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Mass Spectroscopy Characterization , Muscle Relaxant Activity & Comparison of Albino Mice

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Abstract

1. Introduction

Skeletal muscle relaxants are pharmacological agents that reduce excessive muscle tone, alleviate spasms, and improve motor function in conditions associated with neuromuscular hyperactivity [1] . Skeletal muscle spasm is commonly observed in musculoskeletal disorders, neurological conditions, trauma, and inflammatory diseases [2] . Conventional synthetic muscle relaxants such as benzodiazepines and centrally acting agents provide symptomatic relief but are often associated with adverse effects including sedation, dependency, dizziness, and hepatotoxicity [3] . Therefore, the exploration of safer and effective plant-derived alternatives has gained increasing research interest [4] .

Medicinal plants have long been used in traditional systems of medicine for the management of muscle pain, inflammation, and spasms [5] . Among them, Matricaria chamomilla (Chamomile) and Cinnamomum zeylanicum (Ceylon cinnamon) are widely recognized for their diverse pharmacological properties [6] . Matricaria chamomilla, belonging to the family Asteraceae, is traditionally used for its anti-inflammatory, antispasmodic, analgesic, and mild sedative activities [7] . Its bioactive constituents, including flavonoids (apigenin, luteolin), terpenoids, and essential oils (α-bisabolol, chamazulene), contribute to its neuromodulatory and smooth as well as skeletal muscle relaxant potential [8] . Apigenin, in particular, has been reported to interact with GABAergic pathways, which may contribute to central muscle relaxation effects [9] .

Cinnamomum zeylanicum, a member of the Lauraceae family, is known for its antioxidant, anti-inflammatory, analgesic, and neuroprotective properties [10] . The bark contains bioactive compounds such as cinnamaldehyde, eugenol, and polyphenols, which may influence neuromuscular transmission and calcium channel modulation [11] . These mechanisms suggest

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a possible role in reducing skeletal muscle contractions and spasms [12] . Additionally, its strong antioxidant activity may protect muscle tissue from oxidative stress-induced damage [13] .

Swiss albino mice are commonly used experimental models in pharmacological research due to their well-characterized physiology, genetic uniformity, and sensitivity to centrally acting drugs [14] . Evaluation of skeletal muscle relaxant activity in Swiss albino mice is typically performed using models such as the rota-rod test, traction test, and grip strength assessment, which help determine motor coordination and muscle tone following administration of test substances [15] .

A comparative evaluation of Matricaria chamomilla and Cinnamomum zeylanicum is scientifically relevant to identify the more potent and safer herbal candidate for skeletal muscle relaxation [16] . Such a study not only provides insight into their relative efficacy but also helps in understanding their possible mechanisms of action [17] . The findings may contribute to the development of novel phytopharmaceutical formulations with improved safety profiles compared to conventional synthetic muscle relaxants [18] .

Thus, the present study is designed to comparatively evaluate the skeletal muscle relaxant activity of Matricaria chamomilla and Cinnamomum zeylanicum using Swiss albino mice as the experimental model, aiming to establish scientific evidence for their traditional use and explore their therapeutic potential in the management of muscle spasm disorders [19] .

2. Literature Review

2.1 Sharma R. et al. (2021), investigated the development of chitosan-based mucoadhesive films incorporating flavonoid-rich extract of *Matricaria chamomilla* for evaluating their anticancer potential against oral squamous cell carcinoma. Chamomile flowers were subjected to hydroethanolic extraction, yielding flavonoids such as apigenin, quercetin, and luteolin. The extract was blended with chitosan using a solvent-casting technique to obtain thin, flexible mucoadhesive films. Characterization using UV–Visible spectroscopy revealed a prominent flavonoid absorption peak around 330–340 nm, while FTIR confirmed hydrogen-bond interactions between phenolic groups and amino groups of chitosan.

