"COMPARATIVE EXPERIMENTAL STUDY OF THE AQUEOUS ROOT EXTRACT OF *SARIVA* AND ITS MARKET SAMPLES IN DEXAMETHASONE-INDUCED HYPERGLYCEMIA IN WISTAR RATS"

FINAL REPORT

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ABSTRACT

Title: Comparative Experimental Study of the Aqueous Root Extract of Sariva and its Market Samples in Dexamethasone-Induced Hyperglycemia in Wistar Rats

Background: Sariva (*Hemidesmus indicus*), known for its antidiabetic, hepatoprotective, and blood-purifying properties, is increasingly substituted in the market with similar herbs like *Cryptolepis buchanani* and *Decalepis hamiltonii*. With diabetes mellitus posing a global health challenge, there is an urgent need to explore potential botanical interventions that are both effective and standardized.

Objective:To compare the antidiabetic activity of aqueous root extracts of *Hemidesmus indicus* (HIRE) and its commonly used market substitutes—*Cryptolepis buchanan*i (CBRE) and *Decalepis hamiltonii* (DHRE)—in a dexamethasone-induced hyperglycemia model in Wistar rats.

Methods: Thirty-six adult Wistar rats were divided into six groups (n=6): Normal Control, Diseased Control, Standard (Metformin), HIRE, CBRE, and DHRE. Diabetes was induced via intraperitoneal administration of dexamethasone (8 mg/kg) for 10 days. After induction, standard and test groups received oral treatment with Metformin (200 mg/kg), HIRE (500 mg/kg), CBRE (250 mg/kg), and DHRE (400 mg/kg), respectively, for 10 days. Blood glucose levels were monitored via the Oral Glucose Tolerance Test (OGTT) at 0, 30, 60, and 120 minutes following glucose administration (2 g/kg). Biochemical parameters including AST, ALT, ALP, albumin, and total protein were evaluated. Liver histopathology was performed to assess tissue recovery.

Results:The OGTT results indicated a marked elevation in blood glucose levels in the diseased control group across all time points. Metformin significantly reduced glucose spikes, especially at 30, 60, and 120 minutes. Among the test extracts, DHRE showed the closest effect to Metformin, significantly controlling glucose levels at all measured intervals ($p < 0.01$). HIRE followed DHRE in efficacy, while CBRE showed comparatively less glucose-lowering potential.

Biochemical analysis revealed elevated liver enzymes in the diseased control group, confirming hepatic stress. Treatment with DHRE and HIRE effectively reduced AST, ALT, and ALP levels, indicating hepatoprotection, whereas CBRE showed a less pronounced

effect. Albumin and total protein levels were restored significantly by DHRE and HIRE, reinforcing their role in improving liver function.

Histopathological studies further corroborated these findings. Livers from the DHRE group exhibited near-normal cellular architecture with minimal congestion, closely resembling the Metformin group. HIRE-treated samples showed moderate recovery, while CBRE-treated livers displayed only mild improvements compared to the diseased control.

Conclusion: The study demonstrates that *Decalepis hamiltonii* (DHRE) exhibits superior antidiabetic and hepatoprotective effects compared to *Hemidesmus indicus* (HIRE) and *Cryptolepis buchanani* (CBRE) in dexamethasone-induced diabetic rats. These effects may be attributed to its rich content of glycosides, flavonoids, and phenolic compounds. DHRE's performance was comparable to Metformin in many parameters, suggesting its potential as a reliable herbal antidiabetic agent. Ensuring the use of genuine and effective herbal sources like DHRE is critical for maintaining the efficacy and integrity of Ayurvedic formulations.

INSTITUTIONAL ANIMAL ETHICAL COMMITTEE

CERTIFICATE

This is to certify that the project proposal no. SPARK/2024/6176/1505 entitled "COMPARATIVE EXPERIMENTAL STUDY OF THE AQUEOUS ROOT EXTRACT OF SARIVA AND ITS MARKET SAMPLES IN DEXAMETHASONE INDUCED HYPERGLYCEMIA IN WISTAR RATS." submitted by Ms. Neha Parasharam Gojekar has been approved/recommended by the IAEC of KLE College of Pharmacy, Hubballi in its meeting held on 15/4/2025 and 18 Wistar albino rats have been sanctioned under this proposal for a duration of next 1month.

Authorized by	Name	Signature	Date
Chairman	Dr. A H M V Swamy		15/04/2025
Member secretary	Dr. Santosh B Patil		15/04/2025
Main nominee of CCSEA	Dr. Prabhakar Adake		15/4/25

OBJECTIVES AS PROPOSED

To Compare and evaluate the **anti-hyperglycemic potential** of authentic **Sariva** and its market samples (*Decalepis hamiltonii,* and *Cryptolepis buchanani)*.

OBJECTIVES ACHIEVED

The present study successfully achieved the proposed objective of comparing and evaluating the anti-hyperglycemic potential of authentic *Sariva* (*Hemidesmus indicus*) and its commonly used market substitutes (*Decalepis hamiltonii* and *Cryptolepis buchanani*) in a dexamethasone-induced hyperglycemic Wistar rat model. The key findings that reflect the achievement of this objective include:

- Comparative OGTT Data: The oral glucose tolerance test revealed a significant elevation in glucose levels in the diseased control group, while all treatment groups demonstrated glucose-lowering effects. Among the three extracts, *Decalepis hamiltonii* (DHRE) showed the most potent antihyperglycemic effect, followed by *Hemidesmus indicus* (HIRE), and then *Cryptolepis buchanani* (CBRE).
- Statistical Validation: One-way ANOVA followed by Tukey's test confirmed that DHRE significantly reduced glucose levels at all time intervals compared to the diseased control ($p < 0.01$), nearly matching the standard Metformin group.
- Supportive Biochemical Findings: DHRE and HIRE not only reduced fasting blood glucose but also restored liver enzyme levels and protein synthesis markers (albumin and total protein), confirming their systemic antidiabetic and hepatoprotective effects.
- Histopathological Correlation: Liver tissue from DHRE-treated rats showed near-normal architecture with reduced congestion and cellular damage, supporting its superior protective effect.

Thus, the study met its objective by demonstrating that while all three extract samples exhibited anti-hyperglycemic activity, *Decalepis hamiltonii* possessed the most effective potential, even surpassing authentic *Sariva* in certain parameters. These findings highlight the relevance of botanical alternatives in diabetes management and the importance of source validation in Ayurvedic drug formulations.

INTRODUCTION

In India, Sariva (*Hemidesmus indicus* (Linn.) R. Br.) is referred to as Anantamula. A rare and endangered plant from India's Deccan plateau, *Hemidesmus indicus* contains a number of active compounds with potential medicinal properties. Numerous phytoconstituents from the categories of glycosides, flavonoids, tannins, sterols, and volatile oils are present in it. [1] Two types of Sariva are primarily identified in ancient Ayurvedic scriptures as Sweta and Krishna sariva, and both have comparable medicinal properties. [2]

According to API, the genuine source of Shveta Sariva is *Hemidesmus indicus* (Linn.) R. Br., whereas the source of Krishna Sariva is *Cryptolepis buchanani* (Linn.) Roem and Schult. *Decalepis hamiltonii* is used as a real sariva and substitute in southern India. [3] Because they are plentiful and easy to harvest, and frequently used in place of *Hemidesmus indicus* roots. The roots of Sariva are its primary medicinal component. They are recognized for their tonic, diuretic, and alterative properties. A decoction prepared from the roots is beneficial in managing skin disorders, syphilis, elephantiasis, loss of appetite, blood purification, anti-diabetic, various kidney and urinary conditions.[4]

Diabetes mellitus is one of the most severe metabolic disorders globally, with India ranking among the top three affected countries. This condition poses significant health risks and is associated with numerous complications, including retinopathy, neuropathy, and angiopathy, which impact various organs, particularly the eyes, and can lead to the dysfunction and failure of essential organs.[5] The global diabetes prevalence in 2019 is estimated to be 9.3% (463 million people), rising to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045. [6] Increasing prevalence has led to the discovery of new anti-diabetic drugs and along with this, there is a real need for botanical alternatives, especially for patients with type 2 diabetes.

With the increased demand of herbal medicine, the chances of product adulteration are increased. The ambiguity of product is either unintentional or intentional. By identifying and utilizing the other market samples, Ayurveda helps in ensuring the quality of rare species while maintaining the availability of essential medicinal resources. The efficacy of Ayurveda system mainly depends on the use of genuine raw material of quality and standardized ingredients in the manufacture of medicines. Hence, quality assurance of market samples is a very important step for getting the global acceptance of this stream of medicine.[7]

Herbs form the core of ayurveda medicine. Potent and best source plant can show best result in therapeutics. Hence, considering all these factors a study has been planned to conduct

comparative experimental activity of Sariva and its market sample w.s.r to anti diabetic activity. The 2 market samples selected are *Cryptolepis buchanani* (Linn.) Roem and Schult. *(Asclepiadaceae)* and *Decalepis hamiltonii* Wight and Am. *(Asclepiadaceae)*

REVIEW OF LITERATURE

DRUG REVIEW OF SARIVA

VYUTHPATTI:

"Sheeryantenaya doshaha iti" **i**.e. the drug is named as Sariva because it combats the vitiated doshas

PARIBHASHA

'Saari prasaranamstasya'
Sariva (Hemidesmus indicus) is a twinner that spreads on the ground.

VEDIC PERIOD

Sariva is not found in Rig-Veda, Yajurveda, Samveda and Atharvaveda. Atharva-Parishishta described Ananta (1/43/6) and Sariba (*Hemidesmus indicus* R.Br.) (5/1/5); also in Kalpasutra use of Sariva is mentioned.

SAMHITA PERIOD –

Sariva has been extensively used in brihatrayee and laghutrayee.

Caraka Samhita

Two varieties of sariva are mentioned. In Samhita, sariva is enumerated as 'Ananta' in Kashaya skandha and 'Gopavalli' in Madhura skanda. Sutra Sthana 4th Chapter Sariva is mentioned in following six Mahakashaya:

(1) Varnya Gana, (2) Kanthya Gana, (3) Stanyashodhana Gana, (4) Jvaratisarahara Gana,

(5) Purishsangrahniya Gana, and (6) Dahaprashamnan Gana.

It is described in 19 formulations in the treatment of Jvaratisara, Kasa, Kushtha, Atisara, Visarpa, Shiroroga, Arsha, Vishachikitsa, and Grahani.

Sushruta Samhita

Sariva is mentioned in Vidarigandhadi, Sarivadigana and Vallipanchamoola gana. Also appreciative description of this drug found in the treatment of Jangamavisha, Grahabadha, Niruha, and Anuvasana Basti.

It is described in 45 formulations in the treatment of *Garbhasrava, Vranitopasniya Sanshodhana-Sanshamniya, Mahavatvyadhi, Bhagandar, Kushtha, Prameha, Vidradhi, Ahiputana Pratishedha, Pramehapidika, And Mudhagarbha Yoni Vyapad Pratishedha.*

Ashtanga Sangraha

This Samhita has second-highest references about Sariva among all, i.e.,Laghuttrayi and Bruhattrayi granthas after bhaishajya ratnavali (BR). The drug shows its contribution in Balroga and Grahachikitsa in this archaic text. It is mentioned in Prayogika dhoomopayogi gana, Pitta Prashamanagana.

It is described in 59 formulations in the treatment of *Jvaratisara, Rajyakshma Vatrakta, Mutrakruchra, Prameha, Vranashotha, Kushtha, Visarpa, Visphota, Yoniroga, Balroga, Raktapitta, Trushna, Arsha, Grahani, And Gulma.*

Ashtanga Hrudaya

Ashtanga Hrudaya Samhita moreover a synoptic form of Charaka Samhita and Sushruta Samhita described Sariva in Balroga, shalakya, and as Rasayana. Sariva included in Sarivadi and Vidaryadi gana. It is described in 42 formulations in the treatment of *Jvaratisara,Raktapitta, Atisara, Grahani, Gulma ,Visarpa, Kushtha, Rasayana, Vaatshonita, Bhagandara, Balamaypratishedh, Mukharog pratishedha and Varna pratishedha*.

Chakradutta

Chakrakradatta a commenter on Charaka Samhita mentioned Sariva in Karna and Netra Rogachikitsa.

