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Cover story: Digital technology and the future of healthcare delivery

Digital technology is rapidly becoming a day-to-day encounter in healthcare delivery and is predicted to have a profound influence on the health systems, creating a shift of power from the provider to the client. Today, the uses of digital technology in the provision of healthcare range from e-health records to remote diagnostics and management, personalizing data for creating customized treatment plans, risk prediction and disease surveillance.

The cover picture depicts a patient connected to a massive global database through digital technology, whose diagnosis and management depend on remote sensors and artificial intelligence tools. The outcome will be fast, efficient and cost saving. The challenge, however, is to ensure the privacy and confidentiality of the patient, safeguard the data from cyber-security threats, prevent errors due to bias and 'hallucinations' and preserve the unique human touch that in itself is healing to the body, mind and soul.

(AI-artwork created by Dr. Janaka Ruben)

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Instructions to Authors

The Ruhuna Journal of Medicine (RJM) is published by the Faculty of Medicine, University of Ruhuna. The journal publishes original research articles, reviews and case reports.

Types of articles

Original articles

The text of original article encounting up to 2000 words (excluding abstract, references and tables) should be divided into sections with the headings; Abstract (unstructured max 250 words), Key words, Introduction, Material and Methods, Results, Discussion References, Tables and Figure legends.

Review articles

It is expected that these articles would be written by individuals who have done substantial work on the subject or are considered experts in the field. The prescribed word count is up to 4000 words excluding abstract, tables and references. The manuscript should have an unstructured Abstract (max 250 words) representing an accurate summary of the article.

Case reports

These communications could be of up to 1000 words (excluding abstract and references) and should have the following headings; Abstract (unstructured, max 150 words), Keywords (max 5), Introduction, Case Report, Discussion, Reference, Tables and Figure legends.

References

Personal communications and unpublished works should only be mentioned in the text. Reference citations in the text should be identified by numbers in brackets (e.g. [1, 2]) before the punctuation marks. References should be numbered consecutively in the order in which they are first mentioned in the text. List all authors when three or less; when four or more, list only first three and add et al. Examples;

Articles in Journals: Rechel B, Ahmedov M, Akkazieva B, et al. Lessons from two decades of health reform in Central Asia. Health Policy Plan 2012; 27(1): 281-287. (e.g. BMJ type)

Books: Aminoff MJ. Electrodiagnosis in clinical neurology. 2005; Elsevier, USA.

Books chapters: Kumar P, Clark M. Cardiovascular disease: Camm AJ, Bunce NH, editors. Clinical Medicine. USA: Elsevier; 2005; 725-872.

Tables

Tables should be self-explanatory and should not duplicate textual material. Number tables in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.

Illustrations (Figures)

Figures should be numbered consecutively according to the order in which they have been first cited in the text.

Authorship Criteria

Authorship credit should be based only on substantial contributions to each of the three components mentioned below.

1. Concept and design of the study or acquisition of data or analysis and interpretation of data;
2. Drafting the article or revising it critically for important intellectual content; and
3. Final approval of the version to be published.

Message from the Co-Chairperson



It gives me immense pleasure to send this message on the occasion of the 11th Annual Academic Sessions of the Faculty of Medicine, University of Ruhuna-2023. It is a much-awaited annual activity of the faculty academic calendar.

As a co-Chair, I admit this important academic event as sharing intellect, disseminating research findings and showcased brilliance and creativity of academic community in the faculty. The theme of the 11th Annual Academic Session is “*Harnessing Digital Technology in Healthcare Delivery*”. This is a timely topic in an era where technology is rapidly transforming every aspect of our lives. The integration of digital technology in healthcare delivery holds tremendous promise to revolutionize the way we provide care, enhance patient outcomes, and improve population health. The keynote address will be delivered by a respected Emeritus Professor of the University of Rununa with much interest of the selected theme. We are privileged to have three eminent symposium speakers who are actively engaged in the digital health. My sincere gratitude goes to the orator for selecting this platform to present his discovery of research works.

This academic session not just a platform for showcasing our accomplishments, but also a space for collaboration, a platform for undergraduates to show their skills, and strengthening our ties within the academic community.

I wish to extend my heartfelt gratitude to the Vice Chancellor, University of Ruhuna, Dean, Faculty of Medicine and the organizing committee of FMAS 2023 for their unconditional support to make this event a reality.

I hope this academic event will be a fruitful and enriching experience for both academics and undergraduates.

Professor Lanka Dasanayake
Co-Chairperson, FMAS 2023

Message from the Co-Chairperson



I am thrilled to welcome you all to the 11th Annual Academic Sessions of the Faculty of Medicine, University of Ruhuna. This year's theme, "Harnessing Digital Technology in Healthcare Delivery," promises to be a milestone in our pursuit of advancing medical practice and improving patient care.

The academic session provides a precious opportunity for the Faculty of Medicine community to present their groundbreaking research and innovations, contributing to worldwide medical knowledge. We are proud to share our expertise and build collaborations that will benefit healthcare on a larger scale.

In this rapidly evolving era, the integration of digital technology in healthcare has become more vital than ever. This event offers a unique opportunity to enhance our knowledge of current trends and applications of digital technologies in healthcare delivery, presented by esteemed experts in the field. Understanding and embracing these advancements can improve patient outcomes, increase efficiency, and revolutionize medical practices.

I would like to express my heartfelt gratitude to Professor Rifdy Mohideen for delivering the keynote address and sharing his invaluable insights. We are also honoured to have the esteemed presence of Senior Professor Sujeewa Amarasena, Vice-Chancellor of the University of Ruhuna, and Senior Professor Thilak Weeraratna, Dean of the Faculty of Medicine.

I also wish to thank the organizing committee, headed by Professor Lanka Dasanayake, co-chairperson, and our dedicated secretary Dr. Janithra De Silva, for their efforts in ensuring the success of this conference.

With this enriching academic gathering, we will embrace the opportunity to use digital technology to transform healthcare delivery and strive for excellence.

My best wishes go out to all participants for a successful and enjoyable event.

Professor Amaranath Karunanayake
Co-Chairperson, FMAS 2023

Message from the Vice Chancellor



It gives me great pleasure to send this message to the Annual academic Sessions 2023 of the Faculty of Medicine, University of Ruhuna. It is heartening to note that the academic sessions at the Faculty of Medicine have now become an annual event of the faculty, fostering and nurturing the research culture of the institution and giving academics opportunities to be peer reviewed.

As a university committed to academic excellence, high-impact research, community development, and international cooperation, we are proud to witness an improvement in both the quality and relevance of research performed by the community at the Faculty of Medicine. In keeping with our vision of creating a multidisciplinary, borderless university, we are keen to see more and more research being undertaken across the disciplinary boundaries, forming dynamic and winning multidisciplinary teams with synergies.

This year's theme, "Harnessing Digital Technology in Healthcare Delivery," reflects the Faculty of Medicine's determination to pursue academic and research excellence on par with current trends in the 21st century. The current system of health care delivery will be challenged by technology, artificial intelligence along with a borderless world and a knowledge based economy with the blend of old problems with emerging diseases. Hence the theme is of significant value.

I congratulate the Dean and the organizing committee for organizing the FMAS 2023 in a grand manner. I look forward to a successful academic session.

Senior Professor Sujeewa Amarasena
Vice Chancellor
University of Ruhuna

Message from the Dean



I am delighted to write this message as the Dean of the Faculty of Medicine for the Annual Academic sessions ,FMAS 2023. This year, our conference theme, "Harnessing Digital Technology in Health Care Delivery," could not have been more appropriately timed. As we navigate through the 21st century, we find ourselves at the intersection of medicine and technology, a juncture brimming with potential to revolutionize the way we approach medical education and patient care.

The past decade has witnessed an unprecedented acceleration in digital technologies, impacting every sphere of our lives, and medical education and health care is no exception. We are at the cusp of significant transformation, where telemedicine, Artificial Intelligence (AI), machine learning, and digital health records are poised to redefine our traditional systems of delivery of medical education and healthcare.

As the Dean of the Faculty of Medicine, I cannot emphasize enough the importance of harnessing these emerging technologies for the betterment of our profession. It is crucial that we, as medical professionals, remain at the forefront of these developments, acting not just as passive recipients, but active contributors and informed decision-makers.

Digital technology promises to improve the speed and accuracy of diagnoses, expand the reach of medical services, and personalize the care we provide to our patients. However, it also raises significant ethical and practical considerations, including issues of data security, patient privacy, and digital literacy. As we explore this new world, we must strive to strike a balance between embracing innovation and upholding the values and principles that have always guided the medical profession.

It is my hope that FMAS 2023 will stimulate thought-provoking conversations and lead to meaningful collaborations that will push the boundaries of what is possible in health care delivery. As we embark on this journey together, let us take this opportunity to learn from each other, challenge our assumptions, and reimagine the future of medical education and health care in Sri Lanka.

I look forward to the enriching discussions, innovative ideas, and collaborative projects that will undoubtedly emerge from FMAS 2023. Let us harness the power of digital technology to make medical education and health care delivery more effective, equitable, and personalized.

Senior Professor Thilak Weeraratna
Dean, Faculty of Medicine
University of Ruhuna

Programme

Faculty of Medicine Academic Sessions (FMAS) 2023 University of Ruhuna
Wednesday 16th August 2023
TW Wikramanayake Auditorium, Faculty of Medicine, University of Ruhuna
Theme: Harnessing Digital Technology in Healthcare Delivery

07:45 - 08:00	Guests to be seated
08:00 - 08:10	Ceremonial Procession
08:10 - 08:15	University Song & Faculty Song
08:15 - 08:20	Lighting of the Oil Lamp
08:20 - 08:25	Welcome Speech <i>Prof. Lanka Dasanayake, Co-Chairperson - FMAS 2023</i>
08:25 - 08:35	Address by the Dean, Faculty of Medicine <i>Senior Professor Thilak Weeraratna</i>
08:35 - 08:50	Address by the Chief Guest <i>Senior Professor Sujeewa Amarasena</i> <i>Vice Chancellor, University of Ruhuna</i>
08:50 - 09:20	Keynote Address The intersection of technology and medicine: Opportunities and challenges in digital health <i>Professor Rifdy Mohideen</i> <i>Emeritus Professor in Medicine</i> <i>Faculty of Medicine, University of Ruhuna</i>
09:20 - 09:45	Research Publication Awards
09:45 - 10:00	Deans' Awards & Dean's List 2022
10:00 - 10:30	FMAS Oration 2023 The digital health initiative from regional to national level: Development of the National Newborn Screening Information System Database (NSISD) <i>Professor Manjula Hettiarachchi</i> <i>Senior Professor in Nuclear Medicine</i> <i>Faculty of Medicine, University of Ruhuna</i>
10:30 - 10:40	Cultural Event
10:40 - 10:45	Vote of Thanks <i>Dr. Janithra De Silva, Secretary - FMAS 2023</i>
10:45 - 10:50	National Anthem & Closing Ceremony

10:50 - 11:20	Tea Break and Poster Session - I
11:20 - 12:30	FMAS Symposium: “Harnessing Digital Technology in Healthcare Delivery” Artificial Intelligence (AI) and Machine Learning (ML) in medical diagnosis and treatment <i>Dr. Harsha Jayakody</i> <i>Health Information Unit, Lady Ridgeway Hospital for Children</i> Digital health innovations: Disruption, frugality, and 'wow' factor <i>Dr. Pandula Siribaddana</i> <i>Postgraduate Institute of Medicine, University of Colombo</i> Sri Lanka's digital health landscape: Opportunities, challenges, and roadmap for future development <i>Dr. Buddhika Ariyaratne</i> <i>Health Information Unit, Ministry of Health, Sri Lanka</i>
12:30 - 13:15	Emerging Research from Faculty of Medicine, University of Ruhuna Dietary practices, social relations and intervention to change for a healthy diet among office workers at government offices in Galle district <i>Dr. GJ Chandana, Department of Community Medicine</i> Dengue viral replication is increased by prostaglandin and leukotriene mediators: Potential future therapeutic options for severe Dengue infection <i>Dr. CL Fonseka, Department of Medicine</i> Assessment of maternal and birth outcomes and predicting selected birth outcomes using maternal anthropometry with ordinal logistic approach: A cross sectional study <i>Dr. ILAN Darshana, Department of Community Medicine</i>
13:15 - 14:00	Lunch Break and Poster Session - II
14:00 - 15:00	Free Paper Session (Open Category)
15:00 - 16:00	Free Paper Session (Undergraduate Category)
16:00 - 16:15	Awards Ceremony
16:15	Tea

The intersection of technology and medicine: Opportunities and challenges in digital health



The past two decades have witnessed a significant rise in the adoption and impact of information and communication technologies (ICT) on various aspects of daily life. However, the healthcare sector has been relatively slow to embrace digital and mobile technologies. Recent advancements in computing power, cloud computing, big data analytics, artificial intelligence (AI), virtual and augmented reality, Internet of Things (IoT), blockchain technology, robotics, and wearables have paved the way for the integration of digital health technologies into healthcare.

Digital health technologies have the potential to revolutionize healthcare by enhancing medical services, clinical trials, and overall health outcomes. They have already shown promise in areas such as diagnosis, disease management, decision support, and clinical research. Remote patient monitoring and expanding access to care through digital solutions are notable examples of their impact. Artificial intelligence (AI) is emerging as a valuable tool to augment decision-making in healthcare settings and empower patients to actively participate in their healthcare decisions. However, AI cannot replace clinicians and is still evolving, with a critical role to play in the future.

Despite the potential benefits, the widespread adoption of digital health technologies faces obstacles such as concerns about data quality, patient safety, privacy, and accessibility. Collaboration among stakeholders including patients, researchers, industry, payers, and regulators is essential to ensure that these technologies not only improve outcomes but also add value, reduce costs, and enhance the quality of care.

One major barrier to implementation is poor digital health literacy, highlighting the need for training and new practices in work organization and human resource management. Guidelines for appropriate use and maintaining rigorous standards of evidence are also crucial as digital technologies become more affordable and readily available.

The successful development, integration, and implementation of digital health technologies require a shift from traditional and single-disciplinary approaches. A new mindset focused on solving real-world problems is necessary to embrace the opportunities and transform healthcare. This transformation is an ongoing process, and sustained change supported by stakeholders is key to success. As citizens become more responsible for their health and well-being, technology should enable them to be at the centre of their care, integrating digital health into their daily lives.

Looking ahead, digital health is expected to continue evolving and accelerating in the next decade. However, it is important for the healthcare community to view technology as a means to solve problems, improve health, and save lives, rather than becoming enamoured with technology itself.

Professor Mohamed Rifdy Mohideen
Emeritus Professor in Medicine
University of Ruhuna

The digital health initiative from regional to national level: Development of National Newborn Screening Information System Database (NSISD)



Around the globe the health sector has realized the advantages of incorporating Information and Communication Technology (ICT) into the health sector. Sri Lanka is also looking into development of electronic health solutions for the preventive and curative healthcare sectors of the country in the new millennium. The national eHealth Policy was articulated with the vision to streamline the adoption and use of ICT in the Healthcare Sector of Sri Lanka in early 2010. Its mission is to facilitate adoption of ICT solutions appropriately in the healthcare sector of Sri Lanka to improve the quality, efficiency, patient safety, and cost effectiveness of health care thus contributing to achieve the goals set out in the National Health Policy. While this development happening in the centrally operating institutes in Colombo, the Faculty of Medicine, University of Ruhuna was involved in designing and implementation of newborn screening program on congenital Hypothyroidism in the regional level. Hence, to improve the efficiency, reliability and meeting expectations of the stakeholders Information System Database was established in 2013 as a research project initiative. Later with the introduction of national newborn screening program in 2017 this information system database became the national focal point for the research related to the newborn screening. Several undergraduate research projects were successfully conducted during this period too. Economic evaluations will determine policy decisions on any screening programs as estimates of short-term or long-term clinical and economic outcomes are analyzed through a systematic approach. Therefore, a cost-effectiveness analysis was performed as an important tool to allocate funds and make decisions on feasibility of new interventions with budget constraint in healthcare costs. During 2019, there were 159 559 newborns underwent screening with over 92% coverage while 126 babies of 192 screening positive babies were confirmed as having the disease. The annual incidence of hypothyroidism was 1 in 1266 live births among the screened population. The positive predictive value of the program was 66% with a false-positive rate of <0.04% among those screened. The benefit-to-cost ratio was 3.60 with total cost of the program 98,924,300LKR with total benefit of 356,553,781LKR in 2019. This Digital Health project continued to progress of healthcare that can strengthen the relationship between patients and doctors too. The data, the timeliness and its availability will enable providers to make better decisions and provide better service to the Sri Lankan health sector stakeholders including decision makers.

Senior Professor Manjula Hettiarachchi
Head /Nuclear Medicine Unit,
Faculty of Medicine
University of Ruhuna

Artificial Intelligence (AI) and Machine Learning (ML) in medical diagnosis and treatment



Artificial Intelligence (AI) and machine learning (ML) are rapidly transforming the field of medicine, particularly in the areas of medical diagnosis and treatment. The use of AI and ML has the potential to improve accuracy, speed, and efficiency in medical diagnosis and treatment, leading to better patient outcomes.

AI and ML are used in medical imaging to identify patterns and anomalies in X-rays, CT scans, and MRI scans, aiding in detecting cancerous tumors and neurological disorders. They are also used in personalized medicine to analyze patient data and identify the most effective treatments. AI can automate repetitive tasks, reducing the workload for healthcare providers. However, there are concerns about biased algorithms and data privacy, and it is crucial to develop and implement AI and ML in a responsible and ethical manner to ensure patient safety and privacy.

Dr. Harsha Jayakody
MBBS (Sri Lanka) MBA in Health Admin (Malaysia),
MSc in Biomedical Informatics (Sri Lanka)
Health Information Unit, Lady Ridgeway Hospital for Children

Digital health innovations: Disruption, frugality, and 'wow' factor



Digital health is one of the fastest growing fields across the globe particularly after the impact it had in mitigating the effects of the pandemic. The exponential growth in digital health innovations also means that traditional forms of practice are being disrupted both positively and negatively. However this does not mean that all innovations would last or be impactful particularly in low and middle income country (LMIC) settings. Thus, for digital innovations to be impactful in LMIC contexts, it needs to be frugal and generate appeal to the user population, which we refer to as the 'wow' factor. In this session, the link between disruption, frugality and the 'wow' factor will be discussed in the context of digital health in the LMIC contexts.

