



***In-vitro* Antibacterial Activity of Sri Lankan Traditional Rice (*Oryza sativa* L.) Extracts against Bacteria Causing Skin and Soft Tissue Infections**

Pahan Indika Godakumbura^{*1}, Thiloka Ishani Kariyawasam¹, Prashantha Malavi Arachchi¹,
Neluka Fernando², Sirimal Premakumara³

¹Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda 10250, Sri Lanka

²Department of Microbiology, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda 10250, Sri Lanka

³Industrial Technology Institute, Colombo 7, 00700, Sri Lanka

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ABSTRACT

The aim of this study was to evaluate the potential antibacterial activity of the extracts of selected parboiled and un-parboiled Sri Lankan traditional rice against bacteria causing skin and soft tissue infections. Methanolic extracts of five Sri Lankan traditional rice including Kalu Heenati, Pokkali, Rathdal, Kahawanu and Sudu Murunga were used for *in vitro* antibacterial analysis. Antibacterial activity was evaluated in both the parboiled and un-parboiled rice samples. Concentrations of rice extracts used for the assays were 1000 µg/mL and 2000 µg/mL from the each extract. The antibacterial activity was evaluated against common bacteria causing skin and soft tissue infections (*Staphylococcus aureus* (ATCC 25923), *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922) and three clinical isolates of Methicillin resistant *staphylococcus aureus* (MRSA)) by well diffusion method and viable colony count technique. According to the results, methanolic extracts of all the selected Sri Lankan traditional rice varieties exhibited a potent antibacterial activity against *Staphylococcus aureus* with minimum bactericidal concentrations (MBC) of 200 µg/mL (minimum incubation time (MIT); 30 min) for Rathdal, 200 µg/mL (MIT; 60 min) for Kalu Heenati, Pokkali and Kahawanu, and 2000 µg/mL (MIT; 60 min) for Sudu Murunga. The largest inhibition zones were observed in the extracts of Kalu Heenati and Rathdal. Kalu Heenati, Pokkali and Rathdal showed an efficacious inhibitory effect against MRSA (MBC; 200 µg/mL, MIT; 60 min), whereas the highest inhibitory activity was observed for Rathdal. Only the extract of Kalu Heenati was slightly active against *Pseudomonas aeruginosa*. None of the rice extracts studied showed an antibacterial activity against *Escherichia coli*. Reduction and loss of antibacterial activity was detected in rice after subjected to parboiling. In conclusion, Sri Lankan traditional rice varieties with red pericarp are good sources of antibacterial compounds mainly against Gram positive bacteria. Methanolic extract of Rathdal and Kalu Heenati showed a high efficacious inhibitory effect against skin and wound pathogens of *Staphylococcus aureus* and MRSA.

KEY WORDS: Traditional rice; Parboiled; Antibacterial activity; Skin and soft tissue infections

1. INTRODUCTION

Bacterial skin and soft tissue infections (SSTIs) are some of the most common infections which can occur from infants to older adults^[1,2,3]. Clinical manifestations of SSTIs encompass a wide spectrum of clinical presentations ranging from mild superficial epidermal infections to life threatening rapidly progressive infections^[3,4]. This includes cellulitis, erysipelas, impetigo, ecthyma, erythrasma, bacterial

folliculitis, furuncles, carbuncles, and abscesses, hidradenitis suppurativa, surgical site infection, pressure ulcers and venous and arterial ulcers, necrotizing skin and soft tissue infections, fournier gangrene and clostridialmyonecrosis. Bacterial SSTIs involves bacterial invasion of the layers of the skin and underlying soft tissues. Gram positive *Staphylococcus aureus* and *Streptococcus pyogenes* and Gram negative *Pseudomonas aeruginosa* and *Escherichia coli* are the most commonly identified causes of SSTIs^[5,6]. Multidrug resistant Methicillin resistant *staphylococcus aureus* (MRSA) strains are being identified more frequently as the causative agents for SSTIs^[7]. In recent years, these infections have become more difficult to treat, as pathogens have developed resistance to many different types of antibiotics^[8,9]. Despite drugs being

***Corresponding author.**

Dr. Pahan Indika Godakumbura
Department of Chemistry,
Faculty of Applied Sciences,
University of Sri Jayewardenepura,
Nugegoda 10250, Sri Lanka

