



A Review on *Rasam*: A Traditional Southern Indian Soup with Numerous Health Benefits

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Abstract

Rasam is a popular traditional food in the southern part of India. It is consumed on a regular basis, generally with rice. It has a variety of constituents in it, like tomato, pepper, garlic, Indian sesame oil, cumin, mustard, coriander, chili pepper, asafoetida, turmeric and curry leaves, which provide different medicinal and health benefits to the human body. This review is an effort to compile all research work on *rasam* and to highlight its health benefits.

Keywords: Asafoetida, Black Pepper, Cumin, Curry Leaves, Tamarind, Turmeric

1. Introduction

Food is a very basic need and consumed in an unmeasured quantity in every socialized condition. It can also provide benefits beyond nutrition. If consumed in the right manner, it can protect the human body from various disorders. Nowadays, functional foods are in the limelight of research as they provide numerous health benefits, but the main challenge is to scientifically prove the health benefits of such functional foods¹. It is important to find the bioactive properties of these functional foods in a nutritional context so that their health benefits can be showcased². In India, a common adult consumes 80 to 200 milligrammes of curcumin/day, which is the bioactive component of turmeric and an average of 50 gram of garlic per week³. Therefore, it is very easy to reach an effective dose by including it in your daily diet. The so-called “one molecule, one target” paradigm is the basis for the most recent approach to drug development in phytopharmaceuticals. However, not all herbs and spices must contain the same active ingredient because each of them may provide more than one bio-active compound, and in some cases, they may exhibit synergistic effects. But, due to the multifactorial

pathogenesis of the disorders, medicines that act on more than one biological target yield better medicinal effects. It may be due to multiple factors such as more than one synergistic effect; pharmacokinetics based on increased solubility, and increased bioavailability of one chemical constituent over another⁴.

It is important to understand the value of traditional foods in healthcare. These approaches are the link between our past and future in medicine, and they can also provide a better way to resolve many metabolic and chronic disorders. *Rasam* is one such traditional food made of 11 different spices that have medicinal claims for treating various diseases⁵.

2. Traditional Functional Food

Functional foods provide benefits to humans and lower the risk of health issues⁶. Many traditional foods contain prebiotics and probiotics, dietary fibre, omega-3 fatty acids, vitamins, proteins, minerals, phospholipids, amino acids, etc. Basically, functional foods are the usual diet, not medicines, which are consumed on a daily basis with functional ingredients⁷. A functional ingredient is a substance that interacts with the host in a specific way

to have positive impacts on health. In India, traditional foods of every region are primarily a prominent part of its culture. The role of diet is culturally and traditionally well established in India. Many such traditional foods provide mental and physical benefits, but their origins remain unknown to date. Numerous clinical studies show health benefits of conventionally conceived functional foods, including a decrease in cancer risk, improvement in heart health, enhancement of gastrointestinal assistance, anti-inflammatory benefits, a decrease in blood pressure, antiviral effects, a decrease in osteoporosis and improved vision⁸. An average Indian adult has almost four times fewer chances of developing cancer and cardiovascular and metabolic diseases when compared with an average adult in the USA. Due to the different chemical mixture in a definite manner of the components, these traditional functional foods contain high amounts of dietary fibre, antioxidants, probiotics and prebiotics, etc. Here, in India, spices are used to increase the flavour of a dish and also to prevent diseases⁹. They form an important part of traditional food preparation in India. Southern Indian cuisine is centred on the *Siddha* system of medicine¹. *Rasam* is a traditional functional food as it is a traditional food consumed every day, and contains many functional ingredients. Some of the health benefits of the spices used in *rasam* are;

- Turmeric, garlic and asafoetida are known to exhibit antimicrobial properties.
- Garlic, turmeric and onions show anti-diabetic properties.
- Turmeric, chili pepper, garlic and fenugreek have anti-lithogenic activities.

3. Rasam

The traditional spice soup of south India is called *rasam*. “*Charu*” or “*Saaru*” are the different names for it. The word “*rasam*” basically means the essential products of digestion¹⁰. It is generally eaten with rice and in rare cases separately as a spice soup. The main constituents used in the preparation of *rasam* are coriander, garlic, curry leaves, sea salt, tamarind, cumin, Indian sesame oil, black pepper, mustard, turmeric, red chili, and asafetida¹¹. It is a thick, reddish-orange liquid with different flavours that provide both nourishment and healing¹². Traditionally, tamarind juice is used as a base with the addition of various spices. It acts as an appetizer and is based on the permutation of its different spices^{13,14}.