Dr. Pandula Siribaddana

MBBS (Colombo), PhD (Oslo), PGDip. (Med. Ed), CTHE, SEDA (UK)

Postgraduate Institute of Medicine, University of Colombo

Sri Lanka's digital health landscape: Opportunities, challenges, and roadmap for future development



Sri Lanka's healthcare system is currently undergoing a significant transformation with the integration of digital technology into healthcare delivery. While point-of-care systems have been implemented in around 100 government hospitals, there are abundant opportunities within Sri Lanka's digital health landscape. Improved ICT literacy, technological advancements, and increased availability of digital health solutions create a favourable environment for clinicians to leverage these technologies and enhance communication, facilitate remote consultations, and empower patients. Real-time data collection and analysis capabilities also enable evidence-based decision-making and personalized patient interventions.

However, the successful implementation and widespread adoption of digital health in Sri Lanka face several challenges that need to be addressed. These challenges encompass interoperability issues, data privacy and security concerns, infrastructure limitations, limited funds, and the formulation of comprehensive digital health policies and regulations.

The Digital Health Blueprint (DHB) provides a transformative vision for the future state of healthcare in Sri Lanka. It outlines a roadmap where most clinical workflows are automated using user-friendly, integrated, patient-centric point-of-care systems. This vision aims to establish longitudinal health records for each patient, ensuring comprehensive and continuous healthcare information. The DHB will guide the implementation of digital health initiatives across the country, integrating technology into clinical workflows, enhancing patient engagement, facilitating decision support systems, and enabling data-driven insights.

To pave the way for future development, the proposed DHB outlines strategic steps required to advance the digital health landscape in Sri Lanka. These steps include establishing a legislative framework, implementing change management processes, fostering collaboration between stakeholders, investing in infrastructure development, and continuously building capacity. By undertaking these initiatives, Sri Lanka can position itself as a frontrunner in digital health, unlocking the benefits of improved healthcare accessibility, efficiency, and patient outcomes.

Dr. Buddhika Ariyaratne
MBBS, MSc (Biomedical Informatics), MD (Health Informatics)
Health Information Unit,
Ministry of Health, Sri Lanka

Dietary practices, social relations and intervention to change for a healthy diet among office workers at government offices in Galle district

Chandana GJ^{1*}, Wijesinghe CJ¹, Wijesinghe SD²

¹Department of Community Medicine, Faculty of Medicine, University of Ruhuna

²Health Promotion Bureau, Ministry of Health

ABSTRACT

Background and objectives: Unhealthy diet is a key risk factor for developing Non-Communicable Diseases (NCD). Office workers are at a higher risk of getting NCD and the office setting is favourable for health interventions. This study aimed to assess the dietary practices and associated factors among office workers in Galle district and to evaluate the effectiveness of an intervention to change their dietary intake.

Materials and methods: A cross-sectional study was conducted, followed by a cluster randomized trial, among office workers in selected government offices in Galle district. A self-administered questionnaire, a scale on 'stage of change' and a computer-assisted 24-hour dietary recall were used to collect data on study variables. Subsequently participants were randomized to two arms and a stage-matched intervention was applied for intervention clusters while a general awareness session was conducted for control clusters. 'Progressive change in stage of change' and 'change towards a healthy diet' was assessed as primary and secondary outcomes respectively to assess the effectiveness of the intervention.

Results: Among 518 participants, only 24 (4.6%) were having the recommended healthy diet. Having meals in groups (OR=0.31, 95%CI: 0.12–0.77, $p<0.05$), meal skipping (OR=0.09, 95%CI: 0.02–0.52, $p<0.05$) and snacking (OR= 0.4, 95%CI: 0.17–0.96, $p<0.05$) were inversely associated with having healthy diet. Intervention was found to be effective in achieving both primary (OR=12.9, 95%CI: 7.7–21.9, $p<0.05$) and secondary (OR=22.4, 95%CI: 9.5–52.6, $p<0.05$) outcomes.

Conclusion: Dietary intake among office workers was sub-optimal. Group eating and meal skipping were associated with unhealthy diet. Intervention was successful in achieving primary and secondary outcomes. Study recommends more targeted health interventions for office workers based on self-monitoring and goal setting.

Keywords: Behavioural intervention, dietary practices, office workers, Trans-Theoretical Model

This study was carried out as a partial requirement for the degree of Doctor of Medicine in Community Medicine, of Postgraduate Institute of Medicine, University of Colombo in 2023. The results were included in the thesis. Two abstracts were presented in international and local scientific fora.

Introduction

Non-communicable diseases (NCD) are the leading cause of death worldwide, accounting for 74.3% of global deaths in 2019 which is an increase of 10.5% compared to 2009 (1). NCD-related deaths occur mainly among people aged 30 to 70 years and especially in lower and middle-income countries (2). Additionally, NCD cause significant disability and reduce productivity (3). Risk factors such as smoking, alcohol consumption, unhealthy diet, and lack of exercise are strongly associated with the development of NCD. An unhealthy diet alone contributed to 11 million deaths and 225 million disability-adjusted life years (DALYs) in 2017 (4).

Sri Lanka faces a significant burden of NCD, with more than three-quarters of annual deaths attributed to these diseases, especially ischemic heart disease, stroke, and diabetes (5). Sri Lankan men have a higher prevalence of risk factors such as smoking, alcohol consumption. However, risk factors such as low fruit and vegetable intake, and physical inactivity are higher among both males and females (Ministry of Health, Nutrition and Indigenous Medicine, 2017). However, studies on diet and physical activity in local settings are limited.

In 2019, Sri Lanka's labor force participation rate was 52.3%, with 73% of men and 34.1% of women working in all types of jobs (7). More than half of the active workforce were permanent employees; most of them working in the public and semi-government sectors (8). Approximately a third of public sector employees were between the ages of 30 and 39 years. The majority of Sri Lanka's workforce consists of skilled, technical, unskilled, and clerical workers. Nearly 10% of this population, or 137,211 employees, were diagnosed with NCD in 2016, which can negatively impact work efficiency and overall productivity (8). However, there are few studies on risk

factors for non-communicable diseases among office workers in Sri Lanka to understand the extent of their NCD risk. Further, health systems lack the resources to meet the health needs of office workers, as preventive services are often only available during normal working hours and are difficult to access.

When designing health interventions, it is important to understand the antecedents and causal determinants of behavior change (9). The UK Medical Research Council framework emphasizes the need for a clear understanding of the components of an intervention and their impact on desired outcomes (10). The behavioral theory describes the mechanisms, factors, regulators, and assumptions involved in behavioral change (9). Designing interventions based on behavior change theory is critical in understanding and evaluating their effectiveness (11). There are many theories, but our review found that the Trans-Theoretical Model (TTM), Planned Behavior Theory (TPB), and Social Cognitive Theory (SCT) are commonly used (9). TTM explains the process of changing behaviour in five stages (pre-contemplation, contemplation, preparation, action, and maintenance). TTM is effective in interventions such as smoking cessation, dietary behavior change, physical activity, suicide prevention, and improved dental hygiene (11–13). TTM-based staged interventions showed greater success (14–16). However, published studies on TTM interventions in community settings are lacking, particularly in the Sri Lankan context.

Eating and drinking has developed as social and cultural activity (17). An unhealthy diet is now recognized as a major risk factor for NCD (18). A healthy diet can be broadly defined as a diet that has a positive effect on health, or at least a diet that does not have a detrimental effect (18). Many countries have issued dietary guidelines with similar

recommendations, including a varied and balanced diet, increased fruit and vegetable intake, and reduced fat, sugar, and salt intake (18). The Food-Based Dietary Guidelines (FBDG) of Sri Lanka provide recommendations for healthy eating throughout the life cycle. It contains 12 key messages and recommends daily intakes for six food groups (Nutrition Division, Ministry of Health, 2011). A study of compliance of FBDG showed good compliance for cereal products, but poor compliance for fruits and vegetables, indicating the need for interventions to improve compliance (19).

Dietary habits are influenced by many factors, including individual, social, and environmental factors (20,21). Personal factors such as dietary concerns, nutritional knowledge and understanding, and physiological factors such as chronic illnesses play a role in dietary decisions (21). Time constraints and busy work schedules are known to affect eating habits, especially for working people (22,23). Eating behavior is influenced not only by personal choice and self-control but also by the physical and social environment (20). Studies have identified personal factors (cooking skills, taste preferences, knowledge, and perceptions), social factors (peer influence, social norms), and environmental factors (resource availability, food prices) as influencing factors (24,25). Situation-specific factors such as work environment and culture can also affect eating habits (24). Occupational factors, workplace food environment, and social factors were found to influence the food choices, portion sizes, and eating habits of office workers (26).

Sri Lanka is making progress towards the Sustainable Development Goals, especially health and well-being. While the country is experiencing a decline in NCD, it has set a goal of reducing age-standardized mortality from cardiovascular disease, cancer, diabetes, or chronic respiratory disease by

30% by 2030 (27). This target itself is a long way ahead and needs continuous effort and commitment. To address this issue, it is important to focus on both treatment and prevention of NCDs.

Office workers, who make up most of the workforce, are particularly vulnerable to NCD due to their sedentary nature (7). This group spends a considerable time in the offices, therefore, targeted health promotion is both feasible and effective. Workplace-related interventions, including dietary interventions, have shown positive results in terms of improving the health of office workers (28,29). The purpose of this study was to assess the dietary habits and associated factors among office workers in Galle district, Sri Lanka and to evaluate the efficacy of a Trans-Theoretical Model (TTM)-based intervention for improving eating behavior. This study will provide valuable insight into diet-related risk factors and intervention strategies for office workers in the country. In addition, this study will contribute to the existing evidence on TTM-based interventions by investigating the impact of social relationships on behavioral change. The study design included a cluster randomized trial (CRT) to minimize bias and maximize internal validity. The findings of this research will inform health program planning and project development, to facilitate designing of effective interventions for NCD prevention and control in Sri Lanka.

Materials and methods

This study was conducted in two components. Ethical approval for the study was obtained from the Ethical Review Committee, Faculty of Medicine, University of Ruhuna, Sri Lanka (Ref. No: 2020/P/105). Further, the cluster randomized trial was registered in Sri Lanka Clinical Trials Registry (SLCTR/2020/025). Permission for data collection was obtained from District Secretariat, Galle District and the Chief Ministry Office, Southern

Province. Written informed consent was obtained from all participants after explaining the purpose and objectives of the study.

Component I

A descriptive cross-sectional study was conducted to assess dietary practices, and associated factors and to assess social relations among government office workers in the Galle district. Clerical type workers from 20 government offices in the Galle district were selected for the study. Socio-demographic data, general health status data, and data on dietary practices were collected using a self-administered questionnaire. Stage of change was assessed using mutually exclusive four branching questions used in the “five-a-day project” (Havas et al., 1995) and many subsequent studies (30,31). Dietary intake was assessed using computer-assisted 24-hour dietary recall and quantified as the number of servings from the six food groups according to the serving sizes defined in FBDG Sri Lanka 2011. Healthy intake from the six food groups was defined if the daily dietary intake lies within the recommended number of servings for each food group. Overall healthy diet was defined as adherence to the number of servings recommended in FBDG for Sri Lankans for more than three food groups including cereal and cereal-based foods, fruits and vegetables, with the consumption of one or no unhealthy food per day. Data was analyzed using SPSS (Version 25.0). Association between dietary intake and other factors was identified using the chi-square test and binary logistic regression at a 0.05 significance level.

Component II

A cluster randomized trial was conducted to assess the effectiveness of a stage-matched intervention to change dietary behavior among government office workers in the Galle district. Twenty offices selected for the study were randomized to intervention and control arms applying allocation concealment. Figure 1 presents the overview of the study with the number of participants

for each step.

The intervention was designed based on Trans-Theoretical Model to match the stage of change: for participants in pre-contemplation, contemplation stages three monthly awareness lectures were conducted. For participants in the preparation, action, and maintenance stages a daily serving counter indicating the recommended number of servings for six food groups was introduced. The serving counter was prepared in both paper and smartphone-based versions and introduced according to the preference of the participants. Adherence to the intervention was defined according to participation in the awareness session or marking the serving counter and it was assessed monthly. Participation in two or more awareness sessions was considered as a good adherence to the intervention while marking the serving counter without missing two consecutive days in a week for any two months was considered as good adherence to the intervention for the participants who got the serving counter to mark. The intervention was carried out for three months.

For the control clusters, one awareness session was conducted at the beginning of the intervention. A distance of more than five kilometres was ensured between the intervention and control clusters to prevent data contamination.

A 'progressive change in the stage of change' and 'change to a healthier diet' were considered as primary and secondary outcomes of the intervention, respectively. The outcomes were assessed after the intervention using the same tools used to assess the stage of change and dietary intake at the baseline data collection in the component I.

Effectiveness of the intervention was assessed by comparing the achievement of primary or secondary outcome between the intervention and control groups. Chi square test was used to test the significant of the association. Further binary logistic regression with forward selection method was used to assess the effect of intervention

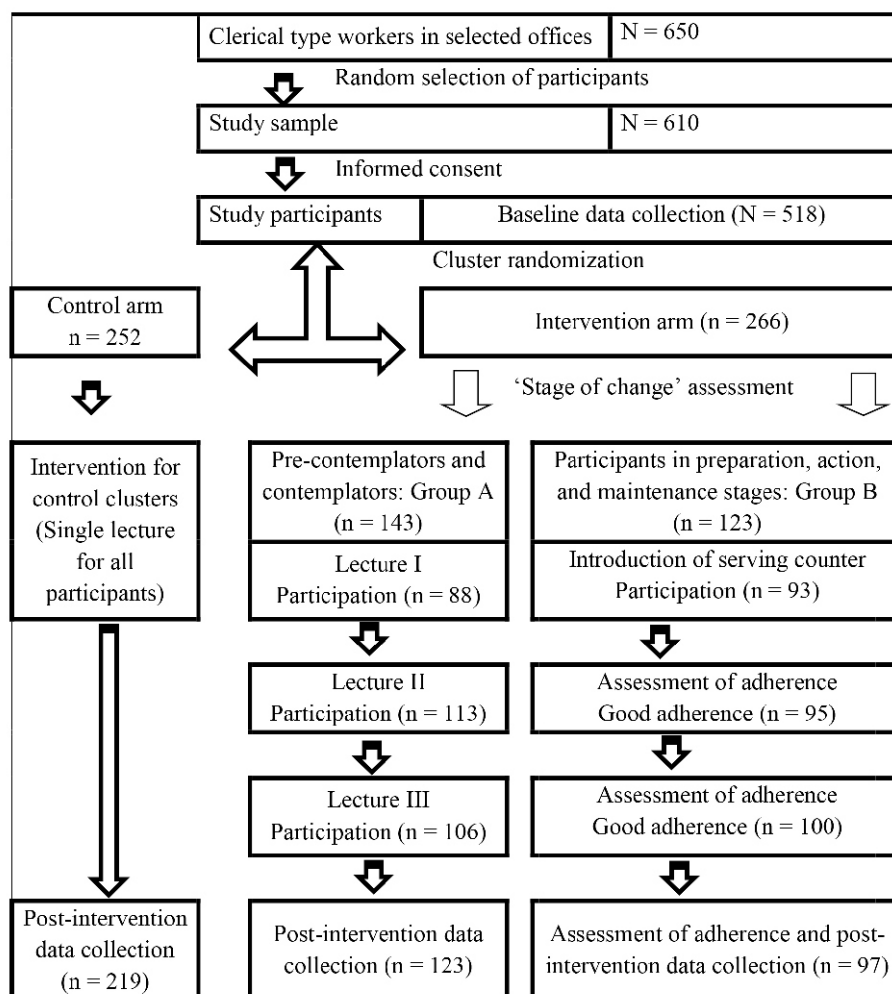


Figure 1. Flow chart and number of participants at different stages of the study

in the presence of socio-demographic, work-related factors and dietary practices. The cut off p-value was set as less than 0.05 and 0.1 was considered as the selection p-value for forward selection.

Results

A total of 518 office workers consented to participate in the study from 610 invited. Thus, the response rate was 84.9%. Median age of the sample was 39.5 {Inter Quartile Range (IQR) = 8} years. The majority were females (81.9%) and Buddhists (99.3%) while all were Sinhalese. A vast majority (n=368, 71%) of participants were clerical and supportive workers. Only 4.6% of participants have met the dietary recommendations in FBDG for all

food groups. However, more than half of the participants reported recommended levels of intake for cereal and cereal based products (65.3%) and fish meat and pulses group (50.8%) with a median intake of 6.1 and 3.6 servings respectively (recommended numbers are 6-7 and 2-3). Most importantly, only 21.4% had the recommended amount of fruit and vegetable intake. Further, median intake of vegetable and fruit servings were 2.8 and 0.6 respectively. Table 1 summarizes the percentages of participants who met the criteria for healthy intake of different food groups and the overall healthiness of diet.

Having meals in groups (OR=0.31, 95%CI: 0.12–0.77, $p<0.05$), meal skipping (OR=0.09, 95%CI: 0.02–0.52, $p<0.05$) and having

Table 1. Percentage of the participants who met the criteria for healthy intake of different food groups and overall healthiness of diet (N = 518)

Food group	Number	Frequency	95 % CI
Cereal based products	338	65.3	61.0 – 69.4
Fruits and Vegetables	111	21.4	18.0 – 25.2
Fish, meat, pulses	263	50.8	46.4 – 55.2
Dairy products	241	46.5	42.2 – 50.9
Nuts and seeds	32	6.2	4.3 – 8.6
Unhealthy foods	190	36.7	32.5 – 41.0
Overall diet	24	4.6	3.0 – 6.9

Table 2. Factors associated with having an overall healthy diet among office workers (n=518)

	Yes No. (%)	No No. (%)	(95% CI)		
Age					
39 years and below	16 (5.0%)	304 (95.0%)	0.26	0.61	1.3 (0.52-2.98)
Above 39 years	8 (4.0%)	190 (96.0%)			
Sex					
Male	1 (1.0%)	93 (99.0%)	3.3	0.07	0.2 (0.02-1.41)
Female	23 (5.4%)	401 (94.6%)			
Education level					
Up to GCE A/L	17 (7.7%)	204 (92.3%)	1.4	0.24	1.4 (0.71-2.85)
Tertiary education	17 (5.5%)	290 (94.5%)			
Monthly income (n=386)					
70,000 LKR and below	10 (4.3%)	220 (95.7%)	0.13	0.721	0.84 (0.32-2.18)
Above 70,000 LKR	8 (5.1%)	148 (94.9%)			
Marital status					
Married	22 (5.0%)	414 (95.0%)	1.1	0.30	2.1 (0.49-9.22)
Other*	2 (2.4%)	80 (97.6%)			
Number of living children					
None	7 (5.6%)	118 (94.4%)	0.93	0.63	
1 to 2	15 (4.7%)	303 (95.3%)			0.83 (0.33-2.1)
>2	2 (2.6%)	73 (97.4%)			0.46 (0.09-2.28)
Post held					
Clerical	19 (5.1%)	349 (94.9%)	0.81	0.37	
Other	5 (3.3%)	145 (92.7%)			1.58 (0.58 – 4.31)

*unmarried/married but separated/ divorced/ widowed

snacks (OR=0.4, 95%CI: 0.17–0.96, $p<0.05$) were inversely associated with having an overall healthy diet. None of the socio-demographic factors was associated with having an overall healthy diet. Table 2 and 3 summarizes factors associated with having an overall healthy diet.

