Popular Article

e-ISSN: 2583-0147

Volume 2 Issue 12
Page: 0306 – 0308

Amudha Kailappan
Department of Rice
Centre for Plant Breeding & Genetics
Tamil Nadu Agricultural University
Coimbatore
Tamil Nadu
India - 641 003

Vanitha Jayaraman
Plant Breeding and Genetics
SRM Institute of Science and Technology
Vendhar Nagar, Baburayanpettai
Tamil Nadu
India

Geetha Seshsadri
Centre for Plant Breeding & Genetics
Tamil Nadu Agricultural University
Coimbatore
Tamil Nadu
India - 641 003

Corresponding Author
Amudha Kailappan
amudha_pbg@yahoo.com

Polyphenols in Rice

Phenolic compounds are the secondary metabolites synthesized in plants. Basically in chemical composition it is a heterogeneous molecule with phenol group in its basic structure. Polyphenols exists in various forms like simple molecules to polymerized structures like phenolic acids to tannins respectively. The major phenolic compounds were phenolic acids, flavonoids and anthocyanins.

INTRODUCTION

Phenolic acids are broadly classified in to benzoic acid derivatives and cinnamic acid derivaties. Benzoic acid derivatives includes p-hydroxybenzoic, protocatechuic, vanillic, gallic and syringic acids while cinnamic acid derivaties includes caffeic ferulic. p-coumaric and sinapic acids. These are found in free form, form of soluble conjugates or in the insoluble bound form (Walter *et al.* 2013). Anthocyanidins being the most abundant form of flavonoids which is a 15 carbon compound organized in two aromatic rings by a three carbon chain are responsible for pigmentation like red, black and purple. The anthocyanidins bound to glycosides were called as anthocyanins (Kong *et al.,* 2003). Phenolic compounds exhibit antioxidant property.

Under present day situation, several chronic diseases including cardiovascular diseases, ageing, diabetes and cancer are of common occurrence and have been related to oxidative stress in humans. Phenolic compounds reduce the oxidative stress by either by increasing the activity of antioxidant enzymes and induction of synthesis of antioxidant proteins (Chung and Shin, 2007) or by directly scavenging reactive species including hydroxyl, peroxyl and superoxide radicals acting as chain breaking antioxidants. The antioxidant property of phenolic acids is mainly due to number and position of hydroxyl group in phenolic ring which can stabilize and delocalize unpaired electrons. In case of anthocyanins, its structural characteristics make them highly reactive towards oxygen species. In this perspective, several research work have been undertaken to study the polyphenol and antioxidant properties in rice which is a staple food for more than a half of the world's population, particularly

using pigmented genotypes/landraces to explore the medicinal or therapeutic value of rice for combating the life style related diseases.

Biochemical profiling of different types of rice had shown that the variation in phenolic content was associated with pericarp colour rather than the subspecies of rice like *indica / japonica.* Pigmented genotypes had four times higher total phenols than the non-pigmented entries.

Comparison of polyphenolic content and antioxidant capacity in the bran of black, red and white colour Thai rice cultivars had shown that antioxidant capacity of polyphenols in bran layer was in high in red colour genotypes followed by black and then white colour genotypes.

Investigation on the effect of processing on concentration of total soluble phenolic content in red, black and brown pericarp genotypes subjected to varied level of processing, like brown rice, polished rice, parboiled brown rice and parboiled polished rice indicated that parboiling reduced the total soluble phenolic content and antioxidant activity in the rice grains of the genotypes studied.

The different methods of cooking also exert a variation in anthocyanin concentration and its antioxidant capacity. In the research work carried out using glutinous and non-glutinous rice genotypes it was observed that the non-glutinous genotypes marked a decrease in anthocyanin concentration and antioxidant capacity when soaked in water prior to cooking. When cooked by the wet cooking method, those glutinous genotypes reported high anthocyanin concentration remained highest whereas in the low anthocyanin concentration genotypes there remained almost no anthocyanin concentration after cooking. Thus various cooking methods play a vital role in maintaining quality in rice genotypes.

