

Physico-chemical properties of different kind of rice water and their effect on diarrhoea causing bacteria and dandruff causing fungi

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Abstract

Rice water has been used for curing various ailments. The experiment was conducted to know the physico-chemical and cooking properties of six fine rice varieties. Length and breadth of the reported varieties ranges from 6–7.8mm and 4.5–5.5mm. The highest amylose (28%) was estimated in Gobindo bhog non - boiled rice followed by Sona Masori half boiled rice (24.2%) and lowest (18.6%) were Saffola arise active rice and Kerala rice. Alkali spreading value ranges from 3.0 to 3.9 of the tested varieties. Cooking time varied from 11min to 31min among the tested rice varieties. Elongation ratio of the fine rice varieties ranges from 1.5 to 2.4. Rice water of Kerala rice, Saffola arise active rice and full boiled rice had shown the significant zone of against diarrhoea causing bacteria. Overnight and 1 hr shocked rice water had shown the effective result against the dandruff causing fungi.

Keywords: Rice, Amylose, Alkali spreading, *Salmonella*, *Shigella*, Dandruff.

INTRODUCTION

Rice is the seed of the monocot plant *Oryza sativa*. As a cereal grain, it is the most important staple food for a large part of the world's human population, especially in East and South Asia, the Middle East, Latin America, and the West Indies. It provides about 75% of the calorie and 55% of the protein in the average daily diet of the people [1]. Yields of rice vary depending on many factors such as variety, grain type, and chalkiness, cultural practice, drying, storing and milling conditions [2, 3, 4]. To attract the consumers' attention, appearance of rice is important which depends on the shininess and chalkiness of the kernel. Size and shape are also important factor to consumer. Preference for grain size and shape vary from one group of consumers to another. High income group of people prefer long slender grain, whereas, lower income group prefer bold grain [5]. The amylose content of rice is considered as the main parameter of cooking and eating quality. Amylose content, volume expansion, water absorption influences many of the starch properties of rice. Cooking time is important as it determines tenderness of cooked rice as well as stickiness to great extent [5]. Higher the imbibitions ratio of rice lower will be the energy content per unit volume or weight of cooked rice, as they will have more water and solid materials [6]. High volume expansion of cooking is still considered to be the good quality by the working class people who do not care whether the expansion is lengthwise or crosswise. Urban people, on the other hand, prefer the varieties that expand more in length than in breadth [7]. Fine rice may be graded as export quality rice with normal

nutritional quality. The present study was done to evaluate the physicochemical and cooking properties of six rice varieties [8]. Rice water is the suspension of starch obtained by draining boiled rice or by boiling rice until it completely dissolves into the water. It is especially effective in the treatment of diarrhoea which is arising in cholera or gastroenteritis [9]. Rice water is also used to get fair, smooth and toned skin [10]. Rice shocked in water for overnight is also considered as a dandruff curing agent and digestible healthy drink in villages.

MATERIALS AND METHODS

Six fine rice varieties were collected from general stores named Kerala Rice, Jeera Kathi Basmati rice; Poni boiled rice, Sona Masori half Boiled rice, Govindo bhog non Boiled rice and Saffola Arise Active rice (Fig-1).



Fig 1.

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Physicochemical properties

Slide Calipers was used for measure of grain length and breadth. Amylose content was determined by colorimetric Juliano procedure, 1971 [11] and Alkali spreading values were recorded after immersion of rice in 1.7% KOH at 30°C for 24 hrs by comparing

the dispersion in comparison to check samples of known behaviour [12]. About 10 gram of rice grain was soaked in 20ml of warm distilled water for one hour. The rice samples were reweighed and the percent water absorption was calculated. Rice samples were covered with warm water and cooked. At five minutes interval rice grains were taken out and pressed by thumbs, until the grain was easily smashed. The cooking time was recorded.

Antibacterial and Antifungal test

Three type of rice water was prepared. First type rice water was the suspension of starch obtained by draining boiled rice. Second type rice water was the cooked rice soaked in normal water for overnight and the shocked rice water was used for analysis. Third type was the uncooked rice grain shocked into water for 1 hour and as such the water was used for analysis. The first and second type rice water was used for antibacterial study. Diarrhoea causing bacteria *Salmonella* & *Shigella* were swabbed on agar plate and allowed to grow for 18 hours in the broth culture. Cork-borer was used to cut out three cups in each of the agar plates which were previously inoculated with the test organisms. The cut discs of agar were removed and 0.1ml of each of the different test suspensions was added to the appropriate cups. After filling the reservoirs with the appropriate dilutions, the plates were incubated in the upright position at 37 °C for 24h. The plates were checked for bacterial

growth after the incubation period and the resultant zones of growth inhibition were accurately measured and expressed in mm.

Second and third type of rice water was used for antifungal test. The rice water samples spread on Martine Rose Bengal Agar (MRBA) media and Dandruff fungus *Malassezia furfur* was inoculated on the centre of the plate and incubated for 5- 6 days at room temperature.