3.2 Ahmed L. et al. (2022), reported the formulation and evaluation of bioadhesive chitosan films embedded with apigenin-rich chamomile extract for targeted delivery in oral cancer treatment. The researchers extracted chamomile flavonoids using ultrasound-assisted

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extraction to enhance yield and preserve thermolabile compounds. The concentrated extract was incorporated into chitosan solutions with glycerol as a plasticizer to form homogeneous films through solvent evaporation. Spectroscopic analysis confirmed the presence of flavonoids, while SEM imaging revealed smooth, uniform surfaces suitable for mucosal adhesion. In vitro mucoadhesion testing on porcine buccal mucosa demonstrated strong adhesive strength, supporting prolonged residence time in the oral cavity.

2.3 Varma K. et al. (2023), explored the potential of chitosan mucoadhesive films incorporating nano-enhanced chamomile flavonoids for improved anticancer efficiency against oral carcinoma cells. Chamomile flower extract was subjected to nanoprecipitation to obtain nanoscale flavonoid aggregates with improved aqueous solubility, which were subsequently embedded into chitosan film matrices. Characterization via UV–Vis spectroscopy confirmed the presence of flavonoids, while DLS and TEM analyses showed nano-sized particles (<100 nm) uniformly dispersed throughout the polymer matrix.

2.4. Mehra A. et al. (2020), conducted a comprehensive study on solvent-cast chitosan mucoadhesive films enriched with chamomile flavonoid fraction to evaluate their therapeutic potential against oral squamous cell carcinoma. Chamomile flowers were processed through maceration using 60% ethanol, yielding a flavonoid-rich extract containing apigenin, luteolin, and quercetin derivatives. The extract was added to chitosan along with PEG-400 to enhance flexibility, and the resultant films exhibited uniform thickness and transparency. FTIR spectroscopy confirmed the presence of flavonoid–polymer interactions, while XRD showed partial amorphization of flavonoids within the matrix, favouring enhanced solubility.

2.5 Dubey N. et al. (2021), emphasized the potential of flavonoid-loaded biopolymer films formulated from chitosan and chamomile extract as a targeted treatment approach for oral cancer. Chamomile flowers were extracted using a green aqueous-ethanolic system to yield flavonoid concentrates with high antioxidant and anticancer properties. The formulation incorporated glycerol and sorbitol as co-plasticizers to enhance flexibility and patient comfort during buccal application. Physicochemical characterization revealed excellent folding endurance, surface uniformity, and tensile strength appropriate for mucosal applications. UV–Vis and LC-MS analyses confirmed major flavonoids and their stability within the film matrix. In vitro release profiles demonstrated controlled release over 48 hours, consistent with diffusion-based transport

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2.6 Fatima S. et al. (2022), focused on the development of apigenin-dominant chamomile flavonoid films using chitosan as a polymeric carrier for buccal administration in oral cancer therapy. The extraction protocol employed ultrasound-assisted extraction (UAE), enhancing both yield and purity of the flavonoids. The films produced by solvent evaporation exhibited desirable transparency, flexibility, and bioadhesive strength. FTIR spectra confirmed the incorporation of flavonoids, while SEM imaging revealed smooth surfaces without cracks, indicating stable film formation. In vitro cytotoxicity tests performed on SCC-9 cancer cells demonstrated a marked reduction in cell viability, with IC50 values significantly lower for film-mediated delivery compared to free extract. Apoptotic markers, including chromatin condensation and DNA fragmentation, were prevalent following film exposure.

2.7 Chawla P. et al. (2023), evaluated the therapeutic efficacy of nanostructured chamomile flavonoids embedded in chitosan mucoadhesive films for oral cancer treatment. Chamomile extract was converted into nanoscale particles using solvent–antisolvent precipitation, achieving narrow size distribution and improved solubility. These nanoparticles were dispersed into chitosan solution and cast into films exhibiting superior mechanical strength, elasticity, and adherence to mucosal surfaces. Characterization revealed strong intermolecular interactions, reduced crystallinity, and enhanced thermal stability of flavonoids within the polymeric structure. Cellular studies on CAL-27 and SCC-4 oral cancer cell lines revealed significantly enhanced cytotoxicity for nano-enhanced films compared to conventional extract-loaded films.