Twenty offices were randomized to intervention and control cluster as allocating (10 offices each). There were 252 participants in the control arm and 266 in the intervention arm. Post intervention data were collected from 219 and 200 participants in control and intervention groups, respectively. Figure 1 illustrates the flow chart and the number of participants at

different stages of the study.

Being subjected to the intervention was significantly associated with achieving both primary (OR=12.9, 95% CI 7.7 - 21.9, $p<0.05$) and secondary (OR=22.4, 95% CI 9.5 - 52.6, $p<0.05$) outcomes at the post-intervention assessment (Table 3 and 4). Only being a clerical worker was significantly associated with achieving primary outcome (OR=1.66, 95% CI 1.05 - 2.16, $p<0.05$). However, no sociodemographic or diet related factors showed association with achieving desired outcomes. Table 3 and 4 summarizes factors associates with achieving primary and secondary outcomes

Table 3. Factors associated with having an overall healthy diet among office workers (n=518)

Characteristics	Overall healthy diet		χ^2	p-value	OR (95% CI)
	Yes No. (%)	No No. (%)			
Having meals in groups (n = 513)					
Yes	8 (2.4%)	330 (97.6%)	7.1	0.01	0.31 (0.12-0.77)
No	12 (7.3%)	152 (92.7%)			
Meal skipping					
Yes	22 (4.3%)	490 (95.7%)	11.3	0.001	0.09 (0.02-0.52)
No	2 (33.3%)	4 (66.7%)			
Having snacks (n = 516)					
3 or more	8 (2.9%)	272 (97.1%)	4.4	0.035	0.4 (0.17-0.96)
2 or less	16 (6.8%)	220 (93.2%)			

Table 4. Factors associates with achieving primary outcome (n=439)

Characteristics	Progressive change in stage of change		χ^2	P- value	OR (95% CI)
	Yes	No			
	No. (%)	No. (%)			
Cluster arm					
Intervention	132 (62.0%)	81 (38.0%)	112.6	<0.001	12.9 (7.7-21.9)
Control	22 (11.2%)	175 (88.8%)			
Age					
39 years and below	99 (37.9%)	162 (62.1%)	0.42	0.83	1.0 (0.68-1.45)
Above 39 years	55 (36.9%)	94 (63.1%)			
Sex					
Male	36 (44.4%)	45 (55.6%)	2.04	0.15	1.43 (0.87-2.34)
Female	118 (35.9%)	211 (64.1%)			
Education level					
Up to A/L	63 (38.2%)	102 (61.8%)	0.05	0.83	1.05 (0.70-1.57)
Tertiary	91 (37.1%)	154 (62.9%)			
Monthly income					
70,000 LKR and below	74 (40.0%)	111 (60.0%)	2.08	0.15	1.41(0.88-2.26)
Above 70,000 LKR	42 (32.1%)	89 (67.9%)			
Married					
Yes	122 (35.6%)	221 (64.4%)	3.55	0.06	0.60 (0.36-1.02)
No	32 (47.8%)	35 (52.2%)			
Number of living children					
0	47 (45.6%)	56 (54.4%)	4.00	0.14	0.62 (0.39-0.99)
1 to 2	85 (34.3%)	163 (65.7%)			
>2	22 (37.3%)	37 (62.7%)			
Post held					
Clerical	118 (41.0%)	170 (59.0%)	4.80	0.03	1.66 (1.05-2.61)
Other	36 (29.5%)	86 (70.5%)			

Table 5. Factors associates with achieving secondary outcome (n=439)

Characteristics	Change to a healthy dietary intake		χ^2	p-value	OR (95% CI)
	Yes No. (%)	No No. (%)			
Cluster arm					
Intervention	85 (38.7%)	135 (61.3%)	83.1	<0.001	22.4 (9.5-52.6)
Control	6 (2.7%)	213 (97.3%)			
Age					
39 years and below	55 (19.9%)	222 (80.1%)	0.35	0.56	0.87 (0.54-1.39)
Above 39 years	36 (22.2%)	126 (77.8%)			
Sex					
Male	18 (21.7%)	65 (78.3%)	0.06	0.81	1.07 (0.60-1.92)
Female	73 (20.5%)	283 (79.5%)			
Education level					
Up to A/L	37 (21.0%)	139 (79.0%)	0.15	0.90	1.03 (0.64-1.65)
Tertiary	54 (20.5%)	209 (79.5%)			
Monthly income					
70,000 LKR and below	41 (21.0%)	154 (79.0%)	0.24	0.62	1.51 (0.66-1.98)
Above 70,000 LKR	26 (18.8%)	112 (81.2%)			
Married					
Yes	72 (19.4%)	299 (80.6%)	2.55	0.11	0.62 (0.34-1.12)
No	19 (27.9%)	49 (72.1%)			
Number of living children					
0	28 (25.9%)	80 (74.1%)	2.48	0.29	
1 to 2	50 (18.7%)	218 (81.3%)			0.66 (0.39-1.13)
>2	13 (20.6%)	50 (79.4%)			0.75 (0.36-1.59)
Post held					
Clerical	68 (22.37%)	236 (77.63%)	1.62	0.20	1.40 (0.83-2.37)
Other	23 (17.04%)	112 (82.96%)			

Discussion

Most of the participants in this study were females and it is explainable because most of the office workers in the study population were female. On the contrary, it was reported in the labour force data report that most workers were males (8). There is no data specific for the government office workers available in the labour force data report, however, the report suggests that the composition or the sex distribution may vary in different sectors of work with more females in teachers' and nurses' groups (8). Further, same sex ratio was noted in a similar study conducted among office workers in Colombo district (32).

A marginally high intake of cereal-based products and a low fruits and vegetables intake was reported in the current study at baseline. Nutritional intake reported in the study conducted among office workers in Colombo district is in line with these findings (32). Overall, the participants in the present study showed a tendency towards a healthier consumption pattern compared to the participants in the above study. However, the measurements used to arrive at the number of servings was not described in the study by Swarnamali et al. Further, a large-scale study that assessed the intake of different macronutrients in workers from different sectors concluded that there is a marginally high carbohydrate intake and low fibre intake among public sector workers (33).

Dietary practices such as group eating, meal skipping and having more than two snacks per day were the factors that showed associations with unhealthy intakes in overall diet and consumption of unhealthy food items. It has been established through other research that presence of friends and familiar people can increase food consumption (34). Another study conducted among 37 adults in a university staff showed an 18% increase in the energy consumption

when eating together as groups (Hetherington et al., 2006).

Postponing or skipping meals could be a result of busy work schedules. The current study showed that meal skipping is associated with an overall unhealthy diet. A study conducted among working women in America has showed that they tend to spend less time on their meals when they are busy (23). As most participants in the current study are females, the practice of meal skipping could also be due to busy schedules. It has been further evident that consumption of pre-cooked foods and take away foods increased with busy work schedules (22,36,37), which can negatively affect the overall diet quality as these food items are often likely to be unhealthy.

The intervention used in this study was strongly associated with achieving both primary outcome (a progressive change in the stage of change) and secondary outcome (a healthier dietary intake). There are several systematic reviews and interventional studies that have shown the effectiveness of interventions based on Trans-Theoretical Model (TTM). A recent systematic review has shown the effectiveness of TTM-based interventions for changing a wide range of behaviours including dietary intake (12). Another systematic review highlights the success of TTM-based interventions to achieve dietary change (38). There have been other studies where notable changes were brought about by interventions aimed to change dietary practices. One study based on TTM has achieved 71.5% reduction in low fruit and vegetable consumption and 19.6% reduction in obesity (14)

None of the socio-demographic factors, or dietary practices showed associations with the achievement of primary or secondary outcome in this study. This indicates that no other tested factors have contributed for the success or failure of the intervention other

than the intervention itself. There are hardly any studies that have assessed factors associated with the effectiveness of TTM-based interventions for dietary behaviour change. There was one study that assessed the effect of decisional balance and self-efficacy on the interventions based on TTM, which concluded that only perceived advantages have significant effect on the success of the intervention (39).

The study sample recruited for this study represents the entire district, enhancing the generalizability of the study finding. Further, a cluster randomized trial with allocation concealment provided more accurate results eliminating confounding and selection bias. However, contamination of intervention between intervention and control groups was not objectively assessed in the study and some other contrasts linked with TTM such as decisional balance and self-efficacy were not incorporated into the study, limiting the internal validity.

Conclusion and recommendations

Dietary intake among office workers was sub-optimal when compared with the recommended numbers of serving for different food groups in FBDG for Sri Lankans. Practices like group eating and meal skipping/ postponing were associated with overall unhealthy diet. Intervention was successful in achieving a progressive change in stage of change and change towards a healthy diet. Study recommends more targeted health education and promotional interventions for this specific community with higher risk of NCD and interventions based on self-monitoring and goal setting to be implemented in changing dietary behaviour among office workers.

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References

1. Institute for Health Metrics and Evaluation (IHME) University of Washington. GBD Results. 2020 [cited 2023 Jul 16]. Institute for Health Metrics and Evaluation (IHME) - GBD Results. Available from: <https://vizhub.healthdata.org/gbd-results/>
2. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020 [Internet]. World Health Organization; 2013 [cited 2022 Jan 31]. Available from: <https://apps.who.int/iris/handle/10665/94384>
3. Hay SI, Abajobir AA, Abate KH, Abbafati C, Abbas KM, Abd-Allah F, et al. Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* [Internet]. 2017 Sep 16 [cited 2022 Jan 31]; 390(10100):1260. Available from: <https://pubmed.ncbi.nlm.nih.gov/30056286/>
4. Afshin A, Sur PJ, Fay KA, Cornaby L, Ferrara G, Salama JS, et al. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the

- Global Burden of Disease Study 2017. Lancet [Internet]. 2019 May 11 [cited 2022 Feb 1]; 393 (10184):1958. Available from: /pmc/articles/PMC6899507/
5. The World Bank. The World Bank [Internet]. 2020 [cited 2022 Feb 7]. Available from: <https://data.worldbank.org/indicator/SH.DTH.NCOM.ZS?end=2019&locations=LK&start=2000&view=chart>
6. Ministry of Health Nutrition and Indigenous Medicine. Non Communicable Disease Risk Factor Survey Sri Lanka 2015 [Internet]. 1st Ed. Colombo: Ministry of Health, Nutrition and Indigenous Medicine; 2017. Available from: <https://www.who.int/ncds/surveillance/steps/STEPS-report-2015-Sri-Lanka.pdf>
7. Department of Census and Statistics. Labour force data [Internet]. Department of Census and Statistics, Battaramulla: Department of Census and Statistics; 2020. Available from: http://www.statistics.gov.lk/samplesurvey/LFS_Annual%20Report_2017.pdf
8. Department of Census, Statistics. Census of Public and Semi Government Sector Employment – 2016. Department of Census and Statistics, Ministry of National Policies and Economic Affairs; 2016.
9. Davis R, Campbell R, Hildon Z, Hobbs L, Michie S. Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review. Health Psychol Rev [Internet]. 2015 Aug 7 [cited 2022 Feb 12]; 9 (3): 323. Available from: /pmc/articles/PMC4566873/
10. Campbell M, Fitzpatrick R, Haines A, Kinmonth AL, Sandercock P, Spiegelhalter D, et al. Framework for design and evaluation of complex interventions to improve health. BMJ : British Medical Journal [Internet]. 2000 Sep 9 [cited 2022 Jul 18]; 321(7262):694. Available from: /pmc/articles/PMC1118564/
11. Spahn JM, Reeves RS, Keim KS, Laquatra I, Kellogg M, Jortberg B, et al. State of the evidence regarding behavior change theories and strategies in nutrition counseling to facilitate health and food behavior change. J Am Diet Assoc [Internet]. 2010 Jun [cited 2022 Feb 10]; 110 (6):879–91. Available from: <https://pubmed.ncbi.nlm.nih.gov/20497777/>
12. Hashemzadeh M, Rahimi A, Zare-Farashbandi F, Alavi-Naeini A, Daei A. Transtheoretical Model of Health Behavioral Change: A Systematic Review. Iran J Nurs Midwifery Res [Internet]. 2019 Mar 1 [cited 2022 Feb 11]; 24 (2): 83. Available from: /pmc/articles/PMC6390443/
13. Coleman MT, Pasternak RH. Effective strategies for behavior change. Prim Care [Internet]. 2012 Jun [cited 2022 Mar 4]; 39(2):281–305. Available from: <https://pubmed.ncbi.nlm.nih.gov/22608867/>
14. Velicer WF, Redding CA, Paiva AL, Mauriello LM, Blissmer B, Oatley K, et al. Multiple behavior interventions to prevent substance abuse and increase energy balance behaviors in middle school students. Transl Behav Med [Internet]. 2013 Mar [cited 2022 Mar 9]; 3(1):82. Available from: /pmc/articles/PMC3622227/
15. Md Yusop NB, Mohd Shariff Z, Hwu TT, Abd Talib R, Spurrier N. The effectiveness of a stage-based lifestyle modification intervention for obese children. BMC Public Health [Internet]. 2018 Mar 1 [cited 2022 Mar 9]; 18 (1). Available from: /pmc/articles/PMC5831594/

16. Boff R de M, Dornelles MA, Feoli AMP, Gustavo A da S, Oliveira M da S. Transtheoretical model for change in obese adolescents: MERC randomized clinical trial. *J Health Psychol* [Internet]. 2020 Nov 1 [cited 2022 Mar 9];25(13–14):2272–85. Available from: <https://pubmed.ncbi.nlm.nih.gov/30112914/>
17. Cornil Y, Chandon P. Pleasure as a Substitute for Size: How Multisensory Imagery Can Make People Happier with Smaller Food Portions: <https://doi.org/10.1509/jmr.140299> [Internet]. 2016 Oct 1 [cited 2022 Jul 20];53(5):847–64. Available from: <https://journals.sagepub.com/doi/10.1509/jmr.14.0299>
18. de Ridder D, Kroese F, Evers C, Adriaanse M, Gillebaart M. Healthy diet: Health impact, prevalence, correlates, and interventions. *Psychol Health*. 2017 Aug;32(8):907–41.
19. Renzella J, Fernando S, Kalupahana B, Townsend N, Rayner M, Wickramasinghe K, et al. Relative validity of a brief dietary survey to assess food intake and adherence to national dietary guidelines among Sri Lankan adults. *BMC Nutr* [Internet]. 2020 Dec 1 [cited 2023 Jan 5]; 6(1). Available from: <https://pubmed.ncbi.nlm.nih.gov/29920535/>
20. Lacaille LJ, Dauner KN, Krambeer RJ, Pedersen J. Psychosocial and environmental determinants of eating behaviors, physical activity, and weight change among college students: a qualitative analysis. *J Am Coll Health* [Internet]. 2011 Jun [cited 2022 Mar 19]; 59(6):531–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/21660808/>
21. Freeland-Graves JH, Nitzke S. Position of the academy of nutrition and dietetics: total diet approach to healthy eating. *J Acad Nutr Diet* [Internet]. 2013 Feb [cited 2022 Jul 28]; 113(2):307–17. Available from: <https://pubmed.ncbi.nlm.nih.gov/23351634/>
22. Devine CM, Farrell TJ, Blake CE, Jastran M, Wethington E, Bisogni CA. Work Conditions and the Food Choice Coping Strategies of Employed Parents. *J Nutr Educ Behav* [Internet]. 2009 Sep [cited 2022 Jul 29]; 41(5):365. Available from: <https://pubmed.ncbi.nlm.nih.gov/197814615/>
23. Bruhn CM. Consumer perceptions and concerns about food contaminants. *Adv Exp Med Biol* [Internet]. 1999 [cited 2022 Jul 29]; 459:1–7. Available from: https://link.springer.com/chapter/10.1007/978-1-4615-4853-9_1
24. Kabir A, Miah S, Islam A. Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLoS One* [Internet]. 2018 Jun 1 [cited 2022 Mar 19]; 13 (6). Available from: <https://pubmed.ncbi.nlm.nih.gov/29920535/>
25. Caperon LI, Arjyal A, C PK, Kuikel J, Newell J, Peters R, et al. Developing a socio-ecological model of dietary behaviour for people living with diabetes or high blood glucose levels in urban Nepal: A qualitative investigation. 2019 [cited 2022 Mar 19]; Available from: <https://doi.org/10.1371/journal.pone.0214142>
26. Clohessy S, Walasek L, Meyer C. Factors influencing employees' eating behaviours in the office-based workplace: A systematic review. *Obesity Reviews* [Internet]. 2019 Dec 1 [cited 2022 Jan 31];20(12):1771–80. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/obr.12920>
27. Jeffrey D, Guillaume Lafortune, Christian Kroll, Grayson Fuller, Finn

