Standardization and Chemical Analysis of Rasam: A South Indian Traditional Functional Food

Agilandeswari Devarajan¹, Muthu Kumaradoss Mohan Maruga Raja²

ABSTRACT
Objective: The traditional Indian food is “functional” as it contains high amounts of dietary fiber, antioxidants, and probiotics. Rasam is a South Indian traditional spice soup. Spices are reputed to possess several pharmacological properties. Due to geographical, ethnic, and traditional differences, rasam recipe and the preparation process have a wide difference. Hence, the objective was to standardize rasam and then to perform a chemical analysis so that its pharmaceutical potential beyond nutritive effect can be explored.

Materials and Methods: The quantity of ingredients and the process followed for preparing rasam by the 17 volunteers selected from in and around Vellore, Tamil Nadu was standardized. The proximate, nutritive, elemental, and phytochemical analysis were determined for the standardized rasam.

Results: The total ash, acid insoluble ash, water soluble ash, and sulfated ash were found to be 1.7%, 0.04%, 0.12%, and 1.86%, respectively. The extractive values such as water soluble, ethanolic and ether soluble were found to be 4.5%, 3.93%, and 0.61%, respectively. The standardized rasam showed very low-energy content of 15.13 kcal/100 g. Rasam contained alkaloids, tannins, saponins, flavonoids, terpenoids, steroids, glycosides, and volatile oil.

Conclusion: The ingredients used in the preparation of rasam are medicinally claimed for various ailments, which makes it a traditional functional food. The standardized procedure provided tremendous opportunity to study the pharmaceutical potential in a systematic scientific way beyond its culinary and nutritive effect.

Key words: Chaaru, Elemental analysis, Nutritional value, Proximate analysis, Saaru, spices.

INTRODUCTION
The traditional Indian food is “functional” as it contains high amounts of dietary fiber (whole grains and vegetables), antioxidants (spices, fruits, and vegetables), and probiotics (curds and fermented batter products). Due to the chemical diversification of the ingredients, these Indian traditional functional foods exhibit the synergistic physiological effect. Epidemiological randomized clinical trials carried out in different countries have demonstrated numerous health effects related to functional food consumption such as 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. ¹ Sambar, a South Indian traditional dish, has shown preventive effect against colon cancer. ² Rasam, also called as chaaru or saaru, is a South Indian traditional spice soup, consumed especially in Tamil Nadu. Spices are used as flavoring agents throughout the world. In addition, they are reputed to possess several medicinal and pharmacological properties.³ It is traditionally prepared using tamarind juice as a base, with the addition of Indian sesame oil, turmeric, tomato, chili pepper, pepper, garlic, cumin, curry leaves, mustard, coriander, asafoetida, sea salt, and water. Rasam is a functional food since all the ingredients used in the preparation are medicinally claimed for various ailments.

In India, traditional foods are filled with multiples of uniqueness that are specific to each region. Similarly, the preparation process of rasam has a wide difference due to geographical, ethnical, and traditional variations exist in the ingredients used its quantity. There are more than 20 different types of rasam based on the permutation and combination of its constituent spices.⁴ Various literatures cite rasam as an effective treatment for cold, fever, flu, and diabetes⁵ but rasam used in those studies were consistent neither in their ingredients nor in the process of preparation. To explore the pharmaceutical potential of rasam beyond its culinary and nutritive effect, there arised a need to standardize the ingredients used, their quantity, and process involved in the preparation of rasam. Hence, the study was planned to standardize rasam prepared in and around a particular geographical location, Vellore, Tamil Nadu, India, and also to per-
form a chemical analysis so that its pharmaceutical potential can be consistently explored in a scientific way.

**MATERIALS AND METHODS**

**Location**

Approximately 33 km in and around Vellore in four directions East, West, North, and South were set as zone of distribution for the study. Vellore was selected as a center of distribution (CoD). Around Vellore, 17 places (four in each direction) were selected. Seventeen volunteers one from each selected place were chosen as samples for studying the process involved in the preparation of rasam based on the following criteria:

- Females above 50 years
- Natives to the region for at least three generations, and Vegetarians.

