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Evaluation of Physicochemical Properties and Chemical Constituents of *Rasam*, a Traditional South Indian Soup

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Authors' contributions

This work was carried out in collaboration among all authors. Author MKMMR designed the study. Author AS performed the study and author RM managed the literature survey and wrote the manuscript. All authors have read and approved the final manuscript.

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Short Communication

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ABSTRACT

Aims: To evaluate the physical and chemical properties of *rasam*, a traditional south Indian soup. Each ingredient present in *rasam* are known for their medicinal value individually. Moreover, *rasam* has being suggested as a general control measure in the treatment of SARS-CoV-2 by Ministry of AYUSH. For formulation designing the properties of material under study is generally determined. Hence, this study was carried out to evaluate the physiochemical properties of *rasam* so that it would be convenient to chose a suitable dosage form.
Study Design: The physical and chemical studies was carried simultaneously in order to achieve the confirmatory results.

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Place and Duration of Study: Study was performed at Parul Institute of Pharmacy & Research, Parul University, Vadodara, Gujarat, India. The study took about 45 days.
Methodology: The physical parameters evaluated were pH, viscosity, density, boiling range, surface tension, miscibility, refractive index and loss on drying. The chemical evaluation included preliminary qualitative phytochemical screening.
Results: The pH of *rasam* was 3.916 ±0.0133*,* viscosity was 0.956 cp*, d*ensity was 0.993 g/mL, relative density was 0.995, boiling point was 110.3333 ± 0.333, surface tension was 107.093 N/m, refractive index was 1.37, and loss on drying was 80%. It contains several chemical constituents like alkaloids, glycosides, saponins, etc*.*
Conclusion: The evaluated physical and chemical properties of *rasam* would provide a gateway for the formulation researchers to follow-up with various dosage forms designing.

Keywords: SARS-CoV-2; functional food; Saaru; chemical constituents; traditional food; Siddha.

1. INTRODUCTION

Food is consumed in various combinations, in comparatively bulk quantities which are not measured over vast socialized conditions. The outlook of considering food to have an expanded function which goes further than providing a source of nutrients truly applies to traditional functional foods. The organized method of consuming the traditional functional food provides a tremendous prophylactic to ward-off several diseases. Various literatures have recommended the consumption of foods rich in bio-active components, such as herbs and spices for improved health [1]. The challenging reality of functional foods are not a mere nutritional and health provision rather the real challenge lies not in proving whether the functional foods have health benefits, but in defining their benefits and the development of methods to expose them by scientific means [2]. *Rasam* is a famous traditional soup of South India. It is consumed on a daily basis in every South Indian home. *Rasam* is traditionally prepared using tamarind juice as a base, with a variety of spices which are considered to be good for health and improving the digestion [3].

Rasam can be regarded as a classic example of an ideal recipe subscribing to the principles laid by Indian system of medicines such as *Ayurveda* and *Siddha* [4,5]. *Rasam* is recommended as one the general measures for the control of the fever and respiratory illness related to SARS-CoV-2 by the Ministry of AYUSH, Government of India [6].

Epidemiological randomized clinical trials carried out in different countries have demonstrated numerous health effects related to functional food consumption like reduction of cancer risk, improvement of heart health, stimulation of immune system, decrease of menopause symptoms, improvement of gastrointestinal health, maintenance of urinary tract health, anti-inflammatory effects, reduction of blood pressure, maintenance of vision, antibacterial effect, anti-viral effect, reduction of osteoporosis and anti-obese effect [7]. The main spices used in the preparation of *rasam* are tamarind, turmeric, chili pepper, cumin, garlic, black pepper, black mustard, curry leaves, coriander and asafetida [8].

To explore the pharmaceutical potential of *rasam* beyond its culinary and nutritive effect, the ingredients used, their quantity, and process involved in the preparation of *rasam* has been standardized [9]. Other studies reported on *rasam* includes, marker based analytical studies [10], antimicrobial studies [11], cytotoxic, antimitotic, and antiproliferation studies [12], analytical studies by Gas Chromatography – Mass Spectrometry (GC-MS) [13] and breast cancer studies [14]. For formulation designing the properties of material under study is generally determined. Till now, the physical and chemical properties of *rasam* formulation have not been determined. Hence, there raised a need to evaluate the physical and chemical properties of *rasam to* open a gateway for the formulation researchers to follow-up with various dosage forms designs with *rasam* formulation.

