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REVIEW ARTICLE

A Narrative Review on the Anti-inflammatory Potential of *Mamsyadi Yoga*: Bridging Ayurveda and Modern Pharmacology

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ABSTRACT

Background: There is a scarcity of *Agada Yogas* in the market which requires scientific exploration.

Aims and Objectives: The aim and objective of the study are to understand *Shotha* and inflammation and to study the probable efficacy of *Mamsyadi Yoga* in *Shotha* condition.

Materials and Methods: The pharmacodynamic properties of plants were taken from Ayurveda Pharmacopoeia of India and anti-inflammatory studies were taken from the past 10 years through Google Scholar and PubMed.

Discussion: The *Mamsyadi Yoga* is composed of 10 ingredients and each ingredients possess anti-inflammatory properties individually. As per Ayurveda also, the formulation was found to be dominant in *Tikta Rasa*, *Laghu Guna*, *Ushna Veerya,* and *Katu Vipaka*. Inflammation is the most common biological response when the body is exposed to microorganisms or toxic compound, or unwanted responses and is ultimately involved in the pathology of diseases initially.

Conclusion: *Mamsyadi Yoga* can be a useful Agada used in treating anti-inflammatory activities and implicating the principles of *Agada* in modern-day *Visha*.

1. INTRODUCTION

Various *Aushadhi Yoga* are mentioned in *Charaka Samhita* of *Adhyaya* "*Visha Chikitsa.*" Many *Agada Yoga* have been explored and always need further evaluation for the purpose of their dissemination among clinicians and scholars. Various *Agada Yogas* have been mentioned such as *Mritasanjeevani Agada* and *Gandhasti Agada*. This review aims to explore the Ayurvedic texts, pharmacological basis, and potential anti-histamine actions of *Mamsyadi Yoga* based on both classical literature and modern studies.

2. MATERIALS AND METHODS

The contents of the *Mamsyadi Yoga* have been obtained from the *Charaka Chikitsa* 23rd *Adhyaya*. Its *Rasapanchaka* would be studied from the *Dravyaguna Vigyana*. For its anti-histaminic studies, it will be explored online through Google.

There are 10 contents in *Mamsyadi Yoga,* i.e., *Mamsi*, *Kumkum*, *Patra*, *Twaka*, *Rajni*, *Nata(tagar)*, *Chandan*, *Mana Sheela*, *Vyaghra Nakha*, and *Suras.* It is prepared by mixing the 10 ingredients with water as per the text. It is used in the form of *Pan Anjan Nasya* and *Lepa* and used in *Sarva Shotha* and *Vishapaha.*[1] Pharmacodynamics[2-11] of ingredients are mentioned in table 1.

2.1. *Shotha* (edema) in Ayurveda

Shotha has been discussed in detail in the *Charaka Chikitsa* chapter 12 *Adhyaya*, *Shvayathu Chikitsa*. It is of two types: *Nija* and *Agantuj Shotha.*[1]

Following *Nidan* has been mentioned in *Nija Shotha*[12]:

2.2. *Nidan of Shotha* as Per *Charaka*

- Intake of *Kshara* (Alkaline preparation)

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- *Amla* (sour food and drinks)
- *Teekshna* (strong, piercing food articles)
- *Guru* (heavy food) by a person who has become emaciated and weak because of *Shuddhi* (Panchakarma therapies)
- Intake of *Dadhi* (curd), uncooked food, *Mrut* (Mud), *Shaka* (leafy vegetable)
- *Virodhi Anna* (wrong food combinations)
- *Dushta Anna* (Polluted food and water)
- *Gara* (artificially prepared poison)
- *Arsha* and lack of exercise
- Not administering Panchakarma purification therapies at appropriate times
- *Marma upaghata* - Afflictions of vital organs because of endogenous diseases (such as kidney disorders and heart disorders)
- *Visham Prasooti* (Irregular delivery, abortion, and miscarriages)
- Inappropriate administration of Panchakarma elimination therapies and improper care of the patient after the administration of these therapies.

2.3. *Poorvaroopa*[13]

- *Ushma* - Hyperpyrexia, increased temperature
- *Davathu* - Burning sensation
- *Siranam Ayama* - Dilatation of the vessels of the locality.

2.4. *Samanya Lakshan*[14]

- *Gauravam* - Heaviness
- *Anavasthitatvam* - Instability
- *Utsedha* - Swelling
- *Ushma* - Rise in Temperature
- *Sira Tanutvam* - Thinning of Vessels
- *Loma Harsha* - Horripilation
- *Anga Vivarnata* - Discoloration of the skin over the limbs.

