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## Message from the Chief Guest



I am pleased to send this message to the Abstract Book of the International Research Conference-2017 of General Sir John Kotelawala Defence University, Sri Lanka, especially on the occasion that it is held for the 10<sup>th</sup> consecutive time.

Research, experiment and invention have been in existence ever since the presence of man on this planet, and it has been brought into a whole new level and caliber in the 21<sup>st</sup> century, which can be witnessed in the pro-research environments and research conferences of this nature promoted and held by universities around the world. In this milieu, KDU-IRC, I believe, has become predominant in providing a collective platform for both civil and military specialists to engage in multidisciplinary discussions while showcasing new discoveries related to multiple disciplines.

I firmly believe that, this year's conference theme Changing Dynamics in the Global Environment, is both timely and appropriate for local as well as foreign scholars to display and gain recognition for their research achievements. Also worth mentioning is the importance of such collaborative multidisciplinary research which will ultimately pave path for inculcating professionalism, boosting international relations and nation-building, which, I presume, is undoubtedly one of the aims of KDU-IRC as well.

Finally, while congratulating and appreciating the work done thus far by Kotelawala Defence University in general and the conference organizers in particular, I wish all the success for the 10<sup>th</sup> International Research Conference of KDU.

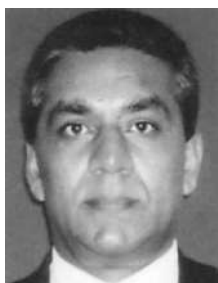
HON SUSIL PREMAJAYANTHA

Minister

Ministry of Science, Technology and Research



## Message from the Secretary Ministry of Defence



It is a pleasure for me to send this message to the International Research Conference 2017 of General Sir John Kotelawala Defence University (KDU) in my capacity as the Secretary to the Ministry of Defence and the Chairman of the Board of Management of KDU.

It is well-known that Kotelawala Defence University has been rendering a yeoman service in the field of defence education catering to the requirement of producing graduate officers for the tri-services in Sri Lanka, and today it has grown in strength to extend its high quality, tertiary level, English medium education for Sri Lankan youth as well as for foreign students. In this context, it is heartening to see that it is also playing a leading role in the field of multi disciplinary research, and I am

sure that the tenth anniversary research conference on the theme, “Changing Dynamics in the Global Environment: Challenges and Opportunities”, would provide a sound platform to discuss with highest intellectual and philosophical depth on diverse issues in the dynamic world we are living today, particularly with a view to opening new avenues for solving our problems.

I take this opportunity to congratulate the Vice Chancellor and KDU staff on organising this important event and also to commend the researchers who took it upon themselves to make a valuable contribution to the knowledge bases of their respective disciplines, particularly in Defence and Strategic Studies. I wish the participants of this International Research Conference an intellectually fulfilling experience.

KAPILA WAIDYARATNE PC  
Secretary  
Ministry of Defence

## Message from the Vice Chancellor



It is with great pride and pleasure that I pen this message for the Abstract Book of the International Research Conference of General Sir John Kotelawala Defence University, Sri Lanka (KDU-IRC), especially at this symbolic moment when it is held for the 10<sup>th</sup> consecutive time. Over the past decade, KDU-IRC has made its distinct mark in the arena of multi-disciplinary research both nationally and internationally. This is certainly a matter that cannot be ignored; it gives me immense pride in reminiscence, especially as we celebrate KDU-IRC's 10<sup>th</sup> anniversary, and I am humbled to be at its helm.

Today, KDU-IRC has attracted specialists in diverse fields across the globe, enriching and encouraging its multi disciplinary space in the field of research and in the practice of knowledge dissemination. This year's conference under the theme Changing Dynamics in the Global Environment gathers experts both local and foreign under various disciplines, including defence and strategic studies. In particular, we are proud to have internationally eminent, Sri Lankan born scientists such as Prof. Chandra Wickramasinghe and Dr.

Bandula Wijay with us this time as they have made our motherland proud in the international arena as renowned experts and intellectuals in their respective domains.

KDU-IRC stands strong today with the great withstanding support of KDU staff and its well-wishers. I am especially thankful to the Ministry of Science, Technology and Research and the National Science Foundation, not forgetting the Ministry of Defence for their unfailing support in co-organising this conference.

It is my sincere wish that the plenary sessions, pre/post-conference workshops, and oral and poster presentations, which will unfold during the course of these significant days, will generate productive discussion and constructive criticism and will instigate thought for development in future. I hope that many would make KDU-IRC events an opportunity to study the changing dynamics in the socio-cultural environment in Sri Lanka, and help place our nation high, driving it towards success in the global matrix.

REAR ADMIRAL JAGATH RANASINGHE USP, psc  
MSc(DS)Mgt, MMaritimePol(Aus), PG Dip in CPS, Dip in CR, AFNI(Lond)  
Vice Chancellor

## Message from the Conferenc Chair



It is with great pride that I write this message as the Chair of 10<sup>th</sup> International Research Conference of General Sir John Kotelawala Defence University (KDU IRC), in this exciting time in KDU history.

For a decade KDU IRC has been a platform for knowledge sharing among researchers of various backgrounds. In this special year on its 10<sup>th</sup> anniversary, KDU IRC has invited over 50 experts from world over to share their knowledge and to initiate collaborations with their local counterparts numbering well over 1000.

KDU IRC received 557 research papers this year. Out of which 365 has been selected through a double blind peer review process for presentation. I, therefore, have no doubt that the outcomes of the conference would not only bring pride to KDU, but also uplift the status-quo of research and development of the country as a whole.

My task as the Chair this year would have been laborious, if not for the guidance, assistance and most of all the freedom given to me by the Vice Chancellor, Rear Admiral JJ Ranasinghe to mould and shape this conference to present-day requirements.

The generous assistance received from the Ministry of Science Technology and Research and the National Science Foundation is also praise worthy.

I hope both local and international participants will actively contribute in discussions, make new connections and have a productive and memorable time during the two days of the conference at KDU. I wish you all the very best.

DR PRASANNA PREMADASA  
PhD(UK) MSc(UK) BSc Hons. (Perad.)  
Chairperson  
10th International Research Conference - 2017

## Message from the Session President



The Basic and Applied Sciences Session of 10<sup>th</sup> Annual International Research Conference (IRC) of General Sir John Kotelawala Defence University, Sri Lanka has been organized to suite the main theme of “Changing Dynamics in the Global Environment: Challenges and Opportunities”.

This session comprises of four plenary lectures delivered by distinguished national and international scientists, oral presentations and poster presentations. It provides a forum for the discussion of advances in recent research in the field of Biological, Physical and Multidisciplinary Sciences which will cover the areas such as evaluation of activity of medicinal plants and ayurvedic drugs, analysis of food products, analysis of soil, analysis of air, analysis of water. In addition it covers the areas relating to health and nutrition, agriculture, biotechnology, microbiology, genetics etc. During this session the students and young researchers will get the opportunity to meet the leading specialists in the above areas who will have the possibilities to impart their knowledge and experience to young generation of future specialists.

Plenary session of Basic and Applied Sciences will feature speeches in 04 emerging scientific topics which will be; “Elimination of lymphatic filariasis in Sri Lanka: Advances in diagnosis and management

of surveillance”, “Air quality monitoring potential of Lichens”, “Drug discovery from natural products in Sri Lanka, a way forward” and “Processing speech in noise- a powerful window into the human brain”.

The call for papers had an overwhelming response. Researchers from all over the country submitted more than 50 abstracts for this session and the specialists in the areas assessed them and categorized them into oral and poster presentations. The oral presentations are classified into 03 areas namely, Health and nutrition, Environmental sciences and Drug discovery and development.

It is hoped that the Conference Proceedings will serve as a comprehensive compilation of the present knowledge and experience and will be used by researchers who are concerned with the subjects presented at the Basic and Applied Sciences Session of 10<sup>th</sup> Annual IRC of General Sir John Kotelawala Defence University, Sri Lanka. On behalf of the Committee of the Basic and Applied Sciences Session of IRC, I wish to thank all the authors, invited plenary speakers (both National and International), abstract reviewers, chairpersons of the session, judges of the session, session coordinators, members of the abstract reviewing committee, and numerous others who helped to shape the content of this session.

Snr. Prof RN Pathirana MSc (UK), PhD (UK)  
President  
Basic and Applied Sciences Session

*Plenary  
Sessions*



## PROCESSING SPEECH IN NOISE - A POWERFUL WINDOW INTO THE HUMAN BRAIN

**Prof Ramesh Rajan**

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Verbal communication remains the most powerful way in which humans exchange and disseminate information, thoughts and emotions. Most normal everyday conditions involve speech communication in noisy backgrounds like lecture rooms, restaurants, markets, etc and hence comprehension of speech requires the use of skills sets beyond the bottom-up processes of hearing but also higher-order cognitive processes such as lexical memory, working memory, executive control and attention, among others. In this talk I will describe the studies in my laboratory on the contribution of bottom-up auditory processes and top-down cognitive to speech comprehension in noise and then describe how these are altered by brain disorders like autism spectrum disorders, Parkinson's disease and Friedrich's ataxia, but spared (at least in early stage) multiple sclerosis.

## ELIMINATION OF LYMPHATIC FILARIASIS IN SRI LANKA: ADVANCES IN DIAGNOSIS AND MANAGEMENT OF SURVEILLANCE

**Prof Mirani V Weerasooriya**

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The World Health Association in July 2016 validated Sri Lanka as having eliminated Lymphatic Filariasis (LF) as a public health problem. LF is a disabling mosquito borne disease caused by nematode parasitic worms *Wuchereria bancrofti* and *Brugia malayi* in Sri Lanka. However latter was eradicated in nineteen sixties. In 1997 the World Health Assembly passed a resolution calling for the elimination of the disease. The World Health Organization established the Global Programme for the Elimination of Lymphatic Filariasis (GPELF) in 2000 aiming to achieve total elimination by 2020. The programme had two principal goals to interrupt the transmission of infection in the entire 'atrisk' population by treating every individual annually with a single dose of two drug regimen to alleviate the suffering and decrease the disability of those already with the clinical disease by reducing the secondary bacterial and fungal infections of the limbs and genitals and conduct of hydrocelectomies for hydrocoeles. In Sri Lanka the disease was considered to be endemic in three provinces, southern, western and north western and covering eight districts. The Ministry of Health, initiated the national programme for the elimination of lymphatic filariasis (PELF) in 2002 covering the three endemic provinces. Five rounds of mass drug administration were completed by 2006. The morbidity control programme too was continued through the years. Having completed ten years of

surveillance after the last MDA, Sri Lanka has now reached the elimination goal. The country needs to maintain the success and to prevent resurgence of the disease. The role of the scientists at the present will be the continuation of surveillance and evaluation utilizing the recommended tools like night blood for microfilariae, tests to detect circulating antigen to *Wuchereria bancrofti* and other techniques to detect parasite DNA in humans and mosquitoes. The application of ICT card and other tests used by PELF; new Alere Filariasis Strip Test (FTS) against Card test; application of urine ELISA; application of independent questionnaire on community leaders and validating data obtained by clinicians and with urine ELISA; LAMP test and PCR used by PELF will be discussed. In addition screening, testing of sentinel sites, hot spots, borderline districts, migrants and value of independent surveys too will be discussed. The remaining hot spots of high endemicity like in Galle, finding of *Brugia malayi* resurgence in the country and less attention paid for a disease after elimination are the challenges at present. Another important aspect of surveillance is to monitor Community Home Based Care approach to alleviate the suffering caused by LF. The newer techniques used for this and continuation of disability alleviation services on a larger scale will be discussed.