- Woelm. SUSTAINABLE DEVELOPMENT REPORT 2022. United Kingdom; 2022.
28. Chandrasiri A, Dissanayake A, De Silva V. Health promotion in workplaces strategy for modification of risk factors for Non Communicable Diseases (NCDs): A practical example from Sri Lanka. *Work*. 2016 Jan 1;55(2):281–4.
29. Shrestha A, Karmacharya BM, Khudyakov P, Weber MB, Spiegelman D. Dietary interventions to prevent and manage diabetes in worksite settings: a meta-analysis. *J Occup Health [Internet]*. 2018 [cited 2022 Feb 10];60(1):31. Available from: <https://pubmed.ncbi.nlm.nih.gov/35799099/>
30. Campbell MK, Symons M, Demark-Wahnefried W, Polhamus B, Bernhardt JM, McClelland JW, et al. Stages of change and psychosocial correlates of fruit and vegetable consumption among rural African-American church members. *Am J Health Promot*. 1998 Feb; 12(3):185–91.
31. de Oliveira M do CF, Anderson J, Auld G, Kendall P. Validation of a Tool to Measure Processes of Change for Fruit and Vegetable Consumption among Male College Students. *J Nutr Educ Behav [Internet]*. 2005 Jan;37(1):2–11. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1499404606602534>
32. Swarnamali AKSH, Jayasinghe MVTN, Katulanda P. IDENTIFICATION OF RISK FACTORS FOR SELECTED NON COMMUNICABLE DISEASES AMONG PUBLIC SECTOR OFFICE EMPLOYEES, SRI LANKA. *Lijhls [Internet]*. 2017 May;1(2):12–24. Available from: <https://grdspublishing.org/index.php/life/article/view/26>
33. Jayasinghe M, Ranaweera K. Nutrition Assessment of Several Sects in the Sri Lankan Community. 2015 Feb; 2:1–2.
34. Wansink B. Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annu Rev Nutr [Internet]*. 2004 [cited 2022 Jul 29]; 24: 455–79. Available from: <https://pubmed.ncbi.nlm.nih.gov/15189128/>
35. Hetherington MM, Anderson AS, Norton GNM, Newson L. Situational effects on meal intake: A comparison of eating alone and eating with others. *Physiol Behav [Internet]*. 2006 Jul 30 [cited 2022 Jul 23]; 88 (4–5): 498–505. Available from: <https://pubmed.ncbi.nlm.nih.gov/16757007/>
36. Herman CP, Roth DA, Polivy J. Effects of the presence of others on food intake: a normative interpretation. *Psychol Bull [Internet]*. 2003 Nov [cited 2022 Jul 23]; 129(6):873–86. Available from: <https://pubmed.ncbi.nlm.nih.gov/14599286/>
37. Liu M, Liu C, Zhang Z, Zhou C, Li Q, He P, et al. Quantity and variety of food groups consumption and the risk of diabetes in adults: A prospective cohort study. *Clin Nutr [Internet]*. 2021 Dec 1 [cited 2022 Jul 23]; 40(12):5710–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/34743048/>
38. Nakabayashi J, Melo GR isa, Toral N. Transtheoretical model-based nutritional interventions in adolescents: a systematic review. *BMC Public Health [Internet]*. 2020 Dec 1 [cited 2022 Feb 15]; 20(1). Available from: <https://pubmed.ncbi.nlm.nih.gov/33054748/>
39. di Noia J, Prochaska JO. Mediating Variables in a Transtheoretical Model Dietary Intervention Program. *Health Educ Behav [Internet]*. 2010 [cited 2023 Jan 26];37(5):753. Available from: <https://pubmed.ncbi.nlm.nih.gov/2900512/>

Dengue viral replication is increased by prostaglandin and leukotriene mediators: Potential future therapeutic options for severe Dengue infection

Fonseka CL^{1,2}, Hardman CS¹, Malavige GN³, Ogg GS¹

¹MRC Human Immunology Unit, MRC Weatherall Institute of Molecular Medicine, University of Oxford, Oxford, United Kingdom

²Department of Medicine, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka

³Allergy Immunology and Cell Biology Unit, Department of Immunology and Molecular Medicine, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

Abstract

Dengue is a mosquito borne tropical infection caused by the dengue virus with a dramatic global spread over the last few decades. Mast cells are known to secrete PGD₂ and LTE₄ and has shown to be activated in dengue infection and high levels of type 2 cytokines are known to be associated with DHF. Group 2 Innate Lymphoid Cells (ILC2) are type 2 cytokine secreting cells that respond to different stimuli including lipid mediators such as prostaglandin D₂ (PGD₂) and leukotrienes. *In vitro*, ILC2 were permissive to infection particularly when activated through PGD₂ and LTE₄ and led to productive viral replication. Blockade of CRTH₂, a PGD₂ receptor, reduced dengue viral infection in ILC2 and PGD₂ reduced the ability of ILC2 to respond to type I IFN. Moreover, LTE₄, another lipid mediator in the group of leukotrienes produced by mast cells increased infectivity of ILC2, and this could be inhibited by leukotriene receptor blockade. Lastly, urinary PGD₂ metabolites were elevated in severe dengue when reaching the 'critical phase' of the disease. In conclusion, ILC2 are highly activated during acute dengue infection and can be infected by dengue virus *ex vivo* and *in vitro*. PGD₂ and LTE₄ activated ILC2 and mediate increased dengue viral replication. We propose CRTH₂ inhibition could be a novel mechanism to reduce viral replication in dengue infection.

Introduction

Dengue fever is an arboviral disease caused by the dengue virus. The dengue virus (DENV) belongs in the genus Flavivirus and under the family Flaviviridae. This has four distinct, but closely related, serotypes (DENV-1, DENV-2, DENV-3 and DENV-4). Over the last few decades dengue has evolved from a sporadic disease to a major public health problem with substantial impact due to the global spread and disease severity. The WHO has named dengue as one of the top 10 threats to global health in 2019 due to the burden of infection in low- and middle-income countries, particularly as there has been a 15-fold increase in dengue over the last 2 decades. The annual global cost of dengue was estimated to be a staggering US\$8.9 billion in 2013—(1). Costs of dengue control activities and

hospitalization were estimated to be US\$3.45 million in year 2012 in Sri Lanka(2), which highlights the economic burden of this disease in resource-poor countries. The case fatality rates (CFRs) due to dengue have declined in Sri Lanka from approximately 1% in 2009 to <0.3% in 2018(1, 3). This was achieved through early presentation and diagnosis and timely hospital admission for detection of plasma leakage and meticulous fluid management in hospitals to prevent deaths due to shock or fluid overload.

The clinical manifestations of dengue vascular leakage are similar to the clinical manifestations of anaphylaxis, although the degree of fluid leakage and the sites of detection of fluids are significantly different. In anaphylaxis increased endothelial and

and capillary permeability is recognised to be the pathogenesis. In anaphylaxis, activated mast cells release vasoactive mediators, such as histamine and PAF that are known to contribute to the initial anaphylactic response by increasing vascular hyperpermeability leading to capillary vasodilation and endothelial barrier disruption. Subsequently, vascular hyperpermeability and plasma leakage into local tissues could lead to systemic reactions, recognised to be the pathogenesis. In anaphylaxis, activated mast cells release vasoactive mediators, such as histamine and PAF that are known to contribute to the initial anaphylactic response by increasing vascular hyperpermeability leading to capillary vasodilation and endothelial barrier disruption. Subsequently, vascular hyperpermeability and plasma leakage into local tissues could lead to systemic reactions, including increased hematocrit levels and hypotension (4). Mast cells are found to be activated in dengue and it was observed that mast cell infection and chemokine release are increased through antibody dependent enhancement (5). It has been previously reported that human mast cells are permissive to antibody-enhanced dengue virus infection, in an Fc γ RII-dependent manner(6).

Innate lymphoid cells (ILC) represent a group of effector lymphoid cells that lack a rearranged antigen-specific receptor (T cell or B cell receptor) and develop from the common lymphoid progenitor in fetal liver and bone marrow(7). They are largely tissue-resident cells and react promptly to stress signals. ILC can be identified in lymphoid and non-lymphoid tissues, and are enriched at epithelial barrier surfaces such as the intestine, lung, and skin(8), with ILC2 being the most preponderant (9). However, ILC2 are present at low frequencies in peripheral blood representing up to 0.1% of circulating lymphocytes (8). In addition to ILC2, ILC1 and ILC3 are described and these cells mirror the cytokine expression of Th1 and Th17

cytokine expression. Their ability to quickly respond to tissue stress and inflammation underpins their critical role in regulating tissue homeostasis.

As above, ILC2 are found to be activated in viral infections such as Respiratory Syncytial Virus (RSV) and influenza virus infections. In RSV infection, ILC2 act as a significant driver of the type 2 response stimulated by epithelial-derived IL-33 leading to mucus production and airway dysfunction and these effects are partly IL-13 driven. In addition, IL-33 induced activation of ILC2 promotes wound healing through improved epithelial repair(10). ILC2 are shown to mediate type 2 responses and to recruit eosinophils during viral lung infections upon the release of alarmins such as IL-33 by damaged epithelial cells. Additionally, a recent paper has shown that ILC2 are increased in COVID-19 patients in parallel with elevated serum type 2 cytokine levels. Also, the authors observed a significantly reduced proportion of patients requiring mechanical ventilation in the severe disease group who had high numbers of NKG2D⁺ ILC2, indicating a possible protective role of this cell subset in the response against the virus(11). It is evident that ILC2 are abundant in tissues and have effector functions in viral infections and allergic inflammation. In severe dengue infection, having vascular hyperpermeability, mast cell activation and prominent type 2 cytokine responses prompted consideration that allergic inflammation a prominent role in the pathogenesis. Therefore, we investigated the role of ILC2 in dengue viral infection.

Materials and methods

RNA sequencing analysis of ILC2 among healthy individuals (HC), dengue fever (DF) and dengue hemorrhagic fever (DHF) patient groups

Blood samples were taken from four adult individuals of Sri Lankan origin on day 2-5 of acute dengue infection (DF and DHF). Control bloods samples from healthy

individuals were obtained. Blood was taken during a period where dengue 2 serotype was predominant. PBMCs were separated by density gradient centrifugation (using Lymphoprep™ density gradient medium) and frozen in -80°C. Frozen peripheral blood mononuclear cells (PBMC) samples from these groups (HC, DF and DHF patients) were thawed and stained for markers to define ILC2 (Live, Lineage -, CD3 -, Cd45+, CRTH2 +, IL-7Ra+). After staining, were washed with PBS (endotoxin, RNase free) and were resuspended in PBS. Then samples were sorted at 100 cells/PCR tube directly into lysis buffer (0.2% Triton X-100 solution containing RNase inhibitor) using BD FACS Aria III flow cytometer in single cell mode. Lysed samples were processed to form cDNA libraries using Nextera XT and SmartSeq2 protocols. RNA-Sequencing was performed in triplicate on an Illumina Hi-Seq 4000 generating 75bp reads.

ILC2 isolation by sorting and cell culture

PBMCs from healthy adult donors were isolated using density gradient centrifugation (Lymphoprep™ density gradient medium). Subsequently, T cells and monocytes were depleted from the PBMCs using magnetic-activated cell sorting (CD3 & CD14 MicroBeads, Miltenyi Biotec) and the enriched sample was used for flow cytometric cell sorting. ILC2 were defined as: lineage (CD3, CD16, CD56, CD4, CD8, CD14, CD19, CD11c, CD11b, CD123, and FcεRI)-, CD45+, IL7Ra+ and CRTH2+. Over the next 4 to 6 weeks the cells expanded and after 4 to 6 weeks, the growing cells were tested by flow cytometry, to ensure a pure population of lineage-CRTH2+IL-7Ra+ ILC2 was obtained.

Infection of cells with DENV2

ILC2 were infected using dengue serotype 2 virus (Strain SL 5-17-04, #NR-49751) which were generated as mentioned above. Stocks with virus titre of 10⁵ – 10⁶ FFU/ml were used. ILC2 were inoculated with virus

at MOI of 5 for 2 hours in 96 well plates. 2% L15 media (concentrated from supernatants from mock T-75 flasks) was used as the negative/mock control. Dengue antibody blocking was performed by incubating virus supernatant and dengue envelope protein antibody (1µg/ml) for 30 minutes and then performing virus adsorption. Next, the cells were

washed twice to remove excess unbound virus and incubated in ILC2 media containing IL-2 (200U/ml) for 48 hours. Infection rate was detected using intracellular envelope protein staining after permeabilizing and fixing cells.

Gene expression in ILC2

qRT-PCR

mRNA extraction was performed from 10⁵ cells/well ILC2, following stimulation for 2 hours using a TurboCapture 96 mRNA kit (Qiagen, 72251) according to manufacturer's instructions. Complementary DNA (cDNA) was prepared from mRNA by reverse transcription PCR (M-MLV, Invitrogen). qPCR performed using Taqman probes and TaqMan gene expression master mix.

Western blot

Protein was extracted from 1million ILC2 in each condition using M-PER (Thermo Scientific - 78501) and protein samples were prepared in reducing buffer and boiled for 5 minutes, analysed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS/PAGE), and transferred to a polyvinylidene difluoride membrane (Invitrogen). IFITM proteins were detected using mouse anti-human monoclonal IFITM3 antibody 1:1000 (kindly donated by Professor Tao Dong's lab). GAPDH (FF26A/F9 - 649202) was used as the loading control (1:1000)

ELISA of PGD2 and PGE2 metabolites

The 11β-prostaglandin F2α (11β-PG F2α)

and prostaglandin E (PG E) metabolite were measured in urine samples collected from acute dengue patients, which was stored in -80°C . These were measured using 11β -prostaglandin F 2α quantitative ELISA (Cayman Chemical, USA) and prostaglandin E metabolite quantitative ELISA (Cayman Chemical, USA). To perform both assays urine samples were diluted at 1:10 ratio using the respective ELISA dilution buffer.

Results

Ex vivo RNA sequencing of ILC2 of in healthy individuals and patients with dengue Fever and dengue Hemorrhagic Fever

From preliminary experiments it was observed that ILC2 frequency is increased in severe dengue, so that it was imperative to investigate for differential gene expression patterns between healthy, mild and severe dengue infections. To investigate the possible role for ILC2, RNA sequencing was performed of ILC2 isolated from PBMC (Figure 1) of individuals with dengue fever (DF) and severe dengue (DHF) and healthy donors (HC) of Sri Lankan ethnicity. We have not explored whether these samples were from patients with primary or secondary dengue infection. Blood was taken at 2-7 days of symptom onset in patients having DF and DHF.

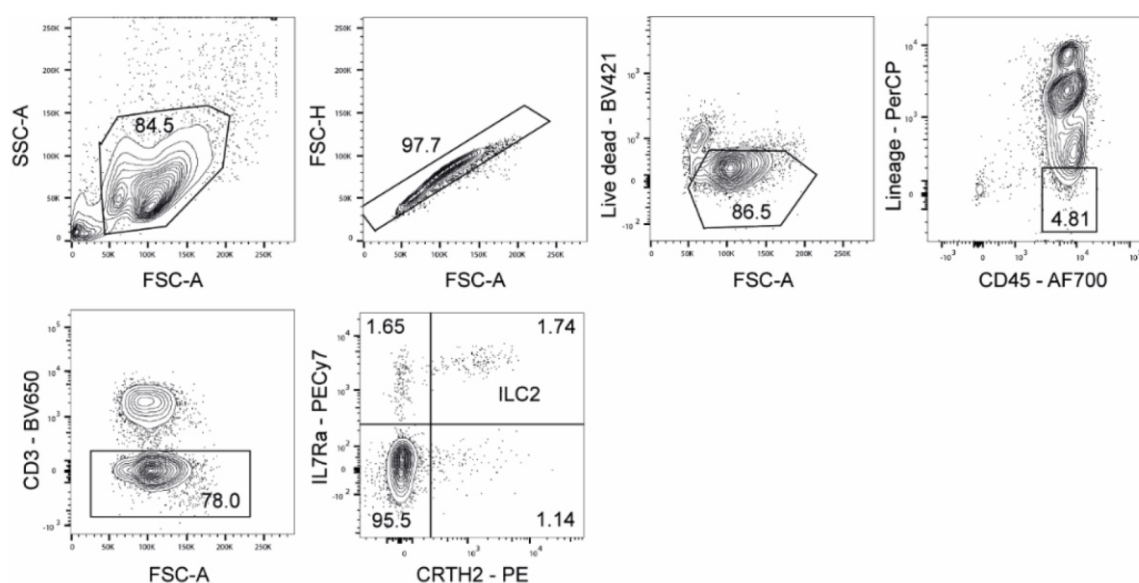


Figure 1: Isolation of blood ILC2 for *ex vivo* RNA sequencing

(A) Representative plot of ILC2 gating of a healthy individual depicted in the figure. Above gating strategy was used for isolation of ILC2 of three clinical groups: Healthy individuals (HC), dengue fever (DF), dengue haemorrhagic fever (DHF). ILC2 are CD45 $^{+}$ /CD3 $^{-}$ /lineage $^{-}$ /CRTH2 $^{+}$ /IL7Ra $^{+}$.

Firstly, an unsupervised analysis approach was undertaken and principal component analysis (PCA) was performed to assess clustering of genes with respect to the patient groups (Figure 2a,b). ILC2 of healthy individuals showed a markedly different gene

expression (DEG) profile compared to the patients with DF and DHF. It was evident that healthy control (HC) samples were clustered separately from dengue disease groups while there were no notable differences between the two dengue infected groups, DF and DHF (Figure 2a). A similar trend was also found in cluster of heatmap generated from 281 DEGs, which were differentially expressed within the 3 disease groups (Likelihood ratio test, FDR < 0.05) (Figure 2b)(12).

A) Principal component analysis (PCA plots) and **(B)** heat map of differentially expressed

genes (DEGs) from *ex vivo* ILC2 from three groups: healthy individuals (HC) (n=3), dengue Fever (DF) (n=4) and dengue Hemorrhagic Fever (DHF) (n=4) (Likelihood ratio test, False discovery rate (FDR) < 0.05 used). Samples analysed in duplicate depicted in PCA plot and heat map. Clinically, DF and DHF groups are categorised using SEARO (WHO 2011) classification.

ILC2 are activated in Dengue infection

Next, it was investigated whether ILC2 are activated in dengue fever. To accomplish this, expression of genes related to activation of

ILC2 in HC, DF and DHF were examined. It was found that ILC2 showed evidence of being highly activated. Genes encoding the key effector receptors *PTGDR2* (CRTH2), a receptor of PGD₂ mediator and *CD127* appeared to be down regulated in DF (Figure 3a), which is known to occur following ILC2 activation. Also, *CD38*, a surface marker that is known to upregulate with cellular activation and through interferon stimulation (13, 14), was significantly upregulated in DF and DHF (Figure 3a). Additionally, *CD25* (*IL12RB*) showed a trend of upregulation in dengue infection (Figure 3a). These findings indicated that *ex vivo* ILC2 are activated in dengue disease.