2.5. Understanding Inflammation

Inflammation is an important biological response induced by various harmful stimuli, like, bacterial infections, viruses, toxins, tissue injury, and toxic compounds. During inflammation, inflammatory cytokines and reactive oxygen species (ROS) are produced [Figure 1].[15]

Usually, acute inflammation removes injurious stimuli and helps to regain the normal healthy status of the organism. In contrast to this, the uncontrolled chronic inflammation – stimulating cells other than immune cells, inducing trans differentiation – can provide the basis of various serious diseases.[16]

Inflammation is a defense process of the body, a biological response of the immune system to harmful stimuli. The inflammation can be triggered by various pathogens (viruses, bacteria), toxins, toxic compounds, and tissue injury.[17] These harmful stimuli initiate a chemical signaling cascade, activating leukocytes that then produce and release inflammatory cytokines, such as interleukin-1β, interleukin-6, and tumor necrosis factor-α.[18]

Thus, the acute inflammation is a protective mechanism, removes the injurious stimuli and initiates a healing process, restoring the homeostasis of the organism.[19]

Uncontrolled acute inflammation, however, can become chronic and can provide the base of a variety of serious, chronic diseases (tumors, a variety of neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, multiple sclerosis, lateral sclerosis, autoimmune diseases, diabetes, cardiovascular diseases, and fibrosis).[20-22]

Although the pathogenesis of these diseases is different, in most cases, the inflammatory mediators, the regulatory and signaling pathways are common.[15]

Inflammation is a far more complex process than it was thought originally. Under inflammatory stimuli (pathogens, toxins, tissue injuries, etc.), inflammatory cytokines and ROS are produced primarily by immune cells and are transported by the blood circulation, transporting them everywhere in the body. Thus, they act not only locally, instead their effect is rather systemic.[15]

A review provides evidence for a strong link between chronic inflammation and cancer.[23]

3. DISCUSSION

Mamsyadi Yoga is a type of Agada mentioned in the *Charaka Samhita* in *Chikitsa Sthana*, 23rd *Adhyaya*, containing 10 ingredients, i.e., 9 of herbal origin and 1 of mineral origin [Tables 1 and 2].

This *yoga* is mentioned in the management of *Sarva Shotha*. In *Ayurveda*, *Shotha* is classified into many types. As per *Ayurveda*, *Viruddha Aahra*, *Dushit Anna,* and *Gara Visha* are considered the etiological factors in *Shotha*, which clearly indicates the importance of *Agada Tantra* concepts in the etiopathogenesis of *Shotha*.

When we analyze the *Rasapanchaka* of *Mamsyadi yoga*, *Tikta Rasa* is found predominantly in the ingredients, followed by *katu*, *madhura kashaya,* respectively, as shown in Figure 2. Similarly, in the case of Guna, Laghu is found to be the dominant Guna, followed by *Ruksha*, *Tikshna, Guru,* and *Picchila* in a descending order [Figure 3]. Moreover, there was the dominancy of *Ushna Veerya* over *Sheeta Veerya* [Figure 4]. All the herbs possess *Katu Vipaka* as their dominant *Vipaka.*

Tikta rasa is *Vishaghna*, *Krimighna*, *Kandu,* and *Kushtha.*[24] *Katu rasa* is useful in *Alaska*, *Shvayathu, Upchaya*, *Udard*, *Abhishyanda, Sneha*, *Sweda*, *Kleda*, and *Shonita Samghat Bhedan.*[24]

Madhura rasa is also known for its *Vishaghna property.*[25] *Kashya Rasa* is known for *Shleshma*, *Rsakta,* and *Pitta Prashaman* and is useful in *Sharir Kleda.*[26]

The predominant *Guna Laghu*, *Ruksha*, *Tikshna*, *Guru,* and *Picchila*.

The Guna of the *Mamsyadi Yoga* aids in reaching deeply in the *Strotasa,* similar to *Visha Guna*.

The predominant *Veerya* was found to be *Ushna* and dominant *Vipaka* was found *katu*.

Various researches can be observed as shown in Table 3 which clearly indicates the individual anti-inflammatory properties of ingredients. These researches help in identifying the anti-inflammatory potential of *Mamsyadi Yoga*.

Inflammation is the response which body gives whenever there is something wrong with the normal physiology whether internal or external. In general, *Mamsyadi Yoga* can be explored for its anti-inflammatory activity.

In *Agada Tantra*, after understanding the concept of *Viruddh Aahar*, *Gara Visha,* and *Dooshi Visha* in modern times, in someway leads to unwanted biological response in the body, i.e., in the form of inflammation. Moreover, it is pretty much proven fact that every

disease starts with a process of inflammation whether it might be a fever or cancer in the long run.

As seen in Figure 2, various etiological factors given by the author such as stress, environmental pollutants, microorganisms, and food factors play a role in both chronic and cute inflammation in the long run.

4. CONCLUSION

In Agada Tantra, Agada Yoga's is still the field of area which needs a lot of research and exploration. There needs to be an incorporation of Agada Yoga at clinical levels which will only be possible through proper research and methodology channels. This yoga was taken to study for its possible anti-inflammatory activity. There is a need to explore the potentials of Agada Yoga in modern times. Through this article, an effort has been made to inculcate the use of Agada formulation in the present time.

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6. AUTHORS' CONTRIBUTIONS

All authors have contributed equally to conception, design, data collection, analysis, drafting, and final approval of the manuscript.

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8. ETHICAL APPROVALS

This study does not require ethical clearance as it is a review article.

9. CONFLICTS OF INTEREST

Nil.

10. DATA AVAILABILITY

This is an original manuscript and all data are available for only review purposes from the principal investigators.