## AIR QUALITY MONITORING POTENTIAL OF LICHENS

**Prof Chandrani Wijeyaratne**

Emeritus Professor of Botany,  
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Although appearing to be a single organism, lichen is actually a symbiotic partnership between a fungus and one or more photosynthetic organisms, an alga or cyanobacterium. Typically the fungal partner provides most of the composite organism's structure and mass, thus exchanging physical protection for carbohydrates manufactured by the photosynthetic partner. Together, the fungus and its partner(s) can inhabit a much wider variety of habitats and conditions than any could on their own. Lichens are extremely sensitive to the impacts of habitat modification and air pollution, which is a major environmental issue both in developed and developing countries. This sensitivity is the foundation of their use as biological monitors or indicators of air pollution. In this respect, they serve as early warning detectors of environmental damage in much the same way that Pap tests are used to detect cancer in early treatable stages. Lichens exhibit changes in health, biodiversity and elemental composition long before any other plant or animal species exhibit any visible symptoms. SO<sub>2</sub> is considered to be the primary factor causing the death of lichens in most urban and industrial areas, with fruticose lichens being more susceptible to SO<sub>2</sub>

than many foliose and crustose species. Ozone, PAN and nitrogen oxides are also toxic to lichens in sufficient concentrations. Distribution mapping is the first classic field method used to indicate air quality using lichens. The total number of species per site (richness), the percentage of the quadrants in which particular species can be found (frequency), presence or absence of indicator species, and the estimated or measured cover are different parameters used in monitoring of lichens. In Sri Lanka, there were no previous data on the relationship of lichens with air pollutants. Thus studies were conducted to correlate ambient Sulphur dioxide (SO<sub>2</sub>) and Nitrogen dioxide (NO<sub>2</sub>) levels with corticolous lichens. Thirty one sites falling on six transects extending upto 40 Km from Colombo city to suburbs were selected and area of each site was 1Km<sup>2</sup>. Computed lichen diversity (Shannon's diversity) on each site. It was evident that lichen diversity values increased when moving away from the city while SO<sub>2</sub> and NO<sub>2</sub> decreased concurrently, indicating that lichen diversity assessments can be successfully exploited in pollution monitoring in tropical countries as well.



# DRUG DISCOVERY FROM NATURAL PRODUCTS IN SRI LANKA

## A WAY FORWARD

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Potential resources for development / discovery of novel drugs would be Combinatorial chemistry, Structure-based drug design, *In Silico* drug development (SAR) and from Natural organisms. Since Sri Lanka processes well documented literature on curative potentials of plants and other natural sources in Deshiya Chikitsa and Ayurveda medical system, the exploring of medicinal plants for new drug entity would be the prime choice. This is again confirms by Sri Lanka being a hot spot in biodiversity in the Indian ocean. During the last half century, numerous work has been done towards the development of new drug entities from our medicinal plants without much direct successes. The isolation of natural products from endemic species in 1960s has been evolved during the period to testing compounds for various *in vitro* and *in vivo* assays, elucidation of many novel structures, even getting national and international patents. Many compounds with high and specific biological activity have been isolated by different groups but none of them could reach the clinical trials mainly due to the lack of collaboration and funding. Development of a new drug will cost nearly one billion US dollars. According to the WHO and UN Reports more than 80% of world population is still depending on Native Medicine (mainly Plant based) for their primary health care. During the last two decades the importance of traditional and complementary medicine [T and

CM] has been well recognised, and now T and CM is widely used around the world and valued for a number of reasons. At the International Conference on Traditional Medicine for South-East Asian Countries in February 2013, the WHO Director-General, Dr Margaret Chan, stated that “traditional medicines, of proven quality, safety, and efficacy, contribute to the goal of ensuring that all people have access to care. For many millions of people, herbal medicines, traditional treatments, and traditional practitioners are the main source of health care, and sometimes the only source of care. In Sri Lanka there are handful of pharmaceutical companies formulating herbal remedies into tablets, capsules or syrups. These productions should be expanded into other remedies so that the native practitioners can have ready access to standardised drugs at ease. So the researches working on natural products drug discovery can go through this detour and formulate crude drugs with better therapeutic index. Most of the cases when the activity guided fractionation continues either you lose the activity or the therapeutic index decreases (increase the toxicity) or you stuck with the purification. So rather than isolating single bioactive compounds scientists and pharmacists can get together and formulate crude drugs with known pharmacological activity with proper quality parameters. That will capture ever growing local and foreign market.

*Oral  
Prasentation*



## REPORTING THE *IN VITRO* ANTIMICROBIAL ACTIVITY OF *Lactobacillus plantarum* B\_16LAB ISOLATED FROM SRI LANKAN GREEN BANANA (*Musa spp*)

DMWD Divisekera<sup>1#</sup>, JKRR Samarasekera<sup>1</sup>,  
MI Choudhary<sup>2</sup>, C Hettiarachchi<sup>3</sup>,  
J Goonerathne<sup>1</sup> and S Gopalakrishnan<sup>4</sup>

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<sup>3</sup>Faculty of Science, University of Colombo, Sri Lanka

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Probiotics are live micro-organisms which, when administered in adequate amounts, confer health benefit to the host. One of the most important properties of probiotics is the protection against pathogens in the intestinal tract of the host. The objective of the study was to evaluate *In vitro* antimicrobial activity of probiotic strain *Lactobacillus plantarum* B\_16LAB isolated from Sri Lankan fermented green Banana variety Kolikuttu against fourteen human pathogens including both Drug Sensitive and Multi Drug Resistant (MDR); *Escherichia coli* ATCC 2592 and ATCC 35218, *Staphylococcus aureus* ATCC 6571, EMRSA 17 COCR and EMRSA 16 NCTC 13143, *Enterococcus faecalis* ATCC 49532 and ATCC 700802, *Streptococcus mutans* ATCC 25175, *Streptococcus pyogenes* ATCC 700294, *Streptococcus sanguinis* ATCC 10556, *Streptococcus salvarius* ATCC 13419, *Salmonella enterica* ATCC 700408, *Acinetobacter baumannii* ATCC 17978 and *Shigella flexenari* ATCC 12022. Agar well diffusion assay was performed in triplicate and Imipenem discs (10 mg) were used as positive control. After incubation, the inhibition zone diameters were measured using calibrated calliper. Antimicrobial activity against Drug sensitive pathogens; *Lactobacillus plantarum* B\_16LAB demonstrated good activity against *S. salvarius*

and *S. flexanary*. Moderate antimicrobial activity was observed against *S. aureus*, *K. pneumonia* and *E. coli*. Very low activity was observed against *A. baumani* and *S.pyogenes* at the tested concentrations. However, *Lactobacillus plantarum* B\_16LAB is inactive against *S. sanguinis*, *E. faecilis* and *S. mutans*. Antimicrobial activity against MDR pathogen; *Lactobacillus plantarum* B\_16LAB demonstrated good antimicrobial activity against *E. coli* and *S. aureus*. It demonstrated moderate antimicrobial activity against *S. aureus* 17 EMRSA at the tested concentrations. However, *Lactobacillus plantarum* B\_16LAB is inactive against *S. enterica*, *E. faecilis* and *K. pneumonia*. In conclusion, the results of the *in vitro* antimicrobial activity of *Lactobacillus plantarum* B\_16LAB indicate its ability to produce antimicrobial compounds which acts as prophylactic agents against enteric and upper respiratory tract infection causing pathogens.

**Keywords:** Antimicrobial Activity, Banana, *Lactobacillus plantarum* B\_16LAB

**Acknowledgment:** Financial assistance for this study from Indo Lanka Joint research cooperation and Joint NAM-ICCBS Fellowship are gratefully acknowledged.

## MACRONUTRIENT INTAKE AND NUTRITION KNOWLEDGE OF ENDURANCE SWIMMERS OF THE CIVIL SECURITY DEPARTMENT OF SRI LANKA

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Swimmers representing armed forces have contributed to the development of sports in Sri Lanka by producing numerous sports achievements. It was evident that the performance of Civil Security swimmers is inferior to that of swimmers from armed forces. The aim of this study was to investigate the relationship between macronutrient intake and nutritional knowledge of endurance swimmers attached to the Sri Lanka Civil Security Department (CSD), in an attempt to find possible causes for their poor performance. The sample included 50 endurance swimmers (35 males, 15 females) of CSD. A nutrition questionnaire and the 24 hour dietary recall method were used to gather required information. Diet records were converted to daily macronutrient intake values using Food Composition Tables. Two-sample t-test was carried out to determine whether the nutrition knowledge scores of males are significantly different from those of females. Pearson correlation analysis was used to investigate whether there is a relationship between nutrition knowledge and macronutrient intake of swimmers. Seventy six percent of athletes did not reach the Acceptable Macronutrient

Distribution Range (AMDR) for carbohydrates (55-65%) whereas 60% athletes failed to reach the AMDR for proteins (12%-15%). However, 72% athletes consumed a fat percentage greater than the AMDR (25-30%). No differences existed among male and female swimmers ( $p > 0.05$ ) with respect to nutrition knowledge, with both males and females scoring 54%. Correlation analysis revealed that there are no relationships ( $p > 0.05$ ) between nutritional knowledge and the intake of three macronutrients: carbohydrates, proteins and fats. It can be concluded that the majority of endurance swimmers of the CSD failed to reach AMDR for carbohydrates and proteins. No correlation was observed between the macronutrient intake and nutrition knowledge, indicating that although these athletes have a considerable knowledge on nutrition, they may not be using the knowledge when planning their diets.

**Keywords:** Nutritional knowledge, Macronutrients, Swimmers

## EFFECT OF RELATIVE STRENGTH AND SKELETAL MUSCLE MASS PERCENTAGE ON PERFORMANCE OF JUNIOR SWIMMERS IN COLOMBO DISTRICT

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Swimming is a sport done through propulsion in water using arms and legs, which is categorized by different strokes and distances. Even though swimming is a prominent sport practiced in Sri Lanka, researches on swimming done in Sri Lanka are scarce; especially on relative strength measurements and skeletal muscle mass. Thus, this study was aimed at determining how relative strength and skeletal muscle mass could affect the performance of male junior sprint swimmers. The objectives of this study were to find out the relationship between relative strength and skeletal muscle mass percentage on performance of the swimmers. Thirty one male swimmers under the age of 18, who have scored over 350 FINA points were randomly selected as the sample for this study. Performance of swimmers was determined by recording personal best times in 50m free style swimming during the competition period of their training program. The relative strength of the subjects was measured using bench press and front press exercises for upper body and full back squat and dead lift exercises for lower body. Skeletal

muscle mass percentages of arms, legs and trunk were measured using bio-impedance analysis. The results showed that the relative strength of the upper body (bench press and front press) and lower body (full back squat and dead lift) has a strong positive correlation with performance ( $p < 0.01$ ). Skeletal muscle mass of arms had a weak positive relationship ( $p < 0.05$ ) with performance, whereas leg muscle mass had a marginally significant weak negative correlation ( $p < 0.05$ ). There was no relationship between trunk muscle mass and performance ( $P > 0.05$ ). It can be concluded that relative strength had a significant effect on performance where performance increased with the increase of relative strength. However, only a weak correlation existed between skeletal muscle mass of lower body and performance.