2. MATERIALS AND METHODS

2.1 Preparation of the Sample

Rasam was formulated as per Devarajan et al. 2017 [9]. The quantity of each ingredients, the number of hand crushing as in the case of tamarind in water, the number of poundings to ground pepper, cumin, chili pepper, garlic and the volume of rinsing water has been already

standardized and reported [9]. The earlier study has also mentioned the sequence of adding different ingredients, utensils to be used and the temperature to be maintained during the preparation of rasam, same procedure was followed to prepare rasam for the current study. Dried tamarind fruit pulp (6.88 g) was soaked in 450 mL of water for 10 min. Then it was crushed in hand for 45 times and further strained and to which dried rhizome powder of turmeric (0.4 g) turmeric powder and sea salt (4 g) was added. In a separate container, fresh riped fruit of tomato (82.44 g) was crushed in hand 60 times. In a mortar and pestle, the dried long pepper chilli (1.33 g) was crushed 85 times, to which dried cumin fruits was added and crushed (2.67 g) for 100 times, then pepper (0.82 g) was added and crushed for 50 times, followed by cloves of garlic (9.63 g) and crushed for 90 times. The crushed tomato mixture and spice mixture tamarind was mixed together. The whole mixture was rinsed with 5mL water. In a stainless-steel bowl, Indian sesame oil (4 mL) was heated at 60°C for 2 min. After which, dried mustard seeds (0.82 g), whole chilli pepper (1.53 g) and fresh curry leaves (0.61 g) were added with an interval of 5s, 3s and 2s respectively. The whole mixture was added and rinsed with 20mL of water. The entire mixture was heated till frothing and fresh coriander leaves (1.50 g) and asafetida powder (0.05 g) was added and finally the heat source was terminated.

2.2 Physical Parameters

2.2.1 pH

The pH value of a solution was determined by means of a pH meter [15].

2.2.2 Viscosity

Viscosity was identified by using the Ostwald's viscometer as per the procedure mentioned in Indian Pharmacopoeia [16].

2.2.3 Density

Density was determined by the procedure from Indian Pharmacopoeia [17].

2.2.4 Relative density

Relative density was determined by the procedure mentioned in Indian Pharmacopoeia [17].

2.2.5 Boiling point

Boiling point was determined by the procedure mentioned in Indian Pharmacopoeia [18].

2.2.6 Surface tension

Surface tension was determined as per reported method [19].

2.2.7 Miscibility

The tests for the miscibility were determined by mixing *rasam* with equal volume of solvents and was allowed to stand for 5 minutes and the results were observed.

2.2.8 Refractive index

The refractive index of the *rasam* was observed by the Abbe's refractometer [20].

2.2.9 Loss on drying

Loss on drying was determined as per the method mentioned in Indian Pharmacopoeia [21].

2.2.10 Organoleptic properties

The organoleptic properties like color, odour and taste were determined.

2.3 Chemical Parameters

2.3.1 Preliminary qualitative phytochemical screening

The phytochemical analysis were carried out as per reported methods [22,23].

3. RESULTS AND DISCUSSION

3.1 Preparation of Rasam

Rasam, a traditional South Indian soup was prepared as per the method mentioned in Devarajan et al 2017 [9] (Fig. 1).

3.2 Physical Parameters

The parameters like pH, viscosity, density, relative density, boiling point, surface tension, refractive index, loss on drying, colour, taste and odour were determined (Table 1). All the parameters mentioned have determined for the first time. It is now known that *rasam* is acidic in nature. The viscosity and density are almost

similar to water, but because of the dissolved solutes and solid residues the boiling point is higher as compared to water. The density and relative density do not show much variation. The miscibility data is as shown in Table 2. As water is the major component in *rasam* and also by its miscibility data it can be considered that rasam is moderately polar in nature like the alcohols.

Fig. 1. Rasam, a traditional South Indian soup

Table 1. Different properties of *rasam*

Property	Value	Unit
pH	3.916	NA
Viscosity	0.956	cp
Density	0.993	g/mL
Relative density	0.995	NA
Boiling point	110.3	°C
Surface tension	107	dynes/cm
Refractive index	1.39	NA
Loss on drying	80	%
Colour	Light reddish brown	NA
Odour	Pungent	NA
Taste	Aromatic	NA

All values are mean of three determinations (n=3)

Table 2. Miscibility of *rasam* formulation with different solvents

S. No	Solvent	Result
1.	Water	Completely Miscible
2.	Toluene	Immiscible
3.	Dimethylformamide	Miscible
4.	Diethyl ether	Immiscible
5.	Methanol	Miscible
6.	Acetic acid	Miscible
7.	Acetone	Miscible
8.	Tetrahydrofuran	Slightly Miscible
9.	Benzene	Immiscible
10.	Ethanol	Miscible
11.	Chloroform	Immiscible
12.	Acetonitrile	Miscible
13.	Ethyl acetate	Immiscible
14.	Carbon Tetrachloride	Immiscible
15.	n- Hexane	Immiscible
16.	Di chloromethane	Immiscible
17.	Iso propyl alcohol	Miscible
18.	Xylene	Immiscible

