Evaluation of *Butea monosperma* & *Boerhaavia diffusa* In Experimentally Induced Neuropathic Pain

Manoj Singh Bhadauria[1*], M. A. Naidu[2]

[1]Research Scholar, Faculty of Pharmacy, Mandsaur University, Mandsaur, M.P., India
[2] Faculty of Pharmacy, Mandsaur University, Mandsaur, M.P., India

Abstract: Aim: The aim of the present investigation is to study the Evaluation of *Butea monosperma* & *Boerhaavia diffusa* In Experimentally Induced Neuropathic Pain. **Material & Methods:** Wistar albino rats weighing between 200-250 grams were selected for the study. The extracts and gallic acid (GA) suspensions were administered to the animals once a day through oral gavage. The suspension of extracts was prepared using 0.5% Na CMC and distilled water. An ideal neuropathic pain model should produce consistent sensory symptoms such as allodynia, hyperalgesia, and spontaneous pain over an extended duration, making it feasible for comprehensive evaluation. The Tibial and Sural Transection Injury model is a surgical technique commonly utilized in experimental settings to induce neuropathic pain in animal subjects, particularly rodents. This model involves the precise transection of the tibial and sural nerves, branches of the sciatic nerve, to elicit neuropathic pain symptoms. In parallel, the surrounding muscular tissue was homogenized with phosphate buffer (pH 7.4) and employed for the determination of myeloperoxidase (MPO) levels. **Results:** The multifaceted nature of neuropathic pain, coupled with the inadequacies of existing treatments, underscores the importance of exploring alternative interventions, and this study aims to contribute valuable insights to this complex field. **Conclusion:** These directions are crucial for advancing our understanding, translating findings into clinical applications, and ensuring the sustainability of therapeutic interventions.

Keywords: *Butea monosperma* & *Boerhaavia diffusa,* Neuropathic Pain, myeloperoxidase (MPO) levels, Transaction of the tibial and sural nerves, Gallic acid (GA)

1. INTRODUCTION

Neuropathic pain, a complex and debilitating condition arising from damage or dysfunction of the nervous system, poses a significant challenge in the field of pain management. Conventional treatments often provide only partial relief and are accompanied by undesirable side effects, necessitating the exploration of alternative therapeutic options. Indigenous medicinal plants have long been a source of traditional remedies, holding potential for novel pharmacological interventions. This study aims to systematically evaluate the pharmacological properties of select indigenous medicinal plants for their efficacy in alleviating neuropathic pain [1]. Neuropathic pain is characterized by abnormal sensory processing and chronic discomfort, resulting from nerve injury, inflammation, or diseases affecting the nervous system. Its challenging nature arises from both peripheral and central sensitization mechanisms, making effective treatment elusive. Traditional medicinal systems worldwide have relied on the therapeutic properties of plants to manage various ailments, including pain. Harnessing the knowledge embedded in these indigenous remedies may offer promising avenues for developing new pharmacotherapy. The indigenous flora of diverse regions often contains a plethora of bioactive compounds with analgesic, anti-inflammatory, and neuroprotective properties. Several medicinal plants have been identified for their potential in mitigating neuropathic pain, and their exploration at the pharmacological level is imperative. By understanding the underlying mechanisms of action, researchers can elucidate the efficacy and safety of these plant-based interventions, paving the way for their integration into mainstream medical practice [2,3]. This study focuses on a carefully selected group of indigenous medicinal plants i.e. *Butea monosperma* & *Boerhaavia diffusa*, each chosen based on traditional knowledge, ethnobotanical relevance, and preliminary evidence suggesting analgesic properties. Through rigorous pharmacological evaluation, we aim to identify the active bioactive extracts or compounds responsible for the observed effects and elucidate their specific mechanisms of action on neuropathic pain pathways [4].

2. MATERIALS AND METHODS

Extraction procedure

Dried plant material was powdered and it was packed and sealed in pouch made from cotton fabric and placed in thimble. The solvent was placed in distillation flask. The vapours of solvent were made to pass through the thimble containing plant material and were liquefied in the condenser. When the liquid reaches the overflow level in thimble, siphon aspirates the solution, which flows back to distillation flask, carrying the extracted solutes into bulk solvent. The extraction process was carried out for period of 30 hrs. Literature search was carried out for selection of solvents, and it was revealed that polar solvents like water, ethanol, methanol etc. were used for extraction [5].