**Keywords:** Skeletal Muscle Mass, Relative Strength, Performance

## DIETARY SUPPLEMENT USAGE AND NUTRITION KNOWLEDGE OF TEAM SPORT ATHLETES IN SELECTED UNIVERSITIES

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Athletes tend to consume different types of supplements in an attempt to optimize their performance. Although supplement use is common among Sri Lankan athletes, studies on athletes' nutrition knowledge and supplement intake are scarce. The objectives of this study were to assess the dietary supplement intake and nutrition knowledge of Sri Lankan university athletes. A total of 328 team sport athletes of four National Universities participated in this cross-sectional study. The participants completed a 3-part, self-administered questionnaire. The first part of the questionnaire focused on demographic information of participants while 2<sup>nd</sup> and 3<sup>rd</sup> parts focused on supplement usage and the nutrition knowledge of participants, respectively. Most of the participants (96%, n=316) consumed dietary supplements. A considerable proportion of athletes (37%) used dietary supplements during all three seasons, i.e., pre-season, competitive season and post-season. It was evident that 91% of athletes (n=298) consumed at least two types of supplements. Energy drinks (89%), electrolyte-replacement fluids (87%) and glucose (77%) were the most frequently used

dietary supplements among the selected athletes. The most important reasons for university athletes to use dietary supplement were to enhance energy, to enhance power or strength and to improve overall health. The majority of athletes obtained information relevant to dietary supplements from their coach/athletic trainer (80%, n=261) or team members (66%, n=216). Results on nutrition knowledge scores revealed that university athletes' nutrition knowledge level is insufficient. The overall knowledge score of the participants was 42% and the majority (79%) of athletes scored below 50%. There were no differences between male and female athletes with respect to the nutrition knowledge level. It can be concluded that the dietary supplement usage is common among the university team sport athletes in Sri Lanka, with the majority of athletes consuming at least two supplement types. However, athletes' nutritional knowledge is inadequate.

**Keywords:** Dietary supplements, University athletes, Nutrition knowledge

## INFLUENCE OF WATER CONTENT, LIGANDS AND PROTONS ON METAL RELEASE IN HEAVY METAL RICH SOILS

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Elevated concentrations of metal release from soils into groundwater generate ecological, agricultural and human health related complications. This study investigates the influence of different physical (i.e., water content) and chemical (e.g., presence of protons and ligands) changes on the release of heavy metals in heavy metal rich serpentine soils from Ussangoda, Sri Lanka. Two samples of serpentine soils were incubated at saturated point (SP) and field capacity (FC) moisture content for two days and leachates were extracted. Bioavailable metal concentrations of SP and FC soils were determined by DTPA extraction followed by AAS. Ni and Mn release rates from the serpentine sediment were demonstrated using three types of organic (citric, acetic and oxalic) and inorganic (sulphuric, nitric and hydrochloric) acids with six different concentrations. Nickel was the highest bioavailable metal reported ( $323 \pm 2.30 \text{ mgkg}^{-1}$  via DTPA extraction) compared to Mn and Cr. Serpentine soil incubated at SP and FC indicated

that the increasing soil water content has a positive influence on the availability of Co, negative influence on Ni and a negligible effect on Mn and Cr. However, the leachates eluted from both SP and FC soils contained Ni and Mn levels exceeding the levels recommended for drinking water. In Ussangoda serpentine soil both Ni and Mn showed prompt release rates with water ( $2.4 \times 10^{-12}$  and  $2.0 \times 10^{-13} \text{ mol m}^{-2} \text{ S}^{-1}$ , respectively). Ussangoda soil sediments assessed with 0.05 to 10 mM of organic and inorganic acids resulted in Ni and Mn release rates as follows:  $\text{HNO}_3 \approx \text{HCl} \approx \text{acetic} < \text{H}_2\text{SO}_4 < \text{citric} < \text{oxalic acid}$ , suggesting that the acceleration of metal release is increased by both protons ( $\text{H}^+$ ) and ligands. Overall, this study indicates that the changes in water content, protons and ligands directly influence metal release from serpentine soils.

**Keywords:** Metal contamination, Serpentine soils, Heavy metals, Chemical extractions

## QUANTIFICATION OF MICROORGANISMS ASSOCIATED WITH PARTICULATE MATTER WITHIN KANDY CITY, SRI LANKA

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Studies on atmospheric microorganisms have been performed widely in the world. However, data in Sri Lanka is minimal. Research on microorganisms associated with particulate matter is vital as it directly affects human health. Therefore the objective of the study was to estimate the microbial concentration associated with particulate matter at nine sites of Kandy city selected based on traffic congestion, using bottles and funnels. Ninety samples were collected from National Institute of Fundamental Studies (NIFS), Railway Station (RS), Police Station (PS), Fire Brigade (FB), Children's Park (CP), Trinity College (TS), Lewalla (LW), Dodanwala (DW), Tea Research Institute (TRI) and dissolved in 10 mL of Mili-Q water. Culturable microorganism concentrations were determined using spread plate method as colony forming units (CFU/mL). Total microorganism concentrations were calculated using epifluorescence microscopy and with real-time quantitative PCR as cells/mL. Culturable microorganism were presented in the range from  $10 - 1.75 \times 10^4$  CFU/mL with

an average of  $2.64 \times 10^3$  CFU/mL. Culturable microorganisms were highest at the site of TRI where the vegetation is highest among the nine sites. Total microorganisms with epifluorescence microscopy were within the range of  $50 - 7.80 \times 10^4$  cells/mL with an average of  $1.38 \times 10^4$  cells/mL. Total microbial cells were highest in DW ( $1.64 \times 10^4$  cells/mL) and TS ( $1.633 \times 10^4$  cells/mL). Total microorganisms using real time PCR ranged from  $79 - 4.0 \times 10^{10}$  cells/mL with an average of  $8.00 \times 10^8$  cells/mL. This was highest in TS ( $>0.05$ ) which is a highly traffic congested spot in Kandy. Though DW is a less traffic area, a construction site was near the vicinity of the sampling site. Therefore it is suggested that the vegetation, anthropogenic activities and the high traffic congestion could be the sources that affect the microbial concentrations observed in the atmosphere in Kandy city.

**Keywords:** Anthropogenic activities, Atmosphere, Traffic congestion, Vegetation



## MOLECULAR CHARACTERIZATION AND PHYLOGENETIC ANALYSIS OF *STAPHYLOCOCCUS SP.* ISOLATED FROM INDUSTRIAL WASTE WATER

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Due to adverse health effects produced by large scale heavy metal contamination, great deal of attention has been paid to the treatment of waste water to minimize pollution. Bio-remediation is considered as a low cost and an eco-friendly method compared to conventional methods of metal decontamination. Bacteria are bio-indicators of metal pollution and have evolved metal tolerant mechanisms. In search of such bacterial strains, samples were collected from an industrial effluent in Sri Lanka and 10 Gram positive bacterial strains having Cu, Cd and Pb ion tolerance ( $1 \text{ mgL}^{-1}$ ) were successfully isolated. Genomic DNA of these bacterial strains were isolated using the Guanidine Thiocyanate method and 16S rRNA gene sequences were amplified using universal primers in order to identify the bacterial strains up to the species level. Amplified PCR fragments were sequenced and BioEdit 7 software was used to analyze the sequences obtained. BLASTn analysis of the sequences were carried out using the nucleotide database at NCBI and 16S rRNA gene sequences of

organisms showing the highest degree of homology were selected. Sequences obtained in this study and sequences already deposited in database were used for the phylogenetic analysis using MEGA 7. Using BLASTn analysis, all the bacterial strains were identified and belonged to the genus *Staphylococcus* and included *S. warneri* (Strain TWSL-6 and Strain TWSL-24) and *S. epidermidis*. Phylogenetic analysis confirmed their evolutionary relationship. Partial 16S rRNA gene sequences acquired in this study were deposited in NCBI GenBank under accession numbers KR027924.1, KT184888.1, KT184892.1, KT184893.1, KT184895.1, KT184896.1, KT184897.1, KT184898.1, KT184899.1 and KT184900.1. Identification of bacterial strains up to species level would be helpful in elucidation of mechanisms of metal tolerance.

**Keywords:** Heavy metal, Bio-remediation, Metal tolerance, *Staphylococcus*

## BEHAVIOURAL CHANGES CAUSED BY WATERBORNE ACETAMINOPHEN EXPOSURE IN THE GUPPY *Poecilia reticulata*

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Acetaminophen (Paracetamol) is a commonly used analgesic and antipyretic drug. It has been detected in aquatic ecosystems in several countries causing inadvertent effects to aquatic fauna. The present study aimed at elucidation of the effects of the chronic exposure to acetaminophen on the behavior of fresh water poeciliid guppy, *Poecilia reticulata*. In a controlled laboratory experiment with two exposure groups, juvenile guppy were continuously exposed to 2 and 5 mg/L of acetaminophen over 42 days (n=15-21). Water was renewed with toxicant levels on each successive fifth day, and the effects were studied on four behavioral end-points compared to the control at the end of experiment. In general, the exposed fish

showed apparent lethargy and weak coordination of movements indicating a possible neurotoxic effect of acetaminophen. There were significant impacts on all the behavioral end-points studied in both exposure groups compared to the control, namely, reduced capacity of non-visual food detection, weakened escape response against tactile stimulus, and retarded capture avoidance response as well as declined feeding efficiency. The results indicate that sub-lethal concentrations of acetaminophen in water cause adverse behavioural effects in guppy fish.

**Keywords:** Acetaminophen, Behavioural effects, Environmental pharmaceuticals

## MOLECULAR AND MORPHOLOGICAL DIVERSITY ASSESSMENT IN FLOWERING RELATED TRAITS OF MUNGBEAN [*Vigna radiata*]

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Mungbean (*Vigna radiata* (L.) Wilczek) is an important food legume widely cultivated in tropical and sub tropical regions of the world. Flowering over an extended period leading to asynchrony in pod maturity is a major problem in mungbean. This may cause low yield, time wasting and additional cost to the farmers. Better understanding of flowering behavior in relation to the morphological traits and flowering gene associated assessment at molecular level are essential for successful breeding programs. To evaluate the diversity in flowering related traits, 20 mungbean accessions were grown in the field and fourteen flowering related phenotypic characters were measured. Four SSR markers closer to the flowering QTLs that were previously reported were used for genotyping of the accessions. Results revealed that, except number of primary branches, all other morphological characters were significantly varied among accessions. Most

of the traits were positively correlated among each other trait while hundred seed weight was negatively correlated with days to first flowering. Successful PCR amplification was found with SSR makers, CEDAAG002, CEDG014, CEDG037 and CEDG044, indicating polymorphism among 20 accessions. A dendrogram was drawn based on SSR marker polymorphism using Jaccard's similarity coefficient. It has separated 20 mungbean cultivars into six clusters at the similarity level of 15, showing suitable parents with maximum intra-cluster distance to be selected for gene mapping studies based on synchrony of pod maturity. However, assessments of more DNA markers are necessary to reveal the relationship between flowering related phenotypic traits with molecular status.

**Keywords:** Genetic diversity, SSR markers, Synchronous pod maturity, *Vigna radiata*

## ANTIOXIDANT ACTIVITIES OF SOLUBLE PHENOLIC COMPOUNDS OF SRI LANKAN RICE VARIETIES

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Rice is the most commonly consumed cereal in Sri Lanka. Recently it has been investigated the importance of rice as a contributor for phytochemicals including phenolic compounds. Those compounds act as defenders against the oxidative stress and attenuate the free radical damages. Phenolic content of a food matrix depends on various factors namely the variety, growing conditions and cooking practices among others. The current study was focused to determine the total phenolic content (TPC) and antioxidant activities (AO) of the Sri Lankan rice varieties, which were grown under inorganic-fertilized and non-fertilized environments. Further, it was aimed to assess the effect of cooking on TPC and AO. Twenty different Sri Lankan rice varieties belonging to BG, LD, AT, BW and H<sub>4</sub> categories grown under inorganic-fertilized and non-fertilized conditions were used in the study. Rice samples were used in raw as well as boiled forms. The soluble phenolic compounds of rice samples were extracted using 80% (v/v) aqueous methanol. Both raw and boiled

rice were analyzed for the total phenolic content (TPC) and antioxidant activities namely ferrous ion chelating activity (FICA), DPPH (2, 2-diphenyl-1-picrylhydrazil) radical scavenging activity (DRSA) and reducing power (RP). All experiments were carried out in triplicates. The TPC of non-fertilized and inorganic-fertilized raw rice were ranged from 0.96-6.18 and 2.15-6.84  $\mu$ mole ferulic acid equivalents per gram of defatted meal (equi/g of DM), respectively. Ability to scavenge the DPPH radicals of raw rice extracts were ranged from 7.61-18.38  $\mu$ mole of EDTA equi/g of DM. Cooked varieties exhibited TPC ranging from 0.80-6.95  $\mu$ mole of ferulic acid (equi/g of DM). The fertilized rice varieties exhibited higher TPC and AO in both raw and boiled forms. Growing conditions and also the cooking process has a direct impact for the TPC and AO of rice.