**Standardization**

The quantity of ingredients and the process used for the preparation of rasam by the 17 volunteers were partially optimized. All the 17 volunteers were provided with the sufficient quantity of ingredients (q.s.) and utensils to prepare a fixed volume (500 mL) of rasam in their traditional way. The ingredients were purchased from Arokya Organic Shop, Vellore. All utensils used for the preparation of rasam were of stainless steel of 316 grade. The whole processes of the preparation of rasam were divided into five different stages as stepwise standardization:

- Preparation of tamarind fruit pulp mixture (T1)
- Preparation of tomato fruit mixture (T2)
- Preparation of spice mixture (T3),
- Preparation of all mixture (T4), and
- Preparation of final product (T5).

The data regarding the accurate quantity of the ingredients used and the exact processes followed by the 17 volunteers in the preparation of rasam were individually recorded as phase wise, and standardized to a fixed recipe with a precise process. Statistical analysis was performed using GraphPad Instat Version 4 software, and the values were expressed as mean ± standard deviation.

**Chemical analysis**

**Proximate analysis of standardized rasam**

The standardized rasam was subjected to proximate analysis such as total ash, acid insoluble ash, water soluble ash, sulfated ash, water-soluble extractive, ethanol soluble extractive, and ether soluble extractive values.

**Nutritive and elemental analysis of standardized rasam**

The quantity of water, carbohydrates, proteins, fats, fibers, and vitamins present in standardized rasam was estimated. Moreover, the quantity of calcium, magnesium, sodium, potassium, phosphorus, sulfur, chloride, iron, molybdenum, boron, copper, manganese, zinc, nickel, aluminum, and selenium present in standardized rasam were also estimated.

**Preliminary qualitative phytochemical analysis of standardized rasam**

The standardized rasam was studied for the presence and absence of secondary metabolites such as alkaloids, tannins, saponins, flavonoids, terpenoids, steroids, glycosides, and volatile oil.

**RESULTS**

The details of the selected 17 places, its coordinates, direction, and distance from the CoD are as shown in Table 1. The biological source of ingredients used for the preparation of rasam is as shown in Table 2. The quantity of ingredients and the processes used for the preparation of T1, T2, T3, T4, and T5 by 17 volunteers is as shown in Tables 3-5.

The procedure for standardized rasam is as follows:

- T1 – 6.88 g of tamarind fruit pulp was immersed in 450 mL of water for 10 min which was then hand crushed for 45 times and strained. The strained liquid was rinsed with 5 mL water into which 0.4 g of turmeric powder and 4 g of sea salt was added.
- T2 – 82.44 g of fresh tomato fruits was hand crushed for 60 times. The crushed fruit was rinsed with 5 mL of water.
- T3 – 1.33 g of pepper drupes was crushed in a mortar and pestle for 85 times. 2.67 g of cumin fruits was added over to the crushed pepper drupes and crushed for 100 times. To the above-crushed mixture, 0.82 g of chili pepper was added and crushed for 50 times. To the above mixture, 9.63 g of garlic cloves was added and crushed for 90 times.
- T4 – Tomato fruit mixture (T2) was rinsed with 10 mL of water, and spice mixture (T3) was rinsed with 10 mL of water. Both rinsing were added to tamarind fruit pulp mixture (T1).
- T5 – 4 mL of Indian sesame oil was heated at 60°C for 2 min. After 5 s, 0.82 g of mustard seeds were added. After 3 s, 1.53 g of whole chili pepper was added. After 2 s, 0.61 g of curry leaves was added. Immediately, all mixture (T4) was rinsed with 20 mL of water and added. The whole liquid was allowed to boil for a 5 min. After 5 min, 1.50 g of coriander leaves was added. When the liquid frothed, 0.05 g of asafoetida was added, and the heating was switched off to yield the final product.

