

NEWSLETTER

NATIONAL RESEARCH COUNCIL

VOLUME 01 | ISSUE NO 3 | DEC 2022 | ISSN NO 2950-7464



THE 1ST RESEARCH SYMPOSIUM OF NATIONAL RESEARCH COUNCIL

The National Research Council (NRC) With the concept of the symposium, we in Sri Lanka conducted the 1st national research symposium in parallel to the world science Day 10th November 2022. The Inaugural program was graced by Honorable Minister of Education, Dr. Susil Premjayanth, ministry officials, and council members of NRC.

There were 10 successfully completed research projects funded within the year 2021, which were presented at the 1st research symposium on the 14th & 15th November 2022.

Since the inception, NRC has been unique in its approaches in assisting the government in Science & Technology by means of funding mechanisms, institutional capacity building, recognition of scientific excellence and motivating researchers. That uniqueness has been instrumental in bringing us to where we stand as an institution today.

The Research Symposium of the NRC, is a novel step we have taken today that we hope to continue annually.

As this is a pioneering institute for research funding in Sri Lanka, it is one of our duties to ensure that public funds are invested in research which can yield the highest benefit to the public in return.



EDITORIAL TEAM

Prof. Hemantha Dodampahala
Prof. Thakshala Seresinhe
Dr. Shanika Jayasekera

The 1st Research Symposium of National Research Council

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INVESTIGATOR DRIVEN GRANTS FUNDED RESEARCH PROJECTS 2022

Grant Number	Principal Investigator & Institution	Title
22-027	Prof. D N Magana-Arachchi National Institute of Fundamental Studies	Transcriptome analysis of mycobacteria in serum exosomes of latent tuberculosis patients for candidate biomarker identification.
22-031	Prof. RD Jayasinghe University of Peradeniya	Fourier transform infrared (FTIR) spectroscopy and, metabolomic screening with gene expression profiling of body fluids for early detection of Oral squamous cell carcinoma (OSCC).
22-035	Dr. K M G K Pamunuwa Wayamba University of Sri Lanka	Development, characterization and antimicrobial activity assessment of carbohydrate films incorporated with antimicrobial agent loaded montmorillonite and halloysite clays for active food packaging applications
22-036	Dr. C T D Dadigamuwage University of Sri Jayewardenepura	Assess the suitable conditions for sustainable and environmentally friendly aquaculture of the sea cucumber <i>Holothuria scabra</i> (sandfish) in northern Sri Lanka.
22-037	Dr. K Vivehananthan Open University of Sri Lanka	Evaluation and Characterization of Biofilm-forming Bacteria from Water Plumbing System for Developing Biofilm free Nano-coated Water Pipelines
22-041	Dr. T H K Nawarathna University of Jaffna	Slope surface stabilization by using polymer modified microbial induced carbonate precipitation method – Ecofriendly and sustainable alternative approach for the conventional cement grouting
22-047	Dr. WMGI Priyadarshana University of Sri Jayewardenepura	Colloidal dispersions of cellulose nanostructures from sustainable raw materials and their applications in packaging industry
22-060	Dr. JR Gamage University of Moratuwa	Development of novel value-added forms of processed cinnamon through automation
22-062	Dr. RP Wanigatunge University of Kelaniya	Assessment of species diversity, anti-phytopathogenic activities of crude extracts and in vitro growth performances of marine macroalgae in Sri Lanka
22-070	Dr. NAID Nissanka University of Moratuwa	Development of a computational model to simulate fate and transport of accidental oil spills for Sri Lankan territorial waters and maritime zone
22-075	Dr. MRN Cassim University of Colombo	"The use of PGE1 in patients with non-revascularizable Chronic limb threatening Ischaemia- randomized study"
22-095	Dr. JMCK Jayawardana Sabaragamuwa University	Developing ecological tools for monitoring river health using bio-indicators: A case study from Walawe River basin
22-101	Prof. SCK Rubasinghe University of Peradeniya	Cryptogamic epiphytes as indicators of successional changes in tropical lowland rainforests in Sri Lanka
22-104	Dr. SMK Widana Gamage University of Ruhana	Identification and characterization of phytotoxic metabolites of actinomycetes; candidates for the development of an eco-friendly tool for sustainable weed management
22-114	Dr. NM Adasooriyage University of Peradeniya	Mechanochemical synthesis of urea cocrystals as a sustained release nitrogen source
22-127	Dr. TBNS Madugalla South Eastern University	Preparation of electrically conductive magnetic toner powders from Sri Lankan graphite and iron ores
22-131	Prof. AJ Mohotti University of Peradeniya	Design and Implementation of Microenvironment Conditions for Tea and Ornamental Foliage Plants using Precision Agriculture Systems Powered by Solar Photovoltaics