**Keywords:** Antioxidant activity, Cooking practices, rice, Growing conditions, Total phenolic content

## DETERMINATION OF IN VITRO ANTIMICROBIAL ACTIVITY OF SELECTED MARINE SPONGES FOUND IN SRI LANKA

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Discovery of new molecules to challenge the drug resistance is critically important. Sponges have developed efficient defense mechanisms by the production of chemical compounds against foreign attackers. The aim of this study was to study the antimicrobial activities of *Clathria rugosa*, *Clathria foliacea*, *Acanthella acuta* and *Antho dichotoma*, against ten human pathogens and to separate and study the active ingredients using Bioautographic TLC assay. Mixture of methanolic and dichloromethane extracts of all four sponges were prepared using cold maceration technique. Using the standard disc diffusion method, extracts were tested against five Gram negative bacteria; *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella sp.* and *Escherichia coli*, three Gram positive bacteria; *Staphylococcus aureus*, Methicillin Resistant *Staphylococcus aureus* (MRSA) and *Staphylococcus saprophyticus* and two fungal species; *Candida albicans* and *Aspergillus niger*. Out of the sponges tested, only *C. foliacea* was active against *S. aureus* (Inhibition Zone Diameter = 11.7 mm) and MRSA (IZD= 9.0 mm). *A. dichotoma* was active against *S. aureus* (IZD = 9.0 mm), MRSA (IZD = 10.0 mm) and *C. albicans* (IZD = 13.0 mm). All Gram negative

bacteria, *S. saprophyticus* and *A. niger* have shown resistance to extracts of all four sponges. The best separation in TLC was observed with a mixture of Hexane, Toluene, Dichloromethane, Diethyl Ether, Methanol and Water mixed in a ratio of 2: 0.05: 0.6: 0.3: 0.1: 0.002. Among the 12 spots of *A. dichotoma*, visualized under UV light, six spots inhibited the growth of MRSA and all the spots have shown the antimicrobial activity against *C. albicans* in TLC bioautography. Three out of seven visualized spots of *C. foliacea* were active against MRSA. Among the four sponges studied, *A. dichotoma* showed higher antimicrobial activity in terms of inhibition of bacterial growth, number of microbial species inhibited as well as higher number of antimicrobial compounds. None of sponges tested were active against Gram negative bacteria in the microbial panel used. *S. aureus* was the most susceptible pathogen. Even though, *S. aureus* and MRSA were susceptible for two sponge extracts, *S. saprophyticus* has shown resistance for all the sponge extracts.

**Keywords:** Sponge, Antimicrobial activity, Cold maceration, TLC bioautography

## OPTIMIZATION OF PARAMETERS AND DEVELOPMENT OF COST EFFECTIVE METHOD FOR ISOLATION AND PROPAGATION OF UMBILICAL CORD BLOOD DERIVED MESENCHYMAL STEM CELLS

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Mesenchymal stem cells (MSCs) are the most popular multi-potent stem cell type present in tissues and blood. Among the sources of MSC, cord and cord blood contain higher number of MSCs. MSC propagation *in vitro* with high quality and low cost with immune compatibility is essential for clinical applications. This paper describes the optimization of the production of MSC *in vitro* from umbilical cord blood (UCB). UCB were collected and mononuclear cell (MNC) fraction was isolated using Ficoll density gradient separation. Five different media were used with two modes of processes. MNCs were cultured in low glucose Dulbecco's Modified Eagle's medium (LG DMEM), high glucose DMEM (HG DMEM), alpha MEM, DMEM F12/HAM and RPMI 1640 supplemented with FBS (fetal bovine serum) at a cell density of  $1 \times 10^4$  MNCs/well in 96 well plates (n=3). Two parallel treatment methods were used. The initial media exchange was performed at 24hr for first series, followed by media change at 3 day time intervals. For the second series, half of the volume of media was added in addition to the medium present in the flasks on the fourth day and complete media change at 7<sup>th</sup> day followed by media exchange every 3 days. Cell viability was evaluated using MTT reagent at different time points for 13 days. Plasma obtained from the cord

blood was used to prepare APRP (activated platelet rich plasma) after treatment with calcium chloride (1M) to compare the Cell proliferation rate between FBS and APRP. The cells of the 4<sup>th</sup> passage were supplemented with FBS (10%) or APRP (10%) in high glucose medium and allowed to grow. Morphology of MSCs was identified by staining with acridine orange, crystal violet, Giemsa and rhodamine 123. Immunocytochemistry technique was used to identify the MSCs with CD45 (negative MSC marker), CD73 (MSC marker) and Vimentin (Positive marker for MSC). Senescence of MSCs obtained from fourth passage was visualized with X-gal staining method. Similar growth rate kinetics was observed with all the media examined. Among them HG-DMEM and alpha MEM showed high MSC population. Less contamination but low growth rate was observed with LG-DMEM. However the growth rate was similar for LG-DMEM, HG-DMEM and alpha MEM after the first passage. Replacing APRP for FBS did not show any difference on the proliferation rates. It reflects that APRP is an alternative cost effective better approach instead of FBS to obtain most immune compatible MSCs for further therapeutic purposes.

**Keywords:** MSCs, DMEM, MTT, APRP

## HIGH ANTIOXIDANT EFFICACY OF LEGUME PHENOLICS EXTRACTED AT LOW TEMPERATURE

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Legumes are widely consumed in the usual diet and are composed of nutrients as well as non-nutritive phytochemicals. The aim of the present work was to determine the antioxidant efficacy of constitute phenolics of legumes subjected to different processing conditions and extraction temperatures. Six different types of commonly consuming legumes namely *Vignaradiata* (Green gram; Ari), *Vignamungo* (Black gram; Anurada), *Cicerarietinum* (Chickpea; Red, Yellow), *Vignaunguiculata* (Cowpea; Varuni), *Glycine max* (Soybean; PB1), and *Lens culinaris* (Dhal; Maisoor) were used. The whole seeds were processed in six different methods namely peeling, soaking with peel, soaking without peel, germinating, soaked and boiling and soaked, peeled and boiling. The soluble phenolic fraction of the each sample was extracted into 50% acetone allowing different temperature combinations. Low temperature extraction was performed at  $10 \pm 5$  °C and high temperature extraction was done at  $60 \pm 2$  °C. Total phenolic content (TPC) and total flavonoid content (TFC) of the legume extracts were determined. The extracts were tested for antioxidant efficacy using ferrous ion chelating activity (FICA) and

DPPH (2, 2-dipenyl-1-picrylhydrazil) radical scavenging activity (DRSA). All the experiments were carried out in triplicates and the statistical analysis was performed using SPSS version 16. TPC of the high and low temperature extracts were ranged from 3.07-161.86 -0.84-119.26  $\mu$ mole of gallic acid equivalent per gram of defatted meal (equi/g of DM). TFC of legumes extracted with low and high temperatures ranged from 0.08-70.76 and 0.13-180.05  $\mu$ mole of catechin equi/g of DM respectively. The efficacy of the high and low temperature extracts to chelate the ferrous ions was measured as 1.80-26.31 and 13.86-207.79  $\mu$ mole of EDTA equi/g of DM respectively. The results showed that high temperature extraction yielded higher total phenolics and flavonoids contents. The antioxidant efficacy was higher in extracts resulted by low temperature. The results revealed that low temperature extraction allow the retention of phenolic compounds exhibiting high antioxidant efficacy.

**Keywords:** Legumes, TPC, Antioxidant efficacy, Extraction, Processed

## COMPARING THE METABOLIC ACTIVITY OF STEM CELLS IN COLLAGEN GELS AS A POTENTIAL THERAPEUTIC IN NERVE TISSUE ENGINEERING

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Differentiated stem cells in collagen constructs have been shown to mimic Schwann cells and support peripheral nerve regeneration. A clinical neural stem cell line (CTX, ReNeuron, UK) in stabilized collagen gels showed differentiation and an upregulation of glial markers in vitro. In this study we used a metabolic assay to test a range of stem cells to compare viability in collagen constructs to identify those cell lines with greatest potential for use in nerve tissue engineering. Three stem cell lines of neural and neural retinal origin were embedded in collagen constructs and maintained in culture to assess metabolic activity at different time points. In all cell types an initial increase in metabolic activity was observed in the

first 4-6h, followed by a decline to a lower level that remained stable from 24-72h. However, one cell line particularly showed lower metabolic activity than the other cell types. This suggests that there are differences between alternative stem cell lines in terms of their metabolism in collagen gels in vitro. Characterizing cell activity in this way provides an insight into the cellular changes that take place over time in vitro during the manufacture of engineered tissue constructs and potentially ensures their quality for therapeutic purposes.

**Keywords:** Clinical stem cell line, Engineered tissue construct, Metabolism



## PROGRESS TOWARDS MAPPING QTLs FOR ROOT TRAITS ON CHROMOSOME 10 IN RICE (*Oryza sativa*) USING ELITE RICE BACKGROUND

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Improvement of root architecture in rice is important to have higher yield potential and greater yield stability under abiotic stress conditions. Root related traits are governed by many genes exhibiting quantitative or polygenic inheritance. The dissection of the genetic basis of the root traits could be achieved by mapping of Quantitative Trait Loci (QTLs) using molecular markers. The present study was conducted with the aim of identifying root related QTLs in rice using the Recombinant Inbred Line population (RIL) derived from At354 and Bg352. At354 has less extensive, thin root structure and Bg352 has large extensive, dense root structure. Phenotyping was done with root volume, top root girth, root dry weight and root length in 91 RILs grown under hydroponics for 56 days. For QTL mapping, Single Nucleotide Polymorphism (SNPs) markers investigated from a previous study on chromosome 10 of At354, Bg352, were obtained. RILs were genotyped using Simple

Sequence Repeat (SSR) markers and molecular map of chromosome 10 was constructed combining SSR markers with SNP markers. Results revealed two significant QTLs for top root girth (qTRG<sub>10</sub>) and root dry weight (qRDW<sub>10</sub>) co-localized at 0.125 Mb on chromosome 10 explaining 8.3% and 13.3% phenotypic variation respectively. The SSR marker RM24894 was closely associated with the identified putative QTL and it could be considered as a user friendly promising marker to be applied in marker assisted breeding for improvement of root traits.

**Keywords:** Chromosome 10, QTL, Rice

**Acknowledgment:** The financial assistance from Wayamba University Research Grant 2016 (SRHDC/RP/04/16-4) is gratefully acknowledged.