The ash values of standardized rasam such as total ash, acid insoluble ash, water soluble ash, and sulfated ash were found to be 1.7%, 0.04%, 0.12%, and 1.86% w/w, respectively. The extractive values such as water soluble, ethanol soluble, and ether soluble were found to be 4.5%, 3.93% and 0.61% w/w, respectively. The nutritional value of standardized rasam per 100 g is expressed in Table 6. Preliminary qualitative phytochemical analysis of standardized rasam results confirmed the presence of alkaloids, tannins, saponins, flavanoids, terpenoids, steroids, glycosides, and volatile oil.

**DISCUSSION**

The traditional foods of each specific region of India are primarily a component of its culture. If these traditional foods are to be standardized, it has to be evaluated within a specific region. Hence, a specific geographical location Vellore, Tamil Nadu was selected to standardize rasam. For better efficiency of the standardization process, 17 volunteers were selected based on specific criterions within the selected geographical zone. The required ingredients and the necessary utensils were provided to all 17 volunteers to maintain uniformity of the study. The 17 preparations from each volunteer were qualitatively and quantitatively recorded in phase wise. The quantity of ingredients and the processes followed by the 17 volunteers involved in the preparation of rasam were combined and standardized to a fixed recipe. Based on the derived recipe, a standardized rasam was prepared and further subjected to chemical analysis.

Ash values identified the presence of inorganic radicals such as carbonates, phosphates, silicates and silica of sodium, potassium, magnesium, and calcium. Total ash and sulfated ash of the standardized rasam indicated high quantity of carbonates and oxides. Inorganic variables such as calcium oxalate, silica, carbonate content affected the “total ash” values. Such variables were removed by the acid treatment (as they are soluble in hydrochloric acid) and then acid-insoluble ash value was determined.
Table 1: The selected places, its coordinates, direction, and distance from the center of distribution

| Samples | Name of the place   | State             | Coordinates                   | Direction       | Distance from center (km) |
|---------|---------------------|-------------------|-------------------------------|-----------------|--------------------------|
| S1      | Vellore             | Tamil Nadu        | 12.9165° N, 79.1325° E       | Centre of distribution | 0                       |
| S2      | Gudipala            | Andhra Pradesh    | 13.1013° N, 79.1249° E       | Toward north from center | 22.4                    |
| S3      | Nangamangalam       | Andhra Pradesh    | 13.0518° N, 79.1725° E       | Toward north from center | 22.8                    |
| S4      | Bomma Samudram      | Andhra Pradesh    | 13.0534° N, 79.1266° E       | Toward north from center | 27.2                    |
| S5      | Gangasagaram        | Andhra Pradesh    | 13.1625° N, 79.1033° E       | North end       | 30                       |
| S6      | Perumugai           | Tamil Nadu        | 12.9395° N, 79.1859° E       | Toward east from center | 8.1                      |
| S7      | Arapakkam           | Tamil Nadu        | 12.9477° N, 79.2219° E       | Toward east from center | 11.7                    |
| S8      | Arcot               | Tamil Nadu        | 12.9044° N, 79.3192° E       | Toward east from center | 24.1                    |
| S9      | Thenkadapanthangal  | Tamil Nadu        | 12.9134° N, 79.3951° E       | East end        | 34.8                    |
| S10     | Kuppam              | Tamil Nadu        | 13.2132° N, 79.6895° E       | Toward south from center | 9.1                      |
| S11     | Kaniyambadi         | Tamil Nadu        | 12.8056° N, 79.1360° E       | Toward south from center | 13.6                    |
| S12     | Kannamangalam       | Tamil Nadu        | 12.7522° N, 79.1478° E       | Toward south from center | 21.2                    |
| S13     | Padavedu            | Tamil Nadu        | 12.6600° N, 79.1126° E       | South end       | 33.5                    |
| S14     | Virinjipuram        | Tamil Nadu        | 12.9208° N, 79.0108° E       | Toward west from center | 16.1                    |
| S15     | Pallikonda          | Tamil Nadu        | 12.9023° N, 78.9430° E       | Toward west from center | 22.3                    |
| S16     | Pasumathur          | Tamil Nadu        | 12.9350° N, 78.9441° E       | Toward west from center | 26.4                    |
| S17     | Gudiyattam          | Tamil Nadu        | 12.9447° N, 78.8709° E       | West end        | 32.4                    |