SOME HIGHLIGHTS OF ACHIEVEMENTS OF NRC RESEARCH PROJECTS

Highlights of achievements of few research projects are presented in this newsletter and in, each Newsletter, NRC will present to the reader a few more outputs of research projects funded by the NRC.

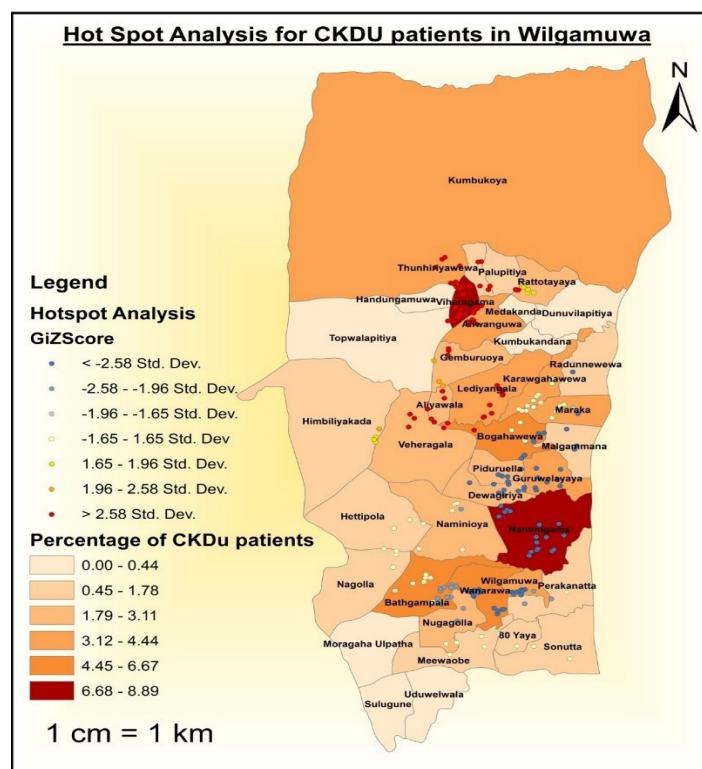
A comprehensive study on chronic kidney disease of uncertain etiology (CKDu) in Sri Lanka **Achievements in Target Oriented Multidisciplinary Research Projects** **NRC Grant No: TO14-05**

The National Research Council of Sri Lanka (NRC) aims at finding scientific solutions for nationally burning issues such as CKDu, dengue, dairy industry, agriculture, water crisis, etc. through Target Oriented Multidisciplinary Research Grants (TO) and the grant scheme was started in 2014 by awarding 5 projects, each worth approximately Rs. 50 million, the highest amount of funding for scientific research in the nation. The NRC has awarded a team of researchers from the University of Peradeniya to carry out a comprehensive study on chronic kidney disease of uncertain etiology (CKDu) in Sri Lanka over a five-year period.

Chronic Kidney Disease (CKD) is an irreversible deterioration in renal function. The incidence of CKD is increasing the world over mainly due to increasing rates of diabetes and hypertension, and an aging population. While this is also true for Sri Lanka, the incidence of CKD is disproportionately high in certain regions of the dry zone which occurs in the absence of the well-known aetiological factors – Chronic Kidney Diseases with undetermined etiology (CKDu). CKDu is more common among males in farming communities in the age group 40-60 years. Early disease is asymptomatic, but there is rapid progression at the end stage of renal disease resulting in high morbidity and mortality. CKDu is a tubulointerstitial disease with interstitial fibrosis and tubular atrophy. Environmental factors, together with occupational and social factors, are likely to play an important role in its pathogenesis.