## ANTIMICROBIAL PROPERTIES OF FINGER MILLET (*Eleusine coracana*) VARIETIES OF SRI LANKA

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Identifying novel antimicrobial drugs and edible antimicrobial agents, preferably from plant materials, is receiving attention worldwide. Polyphenols have been recognized as potential inhibitors on growth of a wide spectrum of microorganisms. Our previous studies confirmed that locally grown finger millet varieties (LGFMV) are rich in polyphenols compared to commonly consumed cereals. Therefore, objective of the present study was to evaluate antimicrobial properties of LGFMV. Flours of whole grains of Ravi, Rawana and Oshadha varieties were extracted with ethanol and methanol separately and those extracts were used in evaluating antibacterial and antifungal activities using Microplate alamar blue assay and Agar tube dilution method, respectively. Six sensitive (*Shigella flexneri*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Salmonella typhi*, *Bacillus subtilis*, *Staphylococcus aureus*) and four resistant (*Klebsiella pneumoniae*, *Escherichia coli*, *Salmonella enterica*, *Staphylococcus aureus*) bacterial strains and six fungal strains (*Candida albicans*, *Candida glabrata*, *Microsporium canis*, *Aspergillus niger*, *Fusarium lini*, *Trichophyton*

*rubrum*) were used in the study. None of the extracts were active against *S. typhi* and *S. flexneri* at 150, 600 and 2400 µg/mL concentrations. Both extracts of three varieties were active against *E. coli* and *P. aeruginosa* (at 2400 µg/mL concentration) and *S. aureus* and *B. subtilis* (at 600 µg/mL concentration) showing more than 50% inhibition. Minimum inhibitory concentrations of the extracts against *S. aureus* and *B. subtilis* were found to be 2100 and 1800 µg/mL respectively. None of the extracts of three varieties were active against resistant bacterial strains at tested concentrations. Both extracts showed no inhibition against tested fungal strains at 400, 800, 1600 and 3200 µg/mL concentrations. To the best of our knowledge, this is the first report on antimicrobial properties of LGFMV and the results provide evidence for the antibacterial potential of ethanolic and methanolic extracts of Ravi, Rawana and Oshadha varieties against some pathogenic bacterial strains.

**Keywords:** Agar tube dilution method, Antimicrobial activity, Finger millet

## ANTI-OXIDANT AND ANTI-PROLIFERATIVE ACTIVITY OF TRIPHALA

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Triphala is one of the oldest and invaluable polyherbal formulation used in Indian ayurvedic medicine. It contains equal proportions of three fruits of, *Emblica officinalis*, *Terminalia bellerica* and *Terminalia chebula*. Attributed to its well-known therapeutic potential, it is commonly used in Sri Lankan ayurvedic medicine, as the decoction form or as the dry powder. The objective of the current study was to identify the phytochemical content, antioxidant and anticancer properties of Triphala decoction used in Sri Lankan ayurvedic medical practice. Total phenolic content and flavonoid content were determined by using Folin-Ciocalteu method and Aluminum chloride colorimetric method, respectively. The anti-oxidant activity was determined by DPPH scavenging potential, reducing power and total antioxidant capacity evaluating assays. Anti-proliferative activity of Triphala on both RD and HepG2 cells was determined by using MTT assay after exposing cells to Triphala for 24, 48 and 72 hours. The LDH enzyme assay was carried out for RD cells after exposing cells to Triphala for 24 hours. Total phenolic content and the flavonoid content were

36.0±3.4% gallic acid equivalents and 29.3±0.5 of EGCG equivalents respectively. DPPH radical scavenging activity gave an EC<sub>50</sub> value of 8.2±0.7. Triphala showed a high reducing power, which was similar to ascorbic acid. Total antioxidant capacity was found to be concentration dependent. Respective EC<sub>50</sub> values of MTT assays for samples treated with Triphala for 24, 48 and 78 hours were 472.9±13.3, 262.0±5.6, 232.3±4 µg/mL with RD cells and 1261.4±165.9, 1520.1± 132.6, 254.4± 11.2 µg/mL for HepG2 cells. EC<sub>50</sub> value for the LDH assay was 875.1±54.9 µg/mL. In conclusion, Triphala used in this study had a high polyphenol and flavonoid content, which might be responsible for its antioxidant potential. Anti-proliferative activity is higher with RD cells compared to HepG2 cells. RD cells also showed a dose dependent and time dependent cytotoxicity.

**Keywords:** Triphala, Phytochemicals, Anti-oxidant, Antiproliferative activity

## PHYTOCHEMICAL SCREENING AND ANTIOXIDANT ACTIVITY OF WATER AND ETHANOLIC EXTRACTS OF *Annona Muricata* (SOURSOP) FRUIT

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The plant *Annona muricata* is a member of the Annonaceae family, which is generally known as soursop or graviola. This evergreen plant is distributed in tropical and subtropical regions of the world. During the past several years, there has been growing interest in the usage of various underutilized fruits of medicinal plants from traditional medicine for the treatment of various health ailments. Soursop plant is used in ayurvedic system and folk medicine for the treatment of wide range of disease conditions in many countries. In this study, dried and undried soursop fruit pulp was extracted using ethanol and water as the solvent. Phytochemical screening was carried out for the above mentioned extracts and results show that soursop fruit pulp is rich in many types of phytochemicals such as alkaloids, flavonoids, steroids, saponines, terpinoids, glycosides and

phenolic compounds. Based on Thin Layer Chromatographic (TLC) studies, antioxidant activity of ethanolic soursop fruit extract was evaluated using DPPH radical scavenging activity and FRAP analysis methods. The IC<sub>50</sub> value of DPPH scavenging activity of the ethanolic extract of dried fruit pulp is 560 µg mL<sup>-1</sup>. According to the FRAP analysis, FRAP equivalent value of ethanolic extract of dried fruit pulp is 45.714 mmoldm<sup>-3</sup>. Based on the results of this research, *Annona muricata* fruit shows promising antioxidant activity warranting further investigation to isolate active compounds from the fruit extracts that can be used as antioxidants.

**Keywords:** *Annona muricata*, Phytochemical analysis, DPPH radical scavenging activity, FRAP Analysis

## PROBIOTIC POTENTIAL OF EXOPOLYSACCHARIDE PRODUCING *Lactobacillus plantarum* Sp. ISOLATED FROM SRI LANKAN DAIRIES

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Bacterial extracellular polysaccharides (EPS) are used in fermented food formulations to improve rheology, texture, mouth feel and have physiological effects on human health (antitumour activity, immunomodulating bioactivity and anticarcinogenicity). As some *Lactobacillus* strains are generally recognized as safe (GRAS) and have been shown to exhibit probiotic activity, EPS from those bacteria can be used as functional food ingredients. Therefore, in this study four, exopolysaccharide producing *Lactobacillus plantarum* strains isolated from Sri Lanka dairies were assayed for their probiotic potentials for future functional food applications. Thirty *Lactobacillus* isolates obtained from raw bovine milk were screened for their exopolysaccharide producing abilities by growing them on ruthenium red milk agar plates (with 0.08 g/L of ruthenium red) and MRS agar plates (with different carbon sources: glucose, sucrose, galactose, lactose, or xylose). Isolates producing ropy colonies were phenotypically and genotypically characterized and out of those, 4 *Lactobacillus plantarum* strains were selected to examine their probiotic potentials by investigating their tolerance to pH (1.5, 3.0, 9.0) bile (0.1%, 0.3%, 0.5% oxgall), temperature (10 °C,

15 °C, 37 °C, 45 °C), simulated gastric enzymes, pepsin and pancreatin (at pH 2 and 8) and inhibitory substances NaCl (2%, 4%, 6.5%) and phenol (0.2%, 0.4%, 0.6%). The 4 isolates produced visible, ropy extracellular polysaccharides when grown in the presence of ruthenium red and different carbon sources therefore, were considered as potential exopolysaccharide producers for industry. The results showed that *Lactobacillus plantarum* strain ZDY128, could not survive under a few gastro-intestinal (GI) conditions (very low pH, high bile and phenol concentrations) throughout the test period (6 hrs). *Lactobacillus plantarum* strain KLB 415 was the finest probiotic strain identified as it was able to withstand all *in vitro* GI conditions provided. Moreover, its probiotic potential was superior to the other two probiotic strains, *Lactobacillus plantarum* strain HL-20 and *Lactobacillus plantarum* strain gp27 assayed.

**Keywords:** Lactobacilli, Exopolysaccharides, Probiotic, *Lactobacillus plantarum*

**Acknowledgement:** Financial support from the NSF Grant (RG/2016/AG/02) is gratefully acknowledged.

*Poster  
Prasentation*



# ANATOMICAL VARIATIONS OF THE VESSELS IN THE FEMORAL TRIANGLE; A CASE REPORT

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The femoral triangle is an important site for various clinical procedures. A sound knowledge about the anatomical variations of femoral vessels and their branches in the femoral triangle is important to prevent inadvertent damage to these vessels during surgical procedures and for successful arterial and venous cannulation for various purposes. This case report describes the clinically important abnormal vascular patterns of the left femoral region of a middle aged Sri Lankan man observed during routine dissection. Profunda femoris artery originated 1 cm below the inguinal ligament from the lateral aspect of the common femoral artery at a higher level than that documented in the standard text books and in most of the previous studies. Subsequently femoral artery crossed superficially over the femoral vein and the femoral vein was lying deep to the femoral artery in most part of the

femoral triangle. The profunda femoral vein drained into the femoral vein as described in the text books nearly 3 - 4 cm below the inguinal ligament. Medial and lateral circumflex femoral arteries originated from profunda femoris artery. Even though the variations are mostly incidental findings and being of general anatomical interest, knowledge of these variations appears to be mandatory for planning surgery and vascular interventions. It also serves as a reminder that constant vascular landmarks can occasionally be subject to marked variability. Ultrasonography should be used particularly for more difficult femoral vascular access.

**Keywords:** Femoral triangle, Femoral artery, Femoral vein, Profunda femoris artery

## ADAPTABILITY OF AGRICULTURAL PRODUCTION SYSTEMS SIMULATOR (APSIM) – MAIZE MODEL IN INTERMEDIATE ZONE OF SRI LANKA

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Agricultural production systems simulator (APSIM) is an internationally recognized highly advanced modeling tool that is employed to simulate agricultural production systems by using sub-models. The main objective of the study was to validate the APSIM-Maize module for the local use by determining the response of maize grain yield in Maha season of 2015 in the field. The study was conducted for existing rain fed maize fields at Siyambalanduwa in the intermediate zone in Sri Lanka. Coefficient of determination ( $R^2$ ) of 0.89 showed that there was an acceptable correlation

between the measured and simulated maize yield values. The measured and simulated grain yields were 2541.9 kg/ha and 3204.8 kg/ha, respectively. Calculated rRMSE and modeling efficiency (ME) values for grain dry weight were 0.33 and 0.7, respectively. In conclusion, our analysis indicated that the APSIM-Maize proves to be a reliable model that can be used as a research and discussion tool to enhance maize production system in Sri Lanka.

**Keywords:** Agriculture, APSIM, Crop modeling, Maize, Simulation



## THE EFFECT OF SOLVENT TYPE AND RECONSTITUTION TEMPERATURE ON THE SOLUBILITY OF COMMERCIALY AVAILABLE MILK POWDERS IN SRI LANKA

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Solubility is considered as one of the major quality attribute of milk powders and there are several factors which effect on the milk powder solubility. The objective of this study was to investigate the effect of water type and water temperature levels on the solubility of commercially available milk powders in Sri Lanka. In addition to that, chemical properties of milk powders were analyzed and compared with international quality standards. Solubility was measured using insolubility index method and three water types were used including distilled water, deionized water and nano-water at two different temperature levels as 24 °C and 80 °C. Altogether 30 milk powder samples were tested including two locally produced and four imported milk powder brands. According to the insolubility index values, imported milk powder brands possessed higher solubility ( $0.49 \pm 0.05$ ) than the locally produced ones ( $0.82 \pm 0.03$ ) in all the three water types and temperature levels.