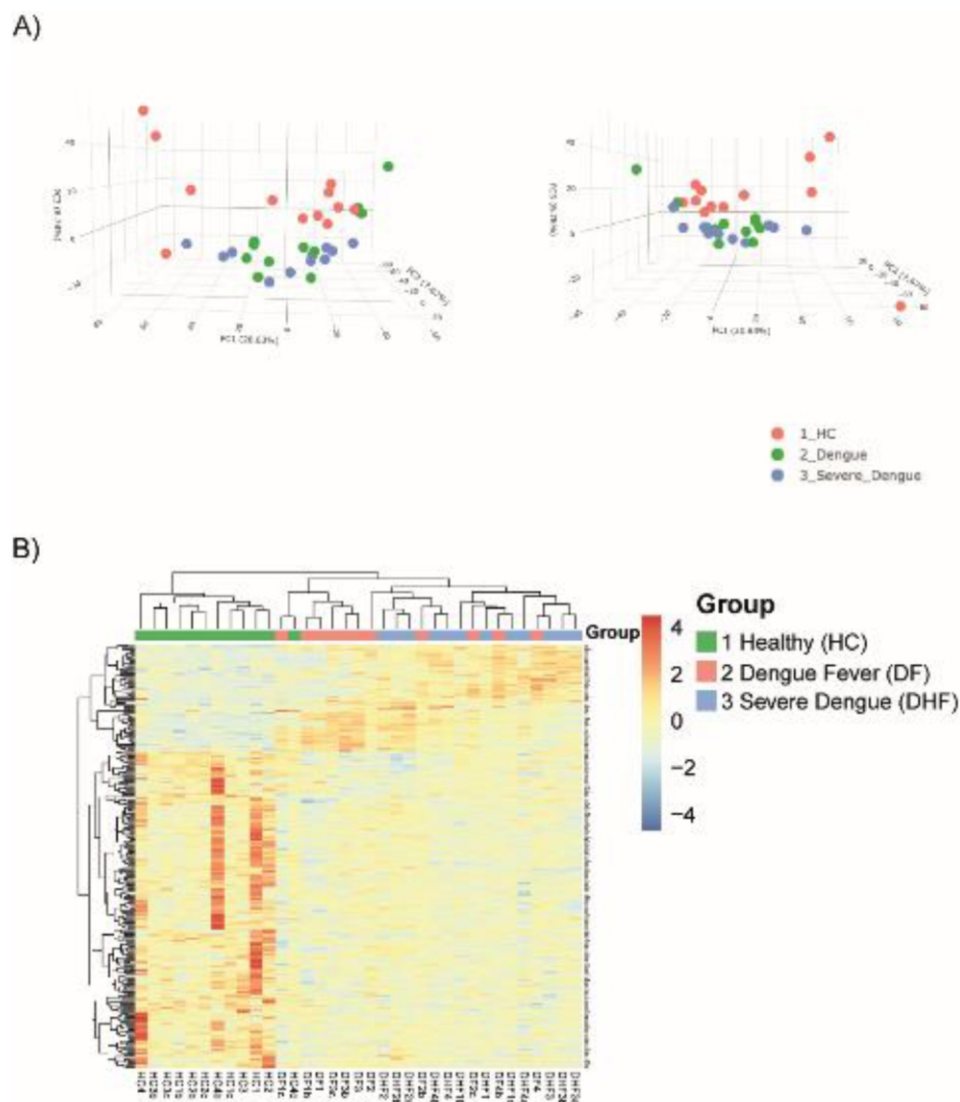


Figure 2: Gene expression profile in healthy and in patients with DF and DHF

Dengue virus detection in *ex vivo* ILC2 from patients with DF and DHF

It was aimed to explore whether *ex vivo* ILC2 show evidence of dengue infection. For this, raw RNA sequencing data from the *ex vivo* sorted ILC2 were aligned against human (hg38) and dengue virus genomes (including all serotypes 1-4) simultaneously to explore whether dengue viral sequences were detectable in ILC2 sequence data. Interestingly, ILC2 from 3 patients (two DF, one DHF) showed detectable dengue sequence of DENV serotype 2. Dengue

serotype 2 was the predominantly detected serotype in Sri Lanka when the samples were obtained. The reads were related to the proteins of the non-structural regions of the dengue viral genome. Most of the reads originated from the region of 600bp-9000bp of DENV genome, corresponding to NS4A, protein-2K, NS4B, RNA-dependent RNA polymerase NS5 (Figure 3b). These data show that dengue virus sequence could be detected in host ILC2 and also that ILC2 are infected *in vivo*.

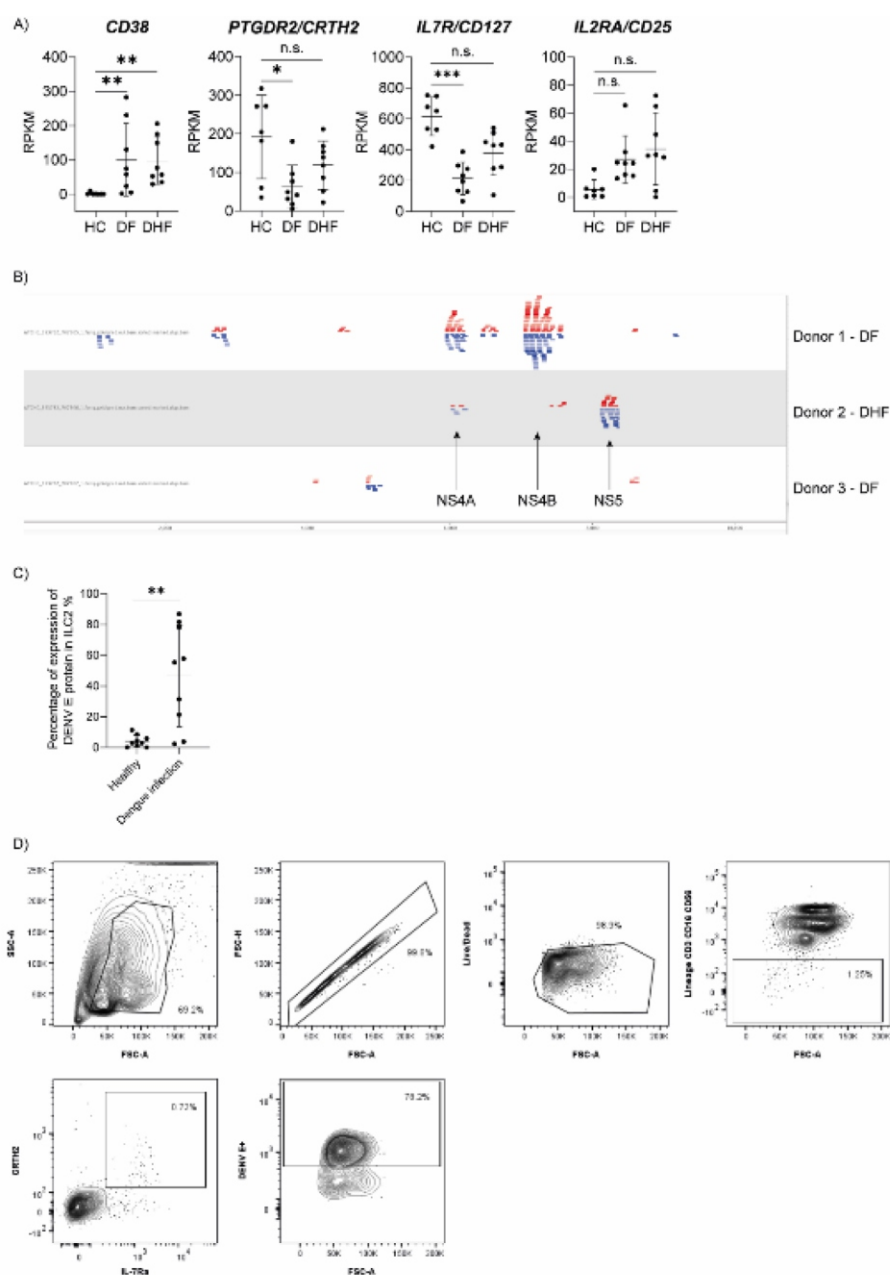


Figure 3: *In vivo* ILC2 are activated and infected in dengue infection.

In addition, it was showed that *ex vivo* ILC2 from dengue patient samples show dengue virus infection through staining for intracellular dengue envelope protein. To demonstrate this, PBMC from individuals with dengue infection (DF, DHF) and healthy controls were stained with surface antibodies to identify ILC2 and with intracellular dengue viral E protein to detect infection. Dengue viral staining among ILC2 was variable from 2-87% (Figure 3c) and it was significantly higher in dengue patient samples (Figure 3 c,d), reaching 75-85% in certain dengue patients.

(A) Activation related gene expression of *CD38*, *PTGDR2* (*CRTH2*), *CD127*(*IL-7R α*), *IL-2RA* (*CD25*) of human blood derived ILC2 of HC, DF and DHF, determined by RNA Sequencing and represented in RPKM values. Statistical analysis performed using adjusted p-value from the DEG result. *P <0.05, ** <0.01, *** <0.001, n.s. not significant. RNA sequencing data from ILC2 from three groups: healthy individuals (HC) (n=3), dengue Fever (DF)(n=4) and dengue Hemorrhagic Fever (DHF) (n=4). (B) Mapping figure from genome browser depicting matching genes of dengue genome to the raw RNA sequencing data from ILC2 in patients having with Dengue fever (DF, n=2) and Dengue Hemorrhagic Fever (DHF, n=1). Corresponding proteins for the base pair ranges were depicted. 6376~6756bp: Non-Structural protein NS4A, 6757~6825bp: protein 2K, 6826~7569bp: Non-Structural protein NS4B, 7570~10269bp: RNA-dependent RNA polymerase NS5. (C) For *ex vivo* staining of ILC2 for dengue infection, frozen PBMC from HC (n=9) and patients with acute dengue infection (n=9) from Sri Lankan ethnicity were used. Samples were thawed and stained for ILC2 (Live/CD45+/CD3-/CD56-/lineage/CRTH2+/IL7R α +) and intracellular dengue virus envelope protein. (D) Representative flow cytometry plot of DENV E protein staining from a patient with dengue infection is shown.

Anti-viral protein expression in ILC2 and its regulation with PGD₂

We have shown that type I interferons establish an anti-viral gene expression state in ILC2, therefore, it was sought to determine regulatory factors of type I interferon responses in ILC2. As above, PGD₂ is a lipid mediator predominantly produced by mast cells, and also produced endogenously by Tc2 and ILC2 following activation (15, 16). Therefore, it was investigated whether PGD₂ activation modifies the anti-viral gene expression and protein responses of ILC2.

Stimulation of ILC2 with PGD₂ significantly down-regulated ILC2 type I interferon receptor, *IFNAR1* expression (Figure 4a). *IFNAR1* expression was significantly upregulated with IFN- β treatment (Figure 4a). IFNAR1 is a membrane protein that forms one of the two chains of a receptor for interferons alpha and beta. Binding and activation of this receptor stimulates Janus protein kinases, which in turn phosphorylate several proteins, including STAT1(17). Activation via PGD₂ also suppressed other anti-viral gene expression such as *OAS1* (Figure 4b) and *IFITM3* (Figure 4c) in a dose dependent manner. IFITM proteins are known mediators of innate immunity that inhibit viral infection in part by blocking viral entry and have shown to restrict replication of multiple viruses including dengue (18, 19). In addition, it has been demonstrated in an experimental model involving K562 human myelogenous leukemia cells that IFITM proteins are able to restrict both direct and ADE-mediated infection(20). These proteins are strongly upregulated by Type I and II interferons (21). IFITM proteins are key mediators of innate immunity that inhibit viral infection by blocking viral entry and replication(19). Additionally, at the protein level PGD₂ downregulated expression of IFN- β induced IFITM3 in ILC2 (Figure 4d). With these results we propose that PGD₂ could suppress anti-viral mechanisms in a setting of dengue infection.

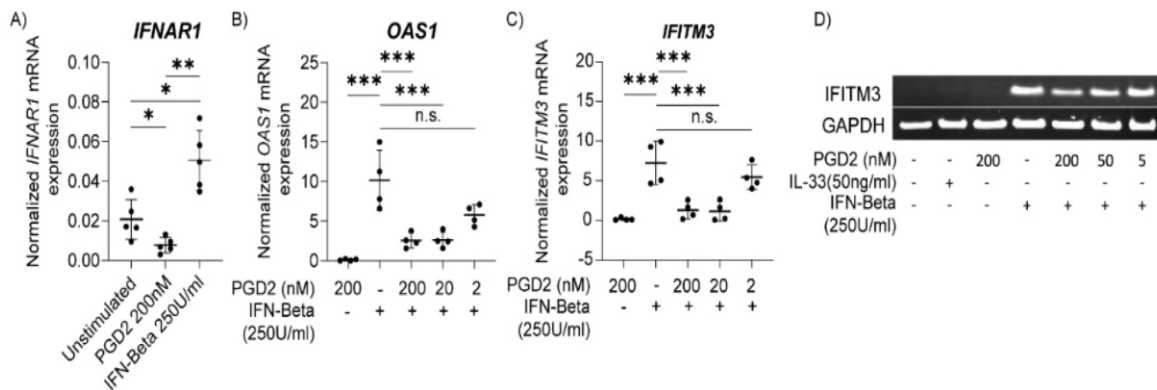


Figure 4: ILC2 activation through PGD₂ suppresses the antiviral state of ILC2

(A) Real-time PCR analysis of *IFNAR1* gene expression by ILC2 following 2 hours of stimulation with PGD₂ (200nM) and IFN- β (250IU/ml). Gene expression normalised to *GAPDH*. Real-time PCR analysis of (B) *OAS1* and (C) *IFITM3* gene expression by ILC2 following stimulation with PGD₂ (2, 20, 200nM) for 1 hour and then treated with IFN- β (250IU/ml). (n=3, one-way ANOVA with Tukey's comparison test, data representative of 3 independent experiments). Gene expression normalised to *GAPDH*. (D) Western blot of IFITM3 protein expression of ILC2 treated with PGD₂ (2-200nM) and subsequently added IFN- β (250IU/ml). Experiment performed twice with 2 donor samples.

The predominant effects were mediated through IL-33, PGD₂ and LTE₄ and so these were further investigated. As above, alarmins such as IL-33 and lipid mediators such as PGD₂ and LTE₄ activate ILC2 (22-24). IL-33, PGD₂ and LTE₄ stimulation increased viral infection of ILC2 in a concentration dependent manner (Figure 5a). PGD₂ significantly increased infectivity of ILC2 and acted together with IL-33 to increase infectivity of ILC2 compared to dengue virus infection in unstimulated ILC2 (Figure 5b). ILC2 activation status may therefore influence dengue viral infection, as stimulation via PGD₂, LTE₄ and IL-33 were observed to increase infectivity. Next, it was investigated whether ILC2 could

support replication-competent dengue virus production. Supernatants from mock and dengue infected ILC2 were collected and Vero cell-based foci-forming assay (FFA) performed to quantify virus titre in the ILC2 cell supernatant. ILC2 underwent productive infection and released infectious viral particles into the supernatant (Figure 5c). Interestingly, activation of ILC2, particularly through PGD₂, induced secretion of significantly greater infectious viral particles compared to unstimulated ILC2 supernatants (Figure 5c). IL-33 mediated activation did not lead to a significantly higher infection and secretion of infectious viral particles although the trend was higher. Combined IL-33 and PGD₂ mediated stimulation led to a further increase in dengue viral infection and productive infection in ILC2 (Figure 5b, c). Similar significant increase in productive dengue viral infection was noted with infection of LTE₄ activated ILC2. This suggests that activated ILC2 may contribute to increased viral replication.

(A) ILC2 were activated through serial concentrations of IL-33 (0-50ng/ml), PGD₂ (0-200nM) and LTE₄ (0-100nM) for 24 hours. Then cells were incubated with dengue virus (MOI 5) for 2 hours. Unbound virus was removed and the cells were plated in fresh ILC2 media containing IL-2 for 48 hours. Thereafter, intracellular DENV E protein was analyzed by flow cytometry. (B) Activation of ILC2 with fixed

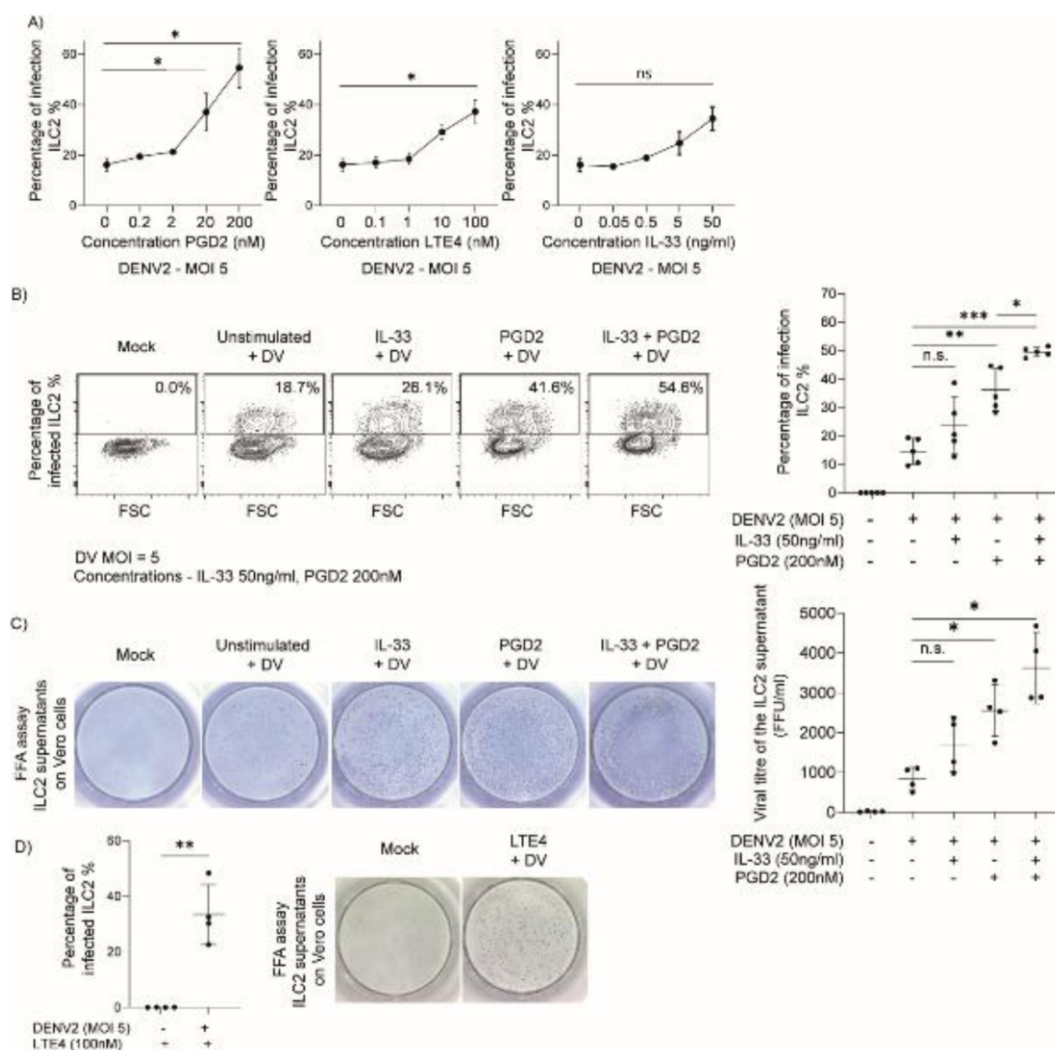


Figure 5: Activated ILC2 are more permissive to infection and secrete infectious viral particles

concentrations of PGD₂ (200nM), IL-33 (50ng/ml) was performed for 24 hours, followed by infection with dengue virus and then incubated for 48 hours. Intracellular DENV E protein was analysed by flow cytometry (y-axis). (C) Supernatants of infected ILC2 of unstimulated and activated conditions (activated with IL-33 (50ng/ml) and/or PGD₂ (200nM)) infected ILC2 (with MOI 5) were added on Vero cells and a Foci forming assay (FFA) was performed. Each focus is representative of an infected Vero cell. (D) With LTE₄ (100nM) 24 hour ILC2 activation and infection was performed and FFA was performed on the ILC2 supernatant collected 48 hours post-infection. All above

data from 3 independent experiments (n=4-5).

