KDU IRC
INTERNATIONAL RESEARCH CONFERENCE

14TH INTERNATIONAL RESEARCH CONFERENCE

" Security, Stability and National Development in the New Normal "

09TH - 10TH SEPTEMBER 2021

BASIC AND APPLIED SCIENCES

ABSTRACTS

GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY

14TH INTERNATIONAL RESEARCH CONFERENCE

SECURITY, STABILITY AND NATIONAL DEVELOPMENT
IN THE NEW NORMAL

BASIC AND APPLIED SCIENCES

ABSTRACTS

General Sir John Kotelawala Defence University

Ratmalana, Sri Lanka

Conference Chair
Dr Harinda Vidanage

Conference Secretary
Ms Lihini M De Silva

Co-secretaries
Maj BMR Ferdinandesz psc IG

Ms GAI Uwanthika

Capt SAAAK Athukorala

Steering Committee
Brig W Chandrasiri RSP USP psc – President

Brig RGU Rajapakshe RSP psc	Prof KAS Dhammika
Col HMGE Herath RSP USP psc	Prof CL Goonasekara
Lt Col AMDB Adhikari RWP RSP psc	Snr Prof ALS Mendis
	Snr Prof SR De Senevirathne
	Mr VD Kithsiri
	Dr LS Liyanage
	Dr NK Gunasekara
	Mrs RMNP Rajapakse
	Dr LP Kalansooriya
	Dr KSC de Silva
	Ms SDKC Sandanayake

Editorial Committee

Mr WAAK Amaratunga – President

Dr FMMT Marikkar – Assistant Editor

Session Coordinators

Defence and Strategic Studies	Brig RGU Rajapaksha RSP psc Col HMGE Herath RSP USP psc Lt Col PP Serasinghe RSP USP LCdr JPPC de Silva Ms SUW Jayaratne
Medicine	Air Cdre (Prof) RANK Wijesinghe Lt Col (Dr) PH Premaratne Dr SL Malaviarachchi Dr SAC Dalpatadu Dr AU Gamage
Engineering	Capt (E) SU Dampage (Retd) Dr PPCR Karunasekara Mr WSP Fernando
Management, Social Sciences and Humanities	Mr WAAK Amaratunga Ms VU Jayasinghe Mr AHMS Sharic
Law	Mr WS Wijesinghe Maj HSD Mendis Dr YP Wijerathne
Allied Health Sciences	Dr DU Kottahachchi Dr WM Ediriarachchi Dr HMAJ Halahakoon
Built Environment and Spatial Sciences	Dr AH Lakmal Lt Col TC Kathriarachchi (Retd) Archt HT Rupasinghe Mr KT Withanage Mr KAM Chathuranga
Computing	Dr ADAI Gunasekara Dr GACN Priyadarshani Ms TGI Udayangi
Basic and Applied Sciences	Prof CL Goonasekara Dr AWMKK Bandara Dr KW Samarakoon

Message from the Chief Guest

It is with great pleasure that I send this message to the publication of selected conference papers, under a theme that seems more relevant today than ever.

Throughout the history, security has always been the central notion of our existence as a nation. It will continue to be, as long as the geographical realities that define the country's location remains so. This centrality causes our development paradigm to always have a nexus with security, undeniably linking itself to the overall stability of the country.

As the world was compelled to enter into a 'new normal' with the COVID-19 pandemic, the traditional focus on maintaining the hard component of security was overshadowed by the need to replenish its soft component. The world has recently witnessed struggles of global powers with the highest military might, to maintain and uphold their health security. The less-talked about soft security has emerged to overshadow its counterpart, calling us to re-think and re-define the security-development nexus.

COVID-19 posed an unprecedented challenge to Sri Lanka and all developing economies, calling those States to experiment with new ways for achieving national development while managing the novel challenges to their security and stability. In this backdrop, I am delighted to see that the KDU has made allowance for this paradigm shift and hosted its International Research Conference - 2021 along the theme, 'Security, Stability and National development in the New Normal'.

I congratulate all scholars who have contributed to the conference, in particular, those who have shared their research and findings. My heartiest appreciation goes to the Vice Chancellor, Faculty and the staff of KDU whose undying commitment has made this event a reality, even during the pandemic situation.

Steering a country forward in turbulent times is a task that needs meticulous inputs from the country's intellectual body. I am certain that the KDU Research Conference – 2021 has made its mark in this endeavour.

Mr Lalith Weeratunga
Principal Advisor to His Excellency the President of Sri Lanka

Message from the Secretary, Ministry of Defence

It gives me immense pleasure to forward this message on the occasion of the 14th International Research Conference of the General Sir John Kotelawala Defence University (KDU). At the outset, I must appreciate the leadership and guidance which the Vice Chancellor has rendered to maintain the continuity of this highest academic event of the University despite times of great national and international challenges due to the COVID-19 pandemic which has devastated the world.

This year's conference theme: 'Security, Stability and National Development in the New Normal' has taken the current realities of our time into the consideration and how to achieve security and development in times of instability. In this context, I strongly feel that this is an important and commendable approach with innovation demonstrated by the KDU in focussing the attention towards a timely pertinent theme.

The national developments reiterate the importance of a Defence University especially when our motherland is facing unprecedented challenges due to the pandemic. Therefore, I must highlight that our ministerial guidance and blessings, have given the potential for the KDU to actively dwell on a developmental approach to research with Security and Stability as core drivers. This approach will enable the KDU to reach a leading position to guide and influence policy decisions through the knowledge and insights gained from its expansive research programmes.

Furthermore, I believe that the great minds that will lead research deliberations at this conference should actively contribute to aid the great endeavour of steering our beloved motherland towards greater heights in the security and economic spheres, as it is the ultimate responsibility of all Sri Lankans at this time of concern. Finally, I wish that the KDU IRC 2021 will provide a sheer guidance and lead the way towards national development mitigating all current and emerging challenges posed by this devastating pandemic situation. As I extend my sincere well wishes towards the Vice Chancellor, his team and all the participants of this conference for its successful execution and for their future endeavours, I would like to assure that my blessings and support will be with KDU at all times.

General Kamal Gunaratne (Retd)
WWV RWP RSP USP ndc psc MPhil
Secretary
Ministry of Defence

Message from the Vice Chancellor

As the KDU celebrates its 40th anniversary, the International Research Conference is entering its 14th year and adapting to the new normal conditions and unprecedented challenges that have forced many programmes to be called off indefinitely. The evolution and continuity of the research conference into the successive 14th year adapting to challenges bears testimony for the success of the KDU as a seat of learning that can withstand any challenge national or international in nature.

The sheer number of papers that the conference received this year demonstrates the enthusiasm shown by presenters both locally and internationally even at a time of a grave crisis that has put educational institutions under severe stress, and it affirms the faith scholars have had on KDU. As the only defence university in Sri Lanka, KDU has been committed to research and knowledge production that will influence and shape the policy deliberations of security and development. These are core pillars of the stability and existence of any society, and it is our national responsibility to provide such insights through the organization of premier research dialogues.

This year's theme 'Security, Stability and National Development in the New Normal' bears witness to the civil military fusion that KDU has created and its commitment to achieving balance and resilience in times of global crises to safeguard and advance the security and developmental interests of the motherland.

KDU IRC is a platform of cooperation and diplomacy, and it encourages academic collaboration across Sri Lanka's higher education institutions. Research conferences are the ultimate networking events, and we are proud to provide these spaces of engagement where Sri Lankan and international scholars can present their findings and deliberate on the way forward for the nation and for the global community to thrive at a time humanity's resolve is tested by the pandemic. I wish all the very best for the academics, practitioners and policy makers who want to showcase their research and experience at our research conference.

Finally, I appreciate the dedication and hard work of all those who worked tirelessly over the last several months contributing in diverse ways to make the KDU IRC 2021 a reality under the trying circumstances, especially the IRC Chair, the Secretary, and the organizing committees headed by the Deputy Vice Chancellor (Defence and Administration).