3.1 Preparation of Rasam

Various pharmacological activities of the spices used in *rasam* have been reported. However, the recipe and the method of preparation fluctuate significantly due to changes in the conditions, such as geographic or historic distinctions. Hence, it is necessary to standardise *rasam* for further chemical research in order to investigate its potential beyond nutritive impact. As per the reported study, 17 volunteers from the Vellore, Tamil Nadu, area participated, and *rasam* preparation was standardised. It also reported the findings of parameters like, 1.7% total ash, 0.04% acid-insoluble ash, 0.12% water-soluble ash, and 1.86% sulphated ash. The extraction values for ethanol solubility, ether solubility, and water solubility were found to be 4.5%, 3.93%, and 0.61% respectively. The energy content of *rasam* was on the lower side at 15.13 kcal/100g⁷.

Rasam is prepared in five stages as per reported literatures⁷;

- Tamarind fruit pulp mixture (T1): 6.88 g of tamarind fruit pulp were diluted in 450 mL of water for 10 minutes, then they were manually crushed 45 times, and finally they were filtered. To the filtered liquid, 5 mL of water, 4 g of sea salt and 0.4 g of turmeric powder were added.
- A combination of fresh tomato fruits weighing 82.44 g with water was manually smashed 60 times. 5 mL of water were used to rinse the crushed fruit (T2).
- Spice blend (T3): 1.33 g of pepper drupes were grinded 85 times in an SS 316 mortar and pestle. To the crushed pepper drupes, 2.67 g of cumin fruits were added and crushed 100 times. 0.82 g of chili pepper was added and crushed 50 times with the aforementioned crushed combination. Garlic cloves weighing 9.63 g were added to the mixture and smashed 90 times.
- The entire combination (T4) was washed with 10 mL of water, including the tomato fruit mixture (T2) and the spice mixture (T3). Both were mixed with tamarind fruit pulp (T1) after being rinsed.
- The final product (T5) was created by heating 4 ml of Indian sesame oil for 2 minutes at 60 °C. About 0.82 g of mustard seeds were added to it after 5 seconds. 1.53 g of whole chili peppers were added after 3 seconds. 0.61 g of curry leaves were added after 2 seconds. The entire mixture (T4) was introduced after being immediately washed with 20 mL of water. The entire liquid was left

to boil for five minutes. Later, it was blended with 1.50 g of coriander leaves and 0.05 g of asafoetida, and when it frothed, the heating was turned off to create the finished product, which was standardized *rasam*.

4. Health Benefits of *Rasam*

4.1 Antipyretic Activity

Rasam can be used to treat the flu or a fever, according to many studies^{15,16}. It's generally used as a treatment for the common cold, fever and diarrhoea¹⁷.

4.2 Hypoglycaemic Activity

In 1997, it was discovered that the glycaemic index and the TAG response in 90 healthy volunteers following the consumption of south Indian meals with *rasam* significantly managed diabetes¹⁸. Researchers have reported that the green pea and tomato in *rasam* are crucial for preventing diabetes¹⁹.

4.3 Anti-microbial Activity

Earlier reports have shown that *rasam* exhibited anti-microbial activity against various microorganisms. The anti-bacterial property of *rasam* may also be due to the presence of cumin²⁰, turmeric²¹, garlic²², pepper²³, curry leaves²⁴ and asafoetida²⁵. One study carried out the broth microdilution method and the agar well diffusion method, in which the Minimum Inhibitory Concentration (MIC) and Zone Of Inhibition (ZOI) were determined. With MIC values of 50.07 and 201.67 $\mu\text{L}/\text{ml}$, *rasam* demonstrated enhanced ZOI against *B. cereus* and *P. aeruginosa*, respectively. By consuming *rasam* regularly, it can reach its therapeutic dose and ensure positive effects. The study clearly demonstrated the importance of *rasam*'s preparation technique in maximising its antibacterial effects. *Rasam*'s effectiveness against *B. cereus* has made it justifiable to eat it with cooked rice, as *B. cereus* is responsible for "fried rice syndrome"²⁶.