Table 2: Biological source of the ingredients used in the preparation of rasam

| Common names     | Morphological part used                          | Nature of the material | Botanical name                   | Family         |
|------------------|--------------------------------------------------|------------------------|----------------------------------|----------------|
| Tamarind         | Ripped fruit pulp                                | Dried                  | Tamarindus indica L.             | Fabaceae       |
| Turmeric         | Rhizome powder                                   | Dried                  | Curcuma longa L.                 | Zingiberaceae  |
| Sea salt         | NA                                               | Solid                  | NA                               | NA             |
| Tomato           | Ripped fruit                                     | Fresh                  | Solanum lycopersicum L.          | Solanaceae     |
| Chili pepper     | Crushed fruit of long chili pepper               | Dried                  | Capsicum annuum L.               | Solanaceae     |
| Cumin            | Ripped fruit                                     | Dried                  | Cuminum cinumin L.               | Apiaceae       |
| Garlic           | Bulb                                             | Dried                  | Allium sativum L.                | Amaryllidaceae |
| Black pepper     | Unripe drupe                                     | Dried                  | Piper nigrum L.                  | Piperaceae     |
| Indian sesame oil| Seed                                             | Oil                    | Sesamum indicum L.               | Pedaliaceae    |
| Black mustard    | Seed                                             | Dried                  | Brassica nigra L.                | Brassicaceae   |
| Chili pepper     | Whole fruit of long chili pepper                 | Dried                  | Capsicum annuum L.               | Solanaceae     |
| Curry leaves     | Leaves                                           | Fresh                  | Murraya koenigii (L.) Sprengel   | Rutaceae       |
| Portable water   | NA                                               | Liquid                 | NA                               | NA             |
| Coriander        | Leaves                                           | Fresh                  | Coriandrum sativum L.            | Apiaceae       |
| Asafoetida       | Dried latex (oleogum resin) exuded from the rhizome or tap root | Powder                 | Ferula assa-foetida L.           | Apiaceae       |

NA: Not applicable

Low acid insoluble ash indicated less silicious materials such as earth or sand. Extractive values are useful as an evaluation tool to provide an idea about the nature of the chemical constituents present. Extractive values of standardized rasam showed very high quantity of polar and moderately polar constituents than nonpolar constituents.

Rasam is used as an appetizer, and its ingredients such as tamarind, turmeric, cumin, black pepper, curry leaves, and asafoetida are known for their digestive aid activity. There are various foods that create a negative-calorie effect, which improves metabolism. These foods are usually plant-derived which are high in water content, rich in fibers, grains, legumes, vegetables, and fruits. A negative-calorie food is a food that requires more energy to digest the food than it provides. Standardized rasam almost contained water (95.03%) with only 15.13 kcal. Hence, the body has to burn more energy to digest than it receives. However, there is no substantial evidence to comprehensively prove that rasam has negative calorie effect.
Table 3: Quantity of ingredients used and the process involved to prepare the tamarind fruit pulp mixture (T1) and prepare the tomato fruit mixture (T2)