Major General Milinda Peiris
RWP RSP VSV USP ndc psc MPhil (Ind)
Vice Chancellor
General Sir John Kotelawala Defence University

Message from the Conference Chair

KDU International Research Conference in its 14th iteration is held amidst celebration of its 40th anniversary and situated in local and global environment that is challenged by a new form of microbial security threat in the form the Covid19 outbreak. KDU stands strong and unbowed to maintain the continuity of this apex academic event this year on the theme, Security, Stability and National Development in the New Normal.

Challenged with the most potent wave of the pandemic, we remain undeterred thanks to the leadership of the Vice Chancellor. The organizing committee has put their heart and soul into adapting and evolving the conference formats that could withstand and confront the new normal conditions in organizing the international research conference.

Academic communities in the world are beacons of hope and resilience and given the sheer number of research papers that were submitted to the conference this year is a testament that KDU remains a space of hope for such communities and a sacred ground where research is encouraged even at trying times.

The theme of this year was a conscious decision to confront the realities that Sri Lanka and the world had to encounter since March 2020, that Covid 19 was a harbinger for a new reality. Universities are centres of resistance and renaissance and the KDU in Sri Lanka sets an example to all other institutions to emphasize the will to confront any challenge.

In this context KDU research conference is nourished by the presentations and deliberations of esteemed plenary speakers and research presentations that will provide vital insights into the key themes of security, stability, and national development. I extend gratitude and best wishes to all presenters who believe in the research culture evolved by the KDU and may you be treated to the finest KDU hospitality that transcend from physical to the cyber space and may you all be contributors to a greater cause for the sake of all humanity.

Dr Harinda Vidanage
PhD (Edin)
Conference Chair

Table of Contents

ORAL PRESENTATIONS

POSTER PRESENTATIONS

ORAL PRESENTATIONS

Gene Expression Analysis of Human Breast Adenocarcinoma (MCF-7) Cells Treated with a Sri Lankan Red Seaweed *Gracilaria edulis* (Gmelin) Silva

MDTL Gunathilaka[1], KW Samarakoon[2], P Ranasinghe[3] and LCD Peiris[1#]

[1]Department of Zoology (Centre for Biotechnology), Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Institute for Combinatorial Advanced Research and Education (KDU-CARE), General Sir John Kotelawala Defence University
[3]Industrial Technology Institute, Halbarawa Gardens, Malabe, Sri Lanka

[#]dinithi@sci.sjp.ac.lk

Marine seaweeds are a rich source of bioactive metabolites that can be used as an alternative source for the development of anti-cancer drugs. Therefore, the present study was aimed to analyse the apoptosis-related gene expression of hexane fraction of *G. edulis* treated human breast adenocarcinoma (MCF-7) cells. De-polysaccharide polyphenol-rich methanol extract of *G. edulis* was sequentially partitioned with hexane, chloroform, and ethyl acetate to determine the cytotoxic potential. The hexane fraction of *G. edulis* (IC_{50}: 29.84±0.65 µg/ml) exhibited the potent cytotoxic activity compared to the standard cycloheximide (IC_{50}: 28.76±0.55 µg/ml). Apoptotic morphological alterations were observed in MCF-7 cells treated with hexane fraction of *G. edulis*. Based on the cytotoxic and apoptotic activity, hexane fraction of *G. edulis* has been selected further to analyze the apoptosis-related *p53*, *p21*, *Bax* and *Bcl2* genes expression in MCF-7 cells. Based on the results, the mRNA expression of apoptosis-related genes *p53, p21, Bax and Bcl2* was increased following treatment of *G. edulis* hexane fraction in a dose-dependent manner. Further, 30 µg/mL of hexane fraction of *G. edulis* treated MCF-7 cells upregulated the *p53* (5.4) gene more prominently compared to the *p21* (1.58) and *Bax* (0.829) genes. Similarly, standard cycloheximide (30 µg/mL) treated MCF-7 cells up-regulated the *p21* (0.96) gene more prominently compared to the *p53* (0.74) and *Bax* (0.753) genes. The expression of the anti-apoptotic *Bcl2* gene is comparatively lower in the hexane fraction of *G. edulis* (15 and 30 µg/mL) treated MCF-7 cells than the standard cycloheximide. Further, a higher expression ratio of *Bax/Bcl2* has been observed in 30 µg/mL of hexane fraction treated MCF-7 (29.69) cells which determines the cells` susceptibility to apoptosis compared to the standard cycloheximide treated cells. Therefore, this study demonstrated that the hexane fraction of *G. edulis* is a promising source to influence apoptosis prominently in MCF-7 cells compared to the standard cycloheximide. Thus, the hexane fraction of *G. edulis* is a potential source of natural compounds that can be utilized for the development of a new drug or a supplement to treat patients suffering from breast adenocarcinoma.

Keywords: MCF-7 cells, Gracilaria edulis, genes, marine seaweeds

Molecular Docking Analysis of Novel Angiotensin-I Converting Enzyme (ACE) Inhibitory Peptides Isolated from Cultured Marine Microalga, *Nannochloropsis oculata*

KW Samarakoon[1#] and YJ Jeon[2]

[1]*Institute for Combinatorial Advanced Research and Education (KDU-CARE), General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka*
[2]*Department of Marine Life Science, Jeju National University, Jeju 690-756, Republic of Korea*

#samarakoonk@kdu.ac.lk

The high protein content in the cultured marine microalgae has been demanded to explore bioactive peptides in the functional food industry. Angiotensin-I converting enzyme (ACE) inhibitory active peptides isolated from the cultured marine microalga, *Nannochloropsis oculata* was subjected for molecular docking studies. The molecular docking system of the ACE-ligand complexes was used to assess the isolated peptides which are posed in the best orientation in the pocket of the ACE active site. Chemically synthesized (purity >98%) two novel peptides known as tri-peptide (LEQ) and hepta-peptide (GMNNLTP) were evaluated for ACE inhibitory activity using a commercial ACE assay kit. The relative IC_{50} values reported on LEQ and GMNNLTP were 70.53±0.17 µg/mL (191 µM) and 76.34±0.45µg/mL (105 µM), respectively. However, both peptides showed the lower ACE inhibitory activity compared to the positive control, captopril with an IC_{50} value of 4.2±0.02 µg/mL (19.5 µM). The docking studies using CDOCKER in Accelrys Discovery Studio 3.1, the calculated binding energy among the identified peptides, LEQ-I, indicated a lower binding energy (-216 kcal/mol) and CDOCK interaction energy (56.83 kcal/mol) compared to the LEQ-II and positive control, captopril. Binding energy and CDOCK interaction energy of the captopril were -53.21 and 30.90 kcal/mol, respectively. However, the association of amino acid residual interaction with a metal ion (Zn^{701}) and H-bond interactions, including Arg^{522}, Ala^{356}, Tyr^{523}, and Glu^{143} of the peptide, GMNNLTP-I showed comparatively lower (-461.55 kcal/mol) interactions and higher CDOCK interaction energy (128.24 kcal/mol) than GMNNLTP-II in the *in-silico* assay. Therefore, GMNNLTP isomer-1 showed the best-fit orientation with the direct coordination of the catalytic Zn (II) as observed in the lowest binding energy and the highest CDOCK interaction energy compared to the captopril. Consequently, these two novel peptides have the potential to use in therapeutic applications after further studies.