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Table 1: Pharmacodynamics of ingredients of herbal origin

Sr. No.	Name of plant	Latin name	Rasa	Guna	Veerya	Vipaka	Karma
1	*Jatamansi*[2]	*Nardostachys jatamansi (Valerianaceae)*	*Tikta*, *kashya*	*Laghu*	*Sheeta*	*Katu*	*Tridoshnut*, *Medhya*, *varnya*, *nidrajanana*, *kushtaghna*
2.	*Kumkum*[3]	*Crocus sativa (Iridaceae)*	*Katu*, *tikta*	*snigdha*	*Usna*	*Katu*	*Varnya*, *sleshmahara*, *vatahara*, *rasayana*, *vishaghna*, *jantuhara*
3	*Tvakpatra*[4]	*Cinnamomum tamala (Lauraceae)*	*Katu*, *Madhura*	*Laghu*, *picchila*, *tikshna*	*Ushna*	*Katu*	*Ruchya*, *kaphavatahara*, *arsoghna*
4	*Tvaka*[5]	*Cinnamomum zeylanicum (Lauraceae)*	*Katu*, *tikta*, *Madhura*	*Laghu ruksha tikshna*	*Ushna*	*Katu*	*Kaphavatahara*, *Vishaghna*, *kanthasuddhikara*, *ruchya*
5	*Haridra*[6]	*Curcuma longa (zingiberaceae)*	*Tikta*, *katu,*	*Ruksha*	*Ushna*	*Katu*	*Kaphapittanut*, *visaghna*, *varnya*, *kusthaghna*, *krimighna*
6	*Nata (tagar)* [7]	*Valeriana wallichii (valerianaceae)*	*Tikta*, *katu*, *kashaya*	*Laghu*, *snigdha*	*Ushna*	*Katu*	*Tridoshara*, *Vishaghna*, *raktadoshahara*, *manasdoshahara*
7	*Chandan (rakta)*[8]	*Pterocarpus santalinus (fabaceace)*	*Tikta*, *madhura*	*Guru*, *ruksha*	*Sheeta*	*Katu*	*Pittahara*, *Netraroga*, *Vishaghna*, *Vrshya*
8	*Vyaghra nakh*[9]	*Capparis sepiaria (capparidaceae)*	*Katu*, *tikta*, *Kashaya*, *Madhura*	*Ruksha*, *Laghu*	*Ushna*	*Katu*	*Vatahara*, *kaphahara*, *varnya*, *Vishaghna*, *kandughna*
9	*Surasa*[10]	*Ocimum sanctum*	*Katu*, *tikta*, *kashaya*	*Laghu*, *ruksha*, *tikshna*	*Ushna*	*Katu*	*Vatahara*, *kaphahara*, *pitthara*, *dipani*, *hrdya*, *krimighna*

Table 2: Ingredients of mineral origin

Sr. No.	Name of mineral	English name	Rasa	Guna	Veerya	Vipaka	Karma
1	*Manahshila*[11] (As_2S_2)	Arsenic sulfide (red realgar)	*Katu*, *tikta*	*Snigdha*, *ushna*, *guru*	*Ushna*	*Katu*	*Lekhana* and *kapha hara*

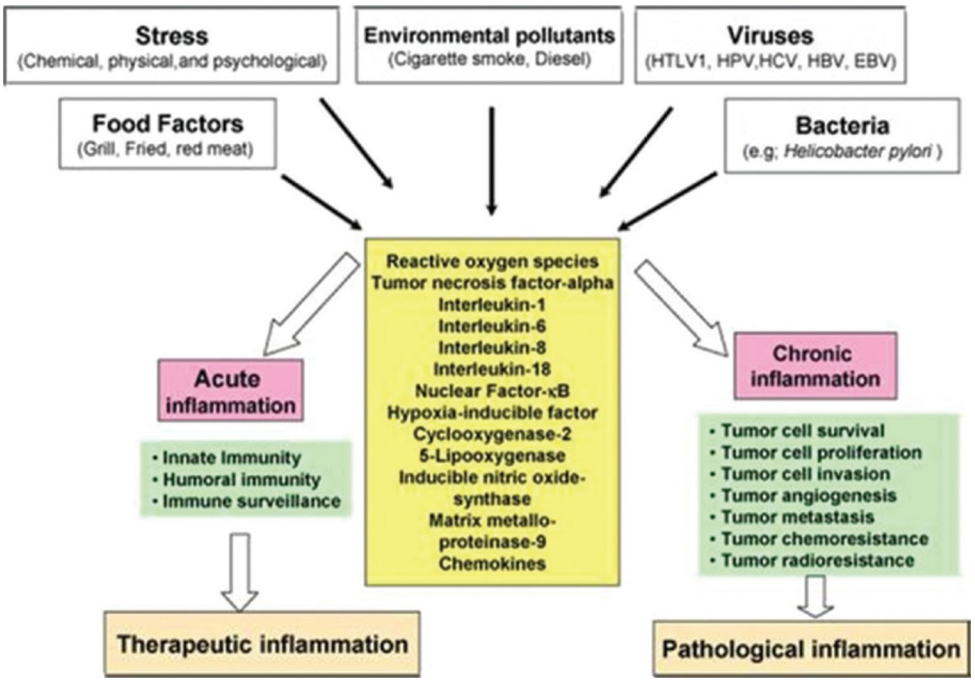

Figure 1: Inflammation and its etiological factor[16]