| Samples | Tamarind fruit pulp (g) | Volume of soaking water (mL) | Soaking time (s) | Number of hand crushes | Volume of rinsing water (mL) | Turmeric powder (g) | Sea salt (g) | Tomato fruit (g) | Number of hand crushes | Volume of rinsing water (mL) |
|---------|-------------------------|------------------------------|-----------------|------------------------|----------------------------|---------------------|-------------|-----------------|------------------------|-----------------------------|
| S1      | 7.2                     | 439.4                        | 573             | 39                     | 4.2                        | 0.39                | 3.85        | 78.62           | 57                     | 4.5                         |
| S2      | 7.5                     | 447.9                        | 562             | 49                     | 4.9                        | 0.42                | 3.91        | 85.16           | 55                     | 5.2                         |
| S3      | 6.8                     | 452.4                        | 588             | 47                     | 5.5                        | 0.46                | 4.17        | 79.28           | 59                     | 4.6                         |
| S4      | 6.4                     | 445.8                        | 626             | 48                     | 3.9                        | 0.37                | 3.82        | 82.13           | 64                     | 4.2                         |
| S5      | 6.2                     | 455.2                        | 615             | 55                     | 5.6                        | 0.34                | 4.15        | 84.3            | 63                     | 4.3                         |
| S6      | 7.3                     | 435.7                        | 568             | 51                     | 4.5                        | 0.41                | 4.23        | 79.45           | 54                     | 4.8                         |
| S7      | 6.2                     | 455.2                        | 577             | 38                     | 5.9                        | 0.45                | 3.95        | 77.8            | 62                     | 5.6                         |
| S8      | 7.5                     | 450.2                        | 594             | 46                     | 4.8                        | 0.34                | 3.84        | 82.75           | 55                     | 4.7                         |
| S9      | 7.0                     | 452.3                        | 619             | 52                     | 3.7                        | 0.38                | 4.05        | 79.92           | 65                     | 5.5                         |
| S10     | 6.6                     | 461.3                        | 632             | 43                     | 5.8                        | 0.31                | 3.84        | 85.77           | 54                     | 5.1                         |
| S11     | 6.2                     | 460.7                        | 643             | 47                     | 5.3                        | 0.45                | 4.31        | 85.17           | 63                     | 4.9                         |
| S12     | 7.5                     | 448.4                        | 581             | 44                     | 4.1                        | 0.49                | 3.87        | 88.25           | 58                     | 5.4                         |
| S13     | 7.3                     | 451.6                        | 594             | 36                     | 6.2                        | 0.35                | 4.33        | 76.52           | 61                     | 5.1                         |
| S14     | 7.6                     | 438.3                        | 621             | 40                     | 4.9                        | 0.39                | 3.95        | 88.61           | 58                     | 5.7                         |
| S15     | 6.7                     | 456.6                        | 602             | 42                     | 5.4                        | 0.45                | 4.10        | 83.36           | 66                     | 5.2                         |
| S16     | 6.7                     | 445.1                        | 596             | 43                     | 4.7                        | 0.40                | 3.74        | 78.37           | 62                     | 3.3                         |
| S17     | 6.3                     | 455.2                        | 604             | 47                     | 5.3                        | 0.46                | 3.91        | 86.04           | 58                     | 4.7                         |

Mean±SD 6.88±0.52 450.08±7.43 599.71±23.6 45.12±5.2 4.98±0.73 0.40±0.05 4.00±0.18 82.44±3.78 59.65±3.92 4.99±0.45

Table 4: Quantity of ingredients used and the process involved to prepare the spice mixture (T3) and prepare all mixture (T4)