Subsequently, it was sought to determine whether infection control could be achieved through inhibiting PGD₂ mediated activation. This was accomplished with the use of CRTH2 antagonist, TM30089. Inhibition of CRTH2-mediated activation of ILC2 reduced dengue infection (Figure 6). TM30089 significantly reduced dengue virus infection in PGD₂ and IL-33 treated ILC2. The latter implicated the inhibition of action of endogenously produced PGD₂ from ILC2 (Figure 6a), and a functional relevance of

endogenously produced PGD_2 in ILC2 in the setting of dengue viral infection. With unstimulated ILC2 the reduction of infection through CRTH2 antagonism is not significant, likely due to the fact that unstimulated ILC2 do not produce adequate levels of PGD_2 . Given that the lipid mediator LTE_4 has been reported to be increased in individuals with severe dengue(25), and as above, associates with elevated ILC2 dengue infection, it was investigated whether inhibition of LTE_4 -mediated ILC2 activation had a similar effect. Montelukast, a leukotriene receptor antagonist, which demonstrates selectivity to the cysteinyl leukotriene receptor type-1,

inhibited exogenous LTE_4 -mediated dengue virus infection of ILC2. However, it did not appear that ILC2 produced LTE_4 endogenously to promote ILC2 activation and dengue viral infection (Figure 6b). Inhibition of the autocrine action of type 2 cytokines IL-4 and IL-13 through blockade of shared receptor $\text{IL4R}\alpha$, did not affect the level of dengue viral infection in ILC2 (Figure 6c). These data further suggest that inhibition of exogenous PGD_2 or LTE_4 has a significant effect in reducing dengue infection in ILC2 and endogenously produced PGD_2 plays a role in dengue infection of activated ILC2.

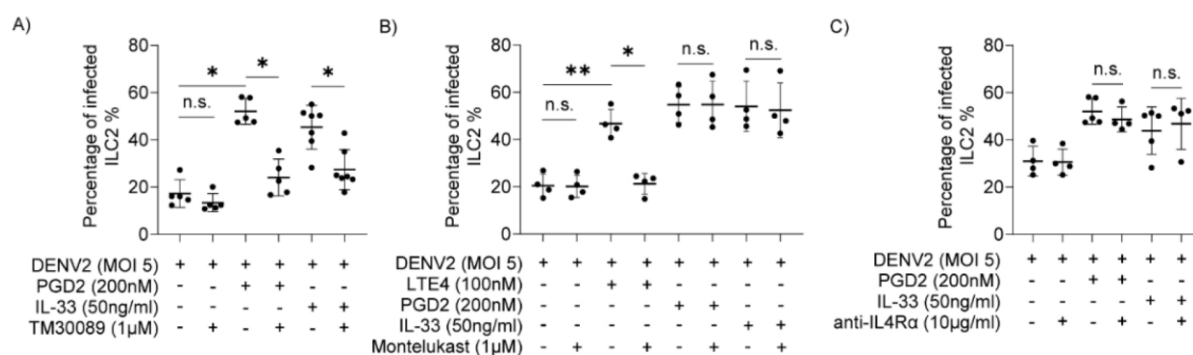


Figure 6: CRTH2 inhibition reduces dengue infection in ILC2

(A) ILC2 were treated with CRTH2 antagonist (TM30089 – 1μM) for 1 hour before treatment with PGD_2 (200nM) or IL-33 (50ng/ml) for 24 hours. ILC2 were infected with DENV2 infection (MOI 5), and infection was assessed. (B) ILC2 were treated with Montelukast (1μM) for 1 hour before treatment with PGD_2 (200nM), IL-33 (50ng/ml), LTE_4 (100nM) for 24 hours. ILC2 were infected with DENV2 infection (MOI 5), and infection was assessed. (C) ILC2 were treated with $\text{IL4R}\alpha$ antagonist (10μg/ml) for 1 hour before treatment with PGD_2 (200nM) or IL33 (50ng/ml) for 24 hours. ILC2 were infected with DENV2 infection (MOI 5), and infection was assessed. Statistical significance was tested using oneway ANOVA with Tukey's multiple comparison test. * $P < 0.05$, ** < 0.01 , *** < 0.001 , n.s. not significant.

From the above data, PGD_2 plays a role in

exacerbating ILC2 infection and dengue viral replication. To understand the PGD_2 and its metabolite levels in humans, concentrations of PGD_2 metabolites in the urine of patients with DF and DHF over the course of illness was measured. Inflammatory lipid mediators such as platelet activating factor (PAF) and secretory phospholipase A_2 levels relevant to the arachidonic acid pathway and urinary leukotriene levels are found to be higher in patients with DHF(25-27). PGD_2 is a product of arachidonic acid metabolism, dependent on cyclooxygenase and haematopoietic PGD synthase. Whilst evidence suggests PGD_2 production occurs in platelets, macrophages, T helper cells and DCs, levels are 100–1000 times lower than that synthesised by activated MCs indicating that PGD_2 production largely reflects MC activity(28). PGD_2 is an unstable compound and is rapidly degraded and excreted as

more stable urinary metabolites (29). In order to determine the changes in urinary prostaglandin metabolites throughout the course of dengue illness, serial 11β -PGF_{2 α} concentrations in the urine were measured in 12 patients with DF and 10 patients with DHF. In patients with DF, urinary PGD₂ metabolite levels (11β -PGF_{2 α}) gradually declined from day 3 of illness onwards. While in patients with DHF the levels gradually increased up to day 6 (Figure 7a). Additionally, 11β -PGF_{2 α} levels were

significantly higher in the critical phase of patients with DHF compared to the levels 24 hours before entering critical phase (Figure 7b). While PGD₂ and its metabolites activate ILC2 function, PGE₂ is considered to be inhibitory to ILC2 function (30). Urinary levels of the PGE₂ metabolite PGE-M did not show such a trend in patients with DF and DHF (Figure 7c). These results in part support the hypothesis that PGD₂ plays a role in DHF progression and the pathway constitutes a promising therapeutic target.

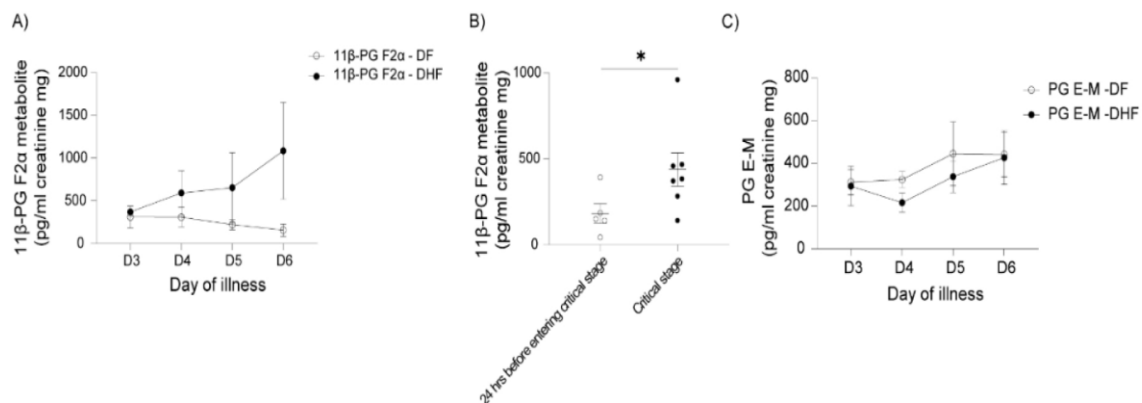


Figure 7: Urinary PGD₂ metabolite 11β -PGF_{2 α} levels in patients with acute dengue

Urinary (A) 11β -PGF_{2 α} levels were measured by quantitative ELISA, in those with DF (n = 12) and those who progressed to develop DHF (n = 10) in serially collected samples on 3rd, 4th, 5th and 6th days of illness. Error bars represent standard error of mean (SEM) and each dot represent the mean. (B) 11β -PGF_{2 α} levels were measured by quantitative ELISA, in those with DHF (n = 7) 24 hours before entering critical stage and during critical stage. Statistical significance was tested using T test. *P < 0.05, ** < 0.01, *** < 0.001, n.s. not significant. Each dot represents one donor. (C) Urinary PGE₂ metabolite PGE-M levels in patients with acute dengue (DF, n=12 and DHF, n=10). Error bars represent standard error of mean (SEM) and each dot represent the mean.

Discussion

The RNA sequencing data presented here showed that ILC2 were highly activated in

dengue infection compared to healthy samples indicated by suppression of PGD₂ receptor expression. Given that ILC2 are resident in barrier tissues, these novel data raised the possibility that early effects of ILC2 at the time of the initial phase of infection, may play a role in the progression. Additionally, it was shown that PGD₂ metabolites were found to be higher in patients with severe dengue compared to milder disease, and the PGD₂ metabolite levels were significantly increased during the 'critical phase' of dengue infection. Interestingly, PGD₂ could suppress protective type I interferon responses. This provides a novel perspective on lipid mediators which plays a role in ILC2 activation in dengue infection. Furthermore, detection of higher PGD₂ metabolites in dengue may translate to increased chemotaxis of ILC2 and Th2 cells and additionally could facilitate proliferation of ILC2. In asthma and allergy ILC2 numbers are higher and PGD₂ metabolites could

significantly increase early with allergen challenge(28). Therefore, we propose that individuals with a background of atopy or allergy are predisposed for early PGD₂ metabolite responses, therefore, could have a propensity to have ILC2 activation and impaired type I IFN responses.

As discussed above, Malavige et al, (25) have shown that lipid mediators such as LTE₄ are increased in severe dengue. It was shown that PGD₂ metabolites are increased in the critical stage of dengue in DHF. Severe dengue, vascular leakage and bleeding manifestation are usually associated with secondary dengue infection through antibody dependent enhancement. Dengue virus induce significantly higher mast cell degranulation through an antibody dependent mechanism compared to direct infection alone(31). This signifies that high mast cell degranulation can occur in secondary dengue infection through a mechanism involving ADE. We propose that higher mast cell degranulation in secondary dengue will lead to abundance of mast cell mediators such as PGD₂ and LTE₄ which mediate pronounced activation of ILC2. We showed activated ILC2 can mediate pronounced productive dengue viral replication. Therefore, we propose that mast cell degranulation in secondary dengue infection could lead to higher ILC2 activation than primary dengue infection leading to increased viral replication and potentially contribute to severe disease.

ILC2 are predominantly tissue resident innate cells that could play a role in responses to dengue virus after a mosquito bite on skin and contribute to productive viral infection. ILC2 could release higher infectious particles to infect bystander cells and additionally assist viral dissemination. Unexpectedly, the dengue viral genome was detected *in vivo* in peripheral blood ILC2 and we showed that *ex vivo* ILC2 from dengue patients had significant infection rates. Furthermore, *ex vivo* sorted and

expanded ILC2 are permissive to infection *in vitro*, and could potentially assist viral dissemination. In fact, both blood and skin ILC2 were permissive to dengue infection, which was increased when ILC2 were activated. Other than PGD₂, IL-33 and LTE₄ activation increased dengue virus replication in ILC2, but to lesser degree than with PGD₂. The effect of PGD₂ on infection and secretion of viral particles is striking and is further increased by co-activation with other ILC2 activators.

We propose that inhibiting action of CRTH2 activation would have favorable responses in reducing productive infection in ILC2. Moreover, due to the fact that PGD₂ suppresses expression of anti-viral genes and proteins, inhibiting PGD₂ responses may have a favourable outcome for anti-viral defense. PGD₂ is a metabolite in the arachidonic pathway and previous studies have shown that this pathway is activated in dengue (26) and downstream lipid mediators such as leukotrienes are shown to contribute to pathogenesis of dengue and vascular leakage(25, 32). Although inhibition of the CRTH2 pathway could lead to reduction of viraemia of dengue infection, it has been clinically observed that use of NSAIDs, which block COX 1 and 2 enzymes at an early step of the arachidonic acid pathway, is associated with higher mortality and bleeding manifestations and derangement of liver enzymes (33, 34). Since, arachidonic acid pathway leads to many downstream effects through a range of mediators, this outcome could occur either due to inhibition of protective mediators of dengue infection or due to additional side effects of these medication outside arachidonic acid pathway. One of the downstream mediators TXA₂, which mediates vasoconstriction and platelet aggregation, is suggested to play a protective role in dengue infection (35). Additionally, PGD₂ shows clues of a protective role through DP1 activation, which is discussed later. Furthermore, PGE₂ has shown to increase viral replication(36), but suppresses ILC2 activation (37, 38).

Therefore, we propose that inhibition of the CRTH2 receptor could have therapeutic potential in dengue viral infection. CRTH2 inhibitors are investigated in allergic diseases such as asthma and allergic rhinitis and considered to be well tolerated given orally (39-41). Such medications are more economically affordable comparatively, especially for tropical countries. Interestingly, dengue viral infection shares certain features of allergic inflammation such as mast cell activation and release of mast cell mediators such as leukotrienes and histamines (25). Furthermore, vascular leakage, which is a clinical hallmark of severe dengue infection, was shown to occur due to increased capillary permeability. Anaphylaxis and urticaria have been shown to have a similar pathogenesis (42) with altered capillary permeability, although the plasma leakage is much more pronounced in dengue infection. In addition, a randomised clinical trial using oral CRTH2 blockade in asthma, observed reduced infections, including influenza in asthmatics in the CRTH2 blockade group (43).

In addition we found that PGD₂ is elevated in severe dengue, which strengthens the mast cell involvement in dengue infection. Through this mediator, a range of type 2 cells in innate and adaptive immune system are activated and likely contribute to the pathogenesis of dengue. Therefore, it is possible that individuals who are predisposed to atopy or allergy may have a more pronounced type 2 response in the bitten site, which could influence the earliest events of viral replication.

Given the consistent evidence of MC activation in dengue infection, several MC mediator based therapies have been investigated. Although primary reduction of DHF was not observed, in the post-hoc analysis, patients who received rupatadine, which is a PAF and histamine blocker, had lower vascular leakage manifestations and

bleeding(44). This suggested early initiation of Rupatadine, less than 3 days from onset of symptoms, may have beneficial effects. However, these data are from a post-hoc analysis and may be associated with some bias. Furthermore, montelukast, a CysLT1 receptor inhibitor, which blocks the leukotriene pathway, showed a significant reduction of the risk of having DSS in dengue infection(45). In an *in vivo* animal model, a potent tryptase inhibitor, nafamostat mesylate was shown to reduce DENV induced vascular leakage(46). In addition to above, we suggest that CRTH2 blocking medications could be used to reduce productive viral infection and reduce the suppression on interferon pathways induced through PGD₂. However, an effect of CRTH2 blockers on vascular leakage would be an interesting avenue to be explored.

Conclusions

Here we present data that implicate ILC2 in the immunopathology of dengue virus infection. PGD₂ and LTE₄ mediates activation and significantly influences productive viral infection in type 2 cytokine producing cells. Moreover, PGD₂ downregulates type I IFN induced anti-viral responses in ILC2. With these insights we propose that inhibition of the PGD₂ pathway through CRTH2 as a therapeutic avenue to modulate viral replication.