Sharangadhara Samhita

Descriptions of various Bhaishajya Kalpana are described in Madhyam Khanda of Sharangadhara. Sariva is mentioned in various formulations of *Kwatha, Churna, Ghrita, Tail, and Lepa. Shaliparnyadi Kwath, Kashmaryadi Kwath, Bruhatmajisthadi Kwath, Bruhatmadhukpushpadi Phant, Pippalyadi Churna, Paniyakalyanaka Ghirta, Mahapanchatikta Ghruta, Kasisadi Ghruta, Jatyadi Ghrita, Gouradya Ghruta, Phala Ghruta, Bhrungraj Tail, Baladi Tail, Chandanadi Tail, Dashamularishtha, Ardhavbhedaka Lepa, Abhishyandnashak Lepa.*

Bhavaprakash Samhita

Acarya Bhavamishra has mentioned Sariva in the treatment part of some diseases such as Jvaratisara, Raktapitta, Vaatrakta, Varna, Kushtha Prameha Streroga, Balroga and Grahabadha. In Mishrak Gana Prakaran, it is mentioned under Vallipanchamool.

Yogaratnakar

Yogaratnakar throws light on the curative aspect of diseases providing different types of formulations of Sariba, namely, Tail, Avaleha, Asava, Putapak, Churna, Guti, and Lepa. Most of the references of Sariba up to this era have been found in this Samhita, mostly specifying toward its properties of Raktashodhan, Deepana, Pachana, Shothaghna, etc.

Bhaishajya Ratnavali

Sariva is described in 84 formulations in the treatment of *Jvaratisara,Raktapitta Atisara, Grahani, Gulma, Unmada, Visarpa, Apasmara, Kushtha, Vaatshonit Bhagandara Vaat*

Vyadhi, Prameha Pitika, Vruddhiroga, Galgand-Gandmala, Bhagna, Upadansha, Amlapitta, Kshudra Roga, Shiro Roga, Netra Roga, Pradara Roga, Yonivyapada, Garbhini Roga and Balroga.

Rasatantrasara and Siddhaoushadi Prayoga Sangraha

Just like BR this text also represents various formulations important in day to day practice such as Kharaliya Rasayana, Asavarishthadi, Pak Avleha Sharbata, various Ghrita and Taila.

NIGHANTU PERIOD

Sariva is extensively quoted in the Nighantu granthas in the context of Raktashodaka.

Table 1- Sariva varga in various nighantus

Sl No	Nighantu	Varga
1	Bhavaprakash Nighnatu	Guduchyadi varga
2	Raja nighantu	Chandanadi varga
3	Kaiyadeva nighnatu	Aushadhi varga
4	Dhanvantari nighantu	Guduchyadi varga
5	Madanapal nighantu	Abhayadi varga
6	Priya nighantu	Pippalyadi varga

VARIETIES

In nighantus, Shveta(white) and Krshna(black) are termed as Sarivadvaya. Dhanvantari Nighantu indicates the black variety as krshnamula. In Shodala nighnatu, the white variety is considerd as Utpala sariva.

SYNONYMS OF SHVETA SARIVA

Sanskrit : Ananta, Gopasuta, Sariva

Assamese : Vaga Sariva

Bengali : Anantamul, Shvetashariva

English : Indian Sarasa Parilla

Gujrati : Upalsari, Kabri

Hindi : Anantamul

Kannada : Namada veru, Bili Namadaberu, Anantamool, Sogadeberu,Namadaberu

Kashmiri : Anant mool

Malayalam : Nannari, Nannar, Naruneendi

Marathi : Upalsari, Anantamula

Oriya : Dralashvan Lai Anantamool

Punjabi : Anantmool, Ushbah

Tamil : Ven Nannar

Telugu : Sugandhi Pala, Tella Sugandhi

Urdu : Ushba Hindi

PROPERTIES AND ACTION

Rasa : Madhura

Guna : Guru, Snigdha

Virya : Shita

Vipaka : Madhura

Karma : Raktashodhaka, Vishaghna, Tridosha nashana, Dipana, Jvarahara

Rogagnata- Agnimandya, Aruci, Atisara, Shvasa, Jvara, Kasa, Kandu, Kushta, Raktavikara

Dose - 20-30 g of the drug for decoction.

SYNONYMS OF KRISHNA SARIVA

Krishnamuli, Bhadra, Krishnavalli, Kalika, Mahashyama, Krishna, Dugdhavalli, Shyama, Shyamlata etc

VERNACULAR NAMES

Sanskrit : Jambu Patra, Shyama, Krshnavalli, Krshnamuli

Hindi : Kaleesar, Kalee Anantmool

Bengali- Shymatalata, krshna sariva

Kannada : Karccumbu

Marathi : Mothi Kawalee, Kallee Kawalee

Malayalam : Kalipalvalli

Telugu : Naltig, Adavipalatige, Rokallipala

English: Black creeper

Gujarati: Kala Phulvali Upalsari

Tamil: Udargoli, Illukata

PROPERTIES AND ACTION

Rasa : Madhura, Tikta

Guna : Guru, Snigdha

Virya : shita

Vipaka : Madhura

Karma : *Raktashodhaka, Kaphaghna, Vrishya, Stanyashodhana, Garbhasthapana, Mootrajanana, Mootravirajaneeya, Kushthaghna, Jwaraghna, Rasayana, Vishaghna, Trushnaprashamana, Sangrahi, Kashar, Shwashar.*

Rogagnata - Agnimandya, Aruci, Atisara, Jvara, Kshaya, Kushta, Pradara,

Prameha, Raktapitta, Shvasa, kasa, Mukha Daurgandhya, Kandu,Vata Rakta, Dehadurgandha

Dose - 5-10 gm.

IMPORTANT FORMULATIONS - Candanadi Taila, Shatavari guda, Kalyanaka Ghrita, Triphala Ghrita, Brihata Phala Ghrita, Maha Tiktaka Ghrita, Maha Pancagavya Ghrita, Vastyamayantaka Ghrita

RASAPANCAKA

Table 2- Sariva and its Rasapancaka in various Nighantus

Nighantu	**Rasa**	**Guna**	**Virya**	**Vipaka**	**Dosha karma**
Bhavaprakasha	Madhura	Snigdha guru	Shita	Madhura	Vata kaphaghna
Raja Nighantu	Madhura				Vata kaphaghna
Kaiyadeva Nighantu	Madhura tikta	Snigdha guru	Shita		Tridoshgna
Nighntu Adarsha	Madhura	Snigdha guru			Tridoshaghna

MODERN DRUG REVIEW

Our classics have mentioned two types of sariva. They are shweta sariva and krishna sariva and they are botanically identified as,

1)Shveta Sariva- ***Hemedesmus indicus*** **R. Br.**

2)Krshna Sariva- ***Cryptolepis buchanani*** **Roem. & Schult**

Under the name of Krishna sariva , two plants have been accepted - They are *Cryptolepis buchanani* Roem. & Schult- leaves of which are big, long exudate milk. It is also known as Jambu patra sariva and the other is *Ichnocarpus frutescens R. Br. (Apocynaceae)* –leaves are

small, root has no fragrance. Also *known as pal-valli in vernacular.*
Decalepis hamiltonii has almost similar constituents as *Hemidesmus indicus* R.Br. and so is commonly used as a substitute for Shveta sariva. At present *Decalepis hamiltonii* is sold in the market as Sariva, as it is comparatively less expensive than *Hemedesmus indicus*.

Dalhana has mentioned Jambupalashika as country name for Krishna Sariva. Aacharya Dalhana quotes that Krishna Sariva has leaves like Jambu and Patalgarudi, it is a climber having latex, root has aroma like sandal and it is called as Karveli. On the other hand, there is no characteristic feature mentioned in the literature which is present in *Ichnocarpus*. Hence, Ayurvedic Pharmacopeia of India accepts *Cryptolepis buchanani Roem. & Schult* as a source of Krishna Sariva. According to Indian Medicinal Plants by Arya Vaidya Sala, in Kerala for Sarivadvaya, *H. indicus* (Sveta sariva), and *Ichnocarpus frutescens* (Krishna sariva) are in use; however, it is to be noted that *Ichnocarpus frutescens* (parvalli) is never used as a substitute for H. indicus.

1) Description of *Hemedesmus indicus* R. Br.

Shveta sariva consists of root of *Hemedesmus indicus (Linn.) R. Br.* (Fam.Asclepiadaceae), a prostrate or semi-erect shrub found throughout India from upperGangetic plains east-wards to Assam, throughout Central, Western and Southern India upto an elevation of 600 m.

Morphology:

Habit- Perennial prostrate or twining shrub. Root stock is woody.

Stem- Numerous, slender, terete, glabrous or pubescent, striate, thickened at the nodes.

Leaves- Simple, opposite, variable, elliptic-oblong to linear-lanceolate, glabrous, dark green often variegated with white above, pale and sometimes, silvery white and pubescent beneath, reticulate venation, petiole 3 to 4 mm long.

Infloroscence- subsessile cyme

Flower- Pedicel short, clothed with numerous bracts, Calyx 2.5 mm long, glabrous outside, ovate, acute corolla, greenish outside, purple inside.

Fruit- Follicles, 10 to 15 cm by 6mm, cylindric, tapering to a point at the apex, straight or sometimes slightly curved, striate glabrous.

Seed- 6 to 8 mm long, ovate-oblong, flattened, black coma is silvery white, 25cm long.

Macroscopic features of root

Roots occur in pieces, about 30 cm long and 3-8 mm in diameter, cylindrical, thick, hard, somewhat tortuous, sparcely branched, provided with few thick rootlets and secondary roots, external appearance dark brown, sometimes with violet grey tinge, centre yellow, woody, surrounded by a mealy white cortical layer, bark brownish, corky, marked with transverse cracks and longitudinal fissures and easily detachable from the hard central core,

odour, characteristic,taste, sweetish, slightly acrid and aromatic.

Pharmacological Properties- anti-cancer, antioxidant, anti-diabetic, anti-ulcerogenic, hepatoprotective, neuroprotective, cardioprotective, nephroprotective, anti-inflammatory, anti-ophidian, antimicrobial etc.

2) Description Of *Cryptolepis buchanani* Roem. & Schult

Krishnasariva consists of dried roots of *Cryptolepis buchanani* Roem. & Schult.

(Fam. Asclepiadaceae), a perennial, much branched climber with milky juice, found

throughout the country from Western Kashmir to Assam, ascending to 1200 m in the

Himalayas and in south upto Kerala.

Morphology:

Habit-Glabrous woody, large, evergreen twinner

Leaf-Opposite-decussate, simple, rounded/short cuneate of the base, suddenly narrowed into a short mucronate apex, shining above. Dried leaf with the mid rib proximally impressed, distally almost flat on the upper side, faintly raised above; lateral veins slightly rise on both surfaces and plain beneath.

Stem-30cm diameter

Bark-smooth, copper-colored, peeling off in papery rolls in old stem.

Flowers-pale yellow in lax dichotomous cymes

Inflorescence- Shorter than leaves, peduncle equaling or exceeding the petiole**.**

Fruit- A stout, paired follicle, pointed above, inflated at base

Seeds-Compressed, oblong-ovate, obovoid and flat with silky coma, white silky hairs.

Latex- white

Macroscopic features of root

Roots vary in length and are 1 to 1.5 cm thick; slender, cylindrical, dark brown or

blackish; rough due to fine longitudinal ridges and wrinkles running sinuously

lengthwise; thicker roots show a few transverse cracks, fissures and longitudinal

wrinkles with remnants of rootlets and a few lenticels; cork easily peelable; fracture,

short and fibrous; odour, slightly aromatic; taste, sweet and astringent.

Pharmacological activities - Antibacterial, antimicrobial, hypotensive, CNS depressant, anti-amphetaminic, anti-diarrheal, anti-ulcerative, blood purifier, diuretic.

3*) Decalepis hamiltonii* Wight & Arn.

Its root is better known as *Nannari* in Rayalseema and *Sugandhi* in Coastal Andhra. According to AP state Biodiversity Board these roots are being smuggled outside the country like in Australia, South Africa and others.

Vernacular names:

Sanskrit: *Sariva, Svewtasariva*

English**:** Swallow root

Tamil: *Magali kizhangu.*

Kannada: *Makali beru*.

Malayalam: *Mahannikizhangu*.

Telugu: *Maredu Kommul.*

Distribution:

Global: Endemic and Endangered to Peninsular India and eastern Ghats of Andhra, Karnataka, Tamilnadu and kerala.

Local: dry and moist deciduous forests, most rocky habitat, crevices of big stones, terrestrial area, places of thick vegetation.

