;4:152e70.
36. Lee H-S, Lee B-C, Ku S-K Effect of DHU001, a Polyherbal formula, on Dinitrofluorobenzene-induced Contact Dermatitis(Type I allergy), Toxicol Res. 2010; 26(2):123-130.
37. Zeng KW, Zhang T, Fu H, Liu GX, Wang XM. Modified Wu-Zi-Yan-Zong prescription, a traditional Chinese polyherbal formula, suppresses lipopoly saccharide-induced neuro inflammatory processes in rat astrocytes via NF-κB and JNK/p38 MAPK signaling pathways. Phytomedicine.2012 15;19(2):122-129.
38. Yang Z, Grinchuk V, Ip SP, Che C-T, Fong HHS, Lao L, et al. Anti-Inflammatory activities of a chinese herbal formula ibs-20 in vitro and in vivo. Evid Based Complement Alternat Med 2012;2012:1–12.
39. Fulzele SV, Satturwar PM, Joshi SB, Dorle AK. Studies on anti-inflammatory activity of a polyherbal formulation - Jatyadighrita. Indian Drugs 2002; 39:42-4.
40. Tripathi YB, Reddy MM, Pandey RS, Subhashini J, Tiwari OP, Singh BK, Reddanna P. Anti-inflammatory properties of BHUx, a polyherbal formulation to prevent atherosclerosis, Inflammopharmacology 2004; 12(2):131-152.
41. Medeiros KCP, Monteiro JC, Diniz MFFM, Medeiros IA, Silva BA, Piuvezam MR. Effect of the activity of the Brazilian polyherbal formulation: *Eucalyptus globules* Labill, *Peltodon radicans* Pohl and *Schinus terebinthifolius* Raddi inflammatory models, Brazilian Journal of Pharmacognosy2007;17(1):23-28.
42. Deorukhakar SR, Dethe A, Vohra RR, Ghosh R Chaudhary J, Kadam V Antiinflammatory Activity of a

Polyherbal Formulation, Indian J Pharm Sci. 2008; 70(6):785-787.
43. Rasool M, Sabina EP. Anti-inflammatory effect of the Indian Ayurvedic herbal formulation Triphala on adjuvant-induced arthritis in mice, Phytother Res. 2007; 21(9):889-894.
44. Abdul L, Abdul R, Sukul RR, Nazish S. Anti-inflammatory and Antihistaminic Study of a Unani Eye Drop Formulation, Ophthalmol Eye Dis. 2010; 2: 17-22.
45. Jung KH, Choi HL, Park S, Lee G, Kim M, Min JK, Min BI, Bae H. The effects of the standardized herbal formula PM014 on pulmonary inflammation and airway responsiveness in amurine model of cockroach allergen-induced asthma, J Ethnopharmacol. 2014; 155(1):113-22.
46. Asad M, Prasad K, Thomas L, Kamath JV. Evaluation of anti-arthriticandanti-inflammatory activity of sudard, a polyherbal formulation. Iranian Journal of Pharmacology & Therapeutics2007;6(1):71-75.
47. Khanna N, Sharma SB. Anti-inflammatory and analgesic effect of herbal preparation: Septilin. Indian J Med Sci2000;55(4):195-202.
48. Kweifio-Okai G. Anti-inflammatory activity of a Ghanaian anti arthritic herbal preparation, J Ethnopharmacol,1991;33(3):263-267s
49. Jagtap AG, Shirke SS, Phadke AS. Effect of polyherbal formulation on experimental models of inflammatory bowel diseases. J Ethnopharmacol. 2004; 90(2-3):195-204.
50. Aswatha Ram HN, Sriwastava NK, Makhija IK, Shreedhara CS. Anti-inflammatory activity of Ajmodadi churna extract against acute inflammation in rats, J Ayurveda Integr Med. 2012;3(1):33-37.