The clinical investigation led to redefining diagnostic criteria and the case definition of CKDu, and identified the superiority of Serum Cystatin C and Creatinine over testing for urinary protein. When screening for CKDu. In addition, a four-marker panel has been established to detect and differentiate CKDu from other CKD at an early stage.

The investigation also found that bone mineral disease and cardiovascular complications were uncommon while anaemia was common in CKDu when compared with CKD. Rapid disease progression was especially seen in young male patients. The environmental component of the study investigated possible causative factors associated with water, soil, tank sediment, food, air, etc. for possible aetiological factors. The results showed that there was no association between CKDu and toxic trace elements, such as, Cd, As, Pb and U; the concentrations of all these elements were found to be low, and in most cases several-fold lower than the recommended safe levels in areas where CKDu was prevalent. The levels of some of these trace elements were higher in the samples tested from other geographic regions in Sri Lanka where CKDu is non-endemic.



Detailed water analyses in the dry zone CKDu-endemic regions showed the synergetic influence of permanent water hardness with high levels of Mg (rather than Ca) and high fluoride content on the development of CKDu.

Investigation on a CKDu animal model found that Fluoride caused the renal cell damage in a dose and time dependent manner with decreased cell viability and mitochondrial activity. Fluoride exposure also caused impaired hepatic function.

The animal model also showed that dehydration can have a significant, albeit indirect, effect on CKDu progression. Initial renal damage that can occur in any person who drinks water with high fluoride content and hardness may be reversible if detected early, and by improving water quality.

Ensuring food security through developing climate smart crop varieties and cultivation techniques in Sri Lanka

Achievements in Target Oriented Multidisciplinary Research Projects

NRC Grant No: TO 14-24



The NRC has awarded a team of researchers from the Ministry of Agriculture to carry out the research project titled Ensuring food security through developing climate smart crop varieties and cultivation techniques in Sri Lanka over a five-year period.

Major objectives of the project were; developing high yielding, pest and disease tolerant/resistant, short duration varieties of Chilli, Maize, Mungbean and Rice for both non stressed and high temperature and water stressed ecosystems, developing climate smart agricultural practices with suitable agronomic and cultural management options and conservation farming systems for identified stressed ecosystems, identification of vulnerable ecosystems and propose possible adaptation strategies, and Identification of vulnerable ecosystems and propose possible adaptation strategies.

Varieties and technologies released under this project replaced 35% and 50% adapted existing cultivation extent for Mungbean and chilli, respectively. This is a big value to the food crop sector in the country.

Providing safe drinking water (with reduced hardness and fluoride content) seems, therefore, to be the most important measure to reduce CKDu in the dry zone of Sri Lanka.

In December 2019, Prof. Rohana Chandrajith and his team successfully completed the grant. They have published more than 14 SCIE publications, produced 5 PhDs, and conveyed research findings to the Ministry of Water and the Ministry of Health. In order to offer society with clean, safe water and prevent CKDu, the NRC awarded 2 additional TO grants in 2016, To two teams of members from University of Colombo and National Institute of fundamental studies(NIFS).

High yielding hybrid chilli variety MICHHY2 was released and a seed production program of MICHHY1 was conducted under this project. Both these varieties have made a significant impact on green and dry chilli production in the country. The achievable green chilli yield level of these varieties under farmer management is greater than 35 t/ha which is comparable or higher than the yields of imported hybrid chilli varieties. One kilogram of hybrid chilli seeds is sold at prices between Rs 120,000 to Rs 180,000 in the local market. Due to this increased chilli production, annual dry chilli importation could be reduced to a considerable amount (nearly 52,000 t). In addition, three promising chilli lines MICHPL 04, MICHPL 22 and MICHPL 38 were identified as drought tolerant lines. Hybrid chilli seed production package developed by the project is adopted in the government seed farms and by the private sector (7 companies) in their local hybrid chilli seed production programs.