Morphology:

Morphologically and chemically the plant resembles African liana called Mondi white Skeels. Both have similar ethnobotanical uses and Phytochemicals.

Habit-climbing shrub, with branchlets jointed.

Latex-Milky

Root- 5-10cm diameter and 4-10 roots arise from the root stock. A 2 year old plant produce 15-20kg of roots and 1 year old plant produces 1-2kg of roots. These are little bitter and then sweet. Vanillin like smell, the substance that is in vanilla planifolia Andr., an orchid used in ice-creams, chocolates, drinks etc. Although vanilin has been synthesized since 1874 natural sources of this flavoring are still in demand and the roots of *Decalepis* can be used as substitute for vanillin.

Leaves- Upto 6×4cm, obovate-elliptic or circular, tip blunt, base wedge shaped, membranous.

Flower-Born in cymes trichotomously branched

Fruit- a follicle, cylindrical, oblong, in pairs, woody when dry.

Seeds-Many, egg shaped with long white silky hairs.

Pharmacological activities- *D. hamiltonii* plant root has antioxidant, antifungal, antibacterial, insecticidal, cryoprotective, antipyretic, antiulcer, anxiolytic, antidiabetic, chemoprotective, hepatoprotective, and neuroprotective properties.

DISEASE REVIEW-PRAMEHA

GENERAL CONSIDERATIONS

In Ayurvedic classics Madhumeha is described along with Prameha Roga. Considering the seriousness of the diseases and its prognosis, Madhumeha is consider as one of the 'Mahagada' or 'Maharoga' i.e. a disease which has grave and serious clinical manifestations with possibility of occurrence of serious complications and at times with fatal prognosis. Description of Prameha from various Ayurvedic classics helps to understand disease thoroughly.

Etymology:

Word *Prameha* has appeared by merging of 'Pra'and 'Meha'. Pra is known as upasarga or prefix which is attached with main dhatu i.e. verb Meha. The word Meha is derived from root '*mih'-sechane* by adding 'lut' pratyaya to it-"Mehati sinchati mutraretansi" i.e. is to excrete. According to Sanskrit Literature the word 'mih' stands for watering, wetting and upasarga 'pra' suggest excessive frequency.

According to Acarya Madavakara,

"Prakarsena Prabhutam Pracuram Varam Varam Va Mehati Mutratvagam Karoti Iti Pramehah", *Premeha* is characterized by increased quantity of urine associated with or without the increased frequency of urination. Hence, primarily *Prameha* may be considered as a systemic disease associated with urinary manifestations caused by enhanced urine formation.

Classification

Etiologically Prameha has been classified into two types by Acharya Sushruta.

- Sahaja (Hereditary)
- Apathyanimittaja (Acquired)

Sahaja Prameha occurs as a result of Beejadosha (genetically susceptible). While describing prognosis, Acharya Charaka has narrated that Prameha occurring due to Beeja dosha is incurable.

Apthyanimittaja Prameha is a result of causative dietary and physical activity.

According to Dosha predominance, Prameha is categorized into three major types, which is solely detected by the physical characteristics of urine

1. Vataja Prameha 2. Pittaja Prameha 3. Kaphaja Prameha.

Further Prameha is sub-classified into 20 types according to different Acharya.

Classification according to body constitution- Charaka has classified Prameha patients into two groups. i.e. Sthula Pramehi and Krisha Pramehi.
Sushruta has also stated that in general Sahaja Pramehis are thin and Apathya Nimittaja Pramehi are Sthula.

Pathophysiology

Exposure to dietary and physical activities associated with the development of *Prameha,* may lead to vitiation of *Tri-dosha* and affects *Meda Dhatu*. When vitiated *Tri-dosha* along with *Meda* become inclined to be excreted via urinary route, the disease *Prameha* is manifested. *Acharya Charaka* has described three different *Sampramti* of *Prameha* according to involved *Dosha*. In general, *Meda* is considered as *Dushya* in *Prameha*. According to *Acharya Charaka*, there are ten *Dushya* in *Prameha* including *Meda, Mamsa, Kleda, Sukra, Sonita, Vasa, Majja, Lasika, Rasa and Ojo*.

Clinical Manifestations

Prameha is generally characterized by "*Avila-Prabhuta-Mutra*" or contamination of urine with excess urine passage. The clinical manifestations of *Prameha* have been described in *Ayurvedic* classical texts solely on urinary feature. The different clinical features of twenty types of *Prameha* are also based on physical character of urine. Systemic manifestations have been described in *Prameha* either in terms of prodromal symptoms or in terms of complications.

Ayurveda describe various treatment modalities for the management of Prameha such as; conduction of pathya, yoga and shodhana karma along with use of ayurveda formulation and herbs.

DIABETES MELLITUS

The word 'diabetes mellitus' means, 'excessive excretion of sweet urine'. Diabetes mellitus is a group of metabolic diseases, characterized by hyperglycemia resulting from defects in insulin secretion, action or both. Chronic hyperglycemia of diabetes is associated with long term damage, dysfunction, and failure of various organs specially the eyes, kidneys, nerves, heart and blood vessels. Insulin is either not secreted in sufficient amounts or does not effectively stimulate its target cells, hyperglycemia occurs. In hyperglycemia blood glucose level becomes so high that glucose "spills over" in urine. However, cells starve since glucose stimulated entry into the cells is impaired. Apparent symptoms of hyperglycemia are excessive thirst and frequent urination. Chronic hyperglycemia causes damage to the eyes, kidneys, nerves, heart and blood vessels.

CAUSES OF DIABETES MELLITUS

Main causes of diabetes mellitus are:

• Genetic defects of beta-cell function

• Genetic defects in insulin action.

• Diseases of the exocrine pancreas.

TYPES OF DIABETES MELLITUS

• Insulin dependant or juvenile-onset diabetes mellitus (Type 1 Diabetes mellitus)

• Non insulin dependant or maturity-onset diabetes mellitus (Type 2 Diabetes mellitus)

PATHOGENESIS:

Pathogenesis of Type-1A DM can be summed up by interlinking the 3 mechanisms: genetic susceptibility, autoimmune factors and certain environment factors.

β-cells act as autoantigens and activate CD4+ T lymphocytes, bringing about immune destruction of pancreatic β-cells by autoimmune phenomena and takes months to years. The trigger for autoimmune may due to infectious and environmental factor which specifically targets β-cells.

Pathogenesis of Type 2 DM this hyperglycemia is not due to destruction of beta cells but instead a failure of beta cells to meet the requirement of insulin in the body.

There is a greater role of genetic defect and heredity.
Two main mechanisms for hyperglycemia in type 2 DM insulin resistance and impaired insulin secretion. Obesity plays a role in pathogenesis of insulin resistance; impaired insulin secretion may be from many constitutional factors.

MECHANISMS OF INSULIN RELEASE:

The secretion of insulin from pancreatic beta cells is a complex process involving the integration and interaction of multiple external and internal stimuli. Thus, nutrients, hormones, neurotransmitters, and drugs all activate -- or inhibit -- insulin release. The primary stimulus for insulin secretion is the beta-cell response to changes in ambient glucose. Normally, glucose induces a biphasic pattern of insulin release. First-phase insulin release occurs within the first few minutes after exposure to an elevated glucose level; this is followed by a more enduring second phase of insulin release. Of particular importance is the observation that first-phase insulin secretion is lost in patients with Type-2 diabetes.

A widely accepted sequence of events involved in glucose-induced insulin secretion is as follows:

1. Glucose is transported into beta cells through facilitated diffusion of GLUT2 glucose transporters.
2. Intracellular glucose is metabolized to ATP.
3. Elevation in the ATP/ADP ratio induces closure of cell-surface ATP-sensitive K+ (KATP) channels, leading to cell membrane depolarization.
4. Cell-surface voltage-dependent Ca2+ channels (VDCC) are opened, facilitating extra cellular Ca2+ influx into the beta cell.
5. A rise in free cytosolic Ca2+ triggers the exocytosis of insulin.

METFORMIN

Metformin is a BIGUANIDE group of antidiabetic drug which was introduced in1950s.

MECHANISM OF ACTION:

Metformin does not cause insulin secretion, but it does require the presence of some insulin for it to work. Hypoglycemic action of Metformin is explained under following headings.

1. Its main effect is to reduce hepatic gluconeogenesis and glucose production.

2. Increases the Peripheral glucose utilization by enhancing anaerobic glycolysis and increases the activity of glucose transporters.
3. Acts as insulin sensitizers in the muscle and adipose tissue and reduces hyperinsulinemia
4. It Retards intestinal absorption of glucose, other amino acids, hexoses and Vit b12.
5. Reduces the appetite which may be helpful in obese patients.

PHARMACOLOGICAL ACTIONS:

Metformin does not lower the blood sugar in normal subjects by itself, it does not produce hypoglycemia in diabetics, however it potentiates the hypoglycemia action of insulin and sulfonylureas. It does not inhibit ketogenesis in the liver. Hence, diabetics on metformin may develop ketoacidosis with minimum hyperglycemia and glycosuria. Further, metformin decreases the glycogen content of the liver.It reduces plasma total and LDL cholesterol and triglyceride levels, and increases plasma fibrinolytic activity. Lipolysis, FFA production and lipid oxidation are reduced. Protein break down and aminoacid turnover are not affected.Weight loss is due to reduction in appetite.Its main benefit is prevention of weight gain in contrast to sulfonylureas.

Dexamethasone Induced Diabetes:

Two possible mechanisms underlying dexamethasone-induced insulin resistance have been suggested. One possibility is the downregulation of insulin receptor substrate (IRS)-1 expression by dexamethasone, because IRS-1 plays a major role in the activation of phosphatidylinositol 3-kinase (PI3-K), which is essential for GLUT4 translocation. On the other hand, in the liver, dexamethasone treatment reportedly decreased IRS-1 phosphorylation and IRS-1–associated PI3-K levels despite an increased IRS-1 protein content. When taking these reports into consideration, impaired PI3-K activation may be regarded as a cause of insulin resistance in both liver and muscle. The other possibility is that dexamethasone impairs the GLUT4 translocation step independently of insulin signaling. This possibility may be supported by evidence that glucocorticoids inhibit not only insulin- induced but also hypoxia induced GLUT4 translocation to the cell surface in skeletal muscle. Thus, whether the step in early insulin signaling in which IRS-1 is involved or whether the impairment of GLUT4 translocation machinery is the main cause of insulin resistance in muscle or adipose tissues remains unclear. Metformin can ameliorate dexamethasone-induced hyperglycemia and insulin resistance in part by increasing glucose disposal into skeletal muscle.

MATERIALS AND METHODS

HYPOTHESIS

Null Hypothesis (H_0):

There is no significant difference in the anti-hyperglycemic activity between authentic Sariva and its market samples.

Alternative Hypothesis (H_1):

There is a significant difference in the anti-hyperglycemic activity between authentic Sariva and its market samples.

RESEARCH QUESTION

Do the pharmacological properties (anti-hyperglycemic activity) of authentic **Sariva** (*Hemidesmus indicus*) differ from those of its market samples?

MATERIALS

- **Literature:** Library, Journals ,Textbooks and Digital media and other scientific sources.
- **Drug collection**
  - Authentication of raw drug
  - Preparation of *Aqueous extracts*
- **Preliminary Phytochemical screening of aqueous extracts**
- **Experimental Study**
  - Animals procurement (Wistar albino rats)
  - Metformin from the pharmacy.
  - Instruments for assessing Lipid profile
  - Experimental procedure

DRUG COLLECTION

- **Authentication of raw drug-**

  The raw drug - roots of *Sariva (Hemidesmus indicus, Cryptolepis buchanani and Decalepis hamiltonii)* was collected from the vendors. Collected drug was authenticated in AYUSH approved ASU DTL, Central ResearchFaculty, KAHER's Shri B M K Ayurveda Mahavidyalaya, Belgavi.

- **Preparation of *Aqueous extract***
  - The 3 raw drugs were dried and pulverised into a coarse powder (40mesh size).
  - Decoction method of extraction is only suitable for extracting heat-stable compounds, hard plants materials (e.g. roots and barks) and usually resulted in more oil-soluble compounds compared to maceration and infusion.
  - The individual extracts were filtered through the filter paper. The filtrates were concentrated by placing them on the hot water bath at low temperature.
  - Extract was prepared freshly on the days of analysis and drug administration.