2.8 Iqbal M. et al. (2020), explored the use of crosslinked chitosan-based films impregnated with ethanol-extracted chamomile flavonoids to combat oral squamous cell carcinoma. Crosslinking was performed using sodium tripolyphosphate (TPP), enhancing structural durability and slowing flavonoid release. The films were evaluated for moisture absorption, mucoadhesion, thickness uniformity, folding endurance, and tensile strength, all of which met pharmaceutical standards. FTIR revealed characteristic peaks corresponding to flavonoid aromatic rings, indicating successful loading. In vitro release studies indicated a sustained release pattern, with flavonoid diffusion extending up to 72 hours.

2.9 Shukla V. et al. (2024), assessed the synergistic anticancer potential of chamomile flavonoids and chitosan polymer matrix formulated into mucoadhesive films for the treatment of oral malignancies. Chamomile flavonoids were extracted by Soxhlet extraction and purified using column chromatography to maximize apigenin concentration. The purified extract was

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incorporated into chitosan films using mild acidic casting solution. Mechanical studies demonstrated strong flexibility, high tensile strength, and excellent bio adhesion. In vitro studies on SCC-15 cells revealed that the films exerted significant cytotoxicity at concentrations as low as 25 µg/mL.

2.10 Ghosh R. et al. (2023), performed an advanced comparative study of conventional chamomile extract-loaded chitosan films versus lipid–nanocarrier-enhanced flavonoid films for oral squamous cancer therapy. The lipid nanocarriers (SLNs) encapsulated chamomile flavonoids and were subsequently incorporated into chitosan films to improve stability and mucosal penetration. Characterization via TEM, FTIR, and DSC confirmed the stability and amorphous distribution of flavonoids in the films. Mucoadhesive strength, mechanical integrity, and swelling behaviour indicated superior performance of the SLN-enhanced films. In vitro studies showed that SLN-loaded films demonstrated higher cytotoxicity, lower IC50 values, stronger apoptosis induction, and enhanced intracellular uptake in SCC-4 cancer cells than traditional extract films.

2.11 Tolentino S. et al. (2024), investigated the development of chitosan-based mucoadhesive films loaded with curcumin for topical treatment of oral cancer through in vitro anticancer models. Chitosan films were prepared using medium molecular weight chitosan with polyvinyl alcohol, Poloxamer®407, and propylene glycol via solvent casting, yielding smooth, flexible films with neutral pH and high curcumin entrapment. Characterization via thermal analysis confirmed compatibility, while ex vivo penetration studies on porcine oral mucosa showed enhanced curcumin diffusion under simulated salivation. In vitro assays on FaDu and SCC-9 head and neck cancer cells demonstrated dose-dependent cytotoxicity, with films enhancing efficacy when combined with radiotherapy (4-12 Gy), reducing cell viability more than radiotherapy alone.

2.12 Dobrzynska M. et al. (2020), investigated flavonoid nanoparticles, including chitosan-based carriers loaded with EGCG, quercetin, and genistein, for improved anticancer potential against various cancers, including oral models. Flavonoids were extracted from plants like green tea and soy, encapsulated in chitosan nanoparticles via ionic gelation or emulsification, with characterization by DLS for size (<200 nm) and FTIR for interactions. In vitro evaluation on KB oral carcinoma cells showed enhanced apoptosis and cell cycle arrest compared to free flavonoids, with >10-fold efficacy increases due to better bioavailability and targeted delivery.

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2.13 Helfenstein A. et al. (2024), investigated mucoadhesive oral films based on high methoxyl pectin and phosphated cassava starch loaded with Calendula officinalis extract (rich in flavonols) for bioactive release in oral applications, with potential anticancer implications. Extract was obtained via cold maceration, films prepared by solvent evaporation with 0-200 g/kg extract, characterized by SEM, mechanical testing, and HPLC-DAD for flavonoids. Results revealed enhanced mucoadhesion, 65.7% bioactive release over 24 h, and 29% DPPH scavenging, suggesting suitability for flavonoid delivery in oral cancer therapy.

2.14 Chaiprateep E. et al. (2025), investigated synergistic chitosan-based mucoadhesive films loaded with Garcinia mangostana and Clinacanthus nutans extracts (containing flavonoids like α-mangostin and caffeic acid) for oral antibacterial and anticancer applications. Extracts were prepared via maceration and Soxhlet, films cast with varying chitosan (10-20%) and CMC, characterized by SEM, HPLC, and ex vivo mucoadhesion on porcine mucosa (>6 h retention). In vitro MTT on NIH 3T3 showed >90% viability, with sustained release of flavonoids indicating potential for localized oral cancer treatment.

