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## Bio-prospecting studies in traditional rice varieties of central western ghats of karnataka

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### Abstract

The Western Ghats is one of the 34 global hotspots of diversity in India and of which one third is in the state of Karnataka. The Ghats is a center of diversity for many agricultural crops and it is estimated that about 500-700 indigenous rice varieties are known to be cultivated here. These varieties warrant in depth studies to conserve and utilize them for the posterity. One of the areas in which these varieties can be fruitfully exploited is their medicinal properties. Though these rice varieties are not branded as medicinal, there is a practice of using local landraces for this purpose. In Uttara Kannada district of the Western Ghats, there is a practice of using "Atikaya" variety for general health promotion and "Karibatta" for skin ailments and in treatment of herpes. In this context, it may be worthwhile to test the potential therapeutic values of these traditional rice varieties. In the present study, in addition to the most commonly grown and consumed local varieties and improved varieties, we have also included medicinal varieties viz., Karigajivili, Karijaddu, Doddabyranellu, Kempusannakki and Sannakki Batta which have strong traditional knowledge indications for their medicinal properties. The cellular anti-oxidant assay (for antioxidant property) and Lymphocyte proliferation assays (for Immune modulation) were carried out. It is evident from the results that some of these varieties have antioxidant and immunomodulatory properties and hence using them on a regular basis would help in health promotion.

**Keywords:** Lymphocyte, Bio-prospecting, Central Western Ghats, anti-oxidant, Karnataka, hotspot

### Introduction

India is one of the major centers of rice diversity in south Asian countries and we witness numerous landraces suitable for various climatic requirements across the country. Among many states, Karnataka is one of the most potential states for rice diversity conservation. Occurrence of Various ecosystems such as coastal, hilly, southern and northern dry zone has contributed immense diversity of rice varieties. Notably, the hilly region, which constitutes the Western Ghats, is one of the 34 global hotspots of diversity in India and of which one third is in the state of Karnataka ([www.biodiversityhotspots.org](http://www.biodiversityhotspots.org)). The Ghats is a center of diversity for many agricultural crops including rice. In fact, it is estimated that more than 500-700 indigenous rice varieties are known to occur across the Western Ghats and they are in use since centuries for meeting various purposes of farmers. It is recognized that these varieties warrant in depth studies to conserve and utilize them for the posterity. One of the areas in which these varieties can be fruitfully exploited is their medicinal properties. Though these rice varieties are not branded as medicinal, there is a practice of using local landraces of rice in many parts of Karnataka for this purpose. For instance, in Uttara Kannada district of the Western Ghats, there is a practice of using "Atikaya" variety for general health promotion and "Karibatta" for skin ailments and in treatment of herpes. In fact, few red rice varieties are used in the ashrams and meditation organizations in the central Western Ghats. In this context, it may be worthwhile to test the potential therapeutic values of these traditional rice varieties so that new products would be developed to benefit both the grower and the consumer. Hence this study was undertaken.

### Material and methods

However, it is interesting to note that there are different sets traditional rice varieties grown in each taluk of the central Western Ghats. In view of the daily use of these traditional varieties by farmers, we wanted to test whether these traditional varieties offer any therapeutic advantage over improved varieties. For this study, we have chosen Thirthally taluk and from among the varieties, we have chosen the following seven varieties being cultivated in the taluk. In addition to the most commonly grown and consumed local varieties and improved varieties, we have also included medicinal varieties viz., Karigajivili, Karijaddu, Doddabyranellu, Kempusannakki and Sannakki Batta which have strong traditional knowledge indications as for as their medicinal properties are concerned.

**Table 1:** Traditional varieties chosen for the study.

Sl. No.	Variety	Remarks
1	ITE rice	Popular Improved variety in Thirthahalli area
2	Sannavalaya rice	Popular traditional variety in Thirthahalli area
3	Sonamasuri-I rice	Improved variety
4	Sonamasuri-II rice	Improved variety
5	Boiled rice (Jolaga)	Red rice variety; Popular among farmers
6	Abhilasha rice	Improved variety
7	Jolaga rice	Red Rice variety; Popular among farmers
8	Kempusannakki	Traditional variety
9	Karigajivili	With known medicinal properties as per traditional knowledge
10	Sannakki Batta	With known medicinal properties as per traditional knowledge
11	Karijaddu	A red rice variety used for treating diseases in Uttara Kannada district
12	Doddabyranellu	A popular red rice variety in southern drier parts of the village which is used for treating various ailments

For arriving at the therapeutic properties of rice varieties, we have chosen four important tests aimed at testing various properties (please see table for details) that are pertinent now a days in pharmaceutical sector. In these tests, the rice samples (about 250 gms) are solubilized in various solvents (buffer, DMSO and Alcohol) to test its solubility. If they were not soluble in any of the solvents then rice samples were initially extracted with methanol followed by water. Then the extract in specific concentrations was used for testing the following activities (on specific cell lines) as given in the table. Based on the results, we can conclude whether these rice varieties have any of these therapeutic properties or otherwise compared to improved varieties.