QUALITY CONTROL AND TESTING

All the three Aqueous extracts were analysed for the following parameters:

- Organoleptic Characters- Form, odor, color
- Preliminary Phytochemical Screening

EXPERIMENTAL STUDY

After approval of Institutional Animal Ethical clearance, Experimental study was conducted at the CPCSEA registered Animal house,KLE Pharmacy College, Hubballi. CPCSEA rules were followed in the study.

36 healthy adult wistar rats of either sex weighing 150-200gms were procured from from licensed dealer and were housed in cages and acclimatized for a week.They were fed with on a normal diet and water given ad libitum. Following acclimatization, the animals were divided into six groups, each group with 6 animals.

- Group I (Normal Control): rats received normal pellet diet and water for 21 days.
- Group II (Diabetic control): rats received *dexamethasone 8mg/kg body weight, intraperitoneally* foe 10 days along with pellet diet and water daily for 4days.
- Group III(Standard treatment Group): Rats received *dexamethasone 8mg/kg body weight, intraperitoneally* for 10 days, followed by Metformin for next 10 days. All rats received pellet diet and water during the study.
- Group IV (Trial Group I): Dexamethasone 8mg/kg body weight IP for 10 days, followed by *Hemedesmus indicus* (500mg/kg/day) aqueous extract along with pellet diet and water daily for next 10 days.
- Group V (Trial Group II) - Dexamethasone 8mg/kg body weight IP for 10 days, followed by *Cryptolepis buchanani* (250mg/kg) aqueous extract along with pellet diet and water daily for next 10 days.
- Group V (Trial Group III)- Dexamethasone 8mg/kg body weight IP for 10 days,followed by *Decalepis hamiltonii* (400mg/kg) aqueous extract.

- **Induction of Diabetes** -Dexamethasone (8 mg/kg) is administered intraperitoneally once daily for 10 days to induce hyperglycemia in Groups II–VI.
- **Treatment Protocol-** After induction, the test drug extracts and metformin are given orally for 10 days.
- **Dose**: Based on previous references and AOT the dose was fixed .
- **Chemicals**: **Okamet (Metformin) 500 mg of Cipla company** were purchased from the local pharmacy

Dose calculation: Rat Dose = Human Dose X Surface area of Wistar strain rats.

Animal Dose: According to Paget and Barnes' conversion factor (1964), the dose conversion from humans to rats is calculated to be 0.018.

For rats weighing around 200 grams, the calculated dose will be 48 multiplied by 0.018= 0.864 ml.

Route of drug Administration: Orally

Induction: 8 mg/kg body weight of Dexamethasone administered Intra- peritoneally in groups II to VI.

TABLE - Animal Study Design

GROUPS	**INTERVENTION**	**ROUTE**
Group I (Normal control) N=6	Distilled water	Orally
Group II (Diseased control) N=6	Dexamethasone 8 mg/kg body weight	Dexamethasone IP (10 days)
Group III(Standard treatment) N=6	Dexamethasone 8 mg/kg body weight + metformin 200 mg/kg	Dexamethasone IP (10 days)+ metformin 200 mg/kg orally for next (10 days)
Group IV(Test group 1)	Dexamethasone 8mg/kg body weight + *Hemidesmus indicus* (500mg/kg/day) aqueous extract	Dexamethasone IP (10 days)+ *Hemidesmus indicus* aqueous extract orally for next 10 days
Group V(Test group 2)	Dexamethasone 8mg/kg body weight + *Cryptolepis buchanani* (250mg/kg) aqueous extract	Dexamethasone IP (10 days)+ *Cryptolepis buchanani* aqueous extract for next 10 days orally

Group VI (Test group 3)	Dexamethasone 8mg/kg body weight + *Decalepis hamiltonii* (400mg/kg) aqueous extract	Dexamethasone IP (10 days)+ *Decalepis hamiltonii* aqueous extract for next 10 days orally

Parameters of Experimental Study

- **Blood collection-** At the end of the experiment, all rats were fasted for about 12 h, and then they were sacrificed under deep anesthesia using a mixture of xylazine and ketamine at the dose of 75mg/kg and 8mg/kg, respectively.

GLUCOSE DETERMINATION -

- **OGTT**: The oral glucose tolerance test (OGTT) was performed measuring plasma glucose response after oral glucose load at the end of the study period. The rats were fasted for 12 hrs. A dose of 2gm/kg of body weight glucose solution was administered by gastric gavages. Blood samples were obtained by the retro orbital plexus puncture at pre- and 30,60 and 120 min post glucose load. **The blood glucose was measured using blood glucose test strips and glucometer**. Plasma glucose levels were measured by the glucose oxidase method.
- **Lipid Profile Test:** After overnight fasting the blood was collected from Retro orbital vein to assess the lipids changes in Blood at the end of the Study. Plasma was separated immediately and used for biochemical estimations.Estimation of specific biochemical parameters was done using **Erba Kits**. Following Parameters are-

  a)AST

  b)ALP

  c)ALT

d)Fasting blood glucose

e)Albumin

f)Total Protein

- **Organs /tissue collected-** Animals were euthanised by utilizing xylazine and ketamine. After sacrifice, Liver samples were collected, washed and fixed in10% formalin.
- **Histopathology**- Liver samples were isolated, sectioned into small fragments and fixed in 10%formalin for 2 days. Subsequently, tissue pieces were treated with different concentrations of alcohol i.e., 505, 70%, 99% and at last with absolute alcohol. Subsequently, tisssues were treated with acetone and xylene and dipped in the melted paraffin wax for 2 hours. After completion of tissue processing, embedding was performed by using L-blocks. A microtome (Leica) was then used to slice the blocks into sections with a thickness of 3 micrometers followed by staining with hematoxylin and eosin and examined under a microscope for any histopathological changes.
- **Statistical Analysis**: one way ANOVA followed by Tukey's Multiple Comparison Test were the statistical methods used to analyze the experimental data. The findings will be presented as Mean ± SEM, with $p<0.0332$ designated as the significance level. 8.0.1 version of GraphPad Prism software was used to conduct the analysis. GraphPad P value range 0.0332(), 0.0021(*), 0.0002(***),0.0001(****) were utilized.

RESULTS

Results are explained under 2 headings

A] Quality control Analysis

B] Experimental Study

A] QUALITY CONTROL ANALYSIS:

SAMPLE I- Organoleptic Characters **of *Hemedesmus indicus* root extract (HIRE)**

TESTS	**RESULTS**
Form	Liquid
Colour	Dark Brown
Taste	Sweet ,Slightly Bitter
Odour	Pleasant, Aromatic

PRELIMINARY PHYTOCHEMICAL SCREENING - The qualitative phytochemical analysis of the root extracts revealed the presence of various secondary metabolites:

Sl No	**Test**	**Results**
1	Carbohydrates	Positive
2	Saponins	Positive
3	Proteins	Positive
4	Tannins	Positive
5	Steroids	Positive
6	Flavonoids	Positive
7	Alkaloids	Positive
8	Phenols	Positive
9	Glycosides	Positive
10	Terpenoids	Positive

SAMPLE II: Organoleptic Characters **of *Cryptolepis buchanani* root extract (CBRE)**

TESTS	**RESULTS**
Form	Liquid, Slightly Viscous
Colour	Brown
Taste	Bitter
Odour	Slightly Aromatic Or Earthy, Characteristic

PRELIMINARY PHYTOCHEMICAL SCREENING

Sl No	**Test**	**Results**
1	Carbohydrates	Negative
2	Saponins	Positive
3	Proteins	Positive
4	Tannins	Positive
5	Steroids	Positive
6	Flavonoids	Positive
7	Alkaloids	Positive
8	Phenols	Positive
9	Glycosides	Positive
10	Terpenoids	Positive

SAMPLE III: Organoleptic Characters **of *Decalepis hamiltonii* root extract (DHRE)**

TESTS	**RESULTS**
Form	Liquid, Sticky Consistency
Colour	Reddish Brown
Taste	Sweet , Slightly Bitter Aftertaste
Odour	Pleasant, Sweet, Aromatic

PRELIMINARY PHYTOCHEMICAL SCREENING

Sl No	Test	Results
1	Carbohydrates	Positive
2	Saponins	Positive
3	Proteins	Positive
4	Tannins	Positive
5	Steroids	Absent
6	Flavonoids	Positive
7	Alkaloids	Positive
8	Phenols	Positive
9	Glycosides	Positive
10	Terpenoids	Positive

EXPERIMENTAL STUDY RESULTS

1) OGTT Result

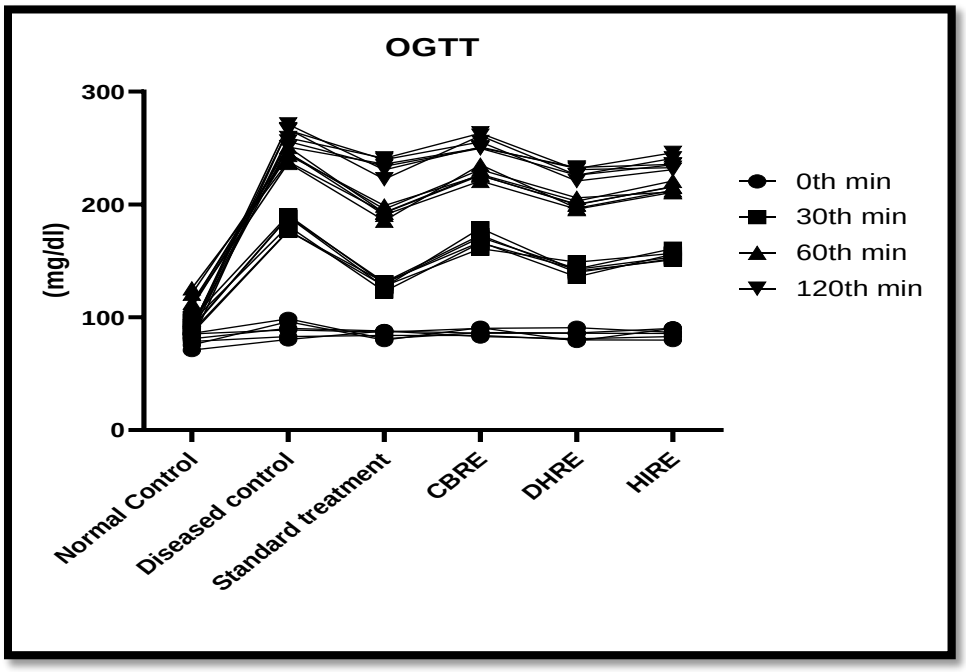
	0th min		30th min		60th min		120th min	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Normal Control	79.46167	2.33501	91.46167	2.068237	114.95	2.733343	88.10833	2.020814
Diseased control	89.54167	2.915144	183.8167	2.669134	243.4833	2.180889	261.5333	3.084441
Standard treatment	84.53333	1.458462	128.23	1.279466	192.7333	1.832606	233.8667	2.783842
CBRE	86.71167	1.307696	169.3633	2.580493	227.5	2	255.05	2.370056
DHRE	83.765	1.878951	141.8283	1.750525	200.22	1.522586	228.05	1.878608
HIRE	85.86667	1.655429	154.9633	1.492563	214.45	1.540725	236.8333	2.263871

The Standard Error of Mean (SEM) values are small, indicating consistency in measurements and reliability of the mean.

All treated groups (Standard and CBRE,DHRE,HIRE) show significant improvement over Diseased Control at each time point.

Among herbal extracts, DHRE consistently performs best in limiting the rise in blood glucose, approaching the effect of standard treatment.

GRAPH-



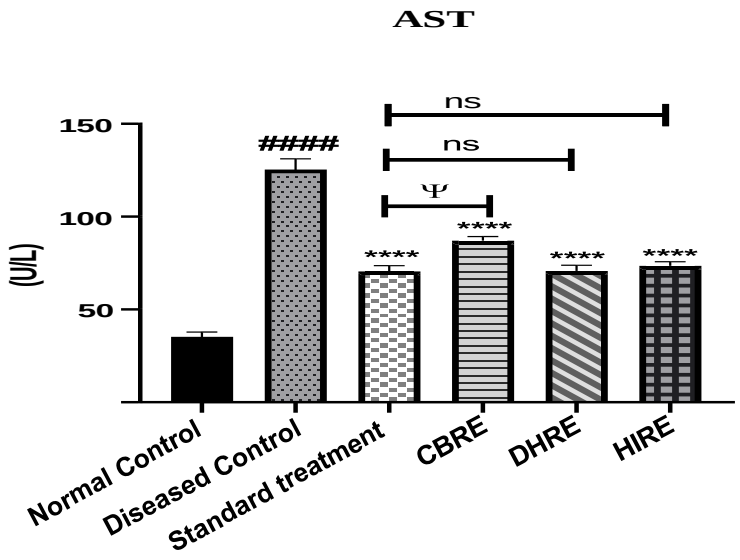
2)HEPATIC BIOMARKERS

a) **Aspartate transaminase/ AST/ SGOT :**

The concentration of AST in the blood serum was assessed for each of the groups.