Table 3: Anti-inflammatory activity of the individual ingredients

Name of publishing	Methodology	Results	Conclusion
1. Evaluation of anti-inflammatory potential of Nardostachys jatamansi rhizome in experimental rodents[27]	N. jatamansi rhizome extract (150 and 300 mg/kg, p.o.) and the reference drugs phenylbutazone (100 mg/kg, p.o.) and acetylsalicylic acid (300 mg/kg, p.o.) were evaluated using models for inflammation (autacoids induced hind paw edema, formaldehyde induced hind paw edema, carrageenan-induced paw edema, cotton pellet granuloma, and subcutaneous air pouch model)	In acute inflammation as produced by carrageenan 29.06% and 55.81%, by histamine 25%. 0 and 39.28%, by 5-hydroxytryptamine 21.37% and 36.95% and by prostaglandin E2-induced hind paw edema 31.03% and 44.82% protection was observed. While in subacute anti-inflammatory models using formaldehyde-induced hind paw edema (after 1.5 h) 13.88% and 33.33% and in chronic anti-inflammatory model using cotton pellet granuloma 7.4% and 17.58%protection from inflammation was observed. N. jatamansi rhizome extract also inhibited the inflammatory mediators (nitric oxide by 12.81% and 38.41%, by prostaglandin E2 12.58% and 47.82% while by TNF-α 13.51% and 41.89%) produced in the pouch.	The results of this study strongly indicate the protective effect of N. jatamansi rhizome extract against acute, subacute, and chronic models of inflammation, which may be attributed to its anti-inflammatory potential.
2. Antinociceptive and anti-inflammatory effects of *Crocus sativus* L. stigma and petal extracts in mice[28]	They used aqueous and ethanolic maceration extracts of Crocus *sativus L.* stigma and petals. The effect of extracts against acute inflammation was studied using xylene-induced ear edema in mice. The activity of the extracts against chronic inflammation was assessed by formalin-induced edema in the rat paw	Only the stigma extracts showed a weak to moderate effect against acute inflammation. In chronic inflammation, both aqueous and ethanolic stigma extracts, as well as ethanolic petal extract, exerted anti-inflammatory effects.	
3. Anti-inflammatory activity of crocus sativus extract in experimental arthritis[29]	Arthritis was induced in mice by injecting Freund's complete adjuvant. Three different doses of Crocus sativus extract (25, 50, 100 mg/kg b.w.) were orally administered to the adjuvant-induced arthritic mice for 47 days.	It was observed significant (P<0.05) reduction in TNF-α and IL-1β levels in the mice of CSE-2 and 3 groups as compared to arthritic mice, while a non-significant change was observed in the CSE-1 group mice. We also recorded a significant (P<0.05) increase in SOD and GR activity in the mice of CSE-2 and 3 groups as compared to arthritic mice, while a non-significant change was observed in the CSE-1 group mice.	It was observed that the crocus sativus extract is capable of reducing the pro-inflammatory cytokines such as TNF-α and IL-1β in adjuvant-induced arthritic mice. The effectiveness of CSE reveals its anti-inflammatory action. On the other hand, CSE resulted in controlling the reduction of antioxidant enzymes such as glutathione reductase and superoxide dismutase in AIA mice.
4. Anti-Inflammatory Activity of Methanolic Fraction of Ethanolic Extract of Crocus Sativus Stigmas in Rats and Mice[30]	After obtaining permission from animal ethics committee, animals were divided into 5 groups of 6 animals each group like control, standard - Diclofenac 10 mg/kg intra-peritoneal or Dexamethasone 0.5 mg/kg orally, CSEEMF (200, 400, and 600 mg/kg). Anti-inflammatory activity of stigmas of Crocus sativus was evaluated by using carrageenan-induced paw edema, cotton pellet granuloma, formaldehyde-induced arthritis in Wistar albino rats, and xylene-induced ear edema model in Swiss albino mice.	Statistical analysis was done by one way analysis of variance followed by Dunnett's test. P<0.05, P<0.01, and P<0.001 were considered statistically significant. CSEEMF (200, 400, and 600 mg/kg) revealed anti-inflammatory activity in a dose-dependent manner in the carrageenan-induced paw edema model. In the cotton pellet granuloma model, CSEEMF (400 and 600 mg/kg P.O) significantly decreased granuloma formation. In the formaldehyde-induced arthritis model, CSEEMF (200, 400, and 600 mg/kg, intraperitoneally) significantly lowered signs of arthritis. Statistically significant result was also obtained in the xylene-induced ear edema model with all three test doses; however, maximum inhibitory results were observed with 600 mg/kg dose, when compared with control.	
5. Evaluation of anti-inflammatory activity of Cinnamomum tamala (buch.- ham.) Leaves growing in Bangladesh[31]	The anti-inflammatory activity was studied using the carrageenan and histamine-induced rat paw edema test at different doses (200 and 400 mg/kg body weight) of the ethanol extract.	At the dose of 400 mg/kg body weight, the extract showed a significant anti-inflammatory activity both in the carrageenan and histamine-induced edema test models in rats showing 60.84% and 59.48% reduction in the paw volume comparable (P<0.01) to that produced by the standard drug indomethacin (63.63% and 66.01%) at 4h, respectively. The percentage inhibition of the edema paw volume by the 400 mg/kg body weight of the extract was also statistically significant (P<0.05; P<0.01) compared favorably with the indomethacin-treated animals at 1, 2, and 3 h in both models	the obtained results tend to suggest the acute anti-inflammatory activity of the ethanolic extract of Cinnamomum tamala leaves and thus provide the scientific basis for the traditional uses of this plant part as a remedy for pain and inflammations.