Table 3. Phytochemical screening of *rasam* for carbohydrates including reducing sugars, hexose sugars, non-reducing sugars, non-reducing polysaccharides and mucilage

S. No	Name of the test	Observation		
		Significant	Positive	Negative
1.	Test for carbohydrates			
	Molisch's test (General tests)	++		
2.	Test for Reducing sugars			
	Fehling's test		+	
	Benidict's test		+	
3.	Tests for hexose sugars			
	Selwiniff's test (for ketohexose like fructose)			-
	Tollen's phloroglucinol test for galactose		+	
	Cobalt-chloride test		+	
4.	Test for Non-Reducing sugars			-
5.	Test for Non-Reducing Polysaccharides (Starch)			
	Iodine test			-
	Tannic acid test for starch			-
6.	Test for Mucilage			-

Table 4. Phytochemical screening of rasam for proteins, amino acids and steroids

S. No	Name of the test	Observation		
		Significant	Positive	Negative
1.	Test for Proteins			
	Biuret test (General test)			-
	Millon's test (for proteins)		+	
	Xanthoprotein test (for protein containing tyrosine or tryptophan)		+	
	Test for proteins containing sulphur			-
	Precipitation test			
	- Absolute Alcohol			-
	- 5%$HgCl_2$			-
	- 5%$CuSO_4$			-
	- 5% Lead acetate	++		
	- 5% Ammonium sulphate			-
2.	Test for Aminoacids			
	Ninhydrin test (General test)			-
	Test for tyrosine			-
	Test for cysteine			-
3.	Test for Steroids			
	Salkowski reaction			-
	Liebermann- Burchard reaction			-
	Liebermann's reaction			-

3.3 Chemical Parameters

3.3.1 Preliminary qualitative phytochemical screening

Some of the major chemical constituents present in the ingredients like tomato, turmeric, pepper, tamarind etc., used for the preparation of *rasam* are identified, but the chemical constituents present in the *rasam* are not yet identified. The results of various tests for the presence and absence of phytoconstituents are shown in Tables 3, 4, 5 and 6. The preparation of *rasam* involves heating the individual ingredients (numerous chemical constituents are present in each of the ingredients) in water and sesame oil. This processing provides tremendous opportunity for a completely altered/different chemical

composition of the finally prepared rasam. Loss of active principles or synergetic effect or breakdown of inactive metabolite to an active one or formation of new chemical entities (NCEs) is a real possibility. *Rasam* has shown the presence of glycosides and flavonoids. Hence, a complete and thorough investigation is essential to understand the active ingredients formed during the process of preparing It is also well-known that concentration of chemical constituents is directly proportional to its therapeutic/physiological effect.

Table 5. Phytochemical screening of rasam for glycosides

S. No	Name of the test	Observation		
		Significant	Positive	Negative
1.	Test for Cardiac Glycosides			
	Baljet's test			-
	Legal's test (Test for cardenoloids)			-
	Test for deoxysugars (Keller- Killani test)		+	
	Liebermann's test (Test for bufadenoloids): steroid test			-
	Kedde's test (Test for unsaturated/actone)			-
	Raymond's test			-
2.	Tests for Anthraquinone Glycosides			
	Borntrager's test for anthraquinone glycosides			-
	Modified Borntrager's test for C-glycosides			-
3.	Tests for Saponin glycosides			
	Foam test	++		
4.	Test for Cyanogenetic Glycoside			
	Grignard reaction or sodium picrate test			-

Table 6. Phytochemical screening of *rasam* for flavonoids, tannin, phenolic acids and alkaloids

S. No	Name of the test	Observation		
		Significant	Positive	Negative
1.	Test for Flavonoids			
	Shinoda test		+	
	Sulphuric acid test		+	
	Lead acetate test		+	
	Sodium hydroxide test		+	
2.	Tests for Tannins and Phenolic compounds			
	5%$FeCl_3$ solution			-
	Lead acetate solution	++		
	Gelatin solution	++		
	Bromine water			-
	Acetic acid solution			-
	Potassium dichromate			-
	Dilute iodine solution			-
	Dilute HNO_3		+	
	Dil. Potassium permanganate solution			-
3.	Test for Alkaloids			
	Dragendroff's test			-
	Mayer's test			-
	Hager's test			-
	Wagner's test		+	

4. CONCLUSION

The individual ingredients used in the preparation of the *rasam* are being claimed for various medicinal uses. *Rasam* is suggested as one of the general control measures of the SARS-CoV-2 by the Ministry of Ayush, Government of India. No scientific details were available till date about the physical and chemical properties of *rasam*. These properties are generally studied as part of pre-formulation studies. Understanding these properties of rasam would provide appropriate information about the suitability of *rasam* in formulation designing and development of dosage forms like conventional and/or novel drug delivery systems.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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