4.4 Anti-platelet Aggregation Property

The ingredients of *rasam*, such as turmeric, chili pepper, cumin, garlic, black pepper and coriander, are responsible for its anti-platelet aggregation property. In the study, blood was collected for the preparation of platelet rich plasma containing trisodium citrate (3.8% w/v) and the

platelet aggregator adenosine diphosphate (ADP). After which, different dilutions of *rasam* were taken and % transmittance was recorded after 5 minutes in a Tecan plate reader at 630 nm. The *rasam* sample had a greater percentage of platelet aggregation inhibition and an IC_{50} of 93.43% and 10.75 $\mu\text{L}/\text{mL}$ respectively²⁷.

4.5 Laxative

A study in 2015 reported that it can be used as a laxative as well²⁸.

4.6 General Health Improvement

In 2012, a study reported that female football players' performance was significantly improved when they had *rasam* in their pregame meal²⁹. In 2006, a study reported that *rasam* can be administered to decrease morbidity during the management of major burns³⁰.

As per a study to prevent COVID-19, it is stated that spicy foods containing traditional spices (which are also major constituents in *rasam*) are good to prevent colds and restrict virus from entering nostrils and also do not cause any harm to the body³¹. Another study identified sinigrin, as one of the active constituent in *rasam*, possessing good binding affinity against IL-6, which can be used as a dietary supplement and can be used as a control measure to fight against COVID-19³². Curcumin exhibited the strongest deterrent as an inhibitor to the development of COVID-19³³.

4.7 Cytotoxic, Antimitotic and Antiproliferation Studies

As the ingredients in *rasam* are known to provide medical benefits, their systematic consumption provides both prevention and treatment for many diseases. This study reported the anti-mitotic, cytotoxic and anti-proliferation potentials of *rasam* by onion root tip inhibition assay, brine shrimp lethality assay, and 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide assay, respectively.

Rasam against brine shrimp demonstrated great mortality (38.7 $\mu\text{L}/\text{mL}$). By suppressing the onion root tips, *rasam* demonstrated potential antimitotic activity (LC_{50} of 189.86 $\mu\text{L}/\text{mL}$). The IC_{50} values for *rasam* against the MCF-7 and Calu-6 cell lines were 350.22 and 410.15 $\mu\text{L}/\text{mL}$, respectively. The findings indicate that *rasam* may have therapeutic activities against breast and lung cancer, although additional research is needed to determine this³⁴.

4.8 Breast Cancer Studies

Rasam at a 3 and 4 mL/kg dose was administered to female Sprague–Dawley rats for 30 days before 7,12-dimethylbenz[a] anthracene (DMBA) induction of mammary carcinoma. In studied parameters like body weight, TBARS, phase I enzymes, HK, AD, G6P, F16P, and CAC enzymes, *rasam*-pretreated groups showed better prevention than tamoxifen-treated groups. Particularly at the dose of 4 mL/kg, it was efficient in reducing the percentage of incidence of tumors, number of tumors, and tumor weight. *Rasam* attenuates the mammary tumor induction magnitude of DMBA in female rats³⁵.

5. Ingredients of *Rasam*

5.1 Tamarind

Its pulp is edible, acidic and sweet by nature. The combination of tartaric acid and reducing sugars causes the acidic flavour. Except for tryptophan, it is a well-known supplier of all essential amino acids³⁶. It shows laxative effects due to tartaric acid, malic acid, and potassium bitartrate. It contains 38.3% carboxylic acid derivatives and 44.4% of furan³⁷⁻³⁹. It is a key ingredient in several traditional foods, juices and drinks as well⁴⁰.

5.2 Turmeric

It is used topically to heal wounds or treat skin sores, as well as for treating illnesses including common colds, throat infections, dyspepsia and liver diseases⁴¹. The most important chemical constituents of turmeric are curcuminoids, of which curcumin (3.14% of dry powder) is best studied⁴². It can be used for anti-oxidant, anti-diabetic, hepatoprotective and antimicrobial properties^{15,43}.