| Samples | Pepper drupes (g) | Number of crushes* | Cumin fruits (g) | Number of crushes* after cumin | Chili pepper (g) | Number of crushes* after Cp | Garlic cloves (g) | Number of crushes* after Gc | Volume of rinsing water used for T2 (mL) | Volume of rinsing water used for T3 (mL) |
|---------|------------------|--------------------|-----------------|-------------------------------|-----------------|-----------------------------|-----------------|-----------------------------|----------------------------------------|----------------------------------------|
| S1      | 1.12             | 75                 | 2.94            | 85                            | 0.78            | 45                          | 9.91            | 75                          | 7.6                                    | 8.7                                    |
| S2      | 0.89             | 82                 | 2.27            | 96                            | 0.63            | 46                          | 9.42            | 92                          | 8.5                                    | 9.1                                    |
| S3      | 0.91             | 94                 | 2.48            | 110                           | 0.83            | 52                          | 8.88            | 79                          | 11.2                                   | 10.4                                   |
| S4      | 1.34             | 85                 | 2.94            | 97                            | 0.91            | 55                          | 10.12           | 81                          | 10.4                                   | 9.7                                    |
| S5      | 1.86             | 88                 | 3.05            | 92                            | 0.72            | 58                          | 9.63            | 84                          | 10.2                                   | 10.3                                   |
| S6      | 1.68             | 91                 | 2.68            | 106                           | 0.89            | 46                          | 9.48            | 94                          | 9.2                                    | 8.9                                    |
| S7      | 1.29             | 67                 | 2.51            | 88                            | 0.92            | 53                          | 9.18            | 92                          | 9.7                                    | 10.8                                   |
| S8      | 1.19             | 84                 | 2.47            | 104                           | 0.83            | 48                          | 9.22            | 83                          | 10.6                                   | 11.2                                   |
| S9      | 1.91             | 104                | 2.77            | 94                            | 0.87            | 41                          | 9.94            | 80                          | 11.7                                   | 9.3                                    |
| S10     | 0.94             | 93                 | 2.22            | 112                           | 0.68            | 51                          | 10.14           | 98                          | 9.4                                    | 8.3                                    |
| S11     | 0.91             | 78                 | 2.84            | 107                           | 0.73            | 60                          | 9.15            | 96                          | 10.8                                   | 9.4                                    |
| S12     | 1.54             | 81                 | 3.13            | 106                           | 0.93            | 47                          | 9.67            | 99                          | 10.3                                   | 10.7                                   |
| S13     | 1.02             | 71                 | 2.57            | 96                            | 0.76            | 56                          | 10.24           | 103                         | 10.4                                   | 11.2                                   |
| S14     | 1.69             | 89                 | 2.29            | 98                            | 0.94            | 43                          | 9.11            | 89                          | 7.9                                    | 10.9                                   |
| S15     | 1.85             | 95                 | 2.23            | 111                           | 0.84            | 54                          | 9.87            | 107                         | 11.9                                   | 10.6                                   |
| S16     | 0.89             | 88                 | 3.05            | 104                           | 0.79            | 56                          | 9.69            | 99                          | 10.2                                   | 9.9                                    |
| S17     | 1.57             | 82                 | 2.96            | 96                            | 0.88            | 44                          | 10.07           | 81                          | 9.8                                    | 10.1                                   |

Mean±SD 1.33±0.38 85.12±9.29 2.67±0.31 100.12±8.09 0.82±0.04 50.29±5.73 9.63±0.42 90.12±9.48 9.99±1.2 9.97±0.9