RESULTS AND DISCUSSION

Physical properties of six fine rice varieties

The Jeera Kathi Basmati is long, opaque &, slender grain (Table 1). Only sona masori half boiled and Gobind bhog no boiled (Superfast) varieties had opaque kernel which is not a good varietal character. All slender type and short bold rice are known as fine grain rice in the market and sold at higher price [8]. Basmati had long slender grain and Poni boiled Rice was medium slender. Sona Masori Half boiled rice, Gobindo Bhog non boiled rice, Saffola Active Arise rice, Kerala Rice varieties were short round. Length and breadth of the reported varieties ranges from 6 – 7.8 mm and 4.5– 5.5 mm, respectively. The highest grain length and length breadth ratio were found in Jeera Kathi Basmati followed by Sona Masori half boiled & Poni boiled rice (Table 1) [8].

Table 1. Physical properties of fine rice varieties

Rice variety	Length (mm)	Breath (mm)	Length: Breath ratio	Chalkiness	Size and shape
Jeera Kathi Basmati	7.8	2	3.9	Opaque	Long slender
Sona Masori half Boiled	4.3	1.2	3.5	Opaque	Short round
Poni boiled	6.6	2.5	2.6	Opaque	Medium slender
Gobindo Bhog non boiled	5.2	1.8	2.9	Translucent	Very Short round
Saffola Arise Active	5.6	1.5	3.7	Opaque	Short round
Kerala Rice	5	4	1.3	Opaque	Short round

Chemical properties of six fine rice varieties

Amylose content of the tested varieties varied ranges from 18.6 to 28.0%. The highest amylose (28%) was estimated in Gobido Bhog non- boiled rice followed by Sona Masori half boiled rice (24.2%) and lowest (18.6%) were in Saffola Arise Active rice and Kerala rice (Table 2). Amylose content of rice determines the

hardness and stickiness of cooked rice. Amylose content higher than 25% gives non sticky soft or hard cooked rice. Rice having 20-25% amylose gives soft and relatively sticky cooked rice [13]. Alkali spreading value ranges from 3.0 to 3.9 of the tested varieties. The highest alkali spreading value (3.9) was found in Saffola Arise Active rice and the lowest (3.0) in Jeera Kathi Basmati 4. Others four varieties remained between the above mentioned ranges [13].

Table 2. Chemical properties of six fine grain rice varieties

Rice variety	Alkali Spreading value (%)	Amylose %
Jeera Kathi Basmati	3.0	23.4
Sona Masori Half Boiled	3.1	24.2
Poni boiled	3.6	20.3
Gobindo Bhog non boiled rice	3.2	28.0
Saffola Arise active	3.9	18.6
Kerala rice	3.8	18.9

Cooking properties of some fine rice varieties

Cooking time varied from 11 minutes to 31 minutes among the tested rice varieties. Kerala Rice and Poni boiled rice took more than 20 minutes (i.e. 31 & 27.1 minutes) (Table 3). Elongation ratio

of the fine rice varieties ranges from 1.5 to 2.4 (Table 3). It is an important parameter for cooked rice. If rice elongates more lengthwise it gives a finer appearance and if expands girth wise, it gives a coarse look [8]. Here the entire rice sample had shown the more elongation ratio in lengthwise and the varieties showed the

finer appearance. However, of the tested varieties only Saffola arise active rice variety had the elongation ratio less than 1.5 which was by no means desirable. The imbibition ratio of all the tested varieties ranges from 1.2 to 1.4 (Table 3) and is a very positive quality from the point of nutrition value. Lesser the imbibition ratio greater energy

it will give. In the findings all the rice varieties has imbibition ratio below 4 so all the rice here provide high energy. However, higher to imbibition ratio of rice, lower will be the energy content per unit volume or weight of cooked rice as they will have more water and less solid materials [14,15].

Table 3. Cooking properties of six fine rice varieties

Variety of rice	cooked Length (mm)	Cooking Time (min)	Wt. of rice After 20 mints Absorb in warm water (g)	Imbibition Ratio	Elongation Ratio
Jeera Kathi Basmati	14.8	13	12.78	1.3	1.9
Sona Masori Half Boiled	10.6	17.5	12.33	1.2	2.4
Poni boiled	11.2	27.1	14.35	1.4	1.7
Gobindo Bhog non boiled rice	9.2	11	12.45	1.2	1.8
Saffola Arise active	8.2	14.8	12.90	1.3	1.5
Kerala rice	9.4	31	14.80	1.5	1.9

Antifungal and antibacterial of rice water

Warm Rice water is poured in the agar hole after incubation, Kerala rice, Saffola Arise Active rice and full boiled rice water had shown the zone of inhibition against diarrhoea causing bacteria *Salmonella* & *Shigella* (table 4). Half boiled rice showed inhibition against *Shigella* and intermediate zone of inhibition against *Salmonella*. Basmati rice water showed the resistant diameter zone against *Salmonella* and intermediate diameter zone against *Shigella* where as non boiled rice didn't show any zone of inhibition

(Table 4) (Fig-2a & b). Secondly the cooked rice soaked in normal water for overnight & the soaked rice water used for analysis didn't show any effect against bacteria, however it stopped the growth of dandruff fungus by growing its fungus as same as antagonistic mechanism. But the fungus present in the rice water may be able to affect the human skin (Fig- 2c). Thirdly the uncooked rice grain soaked into water for 1 hour showed great effect against dandruff. All the rice water shows the positive result. Even after 9th day no growth of fungus was observed. (Fig- 2d).