Hu *et al.,* (2003) profiled bioactive compounds in black rice and reported that antioxidant and anti-inflammatory properties of black rice were due to anthocyanin pigments especially cyanidin-3-glucoside and peonidin-3-glucoside which boosted antioxidant activity and free radical scavenging capacity of black rice. It has immense application in nutritional and functional food formulation

Many indigenous red rice genotypes were evaluated for nutritional as well as medicinal properties in comparison with white rice genotypes. The study revealed that red rice exhibited a nutritional value comparable to many millets with an excellent antioxidant property by possessing high total phenolic, flavonoid and DPHH (2,2-diphenyl-1-picryl-hydrazyl-hydrate) scavenging activity to a tune of 143.38 mg GAE/100g, 120.0 mg R.e./100 gm and 25 percent respectively. So red rice was concluded as best suited for the diets of diabetics, and also tagged as a healthier alternative for white or polished rice (Raghuvanshi *et al.*2017).

In a study undertaken to profile the therapeutic value of *Kavuni* a popular traditional rice variety of Tamil Nadu known for its medicinal value as mentioned in Ayurveda against the popularly eaten white rice varieties of Tamil Nadu it was noticed that *Kavuni* grains had 29-35% reduced level of total soluble sugars, low fat content (8-35%), 21-52% increased dietary fiber and 7-24% increased total protein content than white rice genotypes. Also, *Kavuni* grains possessed significantly higher levels of carotenoids (β- carotene-462µg/100g, lutein -221.6µg/100g) total phenolics (288µg/100g) antioxidant activity and inhibitory activity against α-amylose and α-glucosidase (Valarmathi *et al.* 2015).

Like *Kavuni* there are several other traditional rice cultivars known for its medicinal and nutritional value in Tamil Nadu as mentioned in ancient tamil literatures and Ayurvedic medicines. The scientific basis for its significance is still unknown. Biochemical characterization for understanding the nutritional as well as medicinal significance of important landraces is still in primitive stage.

CONCLUSION

Many such significantly important rice landraces need to be explored for the secondary metabolites. Once such database is created, using advanced molecular approaches like genome sequencing, gene expression studies and OMICS these significantly important landraces may be exploited through conventional breeding for ensuring the nutritional as well as the medicinal concern of the growing population in addition to food security.

REFERENCES

Walter, M., E. Marchesan, P. F. S. Massoni, L. P. da Silva, G. M. S. Sartori, and R. B. Ferreira. 2013. "Antioxidant properties of rice grains with light brown, red and black pericarp colors and the effect of processing."*Food research international* 50 (2):698-703.

Kong, J.M., L.S. Chia, N.K. Goh, T.F. Chia, and R. Brouillard. 2003. "Analysis and biological activities of anthocyanins." *Phytochemistry* 64 (5):923-933.

Chung, H. S., and J. C. Shin. 2007. "Characterization of antioxidant alkaloids and phenolic acids from anthocyanin-pigmented rice (*Oryza sativa* cv. *Heugjinjubyeo*)." *Food chemistry* 104 (4):1670-1677.

Hu, C., J. Zawistowski, W. Ling, and D. D. Kitts. 2003. "Black rice (*Oryza sativa* L. *indica*) pigmented fraction suppresses both reactive oxygen species and nitric oxide in chemical and biological model systems." *Journal of agricultural and food chemistry* 51 (18):5271-5277.

Raghuvanshi, R., A. Dutta, G. Tewari, and S. Suri. 2017. "Qualitative characteristics of red rice and white rice procured from local market of Uttarakhand: a comparative study." *Journal of Rice Research* 10:49-53.

Valarmathi, R., M. Raveendran, S. Robin, and N. Senthil. 2015. "Unraveling the nutritional and therapeutic properties of 'Kavuni'a traditional rice variety of Tamil Nadu." *Journal of Plant Biochemistry and Biotechnology* 24 (3):305-315.