Keywords: *Nannochloropsis oculata, microalgae, ACE-I, molecular docking*

Insights from Computational Approach to Predict the Inhibitory Efficacy of the HDAC Inhibitor on HDLP Enzyme

R Dushanan[1], MSS Weerasinghe[2], DP Dissanayake[2] and R Senthilnithy[1#]

[1]Department of Chemistry, The Open University of Sri Lanka, Nugegoda, Sri Lanka
[2]Department of Chemistry, Faculty of Science, University of Colombo, Sri Lanka

[#]rsent@ou.ac.lk

The nucleosomes transfer the epigenetic information to the lysine residue associated with the histone protein, results from epigenetic modification in lysine. The modifications are governed by the histone deacetylase (HDAC) enzyme. HDACs induce alterations in the gene accessibility in the human body leads to grow cancer. Recent studies showed that HDAC inhibitors are more potent anticancer agents. Suberoylanilide hydroxamic acid (SAHA) is an approved drug by FDA and SAHA is a reference drug in this study. This preliminary work done by the computational technique can assess the inhibitory efficacy of the HDAC inhibitors on histone deacetylase-like protein (HDLP), which reduces the investment and time in cancer research. Also, this study investigates the atomic-level description of the inhibitor binding site of the HDLP and the changes that occurred in the active site due to the inhibitor binding. The inhibitors used for this study are SAHA, trichostatin-A (TSA), and scriptaid (GCK1026). The crystal structure of HDLP was downloaded from the PDB server and the structure of the inhibitor was optimized by Gaussian 9. AutoDock Vina has selected the best binding score of the complex and the best one used to initiate molecular dynamics simulation. The best binding scores of SAHA, TSA, and GCK1026 are -7.9, -8.7, and -6.4 kcal/mol. The trajectories were used to perform the structural analysis. The results of Ramachandran plot and dssp shown that the HDLP with SAHA and TSA contains more percentage of amino acids is favored regions (88.2%, 76.6%) and more amino acids belong to alpha-helical structure (36.42%, 38.05%), which drive the HDLP to a stabilized state. The results revealed that the TSA and SAHA have more potential to stabilize the HDLP than GCK1026. The stabilization efficacy is correlated with the linker length and the IC50 of the SAHA (6.27Å, 10nM), TSA (7.82Å, 1.8nM), and GCK1026 (4.93Å, 39nM). Therefore, it's evident that TSA can use as an alternative to SAHA to inhibit the HDLP.

Keywords: *HDAC enzyme, MD simulation, Ramachandran plot*

Targeting HER2 Positive Breast Cancer Cells by Affibody Labeled, Gefitinib Loaded Apoferritin Nanoparticles

AI Kuruppu[1, 2 #], L Zhang[3], L Turyanska[4], N Thomas[3] and TD Bradshaw[2]

[1]Institute for Combinatorial Advanced Research & Education, General Sir John Kotelawala Defence University, Sri Lanka
[2]School of Pharmacy, Centre for Biomolecular Sciences, University of Nottingham, UK
[3]School of Chemistry, Centre for Biomolecular Sciences, University of Nottingham, UK
[4]Faculty of Engineering, University of Nottingham, UK

[#]kuruppua@kdu.ac.lk

Breast cancer is the most prevalent type of cancer diagnosed among females globally. HER2 positive breast cancer accounts for 25% of all breast cancers. Overexpression of HER2 has been associated with an aggressive phenotype and decreased survival. The HER2 receptor is capable of forming dimers with other receptors, such as EGFR/HER1. The dimerization activates uncontrolled cell growth and survival through PI3K/AKT and MAPK signal transduction when HER2 is overexpressed. Gefitinib is a small molecule that acts as an inhibitor of the intracellular tyrosine kinase domain of EGFR that blocks EGFR/HER2 signalling, and it is used for the treatment of breast cancer. However, there are adverse effects associated with this drug. Herein we report, enhanced targeted delivery of gefitinib to the HER2 receptor using an affibody labeled apoferritin with encapsulated gefitinib. These affibodies can specifically target the HER2 receptor with a high affinity that will ultimately increase cancer cell selectivity and reduce toxicity to healthy cells in the human body. We found that gefitinib, encapsulated *via* the nanoreactor route was 100- fold potent compared to free gefitinib in SKBR3 cells. Further, this agent showed a cytotoxic effect in SKBR3 clonogenic assays compared to gefitinib alone. Results also showed cell cycle inhibition along with cell apoptosis. Our results are encouraging as the newly designed agent showed a potent effect against the HER2 overexpressing SKBR3 cells. Further, a nanomolar concentration of gefitinib can be administered in the encapsulated affibody labeled apoferritin form, thereby reducing the toxicities and increasing patient safety in the clinic.

Keywords: nanoparticles, cancer, targeted therapy

Determine the Reference Intervals of Selected Tumor Markers Using Selected Healthy Adult Populations in Sri Lanka

DRM Panagoda[1] #, GHRE Karunaratne[1], V Abeysuriya[2] and L Chandrasena[2]

[1] *Faculty of Science, Horizon Campus Malabe, Sri Lanka*
[2] *Nawaloka Hospital Research and Education Foundation, Sri Lanka*

#panagoda.rishandi97@gmail.com

Reference Intervals (RI) are the range of values that is deemed normal for a physiological measurement in healthy persons. Due to the lack of locally derived reference values for the parameters, clinicians use RIs derived from the western population. Different studies indicated considerable variation in clinical chemistry reference intervals by several variables such as age, sex. This study aimed to determine RI values of four selected tumor marker tests: Alpha-fetoprotein (AFP), Carcinoembryonic antigen (CEA), Prostate specific antigen (PSA), and CA-125 according to the age and sex group of the selected healthy adult population in Sri Lanka as tumor markers have an important role in the detection, diagnosis, treatment and monitoring of some types of cancers. Population based cross-sectional study was conducted from March 2019 - October 2019 using selected total 1040 healthy adults based on inclusion-exclusion criteria. Minitab 17.3.1 was used to calculate descriptive statistics such as mean, median, and 2.5th – 97.5th percentiles range. Independent sample T-test and one-way ANOVA were used to see the association between variables. $p<0.05$ was considered to determine a significant difference. There was a significant difference in RI values in the levels of CEA and AFP according to sex, but the RIs of PSA and CA-125 were not significantly different. The analyzed data of PSA and AFP across all age groups of participants were similar. However, there was a significant difference in the RI values of CA-125 and CEA. The study showed that some of the selected clinical chemistry parameters reference intervals of healthy adults in Sri Lanka were significantly different in reference intervals according to age and sex. Therefore, further study is required to establish reference intervals for Sri Lankan population.

Keywords: *reference intervals, tumor markers, AFP, CEA, PSA*

Comparative Study on Functional Properties of Insoluble Dietary Fibre Extracted from Bark Waste of Cinnamon (*Cinnamomum zeyalanicum)* Refuse Tea (*Camellia sinensis)* and Empty Fruit Bunch Residue of Oil Palm (*Elaeis guineensis)*

MGOS Thilakarathne[1], JK Vidanarachchi[1#], SP Kodithuwakku[1], SMC Himali[1] and LHMPR Lansakara[2]

[1]*Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka*
[2]*Board of Study - Animal Science, Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka*

[#]janakvid@pdn.ac.lk

This study was conducted to investigate the potentials of applying insoluble dietary fiber (IDF) from cinnamon bark waste (CBW), refuse tea (RT) and empty fruit bunch residue of oil palm (EFROP) in food and pharmaceutical industries. Proximate composition, dietary fiber, and IDF composition were determined. IDFs from these materials were isolated by treating them with a neutral detergent solution. *In-vitro* functional properties including water holding capacity (WHC), oil holding capacity (OHC), water swelling capacity (WSC), Total antioxidant capacity (TAC), and glucose absorption capacity (GAC) of extracted IDFs were determined. IDF contents in CBW (78.86%) and EFROP (75.36%) were not different ($p<0.05$). RT showed the lowest ($p<0.05$) IDF content (43.87%) and the highest ($p<0.05$) soluble dietary fiber content (9.14%). The highest ($p<0.05$) WHC was observed in IDF obtained from RT, followed by EFROP. However, the WSC of IDFs of RT, ICBW, and EFROP were not significantly different ($p<0.05$). OHC of IDFs of RT (408.55%) and CBW (395.23%) were not different ($p>0.05$) and were higher ($p<0.05$) than that of EFROP (287.59%). IDFs of RT reported the highest ($p<0.05$) total polyphenolic content (133.75 GAE mg/g). Highest ($p< 0.05$) TAC was reported by IDF of CBW (347.50 mmol Fe^{+2}/g). The glucose absorption capacity of IDFs of RT, CBW, and EFROP were not significantly different. Results indicate that out of the three residues, IDF of RT has more beneficial *in-vitro* functional properties. Moreover, IDF of CBW shows more *in-vitro* functional properties than IDF of EFROP.