References

1. Malavige GN, Jeewandara C, Ghouse A, Somathilake G, Tissera H. Changing epidemiology of dengue in Sri Lanka—Challenges for the future. PLOS Neglected Tropical Diseases. 2021;15(8):e0009624.
2. Thalagala N, Tissera H, Palihawadana P, Amarasinghe A, Ambagahawita A, Wilder-Smith A, et al. Costs of Dengue Control Activities and Hospitalizations in the Public Health Sector during an

- Epidemic Year in Urban Sri Lanka. PLoS neglected tropical diseases. 2016;10(2):e0004466-e.
3. Malavige GN, Velathanthiri VG, Wijewickrama ES, Fernando S, Jayaratne SD, Aaskov J, et al. Patterns of disease among adults hospitalized with dengue infections. Qjm. 2006;99(5):299-305.
4. Nakamura T, Fujiwara Y, Yamada R, Fujii W, Hamabata T, Lee MY, et al. Mast cell-derived prostaglandin D2 attenuates anaphylactic reactions in mice. The Journal of allergy and clinical immunology. 2017;140(2):630-2 e9.
5. King CA, Anderson R, Marshall JS. Dengue virus selectively induces human mast cell chemokine production. Journal of virology. 2002;76(16):8408-19.
6. Brown MG, King CA, Sherren C, Marshall JS, Anderson R. A dominant role for FcγRII in antibody-enhanced dengue virus infection of human mast cells and associated CCL5 release. Journal of leukocyte biology. 2006;80(6):1242-50.
7. Walker JA, McKenzie AN. Development and function of group 2 innate lymphoid cells. Current opinion in immunology. 2013;25(2):148-55.
8. Vivier E, Artis D, Colonna M, Diefenbach A, Di Santo JP, Eberl G, et al. Innate Lymphoid Cells: 10 Years On. Cell. 2018;174(5):1054-66.
9. Gasteiger G, Fan X, Dikiy S, Lee SY, Rudensky AY. Tissue residency of innate lymphoid cells in lymphoid and nonlymphoid organs. Science (New York, NY). 2015;350(6263):981-5.
10. Rak GD, Osborne LC, Siracusa MC, Kim BS, Wang K, Bayat A, et al. IL-33-Dependent Group 2 Innate Lymphoid Cells Promote Cutaneous Wound Healing. The Journal of investigative dermatology. 2016;136(2):487-96.
11. Gomez-Cadena A, Spehner L, Kroemer M, Khelil MB, Bouiller K, Verdeil G, et al. Severe COVID-19 patients exhibit an ILC2 NKG2D+ population in their impaired ILC compartment. Cellular & Molecular Immunology. 2021;18(2):484-6.
12. Robinson MD, McCarthy DJ, Smyth GK. edgeR: a Bioconductor package for differential expression analysis of digital gene expression data. Bioinformatics. 2010;26(1):139-40.
13. Shubinsky G, Schlesinger M. The CD38 lymphocyte differentiation marker: new insight into its ectoenzymatic activity and its role as a signal transducer. Immunity. 1997;7(3):315-24.
14. Bauvois B, Durant L, Laboureaux J, Barthélémy E, Rouillard D, Boulla G, et al. Upregulation of CD38 gene expression in leukemic B cells by interferon types I and II. J Interferon Cytokine Res. 1999;19(9):1059-66.
15. Maric J, Ravindran A, Mazzurana L, Van Acker A, Rao A, Kokkinou E, et al. Cytokine-induced endogenous production of prostaglandin D2 is essential for human group 2 innate lymphoid cell activation. The Journal of allergy and clinical immunology. 2019;143(6):2202-14.e5.
16. Chen W, Luo J, Ye Y, Hoyle R, Liu W, Borst R, et al. The Roles of Type 2 Cytotoxic T Cells in Inflammation, Tissue Remodeling, and Prostaglandin (PG)D2 Production Are Attenuated by PGD2 Receptor 2 Antagonism. The Journal of Immunology. 2021;206(11):2714-24.
17. Basu L, Yang CH, Murti A, Garcia JV, Croze E, Constantinescu SN, et al. The antiviral action of interferon is potentiated by removal of the conserved IRTAM domain of the IFNAR1 chain of the interferon alpha/beta receptor: effects on JAK-STAT activation and receptor down-regulation. Virology. 1998;242(1):14-21.
18. Brass AL, Huang IC, Benita Y, John SP,

- Krishnan MN, Feeley EM, et al. The IFITM proteins mediate cellular resistance to influenza A H1N1 virus, West Nile virus, and dengue virus. *Cell*. 2009;139(7):1243-54.
- 19.Liu SY, Sanchez DJ, Cheng G. New developments in the induction and antiviral effectors of type I interferon. *Current opinion in immunology*. 2011;23(1):57-64.
- 20.Chan YK, Huang IC, Farzan M. IFITM proteins restrict antibody-dependent enhancement of dengue virus infection. *PloS one*. 2012;7(3):e34508-e.
- 21.Huang IC, Bailey CC, Weyer JL, Radoshitzky SR, Becker MM, Chiang JJ, et al. Distinct patterns of IFITM-mediated restriction of filoviruses, SARS coronavirus, and influenza A virus. *PLoS Pathog*. 2011;7(1):e1001258.
- 22.Salimi M, Barlow JL, Saunders SP, Xue L, Gutowska-Owsiak D, Wang X, et al. A role for IL-25 and IL-33-driven type-2 innate lymphoid cells in atopic dermatitis. *The Journal of experimental medicine*. 2013;210(13):2939-50.
- 23.Salimi M, Stöger L, Liu W, Go S, Pavord I, Klenerman P, et al. Cysteinyl leukotriene E(4) activates human group 2 innate lymphoid cells and enhances the effect of prostaglandin D(2) and epithelial cytokines. *The Journal of allergy and clinical immunology*. 2017;140(4):1090-100.e11.
- 24.Xue L, Salimi M, Panse I, Mjosberg JM, McKenzie AN, Spits H, et al. Prostaglandin D2 activates group 2 innate lymphoid cells through chemoattractant receptor-homologous molecule expressed on TH2 cells. *The Journal of allergy and clinical immunology*. 2014;133(4):1184-94.
- 25.Silva T, Jeewandara C, Gomes L, Gangani C, Mahapatuna SD, Pathmanathan T, et al. Urinary leukotrienes and histamine in patients with varying severity of acute dengue. *PloS one*. 2021;16(2):e0245926.
- 26.Jeewandara C, Gomes L, Udari S, Paranavitane SA, Shyamali NL, Ogg GS, et al. Secretory phospholipase A2 in the pathogenesis of acute dengue infection. *Immun Inflamm Dis*. 2017;5(1):7-15.
- 27.Jeewandara C, Gomes L, Wickramasinghe N, Gutowska-Owsiak D, Waithe D, Paranavitane SA, et al. Platelet activating factor contributes to vascular leak in acute dengue infection. *PLoS neglected tropical diseases*. 2015;9(2):e0003459-e.
- 28.Bochenek G, Nizankowska E, Gielicz A, Swierczyńska M, Szczeklik A. Plasma 9alpha,11beta-PGF2, a PGD2 metabolite, as a sensitive marker of mast cell activation by allergen in bronchial asthma. *Thorax*. 2004;59(6):459-64.
- 29.Song WL, Wang M, Ricciotti E, Fries S, Yu Y, Grosser T, et al. Tetranor PGDM, an abundant urinary metabolite reflects biosynthesis of prostaglandin D2 in mice and humans. *The Journal of biological chemistry*. 2008;283(2):1179-88.
- 30.Maric J, Ravindran A, Mazzurana L, Björklund Å K, Van Acker A, Rao A, et al. Prostaglandin E(2) suppresses human group 2 innate lymphoid cell function. *The Journal of allergy and clinical immunology*. 2018;141(5):1761-73.e6.
- 31.Syenina A, Jagaraj CJ, Aman SAB, Sridharan A, St John AL. Dengue vascular leakage is augmented by mast cell degranulation mediated by immunoglobulin Fcγ receptors. *eLife*. 2015;4:e05291.
- 32.Malavige GN, Ogg GS. Pathogenesis of vascular leak in dengue virus infection. *Immunology*. 2017;151(3):261-9.
- 33.Wijewickrama A, Abeyrathna G, Gunasena S, Idampitiya D. Effect of non-steroidal anti-inflammatory drugs (NSAIDS) on bleeding and liver in

- dengue infection. *International Journal of Infectious Diseases*. 2016;45:19-20.
34. Tam DTH, Ngoc TV, Tien NTH, Kieu NTT, Thuy TTT, Thanh LTC, et al. Effects of Short-Course Oral Corticosteroid Therapy in Early Dengue Infection in Vietnamese Patients: A Randomized, Placebo-Controlled Trial. *Clinical Infectious Diseases*. 2012;55(9):1216-24.
 35. Oliveira ES, Colombarolli SG, Nascimento CS, Batista ICA, Ferreira JGG, Alvarenga DLR, et al. Increased Levels of Txa Induced by Dengue Virus Infection in IgM Positive Individuals Is Related to the Mild Symptoms of Dengue. *Viruses*. 2018;10(3):104.
 36. Lin C-K, Tseng C-K, Wu Y-H, Liaw C-C, Lin C-Y, Huang C-H, et al. Cyclooxygenase 2 facilitates dengue virus replication and serves as a potential target for developing antiviral agents. *Scientific Reports*. 2017;7(1):44701.
 37. Zhou W, Toki S, Zhang J, Goleniewksa K, Newcomb DC, Cephus JY, et al. Prostaglandin I2 Signaling and Inhibition of Group 2 Innate Lymphoid Cell Responses. *Am J Respir Crit Care Med*. 2016;193(1):31-42.
 38. Zhou Y, Wang W, Zhao C, Wang Y, Wu H, Sun X, et al. Prostaglandin E(2) Inhibits Group 2 Innate Lymphoid Cell Activation and Allergic Airway Inflammation Through E-Prostanoid 4-Cyclic Adenosine Monophosphate Signaling. *Front Immunol*. 2018;9:501.
 39. Brightling CE, Gaga M, Inoue H, Li J, Maspero J, Wenzel S, et al. Effectiveness of fevipiprant in reducing exacerbations in patients with severe asthma (LUSTER-1 and LUSTER-2): two phase 3 randomised controlled trials. *Lancet Respir Med*. 2021;9(1):43-56.
 40. Sandham DA, Barker L, Brown L, Brown Z, Budd D, Charlton SJ, et al. Discovery of Fevipiprant (NVP-QAW039), a Potent and Selective DP(2) Receptor Antagonist for Treatment of Asthma. *ACS Med Chem Lett*. 2017;8(5):582-6.
 41. Asano K, Sagara H, Ichinose M, Hirata M, Nakajima A, Ortega H, et al. A Phase 2a Study of DP(2) Antagonist GB001 for Asthma. *J Allergy Clin Immunol Pract*. 2020;8(4):1275-83.e1.
 42. Nakamura T, Murata T. Regulation of vascular permeability in anaphylaxis. *British journal of pharmacology*. 2018;175(13):2538-42.
 43. Barnes N, Pavord I, Chuchalin A, Bell J, Hunter M, Lewis T, et al. A randomized, double-blind, placebo-controlled study of the CRTH2 antagonist OC000459 in moderate persistent asthma. *Clinical & Experimental Allergy*. 2012;42(1):38-48.
 44. Malavige GN, Wijewickrama A, Fernando S, Jeewandara C, Ginneiliya A, Samarasekara S, et al. A preliminary study on efficacy of rupatadine for the treatment of acute dengue infection. *Sci Rep*. 2018;8(1):3857.
 45. Ahmad A, Waseem T, Butt NF, Randhawa FA, Malik U, Shakoori TA. Montelukast Reduces the Risk of Dengue Shock Syndrome in Dengue Patients. *Trop Biomed*. 2018;35(4):1115-22.
 46. Rathore AP, Mantri CK, Aman SA, Syenina A, Ooi J, Jagaraj CJ, et al. Dengue virus-elicited tryptase induces endothelial permeability and shock. *The Journal of clinical investigation*. 2019;129(10):4180-93.

Assessment of maternal and birth outcomes and predicting selected birth outcomes using maternal anthropometry with ordinal logistic approach: A cross sectional study

ILAN Darshana¹, CJ Wijesinghe¹, PARI Kulatunga¹, NR Abeynayake²

¹Department of Community Medicine, Faculty of Medicine, University of Ruhuna

²Department of Agribusiness Management, Faculty of Agriculture & Plantation Management, Wayamba University of Sri Lanka

Abstract

Background and objectives: The state of maternal nutrition, denoted by the maternal anthropometric parameters, plays a pivotal role in determining the birth outcomes. This study was conducted to determine selected birth outcomes based on maternal anthropometric parameters among pregnant mothers admitted for delivery using ordinal logistic regression approach.

Materials and methods: A cross-sectional study was conducted among randomly selected 333 pregnant mothers admitted for delivery at Teaching Hospital Mahamodara after 28 weeks of Period of Amenorrhea (POA). Pregnant mothers who had multiple pregnancies, those awaiting elective caesarian section following past section, who had registered for booking visit after 12 weeks of gestation and who had pre-existing disease conditions that might affect the maternal anthropometric parameters were excluded from the study. Information related to maternal anthropometric parameters and birth outcomes (maturity at birth, birth weight, and APGAR score at birth) were extracted from medical records. Minitab software was used for data analysis at significance level of 0.05.

Results: Maturity at birth (predicted using pregnancy weight gain) birth weight (predicted using pre-pregnancy weight and pregnancy weight gain), and APGAR score at birth (predicted using pre-pregnancy weight and maternal height) could be predicted using selected maternal anthropometric parameters.

Conclusion: Birth outcomes can be predicted using selected maternal anthropometric parameters using ordinal logistic regression approach. These predictions will be beneficial for the provision of better maternal and perinatal care.

Key words: *APGAR score, birth weight, maternal anthropometry, maturity at birth, ordinal logistic regression*

This study was carried out as a partial requirement for the degree of Master of Science in Biostatistics, of Postgraduate Institute of Agriculture, University of Peradeniya in 2021. The results were included in the dissertation. Four abstracts were presented in international and local scientific fora.

Introduction

The state of maternal nutrition, denoted by the maternal anthropometric parameters related to the weight, height, body mass index and antepartum weight gain, is found play a pivotal role in determining the future health of both the mother and the baby in numerous ways. In a review of existing evidence, the effects of maternal anthropometric parameters were classified into several distinct categories; namely, maternal antepartum and intra-partum outcomes, birth outcomes, neonatal outcomes, infant outcomes, child outcomes and short- and long-term maternal outcomes (1).

Low maternal pre-gravid weight and poor weight gain during pregnancy was found to be associated with low birth weight, prematurity and delivery complications in many studies (2-4). Similarly, high maternal weight was also found to increase the risk for certain adverse pregnancy outcomes such as pre-eclampsia, pregnancy induced hypertension, fetal macrosomia, induction of labor and caesarian delivery (4-7). On the contrary, underweight women were found to have better birth outcomes than women with normal BMI in a study conducted in the United Kingdom (5). However, the strength of evidence confirming the association of maternal anthropometric parameters with different outcomes under each category varied to a considerable extent or provided inconclusive evidence (8).

Ordinal logistic regression is a statistical analysis method that can be used to model the relationship between an ordinal response variable and one or more explanatory variables. An ordinal variable is a categorical variable for which there is a clear ordering of the category levels. The explanatory variables may be either continuous or categorical. Ordinal logistic regression is an extension of logistic regression where the logit of a binary

response is linearly related to the independent variables. A major assumption of ordinal logistic regression is the assumption of proportional odds: the effect of an independent variable is constant for each increase in the level of the response. Hence, the output of an ordinal logistic regression will contain an intercept for each level of the response except one, and a single slope for each explanatory variable.

Ordinal logistic regression model is sometimes referred to as the constrained cumulative logit model originally proposed by Walker and Duncan (1967) and later called proportional odds model. The ordinal logistic approach was used by many researchers in various fields of study but rarely in the present study area; maternal anthropometric parameters and birth outcome. The only study found in literature was the study done by Adeleke and Adepoju in 2010 to focus on

ordinal logistic regression model to model the three major factors (environmental, behavioral and demographic) that affected the outcomes of pregnancies (9). As clinicians are more interested in clinical outcome rather than raw values (ex: maturity at birth as term, preterm, extreme preterm instead of exact POA at delivery), ordinal logistic regression approach was identified as the most suitable statistical approach for data analysis. Hence, this study was conducted to determine the selected birth outcomes based on maternal anthropometric parameters among pregnant mothers admitted for delivery at Teaching Hospital Mahamodara using ordered logistic regression approach.

Materials and methods

Study design and sample

A cross-sectional study was conducted among randomly selected pregnant mothers admitted for delivery after 28 weeks of POA at Teaching Hospital Mahamodara, Galle. Pregnant mothers who had multiple

pregnancies, who were awaiting elective caesarian section following past section, who had registered for booking visit after 12 weeks of gestation and who had pre-existing disease

conditions that might affect the maternal anthropometric parameters were excluded from the study. The sample size was calculated using the formula given for the sample size calculation in cross sectional studies (10) and based on it, a minimum sample of 241 pregnant mothers was required for the study. However, data were collected from 333 pregnant mothers admitted for delivery after 28 weeks of POA at Teaching Hospital Mahamodara. The study was carried out after obtaining ethical clearance from the Ethical Review Committee, Faculty of Medicine, Galle.

Data collection

A data collection sheet was used to gather relevant information for the study. The weight and Body Mass Index (BMI) at the booking visit were considered as the pre-pregnancy weight and BMI in mothers less than 12 weeks of gestation, as the literature indicates that there is not much weight gain associated with pregnancy before this period (). The birth outcomes were identified using the medical records and Bed Head Tickets (BHTs) of the relevant study subjects and were recorded in the data collection sheet. Birth weight, head circumference and length of the fetus were extracted from Child Health Development Records (CHDR) at birth. All the data were collected by the principal investigator. Prior approval for data collection was obtained from the Director of Teaching Hospital, Mahamodara.

Data analysis

All data were coded and entered into a database created using Epi info and were analyzed using Minitab software (version 18). Descriptive data were presented using frequency tables, graphs and figures. Proportions and means were calculated and normality assessment for data set was done

before applying statistical tests where appropriate.

Expected weight gain during pregnancy was assessed based on pre-pregnancy (BMI: $<18.5\text{kg/m}^2$ -expected weight gain 12.5-18.0kg, BMI: 18.5 to 24.9kg/m^2 - expected weight gain 11.5-16.0kg, BMI: 25.0 to 29.9kg/m^2 - expected weight gain 7.0-11.5kg, BMI: 30kg/m^2 and above - expected weight gain 6.5kg or less). If the pregnancy weight gain was in the recommended range for respective BMI category, weight gain was considered as adequate.

Selected birth outcomes were ordered and analyzed using ordered logistic regression to predict them based on maternal anthropometry. Maturity at birth, birth weight, and APGAR score at birth were considered as selected birth outcomes for ordinal logistic regression analysis. Maturity at birth was ordered into three categories based on period of gestation at delivery as extreme preterm delivery, preterm delivery and term delivery. Birth weight was ordered into three categories; low birth weight, normal birth weight and macrosomia. APGAR score at birth was ordered into three categories; score less than 9, score equal to 9 and score equal to 10. Data were analyzed after checking assumptions for ordinal logistic approach.

Results

This study was conducted to determine the selected birth outcomes based on maternal anthropometric parameters among pregnant mothers admitted for delivery at Teaching Hospital Mahamodara (THM) using ordinal logistic regression approach.