Preparation of animals, house and feeding conditions

The animals for the study were sourced from Bharat Serum and Vaccines Pvt. Ltd. in Thane, Bombay Veterinary College in Mumbai, and Global Bio Research Centre in Pune. These animals were housed in the animal facility of C. U. Shah College of Pharmacy. After procurement, the animals underwent a one-week acclimatization period in the experimental room, where they were conditioned at room temperature and exposed to natural photoperiods [6].

Wistar albino rats weighing between 200-250 grams were selected for the study. The extracts and gallic acid (GA) suspensions were administered to the animals once a day through oral gavage. The suspension of extracts was prepared using 0.5% Na CMC and distilled water. Pregabalin, obtained as a gift sample from Alembic Pharma, was also administered orally in the suspension form [6].

Induction of Neuropathic pain in Rats:

Animal models play a pivotal role in comprehending the mechanisms underlying neuropathic pain and in the development of effective therapies for its optimal management. Assessing neuropathic pain in humans is a complex process, as stimuli that do not cause irreversible damage can be utilized in these subjects. Additionally, recruiting the substantial number of patients required for a clinical trial poses a significant challenge. Hence, the utilization of animal models of peripheral nerve injury becomes essential to expand our understanding of the intricate mechanisms involved in neuropathic pain [7].

An ideal neuropathic pain model should produce consistent sensory symptoms such as allodynia, hyperalgesia, and spontaneous pain over an extended duration, making it feasible for comprehensive evaluation. Additionally, the model should enable the measurement of the degree of mechanical, chemical, and temperature-induced allodynia and hyperalgesia. The utilization of such models not only allows for a more thorough understanding of neuropathic pain mechanisms but also facilitates the assessment of various pharmacotherapies at the pre-clinical level [8].

Chronic Constriction Injury Method:

The Chronic Constriction Injury (CCI) method, developed by Bennett and Xie in 1988, stands as a prominent animal model for inducing neuropathic pain in experimental settings. In this surgical approach, typically conducted on rats or mice, the sciatic nerve is surgically constricted with loose ligatures proximal to its trifurcation. This meticulous procedure ensures that the nerve remains viable, preventing ischemia while inducing lasting neuropathic pain symptoms. Following the surgery, the animals undergo behavioral assessments to gauge responses indicative of neuropathic pain, including allodynia, hyperalgesia, and spontaneous pain behaviors. The time course of neuropathic pain in the CCI model is characterized by sustained symptoms over an extended period, providing a valuable platform for longitudinal studies. This temporal aspect allows researchers to explore the progression and persistence of neuropathic pain, contributing to a deeper understanding of its mechanisms [9, 10].

Tibial and Sural Transection Injury:

The Tibial and Sural Transection Injury model is a surgical technique commonly utilized in experimental settings to induce neuropathic pain in animal subjects, particularly rodents. This model involves the precise transection of the tibial and sural nerves, branches of the sciatic nerve, to elicit neuropathic pain symptoms. The surgical procedure entails exposing the sciatic nerve, identifying the tibial and sural branches, and carefully severing them. This targeted nerve injury leads to the development of persistent neuropathic pain, making it a valuable model for studying the mechanisms and potential treatments of neuropathic pain [11].

Behavioural Assessment of for Painful Neuropathic Parameters:

Behavioural examination

Surgically induced neuropathies are commonly employed in experimental models to investigate the mechanisms and characteristics of neuropathic pain. Behavioral examination plays a crucial role in assessing the impact of these surgical interventions on the animals' sensory and motor functions, providing valuable insights into the development and progression of neuropathic pain [12].

Biochemical Estimations:

Following the assessment of behavioural parameters, nerve function, and electrophysiological measurements, animals were euthanized on the 21st day using a carbon dioxide chamber. Subsequent to euthanasia, the skin and muscle layers were carefully removed from the thigh region of the hind limbs in the rats. Immediate isolation of portions of the sciatic nerve and the tissue beneath it was conducted. The excised sciatic nerve portion included the segment proximal to the point of transaction up to its emergence from the spinal cord, as well as the distal portion extending to its termination. In particular, a tissue sample with a 1 cm diameter precisely beneath the point of sciatic nerve transaction and ligation was obtained. The maintenance of uniformity among different nerve and tissue samples was ensured by consistently taking samples with a constant weight. Subsequently, the assessment of superoxide anion levels was promptly carried out in the sciatic nerve. A 10% (w/v) sciatic nerve homogenate was prepared using 0.1 M Tris–HCl buffer (pH 7.4) and distilled water, facilitating the estimation of total protein content. In parallel, the surrounding muscular tissue was homogenized with phosphate buffer (pH 7.4) and employed for the determination of myeloperoxidase (MPO) levels [13].