* Mechanical crushes. Cp: Chili pepper, Gc: Garlic cloves, SD: Standard deviation
Rasam being an everyday traditional food, with high content of sodium, potassium, chloride, phosphorus and sulfur can be a daily dietary source. The presence of almost all the classes of secondary metabolites such as alkaloids, tannins, saponins, flavonoids, terpenoids, steroids, glycosides, and volatile oil is due to the chemical diversification in the ingredients used in rasam. These secondary metabolites may exert myriad physiological effects apart from digestive aid. The different ingredients used in rasam have been individually attributed to various pharmacological effects in preclinical and clinical studies. Hepatic tonic, anti-inflammatory, and antioxidant effect of tamarind fruit pulp; hepato-protective, anti-inflammatory effect of coriander leaves, and anti-inflammatory effect of asafoetida.
antioxidant, anti-inflammatory, anticarcinogenic, and antimicrobial, antidiabetic, antiangiogenic effect and antithrombotic effect of turmeric;\textsuperscript{2,13} antioxidant and anticancer activity of chili pepper;\textsuperscript{2} anti-flatulent, hypoglycemic, hypolipidemic, antimicrobial, antioxidant, and anti-inflammatory activity of garlic bulbs;\textsuperscript{15,16} antioxidant, antiinflammatory, anti-atherosclerotic, and antiplatelet effect of black pepper;\textsuperscript{17,18} hypoglycemic effect of black mustard;\textsuperscript{19} heptaprotective, antimicrobial, anti-inflammatory, cardioprotective, hypoglycemic, and antipyretic activity of curry leaves;\textsuperscript{9,10,22} diuretic, antioxidant, and antiplatelet activity of coriander leaves;\textsuperscript{9,14} antiflatulent, anti-microbial, and antiasthmatic effect of asafoetida\textsuperscript{20} are reported. These facts ascertain that rasam is a classical example of traditional functional food.

CONCLUSION

The processing followed in the formulation of rasam involved heating the spices in water and oil. This processing provided tremendous opportunity for a completely altered/different chemical composition of rasam. The altered/different chemical composition of the rasam may be due to the loss of active principles or synergistic effect or breakdown of inactive metabolite to an active one or formation of new chemical entities. In the era of preventive medicines, a standardized procedure for the preparation of rasam can aid the exploration of its pharmaceutical potential in a systematic scientific way beyond its culinary and nutritive effect.

Financial support and sponsorship

Nil.

ACKNOWLEDGEMENT

The authors sincerely thank all the seventeen volunteers participated in the standardization study.

CONFLICTS OF INTEREST

There are no conflicts of interest.

ABBREVIATION USED

CoD: Center of distribution; T1: Preparation of tamarind fruit pulp mixture; T2: Preparation of tomato fruit mixture; T3: Preparation of spice mixture; T4: Preparation of all mixture; T5: Preparation of final product; Cp: Chili pepper; Gc: Garlic cloves; SD: Standard deviation; Is: Indian sesame oil; T: Temperature of cooking; ToH: Time of oil heating; Ms: Mustard seeds; ToA Ms: Time of addition for Ms after ToH; ToA Cp: Time of addition for Cp after ToA Ms; CuL: Curry leaves; ToA CuL: Time of addition for CuL after ToA Cp; Vrw: Volume of rinsing water; Bt: Boiling time; CoL: Coriander leaves; Asa: Asafoetida.