Micro irrigation based agronomic management packages were developed by this project further increasing the productivity of green chilli up to 45 t/ha. In some of the farmers' fields, the variety MICHHY 1 has recorded more than 50 t/ha with the drip irrigation-based agronomic management package. These drip and sprinkler-based packages could save irrigation water by 70% and 30% respectively. These water saving packages are viable options to achieve higher yields with limiting water resulted from climate change impacts. Moreover, labour and energy savings can be achieved due to the lower weeding requirement and lesser pumping time resulting more economic benefits in chilli cultivation. Three Maize varieties (MIMZHY3, MIMZHY4 and MIMZHY5) with an average yield of 6.5 t/ha (potential yield is 8 t/ha) were released under this project. The per plant yield of MIMZHY 5 is higher than that of Pacific 339 under moisture stress condition Pacific 339 gives an average yield of 7 t/ha. The lowest yield reduction percentage was showed by MIMZ03 among other tested varieties (MIMZHY4, MIMZHY5 and Pacific 339) under drought stress condition. An agronomic package was developed for maize hybrid seed production. Around 1105 ha has already been cultivated for F1 seed production from these maize varieties in 2021. Five Quality Protein incorporated Maize lines (yield>5 t /ha) developed using molecular markers are now at NCVT (National Coordinated Varietal Trials) level. The five Qualitative protein maize (QPM) maize lines developed through the research supported by this project are rich in two essential Amino Acids, Tryptophan and Lysine and therefore, they are specifically useful in animal feed manufacturing and human consumption as well.

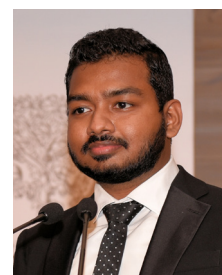


Short duration (50-55 days) Yellow mosaic virus resistant mungbean variety MIMB07 (2t/ha) released under this project was recommended for cultivation in between two main cropping season cultivation to assure the farmer an additional income. Additional benefit of this short duration is its capability to avoid drought, improve soil nutrient content and energy saving due to improve soil nutrient content and energy saving due to short duration for cooking. Presently, seed production of MIMB07 is carried out in an extent of 60 ha in government seed farms expecting seeds for the next season. Further, seven drought tolerant /escaping mungbean lines were identified in a drought screening trial. Climate smart micro irrigation package introduced by this project has increased the productivity up to 2.5-3 t/ha while saving irrigation water by 30% compared to surface irrigation water.

Drought tolerant rice variety Bg 314 (8.06 t/ ha) matured within 95-100 days was released under this project and recommend for dry and intermediate zones under rain fed farming. AERON 9-3 identified under this project matured within 101-110 days selected for VAT under rainfed condition. Further Bg 14- 2448, a drought tolerant line was tested under rainfed condition at VAT. Major rice growing ecosystems are vulnerable to heat and drought stress and 8 different crosses for drought resistance, and 10 promising heat tolerant rice lines are in the pipe line and will be released for farmer cultivation soon.

The varieties and the technologies developed in this project supported to increase the production and productivity of chilli, maize mungbean and rice in the country. This has significantly contributed to increase farmers' income and to save a significant amount of foreign exchange through reduction of seed imports both for consumption and as seed materials.

Dr. W. M. W. Weerakoon and his team successfully completed the grant in March 2021. They have published over 48 publications, produced one M.Phil. and one Ph.D., and conveyed research findings to the Ministry of Agriculture. Currently, the private and public sectors are producing seeds based on the research findings.



Mr. Supun Katugampala
Scientific Research Officer
Coordinator - TO Grants
National Research Council

Health promotion through mobile phone can bring down risk of heart disease: Medical scientists reveal

Achievements in Investigator Driven Research Grants

NRC Grant No: IDG 15-148

Introduction

Cardio Vascular Diseases are a group of diseases that affects heart or blood vessels, such as heart attacks and stroke. Heart diseases occur frequently, and at relatively younger ages now than ever before. Many people die due to heart diseases in their middle age. Improving healthy dietary habits and lifestyle changes could achieve a substantial reduction in the occurrence of heart attacks and stroke. With the evolution of mobile phone technology and its widespread use, mHealth (medical and public health practice supported by mobile devices) is viewed as an attractive and promising approach to foster behavior change.