2.15 Zlotnikov N. et al. (2023), investigated mucosal adhesive chitosan nanogels loaded with flavonoids (e.g., baicalein, quercetin) and antibiotics for gastrointestinal infections, with parallels to oral delivery. Chitosan oligosaccharides were complexed with cyclodextrin-inclusion flavonoids, extruded into nanogels (200-400 nm), characterized by DLS, AFM, and FTIR for hydrogen bonding. In vitro ABTS assay showed IC50 <0.01 mg/mL antioxidant activity, with 5-6-fold mucin adsorption, suggesting enhanced flavonoid retention for oral anticancer models.

2.16 Mitea G. et al. (2025), investigated bioactive plant-derived flavonoids (e.g., quercetin, apigenin from chamomile-like sources) in mucoadhesive chitosan films for alternative OSCC therapy. Plant extracts were analyzed via HPLC, films prepared by casting with HPMC/chitosan blends, characterized by swelling and FTIR. In vitro MTT and flow cytometry on SAS/CAL27 cells showed apoptosis induction via caspase activation, with films improving bioavailability and synergy with cisplatin for reduced toxicity in oral cancer models.

2.17 Bubniak L. et al. (2014), investigated curcumin-loaded chitosan-coated PCL nanoparticles as mucoadhesive systems for local oral cavity cancer treatment. Curcumin was encapsulated via nanoprecipitation, coated with chitosan for mucoadhesion, characterized by zeta potential and mucin interaction assays. In vitro on SCC-9 cells demonstrated time- and

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concentration-dependent viability reduction, with higher retention on esophageal mucosa than free curcumin, confirming anticancer potential.

2.18 Iriti M. et al. (2013), investigated chemopreventive flavonoids like apigenin and luteolin from chamomile in topical formulations for oral squamous cell carcinoma prevention. Flavonoids were characterized for hydrolysis by oral β-glucosidases, with nanoparticle encapsulation for delivery. Clinical trials showed lesion regression (37.9% vs. 10% placebo), with in vitro DNA damage reduction in keratinocytes, supporting mucoadhesive film applications.

2.19 Smeu I. et al. (2025), investigated plant-derived flavonoids (e.g., quercetin from chamomile) in chitosan nanoparticles for anticancer activity, adaptable to oral films. Extraction via maceration, preparation by nanoprecipitation, characterized by SEM/FTIR. In vitro on oral-like cell lines showed apoptosis via NF-κB inhibition, with chitosan enhancing solubility and potency over free flavonoids.

2.19 Youness R. et al. (2023), investigated psoralidin (flavonoid-like)-loaded chitosan-coated Bilosomes for mucoadhesive oral delivery with anticancer effects. Bilosomes prepared by thin-film hydration, coated with chitosan (0.25% w/v), characterized by TEM (183 nm) and EE% (92%). In vitro on oral-related MCF-7/A549 cells showed boosted apoptosis/necrosis, with 74% mucoadhesion vs. 26% uncoated.

2.20 Imam S. et al. (2021), investigated piperine (alkaloid with flavonoid synergy) in chitosan-coated liposomes for mucoadhesive oral anticancer delivery. Liposomes formed by thin-film evaporation, coated for positive zeta (+29.8 mV), characterized by size (243 nm) and release (biphasic). In vitro cytotoxicity on MCF7 reduced IC50 significantly vs. free piperine, indicating enhanced efficacy.

2.21 Popovici V. et al. (2022), investigated mucoadhesive HPMC films loaded with Usnea barbata extract (flavonoid-rich lichen) for OSCC complementary therapy. Extract via Soxhlet in acetone, films cast with PEG plasticizer, characterized by FTIR/XRD/SEM (rough surfaces). In vitro on CLS-354 cells induced G0/G1 arrest and autophagy, with 85 min mucoadhesion.