The level of AST significantly increased in Diseased group to 125.4 ± 5.833 ($p < 0.0001$), when compared to Normal Control i.e., 35.23 ± 2.595.

Treatment with standard drug (Metformin), CBRE, DHRE and HIRE significantly decreased the levels of AST to 70.48 ± 3.085 ($p < 0.0001$), 87.08 ± 2.254 ($p < 0.0001$), 70.73 ± 3.133 ($p < 0.0001$) and 73.47 ± 2.271($p < 0.0001$), respectively when compared to diseased control group.



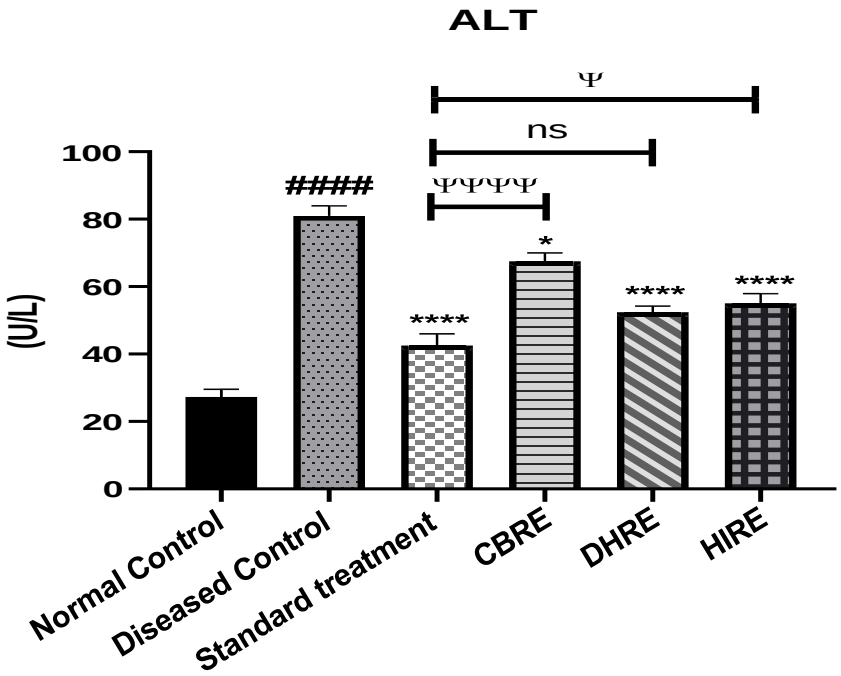
All the values are expressed as Mean ± SEM; n=6 in each group, ####$p<0.0001$ when compared to Normal Control group, ****$p<0.0001$, when compared to Diseased group, $^{\Psi}p<0.0332$ when compared to standard treatment group.

b) **Alanine aminotransferase/ ALT/ SGPT:**

The concentration of ALT in the blood serum was assessed for each of the groups.

The level of ALT significantly increased in the Diseased group to 80.96 ± 2.987 ($p < 0.0001$), when compared to the Normal Control, i.e., 27.25 ± 2.286.

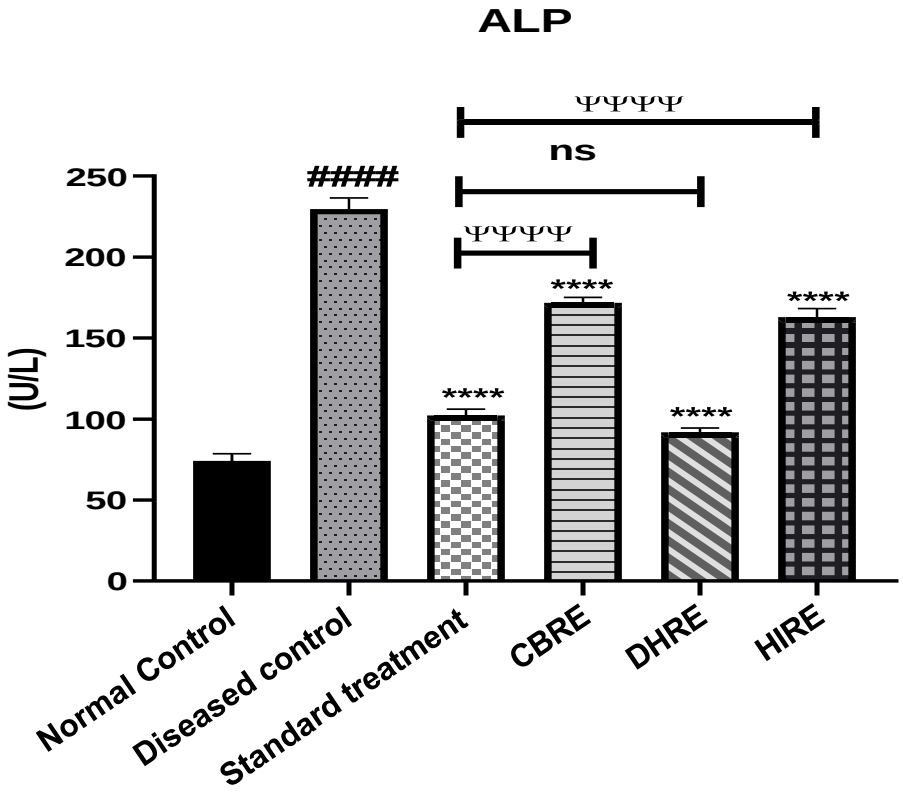
Treatment with standard drug (Metformin), DHRE and HIRE significantly decreased the levels of AST to 42.51 ± 3.457 ($p < 0.0001$), 52.40 ± 1.807 ($p < 0.0001$), and 55.07 ± 2.838 ($p < 0.0001$) when compared to the Diseased group. However, treatment with CBRE showed a slight decrease in ALT level, i.e., 67.51 ± 2.47 (*$p<0.0332$) compared to the diseased group.



All the values are expressed as Mean ± SEM; n=6 in each group, ####$p<0.0001$ when compared to Normal Control group, ****$p<0.0001$,*$p<0.0332$ when compared to Diseased group. ΨΨΨΨ$p<0.0001$, Ψ$p<0.0332$ when compared to the standard treatment group.

c) **Alkaline Phosphatase/ ALP:**

The concentration of ALP in the blood serum was assessed for each of the groups.
The level of ALP significantly increased in the Diseased group to 229.7 ± 6.861 ($p< 0.0001$), when compared to the Normal Control, i.e., 74.19 ± 4.391.
Treatment with standard drug (Metformin), CBRE, DHRE and HIRE significantly decreased the levels of ALP to 102.2 ± 3.839 ($p< 0.0001$), 171.8 ± 3.4($p< 0.0001$), 91.89 ± 2.537($p< 0.0001$) and 163 ± 5.129($p< 0.0001$), respectively, when compared to diseased control.
It was found that there is no significant difference between the effect of standard treatment and DHRE.



All the values are expressed as Mean ± SEM; n=6 in each group, ####$p<0.0001$ when compared to Normal Control group, ****$p<0.0001$, when compared to Diseased group. ΨΨΨΨ$p<0.0001$, when compared to the standard treatment group.

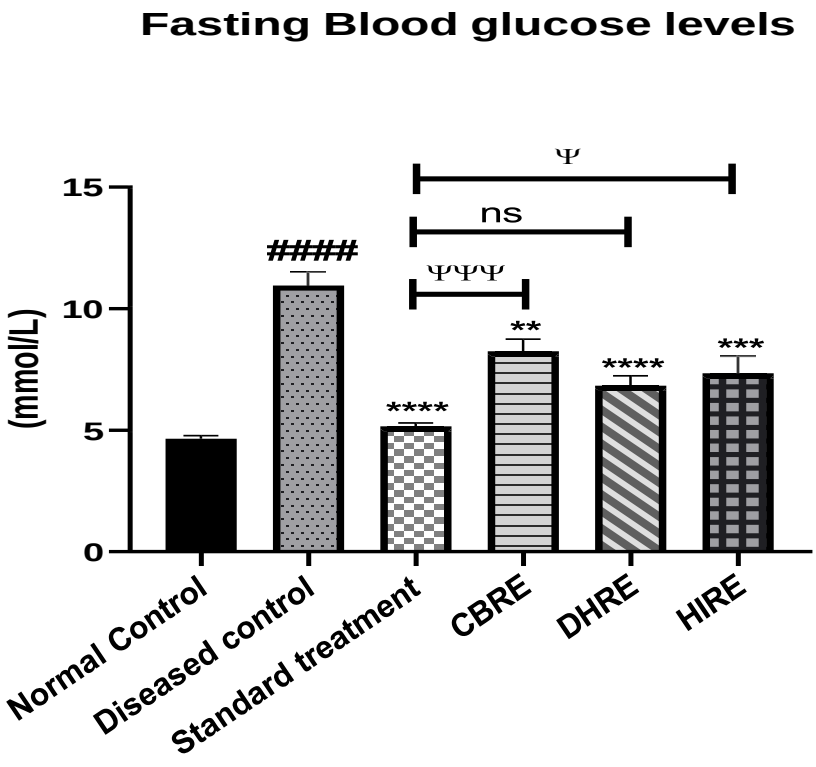
d) **Fasting Blood glucose level:**

The concentration of Fasting glucose levels in the blood serum was assessed for each of the groups.

The level of Fasting glucose levels significantly increased in the Diseased group to 10.95 ± 0.55 ($p < 0.0001$), when compared to the Normal Control, i.e., 4.64 ± 0.12.

Treatment with standard drug (Metformin), CBRE, DHRE and HIRE significantly decreased the levels of Fasting glucose levels to 5.165 ± 0.13($p < 0.0001$), 8.24 ± 0.49($p < 0.0001$), 6.835 ± 0.4($p < 0.0001$) and 7.34 ± 0.69($p < 0.0001$), respectively when compared to diseased control.

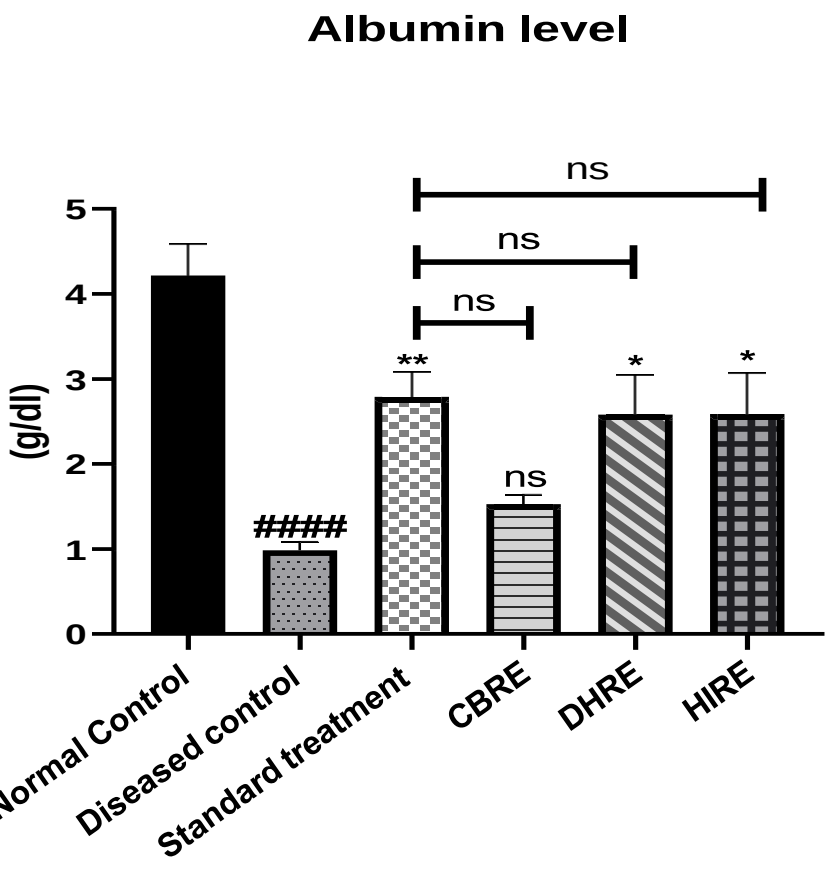
It was found that there is no significant difference between the effect of standard treatment and DHRE.