When comparing the three different water types, solubility of milk powders were significantly lower ( $p < 0.05$ ) in de-ionized water, compared to nano-water and distilled water at 24 °C temperature in both imported and local milk powders. At 80 °C temperature level, imported milk powder brands showed a lower solubility in de-ionized water while local milk powder brands showed significantly lower solubility ( $p < 0.05$ ) in nano-water. All the milk powders had much higher solubility at 80 °C when compared to that of 24 °C. All the other chemical properties including fat, protein, ash, Ca, pH, moisture and water activity were within the acceptable standard levels except free fatty acid content in both local and imported milk powders and it can be concluded that compositional changes of milk powders also effect on the solubility other than water type and temperature levels.

**Keywords:** Chemical Properties, Insolubility index, Solubility, Water types

## FUNGAL PATHOGEN ASSOCIATED WITH YAM (*Dioscorea esculenta*) ROT IN BATTICALOA DISTRICT, SRI LANKA

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*Dioscorea esculenta*, commonly known as the lesser yam is cultivated in Batticaloa district of Sri Lanka in a small scale. Pathogenic fungi reduce the quantity and quality of yam produced. Pathological investigations were carried out to find out the fungal organisms associated with yam rot of lesser yam. Eight pieces (2 mm in diameter) of the infected yam tissues were picked from the point of advancement of rot and inoculated on a solidified Potato Dextrose Agar (PDA) medium. Two replicates were made for each of the four yam tuber samples and the eight plates were inoculated. The inoculated plates were incubated at room temperature (30°C) and observations were made daily for possible fungal growth. Sub-culturing was done to obtain pure cultures of the isolates. Cultural characteristics of the fungi were observed and recorded. The identification of the isolates was

done by examining the isolates macroscopically and microscopically. The causative fungal pathogen was identified as *Fusarium solani* (Mart.) Sacc. based on the colony and microscopic characteristics of the pathogen. *Fusarium solani* produced white cream mycelia. Macroconidia are three to four-septate, slightly curved, 28-42 x 4-6 µm. Microconidia are abundant, cylindrical to oval, one to two-celled, 8-16 x 2-4.5 µm. Pathogenicity test carried out confirmed this fungal species as the pathological agent of the lesser yam rot. The finding of the causal organism of the yam rot disease would be very useful in choosing effective control measures to extend the life span of yam in storage.

**Keywords:** Fungal pathogen, Lesser yam, Yam rot

## A FUCOIDAN ISOLATED FROM SRI LANKAN MARINE BROWN ALGA *Chnoospora minima*; A POTENTIAL INHIBITOR OF LPS-INDUCED INFLAMMATORY RESPONSES

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Ocean covering more than 70% of earth's surface is a magnificent creation of nature. Marine Natural products are functional ingredients from marine organisms widely used in food, cosmetics and pharmaceutical industries due to their broad spectrum of bioactivity with least toxicity. However, Sri Lankan marine fauna and flora that inhabit the coastal areas represent an underexplored natural resource. Polysaccharides of marine algae exhibit different structural characteristics and interesting biological functions. Among the polysaccharides, fucoidans are sulphated polysaccharides, abundantly found in brown seaweeds and act as a bioactive functional ingredient. In the present study, crude polysaccharides (CP) of eleven Sri Lankan marine algae were separated and characterized using Fourier transform infrared (FTIR) spectroscopy and analyzed for their monosaccharide compositions using high performance anion-exchange chromatography with pulsed amperometric detection (HPAE-PAD) spectroscopy. Purification of fucoidan from Sri Lankan marine brown alga, *Chnoospora minima* by enzyme-assisted extraction using celluclast was done and evaluated for its anti-inflammatory

potential through *in vitro* and *in vivo* studies. The purified fucoidan from *C. minima* (CMF) indicated an ability to inhibit the nitrous oxide (NO) production ( $IC_{50} = 27.82 \pm 0.88 \mu\text{g/mL}$ ) and expression of prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) through the subsequent down regulation of inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) expression in lipo-polysaccharides (LPS) stimulated RAW 264.7 macrophages. CMF inhibited the expression levels of tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin-1 $\beta$  (IL-1 $\beta$ ), and interleukin-6 (IL-6) in a dose-dependent manner. In addition, CMF could suppress the NO and reactive oxygen species (ROS) production in LPS stimulated zebrafish embryos while exerting a protective effect against the cell damage caused by LPS. Current findings confirm the potential anti-inflammatory activity of fucoidan purified from *C. minima* and elaborate its potential application as a functional ingredient in consumer products.

**Keywords:** Marine algae, Anti-inflammatory activity, *Chnoospora minima*, Fucoidan, Zebrafish

## PROPENSITY OF ENDEMIC *Exacum spp.* (BINARA) AS AN ORNAMENTAL PLANT: A CASE STUDY AMONG AGRICULTURAL UNDERGRADUATES, UNIVERSITY OF RUHUNA, SRI LANKA

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Introduction of new plants is critical to the survival and profitability of the floricultural industries. Present survey was conducted to observe the potential of endemic *Exacum spp.* (Binara) as ornamental plant. The sample was selected from undergraduate students (n=125), Faculty of Agriculture, University of Ruhuna, Sri Lanka. Semi-structured interviews were carried out among the undergraduates representing all districts of Sri Lanka using a pre-tested questionnaire. Group discussions were conducted with randomly selected students. Data were analyzed with appropriate descriptive tools. The survey revealed that lack of awareness about Binara plant among the university students (66%) in most of the Districts of Sri Lanka. The results showed around 78% of respondents like colour (blue-purple), flower size (50%), natural texture of flower petal

(60%) and the height of the plant (70%). The 36% of respondents have not clear idea about vase-life of Binara flower. The respondents are more like to use Binara plant as a potted plant (60%) than cut flower (40%). When considering the propagation of Binara, 58% respondents accept propagation by seeds (58%) rather than asexual propagation (42%). However seed propagation of *Exacum spp.* is hard in home level as its seeds are very small (110-140 µm). Among vegetative propagation techniques, 68% respondents suggested to develop cutting than layering (42%). The most of the respondents were alike to use Binara plant as an ornamental plant and it was shown that the ornamental value of Binara flower will help to develop the floriculture industry.

**Keywords:** *Exacum spp.*, Ornamental, Propagation, Vase-life

# IMPACT OF DIFFERENT TYPES OF BACKGROUND MUSIC ON AEROBIC ENDURANCE AMONG NATIONAL TAEKWONDO PLAYERS: SRI LANKAN PERSPECTIVE

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Music is used in many sport and exercisers. People generally seem to enjoy listening to music while exercising. In Sri Lankan context; according to the survey data, most of the people and athletes are not aware about the effects of music on their performance even though they use various types of music for their practices. The objective of this study was to identify the impact of different types of background music on aerobic endurance among National Taekwondo players. The effects of different types of music on heart rate (HR), during treadmill running were recorded for 12 national taekwondo players. The Treatments were randomly assigned according to three age categories (Age 20-24, Age 25-29, and Age 30-33). Participants were taken to the laboratory in order to measure their moderate level speed by using treadmill before assigning the treatments. The four treatments were: Non-music (Type A), Rock music (Type B), Jazz

music (Type C) and North Indian classical music (Type D). Subjects participated on treadmill run, wearing a head-set. HR was recorded at the end of the 7<sup>th</sup> minute. Collected data were statistically analysed by using MINITAB® 14 Software and Microsoft Office Software. Differences ( $p < 0.05$ ) among experimental treatments were determined by a two-way ANOVA and Tukey's Multiple Comparisons Test. HR of Type D music group was lower and HR of Type B music group was higher at the end of the 7<sup>th</sup> minute. There was no significant difference between Type A and Type C. This study provided some support for the hypothesis that North Indian Classical Music reduces heart rate level and increases aerobic endurance during moderate level.

**Keywords:** Aerobic endurance, Background music, Taekwondo and Heart Rate (HR)

# OCCURRENCE OF SOME ANTIBIOTIC-RESISTANT ENTEROBACTER SPECIES AT THE TURTLE POND BAYAZID BOSTAMI SHRINE, CHITTAGONG, BANGLADESH

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The freshwater pond at the Shrine of Bayazid Bostami in Chittagong, Bangladesh, houses a captive population of black softshell turtles. Pilgrims and visitors believe these turtles to be descendants of ancient deities and make religious offerings, and use the pond water for drinking, washing and bathing. However, freshwater turtles are known to harbor *Enterobacter* which may cause illnesses. During the monsoon season, pond water might also be contaminated by domestic and human waste and, therefore, has a potential to contain diverse populations of bacteria. This study aimed to identify *Enterobacter* and their antibiotic resistance at the Bayazid Bostami turtle pond in order to determine the potential exposure of pilgrims to human pathogens. Water samples were collected from the pond surface (22° 23' 13.85" N, 91° 48' 37.34" E) in September 2013 and January 2014. Five species of *Enterobacter*, *Citrobacter freundii*, *Enterobacter aerogenes*, *Enterobacter cloacae*, *Escherichia coli* and *Serratia plymuthica*, were isolated from pond water. One *Enterobacter* species, *Serratia spp.*, isolated during this study has

been known to cause infections in turtles, and all *Enterobacter*, except *Serratia plymuthica*, isolated in this study have been found in human gut flora and identified as human pathogens. After performing resistance tests for seven antibiotics, each isolate was categorized as susceptible, intermediate or resistant depending on the diameter of the zone of inhibition according to standards of the Clinical and Laboratory Standards Institute. Most isolates (92%) demonstrated resistance to ampicillin, erythromycin and penicillin-G. Results of this study suggest that humans are the potential source of antibiotic resistant bacteria and resistance genes may be transferred to naïve bacteria in the environment or turtles from humans. Comparisons of bacteria among the water samples from different locations around the turtle pond are recommended to better understand the *Enterobacter*'s resistance mechanisms to particular antibiotics.

**Keywords:** *Enterobacter*, Antibiotic-resistant, Freshwater, Turtles

## BOX-JENKINS APPROACH TO FORECAST MONTHLY GOLD PRICE IN SRI LANKA

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Based on the recent records, the price of gold is rising in the current global market. Similar characteristics have shown in Sri Lankan gold prices. This study was carried out on two levels with a view to forecast the monthly price fluctuations. In the first level models were constructed to forecast monthly gold price. The data was mined from World Gold Council and Central Bank of Sri Lanka. The sample data of gold price were gathered from 2007 January to 2016 March in the currency of US dollars per troy ounce. It was converted into Sri Lankan

rupees per 22 carat. 75% of data were used to build the model and remaining data were used to forecast the gold price and to check the accuracy of the model. Box-Jenkins, Auto Regressive Integrated Moving Average (ARIMA) methodology has been used to build forecasting models. Components with AR(3) and MA(3) is the best suggested model by the results.