Keywords: *Ceylon cinnamon, antioxidant properties, glucose adsorption*

Effect of Total Mixed Ration (TMR) Briquette on Milk Yield, Composition and Sensory Properties of Cow Milk

RHWM Karunanayaka, WAD Nayananjalie[#], WVVR Weerasingha,
MAAP Kumari, AMJB Adikari and SC Somasiri

Department of Animal and Food Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Sri Lanka

[#]deepthin@agri.rjt.ac.lk

The production and composition of cow milk can be affected due to an inconsistent supply of quality forages throughout the year. Preservation of forages is one of the strategies to overcome this problem in Sri Lanka. Total mix ration (TMR) diets can be formulated by blending dried feed ingredients and preserved as briquettes. The present study aimed to assess the effect of feeding TMR briquettes on the yield, composition, and sensory attributes of cow milk. Nine, Jersey x Sahiwal crossbred, lactating dairy cows were assigned to three treatments in a Latin square design; control (T1: guinea grass with commercial feed) and two TMR recipe briquettes selected from a previous trial (T2 and T3). They were fed *adlibitum*. Milk yield was measured daily and composition was determined by an automated milk analyser. The sensory analysis was conducted using 30 un-trained panelists on a 9-point hedonic scale. There was no significant difference among the treatments in milk yield, composition; milk fat, lactose, solids non-fat, protein, and water. Milk yield was recorded for T1, T2, and T3 as 5.55 ± 0.56, 6.59 ± 0.56, and 6.04 ± 0.56 L per cow/day while milk fat content was 3.84 ± 0.21, 3.45 ± 0.21, and 3.76 ± 0.21%, respectively. However, all the sensory attributes; colour, odour, taste, mouthfeel, and overall liking were significantly higher in T2 compared to T1 and control. Hence, the study reveals that TMR briquettes can be used to maintain continuous milk production without interfering with milk yield, composition, and sensory attributes.

Keywords: inconsistent supply of quality forage, milkfat, preserved briquettes

Assessment of the Phosphate Solubilization Ability of Nitrogen Fixing Rhizobia (*Bradyrhizobium japonicum*)

PAIU Hemachandra[1,2#], S Niraula[1], M Rose[1], S Ruesewald[1], C Phan[1] and WS Chang[1]

[1]Department of Biology, The University of Texas – Arlington, Arlington, Texas, USA
[2]Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Sri Lanka

#ishankah@agri.pdn.ac.lk

Symbiotic association between soybean (*Glycine max* L.) and *Bradyrhizobium japonicum* is of agricultural and ecological importance due to its contribution to soil nitrogen (N) fertility. The symbiotic nitrogen fixation and its benefits in legume-based cropping systems are well studied and understood. Co-inoculation of the widely used N biofertilizer and *B. japonicum* with other plant growth promoting rhizobia such as phosphate solubilizers has reported a significant increase in crop yield. Solubilization of inorganic phosphate by gluconic acid, produced through the direct oxidation of glucose via glucose dehydrogenase (GDH) enzyme whose prosthetic group is pyrroloquinoline quinone (PQQ) is the major mechanism employed by most phosphate solubilizing bacteria. This study aimed to investigate the potential use of *B. japonicum* as a phosphorous (P) biofertilizer. Its GDH activity, PQQ production, and phosphate solubilization ability were studied. *B. japonicum* USDA110 showed inorganic phosphate solubilization ability by dissolving $Ca_3(PO_4)_2$ up to 69.56 µg/ml of PO_4^{3-}. The pH of the growth medium gradually dropped to the final pH of 5.29 with increased solubilization of phosphate showing that the medium became acidic. Adding exogenous PQQ did not have a significant effect on its phosphate solubilization ability. Reconstituted GDH enzyme activity showed that *B. japonicum* produces PQQ and its production is regulated by P availability and carbon source. Thus, the current study indicates that *B. japonicum* is a potential candidate to be used as a dual function biofertilizer with N fixation and P solubilization abilities.

Keywords: *Rhizobia, phosphate solubilization, PQQ*

Antioxidant Capacity of Water and Methanol Extracts of *Vigna mungo* (Black Gram) Cultivated in Sri Lanka

G Nirubalini[1], KDKP Kumari [2#] and LV Athiththan[1]

[1]Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka
[2]Department of Basic Sciences, Faculty of Allied Health Sciences, General Sir John Kotelawala Defence University, Sri Lanka

#krishanthi.peshala@kdu.ac.lk

A diet with high antioxidant content is recommended for the protection of the human body from oxidative stress-related diseases. Legumes are one of the top nutrient-rich foods which exhibit comparatively higher antioxidant activity. Therefore, the present study aimed to assess the antioxidant activity of seeds of locally available commonly consumed *Vigna mungo* cultivar called Anuradha. The seeds were collected from the Field Crops Research and Development Institute of Sri Lanka at Mahailluppallama. The 20% water and methanol extracts of finely ground seeds were evaluated for antioxidant capacity by the means of DPPH free radical scavenging and nitric oxide scavenging activity. The total phenolic content (TPC) and total flavonoid content (TFC) were estimated by standard methods. DPPH scavenging activity in methanol extract (23.80 ± 0.2 µg/mL) was slightly higher ($p>0.05$) than the water extract (21.40 ± 1.20 µg/mL). The NO scavenging activity (4.30 ± 0.03 mgGAE/g), TPC (2.50 ± 0.05 mg GAE/g) and TFC (1.20 ± 0.09 mgQE/g) in water extract were significantly higher ($P < 0.05$) compared to methanol extract (NO scavenging activity: 3.70 ± 0.04 mgGAE/g, TPC: 1.1± 0.01 mg GAE/g: TFC: 0.058± 0.009 mg QE/g). The solubility of secondary metabolites such as phenols and flavonoids depend on the polarity of the compound. The results of the present study indicate that majority of active antioxidant compounds present in the tested seed sample are water soluble while a certain amount of methanol soluble antioxidant compounds attributes for DPPH activity. In addition, nitric oxide scavenging activity in local black gram is exerted mainly by water soluble compounds.

Keywords: antioxidant capacity, Vigna mungo, black gram

Bayesian Secondary Structure Assignment of Human Activating Signal Co-integrator 1 Complex Subunit 2 (ASCC2): Structural Architecture for Somatic Cancer Prophylaxis and Therapy

S Suthaharan[1#], R Balakumar[1] and S Mohan[2]

[1]Department of Chemistry, University of Jaffna, Sri Lanka
[2]Faculty of Medicine, University of Colombo, Sri Lanka

[#]ssivanujan@univ.jfn.ac.lk

The human genome experiences a constant threat due to deoxyribonucleic acid (DNA) damaging agents unwittingly leading to somatic cancer mutations. Cell level evolutions have developed functional units to recognize DNA damages and to devise mechanisms for DNA repairs. This is highly advantageous in preventing risks leading to somatic cellular mutations and cancers. The DNA repair mechanisms involving human activating signal co-integrator complex (ASCC) are highlighted in many enzyme-mediated repairs, especially AlkBH3-mediated DNA repair. Among four subunits of the ASCC (ASCC1, ASCC2, ASCC3 and ASC1/TRIP4), ASCC2 is ultimately poignant in signaling and repairing for the instances of DNA alkylation damages. ASCC2-ASCC3 complex is widely recognized in the DNA repair mechanisms and experimental investigations have raised concerns around precise interacting regions of these two subunits. Structural knowledge of the complex is essential in figuring out molecular mechanisms and is widely lacking. To better appreciate this interaction, a computational structural informatics analysis of the ASCC2 is carried out at the secondary level employing Bayesian statistical inference of minimum message length (MML). Secondary structure (SST) segmentations (SEGs), SST assignment and secondary structural elements (SSEs) are computed for the input coordinate data of the ASCC2. The right-handed α helix type is observed to be frequently occurring in the sequence. Nine distinguished segment indices are identified upon computing. Segment index 3 of chain A is found to be right/ left-handed α-like helix. All the four different secondary structural elements of the human ASCC2 identified in this work correspond to a common H type with variation in the number of residues. Overall, the present informatics study is aimed to further investigate joint conformation of the ASCC2-ASCC3 complex in the light of establishing promising prophylaxis and treatment.