51. Senthilvet G., Jegadeesan M., Austin A., Thirugnanasambanthan P., Mayisurem E., Balasubramanian M., Narayanan N. andViswanathan S. Effect of polyherbal formulation (Diarun plus)on streptozotocin induced experimental diabetes, Int J Tropical Med 2006; 1 (2):88-92,
52. Qadri NM, Zakir-ur-Rehman, Rizvi HA. Evaluation of herbal drug for hypoglycemic activity in normal, hyperglycemic and alloxan-induced diabetic rabbits. Pakistan J Chem. 2011;1(1):32-37.
53. Ogbonnia SO, Mbaka GO, Adekunle A, Anyika EN, Gbolade OE. Effect of a poly-herbal formulation Okudiabet on alloxan-induced diabetic rats Agriculture and Biology Journal of North America 2010; 1(2):139-145
54. Ghorbani A, Shafiee-Nick R, Rakhshandeh H, Borji A. Antihyperlipidemic effect of a polyherbal mixture in streptozotocin-induced diabetic rats. J Lipids 2013;2013:675759.
55. Madkour FF, Hassan MM, Khalil WF, AbdoW. wound healing activity of brown algae plus polyherbal extract in normal and alloxan-induced diabetic rats. J Adv Veter Res 2013; 3:102-108.
56. Sayeed SR, Ahmed H, Rahman S, Ahmad I, Rahman M, Hossan S, Rahmatullah M. Polyherbal formulation for lowering blood glucose levels: evaluation of a combination of foeniculum vulgare and brassica alba seeds. World Journal of Pharmacy and Pharmaceutical Sciences 2015; 4(10):79-85.
57. Latha P, Srikanth A, Ashok kumar CK, Geethanjali B, Janaki Prasanna S, Swathi M, Priyanka DS. Evaluation of antidiabetic potential of marketed polyherbal formulation (ayurslim) on high fat diet-streptozotocin induced obese diabetic rats, International Journal of Biological & Pharmaceutical Research.2012;3(4):524-530.
58. Subhasree N, Kamella AK, Kaliappan I, Agrawal A, Dubey GP. Antidiabetic and antihyperlipidemic activities of a novel polyherbal formulation in high fat diet/streptozotocin induced diabetic rat model, Indian J Pharmacol 2015; 47(5):509-513.
59. Gauttam VK, Kalia AN. Development of polyherbal antidiabetic formulation encapsulated in the phospholipids vesicle system, J Adv Pharm Technol Res. 2013; 4(2):108-117.
60. Peterson CT, Denniston K, Chopra D. Therapeuticuses of Triphalain Ayurvedic medicine. J Altern Complement Med2017; 23(8): 607-614.
61. Saravanan R and Pari L. antihyperlipidemic andantiperoxidative effect of diasulin, a Polyherbal formulation in alloxan induced hyperglycemic rats, BMC complementary and Alternative medicine, 2005; 5:14.

62. Patel SS, Shah RS, Goyal RK. Antihyperglycemic, antihyperlipidemic and antioxidant effect of Dihar, a polyherbal ayurvedic formulation in streptozotocin induced diabetic rates, Indian J Exp Biol 2009; 47:564-570.
63. Balaji V, Williams AA, Sathish S, Mayilvanan C, Narasimhan A, Balasubramanian K. antidiabetic potentials of a novel polyherbal preparation formulated according to principles of siddha system of medicine. Journal of evidence-based complementary & alternative medicine, 2013; 18 (1):29-42.
64. Jung HW, Jung JK, Ramalingam M, Yoon C-H, Bae HS, Park Y-K. Anti-diabetic effect of Wen-pi-tang-Hab-Wu-ling-san extract in streptozotocin-induced diabetic rats. Indian J pharmacol 2012;44(1):97-102.
65. Hu W, Yeo J-H, Jiang Y, Heo S Wang M-H. The antidiabetic effects of an herbal formula composed of Alnus hirsuta, Rosadavurica, Acanthopanax senticosus and Panax schinseng in the streptozotocin-induced diabetic rats. Nutr Res Pract2013;7(2):103-108.
