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A REVIEW ON *SITHAANANTHA BAIRAVA MATHIRAI* FOR THE TREATMENT OF *THANDAGA VATHAM* (LUMBAR SPONDYLOSIS)

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ABSTRACT
Lumbar spondylosis is characterized by disc degeneration and osteophytosis, and is more prevalent among the middle-aged and elderly population. The prevalence of lumbar spondylosis ranges from 38% to 85% depending on age and ethnic groups. Siddha is one of the ancient system of medicine in much older that Ayurveda and is considered as the mother medicine of ancient Tamils/Dravidians in South India. Siddha medicine utilizes plant extracts and metal oxides for the preparation of medicines. Nowadays people are focusing their interest towards traditional system of medicine for a longterm relief. In Siddha system, *Sithaanantha Bairava Mathirai* a herbo mineral formulation has been indicated in Classical literature towards the management of *Thandaga vatham* (Lumbar Spondylosis). This review is focused on the various biological activity of the medicinal plants used in the *Sithaanantha Bairava Mathirai* with special focus on the anti-inflammatory, antipyretic and antioxidant properties on these medicinal plants. This review will enlighten the mind with effective pharmacological nature of the herbs used in *Sithaanantha Bairava Mathirai* and its medical importance in the treatment of lumbar spondylosis.

KEYWORDS: *Thandaga vatham*, Lumbar Spondylosis, *Sithaanantha Bairava Mathirai*, Traditional medicine.

INTRODUCTION
Lumbar spondylosis is a chronic, non-inflammatory disease caused by degeneration of lumbar disc and/or facet joints. The long term complication of Lumbar spondylosis may cause pressure on nerve roots with sensory and/or motor disturbances. Spondylosis can affect people depending on age. Chronic low back pain, defined as pain symptoms persisting beyond 3 months, affects an estimated 15–45% of the population.[1,2] Spondylolysis is seen increasing to 63% among people involved in sporting activities.[3] It is encountered most frequently in adolescents, most commonly involving the lower lumbar spine, with particularly high prevalence among athletes involved in certain sports or activities. Spondylolysis is rarely seen for children under the age of 5 years and much more likely seen in patients above 10 years.[4] Lumbar Spondylosis primarily involves the L5 vertebra (95% of cases).[5] It almost always occurs bilaterally,[6] thus dividing the vertebra into two segments. It is asymptomatic or can be a cause of spine instability, back pain, and radiculopathy. The pars interarticularis is vulnerable to fracture during spinal hyperextension, especially when combined with rotation or when experiencing a force during landing. This stress fracture most commonly occurs where the concave lumbar spine transitions to the convex sacrum (L5-S1).

Pathogenesis of Lumbar spondylosis is debated, but the most accepted theories postulate repetitive micro-trauma on congenitally predisposed anatomical conditions leading to stress fracture.[7,8] The mechanism of lumbar spondylolysis however, is multifactorial with a stress fracture occurring through a congenitally weak or dysplastic pars interarticularis.[9] The mechanism of injury is usually a combination of repetitive flexion, extension, or rotation of the lumbar spine.[10] In particular, the pars interarticularis of L5 is sheared during extension by the inferior articular process of L4 and the superior articular process of the sacrum acting as a pair of wedges. This mechanism leads to stretching of the pars and eventually to a stress microfracture. Individuals lacking sufficient increase in transverse interfacet distances in their lumbar spines could be at greater risk of developing and maintaining spondylolytic defects.

The present day treatment for Lumbar spondylosis and spondylolisthesis is initially conservative and aims to reduce pain by NSAID's and facilitate healing. Conservative treatment typically requires cessation of aggravating sporting activities and a spinal brace with a thoraco-lumbo-sacral orthosis for 3–6 months.[11] Surgical treatment for Lumbar spondylosis is generally

reserved for patients who fail to respond to conservative treatment.

The Siddha system is a treasure house of secret science, embodying the results of the ardent pursuit thereof by the ancient Siddhars. This civilization dates back to 12,000 years B.C. The Siddha medicines meant for the human body are prepared, based on the theory of Panchabuthas (metals of gold, lead, copper, iron and zinc). In this review we have shed light on to the beneficial effect of the ingredients used in the *Sithaanantha Bairava Mathirai* which can be a potential drug in the treatment of Lumbar spondylosis.