Keywords: *ASCC2, secondary structure, DNA repair, structural informatics, Bayesian method*

Variation in Avifaunal Diversity and Composition along a Land Use Gradient in Kandy, Sri Lanka

MHA Haseena[1][#], TSP Fernando[2], VK Fernando[1] and DD Wickramasinghe[1]

[1] Department of Zoology and Environment Science, University of Colombo, Sri Lanka
[2] Department of Zoology, The Open University of Sri Lanka, Sri Lanka

[#]ahdheer1@gmail.com

Sri Lanka accommodates a high diversity of birds. With increasing developmental and population pressure, land use changes have long been apparent in many cities and suburbs. Even though habitat use of birds has gained much attention, studies are sparse on the functional diversity of birds in distinct landscapes. This study attempts to investigate different bird assemblage attributes and habitat characteristics in five land use systems in Kandy. Bird assemblages in natural (Forest patch) and areas under human influence (Residential area, Riparian zone, Coconut plantation, Paddy Field) were investigated from November 2020 to March 2021. The results suggest that bird assemblages were significantly different in relation to diversity, evenness and dominance. According to PCA characterization, the Riparian zone and the Coconut plantation showed similar habitat characteristics among others while the Forest patch, Residential area and the Paddy field well differed from each other. The abundance of birds was highest in the Residential area (42.9%) and low in the Coconut plantation (9.0%) and Riparian zone (9.0%). Species richness was highest in the Forest patch (18) and lowest in the Coconut plantation (10). Vegetation architecture too has played a significant role: Abundance of birds and shrubs (r=0.961, $p<0.05$) as well as a diversity of birds and herbs (r=0.925, $p<0.05$) were linked positively. The distribution of birds and the abundance of shrubs had a strong negative relationship (r = - 0.982, $p=0.003$). Bird diversity (Shannon Wiener Index = 1.7941) and dominance (Dominance Index = 0.2871) were highest in the Paddy field; a moderately disturbed land use system. However, the birds were highly distributed in the Coconut plantation which is a monoculture land, then in the other mixed culture land use systems (Evenness Index = 0.6833). This study demonstrates the impacts of spatial structure on habitat use of birds and provides vital information for conservation and management. As much as less disturbed landscapes are important for maintaining bird diversity, promoting shrubs and herbs in more disturbed landscapes such as home gardens can enhance the abundance and diversity of birds.

Keywords: land use systems, abundance of birds, bird diversity, dominance, evenness

Satellite Remote Sensing Observations of the Changes of Night Lighting in the Hambantota Area

WPTA Perera[1#], D Wickramasinghe[1] and DDGL Dahanayaka[2]

[1]*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*
[2]*Department of Zoology, Faculty of Natural Sciences, The Open University of Sri Lanka*

[#]thisaruanjanaperera@gmail.com

Excessive light during the nighttime affects wildlife and influences human health. However, studies that used remote sensing data to report light pollution are sparse in the world. This study attempts to investigate the spatial distribution and temporal changes of nighttime light intensities in a rapidly urbanizing area of Hambantota district, Sri Lanka. An intensification of anthropogenic activities and changes in land uses were evident in the area with several major development projects including the Hambantota harbor. The study area includes a portion of Bundala National Park (NP), the first Ramsar wetland in Sri Lanka which accommodates high biodiversity. Remote sensing data from the Daily Moonlight-adjusted Nighttime Lights product (VNP46A2) of the Black Marble product suite developed by NASA was used to analyze light intensities from 2012 to 2018. Nighttime light was analyzed based on digital number (DN) values representing brightness. This study is the first detailed investigation in Sri Lanka that reports nighttime light intensities using remote sensing data. Light intensities peaked in 2014 suggesting a rapid intensification of anthropogenic activities where over 83% of the total land had experienced an increment in the light intensity. From 2014 to 2018, a significant fall in light intensity was observed. These changes could be attributed to the onset of seaport development, which was fully functioning in 2014, and its subsequent halt in operation from 2014 – 2018. Increased lights towards the coastal areas and the western edge of Bundala NP could affect wildlife, especially nocturnal animals, birds, and turtles.

Keywords: LULC, VNP46A2, Ramsar, Bundala, Hambantota, nighttime light, biodiversity

Assessment of Freshness of Skipjack Tuna *(Katsuwonus pelamis)* Harvested in Multi-Day Boats in Mirissa Fishery Harbour in Sri Lanka

MSA Perera[1], MGCR Wijesinghe[2], KGS Nirbadha[2], P Ginigaddarage[2], MAAP Kumari[1#] and KWS Ariyawansa[2]

[1]Department of Animal and Food Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka
[2]Institute of Post-Harvest Technology (IPHT), National Aquatic Resources Research and Development Agency (NARA), Colombo -15, Sri Lanka

[#]amalipubudu@agri.rjt.ac.lk

Skipjack tuna (ST) (*Katsuwonus pelamis*) is the main species that contribute to the inboard multi-day boats (IMDBs) catch and significant losses have been observed during the postharvest handling. This study aimed to investigate the effect of storage duration on the freshness of ST harvested by IMDBs in *Mirissa* fishery harbor. Fish samples (n=30) were collected from IMDBs and categorized as their storage period in IMDBs as 0-20 days (T1), 21-40 days (T2), and 41-60 days (T3). Further, fresh fish (C) (n=10) were collected from single-day boats. Sensory evaluation was done by 6 trained panellists. The samples were assessed microbiologically by Total Coliform Count (TCC), Faecal Coliform Count (FCC), *Escherichia coli (E. coli)*, and *Salmonella.* The Total Volatile Base Nitrogen (TVB-N), Trimethylamine (TMA), and Histamine (H) were used to assess biochemical quality. Parametric and sensory data were analyzed using ANOVA and the Kruskal-Wallis test, respectively. Sensory analysis revealed the occurrence of stale fish in T3 was significantly higher. Further, T3 recorded significantly higher parameters; TVB-N (61.20 mgN100g^{-1}), TMA (27.68 mgN100g^{-1}), H (37.70 ppm), TCC (0.36-93 MPNg^{-1}) and FCC (0-9.3MPNg^{-1}). *E. coli* counts were not different *(p>*0.05*)* among the treatments while *Salmonella* was absent in samples. Further, all measured parameters of T1, T2, and C fishes did not exceed the maximum permissible limits and had acceptable sensory qualities. In conclusion, fish stored for up to 40 days in IMDBs are in a fresh condition and suitable for consumption. However, proper storage management practices are required to extend the storage duration in IMDBs.

Keywords: *biochemical quality, microbiological quality, sensory quality*

Vocal Divergence in a Group of Divergent Forest Babblers in Sri Lanka

IU Peiris and SS Seneviratne#

Avian Evolution Node, Department of Zoology and Environment Science, Faculty of Science, University of Colombo, Colombo, Sri Lanka

#sam@sci.cmb.ac.lk

Vocal divergence can be driven by genetic relatedness, environment, or both. Vocalization plays a key role in the evolution of birds, therefore the evolutionary significance of vocalization can be understood by studying how vocal traits drive phenotypic and genotypic divergence in them. Sri Lanka has seven species of babblers (members of the families Timaliidae, Pellorneidae, and Leiothrichidae), of the four, are endemic species and the rest of the three are endemic subspecies, making the members of the entire group unique to the island. The vocal divergence in this group were studied by analysing the frequency, temporal, and syllable attributes of their vocalization to understand the contribution of vocalization towards achieving endemicity. A vocal phylogeny was constructed using nineteen vocal characters and using that we compared the divergences in babblers. An ancestral state reconstruction was performed for the vocal phylogeny by using a molecular phylogeny based on 645 bp of mitochondrial ND2 gene. This character reconstruction showed vocal convergence of distantly related species and divergence of closely related species based on their environment. It was found that temporal characters were more congruent with the molecular phylogeny and morphological features such as body weight and beak shape influence the vocalization in these highly divergent forest birds.