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Table 3: *(Continued)*

Name of publishing	Methodology	Results	Conclusion
6. *In vitro* analysis of anti-inflammatory activity of cinnamomum tamala and ointment formulation[32]	*In vitro* anti-inflammatory activity of Cinnamomum Tamala extract (0.1–1 mL) was studied by the protein denaturation method. Diclofenac sodium was taken as a standard drug on concentrations (10 µg 100 µg).	*In vitro* anti-inflammatory activity was conducted by protein denaturation method given by Mizushima and Kobayashi (1968). The reaction mixture (5 mL) contained 0.2 mL of egg albumin, 2.8 mL of phosphate-buffered saline (PBS, pH 6.4), and 2 ml of plant extract at various concentrations (10, 20, 50, 100 ug/L). As a control, a similar volume of double distilled water is employed. The mixture was then heated at 70°C for 5 min after being incubated at 37°C for 15 min in a BOD incubator. After cooling, their absorbance was measured at 660 nm using the vehicle as a blank. The percentage of inhibition of protein denaturation was calculated.	The protein denaturation method was used to conduct the *in vitro* anti-inflammatory experiment. When compared to hexane, acetone, and chloroform extracts, the ethanolic extract had a high percentage of solubility. As a reference standard, diclofenac sodium was used. The table shows the 560 nm absorbance of protein treated with the assay. The ointment shows higher anti-inflammatory activity at 80µg/ml. So the C. tamala ointment ethanolic extract demonstrated a high percentage of inhibition
7. Anti-inflammatory, cytotoxicity and antilipidemic properties: novel bioactivities of true cinnamon (*Cinnamomum zeylanicum* Blume) leaf[33]	Ethanolic (95%) and Dichloromethane: Methanol (DM, 1:1v/v) leaf extracts of Ceylon cinnamon were evaluated for a range of medically important bioactivities namely anti-inflammatory [nitric oxide scavenging activity (NOSA),	Ethanolic leaf extract (ELE) exhibited the highest activities ($IC_{50:}$ µg/mL) for NOSA (40.26±0.52)	Both leaf extracts of Ceylon cinnamon had all the tested bioactive compounds and possessed all the investigated bioactivities
8. Determination of *in-vivo* anti-inflammatory potential of Cinnamomum zeylanicum oil in female Wistar rats[34]	Carrageenan-induced paw edema model was used for the *in-vivo* anti-inflammatory activity of cinnamon oil in female Wistar rats. As a standard drug control indomethacin was administered at the dose rate of 10 mg/kg female Wistar rats. Rats of control groups were kept untreated. Other three groups were treated with cinnamon oil at the dose rates of 50, 100, and 200 mg/kg b. wt., respectively.	Cinnamon oil showed dose dependent anti-inflammatory effect at various doses in female Wistar rats. The anti-inflammatory effect of cinnamon oil was highest at 3 h (30.58%) at the dose of 200 mg/kg. It was lower than anti-inflammatory effect of the standard drug indomethacin at 3 h (42.99%)	The highest anti-inflammatory activity was observed at 3-h post oral administration of cinnamon oil at 50, 10, and 200 mg/kg b. wt. in female Wistar rats
9. Anti-Inflammatory Activity of Polysaccharide Fraction of Curcuma longa Extract (NR-INF-02)[35]	F1 was evaluated for its acute oral toxicity and found to be safe up to 5000 mg/kg body weight in rats. The anti-inflammatory activity of F1 was evaluated in acute (carrageenan-induced paw edema; xylene-induced ear edema) and chronic (cotton pellet-induced granuloma) models of inflammation	The results of the study demonstrated that F1 significantly ($P \leq 0.05$) inhibited carrageenan-induced paw edema at 1 h and 3 h at doses of 11.25, 22.5, and 45 mg/kg body weight in rats. Also, F1 at doses of 15.75, 31.5, and 63 mg/kg significantly inhibited the xylene-induced ear edema in mice. In a chronic model, F1 at 11.25, 22.5, and 45 mg/kg doses produced a significant reduction of wet and dry weights of cotton pellets in rats.	F1 of NR-INF-02 significantly attenuated acute and chronic inflammation in rodent models. This study emphasizes the importance of Curcuma longa polysaccharides' role in acute and chronic inflammation.
10. Anti-inflammation and Antimicrobial Constituents from the Roots and Their Production in Callus Cultures of *Valeriana jatamansi* Jones[36]	The anti-inflammatory activity of iridoids was assessed by using carrageenan and Complete Freund's Adjuvant (CFA-induced adjuvant) models in experimental rats.	Maximum anti-inflammatory activity demonstrated by jatamansi valtrate R (46.8%) at the dose of 20 mg/kg body weight (bw) at 8 h after carrageenan injection. Similarly, the jatamansi valtrate R also displayed maximum inhibitory activity (49.9%) to CFA-induced adjuvant arthritis in rats on day 8	In this study, all the isolated iridoids found as bioactive molecules and exhibited promising anti-inflammatory and antimicrobial activities