PREPARATION OF *SITHAANANTHA BAIRAVA MATHIRAI*

The ingredients of SBM consist of *Lingam* (Cinnabar), *Vengaaram* (borax), *Naabi (Aconitum ferox), Sukku (Zingiber officinale), Valmilagu (Piper nigrum), Thippili (Piper longum), Perungayam (Ferula asafoetida) and Elumicchai (Citrus limon)*. Prior to the preparation of SBM, Linga kattu was prepared by placing the Purified *Serangottai* (1050 gms) (*Semicarpus anacardium*) inside a clay pot and Cinnabar (70 gm) was placed in the centre of it and was covered with the remaining Purified *Serangottai* (*Semicarpus anacardium*) and the vessel was subjected to heat. After the *Serangottai* was completely burnt, the Linga kattu was taken out and used for the preparation of SBM.

All the ingredients including the prepared linga kattu were taken in equal quantity (35 gms) and were grinded using lemon juice in a stone mortar until pill rolling consistency and the pills were made in the size of 130mg (*Kuntrimani alavu*).[12]

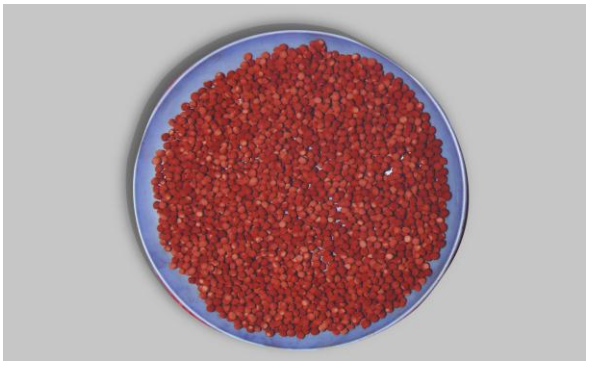


Figure 1: Sithaanantha Bairava Mathirai.

SCIENTIFIC ANALYSIS OF INGREDIENTS USED IN *SITHAANANTHA BAIRAVA MATHIRAI*

1. *Lingam* (Cinnabar)

Cinnabar known as *Lingam* in Siddha literature (contains mercury sulfide) has been therapeutically used in traditional medicines for thousands years as an ingredient in several formulations used for chronic ailments and 40 cinnabar-containing traditional medicines are still used today. Cinnabar is the naturally occurring mineral with mercury in combination with sulfur, and is red in color so called red mercury sulfide.[13] The effects of cinnabar on anxiety-like behaviors in mice were studied using the elevated plus maze test. Cinnabar at the oral dose of 50 and 100 mg/kg/d for 10 days significantly improved the performance in the elevated maze test. This pharmacological effect is associated with the decreased in serotonin levels in mouse brain, but the dose-dependent relationship is not clear.[14] In mice low dose of cinnabar (10 mg/kg/d) administerd for 11 weeks showed that locomotor activity was reduced and pentobarbital sleeping time was increased, suggesting sedative or hypnotic effects. Hence it may have analgesic and anti-inflammatory property in its use in *Sithaanantha Bairava Mathirai*.[15]

2. Vengaaram (Borax)

Sodium borate, which is generally described as sodium tetraborate decahydrate ($Na_2B_4O_7{\cdot}10H_2O$) and commonly known as borax, is an important compound of boron and a salt of boric acid (H_3BO_3).[16] Borax occurs naturally in evaporate deposits produced by repeated deposition of seasonal lakes. It is also known as Sodium biborate, Sodium tetra borate and Disodium tetra borate. It is sweet and astringent in taste. It has coolant, lithotriptic, emmanogogue activity. Externally it is used as emollient, antiseptic and astringent activities. It has got potent anti-inflammatory and analgesic properties.[17] According Newhamm 1960, the arthritis joint and synovial fluid during arthritis were found to be boron deficient. Hence supplementing Boron caused bones to become harder and additionally bone fractures healed in about half the normal time than in normal humans and animals.[18] The chemical mediators of inflammation (CMI) are released by the monocytes and macrophages includes the lipopolysaccharide (LPS), tumor necrosis factor α (TNF-α), interleukin (IL)-1β, IL-6, and nitric oxide (NO) that have been implicated in host defense against infections.[19] In animals and human, boron has been implicated in hormone and mineral metabolism and is also reported for its ability to modulate these inflammatory response thereby indicating the role of boron in chronic inflammatory disease.[20]