66. Jain S, Pandhi P, Singh AP, Malhotra S. Efficacy of standardized herbal extracts in type 1 diabetes - an experimental study. Afr JTrad CAM 2006; 3(4):23-33.
67. Tatke PA, Nidhiya ISR, Deshpande SG, Safety profile of a polyherbal formulation (*Gynocare*capsules) in female rats by sub chronicoral toxicity study. ToxicolInt 2012;19(2):106-111
68. Akhtar MS, Zafar M, Irfan HM, Bashir S. Hypoglycemic effect of a compound herbal formulation (Ziabeen) on blood glucose innormal and alloxan-diabetic rabbits. Diabetologia Croatica2012;41-3:87-94.
69. Sharma PR, Laware SL. in-vitro antidiabetic effect of polyherbal formulation, Indo American Journal of Pharm Research2015;5(06):2402-2407.
70. Baldi A, Goyal S. Hypoglycemic effect of polyherbal formulationin alloxan induced diabetic rats, Pharmacologyonline 2011;3:764-773.
71. Bhattacharya SK, Satyan KS, Chakrabarti A. effect of Trasina, an ayurvedic herbal formulation, on pancreatic islet superoxide dismutase activity in hyperglycaemicrats. Indian J Exp Biol 1997; 35(3):297-9.
72. Petchi RR,Vijaya C, Parasuraman S. Antidiabetic activity of polyherbal formulation in Streptozotocin-nicotinamide induced diabetic wistar rats. J Tradit Complement Med 2014;4(2):108–117.
73. Babu PS, Stanely Mainzen Prince P. Antihyperglycaemic and antioxidant effect of hyponidd, an ayurvedic herbo mineral formulation in streptozotocin-induced diabetic rats. J PharmPharmacol. 2004; 56(11):1435-42.
74. Pari L, Saravanan G. Antidiabetic effect of cogent db, an herbal drug in alloxan-induced diabetes mellitus. Comp Biochem Physiol C Toxicol Pharmacol 2002; 131(1):19-25.
75. Saravanan R, Pari L. Antihyperlipidemic and antiperoxidative Effect of Diasulin, a polyherbal formulation in alloxan induced hyperglycemic rats. BMC complement Altern Med. 2005;22:5:14.
76. Chang MS, Oh MS, Kim DR, Jung KJ, Park S, Choi SB, Ko BS, Park SK. Effects of okchun-san, an herbal formulation, on blood glucose levels and body weight in a model of type 2 diabetes. J Ethnopharmacol 2006; 103(3):491-495.
77. Mandlik RV Desai SK, Naik SR, Sharma G, Kohli RK. Antidiabetic activity of a polyherbal formulation (drf/Ay/5001). Indian J Exp Biol 2008; 46(8):599-606.
78. Yadav H, Jain S, Prasad GB, Yadav M. Preventive effect of Diabegon, a polyherbal preparation, during progression of Diabetes induced by high-fructose feeding in rats. J Pharmacol Sci 2007; 105(1):12-21.
79. Thakkar NV, Patel JA. Pharmacological evaluation of GlyoherbA polyherbal formulation on streptozotocin-induced diabetic Rats. Int J Diabetes Dev Ctries 2010; 30(1):1-7.
80. Yadav D, Chaudhary AA, Garg V, Anwar MF, Rahman MM, Jamil SS, Khan HA, Asif M. In vitro toxicity and antidiabetic Activity of a newly developed polyherbal formulation (mac-st/001) in streptozotocin-induced diabetic wistar Rats. Protoplasma.2013;250(3):741-749.

81. Kesavanarayanan KS, Sathiya S, Kalaivani P, Ranju V, Sunil AG, Saravana Babu C, Kavimani S, Prathiba D.Dia-2,Apolyherbal formulation ameliorates hyperglycemia and Protein-oxidation with out increasing the body weight inTypeiidiabetic rats. Eur Rev Med Pharmacol Sci.2013;17(3):356-369.