5.3 Tomato

It contains β - carotene, lycopene and terpenoids (isoprenoids). Medical authorities most often recommend β -carotene from foods like tomatoes in comparison to other diet supplements⁴⁴.

5.4 Chili Pepper

Capsaicin is the most active constituent of the chili pepper and is used in nasal sprays, dermal patches and analgesic topical ointments. The Aztecs used chili pungent taste to

get rid of toothache¹⁵. The presence of carotenoids is the reason behind the colour of chili powder.

5.5 Cumin

Cumin is an integral part of the *Siddha* system of medicine and has also been used in cheeses, pickles, meats and chutneys⁴⁵. It is used as a carminative, antispasmodic and stimulant. It is widely used for treating dyspepsia, diarrhoea and jaundice⁴⁶. It also shows a hypoglycemic response¹⁵. The main volatile components of cumin are cumin aldehyde, cymene, cuminic alcohol and terpenoids⁴⁷.

5.6 Garlic

Garlic cloves are used for various medical purposes. Fresh garlic yields sulphur containing compounds such as ajoene, diallyl polysulfides, vinylthiophene, alliin, and S-allylcysteine. Allicin is the reason behind the aroma of fresh garlic⁴⁸. Garlic can be used as an anticoagulant and is also effective against the common cold^{49,50}. Studies have reported on the property of garlic to reduce blood pressure, glucose concentration and the risk of atherosclerosis⁵¹. Ajoene can be used in myeloid leukaemia therapy⁵²⁻⁵⁴.

5.7 Black Pepper

Black pepper is used to cure several illnesses like constipation, sunburn, toothaches, insomnia and oral abscesses. It has antioxidant, anti-obesity, gastroprotective, anti-cancer and antimicrobial properties⁵⁵. It has been used for treating nausea, fever, poor digestion, arthritis and even coma⁵⁶⁻⁵⁸. It is also used as an insecticide¹⁵. Piperine enhances the absorption of vitamin B12, beta carotene, selenium, and curcumin^{59,60}. Black pepper contains piperine in a range of 4.6% to 9.7%. It also contains various other constituents such as piperidines, amides and trace amount of safrole⁶¹.

5.8 Indian Sesame Oil

The colour of sesame oil varies numerically; Indian sesame oil is golden, whereas cold-pressed sesame oil is light yellow. According to the *Ayurveda* and *Siddha* medical traditions, it is used during massage to reduce body heat. It can be used for cosmetic applications⁶². It is composed of oleic acid (39%), palmitic acid (8%), linoleic acid (41%) and stearic acid (5%)⁶³.

5.9 Black Mustard

It has shown hypoglycemic effects and insulinemia in rats^{64,65}.

5.10 Curry Leaves

Curry leaves are used in treating wounds, itching, hypertension, pimples, rashes, scabies and weight loss; they are also beneficial for hair growth⁶⁶. It is used for the treatment of nausea and indigestion. It shows cardioprotective, hepatoprotective, anti-inflammatory and antipyretic activities^{64,67}. According to a 1995 study, adding fresh curry leaves to the diet of Albino rats resulted in a favourable change in the peroxidation level⁶⁸. The delayed-type hypersensitivity response brought on by ovalbumin was greatly decreased by oral administration of the aqueous extract of curry leaves at dosages of 250 and 500 mg/kg, according to an investigation⁶⁹.

5.11 Coriander Leaves

Coriander leaves improve digestion and assimilation; they also increase diuresis⁷⁰. It is a good source of antioxidant and anti-platelet activity^{71,72}.

5.12 Asafoetida

It is used as digestive remedy, in treating stomach aches and has anti-flatulent properties. It is also used to treat asthma and bronchitis⁷³⁻⁷⁶. It contains, 25% endogenous gum, 10% to 17% volatile oil, 40% to 64% resin and 1.5% to 10% ash.

6. Marker Based Analytical Studies

Studies were carried out on *rasam* in HPTLC and HPLC for identifying the different marker compounds⁷⁷ (Figure 1) as mentioned below;

6.1 Ascorbic Acid

Ascorbic acid (vitamin C), is used as a supplement to treat and prevent scurvy, has been found in tamarind, tomato, cumin, chili- pepper, garlic, mustard and coriander. The quantity of ascorbic acid was enhanced in the finally prepared *rasam*⁷⁷.