A research team from the Faculty of Medicine of the Colombo University led by Professor Upul Senarath has conducted a study to examine whether mobile phone-based health promotion (mHealth in short) could reduce the risk of heart attacks. The National Research Council provided financial support for this project.

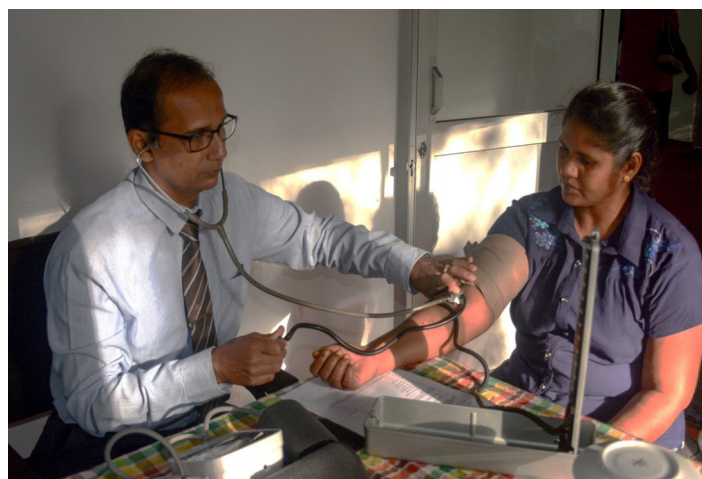
Outputs

In this study, the researchers investigated 1200 overweight or obese men and women in the Colombo district over a one year period - half of whom followed a mHealth nutrition and lifestyle package, and other half the usual care. The mHealth package includes SMS and voice messages in Sinhala and Tamil on regular basis. These messages focused on healthy eating practices, for example, to add more servings of vegetables and fruit; to cut down refined calories; to avoid unhealthy fats, and to engage 30 minutes of exercise etc. The research team outsourced Data Management Solutions for application development in partnership with Mobitel Pvt Ltd for connectivity services.

Outcomes

Analysis of data revealed that participants who followed mHealth package improved their dietary practices, physical activity and reduce unhealthy behavior that are associated with heart attacks in contrast to the group who did not follow it.

Although it is too early to see effects of this mHealth intervention on occurrence of heart attacks, it did dramatically reduce their overall risk towards heart attack. It is a good indication, that the group who followed mHealth for 12 months definitely improved their dietary practices and physical activity.



High blood pressure is a key predictor of heart disease

It was also observed that there was a great enthusiasm among the middle-aged to follow these health promotional messages sent to their mobile phones and to change their behavior accordingly. The researchers suggest that this effect may be due to appropriate and frequent health messages, which were tailored to participant's preferred language and time. However, the researchers note that this effect has only been tested in a high risk population (urban, overweight/obese, middle aged), and further studies are needed among the low risk categories including younger adults.



Body composition analysis using bio-impedance assessment method

Co-investigators

Prof Prasad Katulanda¹, Late Prof. Duliitha Fernando¹, Prof. Sudheera Kalupahana², Prof. Michael J Dibley³

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²Faculty of Medicine, University of Peradeniya, Sri Lanka

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Blood testing for diabetes and cholesterol



Face-to-face interviews and body measurements at the household

Way Forward

This work concludes that mHealth could be effectively utilized by the health system as a means to slow down the rapidly rising trend of non-communicable disease in the country such as diabetes and cardiovascular disease. We also need to explore the long-term effects of this type of interventions.



Prof. Upul Senarath
 Professor of Community Medicine,
 Faculty of Medicine,
 University of Colombo
 Principle Investigator NRC Grant 15/148

EVENT HIGHLIGHTS

Awarding Investigator Driven Research Grants for year 2022

National Research Council funded 17 investigator Driven Research projects in the year 2022. There were 132 research proposals received for consideration for funding and 107 sent out for evaluation.

21 research proposals were selected for funding and only 17 research projects funded in December 2022 and remaining 4 projects will be funded in year 2023 on availability of funds.





NRC 1st Research Symposium 2022



NRC Staff Celebrating Christmas 2022



Compiled By :Nadeeka Dissanayake Scientific Research Officer/NRC