All the values are expressed as Mean ± SEM; n=6 in each group, ####$p<0.0001$ when compared to Normal Control group, ****$p<0.0001$, when compared to Diseased group. ΨΨΨ$p<0.0002$, Ψ$p<0.0332$ when compared to the standard treatment group.

e) **Albumin**:

The concentration of Albumin in the blood serum was assessed for each of the groups. The level of Albumin significantly decreased in the Diseased group to 0.98 ± 0.09 ($p < 0.0001$), when compared to the Normal Control, i.e., 4.21 ± 0.368.
Treatment with standard drug (Metformin), DHRE and HIRE significantly increased the levels of Albumin to 2.788 ± 0.29 ($p < 0.0021$), 2.580 ± 0.46($p < 0.0332$), 2.58 ± 0.48($p < 0.0332$), respectively, when compared to diseased control. However, treatment with CBRE showed no significant effect when compared to diseased group.

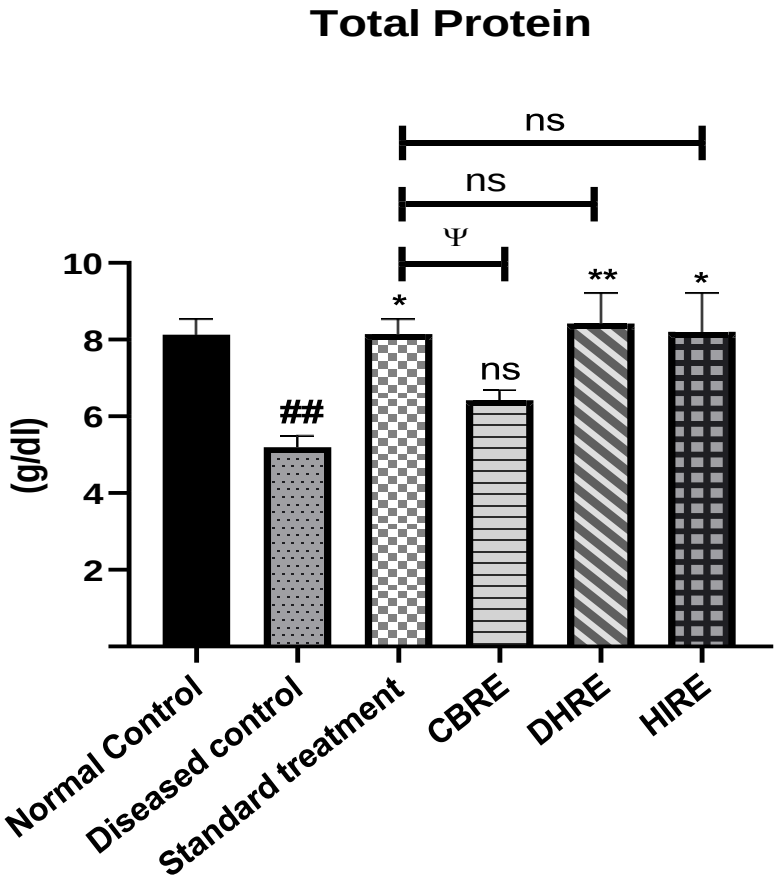


All the values are expressed as Mean ± SEM; n=6 in each group, ####$p<0.0001$ when compared to Normal Control group, **$p<0.0021$, *$p<0.0332$ when compared to Diseased group.

f) **Total Protein:**

The concentration of Total Protein in the blood serum was assessed for each of the groups. The level of Total Protein significantly decreased in the Diseased group to 5.197 ± 0.29 ($p< 0.0001$), when compared to the Normal Control, i.e., 8.125 ± 0.4.

Treatment with standard drug (Metformin), DHRE and HIRE significantly increased the levels of Total protein to 8.147 ± 0.38 ($p< 0.0332$), 8.425 ± 0.78($p< 0.0021$), 8.2 ± 0.99($p< 0.0332$), respectively, when compared to diseased control. However, treatment with CBRE showed no significant effect when compared to diseased group.



All the values are expressed as Mean ± SEM; n=6 in each group, ####$p<0.0001$ when compared to Normal Control group, **$p<0.0021$, *$p<0.0332$ when compared to Diseased group. Ψ$p<0.0332$ when compared to the standard treatment group.

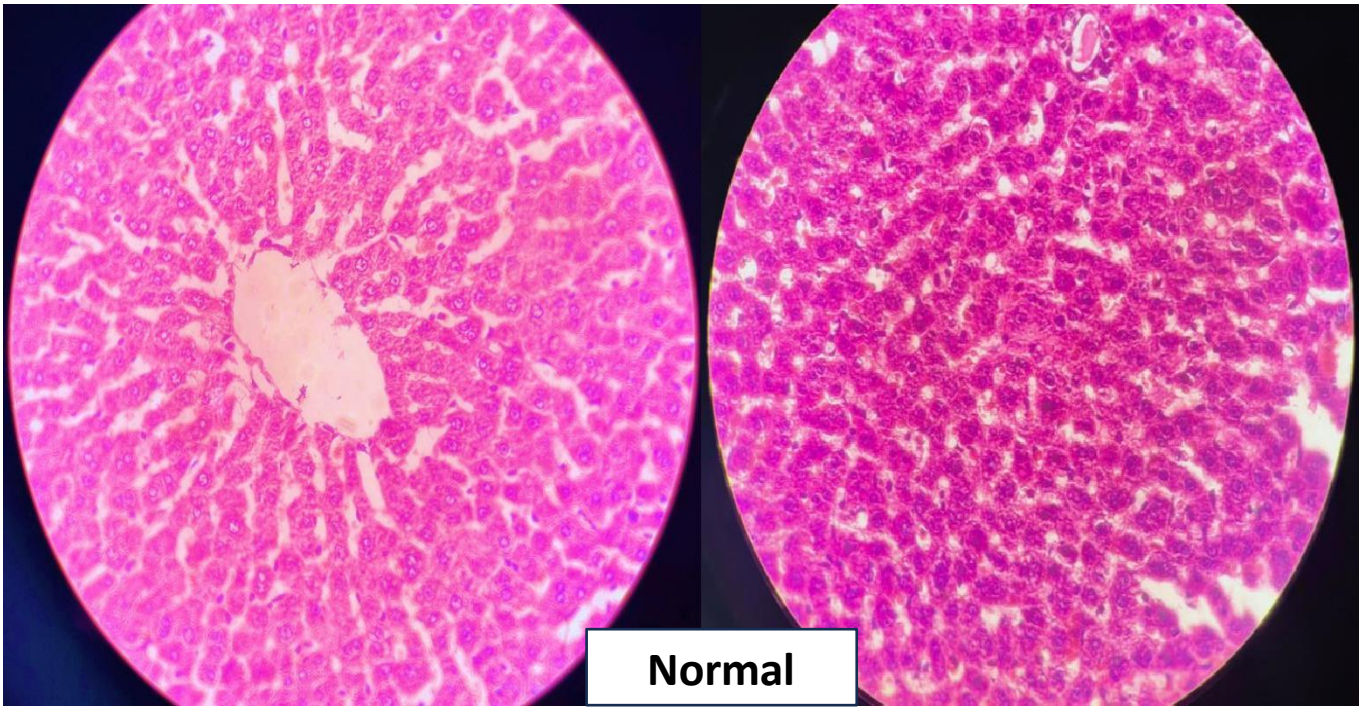
3)HISTOPATHOLOGICAL FINDINGS

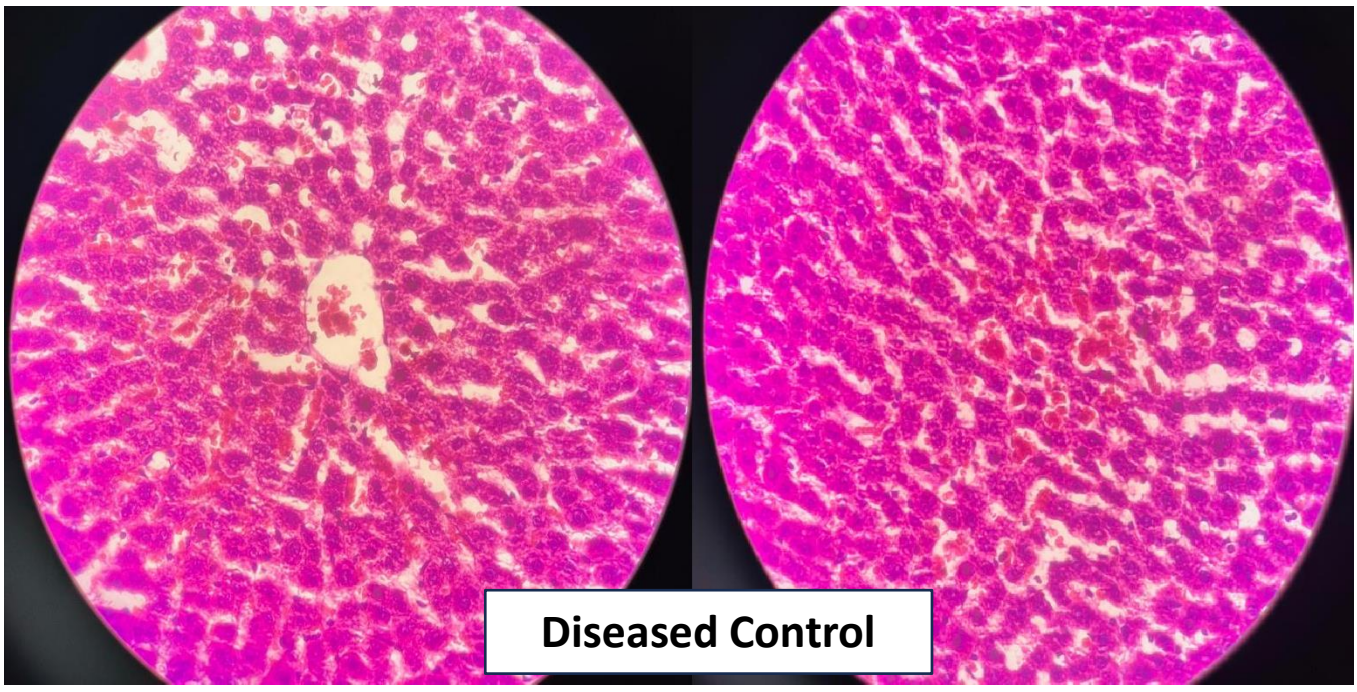
Histopathological examination of liver tissues revealed significant alterations in the diseased control group (Group II), which was induced with dexamethasone to model diabetes mellitus. Liver sections from this group showed moderate venous congestion, portal congestion, inflammatory cell infiltration, and ballooning degeneration, indicative of hepatic damage associated with diabetic conditions.