Table 4. Diameter of zone of inhibition of six fine rice water varieties

Bacteria	Poni boiled	Sona Masori half boiled	Jeera Kathi Basmati	Gobindo Bhog non boiled	Kerala rice	Saffola Arise active
<i>Salmonella</i>	28	18	15	0	29	25
<i>Shigella</i>	26	26	20	0	39	29

Diameter of zone of inhibition is in mm*

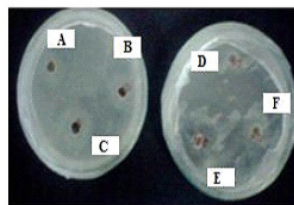


Fig 2.

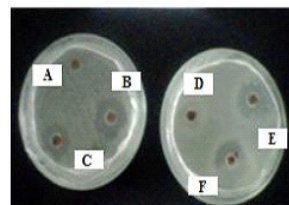


Fig 3.

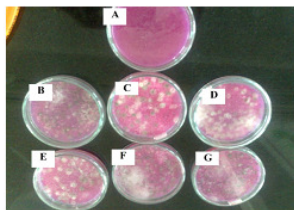


Fig 4

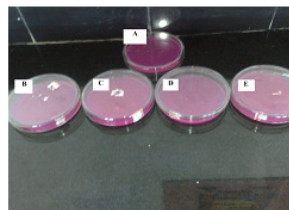


Fig 5.

Figure 1. Six rice varieties used in the present study: A.:Saffola Arise Active Rice, B:Sona Masori Half boiled Rice, C:Gobindo Bhog non boiled Rice, D:Poni Boiled Rice, E:Kerala Rice, F:Jeera Kathi Basmati Rice. **Figure 2:** Zone of inhibition against *Salmonella*: A: Zone of inhibition of cooked Gobindo Bhog Rice water, B:Zone of inhibition of cooked Saffola Arise Active rice water, C:Zone of inhibition of cooked Poni boiled rice water, D:Zone of inhibition of cooked Jeera Kathi Basmati rice water,E:Zone of inhibition of cooked Kerala rice water, F:Zone of inhibition of cooked Sona Masori half boiled rice water. **Figure 3:** Zone of inhibition against *Shigella*: A:Zone of inhibition of cooked Gobindo Bhog Rice water, B:Zone of inhibition of cooked Saffola Arise Active rice water, C:Zone of inhibition of cooked Poni boiled rice water, D:Zone of inhibition of cooked Jeera Kathi Basmati rice water, E:Zone of inhibition of cooked Sona Masori half boiled rice water, F:Zone of inhibition of cooked Kerala rice water. **Figure 4:** Effect of Second type of rice against fungus *Malassezia furfur*: A: Control plate, B:B, C, D, E, F, G : All the rice water variety have fungus growth. **Figure 5:** Effect of Third type of rice against fungus *Malassezia furfur*: A:No dandruff fungus growth in uncooked Saffola Arise Active rice water, B:No dandruff fungus growth in uncooked Poni boiled rice water, C:No dandruff fungus growth in uncooked Jeera Kathi Basmati rice water, D:No dandruff fungus growth in uncooked Kerala rice water, E: No dandruff fungus growth in uncooked Sona Masori half boiled rice water

CONCLUSION

We found marketed rice brand in Bangalore, India varied significantly in their physical characteristics, chemical compositions and antimicrobial activity. All the six types of rice varieties gives a finer appearance and lesser imbibition ratio which gives higher energy. But amount of amylose is significantly less in Saffola Arise Active (18.6%) and Kerala rice (brown rice) (18.9%). On the other hand antimicrobial activity of rice water is evident due to the active compounds present in the crude extracts. Except Gobindo bhog non boiled rice water all other varieties showed zone of inhibition against diarrhea causing bacteria *Salmonella* & *Shigella*, The highest range showed by Kerala rice water (brown rice). All type of rice water showed dandruff causing fungus inhibition. Zinc and selenium is important for healthy skin. May be rice water contains some amount of Zinc and selenium which cause antimicrobial effect. Cooked rice water (starch) works as a primary or first aid supplement to the diarrhea patients to their water and nutrients lose. Further pursuit on the isolation of bioactive compounds would enable more potential natural antibiotics and fungicides against inhibiting number of pathogens.

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