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Table 3: *(Continued)*

Name of publishing	Methodology	Results	Conclusion
11. Anti-inflammatory and Analgesic Activities of Topical Formulations of Pterocarpus Santalinus Powder in Rat Model of Chronic Inflammation[37]	Albino rats of either sex were divided into five groups of six rats each (Group I - Control, Group II -Gel base, Group III -P. santalinus paste, Group IV -P. santalinus gel, Group V- Diclofenac gel). Chronic inflammation was induced on day 0 by injecting 0.1 ml Complete Freund's Adjuvant (CFA) in sub-plantar tissue of left hind paw of the rats. Topical treatment was started from day 12 till day 28. Body weight and paw volume (Plethysmometer) were assessed on day 0, 12, and 28. Pain assessment was done using Randall and Selitto's paw withdrawal method. Data were analyzed using GraphPad Prism version 5. Unpaired students t-test and ANOVA followed by Tukey's test were used for comparison among groups.	Only topical P. santalinus gel significantly reduced the body weight (P=0.02) due to reduction in inflammatory oedema of the left limb. P. santalinus gel also showed significant reduction (P=0.03) in paw volume of rats compared to the other groups. There was a significant reduction in pain threshold (g/s) due to chronic inflammation, with all the study drugs (P<0.05) but with P. santalinus gel, this reduction was less (P<0.001).	Gel showed significant anti-inflammatory and mild analgesic activity on topical application in rat model of chronic inflammation
12. Screening of phytocompounds, molecular docking studies, and *in vivo* anti-inflammatory activity of heartwood aqueous extract of *Pterocarpus santalinus* L.f.[38]	An aqueous extract of *Pterocarpus santalinus* heartwood was prepared using a Soxhlet apparatus. Phytocompounds in the extract were tentatively identified using high-resolution mass spectrometry. Molecular docking experiments were carried out to evaluate the binding affinity of selected compounds, phloridzin to cyclooxygenase-1 (COX-1), cyclooxygenase-2 (COX-2), prostaglandin E synthase-1 (PGES-1), and 5-lipoxygenase (5-LOX). Anti-inflammatory potential was evaluated by the carrageenan-induced paw edema model in rats.	The presence of major component phloridzin along with quercetin, parthenin, ginkgolide B, picrotoxinin, usnic acid, octopine, and epigallocatechin was detected in the extract. Molecular docking study showed that phloridzin inhibited COX-1, COX-2, PGES-1 and 5-LOX with more affinity than ibuprofen and paracetamol. *Pterocarpus santalinus* heartwood extract at 200 and 400 mg/kg BW showed a significant reduction in carrageenan-induced hind paw edema in a dose-dependent manner, but the effect was slow when compared with the standard ibuprofen (30 mg/kg *p.o*.).	The study indicated that after clinical trials, the aqueous extract of Pterocarpus santalinus heartwood can be effectively used in phytotherapy to treat inflammation.
13. Anti-inflammatory and analgesic activity of oral decoction of Pterocarpus santalinus bark wood powder in acute inflammation model[39]	Albino rats of either sex were divided into 4 groups of 6 rats each (Group I - Control (CMC-vehicle), Group II - Ibuprofen suspension, Group III - P. santalinus suspension 3.5 mg/kg, Group IV - P. santalinus suspension 7 mg/kg. All the experimental animals were given standard and test drugs orally, 45 min before inducing inflammation. Acute inflammation was induced by injecting 0.1 mL of 1% carrageenan solution in sub-plantar tissue of left hind paw of the rats. Paw volume (Plethysmometer) and pain assessment (Randall and Selitto paw withdrawal method) were done at 0 h (before medication), then at 1 h, 2 h, 3 h, and 4 h after induction of inflammation. Data were analyzed using GraphPad Prism version 5. ANOVA followed by Tukey's test was used for comparison among groups	P. santalinus suspension 7 mg/kg and ibuprofen-treated rats showed a significant reduction (P<0.05) in their paw volume compared to the other groups. There was a significant reduction in pain threshold (g/s) in all the groups (P<0.05) but in P. santalinus 7 mg/kg and ibuprofen-treated groups. The pain threshold gradually increased after 2 h of induction of inflammation.	Orally given decoction of Pterocarpus santalinus bark-wood powder in 7 mg/kg dose showed significant anti-inflammatory and analgesic activity in carrageenan-induced inflammatory model in rats