6.2 Capsaicin

Capsaicin is the active constituent of the chili pepper and is used as an analgesic in pain associated with arthritis, backaches and sprains. Capsaicin was also detected in *rasam*^{78,79}.

6.3 Curcuminoids

Curcuminoids are major constituents of turmeric. But it has not been approved to date for treating any human disease. A HPTLC method has reported the presence of curcumin in *rasam*⁷⁹.

6.4 Ferulic Acid

Ferulic acid is an anti-oxidant. According to studies, it may have anti-tumor properties that may help fight liver and breast cancer. Ferulic acid was identified and the study also showed that a change in temperature did not affect the quantity of ferulic acid in *rasam* during the preparation process⁷⁷.

6.5 Mahanimbine

It is a carbazole alkaloid found in curry leaves. It has anti-diabetic, hypolipidemic and anti-oxidant properties. A very minute traceable quantity was only detected in *rasam*⁷⁷.

6.6 Piperine

The piperine alkaloid, together with chavicine (its isomer), gives black pepper its pungency. Piperine enhances the absorption of vitamin B-12, β - carotene, selenium and curcumin. Piperine was identified and quantified in *rasam*^{78,79}.

6.7 Quercetin

Quercetin is a flavonoid; it has been reported to inhibit the oxidation of other molecules, hence its classification as an anti-oxidant. A very minute traceable quantity was only detected in *rasam*⁷⁷.