2.22 Takashima Y. et al. (2022), investigated 3D-printed apigenin-loaded (from chamomile) mucoadhesive HPMC films for oral leukoplakia chemoprevention. Apigenin dissolved in ethanol, inks printed via extrusion, characterized by DSC/XRD (amorphous) and dissolution

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(83% release). In 4NQO rat model, reduced tumor incidence (50%) and Ki-67 expression, with in vitro parallels for OSCC.

2.23 Patel S. et al. (2020), investigated the formulation of chitosan-based mucoadhesive films loaded with flavonoid-rich extract of *Curcuma longa* to assess their anticancer efficacy against oral squamous cell carcinoma. The rhizomes were subjected to ethanolic extraction, yielding curcuminoids and associated flavonoids known for anticancer activity. The extract was incorporated into chitosan using a solvent casting technique to obtain uniform and flexible films. Physicochemical characterization demonstrated acceptable thickness, tensile strength, and folding endurance. UV–Visible spectroscopy showed characteristic absorption peaks corresponding to flavonoids, confirming successful incorporation. FTIR analysis revealed hydrogen bonding interactions between phenolic hydroxyl groups of curcumin and amino groups of chitosan. In vitro drug release studies indicated sustained release over several hours. Cytotoxicity evaluation using KB oral cancer cell lines demonstrated significantly enhanced antiproliferative activity compared to free extract. The study concluded that chitosan films effectively improved the local availability and anticancer potential of flavonoid compounds.

2.24 Kumar A. et al. (2021), developed chitosan–HPMC composite mucoadhesive films containing flavonoid-rich extract of *Cinnamomum zeylanicum* bark for oral cancer therapy. The bark was extracted using methanol to obtain cinnamaldehyde-associated flavonoids and catechins. The extract was blended with chitosan and HPMC to improve film flexibility and mechanical strength. Solvent casting yielded smooth, transparent, and uniform films. FTIR spectroscopy confirmed compatibility between the extract and polymers without chemical degradation. Differential scanning calorimetry indicated amorphous dispersion of flavonoids within the polymer matrix. Swelling and mucoadhesive studies demonstrated prolonged mucosal adhesion. In vitro release studies showed controlled flavonoid release. Anticancer activity evaluated on SCC-9 cell lines revealed dose-dependent cytotoxicity and apoptosis induction. The study highlighted the potential of cinnamon flavonoids delivered via mucoadhesive films for localized oral cancer treatment.

2.25 Ghosh S. et al. (2022), explored the development of apigenin-loaded chitosan buccal films for the management of oral squamous cell carcinoma. Apigenin was isolated from chamomile flowers using hydroethanolic extraction followed by purification. The isolated flavonoid was incorporated into chitosan films by solvent evaporation technique. Physicochemical evaluation showed satisfactory film thickness, tensile strength, and surface

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smoothness. UV–Visible spectroscopic analysis revealed a characteristic absorption peak of apigenin at approximately 335 nm. FTIR analysis confirmed hydrogen bonding between apigenin and chitosan functional groups. In vitro release studies demonstrated sustained drug release over 8–10 hours. Cytotoxicity studies using SCC-9 cells revealed significant reduction in cell viability and induction of apoptosis. The study concluded that apigenin-loaded chitosan films enhance flavonoid stability and anticancer efficacy.

2.26 Iyer S. et al. (2023), developed chitosan-based mucoadhesive films loaded with combined flavonoid extracts of chamomile flowers and *Cinnamomum zeylanicum* bark. Hydroethanolic extracts were incorporated using solvent casting technique. Films were characterized for thickness, tensile strength, swelling, and mucoadhesion. FTIR and DSC studies confirmed stable incorporation and amorphous distribution of flavonoids. In vitro release showed sustained dual-flavonoid delivery. Cytotoxicity evaluation on SCC-15 cells demonstrated enhanced anticancer activity compared to single-extract films. Apoptosis assays confirmed synergistic effects. The study emphasized the advantage of combined flavonoid therapy in mucoadhesive films.