**Keywords:** ARIMA, Gold price, ADF test

## EFFECTS OF HIGH TEMPERATURE ON THE GROWTH AND YIELD OF SELECTED CHILLI (*Capsicum annum* L.) CULTIVARS

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Chilli (*Capsicum annum* L.) is an economically important spice crop widely cultivated in Sri Lanka and is mainly consumed as a spice in the preparation of curry dishes. In late harvest season chilli peppers are frequently exposed to high temperature and leads to severe yield losses. Hence, a study on heat tolerance in selected chilli cultivars was conducted at the Field Crops Research and Development Institute, Maha Illuppallama from August to December 2016. An experiment was carried out to investigate the influence of high temperature on selected chilli cultivars on growth, development and yield attributes. The cultivars were 'Michhy 1', 'Waraniya', 'Galkiriyagama', 'KA 2', 'MI Green', 'Michpl 1' and 'Mich 3'. Performance of these cultivars was evaluated by growing these plants under two different temperature regimes of 48°C and 32°C (ambient temperature). The experiment was laid out in a two factor (cultivar\* temperature stress) Factorial Complete Randomized Design with 14 treatments and 4 replications. High temperature was given for one set of three weeks old seedlings after transplanting them at a temperature regulated polytunnel while another set of seedlings was transplanted in open space (ambient temperature

regime) Higher temperature significantly ( $P < 0.05$ ) reduced the plant height, leaf area, total chlorophyll contents and the number of fruits per plant of the tested chilli cultivars. Cultivars 'Michpl 1' and 'Waraniya' showed the highest plant height (49.2 and 43.6 cm) while the lowest (18.5 and 19.7 cm) were observed in 'Galkiriyagama' and 'KA 2' respectively. The Lowest leaf area (207 and 230 cm<sup>2</sup>) was obtained in 'KA 2' and 'MI green' whilst the highest leaf areas (425 and 378 cm<sup>2</sup>) were found in 'Waraniya' and 'Michhy 1' at high temperature. High temperature significantly ( $P < 0.05$ ) decreased the plant leaf area and total chlorophyll contents of the tested chilli cultivars. 'Michhy 1' and 'Michpl 1' showed highest chlorophyll content (57.8 and 53.0 spad units) while 'Galkiriyagama' and 'MI Green' showed the lowest (36.7 and 26.3 spad units) total chlorophyll content. Cultivars 'Michhy 1' and 'Waraniya' showed the highest number of fruits (27 and 16) under high temperature while the lowest (3 and 2) were obtained in 'MI Green' and 'Galakiriyagama'.

**Keywords:** Ambient temperature, Chilli cultivars, Temperature stress



## RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND BODY MASS INDEX (BMI) IN A MIDDLE-AGED ADULT POPULATION IN KARAPITIYA, SRI LANKA

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Physical inactivity is identified as the fourth leading risk factor for global mortality as it associates with various adverse health conditions including non-communicable diseases (NCDs). Sri Lanka is a middle-income earning country with a considerable number of overweight and obese individuals. Additionally, prevalence of NCDs is also very high in Sri Lanka, particularly among adult communities. This study aimed to identify the relationship between physical activity and body mass index (BMI) and their associated factors in a middle-aged adult population (aged between  $\geq 40$  -  $\leq 65$ ) in Karapitiya, Sri Lanka. Information on physical activity was collected using the short version of the International Physical Activity Questionnaire (IPAQ). Accurate weighing scale and stretch-resistant measuring tape were used to measure participants' weight (kg) and height (cm), respectively. Metabolic Equivalent Task-Minutes (MET-minutes/week) values were calculated to determine the intensity of physical activity. Data analysis was performed using SPSS version 21.0.

In this study, prevalence of overweight/obesity was 38.1%, whereas the prevalence of obesity among physically inactive adults was 84.2%. Statistically significant negative correlation was observed for the relationship between physical activity and BMI ( $r = - 0.527$ ). Particularly, the observed inverse correlation was more significant in the category of vigorous physical activity (HEPA active) and BMI. Moreover, statistically significant negative correlation was observed for the relationship between physical activity and BMI for both male and female middle-aged adults. Findings of this study suggest that physical activity tend to reduce overweight/obesity in middle-aged adults as it involves in energy expenditure and reduction of fat accumulation in the body. Prospective longitudinal studies on physical activity and BMI are recommended to better understand the association between physical activity and BMI.

**Keywords:** Physical activity, Body Mass Index (BMI), Middle-aged adults

## EVALUATION OF GENETIC DIVERSITY OF OSHKT8 GENE IN SELECTED SRI LANKAN RICE VARIETIES

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Rice which is an important cereal crop in many parts of the world is considered to be salt sensitive. Salinization of irrigated lands has been detrimental to rice productivity worldwide. Sodium ion transport process plays a major role in the context of salinity stress and tolerance responses. Members of HKT (High Affinity K<sup>+</sup> Transporters) gene family are important for controlling Na<sup>+</sup> accumulation in the cells, thus improving salinity tolerance. There are nine HKT genes found in rice. Hence the study focuses on analyzing nucleotide diversity of OsHKT8 which is a significant member of rice HKT gene family. Physiological analysis suggested that HKT8 is involved in regulating Na<sup>+</sup>/K<sup>+</sup> homeostasis under salt stress. HKT8 also known as SKC1 gene is located on chromosome 1. Sequences of HKT8 gene (3985 bp) of seven Sri Lankan rice varieties, a salt tolerant recombinant inbred line, FL478 and a reference variety, Nipponbare were retrieved from the Rice SNP-Seek Database of International Rice Research Institute. Sequences

were aligned using Clustal omega multiple sequence alignment program. Analysis revealed 58 SNPs and 25 INDELS throughout the gene. The frequency of occurrence of all SNP sites and all INDEL sites in the considered region is 1.5% and 0.6% respectively. The INDEL with a 22 bp is the longest region with insertions and deletions. The presence of SNPs and INDELS clustered the varieties into nine groups. Cladogram shows that traditional salinity tolerant variety Pokkali has a separate phylogeny from other selected varieties and carries alone an INDEL of 13 bp region. FL478 alone has a deletion of 14bp region but cladogram shows a close relationship with a traditional cultivar. The genetic diversity revealed in this in-silico analysis has to be further studied with respective to phenotypic data for the validation to be used in improving salt tolerant lines followed by breeding.

**Keywords:** OsHKT8 Gene, Salinity, Genetic diversity

## ASSESSMENT AND RECONSTRUCTION OF AAHPER TEST FOR SRI LANKAN YOUTH AGED 10 – 17

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The physical fitness is the ability to carry out daily tasks with vigorous and alertness without undue fatigue. A fit and healthy person will live longer and youth are backbone to nation. Therefore the research question raised to assess the fitness level of the Sri Lankan youth and objective of the study was to construct a new fitness test norms for Sri Lankan age 11, 12, 13, 14, 15 and 16 years old youth boys and girls based on AAHPER test. To achieve the purpose of this study 1000 girls and boys (age 10-17 years) selected from various provinces in Sri Lanka by random sampling method. The data were collected using the AAHPER test batteries which consist with six test items 50 yard run, standing broad jump, shuttle run, pull-up for

boys and flex arm hang for girls, sit up and 600 yard run respectively and was analyzed by using SPSS. From the results, following percentile norms were created 5<sup>th</sup> 10<sup>th</sup> 15<sup>th</sup> 20<sup>th</sup> 25<sup>th</sup> 30<sup>th</sup> 35<sup>th</sup> 40<sup>th</sup> 45<sup>th</sup> 50<sup>th</sup> 55<sup>th</sup> 60<sup>th</sup> 65<sup>th</sup> 70<sup>th</sup> 75<sup>th</sup> 80<sup>th</sup> 85<sup>th</sup> 90<sup>th</sup> 95<sup>th</sup> 100<sup>th</sup>. From the results it was concluded that, newly constructed norms are slightly lower than AAHPER youth fitness test battery. Hence it was recommended that, newly constructed fitness norms are appropriate to categorize fitness level of the Sri Lankan youth. Further studies are essential to enhance the reliability and validity of the newly constructed norms.

**Keywords:** Physical fitness, Youth age, AAHPER

## DESIGNING A PHYSICAL LITERACY MODEL FOR SRI LANKAN CHILDREN GRADES 4 TO 6 (8 TO 12 YEARS)

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This paper examines that the action taken to design a physical literacy model for Sri Lankan children grade 4 to 6 (aged 8-12). The aim of this study was to find the low level of development of physical literacy as one of the main factor for low level of sport achievements at international level. Physical literacy mainly concerns the Fundamental Motor Skills as well as sports skills. Pre-test and Post-test pre experimental design was used as the research design. Hundred (N=100) subjects were taken from Karawita central college, Rathnapura by using random sampling method. Data were gathered by cognitive, psychomotor, affective test and observation. Especially FMS cycle was used to develop physical literacy level in students within the course of 08 weeks. Paired t test was used to analyze the data by using MS Office and Minitab 17. According to the cognitive test, there was

significant difference between pre-test and post test and the P value is 0.000 ( $P < 0.05$ ). According to the psychomotor test, there was significant difference between pre-test and post test and the P value is 0.000 ( $P < 0.05$ ). According to the affective test, there was significant difference between pre-test and post-test and the P value is 0.000 ( $P < 0.05$ ). Therefore, the physical literacy model designed could be used to develop physical literacy level of Sri Lankan student's grade 4-6 (aged 8-12). Monitoring of these measures enhances our understanding of children's physical literacy and assists with the identification of areas where additional supports are required.

**Keywords:** Literacy, Physical literacy, Fundamental motor skills

## PHYLOGENETIC IDENTIFICATION OF *Caryota* (KITHUL) STRAINS USING DNA BARCODING

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DNA barcoding is a reliable method that is used to discriminate species at molecular level by using short highly variable DNA sequences known as “DNA barcodes”. This method is frequently used in animals and plant identification processes. In plants, chloroplast genome regions are most commonly used as DNA barcodes as they show high sequence variation among plant species. Genus *Caryota* belongs to palm family and widely distributed in Asia, Australia and Southern Pacific areas. Systematic identification of *Caryota* species available in Sri Lanka has not been carried out so far because identification using morphological characters is much difficult in genus *Caryota*. Therefore application of DNA barcoding technique in *Caryota* species identification was subjected to be investigated during this study. CTAB method was optimized to extract *Caryota* genomic DNA from leaves. Partial sequences of matK gene and psbA-trnH intergenic spacer region were amplified by polymerase chain reaction using palm specific primers. Amplified products got sequenced and sequences were analyzed using

BLAST, BioEdit and ClustalX 2.1 software to develop barcodes. . In order to phylogenetically identify *Caryota* species present in Sri Lanka, samples were collected from 12 random locations and obtained sequences were analyzed against developed barcodes and phylogenetic relationship was interpreted. matK and psbA-trnH barcodes for two available identified *Caryota* species, which are *Caryota urens* and *Caryota mitis* were developed. It has been found that the psbA-trnH barcode is more suitable as a barcode to identify *Caryota* species because it shows higher sequence variation among *Caryota* species than matK barcode. All the collected samples shared the same sequences with both matK and psbA-trnH barcodes of *Caryota urens*. Therefore it suggests that all these *Caryota* samples phylogenetically belong to same species *Caryota urens* and hence the most prominent *Caryota* species available in Sri Lanka is *Caryota urens*.

**Keywords:** DNA barcoding, *Caryota*, psbA-trnH intergenic spacer region, matK gene

## HEALTH AND ECOLOGICAL RISK ASSESSMENT OF HEAVY METALS IN ATMOSPHERIC DEPOSITION IN KANDY CITY AND SUBURBS, SRI LANKA

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Atmospheric pollution due to heavy metals has gained recent interest since they have been widely reported in high concentrations in Sri Lanka due to increased traffic activities. However, the studies on human and eco-system risk assessments based on atmospheric deposition of heavy metals are still lacking in Sri Lankan context. The presence of heavy metals in the atmospheric deposition was investigated in Kandy, Sri Lanka, a city with significant traffic congestion and thermal inversion, in order to assess the human and ecological health impacts. Atmospheric deposition samples were collected weekly from nine sampling sites and analyzed for heavy metals, namely, Al, Cr, Mn, Fe, Ni, Cu, Zn, Cd and Pb which are common in urban environments. The health risk was assessed using hazard quotient (HQ) and hazard index (HI). The ecological risk was assessed using ecological risk

index (RI). Contamination factor (CF) and geo-accumulation index ( $I_{geo}$ ) showed that Fe and Al are in uncontaminated levels and other metals are in the range of uncontaminated to contaminated. The influence of three exposure pathways were in the order of; ingestion>dermal contact>inhalation. Generally, almost all HQ and HI values for both adult and children were below the safe level. Meanwhile, the HQ and HI values for children were higher than that of the adults. The ecological risk assessment showed high heavy metal contamination pressure into the environment i.e. Cd and Pb indicated high ecological risk while Ni and Cu demonstrated moderate risk on the environment.