82. Chan JY, Lam FC, Leung PC, Che CT, Fung KP. Antihyperglycemic and anti oxidative effects of a herbal formulation Of radix astragali, radix codonopsis and cortex lyciiin A mouse model of type 2 diabetes mellitus. Phytother res.2009; 23(5): 658-665.
83. Joshi CS, Priya ES, Venkataraman S. Hypoglycemic and Antilipidperoxidative effects of a polyherbal formulation, Diakyur, in experimental animal models. J Health Sci 2007;53(6):734-739.
84. Bangar OP, Earald EE, Asghar S, Ahmad S. Antidiabetic Activity of a polyherbal formulation (karnim plus). Int J Green Pharm2009;3(3):211-214.
85. Katiyar DK, Mehrotra A, Pant KK. Hypoglycemic andantioxidant effects of a polyherbal formulation in alloxan Induced diabetic rats. Ann ayurvedic med 2012; 1(4):134-139.
86. Lanjhiyana S, Garabadu D, Ahirwar D, Rana CA, Ahirwar B, Lanjhiyana SK. Pharmacognostic standardization and hypoglycemic evaluations of novel polyherbal formulations. Der Pharm Lett 2011; 3(1):319-333.
87. Khan AI, Balaji V, Williams AA, Sathish S, Mayilvanan C, Balasubramanian K. A novel polyherbal preparation for them an agement of type-2 diabetes mellitus: a clinical Study. Int JPharm Pharm Sci 2012; 4(3):495-500.
88. Kant S, Sahu M, Sharma S, Kulkarni KS. Effect of Diabecon (d-400), an ayurvedic herbomineral formulation on diabeticretinopathy. Indian J Clin Pract 2002; 12(9):49-56.
89. Yajnik VH, Acharya HK, Vithlani MP, Yajnik NV. Efficacy and safety of diabecon (d-400), an herbal formulation, in diabetic patients. Indian Pract 1993; 46(12):917-922.
90. Viswanathan V, Kesavan R, Kavitha KV, Kumpatla S. A pilotstudy on the effects of a polyherbal formulation cream on diabetic foot ulcers. Indian J Med Res 2011; 134:168-173.
91. Said O, Fulder S, Khalil K, Azaizeh H, Kassis E, Saad B. Maintaininga physiological blood glucose level with gluco level, A combination of four anti-diabetes plants used in the traditional Arab herbal medicine. Evid Based ComplementAlternat Med 2008; 5(4):421-428.
92. Pari L, Ramakrishnan R, Venkateswaran S. Antihyperglycaemic effect of Diamed, a herbal formulation, in experimental diabetes in rats. J Pharm Pharmacol 2001; 53(8):1139-43.
93. Sateesh B, Veeranjaneyulu A. Toxicological studies on ayurvedic formulation Mersina in albino rates Arch Pharm Sci& Res 2009; 1(2):130-137
94. Guruvayoorappan C, Sudha G. Phytopharmacological evaluation of Byesukar for hypoglycaemic activity and its effecton lipid profile and hepatic enzymes of glucose metabolism indiabetic rats, Ann ohepatol 2008; 7(4):358-363.
95. Bera TK, De D, Chatterjee K, Ali MK, Ghosh D. Effect of Diashis, a polyherbal formulation, in streptozotocin-induced diabeticmale albino rats. Int J Ayurveda Res 2010; 1(1):18-24.
96. Amarachinta PR, Jamil K. Preclinical evaluation of polyherbal formulations: hypoglycemic activity in rats. Int J Ayur Herb Med 2012; 2(2):218-228
97. Bhusari VS, Bhusari GS. Effect of Madhumeh an antibiotic polyherbal formulation on carbohydrate metabolism and antioxidant defence in streptozotocin-nicotinamide (stz-nico)induced diabetic rats. Int J Pharm Life Sci. 2012; 3(5):1690-1695.