Keywords: *ancestral state reconstruction, babblers, phylogeny, vocal divergence*

Effects of Skill Program to Decision Making: Comparison between Prohibited Substance (Recreational Drugs) Addicted and Non-Addicted Young Rugby Players in Sri Lanka

SKIUK Senarath# and S Sriharan

Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka

#indeeshas@gmail.com

The aim of the current study is to identify the effects of psychological skill programs conducted to decision making: comparison between prohibited substances (recreational drugs) mentioned as alcohol, cigarettes, and cannabis addicted and non-addicted young rugby players in Sri Lanka. Participating in sports can be perfectly benefitting positively in mentally and physically in multifold ways. The attention giving to the decision-making process of the dangerous drug-addicted and non-addicted young athletes should be more concerning among modern society. This study examines the relationship between drug addiction along with the decision-making of young athletes and the effects of the psychological skill program conducted on young rugby players. The study was structured as a combination of survey and experimental research designs. All the data of this study were collected from dispensing two standard and subject related questionnaires to the study sample at three stages under the topics of athletes' decision making and athletes drug consumption. Psychological skill program conducted covering two weeks for each district Colombo and Kegalle, to enhance the decision-making ability of the youngsters. Results indicate that there was a significant negative correlation between drug addiction and young athlete's decision-making ability ($p<0.05$). Results show that there was a minus correlation between drug addiction and decision making of the Kegalle district study sample (-0.772) and for the Colombo district (-0.874). The study designated that there is a positive effect of psychological skill training on the decision making of young rugby players with a mean value difference of respectively highlighted segments of the questionnaire. This study concludes that most young athletes are addicted to using recreational drugs from their childhood and it caused their decision-making ability as school students as well as athletes. Moreover, the respondents mentioned that the main factor for their drug addiction was the influence that they got from their friends and peers. This study recommends that giving a high knowledge to teenagers about drug abuse and switching their minds to open up for psychological practices lead their value of life as to become valuable teenage contributors to the society.

Keywords: decision making, recreational drugs, psychological program

Analyzing the Service Performance of a Post Office in Kurunegala District: A Case Study

MAN Perera, BMMT Bandaranayake, KHMSD Goonatillake, MASD Premarathne and BMAM Balasooriya#

Department of Industrial Management, Wayamba University of Sri Lanka, Sri Lanka

#amandabalasooriya0629@gmail.com

The postal service is an essential service organization that provides a quality service leading to customer satisfaction. However, long queues were observed at a post office in the Kurunegala district. Since it affects the service quality, this study aims to suggest an improved configuration for the selected post office by analyzing its queuing performance. This study collected 300 data from two counters in the post office during three hours from 10.00 am on two consecutive weekdays. The system was modelled using the Rockwell ARENA 16 software. The queues for the observed registered post and speed post counters were named queue 01 and queue 02, respectively. The existing system resulted in 19.03 and 18.43 minutes of waiting time in queues 01 and 02. The number waiting in queues 01 and 02 were 25 and 24. The percentage of customers served by the system was 58.23 percent. Since the existing system showed a low performance rate, the study recommended doubling the staff at the counters. Therefore, three models were suggested as models 01, 02, and 03. The suggestions were to double the resources at counter 1, double the resources at counter 2, and double the resources at both counters. Compared to models 01 and 02, model 03 shows less waiting time and number waiting. Therefore, the study recommends model 03 as the best-fitted model. It reduced waiting times to 3.52 and 1.27 minutes, and the numbers waiting to 6 and 2 in queues 01 and 02. Moreover, the proposed system could increase its performance by 33.72 percent.

Keywords: c*omputer-based, simulation model, post office, service quality*

Analyzing the Service Performance of Gampaha Railway Ticket Counters by Simulation: A Case Study

PL Wanniarachchi[#], KAAR Kumara, AMCS Athapaththu, AST Athukorala and WMAM Weerasinghe

Wayamba University of Sri Lanka

[#]piumilakshani99@gmail.com

Waiting at ticket counters at railway stations is a typical act of the passengers in busy hours. Intending to reduce disappointments and obstructions over the opportune transportation of travellers, this investigation chose a ticketing section at Gampaha railway station in the Western Province, Sri Lanka, focusing on improving its administration execution. The investigation chose two ticket counters issuing tickets towards Colombo Fort and noticed one hour from 6.00 a.m. to 7.00 a.m. of continuous five workdays. The sample was 600 passengers. The separate occasions were then recorded and demonstrated as a multi-server queueing system using Rockwell ARENA 16 software. The input analyzer showed the inter-arrival time followed by BETA distribution. The existing system resulted those 74 passengers left the counters after being served among 83 successive arrivals per day. The performance was identified with the percentage of passengers served as 89.15%. The average waiting time of passengers in a queue near counters 1 and 2 were 2.83 and 3.72 in minutes respectively. Further, the number of passengers waiting at counters 1 and 2 were 1.79 and 2.70 respectively. Since the existing system has shown a low performance, the study recommended adding one more counter since there already exists one shut counter there. The study resulted that adding another ticket counter could diminish waiting time at counters 1, 2, and 3 to 1.05, 0.57 and 0.82 respectively. Hence by opening that shut counter could improve the service execution with the percentage of passengers served to 96.39% in this railway station.

Keywords: *queue, railway, simulation*

Design and Development of Multipurpose Measurement Wheel for Road Data Collections and Analysis

A Pallegedara[1#], KVDSL Pathamasiri[2], S Maduranga[2] and NR Indika[2]

[1]Faculty of Engineering, University of Peradeniya
[2]Ministry of Highways and Road Development, Sri Lanka

#achalaxp@gmail.com

A novel multifunctional measuring wheel is proposed and developed to replace the measuring wheel currently used for distance measurement. The main objective was to move away from the traditional method and capture all the data at once, as the measuring wheel currently in use only obtains primitive distance information. Getting decent accuracy is the main objective. Thus, encoders are introduced to increase the measurement accuracy. RTK-GPS technology is used to obtain the location information and it was equipped with two antennas to improve the connectivity. Further, camera arrangement is embedded to obtain pictures of the instances while taking the relevant distance measurements along the route. The display unit is attached to the system and able to view the data during the run. Software application for processing the simultaneous perceptions from the system and storing the data is built. Moreover, data representing the pre and post development formats of the roads can be retrieved and uploaded simultaneously through the relevant sub-office to the main office of interest. The proposed system is capable of achieving precise and accurate data and analysing them simultaneously through the developed software application. This allows users to make the right decisions in a short period, reduce labour and hence lower the cost by enabling the ability to capture required data simultaneously.

Keywords: *multifunctional, GPS, encoder, simultaneous-perceptions, RTK*

Analysis of Selected Physiological Parameters of an Elite Male Triathlete in Sri Lanka

MKK Perera# and LRND Weerarathne

Department of Sports Sciences & Physical Education, Faculty of Applied Sciences of Sabaragamuwa University of Sri Lanka

#mkkperera.kd@gmail.com

A triathlon is an endurance event, consists of three individual disciplines such as swimming, cycling, and running which should be completed in this sequential order. This study aimed to identify the distribution of selected physiological parameters and the relationships of those physiological parameters with elite Sri Lankan triathletes' performance. Among fifty-five (N=55) elite male triathletes who participated in Defence Triathlon Meet 2018, twenty (n=20) elite male athletes, age (25.6±2.68 years) were randomly selected for this study which was conducted under pre-experimental design. The Cooper 12-minute test, running-based anaerobic sprinting test, 35m sprinting test, modified sit & reach test standing broad jump test were performed to identify the mean values of the VO2 max, peak power output, speed, flexibility and elastic strength of lower limb respectively. Bioelectrical Impedance Analysis (BIA) was performed to identify the fat mass (FM), fat-free mass (FFM) and muscle mass (MM). The finishing timings of the above meet of selected triathletes were taken as their triathlon performance. Descriptive statistics, Pearson correlation and ANOVA were used to analyse the data. There was strong negative relationship between triathlon performance and maximum power (R= -0.892), minimum power (R= -0.611), average power (R= -0.838) values of peak power, VO2 max (R= -0.844), flexibility (R= -0.852) and elastic strength (R= - 0.929). Moreover, resting heart rate (RHR) (R= 0.845), speed (R= 0.930) and FM (R= 0.572) had shown strong and moderate positive relationships on performance respectively. There was a significant effect of an early engaged event (p= 0.002) on triathlon performance. Furthermore, there was a significance difference of VO_2 max (p= 0.024) between early swimmers (62.23 ml/kg/min) and pure triathletes (57.27 ml/kg/min). The VO_2 max, peak power output, speed, flexibility and elastic strength were found to have a significant impact on triathletes' performance. Moreover, type of early engaged event was a significant determinant of the triathlete's performance.