3. *Sukku (Zingiber officinale*)

Ginger, the rhizome of *Zingiber officinale* (Zingiberaceae) is a perennial herb with an aromatic pungent taste. The rhizomes of ginger are used as spice in food and beverages and in traditional medicine as carminative, antipyrexia and treatment of waist pain rheumatism and bronchitis. The Ethanol extract of *Zingiber officinale* rhizome inhibited carrageenan – induced suplantar edema in rats. It is a valid test used to predict of anti-inflammatory agents and inhibit the mediators of acute inflammation in rat.[21] Ginger has been reported to inhibit prostaglandin biosynthesis and interfere with the inflammatory cascade and the vanilloid nociceptor. This inhibitory property of *Zingiber officinale* makes it a successful anti-inflammatory agent. It also believed to suppress induction of several genes involved in the inflammatory response, including genes encoding cytokines, chemokines, and the inducible

enzyme cyclooxygenase-2.[22,23] An in vivo study on the extract of Z. officinale rhizome exhibited analgesic activity in mice, by inhibiting the acetic acid – induced writhing. This is a model of visceral pain,[24] was believed to be a very sensitive test for analgesic drug development. An in vitro study had proved the antioxidant property of ginger component (6)-gingerol by protecting the HL-60 cells from oxidative stress.[25] Gingerols, the most biologically active components of ginger, have been reported to possess an array of interesting pharmacological and physiological actions, including anti-inflammatory, analgesic, antipyretic, cardiotonic and inhibition of prostaglandin and leukotriene biosynthesis.[26-31]

4. *Milagu (Piper nigrum)*

Piper nigrum belongs to Piperaceae family and is famous as the king of spices due to its pungent quality. There are more than 1000 species in piper genus out of which the most well know is *P. nigrum*, *P. longum* and *P.betle*.[32] Different free radicals attack on membranes causing oxidation of lipids, loss of different enzyme activities and may cause cancer. Antioxidants completely stop or delay the process of oxidation. Some *in vitro* studies revealed that Piperine inhibited free radicals and reactive oxygen species, therefore known to possess protective effects against oxidative damage. *Piper nigrum* or piperine also found to decrease lipid peroxidation *in vivo*. *Piper nigrum* reported to possess antioxidant activity that might be due to the presence of flavonoids and phenolic contents. The memory enhancing and antioxidant proprieties of the methanolic extract of *Piper nigrum* L. fruits at a doses of 50 and 100 mg/kg, orally, for 21 days in amyloid beta.[33-35] The antioxidant effect of three Piper species viz *P. nigrum*, *P. guineense* and *P. umbellatum* was evaluated for the protection of renal, cardiac, and hepatic antioxidant status in atherogenic diet fed hamsters.[36] The acetic acid-induced writhing and tail flick assay models in mice were used to evaluate the analgesic activity of piperine. The analgesic activities of both piperine and morphine in the tail flick assay were reversed on pre-treatment of animals with naloxone at dose of 5 mg/kg (i.p.). These results revealed the analgesic activity of piperine which possibly mediated via opioid pathway.[37] The piperine was evaluated for the anti-inflammatory, analgesic, and anti-arthritic activities The prostaglandin E2, cyclooxygenase 2, interleukin 6 and matrix metallo-proteinase levels were evaluated by ELISA and RT-PCR methods of analysis. Piperine treated groups were found to reduce the synthesis of prostaglandin E2 in a dose dependant comportment at the concentrations of 10-100 µg/mL.[38]