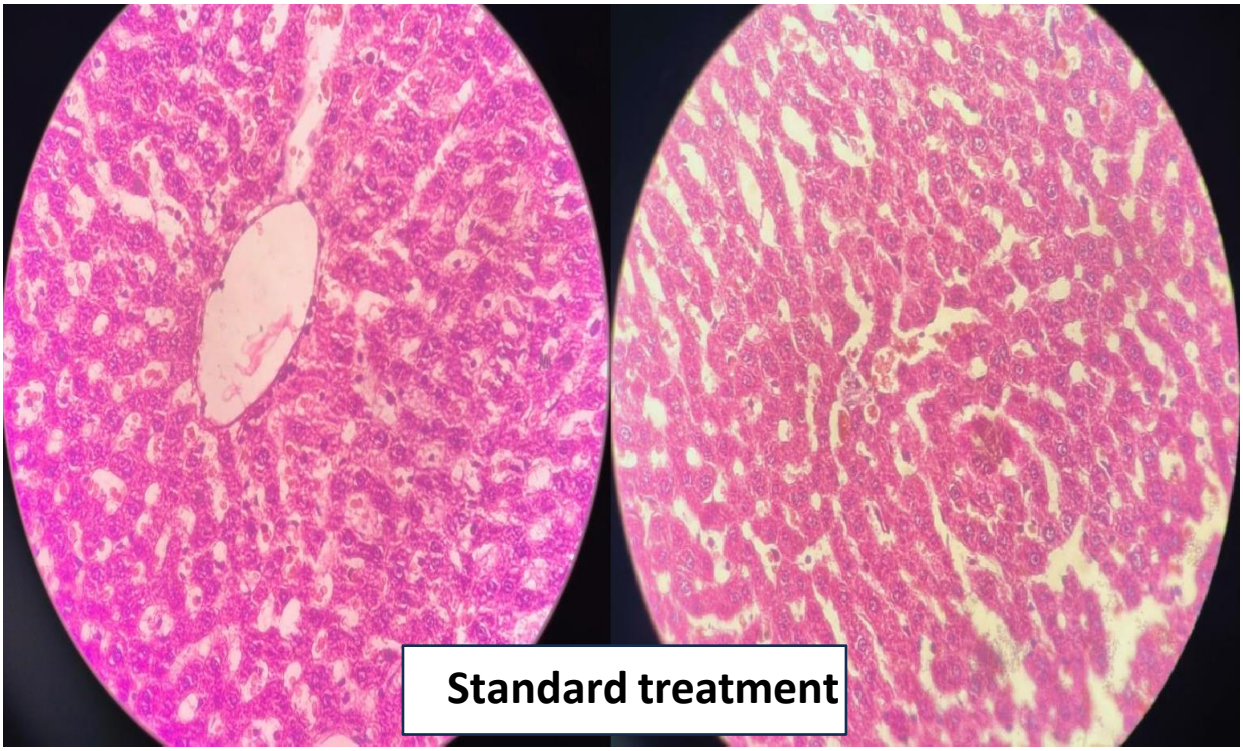
In contrast, the standard treatment group (Group III), administered metformin, exhibited marked improvement in hepatic architecture with minimal signs of congestion and inflammation, suggesting partial restoration of normal liver histology. Among the extract-treated groups (Groups IV–VI), all three—CBRE, DHRE, and HIRE—demonstrated varying degrees of histopathological improvement compared to the diseased control.

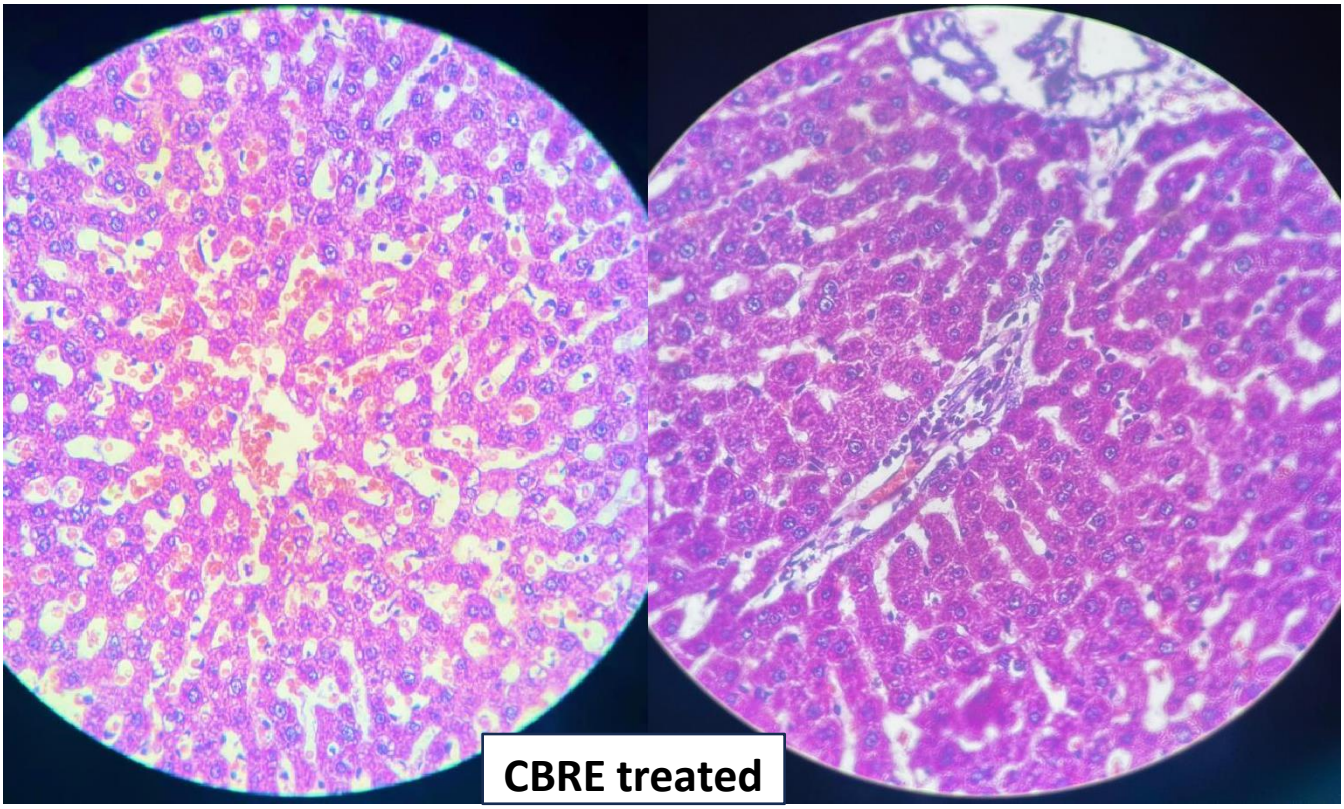
Notably, the DHRE-treated group (Group V) showed a more pronounced protective effect, with near-normal liver histoarchitecture, reduced venous and portal congestion, and minimal ballooning degeneration. The CBRE (Group IV) and HIRE (Group VI) treated groups also showed improvements; however, these were comparatively less effective than DHRE.

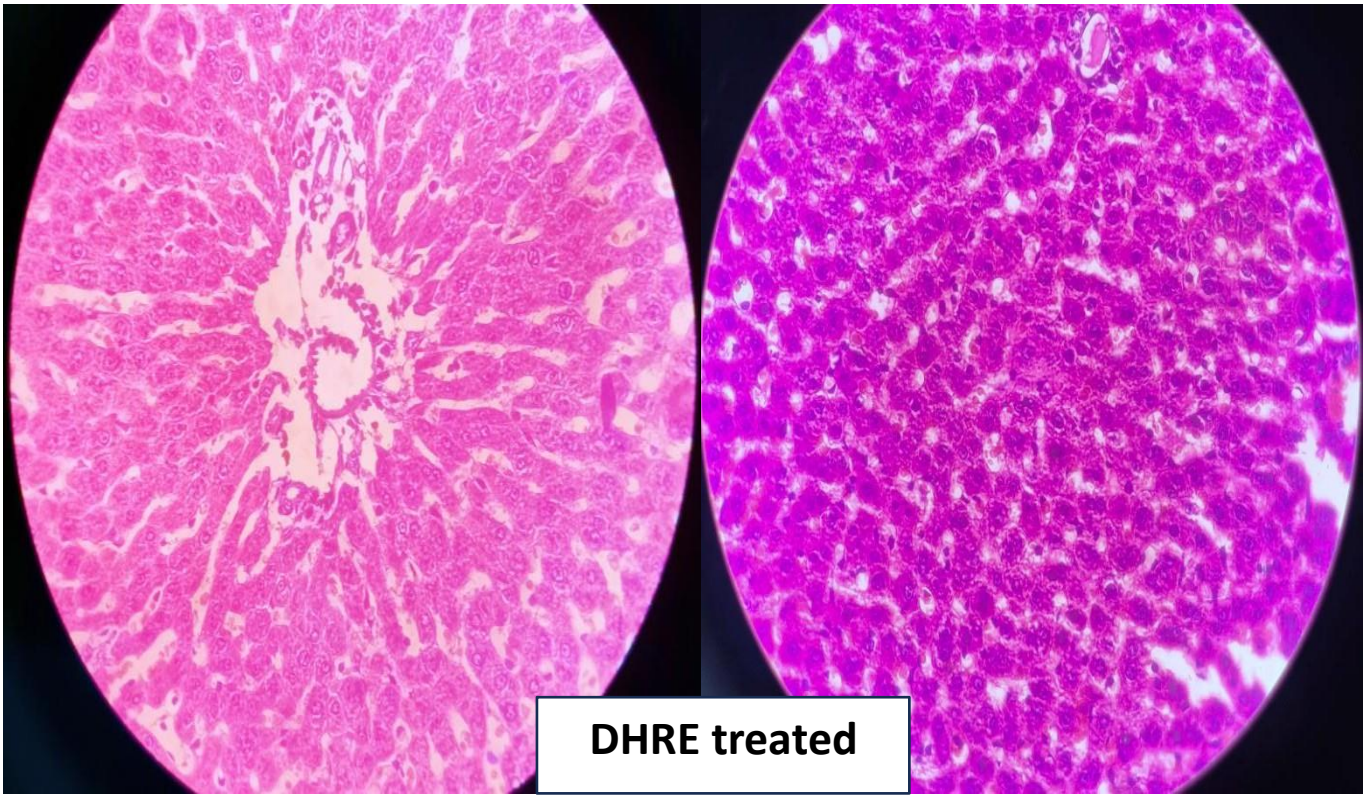
Overall, the histological recovery observed in the DHRE group was superior among the plant extract-treated groups, though still slightly less effective than the standard treatment group receiving metformin. These findings suggest a potential hepatoprotective role of DHRE in dexamethasone-induced diabetic hepatic injury, warranting further investigation.

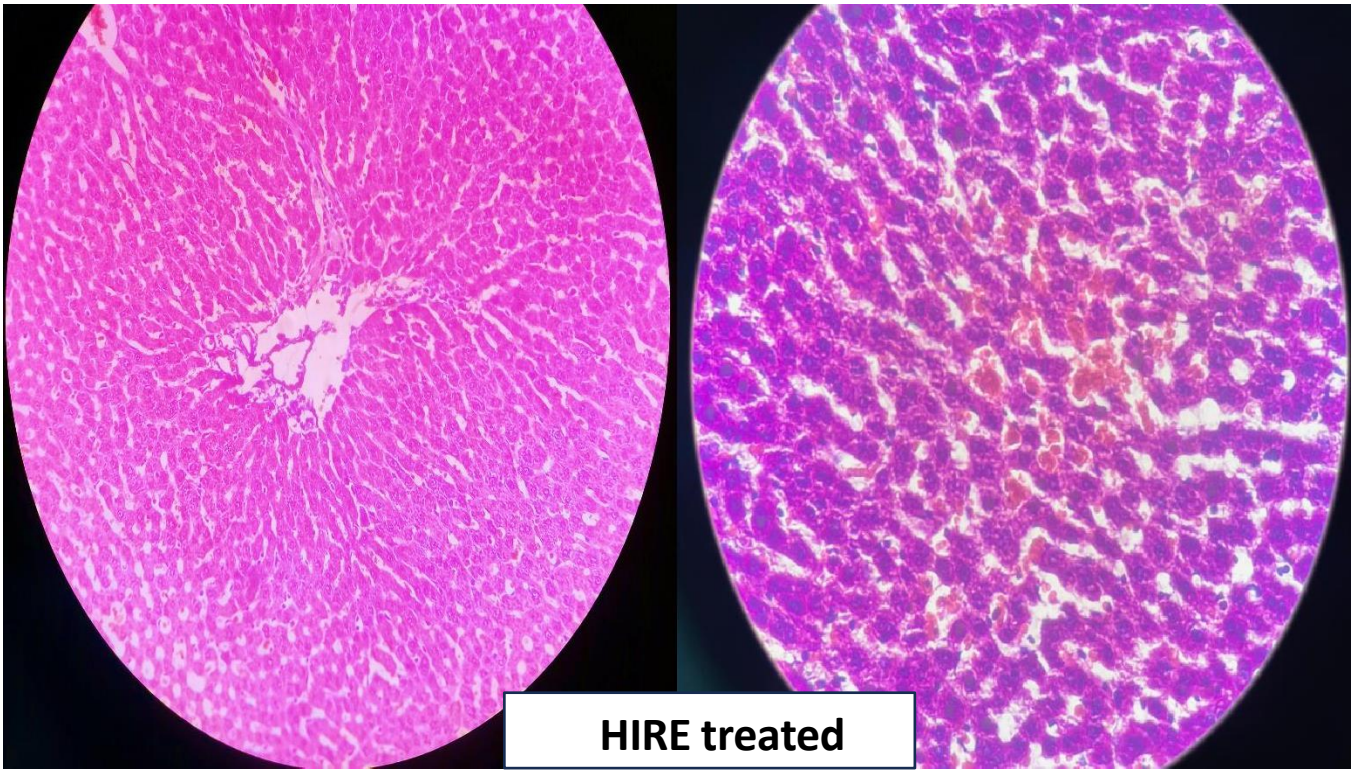

Normal


Diseased Control


Standard treatment


CBRE treated


DHRE treated


HIRE treated

DISCUSSION

This study explored the antidiabetic and hepatoprotective effects of *Cryptolepis buchanani* (CBRE), *Decalepis hamiltonii* (DHRE), and *Hemidesmus indicus* (HIRE) root extracts in a dexamethasone-induced diabetic rat model. Biochemical parameters and liver histopathology were assessed, with metformin used as the standard reference.