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Table 3: *(Continued)*

Name of publishing	Methodology	Results	Conclusion
14. *In vitro* evaluation of the thrombolytic and anti-inflammatory activity of Capparis sepiaria root extracts[40]	The dried roots of Capparis sepiaria was powdered and extracted successively in soxhlet assembly. The extracts acquired had been dried after which subjected to preliminary phytochemical screening. The *in vitro* thrombolytic and anti-inflammatory activities of total ethanolic and aqueous extracts for Capparis sepiaria roots were performed using thrombolytic and inhibition of protein denaturation assays, respectively	Total aqueous and ethanol extracts were tested for clot lysis and inhibition of protein denaturation showed significant thrombolytic and anti-inflammatory activity. The total aqueous extract has shown more potential as compared to the total ethanolic extract.	It can be concluded that the Thrombolytic and Anti-inflammatory properties of the total ethanolic and aqueous extracts are due to the presence of specific phytoconstituents present in the root extracts.
15. Pharmacological and phytochemical evaluation of Ocimum sanctum root extracts for its anti-inflammatory, analgesic, and antipyretic activities[41]	Anti-inflammatory profile of hexane (STH), chloroform (STC), ethyl acetate (STE), butanol (STB) and water (STW) extracts of OS was carried out by using carrageenan induced paw edema. STE a most active extract was further validated in a dose-dependent manner for anti-inflammatory, analgesic, and antipyretic activity as well as oral toxicity profile in small laboratory animals	An ethyl acetate fraction (STE) exhibits most potent anti-inflammatory activity followed by STB, STW, STC and STH. Dose response study of STE showed anti-inflammatory, analgesic and anti-pyretic potential in a dose-dependent manner without any toxic effect at dose 2,000 mg/kg.	The present research revealed that STE possesses anti-inflammatory, analgesic, and anti-pyretic properties.
16. Antioxidant, Anti-inflammatory, and antidiabetic activity of hydroalcoholic extract of Ocimum sanctum: An *in-vitro* and *in-silico* study[42]	Hydroalcoholic whole plant extract of O. sanctum was screened for its antidiabetic potential and ability to counter oxidative and inflammatory stress through various *in vitro* assays. Further, bioactive compounds that may be responsible for its antidiabetic activity were predicted through molecular-docking studies.	Crude extractive yield of 35.43% was obtained from Soxhlet extraction which mainly showed the presence of flavonoids, alkaloids, glycosides, and saponins. Plant extract showed good potential to scavenge 2,2-diphenyl-1-picrylhydrazyl free radical (40.95–68.71%) which may be attributed\ to its high phenolic (0.366 mg gallic acid equivalent/g) and flavonoid (0.113 mg quercetin equivalent/g) contents. Plant showed exceptional anti-inflammatory activity which was evaluated through inhibition of protein denaturation (47.61–82.37%) and red blood cell membrane stabilization assay (43.66–78.28%). Further, extract treatment greatly inhibited Î±–glucosidase enzyme (34.17–71.45%) but failed to produce noticeable inhibition of Î±-amylase activity (1.94–14.88%). Docking studies predicted that rosmarinic acid, stigmasterol, linalool, bieugenol, and esculin may be responsible for the antidiabetic activity possessed by the plant through their interaction with the insulin receptor.	These findings conclude that O. sanctum may be beneficial in managing diabetes and its associated complications through inhibiting Î±-glucosidase activity, reducing oxidative and inflammatory stress
17. Anti-Inflammatory and antimicrobial activities of fermented Ocimum sanctum Linn. Extracts against Skin and Scalp Microorganisms[43]	The anti-inflammation was investigated by means of nuclear factor kappa B (NF-κB) expression inhibition by Western blot analysis.	Also possessed comparable anti-inflammatory activity to indomethacin with the NF-κB suppression of 42.7±4.6%.	Therefore, FE are potentially natural anti-inflammation and antimicrobial agents for topical applications in the pharmaceutical and cosmetic industries.
18. Anti-inflammatory, anti-oxidant effect and cytotoxicity of ocimum sanctum intraoral gel for combating periodontal diseases[44]	Hence, 2% of O. sanctum gel was prepared with Carbopol940 soaked in purified water containing 0.2% w/v sodium benzoate overnight. Hydroxy propyl methyl cellulose (HPMC) solution was mixed with propylene glycol using tissue homogenizer. Anti-oxidant effect was analyzed using DPPH radical assay and anti-inflammatory effect was assessed using the inhibition of albumin denaturation assay.	Ocimum sanctum gel with various dilutions from 10 µL to 50 µL showed exponential increase in percentage of inhibition from 60.9 to 72.2 exhibiting antioxidant activity. The anti-inflammatory effect of Ocimum sanctum gel showed comparatively equivalent effect with standard diclofenac gel with values ranging from 76.6 for 50 µL of Ocimum sanctum gel and 89.6 for standard gel at 50 µL.	Thus we show that Ocimum sanctum gel showed potent anti-oxidant and anti-inflammatory effect.