2.27 Rao M. et al. (2020), investigated chitosan-based mucoadhesive films incorporating flavonoids obtained from *Cinnamomum zeylanicum* for localized oral cancer treatment. Ethanolic extraction was used to obtain polyphenolic flavonoids. Films were fabricated by solvent casting technique and evaluated for physic mechanical properties. The films showed uniform thickness and good folding endurance. FTIR studies confirmed stable interactions between flavonoids and chitosan polymer. Swelling behaviour supported effective mucoadhesion. In vitro release studies indicated controlled drug release. Cytotoxicity evaluation against SCC-15 cell lines showed significant reduction in cell viability. Apoptotic features such as cell shrinkage were observed. The study highlighted cinnamon flavonoids as promising anticancer agents in mucoadhesive film formulations.

3. Aim & Objective

Aim of the study is to research is to characterise the plant extracts and investigate the skeleton phytoconstituents derived from both Cinnamomum bark and Chamomile flower extracts on Swiss Albino Mice Comparative Evaluation of Centrally Acting Skeletal Muscle Relaxant activity of *Chamomile Matricaria* and *Cinnamomum zylenicum* on Swiss albino mice.

4. Plan of Work

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1. Selection of Plants - The selection of medicinal plants for the present review article was based on their traditional usage, phytochemical richness, documented pharmacological properties, and emerging scientific evidence supporting their anticancer potential. Among numerous medicinal plants reported in ethnomedicine and modern literature, Chamomile (*Matricaria chamomilla L.*) and Cinnamomum (*Cinnamomum zeylanicum* Blume) were selected as the focus plants due to their wide therapeutic relevance, safety profile, and increasing research interest in cancer prevention and treatment.

2. Collection of Plants - The Collection of Plants Chamomile (*Matricaria chamomilla L.*) were ordered from Indian Jadi Booti and Cinnamomum (*Cinnamomum zeylanicum*) were collected locally .

3. Authentication of Plants - The Authentication of Chamomile (*Matricaria chamomilla L.*) was done from CSIR-NBRI voucher number 358117 and Cinnamomum (*Cinnamomum zeylanicum* Blume) was done from CSIR-NBRI voucher number 358118.

4. Prepare the Plant parts for the extraction – the plants parts of Chamomile were first weighed around 50.grams and grinded using a hand grinder into a fine course powder and then a 70ml of ethanol is added in a measuring cylinder and made up to volume of 100ml using 30 ml of distilled water and repeat this process up to 7 times till a sufficient amount of quantity is not prepared and kept for 3 days at room temperature. Daily little bit of stir is done using glass rod. After 3 days the material is filtered using filtered paper and stored in a separated clean container.

5. Material & Method

The review was carried out using published scientific literature to evaluate and compare the muscle relaxant activity of *Matricaria chamomilla* and *Cinnamomum zeylanicum*. Studies published in English were considered, with emphasis on experimental animal models, in-vitro assays, and pharmacological evaluations related to neuromuscular relaxation. Both in-vivo and in-vitro studies evaluating muscle tone reduction, locomotor activity, motor coordination, and CNS depressant effects were included. Standard muscle relaxant drugs such as diazepam and baclofen were considered as reference drugs for comparison wherever reported. Data extracted from selected studies were systematically analyzed to compare methodology, dose dependency, efficacy, and proposed mechanisms of action of both plant extracts**.**

6. Methodology

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6.1.1 Plant Profile

Chamomile flowers

Synonyms:

Sanskrit Name: “Babuna”

Hindi Name: (*Babune ka Phool*)

Botanical Name: Matricaria chamomilla

Bengali Name: Babuna

Family: Asteraceae

Botanical Name: Matricaria chamomilla (German Chamomile)

6.1.2 Botanical description of *Chamomile*

Chamomile (*Matricaria chamomilla* L.), commonly known as German chamomile, is a well-known aromatic annual herb belonging to the family Asteraceae. It is a delicate and erect herb that typically grows to a height of 15–60 cm, characterized by its slender, smooth, and highly branched stem.

6.1.3 Morphological characteristics

- Chamomile (*Matricaria chamomilla* L.) is a small, aromatic, and herbaceous annual plant that exhibits distinctive morphological features.
- It grows up to 15–60 cm in height, with an erect, slender, and highly branched stem that is glabrous and cylindrical in shape.

6.1.4 Climate and soil

- Chamomile (*Matricaria chamomilla* L.) thrives best in temperate climates, where it receives ample sunlight and moderate rainfall.