Keywords: *physiological parameters, triathletes, Sri Lanka*

POSTER PRESENTATIONS

ID 34

An Analysis of Sports Psychological Skills of a Sample of Hockey Players in a Selected State University in Sri Lanka

DRSW Dissanayake # and S Sriharan

Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, P.O. Box 02. Belihuloya

#shalineedissanayake@gmail.com

The objective of the present study was to analyze the sports psychological skills of a sample of state university hockey players in Sri Lanka. The Athletic Coping Skills Inventory-28 prepared and developed by Smith, 1995 was used to measure the seven dimensions of psychological characteristics. The seven psychological Characteristics were coping with Adversity, Coachability, Concentration, Confident and achievement motivation, Goal setting and mental preparation, Peaking under pressure, Freedom from worry. The sample was selected using the Convenience Sampling Method and one hundred and two hockey players were the sample size of this research. A nonparametric Kruskal Wallis test and Mann-Whitney test were used to analyse the results of sports psychological skills of selected state university hockey players. The level of significance was used as the p-value (p value<0.05). There was a significant difference in sports psychological skills according to the players' gender (p=0.000). Male hockey players had better sports psychological skills than female hockey players. According to the players' playing experiences, a significant difference was found in their sports psychological skills (p=0.018). There was no significant difference in sports psychological skills according to their playing positions (p=0.871). The result of this study confirms that there are differences in sports psychological skills in selected state university hockey players in Sri Lanka.

Keywords: hockey players, sports psychological skills

The Test Battery: Evaluate Muscular Strength and Endurance of the Abdominals and Hip-Flexor Muscles

AWS Chandana[1][#] and W Xubo[2]

[1]*Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Sri Lanka*
[2]*Institute of Sports Art, Wuhan Sports University, Wuhan, China*

[#]surajchandana@appsc.sab.ac.lk

The purpose of this was to evaluate the performance level of the muscular strength and endurance of abdominal and hip-flexor muscles of youth people in Sri Lanka. Though fitness test batteries are available for a particular group of people relevant to their anthropometric measurements and geographic variation, those are not reflecting accurate performance evaluation for youth. The thirty-second sit-up test introduces youth people (n=405, male and n=306, female) in Sri Lanka. Assumed that Geographic variation and socio-cultural factors in Sri Lanka do not affect the performance of the Sit-Up test. The percentile method was used to distinguish the performance levels. The average number of sit-ups of males and females are 17 (SD=5.98) and 13 (SD=4.99), respectively. University students (68), who have already tested their physical fitness levels (satisfactory level or above) through the Eurofit test, were selected to observe their performance levels under the new protocol. Hence, nearly 90% of students were at the average level or above. The reason for the difference between performance levels of the same subject is the Eurofit test battery (sit-up test) designed based on European people. Therefore, the '30s sit-up test battery' under the new protocol provides reliable performance levels of youth people in Sri Lanka.

Keywords: *movements of torso, youth people, sit-up protocol*

Catalytic Reduction of Methylene Blue by Magnetite - Silica Composite

WMN Wijesundara[1], TC Jayaruk[2] # and RD Wijesekera[1]

[1]Department of Chemistry, Faculty of Science, University of Colombo, Colombo 03, Sri Lanka
[2]Faculty of Humanities and Sciences, Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka

#charitha.t@sliit.lk

Iron oxide nanoparticle-based nanomaterials have well-known catalytic activity for the degradation of organic dyes in the water remediation process. The objective of this research was to synthesize iron oxide silica composite by sol-gel method and assess their applicability in wastewater treatment as a catalyst. Synthesized catalysts were characterized by FT-IR spectroscopy, X-ray diffractometry (XRD) and scanning electron microscopy (SEM). Vibration modes in FT-IR spectra show the presence of SiO_2 and Fe-O bonds. Formation of Fe_3O_4 is shown by the XRD patterns. SEM images indicate that iron oxide particles and flakes are distributed in the silica matrix. The effects of catalyst dosage, temperature, initial concentration of methylene blue (MB), $NaBH_4$ concentration, foreign salts, and ionic strength on MB degradation were studied. Maximum degradation of MB (99.89%) was obtained with an initial MB concentration of 20 mg/dm^3, catalyst dose of 1.0 g/dm^3, $NaBH_4$ concentration of 6.25 mmol/dm^3, and a temperature of 50^{0}C. Common salts found in industrial wastewater such as NaCl, KCl, $CaCl_2$ and $MgCl_2$ inhibit the degradation of MB, while Na_2SO_4 enhanced the degradation rate. Iron oxide helps in electron relay from BH_4^- to MB and silica tends to adsorb MB molecules and provide the proximity required for the catalytic reaction.

Keywords: *iron oxide nanoparticle, silica, methylene blue, wastewater treatment*

Effect of Stocking Density during Brooding Period on Welfare Conditions of Broilers: A Case Study

WM Ayanthini[1], KGD Gunathilaka[2], MAAP Kumari[1], KGJF Disnaka[2],
AGSN Abeykoon[1] and SC Somasiri[1#]

[1]*Department of Animal and Food Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka*
[2]*National Livestock Development Broad Farm, Mahaberiyathenna, Digana, Sri Lanka*

[#]sharinisc@agri.rjt.ac.lk

Assessment of broiler welfare is important to obtain information for making evidence-based decisions related to broiler production. The present study was undertaken to assess the effect of stocking density during brooding period on the welfare conditions of broilers. Seven hundred and eighty (780), day-old broiler chicks were randomly stocked at four stocking densities (SD=T1-T4) at brooding period (1-7 days); T1 = 50, T2 = 60, T3 = 70 (existing SD in the farm) and T4 = 80 chicks/m². Stocking densities were reduced by half at the start of the 2nd week of the brooding period (8-14 days) with the growth of the chicks. There were three replicates per treatment arranged in a completely randomized design. All other management practices were provided optimally and those were constant between treatments. The welfare of chicks was measured by using the welfare measures; tonic immobility (TI) duration, plumage cleanliness, and footpad dermatitis (FPD) at end of the brooding period (14th day) and end of the finisher period (35th day). Plumage cleanliness and FPD were measured and calculated according to welfare quality protocol. The data were analysed using one-way ANOVA. Tonic immobility duration was significantly ($p<0.05$) lower in T1 compared to T2, T3, and T4 at end of the brooding period. Plumage cleanliness at the end of a brooding period in T1 was higher ($p<0.05$) compared to T2, T3, and T4. End of the finisher period, TI duration and plumage cleanliness were not significantly different among treatments. Footpad dermatitis was not recorded in any treatments. According to the results of the present study, TI duration was increased and plumage cleanliness was decreased with increasing stocking density. Thus, the lowest stocking density (50 chicks/m² from 1 to 7 days and 25 chicks/m² from 8 to 14 days) enhanced the welfare conditions compared to higher stocking densities.

Keywords: *footpad dermatitis, plumage cleanliness, tonic immobility*

Injury Prevalence and Biomechanical Movement Analysis among Fast Bowlers in Cricket: A Review of Prevalence and Risk Factors

KIU Kodagoda# and AWS Chandana

Sabaragamuwa University of Sri Lanka, Sri Lanka

#ushedya.kodagoda@gmail.com

Cricket is a sport in which players are involved in a highly active game situation. That causes the possibility of the occurrence of injuries. This study is aimed at reviewing current studies conducted on injuries of Cricket bowlers and biomechanics regarding the bowling action. According to the studies, it can be seen that fast bowlers are mostly suffering from several injuries among bowlers. Also, the most prevailing injury type is lower back injury according to the studies. There are hamstring injuries, knee injuries following that. Increased counter-rotation during the delivery stride has been mentioned mainly as a major reason behind the lower back injuries among fast bowlers. Overuse, age, bowling action, physical characteristics, and muscle asymmetry are also called causes for lower back injuries. It has highlighted clearly that it should be minimized by the players. By several studies conducted on other types of injuries, fast bowlers have shown an increased possibility among all the playing roles in cricket. When considering training load as a factor for injuries of bowlers, both too high and too low training loads are mentioned as risk factors. In most studies on the biomechanical analysis regarding the bowling action of the bowlers, three-dimensional video analysis has been used by researchers. Furthermore, in the Sri Lankan context, it can be mentioned that there is a lack of successful studies on cricket injuries and biomechanical analysis. These studies should be developed to reduce actual causes of injuries and to increase the effectiveness of players.