3. RESULTS & DISCUSSION

Induction of Neuropathic pain in Rats:

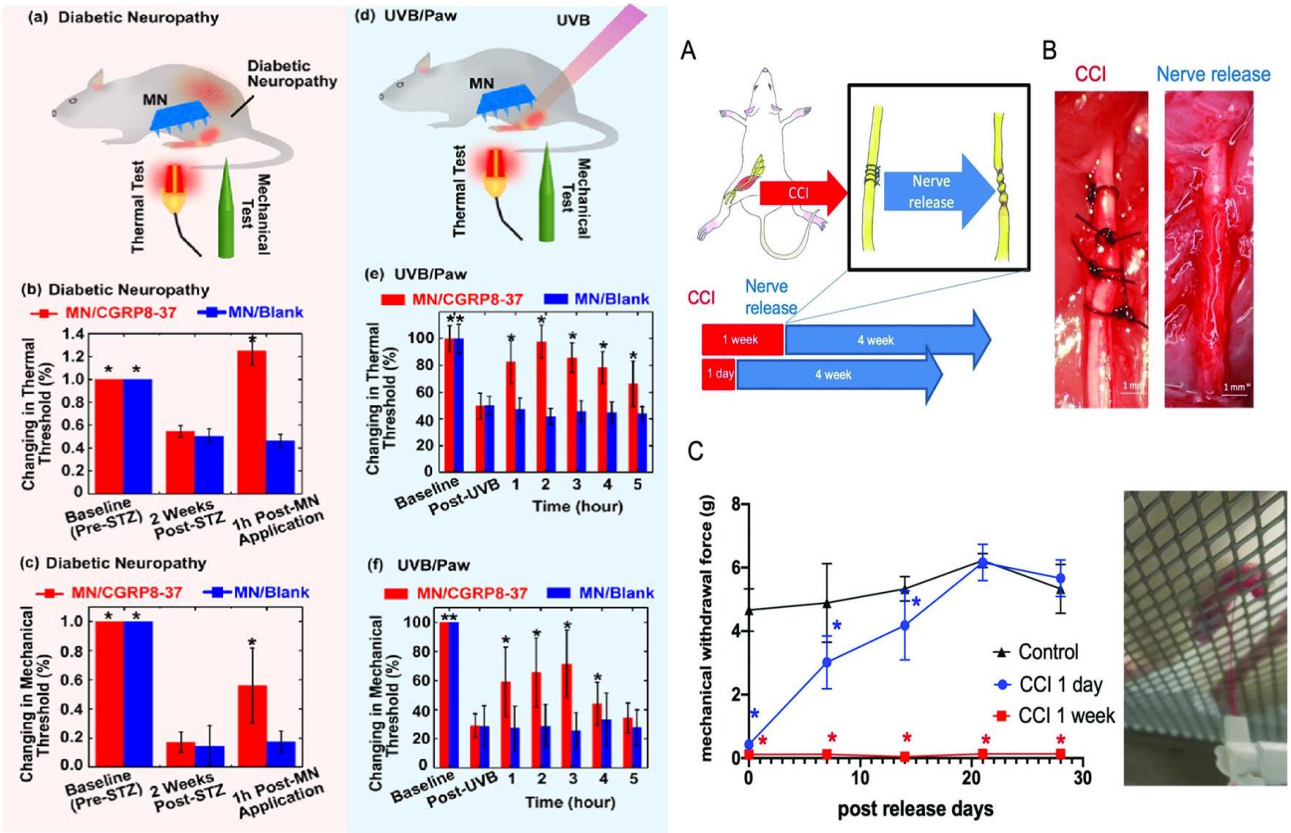

Fig. 1: Chronic Constriction Injury Method

Tibial and Sural Transection Injury:

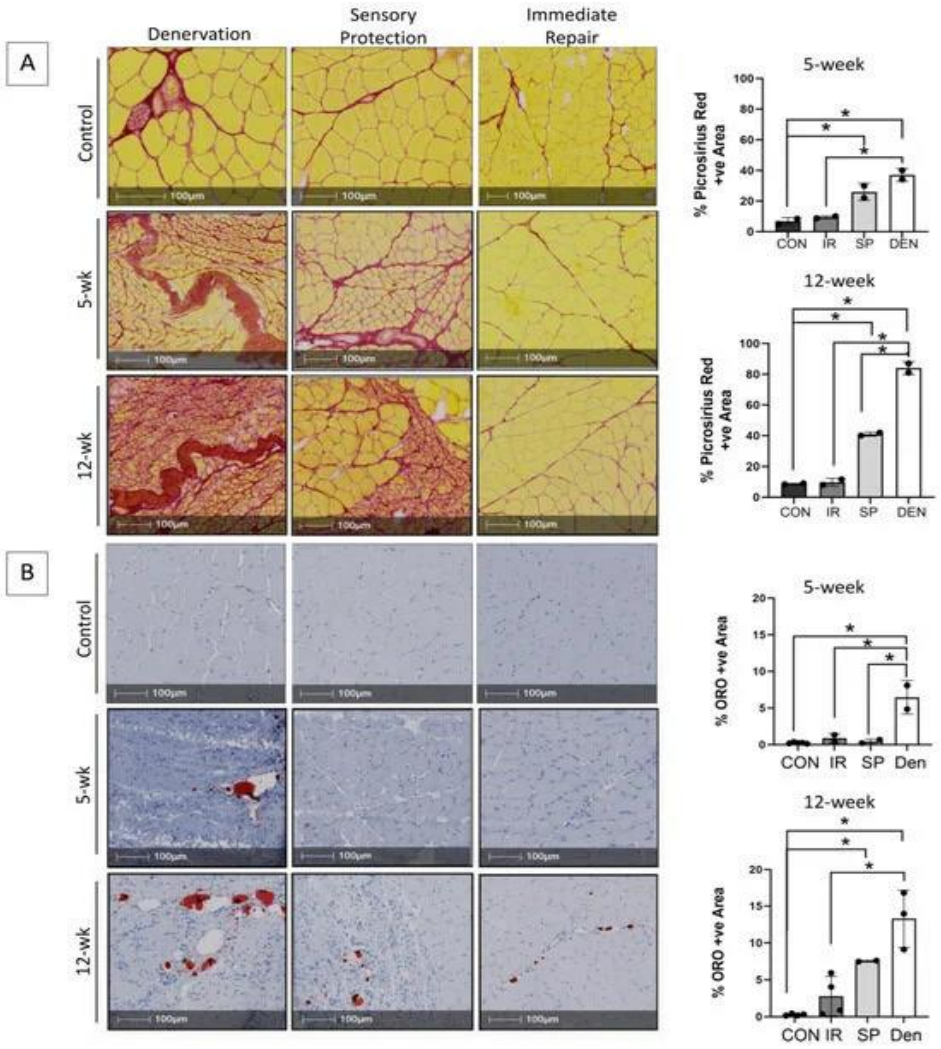

Fig. 2: Tibial and Sural Transection Injury

Behavioural Assessment of for Painful Neuropathic Parameters:

For surgically induced neuropathies:

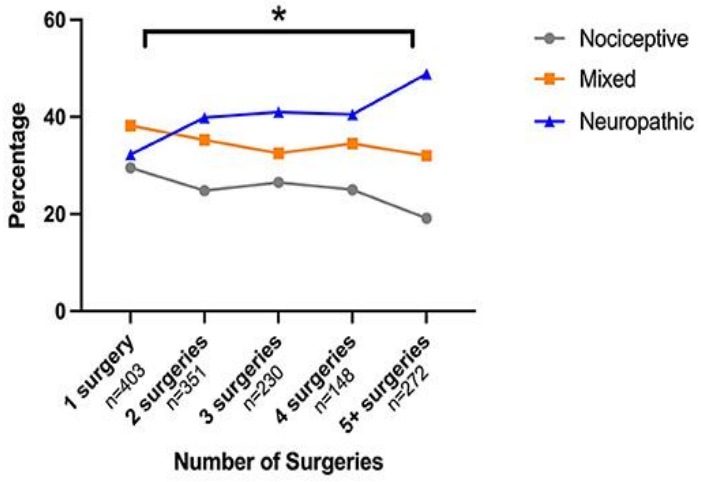

Fig. 3: Painful Neuropathic Parameters

Biochemical Estimations:

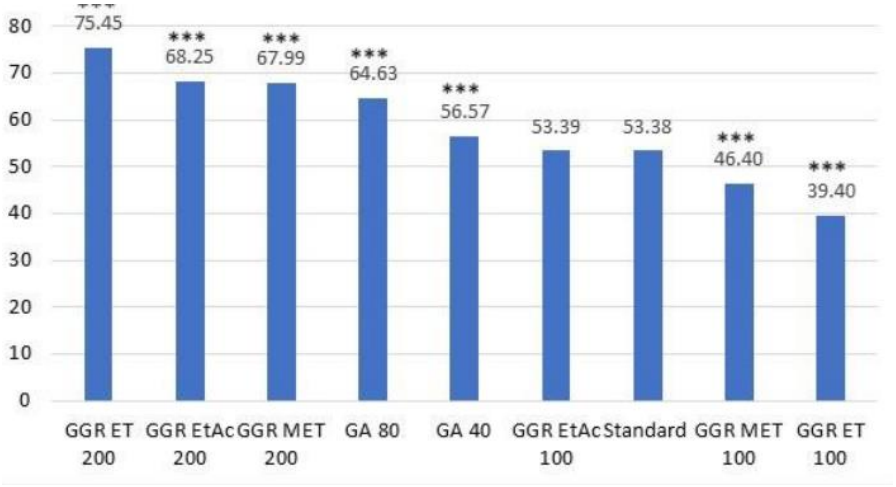

Fig. 4: %MPE of BM Extracts on MDA Levels

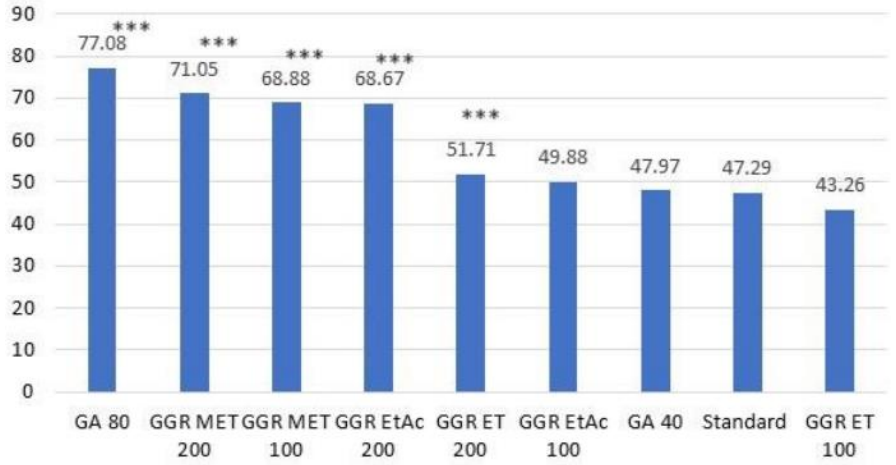

Fig. 5: %MPE of BD extracts on MDA levels

The research on the pharmacological evaluation of indigenous medicinal plants for neuropathic pain represents a significant and promising endeavor that holds the potential to address the limitations of current therapeutic approaches. The multifaceted nature of neuropathic pain, coupled with the inadequacies of existing treatments, underscores the importance of exploring alternative interventions, and this study aims to contribute valuable insights to this complex field [14]. The systematic review and selection of indigenous medicinal plants based on traditional knowledge and ethnobotanical relevance lay the foundation for a comprehensive exploration of their pharmacological potential. By bridging the gap between ancient healing practices and modern scientific methodologies, this research integrates the rich tapestry of traditional wisdom with rigorous pharmacological evaluation. The preclinical studies using animal models further contribute to the depth of understanding regarding the efficacy of the identified compounds. These studies provide a bridge between laboratory findings and potential clinical applications, offering insights into the potential translational impact of the research on human subjects. Additionally, the consideration of sustainable harvesting and cultivation practices underscores the ethical dimension of utilizing natural resources for medicinal purposes [15]. Balancing the therapeutic potential of indigenous plants with environmental conservation aligns with a holistic approach to healthcare that recognizes the interconnectedness of human health and the well-being of the planet. the findings of this research have the potential to revolutionize neuropathic pain management by uncovering novel therapeutic agents derived from indigenous medicinal plants. By embracing the wisdom of traditional healing practices, this study contributes not only to the advancement of medical science but also to the broader dialogue on the integration of traditional knowledge into contemporary healthcare. The outcomes hold promise for the

development of safer, more effective, and culturally resonant treatments for individuals grappling with the challenges of neuropathic pain [15, 16].

4. CONCLUSION

The successful completion of the research on the pharmacological evaluation of indigenous medicinal plants for neuropathic pain opens avenues for several promising directions in future work. These directions are crucial for advancing our understanding, translating findings into clinical applications, and ensuring the sustainability of therapeutic interventions.

5. REFERENCES

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