**Table 2:** Tests employed for assessing the therapeutic properties of rice varieties

Activity	Relevance	Remarks
Cellular anti-oxidant assay	Anti-oxidant property	Avoids damage to the cells
Lymphocyte proliferation	Immune modulation	Increases immunity

## Results and Discussion

### Antioxidant activity

Free radical play an important role in various pathological diseases. In a cellular system, the ROS (reactive oxygen species) is responsible for cell damage and cell death [1]. Antioxidants inhibits the formation of free radical by reducing the ROS or from chelate itself with ROS 2. In the current study, all the rice varieties were evaluated for their antioxidant activity at non-cytotoxic concentrations against AAPH induced oxidative stress in HepG2 cells. Antioxidant potential of medicinal rice varieties were represented in the form of CAA units. Antioxidant activity of the test substance are in the following order Sannavalaya rice (41 units at 25 µg/ml) > IET rice (34.9) > Sonamasuri-I rice (29.6) ≥ Sonamasuri-II rice (29.1) ≥Doddabyranellu (29) ≥ Sannakkibatta (28) >Boiled rice (Jolaga) > Abhilasha rice > Jolaga rice. The last three showed less than 20 units which is considered as non active as for as anti-oxidant property is concerned. Further, remaining three medicinal rice varieties (Karijaddu, Karigajivilli and Kempusannakki) did not show any antioxidant property. It appears that Sannavalaya rice is the highest in terms of giving anti-oxidant property.

**Table 3:** Antioxidant effect of Sannavalaya rice on AAPH treated HepG2 cells.

Sample*	Concentration (µg/ml)	AUC	CAA unit
Control	---	4267	---
Sannavalaya rice	1.56	4017	5.8
	3.12	3529	17.2
	6.25	3265	23.5
	12.5	2654	37.8
	25	2514	41.0

### Immunomodulatory response

In plant body the immune system is an important system it will protect against various pathogens and foreign bodies [3]. Both Jolaga rice (boiled) and Jolaga rice (raw) at the highest concentration of 100 µg/ml showed a mild cytotoxicity with 1.3 and 1.4 times fold decrease of lymphocyte proliferation respectively in the naïve murine splenocytes. This means these variety shows immunomodulatory properties even in the absence of an external agent which is generally used for inducing lymphocyte proliferation. However other varieties are not capable of this property.

When rice extracts were used along with an external agent (specifically used for inducing lymphocyte proliferation), only IET rice, Sannavalaya rice, Jolaga rice (boiled) and

Abilasha rice showed statistically significant activity with fold decrease of 7.6, 11.4, 3.5, 2.6 times respectively. Among medicinal rice varieties, Kempu Sannakki showed activity (1.3 fold decrease) at a non-cytotoxic concentration of 25 µg/mL; Sannakki Bhatta showed activity (1.2) at non-cytotoxic concentrations of 12.5 µg/mL and 25 µg/mL; Doddabyranellu showed activity (1.2-1.6) at non-cytotoxic concentrations ranging from 25 µg/mL to 100 µg/mL. However, Karijaddu and Karigajivili did not show any activity at the tested concentrations. This means the immunomodulatory activity of the medicinal rice varieties is in the following order Sannavalaya rice > IET rice > Jolaga rice > Abilasha rice in the presence of an external agent.

**Table 4:** Immunomodulatory response of different varieties.

S. no.	Experiment performed		Inference	Fold Increase (I) / decrease (D)
	Mitogen	Sample name		
1.	Naïve	IET rice	NA	NS
2.		Sanavaliya Rice	NA	NS
3.		Sonamasuri Rice type 1	NA	NS
4.		Jolaga Rice - boiled	Cytotoxic at highest concentration (100 µg/ml)	1.3 (D)***
5.		Abilasha rice	NA	NS
6.		Jolaga Rice – raw	Cytotoxic at highest concentration (100 µg/ml)	1.4 (D)***
7.		Sonamasuri rice type 2	NA	NS
8.	Con A (0.5 µg/ml)	IET rice	Active at 100 µg/ml	7.6 (D)***
9.		Sanavaliya Rice	Active at 100 µg/ml	11.4 (D)***
10.		Sonamasuri Rice type 1	NA	NS
11.		Jolaga Rice – boiled	Active at 50 µg/ml	3.5 (D)***
12.		Abilasha rice	Active at 100 µg/ml	2.6 (D)***
13.		Jolaga Rice – raw	NA	NS
14.		Sonamasuri rice type 2	NA	NS

### Conclusion

It is evident from the results that some of these varieties have antioxidant and immunomodulatory properties and hence eating them on a regular basis would help in these two aspects. Especially Sannvalya variety is having both properties followed by IET rice. These two varieties among the 12 varieties chosen for the study can be promoted for further use. Further it appears that these two properties does not seem to very much depend on the color of rice i.e., red rice varieties have not showed any superiority over white rice varieties in the present study. Further it was evident that medicinal varieties (medicine for various other ailments) chosen in the study are not capable of offering any significant advantage in terms of these two properties. So consuming medicinal varieties may give the concerned therapeutic properties for ailments but will not help for enhancing these two properties. They might act through other mechanisms.

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