Keywords: *bowling in cricket, injuries, biomechanics*

Comparison of Insect Assemblages on Two Invasive Alien Plant Species *Annona glabra* L. and *Lantana camara* L. in Selected Habitats of the Wet Zone

M Liyanagamage[1][#], N Pallewatta[2], C Dangalle[2], S Wijesundara[3] and S Viswakula[4]

[1]*Asia Pacific Evaluation Association*
[2]*Department of Zoology and Environment Sciences, University of Colombo*
[3]*Institute of Fundamental Studies, Kandy*
[4]*Department of Statistics, University of Colombo*

[#]madhukalg@gmail.com

Invasive alien plants have the ability to alternative animal populations by providing a range of food and habitats. This is an aspect that requires greater research especially from Sri Lanka where it is near absent. This study was based on insect assemblages associated with two major invasive alien plant species; *Annona glabra L.* and *Lantana camara L.* The research identified the composition of insect assemblages, their behaviour and preference for spatial layers along the axis of both plant species growing in habitats with different disturbance levels. Field sampling was carried out in selected sites within Bellanwila, Attidiya wetland in the Colombo District and Garaduwa marshy area in Matara District. In each location, two 10m*10m stands of plants were selected from each plant species, where one stand was in a location more disturbed by human activities, while the other was in a less disturbing situation. Each selected plant, from both species, was divided into three spatial layers as bottom, middle, and canopy. Insects collected from each layer of both plant species were identified as much as possible. Results show that insects belonging to ten orders; Lepidoptera, Coleoptera, Hemiptera, Hymenoptera, Homoptera, Orthoptera, Odonata, Diptera, Mecoptera, and Thysanoptera were associated with *A. glabra* and insects from other eight orders except for the orders; Thysanoptera and Mecoptera were associated with *L. camara*. Using statistical models, the probability of occurrence of insects in contrasting situations was calculated. Results prove that despite being alien plants, a high diversity of insects is associated with each plant species. The composition of insects and their preference for spatial layers are significantly different between the two plant species.

Keywords: *Invasive alien plants, Annona glabra, Lantana camara, insect assemblages*

Determine Reference Intervals for Selected Clinical Chemistry Parameters Using Selected Healthy Adult Population in Sri Lanka

DRM Panagoda[1#], GHRE Karunaratne[1], V Abeysuriya[2] and L Chandrasena[2]

[1] Faculty of Science, Horizon Campus Malabe, Sri Lanka
[2] Nawaloka Hospital Research and Education Foundation, Sri Lanka

[#]panagoda.rishandi97@gmail.com

This study was aimed to determine the reference interval values for selected clinical chemistry parameters: Full Blood Count, ESR, TSH, blood sugars, liver function test, lipid profile test, and renal profile test using selected healthy adult population of Colombo city, Sri Lanka. Data was collected from March 2019 - October 2019 using a selected total of 991 healthy adults (656 males and 335 females)population in the Nawaloka Hospital laboratory database. Descriptive statistics were used to calculate mean,median, 2.5^{th} – 97.5^{th} percentiles range, 95% CI, maximum, and minimum using Minitab 17.3,1 software. Data were statistically analyzed using the paired sample T-test and one-way ANOVA to see the association between age and gender. There was a significant difference ($p<0.05$) between gender and the levels of eosinophil, basophils, haemoglobin, PCV, MCHC, RBC, MCH, MCV, platelet count, specific gravity, TSH, ESR, Albumin, Globulin, Bilirubin, ALT, GGT, AST, Triglyceride, HDL, Total HDL ratio, VLDL, Urea, Creatine, Uric acid Calcium and Phosphorus. Further, there was a significant difference in the values of WBC, Hemoglobin, PCV, RBC, MCH, MCV, platelet count, TSH and ESR, ALT, total cholesterol,triglycerides, HDL, LDL, Total HDL ratio, VLDL, Chloride, Creatine, Phosphorus, FBS and PPBS ($p<0.05$) according to the age groups.

Keywords: *reference interval, biochemical investigation, liver function test*

Comparative Study on Antioxidant Activity of Fruit Peels and Seeds of Pomegranate Cultivars Grown in Sri Lanka

TI Punchipatabendi# and MKB Weerasooriya

Department of Chemistry, Faculty of Science, University of Kelaniya, Sri Lanka

#ishankatt94@gmail.com

Pomegranate (*Punica granatum* L., family Punicaceae) is well known antioxidant source. Non-edible peels and seeds are reported to contain a diverse range of phytochemicals which are believed to possess antimicrobial, antioxidant and anticancer properties. Hence, to develop healthy and eco-friendly pharmaceutical, herbal products, evaluation of the antioxidant potential of peel and seed of *Kalpitiya hybrid*, *Daya* and *Nimali* pomegranate varieties were targeted in the study. Total phenolic content (TPC), proanthocyanidins content (PAC), total anthocyanin content (TAC), total flavonoid content (TFC), DPPH radical scavenging activity, and ferric reducing antioxidant power (FRAP) were assessed under the antioxidant activity evaluation. The highest TPC was observed in *Daya* peel (DP) and *Nimali* Seed (NS), the least was for *Hybrid* Peel (HP) and *Hybrid* Seed (HS). The highest TFC was observed in DP and HS, the least was for HP and NS. The highest IC_{50} was observed in HP and HS, the least was for DP and NS. The highest FRAP was observed in HP and NS, the least was for DP and HS. The highest PAC was observed in HP and HS, the least was for *Nimali* peel (NP) and NS. The highest TAC was observed in Hybrid juice, and the least was for HS. Hybrid Juice showed the least amount of TPC, TFC, FRAP, and moderate IC_{50}, PAC compared with peel and seed. Findings revealed that peel possesses significantly high antioxidant activity than their seed and juice and are potent sources of antioxidants that can be used to develop nutritionally valuable, healthy products.

Keywords: *pomegranate, antioxidant activity, total phenolic content, total flavonoid content, DPPH*

Variation of Selected Agronomic Characters of Traditional Rice Variety *Masuran* in Response to Different Planting Dates within a Year

WHDU Pushpakumari[1], LALW Jayasekera[2], G Senanayake[3,4] and S Geekiyanage[4#]

[1]Faculty of Graduate Studies, University of Ruhuna, Matara
[2] Department of Mathematics, Faculty of Science, University of Ruhuna, Matara
[3] Sri Lanka Council for Agricultural Research Policy, Colombo 7
[4] Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya

[#]sudarshanee@agbio.ruh.ac.lk

Determination of the effect of the environment on the agronomic characters of traditional rice would be useful for reintroducing them for Sri Lankan farmers. This study was conducted to determine the selected agronomic characters of accessions 4132 and 5530 of the variety *Masuran* in response to different planting dates within a period of one year. Seedlings were transplanted in a completely randomized design at a one-month interval from November 2018 to March 2019 in a uniform field condition with 10 replicates in Kurunegala district (IL1). Plant height (PH) and total tiller number (TN) at flowering and DF were recorded. The PH and TN were significantly affected by the planting date and there were significant interaction effects between accession and planting date for PH and TN. Planting in November and December 2018 resulted from the highest and the lowest PH (151.63 $\pm$ 1.1 cm and 85.7$\pm$ 0.36 cm) respectively in the accession 4132. The PH varied from 105 $\pm$ 1.4 cm (in February 2019) to 149.3 $\pm$ 2.63cm (in November 2018) in accession 5530. TN varied from 3$\pm$1.5 and 4 $\pm$ 2.1 (in March 2019) to 8 $\pm$ 3.1(in February 2019) and 16 $\pm$ 1.9 (in November 2018) in 4132 and 5530 respectively. The DF varied from 65 $\pm$4.23 and 75 $\pm$0.9 (in February 2019) to 104 $\pm$ 1.03 and 78 $\pm$ 0.3 days (in March and January 2019) in 4132 and 5530 respectively. Effect of planting date on DF was not detected in 5530, while only the planting date in March 2019 resulted in extended DF in accession 4132. The above results suggest that the two accessions 4132 and 5530 differently respond to the different growing periods due to monthly planting dates under Sri Lankan field conditions.

Keywords*: days to flowering, planting date, traditional rice "Masuran"*