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Table 3: *(Continued)*

Name of publishing	Methodology	Results	Conclusion
19. Comparative evaluation of anti-inflammatory activity of *Manahshila* (Realgar)[45]	In the present study, Shodhana of Manahshila is performed by the Bhavana (levigation) where trituration of Manahshila is done with ginger (Zingiber officinale Rosc.) juice, sesbania leaves (Sesbania grandiflora Poir.) juice, lemon (Citrus medica Linn.) juice, and lime water. The anti-inflammatory activity of the Manahshila at 0.35, 0.7, and 1.4 mg/kg, p.o. was evaluated by egg albumin-induced hind paw edema in rats.	The Ashodhita Manahshila (crude realgar) showed mortality, while Shodhita Manahshila (purified with all four media) did not showed mortality in the treated rats up to a dose of 2,000 mg/kg. Ashodhita and Shodhita Manahshila revealed that at the dose level of 1.4 mg/kg it showed inhibition (P<0.05) of egg albumin-induced hind paw edema. But, Shodhita Manahshila showed anti-inflammatory activity at all three dose levels in a dose-dependent manner. The ginger juice-treated Manahshila (56.60%) was found best alleviate rat's response to egg albumin-induced inflammation among all the groups.	The results validate its usage in the healing of inflammation and also give support to its perspective as a source of novel pain relief medicine prototype.
20. *In vitro* anti-inflammatory activity of unpurified and purified *Manahshila*[46]	*Shodhana* (Purification) of Manahshila w Material and methods: As carried out by seven Bhavana (levigation) with ginger juice. Five concentration levels (20, 40, 60, 80, and 100 µg/mL) of the AM, SM were evaluated by using heat-induced protein denaturation and heat-induced hemolysis of the erythrocyte and subjected to determination of absorbance to assess the anti-inflammatory activity. Indomethacin was used as the positive control at the same concentration levels.	The present findings exhibit a concentration dependent inhibition of protein denaturation and hemolysis of the erythrocyte by the SM. The effect of AM was found to be less when compared with the SM and indomethacin. From the present study, it can be concluded that SM marked anti-inflammatory effect *in vitro* as compared to AM against the denaturation of protein and hemolysis of the erythrocyte	By this study, it can be concluded that after *Shodhana*, drug is not only transformed into physical and chemical changes but also becomes safely digestible as well as improves therapeutic efficacy

IL-1β: Interleukin-1β, TNF-α: Tumor necrosis factor-α

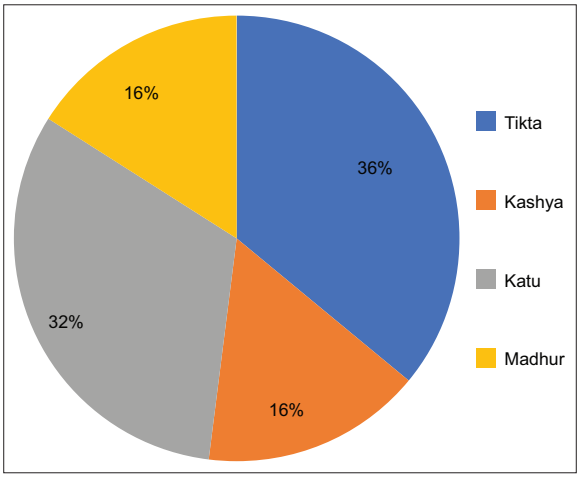

Figure 2: *Rasa* of *Mamsyadi Yoga*

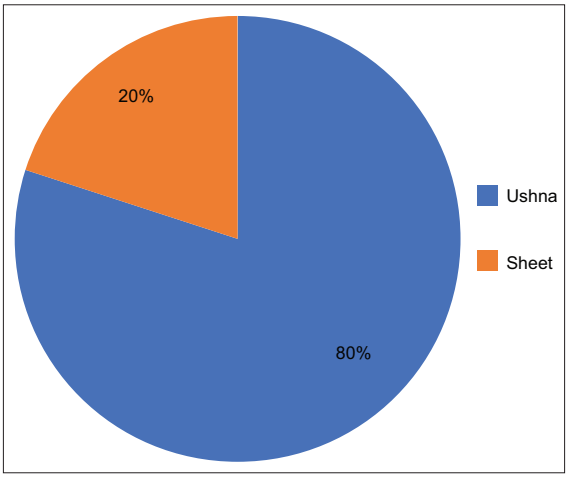

Figure 4: *Veerya* of *Mamsyadi Yoga*

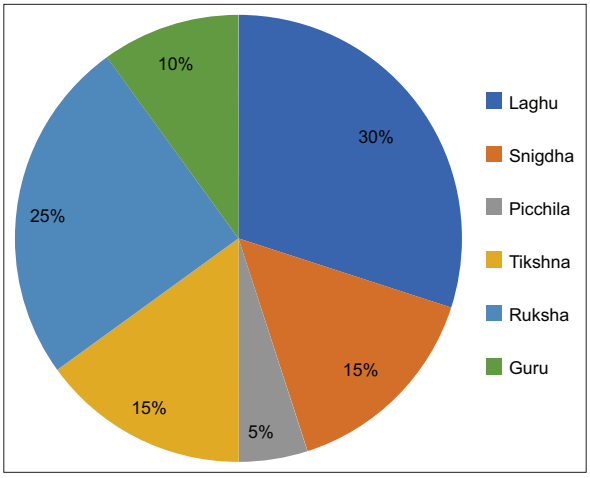

Figure 3: *Guna* of *Mamsyadi Yoga*