**Keywords:** Heavy metals, Human health risk, Ecological risk, Sri Lanka

## EXTRINSIC FACTORS AFFECTING THE MOST PROMINENT INJURY PATTERN AMONG SRI LANKA ARMY FOOTBALL PLAYERS

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Football is a contact sport combining high demands for physiological and technical skills, which make the players more vulnerable to injuries. Injured players have to undergo rehabilitation to get relief from the injury, which could impede their sporting career. Therefore, identification of factors that cause the injuries and taking precautions to prevent them are a timely need. The objectives of this study were to identify the most prominent injury pattern that can be seen in football players and to identify the extrinsic factors responsible for causing these injuries. The mechanisms of the common injuries were also studied. This study was a cohort survey research. The study population (n=45) consisted of both male and female players. The most prominent injury pattern among players was identified using a self-administered questionnaire, which recorded the frequency of injuries that occurred during the competitive season. Following identification of the most prominent injury pattern, data were collected on the extrinsic factors contributing to the identified injury pattern, using a separate

questionnaire. Regression analysis was used to identify the extrinsic factors contributing to the prominent injury pattern. Within the confines of this study, foot and toe injuries were identified as the most prominent injury pattern among the players (100%). Results revealed that lack of proper medical screening ( $p=0.001$ ), improper playing surface ( $p=0.007$ ) and improper protective equipment ( $p=0.009$ ) significantly affected the prominent injury pattern, foot and toe injuries. Twisting/turning mechanism was the most common injury mechanism (73.34%) among Sri-Lankan army football players. It can be concluded that foot and toe injuries are the most prominent injury patterns among SL Army football players, and lack of proper medical screening, improper playing surface and improper protective equipment were major extrinsic factors contributing to these injuries.

**Keywords:** Football, Injury, Extrinsic factors

## A STUDY ON THE RELATIONSHIP BETWEEN ANTHROPOMETRIC CHARACTERISTICS AND PERFORMANCE OF JUNIOR NATIONAL KABADDI PLAYERS IN SRI LANKA

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This study was aimed at identifying the effect of anthropometric characteristics on performance of Junior National Kabaddi players in Sri Lanka. The objectives of the study were to determine whether there is a significant relationship between anthropometric characteristics and performance of Kabaddi players. Forty-three players from group winners at the Junior National Kabaddi Championship, 2016 were randomly selected as the sample. Height, weight, arm length, leg length, upper arm girth, forearm girth, wrist girth, chest girth, waist girth, hip girth, thigh girth, ankle girth and skin folds (chest, abdominal, thigh, subscapular, suprailliac, midaxillary and triceps) were measured as anthropometric characteristics. The performance was assessed using the standard criteria which have been used to select the best Kabaddi player in Sri Lanka. Spearman's rho product moment correlation was used to determine the correlation between tested anthropometric

characteristics and performance, at 5% level of significance. The results revealed that the height ( $r = 0.813, p = 0.000$ ), weight ( $r = 0.646, p = 0.000$ ), total arm length ( $r = 0.813, p = 0.000$ ), total leg length ( $r = 0.803, p = 0.000$ ), chest girth ( $r = 0.568, p = 0.000$ ), waist ( $r = 0.436, p = 0.003$ ), hip circumference ( $r = 0.336, p = 0.027$ ) and body fat ( $r = 0.393, p = 0.009$ ) correlated with performance. No correlation existed among performance and upper arm girth ( $r = 0.234, p = 0.130$ ), forearm girth ( $r = 0.270, p = 0.080$ ), wrist girth ( $r = 0.223, p = 0.151$ ) and thigh girth ( $r = 0.059, p = 0.709$ ). It can be concluded that the performance of Kabaddi players is significantly affected by their height, weight, total arm length, total leg length, chest girth, waist, hip circumference and body fat.

**Keywords:** Kabaddi, Anthropometric characteristics, Performance



## TRENDS IN PRODUCTION OF PRINCIPAL AGRICULTURAL CROPS IN SRI LANKA AND ITS CONTRIBUTION TO THE GDP

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Principal agricultural crops such as paddy, tea, rubber and coconut contribute a significant proportion in percentage of GDP for agricultural sector. The objectives of this study were to (i) identify the trend of percentage share of agriculture sector to GDP over the last six decades (ii) detect the contribution of principal crops to the percentage of agriculture sector to the GDP and (iii) examine the production and the land extent of principal agricultural crops. The study uses the secondary data obtained from the Annual Reports of the Central Bank of Sri Lanka and the Department of Census and Statistics. The data was tabulated and graphs were generated and based on the observed patterns certain inferences were made. The percentage share of GDP of agriculture sector was just above 45% in 1950 and reached 7% in 2016 where it showed a decreasing trend. Likewise, contribution of principal crops also displayed a declining contribution. The percentage share of contribution of all four principal agricultural crops

showed a decreasing trend with paddy showing a significant decrease. The production of tea and area under cultivation remained at a certain level since 2006 and observed a considerable decline in 2016 as a result of both supply and demand factors. Production of rubber showed a rising trend from 2006 and reached its peak in 2012 and thereafter it declined significantly each year. The production of coconut and extent of cultivation remained at the same level with frequent fluctuations. Principal agricultural crops are becoming an unattractive venture for farmers compared to other field crops. Further research is needed to find potential crop varieties and value added products especially for tea, rubber and coconut for Sri Lanka to achieve a higher economic development.

**Keywords:** Principal Agricultural Crops, GDP, Production

## SLIPPAGE OF TRADITION AND CONVERSION INTO NEW TECHNOLOGY IN THE PADDY CULTIVATION IN MUTHUKANDIYA AREA

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Rice becomes the top of the food consumption around the globe. In Sri Lanka, it has fluctuation in the cultivation for paddy supply from the different provinces and the districts. Presently, we can identify the competition in the paddy cultivation because of the using new technology. And also adding competition for the paddy cultivation, makes bad effects to the traditional paddy cultivation. At present, we discovered new genetic technological seeds and agrochemicals used for the paddy cultivation in Muthukandiya area. The farmers who live in Muthukandiya area, have to face lot of annoying situations because of the non-used traditional paddy cultivation and directly use of the new technology based paddy cultivation. Therefore, it shows the forgetting of the farmers' knowledge about the traditional cultivation used in the protected methods, equipment and different kinds of seeds in the Muthukandiya area. The main objective of this research is reveal the difference and influence of the past traditional paddy cultivation and newly use technology based paddy cultivation

in the Muthukandiya area. To collect fundamental information according to the main points, used questionnaires giving to the farmers who live in Muthukandiya area which is situated in Uva province, Monaragala district in Siyabalanduwa regional division. And also used interviews and case study to collect the information. According to the collected information, hundred percent (100%) of the farmers ignored the traditional paddy cultivation and turn into the new technology based paddy cultivation. Also identified thirty five percent (35%) of the people live in Muthukandiya area, suffering from the kidney deceases, heart attacks and weakness of the vision because the use of new technology methods for the paddy cultivation. After the analyzing the collected information, it is reveal the problems they have to face because the traditional paddy cultivation convert into the new technology based paddy cultivation.

**Keywords:** Traditional, New technology, Agrochemical, Paddy cultivation, Influence

## EVALUATION OF THE EFFICACY OF DANDRUFF CARE HERBAL OIL IN THE MANAGEMENT OF *DĀRUNAKA* (DANDRUFF)

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*Darunaka* is a common condition in scalp producing white flakes and itchy scalp. The aim of this study was to assess the efficacy of a traditional oil (dandruff care herbal oil) against coconut oil as an external mode of therapy for *darunaka*. The main ingredients of the test drug were *Trigonella foenum graefum*, *Phyllanthus emblica* Linn, *Dillenia retusa* thumb, *Bacopa monniera* Linn, *Elaeocarpus serratus* Linn, *Seasamum indicum* and *Glycyrrhiza glabra* Linn. The study was conducted using 30 patients. The test group (15 patients) was treated with the test drug and the control group (15 patients) was treated with coconut oil for a month. All patients were advised to avoid the other treatments for *darunaka* and rinse the hair using baby soap when bathing during the trial period. The improvement was assessed using the reduction of scaling off of white skin flakes from the scalp, itching of scalp, dryness, affected scalp quadrant and erythema on scalp. Observations were recorded at

interval of every 7<sup>th</sup> day for one month. The P values for removal of white flakes (test group P=0.00, control group P=0.00), affected area of scalp quadrant (P=0.00, P=0.04) and dryness on scalp (P=0.00, P=0.00) were less than <0.05 for both groups which suggests that both oils are effective in relieving the symptoms. However, according to P values, the test drug is more effective than coconut oil. The improvement of itching (P=0.00, P=0.08) and erythema (P=0.00, P=0.33) was better in the test drug than coconut oil. According to the study, the test drug, dandruff care herbal oil, significantly reduces the symptoms of *darunaka* than coconut oil hence can be used effectively in the management of *darunaka*.

**Keywords:** *Darunaka*, Dandruff care herbal oil, Coconut oil

## PHYTOCHEMICAL ANALYSIS AND EVALUATION OF TOTAL PHENOLIC AND FLAVONOID CONTENT OF SELECTED PARTS OF *Caryota urens* (KITHUL)

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*Caryota urens* (Kithul), also called fishtail palm is one of the native sugar palms in Sri Lanka, which is used to produce sweeteners (treacle and jaggery) and fermented beverage (toddy). In Sri Lankan ethno medicine, *C. urens* is traditionally claimed to possess various health benefits such as antioxidant, anti-diabetic and many other medicinal applications. Therefore, we proceeded to investigate bioactive phytochemicals and antioxidant potential of selected parts of *C. urens* aiming to identify their functional and medicinal components. Phytochemical screening was performed on five distinctive parts of the plant: leaf, root, flower, bark and fruit. Total phenolic content (TPC) and total flavonoid content (TFC) were determined for the leaf, root and flowers of *C. urens*. The extractions were performed with methanol and the crude was obtained, with which Folin-ciocalteu assay and Aluminium Chloride assay were performed for TPC and TFC, respectively. Qualitative phytochemical analysis showed the presence of several bioactive compounds such as flavonoids,

phenols, diterpenes and saponins which differed from one part of the plant to other. Flavonoids and phenols are the principal constituents of the plant. The *C. urens* flower showed the highest TPC, which was  $16.07 \pm 3.83$  (mg GAE/ 10g of sample) and for the leaf  $6.64 \pm 0.49$  (mg GAE/ 10g of sample) and root  $6.92 \pm 1.99$  (mg GAE/ 10g of sample). TFC was reported highest for the leaf with a mean of  $960.32 \pm 132.55$  ( $\mu$ g Quercetine/ 10g of sample), flower with  $28.24 \pm 1.20$  ( $\mu$ g Quercetine/ 10g of sample) and the lowest for the root with  $16.37 \pm 2.77$  ( $\mu$ g Quercetine/ 10g of sample). *C. urens* possesses several phytochemicals with varying degrees in different parts of the plant, and the presence of phenols and flavonoids may increase its medicinal values by contributing to antioxidant and anti-inflammatory activity in the plants.

**Keywords:** *Caryota urens*, Antioxidant, Phytochemicals, TPC, TFC