REFERENCES

1. Choudhary R, Tandon RV. Consumption of functional food and our health concerns. Pak J Physiol 2009;5:76-83.
2. Prasad VG, Reddy N, Francis A, Nayak PG, Kishore A, Nandakumar K, et al. Sambar, an Indian dish prevents the development of dimethyl hydrazine-induced colon cancer: A preclinical study. Pharmacogn Mag 2016;12 Suppl 4:S441-5.
3. Pathrasarathy VA, Chenpakam B, Zachariah TJ, editors. Chemistry of Spices. 1st ed. Oxfordshire: CAB International; 2008.
4. [Homepage on the Internet]. San Francisco: Wikimedia Foundation, Inc. Available from: https://www.en.wikipedia.org/wiki/Rasam. [Last updated on 2017 Mar 04; Last cited on 2017 Mar 13].
5. Devi KK, Priyadarshini VP. Exploration of nutrient content of traditional recipes of Tamil Nadu with therapeutic properties. Int J Res Appl Nat Sci 2014;2:1-12.
6. Ministry of Health and Family Welfare; Government of India, Department of Ayush. The Ayurvedic Pharmacopoeia of India, Part-II (Formulations). 1st ed., Vol. II. New Delhi, India: Department of Ayush; 2008.
7. Montagnac JA, Davis CR, Tanumihardjo SA. Nutritional value of cassava for use as a staple food and recent advances for improvement. Compr Rev Food Sci Food Saf 2009;8:181-94.
8. Bureau of Indian Standards, The National Standards Body of India. Indian Standard, Method for determination of protein in foods and feeds. IS: 7219-1973. New Delhi, India: Bureau of Indian Standards; 2005.
9. Liang L, Wu X, Zhu M, Zhao W, Li F, Zou Y, Yang L. Chemical composition, nutritional value, and antioxidant activities of eight mulberry cultivars from China. Pharmacogn Mag 2012;8:215-24.
10. Misra A, Srivastava S, Verma S, Rawat AK. Nutritional evaluation, antioxidant studies and quantification of poly phenolics, in Roscoea purpurea tubers. BMC Res Notes 2015;8:324.
11. Ahmad M, Masood S, Sultana S, Hadda TB, Bader A, Zafar M. Report: Antioxidant and anthocyanidin content of wild medicinal Rubus berries. Pak J Pharm Sci 2015;28:241-7.
12. Khandelwal KR. Practical Pharmacognosy Techniques and Experiments. 19th ed. Pune: Nirlingi Prakashan; 2008.
13. Caluve ED, Halamova K, Damme PV. Tamarindus indica L. – A review of traditional uses, phytochemistry and pharmacology. Afr Focus 2010;23:53-83.
14. Kondamudi PK, Kovalemudi H, Nayak PG, Rao MC, Shenyon RR. Curcumin half analog modulates interleukin-6 and tumor necrosis factor- alpha in inflammatory bowel disease. Pharmacogn Mag 2015;11 Suppl 2:S296-302.
15. Dwarampudi LP, Pelanisivamy D, Nithyanantham M, Raghu PS. Antipsoriatic activity and cytotoxicity of ethanolic extract of Nigella sativa seeds. Pharmacognosy Journal, Vol 9, Issue 5, Sep-Oct, 2017

Table 6: Nutritional value of standardized rasam (values expressed per 100 g)

| Nutrient | Value | Unit |
|----------|-------|------|
| Water    | 95.03 | g    |
| Energy   | 15.13 | kcal |
| Proteins | 0.54  | g    |
| Total lipid (fat) | 0.41 | g    |
| Carbohydrate | 2.32 | g    |
| Fiber, total dietary | ND | NA |
| Minerals |       |      |
| Calcium, Ca | ND | NA |
| Iron, Fe | 0.5 | µg |
| Magnesium, Mg | ND | NA |
| Phosphorus, P | 10 | mg |
| Potassium, K | 100 | mg |
| Sodium, Na | 410 | mg |
| Zinc, Zn | 6 | µg |
| Copper, Cu | 0.8 | µg |
| Manganese, Mn | <0.25 | µg |
| Selenium, Se | <0.25 | µg |
| Sulphur, S | 400 | µg |
| Chloride, Cl | 750 | mg |
| Molybdenum, Mo | <0.25 | µg |
| Boron, B | <0.25 | µg |
| Nickel, Ni | <0.25 | µg |
| Aluminum, Al | <0.25 | µg |
| Vitamins |       |      |
| Vitamin C, total ascorbic acid | 0.58 | g |
| Thiamine | ND | NA |
| Riboflavin | ND | NA |
| Niacin | ND | NA |
| Vitamin B-6 | 0.34 | g |

ND: Not detected, NA: Not applicable
The ingredients used in the preparation of rasam are medicinally claimed for various ailments, which makes it a traditional functional food.

Due to geographical, ethnical, and traditional differences, rasam recipe and the preparation process have a wide difference.

The present study was aimed to standardize rasam and then to perform a chemical analysis.

The standardized procedure provided tremendous opportunity to study the pharmaceutical potential in a systematic scientific way beyond its culinary and nutritive effect.

Cite this article: Devarajan A, Raja MK. Standardization and chemical analysis of Rasam: A South Indian traditional functional food. Pharmacognosy Journal. 2017;9(5):587-93.