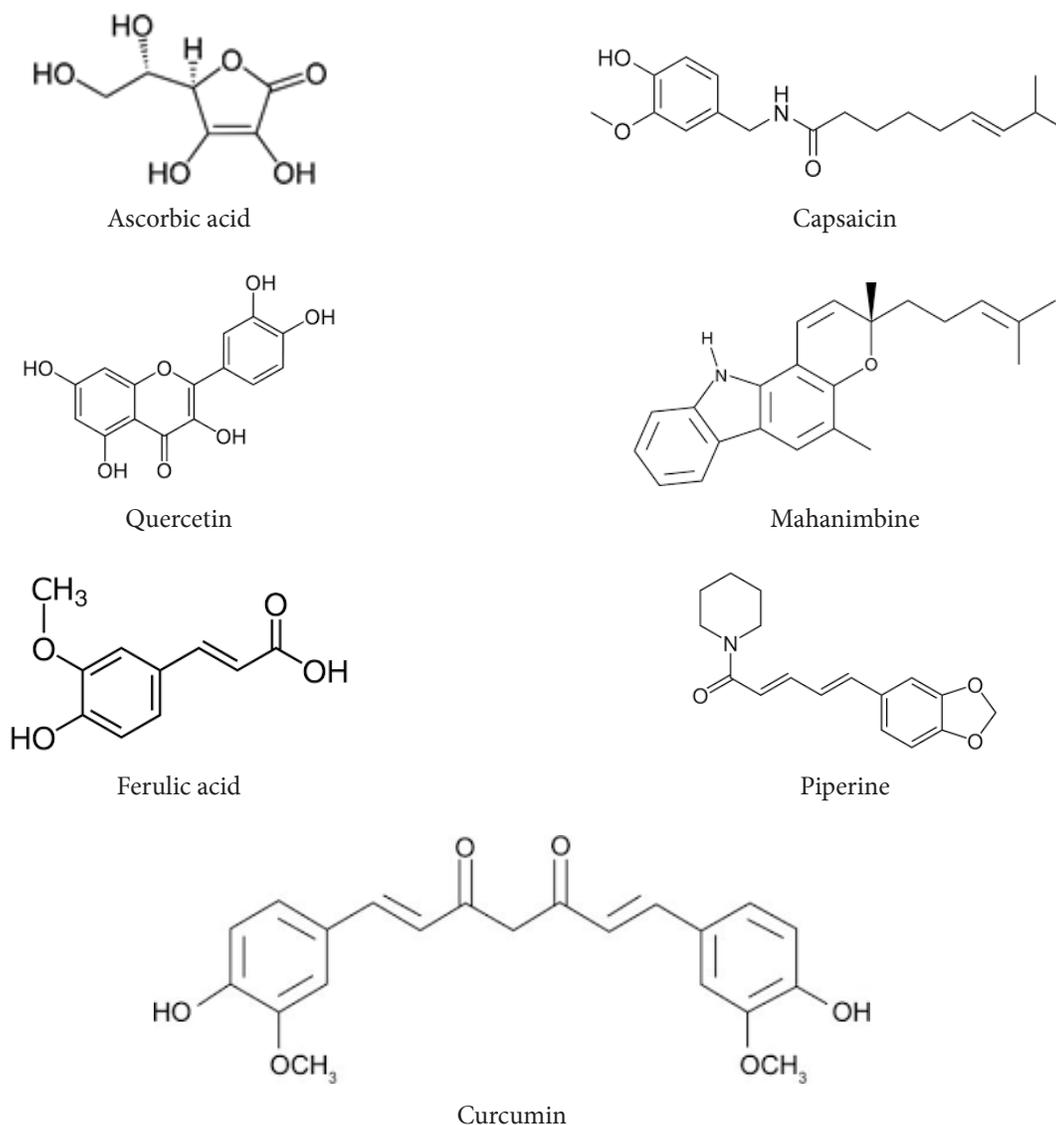


Figure 1. Chemical constituents in *Rasam*.

7. Loss of Active Principles of Common Spices during Domestic Cooking

Spices are the major constituents in the preparation of *rasam*, and the process involves heating in the presence of water. As per a study investigating the loss of active properties of spices during cooking, it was stated that:

- Tamarind's presence or absence causes the pH to change. The pH of the meal preparation was 6.1 when tamarind was absent, but it dropped to 5.1 after tamarind was added at a dose of 0.5%.
- After cooking for 15-20 minutes, the content of curcumin was reduced by 86-91%.
- Similarly, between 53% and 62% of piperine was lost after cooking.
- The study also found that cooking meals results in the loss of the active constituents of black pepper and turmeric.
- It was interesting to note that there were no major changes in capsaicin under similar conditions, making it somewhat heat resistant, although it has a similar chemical structure to curcumin⁸⁰.

8. Analysis of Chemical Constituents by Gas Chromatography-Mass Spectrometry (GC-MS)

Different samples collected at various stages of *rasam* preparation were evaluated. Only 1,2- benzene dicarboxylic acid diethyl ester was retained in all stages. 5-(propenyl-2)-1,3,7-nonatriene and di-n-octyl phthalate were present in the first three stages of preparation but not in the last stage. 4h-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl and mome-inositol were present only in the last 2 stages. Mome-inositol is the reason behind the anti-cirrhotic, anti-neuropathic, cholesterolytic and sweetening properties. Acyclovir (anti-viral drug) and Abacavir (anti-HIV drug) are analogues of guanosine, which was found in the last stage of preparation of *rasam*. According to this study, it is clear that the final preparation, *rasam* has a completely different chemical composition⁸¹.

9. HPTLC Method Development for the Quantitative Determination of Piperine, Curcumin and Capsaicin

A simultaneous HPTLC method for the quantitative determination of piperine and capsaicin has been reported. The mobile phase employed was toluene and ethyl acetate in (7:3, v/v) and the densitometric scanning was performed in absorption reflection mode at 527 nm. The linear range was 1 to 5 $\mu\text{g spot}^{-1}$ for both capsaicin and piperine⁷⁸. Another HPTLC method has also been reported for the simultaneous determination of curcumin, piperine and capsaicin. The optimized mobile phase was toluene and ethyl acetate (7:3, v/v) and the densitometric scanning was done at 254 nm. The R_f values of curcumin, piperine and capsaicin were found to be 0.26, 0.40 and 0.47 respectively. The calibration range of curcumin, piperine and capsaicin was found to be linear in the range of 2 to 7 $\mu\text{g spot}^{-1}$ ⁷⁹.

10. Conclusion

Rasam is a prime example of a traditional functional food that may be used to treat a variety of illnesses. Heating the spices in water and oil when preparing *rasam* provides

a fantastic possibility for a varied chemical makeup of the finished product. There is also a real possibility of forming new chemical entities during the formulation of *rasam*. New leads can provide a better structure-activity relationship between constituents present in *rasam* and their numerous health benefits.

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