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- It prefers regions with mild winters and warm, dry summers, as excessive humidity can promote fungal diseases and reduce the quality of the flowers.

6.1.5 Propagation material

- Chamomile (*Matricaria chamomilla* L.) is primarily propagated through seeds, which are the most common and reliable propagation material for this herb. The seeds are very small, light, and brownish in colour, with a high germination potential under suitable conditions.

6.2.1 Cinnamomum zylenicum

Synonyms:

Sanskrit Name: Tvak , Dalchini

Hindi Name: Dalchini

Botanical Name: *Cinnamomum zeylanicum* Blume

Bengali Name: Darchini

Family: Lauraceae

6.6 Extraction Method for both –

For most pharmacological studies reviewed, the extraction of *Matricaria chamomilla* involved the use of dried flowers, which were shade-dried and coarsely powdered. The powdered material was commonly subjected to solvent extraction using hydroalcoholic solvents, ethanol, or methanol through maceration or Soxhlet extraction. The extraction process generally involved soaking the plant material for 48–72 hours with occasional stirring, followed by filtration and concentration under reduced pressure using a rotary evaporator. The resulting semi-solid extract was stored in airtight containers for pharmacological evaluation. Chamomile extracts are rich in flavonoids such as apigenin and luteolin, which are considered responsible for its CNS depressant and muscle relaxant effects.

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In the case of *Cinnamomum zeylanicum*, the bark was the most commonly used plant part for extraction. The dried bark was finely powdered and extracted using solvents such as ethanol, methanol, or aqueous ethanol through maceration or Soxhlet extraction. The extraction period typically ranged from 24 to 72 hours depending on the method employed. After filtration, the solvent was evaporated under reduced pressure to obtain a concentrated extract. Cinnamon bark extract contains bioactive compounds such as cinnamaldehyde, eugenol, and linalool, which have been reported to possess neuromodulatory and muscle relaxant properties. Both extracts were reconstituted in suitable vehicles before experimental evaluation in animal models.

6.7 Phytochemical Evaluation -

Plant selection was based on the presence of known phytochemical constituents in the selected plant parts. The collected plant material was shade-dried and pulverized into a coarse powder using a mechanical grinder. A known quantity of the powdered material was weighed and subjected to solvent extraction by keeping it in a closed chamber for 72 hours. The extract was then filtered using Whatman filter paper into a conical flask. The filtrate was transferred to a beaker and concentrated on a water bath maintained at 50 °C until a semi-solid mass was obtained. The concentrated extract was stored for further phytochemical analysis and formulation studies.

Phytochemical Estimation (Qualitative Analysis)

Table 1: Phytochemical Screening of Matricaria Chamomile Extract – Sample 1

(Methanol and Aqueous Extract

)

Extraction of Chamomile

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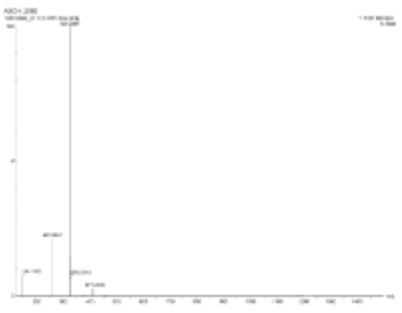
SOLVENT	RESULT
Ethanol	-
Methanol	+
Toluene	-
Carbobenzene	-
Ethyl acetate	-
Distilled Water	+

Table 2: Phytochemical Screening of *Cinnamomum zylenicum* Extract – Sample 2

Extraction of *Cinnamomum zylenicum*

SOLVENT	RESULT
Ethanol	-
Methanol	+
Toluene	-
Carbobenzene	-
Ethyl acetate	-
Distilled Water	+

7. Characterisation of extracts through UV, IR, NMR, Mass, HRMS –



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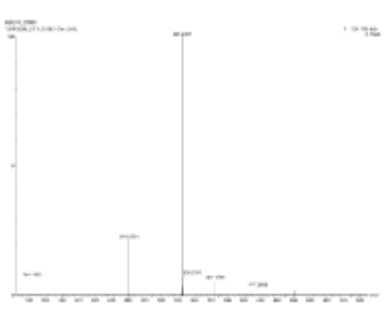