EFFECT OF PARBOILING ON MINERALS AND HEAVY METALS OF SELECTED SRI LANKAN TRADITIONAL RICE VARIETIES GROWN UNDER ORGANIC FARMING

TI Kariyawasam¹, PI Godakumbura^{1*}, MAB Prashantha¹ and GAS Premakumara²

¹Department of Chemistry, University of Sri Jayewardenepura, Nugegoda 10250, Sri Lanka

²Industrial Technology Institute, Colombo 7, 00700, Sri Lanka

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ABSTRACT

The study was conducted to evaluate the effects of parboiling treatment on the minerals and heavy metals of six Sri Lankan traditional rice varieties; Kalu heenati, Pokkali, Gurusinghe wee, Kahawanu, Sudu murunga and Unakola samba. Metals were determined by using ICP-AES and AAS. Parboiling can be considered as a suitable rice processing method for Pokkali and Kahawanu and not for Kalu heenati and Unakola samba in order to furnish the recommended daily intake of the micronutrients. Un-parboiled Kalu heenati and both un-parboiled and parboiled Kahawanu can be considered as the most suitable rice varieties for daily consumption in order to maintain the recommended daily intake of iron. It was identified that Pokkali rice contained the highest iron content of 29.5 mg/100 g. This amount has further increased by 66.7% after parboiling. Therefore both parboiled and un-parboiled Pokkali can be considered as the best dietary supplement among these rice varieties for iron deficiency and for pregnant mothers. Selected heavy metals including As, Cd, Pb and Cu were not detected in the selected Sri Lankan traditional rice varieties.

Key words: Heavy metals, Parboiling, Sri Lanka, Traditional rice varieties

INTRODUCTION

In ancient times, over 2000 different varieties of rice are said to be grown all over the Sri Lanka (Amarasingha *et al* 2013). With the current trend of global awareness of the benefits of organic food and medicinal properties of Sri Lankan traditional rice varieties (STRV), and nowadays need of traditional rice is becoming very high. Organic farming relies on ecofriendly techniques which preserve the nutritional values and sustainability of the environment. Almost all the STRV were organically farmed, which relies on techniques such as crop rotation, green manure, compost, biological pest control and depends on ancient irrigation systems for a sustained water supply. The trend of organically farmed STRV is becoming popularized as a result of the negative impact of agrochemicals and fertilizers to the environment and human health.

STRV show high nutritional value, different texture, appearance, aroma and taste compared to improved rice varieties. Previous studies of twenty five indigenous rice varieties showed bio-activities such as antioxidant, anti-amylase, anti-glycation and anti-inflammatory properties and higher nutritional composition compared to improved varieties (Abeysekera *et al* 2013). Nutrient rich food play a vital role as a way to decrease the growing numbers of children and women in Sri Lanka affected by nutrient deficiencies, including Iron Deficiency Anemia (IDA).

Parboiled rice is the major staple throughout South Asia. About one-fifth of the world's rice is parboiled (Bhattacharya *et al* 1985). Hence, parboiling can be regarded as one of the most popular processing methods in the rice industry. This includes soaking paddy, steaming at high or atmospheric pressure, and

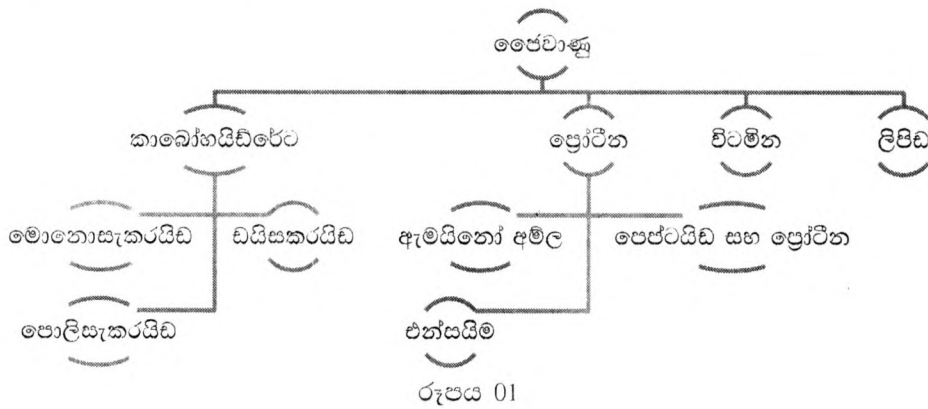
*Corresponding author: pahanig@gmail.com