5. *Thippili (Piper longum)*

Piper longum Linn. (Piperaceae) has been used as a therapeutic agent in the treatment of various pathological conditions.[39] Roots of the plant are reported for the treatment of heart diseases in ancient literature of East Asia. It can act as a valuable alternative tonic in paraplegia, chronic cough, enlargement of the spleen and other abdominal viscera.[40] Anti-inflammatory activity of a decoction of P. longum fruits has been reported using carrageenan induced rat edema.[41] *Piper longum* showed a greater content of phenolics and augmented *in vitro* antioxidant activity. Phytonutrients or phytochemicals are well known for their antioxidant activity. Phenolic compounds have been demonstrated to have a number of therapeutic properties such as anti inflammatory, anti-allergenic, anti-ageing, anti-carcinogenic activities which can be attributed to their antioxidant property. These properties of phenolic compounds are exerted through their ability of direct chain breaking antioxidant action by radical scavenging.[42] Also the chloroform extract exhibited greater amount of phenolics and had significant antioxidant activity compared to the hexane, ethyl acetate, ethanol, hydroethanol and aqueous extracts. This validates the correlation of the total phenolic content of plant extracts with their antioxidant and antimicrobial properties. The flavonoid content was found significant in both the varieties of *P. longum*. The total antioxidant capacity was also observed to be significant for all the extracts, but *P. longum* ethanol extract was found to be the highest. In FRAP assay, *P. longum* ethanol extract showed better activity.[43]

6. Perungaaya*m (Ferula asafoetida)*

Ferula asafoetida is well known for its medicinal and therapeutic values in Iranian folk medicine and is herbaceous plant of the Umbelliferae family. It has a strong, tenacious and sulfurous odor and a popular ingredient in the Indian cuisine. In hot plate test, asafetida showed significant antinociceptive effect in all administered doses with most effective dose of 10 mg/kg. Similarly this study showed a remarkable antioxidant and also inhibitory action against lipoxygenase activity of asafoetida. The Paw weight was significantly reduced only in treated animals with 2.5 mg/kg asafoetida *in vivo* showing a clear indication that the asafoetida can be a potential source of anti-inflammatory and analgesic agent. Its biological activity is believed to be due to its effective constituents such as monoterpenes, flavonoids and phenolic components that have antioxidant properties and inhibit lipoxygenase activity.[44] The gum extract of the *Ferula asafoetida* have a significant analgesic and anti-inflammatory effects *in vivo*.[45] Recent pharmacological and biological studies have also shown several activities, such as antioxidant, antimicrobial, antiviral, antifungal, anti-diabetic, anticarcinogenesis, antispasmodic and hypotensive effect.

7. *Elumicchai (Citrus limon)*

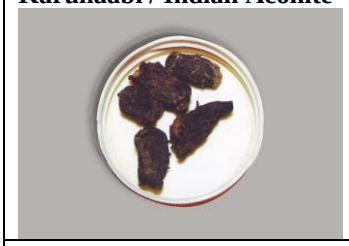
The plants of the family Rutaceae comprise 150 genera with approximately 2.000 species, the largest of which are Citrus (about 70 species) and Terminalia (about 200 species).[46] Lemon juice is widely known as diuretic, antiscorbutic, astringent, and febrifuge. In Italy, the sweetened juice is given to relieve gingivitis, stomatitis, and inflammation of the tongue. Lemon juice in hot

water has been widely advocated as a daily laxative and preventive of the common cold, but daily doses have been found to erode the enamel of the teeth. Prolonged use will reduce the teeth to the level of the gums. Lemon juice and honey, or lemon juice with salt or ginger, is taken as a cold remedy.[47] *Citrus limon* essential oil (EO) (50, 100, and 150 mg/kg) significantly reduced the number of writhes, and, at highest doses, reduced the number of paw licks. This is exhibited by the antioxidant action of *Citrus limon* by preventing the lipoperoxidation and a clear antinociceptive activity. *C. limon* show that the extract of the Eureka variety presents a more significant antiradical capacity (SC50 = 3.6g/l, CE50 = 4.6 x 104 g/mol and AC = 2.19 x10 -5). Results show that essential oils of *C. aurantifolia* var "sans épines" and *C. limon* var Lisbon are very effective, as effective as the BHT.[48] Galati et al. (2005) stated that lemon mucilage significantly inhibited carrageenan-induced edema in rat paw from 59% to 73.5%. In traditional Chinese medicine the dried mature fruit peels of Citrus reticulata and their varieties have been widely used as remedies in the treat indigestion and to improve inflammatory syndromes of the respiratory tract.[46]