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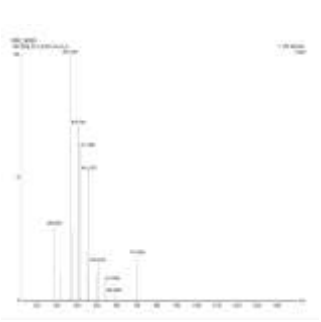

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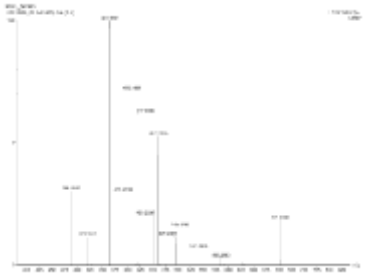

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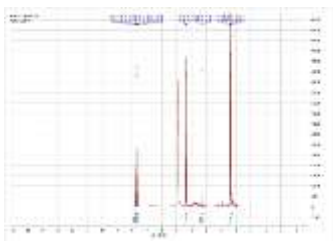

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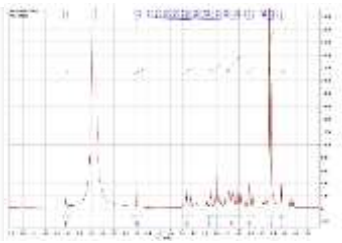

NMR-RSC-56393-1

UV-ASCH-2060-R

UV-RSC-56393

7. Muscle Relaxant Activity –

The muscle relaxant activity of both plants has been evaluated using standard experimental models such as the rota-rod test, traction test, grip strength test, and locomotor activity assessment in rodents. Chamomile extract has shown significant dose-dependent reduction in muscle tone and motor coordination, indicating central muscle relaxant activity. The flavonoid apigenin present in chamomile is known to bind to benzodiazepine receptors of the GABA-A complex, producing sedative and muscle relaxant effects similar to standard benzodiazepines.

Cinnamomum zeylanicum extract has also demonstrated notable muscle relaxant activity, primarily through CNS depressant action. Studies report a significant reduction in spontaneous locomotor activity and impaired motor coordination at higher doses, suggesting central muscle relaxation. The activity is attributed to the modulation of neurotransmitters such as GABA and inhibition of excitatory neuronal pathways. Compared to chamomile, cinnamon shows moderate muscle relaxant effects but with additional antioxidant and anti-inflammatory benefits that may indirectly support neuromuscular relaxation.

8. Comparison of Both Plants with Results –

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Comparative analysis of the reviewed studies indicates that *Matricaria chamomilla* exhibits stronger and more consistent muscle relaxant activity than *Cinnamomum zeylanicum*. Chamomile extracts produce significant muscle relaxation at lower doses and show effects comparable to standard drugs like diazepam, particularly in rota-rod and traction tests. The presence of apigenin and other flavonoids contributes to its pronounced central muscle relaxant action via GABAergic mechanisms.

Cinnamomum zeylanicum, while effective, generally requires higher doses to achieve comparable muscle relaxation. Its muscle relaxant activity appears to be milder but is supported by its CNS depressant, antioxidant, and anti-inflammatory properties. Cinnamon may therefore be more suitable as an adjunct rather than a primary muscle relaxant agent. Overall, chamomile demonstrates superior efficacy, whereas cinnamon provides moderate muscle relaxation with added therapeutic benefits.

9. Conclusion

Based on the available literature, both *Matricaria chamomilla* and *Cinnamomum zeylanicum* possess significant muscle relaxant activity mediated primarily through central nervous system mechanisms. Chamomile shows stronger and more reliable muscle relaxant effects due to its flavonoid-mediated interaction with GABA-A receptors, making it a promising natural alternative to conventional muscle relaxants. Cinnamon exhibits moderate muscle relaxant activity and may offer supportive benefits due to its antioxidant and neuromodulatory properties. The comparative evaluation suggests that chamomile is more effective as a primary muscle relaxant, while cinnamon may serve as a complementary therapeutic agent. Further experimental and clinical studies are required to establish standardized doses, safety profiles, and potential synergistic effects of these plants in muscle relaxation therapy.

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