Phytochemical screening revealed that all three extracts contained tannins, flavonoids, and phenols—compounds known for antioxidant and liver-protective properties. Alkaloids were present in CBRE and HIRE, while glycosides were unique to DHRE, potentially explaining its superior therapeutic performance.

Dexamethasone administration caused significant elevations in liver enzymes (AST, ALT, ALP), indicating hepatic damage. Metformin effectively restored these levels, and among the extracts, DHRE and HIRE significantly lowered enzyme levels, with DHRE showing the most comparable effect to metformin. CBRE showed limited efficacy, particularly with ALT reduction. All extracts helped lower elevated fasting blood glucose levels, with DHRE showing the most pronounced hypoglycemic effect, nearly matching metformin, followed by HIRE and then CBRE. Albumin and total protein levels, which dropped in diabetic conditions, were significantly restored by DHRE and HIRE but not by CBRE, indicating limited impact of CBRE on liver synthetic function.

Histological analysis supported the biochemical findings. Metformin-treated livers showed near-normal architecture. DHRE-treated livers displayed notable recovery with reduced congestion and cellular damage. CBRE and HIRE also showed improvements, though less marked than DHRE.

In Ayurveda, several herbs have been described with *Rasayana* and *Rakta Prasadana* properties—two actions closely associated with systemic rejuvenation and blood purification. One such extensively mentioned drug is *Sariva* (*Hemidesmus indicus*), which is traditionally attributed with *Varnya* (enhancing complexion), *Rakta Prasadana* (blood purifying), and *Rasayana* (rejuvenating) *karma*.

The pathogenesis (*samprapti*) of *Prameha* primarily involves the vitiation of *Kapha dosha*, which leads to *Medas dushti* (vitiation of fat tissue) and impaired function of *Agni* (metabolic/digestive fire). This cascade results in excessive *Kleda* (pathological moisture) and manifests clinically as *Madhumeha* .

In this pathological context, *Sariva* offers a multidimensional therapeutic effect. Its *Kapha-Pittahara* property helps in pacifying the deranged doshas, while its *Medohara* (lipid-reducing) and *Mutrala* (diuretic) actions assist in channel clearance and metabolic regulation. These attributes make *Sariva* highly relevant in the management of *Prameha*, especially the *Medoja* type, where excess *Medas* causes *Srotorodha* (obstruction in bodily channels), thereby affecting *Rakta* circulation and disturbing *Pitta* balance.

Furthermore, when *Kleda dushti* occurs in *Rakta dhatu*, it results in *Rakta dushti*, further aggravating the condition. *Sariva*, being a potent *Rakta Prasadana* drug, aids in reducing the vitiated *Kleda* and purifying the blood. This mechanism aligns with both classical Ayurvedic understanding and the modern antioxidant perspective, reinforcing the rationale behind its selection in this experimental model for *Prameha*.

Thus, the present study validates the traditional claims of *Sariva* through both biochemical and histopathological outcomes, showing its potential not only as an antidiabetic agent but also as a hepatoprotective and antioxidant drug. This highlights the relevance of integrating classical Ayurvedic knowledge with modern scientific approaches in drug validation and therapeutic application.

CONCLUSION

- The present study achieved its primary objective of evaluating and comparing the anti-hyperglycemic efficacy of *Hemidesmus indicus* (authentic Sariva) and its two commonly used market substitutes, *Decalepis hamiltonii* and *Cryptolepis buchanani*, in a dexamethasone-induced hyperglycemia model in Wistar rats.
- The findings suggest that *Decalepis hamiltonii* root extract (DHRE) and *Hemidesmus indicus* root extract (HMRE) possess significant antidiabetic and hepatoprotective properties, closely approximating the efficacy of metformin. These effects may be attributed to its unique phytochemical composition, particularly the presence of glycosides and flavonoids. *Cryptolepis buchanani* (CBRE), although commonly used as a market substitute, showed comparatively weaker anti-hyperglycemic and hepatoprotective effects, underscoring concerns regarding its interchangeable use in herbal formulations.
- Further studies, including isolation of active constituents and mechanistic investigations, are warranted to validate and expand upon these promising findings.

SCOPE FOR FUTURE WORK

- Dose Optimization: Exploring different doses and treatment durations may help determine the most effective and safe therapeutic range for each extract.
- Chronic Models: Future studies should evaluate long-term efficacy in chronic diabetes models and assess effects on complications such as nephropathy and neuropathy.
- Clinical Translation: Clinical trials in humans are necessary to validate the experimental findings and assess safety, tolerability, and efficacy in diabetic patients.
- Market Surveillance: Regular quality assessment and authentication of market samples are essential to avoid adulteration and ensure therapeutic consistency in Ayurvedic practice.

Outcomes of the Project

The study demonstrated that all three test drugs—*Hemidesmus indicus* (Sariva), *Decalepis hamiltonii,* and *Cryptolepis buchanani*—exhibited antihyperglycemic effects in dexamethasone-induced hyperglycemic rats.

Among them, *Decalepis hamiltonii* showed the most significant blood glucose-lowering effect, closely approaching the standard drug Metformin.

Hemidesmus indicus also showed notable improvement in glycemic control and liver function, validating its classical use in Prameha management.

Cryptolepis buchanani was comparatively less effective, emphasizing the need for careful identification and selection of herbal raw materials in the Ayurvedic pharmacopeia.

Histopathological findings supported the biochemical results, particularly highlighting the hepatoprotective effects of *Decalepis hamiltonii* and *Hemidesmus indicus*.

Significance of the Project

The study supports the Ayurvedic view of Sariva as a Rakta Prasadaka, Medohara, and Rasayana drug, with scientific evidence backing its use in diabetes management.

It highlights the superior therapeutic potential of *Decalepis hamiltonii*, suggesting its possible role as a validated herbal alternative for diabetes care.

The findings reinforce the importance of authenticity and standardization of herbal drugs to ensure efficacy and safety.

The project bridges classical Ayurvedic knowledge with modern pharmacological understanding, contributing to integrative and evidence-based herbal medicine research.

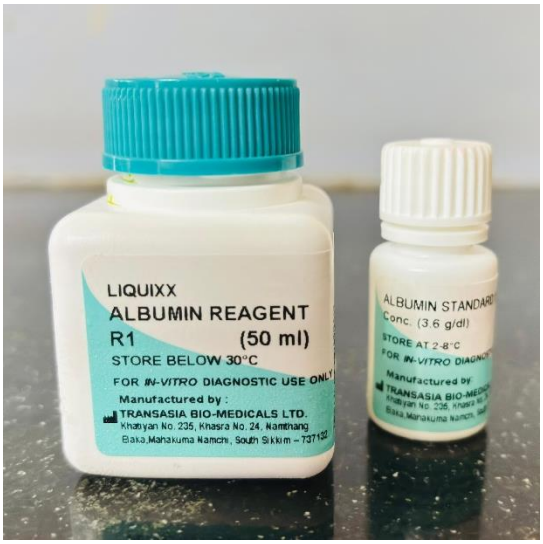
ANNEXURES

Hemedesmus indicus

Cryptolepis buchanani

Decalepis hamiltonii

LIPID PROFILE REAGENTS



SHRI B.M.K. AYURVEDA MAHAVIDYALAYA

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Central Research Facility

DRUG AUTHENTICATION REPORT

Outward: - BMK/CRF/14\/2025-26

Submitted By: Dr. Vishala
Submitted Date : 21/03/2025

Date of Issue: 25/03/2025

S.No	Sample Name	Scientific Name	Family	Part submitted	CRF Code	Authenticated as			
						Common Name	Scientific Name	Family	Part Authenticated
1.	Shweta Sariva	*Hemidesmus indicus*. R.Br	Asclepiadaceae	Root	CRF/Auth/319 /2025-2026	Shweta Sariva	*Hemidesmus indicus*. R.Br	Asclepiadaceae	Root
2.	Jambupatra Sariva	*Cryptolepis buchananii* R.Br	Asclepiadaceae	Root	CRF/Auth/320 /2025-2026	Jambupatra Sariva	*Cryptolepis buchananii* R.Br	Asclepiadaceae	Root
3.	Sariva (Source plant)	*Decalepis hamiltonii* Wight & Arn.	Asclepiadaceae	Root	CRF/Auth/321 /2025-2026	Sariva (Source plant)	*Decalepis hamiltonii* Wight & Arn.	Asclepiadaceae	Root

Reference : Bhavaprakash Nighantu by Prof. K C Chunekar. Page no.111 to 113

Signature:
Authentication Expert Name: Dr.Divya Khare
Date: 25/03/2025

CRF BHAHAPUR, BELGAUM

Signature of Coordinator
ASU Drug Testing Laboratory

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Approved by Pharmacy Council of India (PCI) & All India Council for Technical Education (AICTE), New Delhi
(Re-accredited by NBA, AICTE, New Delhi)

Ref No: Klecoph/HBL/2025/185(A1) Date: 07/05/2025

ANALYTICAL REPORT

SAMPLE I: Aqueous extract of *Hemedesmus indicus* root

Submitted by: Jain AGM AMC&H, Varur, Hubli.

DESCRIPTION MACROSCOPIC

TESTS	RESULTS
FORM	Liquid
COLOUR	Dark brown
TASTE	Sweet, slightly bitter
ODOUR	Pleasant, aromatic

PRELIMINARY PHYTOCHEMICAL SCREENING

Sl No	Test	Results
1	Carbohydrates	Positive
2	Saponins	Positive
3	Proteins	Positive
4	Tannins	Positive
5	Steroids	Positive
6	Flavonoids	Positive
7	Alkaloids	Positive
8	Phenols	Positive
9	Glycosides	Positive
10	Terpenoids	Positive

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Ref No: Klecoph/HBL/2025/185(A) Date: 07/05/2025

ANALYTICAL REPORT

SAMPLE II: Aqueous extract of *Cryptolepis buchanani* root

Submitted by: Jain AGM AMC&H, Varur, Hubli.

DESCRIPTION MACROSCOPIC

TESTS	RESULTS
FORM	Liquid, slightly viscous
COLOUR	Brown
TASTE	Bitter
ODOUR	Slightly aromatic or earthy, characteristic

PRELIMINARY PHYTOCHEMICAL SCREENING

Sl No	Test	Results
1	Carbohydrates	Negative
2	Saponins	Positive
3	Proteins	Positive
4	Tannins	Positive
5	Steroids	Positive
6	Flavonoids	Positive
7	Alkaloids	Positive
8	Phenols	Positive
9	Glycosides	Positive
10	Terpenoids	Positive

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Ref No: Klecoph/HBL/2025/185(A) Date: 07/05/2025

ANALYTICAL REPORT

SAMPLE III: Aqueous extract of *Decalepis hamiltonii* root

Submitted by: Jain AGM AMC&H, Varur, Hubli.

DESCRIPTION MACROSCOPIC

TESTS	RESULTS
FORM	Liquid, sticky consistency
COLOUR	Reddish brown
TASTE	Sweet , slightly bitter aftertaste
ODOUR	Pleasant, sweet, aromatic

PRELIMINARY PHYTOCHEMICAL SCREENING

Sl No	Test	Results
1	Carbohydrates	Positive
2	Saponins	Positive
3	Proteins	Positive
4	Tannins	Positive
5	Steroids	Negative
6	Flavonoids	Positive
7	Alkaloids	Positive
8	Phenols	Positive
9	Glycosides	Positive
10	Terpenoids	Positive

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(Guide)

Ashwini vastrad 30/5/25

6. DR. ASHWINI VASTRAD

(Head of Department)

Dept. of Dravya Guna
Jain AGM Ayurvedic Medical
College & Hospital, Varur.

Forwarded by Head of the Institute

I/c. Ashwini vastrad 30/5/25

(Name and signature with date & Seal)

DR. ASHWINI VASTRAD

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