8. *Karunaabi (Aconitum ferox)*

Aconitum, commonly known as aconite belongs to the family Ranunculaceae and is widely distributed in the alpine and subalpine regions of the tropical parts of the Northern hemisphere.[49] The Aconitum species are commonly used in the treatment of antirheumatism, as an analgesic, and for antiinflammatory purposes. Aconitum has anti-pyretic, analgesic, antirhumatic appetizer, digestive properties used for all types fever. The most common aconite-based medicinal plant (A. ferox Wall.) is used in traditional medicines as an antipyretic, analgesic, anti-rheumatic, appetizer and digestive. *Aconitum ferox* & *Aconitum chasmanthum* roots are potent antipyretic and analgesic & high therapeutic index.[50]

Table 1: Medicinal Properties of the ingredients used in *Sithaanantha Bairava Mathirai.*

Common Name Tamil/English	Botanical name/Family	Phytochemistry	Biological Properties
Karunaabi / Indian Aconite 	*Aconitum ferox*	alkaloids,Cyanogenicglycosides, tannins, saponins, and steroids Flavonoid, Diterpenoid etc.	Antipyretic, Anti-rheumatic, Anathematic Paralysis, Snake bite, Abdominal Pain, Neuronal disorders and Anti-inflammatory activities etc.[50]
Chukku/ Ginger 	*Zingiber officinale* (dried)	Essential oils, Phenols, Flavonoids, Alkaloids, Glycosides, Saponins, Steroids, Terpenoids Tannin etc.	Antimicrobial, Antioxidant, Anti-cancer, Analgesic, Antipyretic activities [21]
Milagu/BlackPepper 	*Piper nigrum*	Phenolics, Flavonoids, Alkaloids, Amides ,Steroids, Lignans, Terpenes, Chalcones etc	Antimicrobial, Antioxidant, Anti-inflammatory, Analgesic, Anti-cancer activities. [33]
Thippili/Indian long Pepper 	*Piper longum*	Alkaloids, Lignans, esters, Essential oils	Antioxidant, Anti-inflammatory, Analgesic, Immunomodulatory, Antimicrobial activities.[41]

Asafoetida/Perungayam 	*Ferula asafoetida*	Terpenoids, Essential oils, Disulfides	Analgesic,Anthelminitic,Antiseptic, Antioxidant, Antispasmodic, Hypotensive, Hepatoprotective, Antiviral, Antifungal, Anticancer, Anxiolytics activities. [45]
Lemon/ Elumicchai 	*Citrus limon*	Alkaloids, Essential oil, Flavonoids	Antihelmintic,Antilithic, Antipyretic, Anti-inflammatory activities.[47]
Cinnabar (*Lingam)* 	Mercury sulphide (HgS)		It is used against chronic inflammatory and infectious diseases.[13]
Borax (*Vengaram*) 	sodium borate Na2[B4O5(OH)4]·8H2O		Refrigerant, Diuretic, Lithotriptic, Antiseptic, Alterative, Astringent.[17]

CONCLUSION

Nowadays traditional system of medicine is believed to be highly curative and preferred due to is effective control, long term relief and safe to use. Ancient literature has already reported pharmacologically relevant properties of the herbal ingredients used in the herbo mineral formulation of *Sithaanantha Bairava Mathirai*. Siddha system of medicine is the oldest documented medical system in the world. In siddha medicine the drug *Sithaanantha Bairava Mathirai* is used in the treatment of lumbar spondylolysis. Through this review, all the herbal ingredients used in this drug has been found to have significant and effective pharmacological properties like anti-inflammatory, antipyretic and antioxidant activity which confirms its traditional claims.

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