ජෛවාණු හඳුනාගැනීම



ආචාර්ය පහන් ගොඩකුඹුර
ජ්‍යෙෂ්ඨ කථිකාචාර්ය
ව්‍යවහාරික විද්‍යා පීඨය
ශ්‍රී ජයවර්ධනපුර විශ්වවිද්‍යාලය

ජීවීන් තුළ සිදුවන රසායනික ක්‍රියාවලි පිළිබඳ හැදෑරීම ජෛව රසායනය තුළ සිදුවේ. ජීවීන්ගේ තැනුම් ඒකකය සෛල වන අතර සියලු ම සජීවී සෛල නිර්මාණය වී තිබෙන්නේ ජෛවාණුවලිනි. සජීවී දේහ තුළ පවතින ඕනෑම ජෛවාණුවක් කාබනික අණුවක් වේ. කාබන් විවිධ ආකාරයට සම්බන්ධ වීමෙන් සෑදෙන ජෛවාණු මඟින් ජීවය පවත්වා ගැනීමට විශාල මෙහෙයක් ඉටු කරයි. කාබෝහයිඩ්‍රේට්, ප්‍රෝටීන, ලිපිඩ සහ නියුකිලික් අම්ල, විටමින් හා ලැක්ටික් අම්ලය ජෛවාණු සඳහා උදාරහණ වේ. ජීවී පද්ධති සෑදී ඇති ජෛවාණුවල ව්‍යුහය, කෘත්‍ය සහ ඒවා හඳුනා ගන්නා පරීක්ෂණ පිළිබඳ අවධානය මෙහි දී යොමු කෙරේ. ඔබ විෂය මාලාවට අනුකූල වන ජෛවාණු පහත රූපයෙන් දැක්වෙන අතර කොටස් වශයෙන් විදුනෙන සඟරාවෙන් ඔබ වෙත පෙළගැස්වීමට අපේක්ෂා කෙරේ.



මෙම පරිච්ඡේදය තුළින් කාබෝහයිඩ්‍රේට් පිළිබඳ හදාරමු.

කාබෝහයිඩ්‍රේට්

කාබෝහයිඩ්‍රේට් යනු කාබන්, හයිඩ්‍රජන් හා ඔක්සිජන් අන්තර්ගත සංයෝග කුලකයකි. ජීවී දේහ තුළ ඇති සෛලවල ව්‍යුහය සෑදීමත්, ශක්තිය ගබඩා කරන අණුවක් ලෙසත් කාබෝහයිඩ්‍රේට් විශාල මෙහෙයක් ඉටු කරයි. මේවායේ අඩංගු වන ක්‍රියාකාරී කාණ්ඩ වනුයේ හයිඩ්‍රොක්සිල් කාණ්ඩ (OH) හෝ කාබනයිල් (C=O) කාණ්ඩ වේ. මෙහිදී (OH) කාණ්ඩ දෙකක් හෝ වැඩි ගණනක් අඩංගු විය හැකි අතර කාබනයිල් කාණ්ඩය, ඇල්ඩිහයිඩ් (CHO) හෝ කීටෝ (C=O) කාණ්ඩයක් ලෙසට ප්‍රවර්තනය හැකි වේ. ජලය සමඟ ප්‍රතික්‍රියා කිරීමෙන් සරල සංයෝග වලට නැවත බිඳ හෙළිය නොහැකි කාබෝහයිඩ්‍රේට් සරල සීනි ලෙස හැඳින්වේ. මෙම සරල සීනි අණුවල කාබන් දාමයේ කාබන් (3-7) දක්වා අඩංගු විය හැකි අතර ඔබ විෂය මාලාවට අඩංගු වන්නේ C6 ඇති සංයෝග (හෙක්සෝස්) පමණි. මේවා විවෘත දාම ලෙස ද වක්‍රීය සංයෝග ලෙසද පැවතිය හැකිය. සරල සීනි එකිනෙක සම්බන්ධ වීමෙන් විශාල බහුඅවයව සෑදීමට හැකියාවක් ඇත. එබැවින් කාබෝහයිඩ්‍රේට් වල ඇති පුනරාවර්තන ඒකක ගණන අනුව මොනොසැකරයිඩ, ඩයිසැකරයිඩ සහ පොලිසැකරයිඩ ලෙස වර්ග