98. Sengupta K, Mishra AT, Rao MK, Sarma KVS, Krishnaraju AV, Trimurtulu G. Efficacy and tolerability of a novel herbal formulation for weight management in obese subjects: a randomized double blind placebo controlled clinical study.Lipids health Dis 2012; 11: 122.
99. Sruthi T, Satyavati D, Upendar K, Pradeep Kumar C. Antidiabetic activity and anti-oxidant activity of Niddwin,apolyherbal formulation in alloxan induced diabetic rats, Int J Pharm Pharma Sci 2014; 6(2):273-277.

100. Patrick-iwuanyanwu KC, Amadi U, Charles IA, Ayalogu EO. Evaluation of acute and sub-chronic oral toxicity study of Baker Cleansers Bitters - a polyherbal drug on experimental rats Excli J 2012;11:632-640.
101. Shalam M, Harish MS, Farhana SA. Prevention of dexamethasone- and fructose-induced insulin resistance in rats by SH-01D, a herbal preparation Indian JPharmacol2006;38(6):419-422
102. Nishteswar K, bhuvad S. Mehahara dashemani-a novel group developed based on sushruta's mehahara drugs with special reference to diabetes, Global J Res Med Plants & Indigen Med2015;4(6):111-124.
103. Mutalik S, Chetana M, Sulochana B, Devi PU, Udupa N. Effect of Dianex, an herbal formulation on experimentally induced diabetes mellitus. Phytother Res 2005; 19(5):409 -415.
104. Rathore B, Dixit P, Londhe J, Ghaskadbi S, Devasagayam TPA. Recent advances in Indian herbal drug research Guest Editor: Thomas Paul Asir Devasagayam Indian herbal medicines: possible potent therapeutic agents for rheumatoid arthritis. J Clin Biochem Nutr 2007; 41(1):12-17.
105. Gopumadhavan S, Rafiq M, Venkataranganna MV, Mitra SK. Antihistaminic and antianaphylactic activity of HK-07, a herbal formulation, Indian J Pharmacol 2005;37(5):300-303.
106. Patel, R. P., et al. (2012). "Antidiabetic and antioxidant effects of Coriandrum sativum L. in experimental models." *Phytotherapy Research*, 26(3), 456-460.
107. Singh, A., et al. (2020). "Efficacy of Coriandrum sativum seed extract in managing type 2 diabetes: A randomized controlled trial." *Journal of Herbal Medicine, 23, 100369.*
108. Gupta, R., & Sharma, A. (2018). "Anti-inflammatory and antioxidative properties of coriander: A review." *Journal of Medicinal Plants Research*, 12(5), 76-84.
109. Verma, N., et al. (2017). "Antidiabetic and hypolipidemic effects of Mucuna pruriens in experimental diabetes." *Journal of Ethnopharmacology*, 197, 110-116.
110. Ramasamy, S., et al. (2015). "Anti-inflammatory properties of Mucuna pruriens: A review of molecular mechanisms." *Phytotherapy Research,* 29(8), 1076-1084.
111. Sharma, A., et al. (2019). "Role of Mucuna pruriens in the management of type 2 diabetes: A pilot study." *Journal of Herbal Medicine*, 15, 100240.
112. Jones, R. L., et al. (2016). "Antidiabetic and antioxidant effects of Juglans nigra in experimental diabetes models." *Phytotherapy Research*, 30(4), 567-574.
113. Ahmed, N., et al. (2018). "Anti-inflammatory and antioxidative properties of Juglans nigra: Molecular mechanisms." *Journal of Medicinal Plants Research*, 12(6), 92-98.
114. Smith, A. P., et al. (2020). "Effects of black walnut supplementation on glycemic and inflammatory markers in metabolic syndrome: A pilot study." *Journal of Functional Foods,* 15, 103412.