Socio-demographic and pregnancy related information

Mean age (SD) of the sample was 29.2 (5.5) years. Nearly half of the pregnant mothers (46.6%) were educated only up to G.C.E. O/L. Majority of mothers were housewives

(80.5%). A majority (61.6%) was unplanned pregnancies and 50.2% were primi mothers. A bad obstetric history was reported by a minority of pregnant mothers; subfertility (7.5%), miscarriage (18.0%) and history of intrauterine death or still birth (2.7%). Nearly 42% were in their first pregnancy. Pre-pregnancy diseases were observed among 13.2% mothers. Majority of pregnancies were uncomplicated pregnancies. Nearly 16% were elderly mothers, while 2.7% were teenage pregnancies. Only a minority were elderly primi (4.8%) and short primi (0.9%).

Distribution of selected maternal anthropometric parameters

Weight, height, BMI and pregnancy weight gain of the study subjects were assessed under selected maternal anthropometric parameters. All four maternal anthropometric parameters were normally distributed. Mean pre-pregnancy weight (SD) was 55.1 (12.8) kg, while mean height (SD) was 154.7 (5.7) cm. Mean BMI (SD) was 22.9 (4.9) kg/m². Nearly half of the pregnant mothers had unsatisfactory pre-pregnancy BMI; BMI: <18.5 kg/m² (19.8%), BMI: 25.0 to 29.9 kg/m² (21.1%) and BMI: 30 kg/m² (9.3%). Mean pregnancy weight gain (SD) among the mothers was 9.6 (4.1) kg. According to the expected weight gain based on pre-pregnancy BMI, a majority of the pregnant mothers had unsatisfactory weight gain (n=228, 68.5%).

Maternal outcomes

Pre-eclampsia, eclampsia, Pregnancy Induced Hypertension (PIH), Gestational Diabetes Mellitus (GDM), Premature Rupture of Membranes (PROM/ PPRM) and uterine rupture etc. were assessed under maternal antepartum outcomes (Table 1). GDM (12.3%), PIH (8.7%), maternal anemia (8.1%) were identified as common maternal antepartum outcomes, followed by PROM (4.8%), pre-eclampsia (3.9%) and PPRM (3.3%). Delivery status, presence of maternal mortality and labor trauma were assessed

under maternal intrapartum outcomes. However, no maternal deaths and labor trauma were reported. Regarding delivery status, nearly 56% were normal vaginal deliveries. Interestingly, 28.2% were emergency caesarian sections while the rest were elective caesarian sections and assisted vaginal deliveries (Figure 1).

Birth outcomes

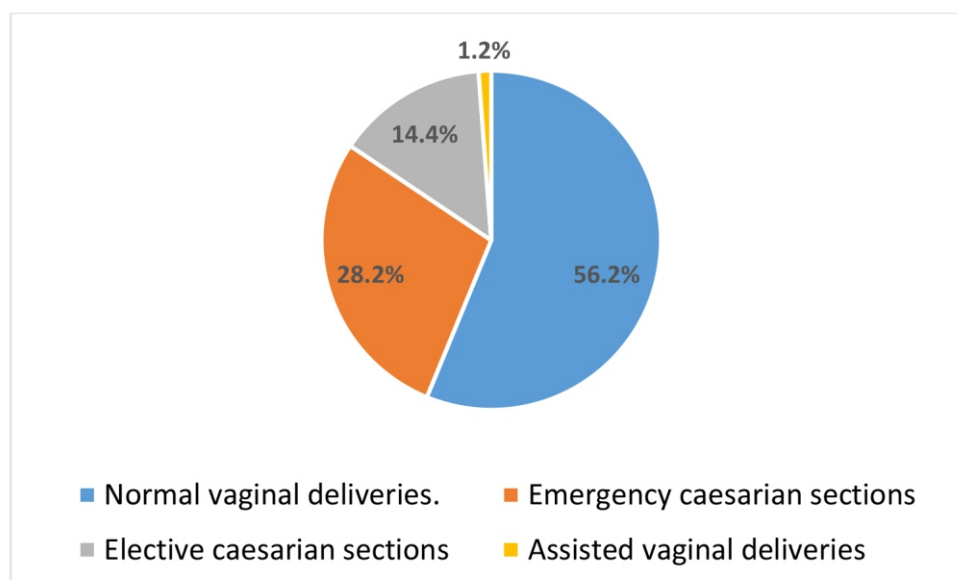
Maturity at delivery, gender of fetus, outcome of delivery (live birth, still birth, intrauterine death etc.), APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) score at birth, presence of birth defects and birth weight category were assessed under birth outcomes. Nearly 54% were male births and 70.9% were term deliveries. Normal birth weight was reported among 73.3% child births while 47.7% had an APGAR score of 10. Almost all were live births (99.7%) and only 0.9% had birth defects. Birth weight, head circumference and length of the fetus were documented at birth. All three fetal anthropometric parameters were normally distributed. Mean (SD) birth weight was 2.79 (0.6) kg, while mean (SD) head circumference was 32.6(1.7) cm. Mean (SD) length was 50.8 (3.0) cm.

Prediction of selected birth outcomes based on maternal anthropometric parameters

Logit link function was used for the ordinal logistic regression approach. Before applying ordinal logistic regression model, assumptions were checked; No Multi-collinearity and Proportional Odds were observed. All dependent variables (birth outcomes) were entered in ordinal scale (Table 2). Birth weight was ordered into three categories; low, normal and macrosomia. Maturity at birth was ordered into three categories based on period of gestation at delivery; extreme preterm, preterm and term. APGAR score at birth was ordered into three categories; score less than 9, equal to 9 and equal to 10. Pre-pregnancy weight, height of the mother and pregnancy weight gain were

Table 1: Distribution of selected maternal antepartum outcomes among pregnant mothers admitted for delivery at Teaching Hospital Mahamodara (N=333)

Maternal Outcomes	Number	Percentage
GDM	41	12.3
PIH	29	8.7
Pre-eclampsia	13	3.9
Eclampsia	5	1.5
PROM	16	4.8
PPROM	11	3.3
Hysterectomy	2	0.6
Oligohydroamniosis	2	0.6
Polyhydroamniosis	2	0.6
APH	6	1.8
Cervical Incompetence	3	0.9
Anemia	27	8.1

**Figure 1: Distribution of delivery status among pregnant mothers admitted for delivery at Teaching Hospital Mahamodara (N=333)**

considered as independent variables and all of them were continuous variables. None of them were highly correlated with each other; Pre-pregnancy weight vs. height of the mother vs. pregnancy weight gain ($r=0.14$, $p<0.05$). Moreover, all three-independent variables had an identical effect at each cumulative split of the ordinal dependent variable. As pre-pregnancy weight and maternal height were used to calculate pre-pregnancy BMI, pre-pregnancy BMI was not considered as a separate independent variable.

Prediction of birth weight

Pre-pregnancy weight ($p<0.001$) and pregnancy weight gain ($p<0.001$) had statistically significant association with birth

weight. As maternal height was not associated with birth weight, it was removed from the model. Then birth weight was predicted based on pre-pregnancy weight and pregnancy weight gain using ordinal logistic approach (Table 3). Estimated coefficient for pre-pregnancy weight is negative and odd ratio (OR) is 0.96 ($OR<1$). It implies as when pre-pregnancy weight increases expected decline of low birth weight and normal birth weight experience decline by 0.96 times compared to macrosomia group. Estimated coefficient for pregnancy weight gain is negative and OR is 0.86 ($OR<1$) implies as when pregnancy weight gain increases expected decline of low birth weight and normal birth weight experience decline by 0.86 times compared

Table 2: Distribution of response variables used for ordinal logistic regression (N=333)

Response Variable	Number (N=333)	Percentage
Birth weight		
Low birth weight (1)	82	24.6
Normal birth weight (2)	244	73.3
Macrosomia (3)	7	2.1
Maturity at birth		
Extreme preterm (1)	19	5.7
Preterm (2)	42	12.6
Term (3)	272	81.7
APGAR score at birth		
APGAR score <9 (1)	40	12.1
APGAR score = 9 (2)	134	40.2
APGAR score = 10 (3)	159	47.7

to macrosomia group. The model fits the data adequately (deviance method, $p>0.05$) and predictive ability of the model is good (Somer's D = 0.42).

Prediction of maturity at birth

Maturity at delivery was ordered into three categories based on period of gestation at delivery; preterm, term and post term. Logit link function was used. When predicting

maturity at birth based on maternal anthropometric parameters using ordinal logistic approach, only pregnancy weight gain ($p<0.001$) had statistically significant association with maturity at birth. Therefore, maternal height and pre-pregnancy weight were removed from the model using model reduction approach. Then maturity at birth was predicted based on pre-pregnancy

Table 3: Prediction of birth outcomes based on maternal anthropometric parameters

Predictor	Regression Coefficient	Odds Ratio (95% CI)	Significance
<i>Birth weight</i>			
Pre-pregnancy weight	-0.04	0.96 (0.94 – 0.98)	< 0.001
Pregnancy weight gain	-0.14	0.86 (0.81 – 0.92)	< 0.001
<i>Maturity at birth</i>			
Pregnancy weight gain	-0.09	0.91 (0.84 - 0.98)	0.009
<i>APGAR score at birth</i>			
Pre-pregnancy weight	0.03	1.03 (1.02 - 1.05)	<0.001
Height	-0.05	0.94 (0.91 - 0.98)	0.005

weight and pregnancy weight gain using ordinal logistic approach (Table 3). Estimated coefficient for pregnancy weight gain is negative and OR is 0.91 (OR<1). It implies as when pregnancy when pregnancy weight gain increases expected decline of extreme preterm and preterm experience decline by 0.91times compared to term group. The model fits the data adequately (deviance method, $p>0.05$) and predictive ability of the model is moderate (Somer's D = 0.24).

Ordinal logistic approach for APGAR score at birth

APGAR score at birth was ordered into three categories; score less than 9, 9 and 10. Logit link function was used. When predicting APGAR score at birth based on maternal anthropometric parameters using ordinal logistic approach, pre-pregnancy weight ($p<0.01$) and maternal height($p<0.05$) had statistically significant association with response variable (APGAR score at birth).Therefore, pregnancy weight gain was removed from the model. Then APGAR score at birth was predicted based on pre-pregnancy weight and maternal height using ordinal logistic approach (Table 3). Estimated coefficient for pregnancy

weight gain is positive and OR is 1.03 (OR>1). It implies as when pre-pregnancy weight increases expected increase of APGAR score less than 9 and APGAR score equal to 9 experience increase by 1.03 times compared to APGAR score equal to 10 group. Estimated coefficient for maternal height is negative and OR is 0.94 (OR<1). It implies as when pre-maternal height increases expected decline of APGAR score less than 9 and APGAR score equal to 9 experience decline by 0.94 times compared to APGAR score equal to 10 group. The model fits the data adequately (deviance method, $p>0.05$) and predictive ability of the model is moderate (Somer's D = 0.21).

Discussion

This study was conducted to determine the selected birth outcomes based on maternal anthropometric parameters among pregnant mothers admitted for delivery at Teaching Hospital, Mahamodara, using ordered logistic regression. In literature, many studies predicting birth outcomes based on maternal anthropometric parameters have used traditional linear or binary logistic regression, but not ordinal regression.

The present study revealed that nearly half

of the pregnant mothers had unsatisfactory pre-pregnancy BMI; underweight (19.8%), overweight (21.1%) and obese (9.3%). According to a study of Bhattacharya et al. in United States, 11.7% pregnant mothers were underweight, 21.9% were overweight and 8.3% were obese (5) compatible to present study. However, a study conducted in China (12) revealed lower percentages of unsatisfactory pre-pregnancy BMI (underweight - 13.2%, overweight -12.6% and obesity - 1.9%) compared to present study and study of Bhattacharya et al. This difference may be mainly due to geographical difference in the three study populations. Moreover, Sun et al.(12) found that 58.7% of pregnant mothers had unsatisfactory pregnancy weight gain which is also lesser compared to present study (68.5%).

The main aim of this study was to predict selected birth outcomes based on maternal anthropometric parameters among pregnant mothers admitted for delivery using ordered logistic regression approach. Although this approach was used by many researchers in various fields of study, it was hardly found in literature related to maternal nutrition and its impact on birth outcomes. The only study predicting birth outcomes found in literature was conducted by Adeleke and Adepoju in 2010 (9). However, their study also did not predict birth outcomes based on maternal anthropometric parameters. Instead, they had used ordinal logistic regression

o model the three major factors viz., environmental (previous cesareans, service availability), behavioral (antenatal care, diseases) and demographic (maternal age, marital status and weight) that affected the outcomes of pregnancies (live birth, still birth and abortion). Study revealed that pre-pregnancy weight and diseases increase the likelihood of favoring a higher category i.e., (live birth), while medical service availability, marital status age, antenatal and previous cesareans reduce the

likelihood/chance of having still birth. However, in the present study, the study objective was different from the study done by Adeleke and Adepoju, limiting comparability of two studies.

Interestingly, present study identified that all three anthropometric parameters (pre pregnancy weight, maternal height and pregnancy weight gain) can be used to predict birth outcomes. According to present study, pre-pregnancy weight and pregnancy weight gain were identified as predictors of birth weight. Pregnancy weight gain was identified as a predictor for maturity at birth, while pre-pregnancy weight and maternal height were identified as predictors for APGAR score at birth in ordinal logistic regression.

Although with the use of different analytical approaches, many other studies had revealed similar associations of maternal anthropometric parameters with birth outcomes. A study conducted by Ehrenberg et al. in United States using large data base revealed that low pre-pregnancy weight and unsatisfactory BMI at conception, as well as poor weight gain during pregnancy are associated with low birth weight and prematurity, (3). However, instead of ordinal logistic regression, they had used Chi-square and t tests for data analysis as appropriate. Compatible with the findings of Ehrenberg et al., Frederick and co-researchers also found that pre-pregnancy weight and gestational weight gain are predictors of birth weight (4), using multiple regression and a similar finding was revealed by Agarwal et al. (2).

Similarly, high maternal weight was also found to increase the risk for certain adverse pregnancy outcomes such as pre-eclampsia, pregnancy induced hypertension, fetal macrosomia, induction of labor and caesarian delivery (4-7). On the contrary, underweight women were found to have

better pregnancy outcomes than women with normal BMI in a study conducted in the United Kingdom (5). However, the present study did not try to identify any association between maternal anthropometric parameters and antenatal maternal outcomes using ordinal logistic regression approach as it was not in the study objective and inability of making it as ordinal response variable. However, considerable proportion of pregnant mothers were detected with those adverse antenatal maternal outcomes in the present study (Table 2). However, the strength of evidence confirming the association of maternal anthropometric parameters with different outcomes under each category can be varied to a considerable extent or can provide inconclusive evidence as described by Viswanathan et al. (8).

There were few strengths and limitations in this study. Having well-organized healthcare delivery system in the country with extensive and uniform documentation at field and institutional levels facilitated retrieval of information for the study. As data were extracted from medical records (pregnancy records, BHTs, clinic records etc) which had already been documented, it facilitated accurate, unbiased data collection and minimized missing data due to incomplete recall. However, not using same instrument for taking anthropometric measurement (maternal, fetal and neonatal) add some limitation for the study. However, as all health care workers at field level and hospital were well trained to obtain anthropometric measurements using standard techniques and calibrated instruments the variation would have been minimal.

With this evidence, it is clear that maternal anthropometric parameters relating to the weight, height and pregnancy weight gain play a pivotal role in determining birth outcomes. As there are some inconclusive

areas in literature related to association of maternal anthropometric parameters with certain outcomes, further studies will be required in diverse populations and larger samples to obtain more precise and accurate results on impact of maternal anthropometric parameters on birth outcomes. However, as findings of present study will add to the literature due to its unique approach in data analysis, i.e. the use of ordinal logistic approach, which will be more beneficial in predicting risk of adverse birth outcomes in clinical settings.

Conclusions and recommendations

A majority of pregnant mothers had unsatisfactory weight gain and unsatisfactory pre-pregnancy BMI. Pre-pregnancy weight and pregnancy weight gain were predictors of birth weight and pregnancy weight gain was a predictor of maturity at birth. Both pre-pregnancy weight and maternal height were identified as predictors of APGAR score at birth. In conclusion, assessment of maternal anthropometric parameters is important during antenatal period as they play a pivotal role in predicting birth outcomes. Such prediction can be used for identification of high risk neonates to ensure a better service provision in perinatal and early neonatal care. As the majority of pregnant mothers did not have satisfactory pre-pregnancy BMI and weight gain during pregnancy, necessary interventions should be taken to address this problem in order to prevent the adverse outcomes. Study identified the lack of research evidence related to prediction of birth outcomes based on maternal anthropometric parameters in Sri Lanka and even in the global context. Therefore, further studies are recommended to explore the effects of maternal anthropometry on birth outcomes in different populations, taking into consideration the novel measures such as body composition.

Acknowledgement

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References

1. Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., De Onis, M., Ezzati, M., Mathers, C., Rivera, J., Maternal & Group, C. U. S. 2008. Maternal and child undernutrition: global and regional exposures and health consequences. *The lancet*, 371, 243-260.
2. Agarwal, S., Agarwal, A., Bansal, A., Agarwal, D. & Agarwal, K. 2002. Birth weight patterns in rural undernourished pregnant women. *Indian pediatrics*, 39, 244-253.
3. Ehrenberg, H. M., Dierker, L., Milluzzi, C. & Mercer, B. M. 2003. Low maternal weight, failure to thrive in pregnancy, and adverse pregnancy outcomes. *American journal of obstetrics and gynecology*, 189, 1726-1730.
4. Frederick, I. O., Williams, M. A., Sales, A. E., Martin, D. P. & Killien, M. 2008. Pre-pregnancy body mass index, gestational weight gain, and other maternal characteristics in relation to infant birth weight. *Maternal and child health journal*, 12, 557-567.
5. Bhattacharya, S., Campbell, D. M., Liston, W. A. & Bhattacharya, S. 2007. Effect of body mass index on pregnancy outcomes in nulliparous women delivering singleton babies. *BMC public Health*, 7, 1-8.
6. Ehrenberg, H. M., Durnwald, C. P., Catalano, P. & Mercer, B. M. 2004a. The influence of obesity and diabetes on the risk of cesarean delivery. *American journal of obstetrics and gynecology*, 191, 969-974.
7. Ehrenberg, H. M., Mercer, B. M. & Catalano, P. M. 2004b. The influence of obesity and diabetes on the prevalence of macrosomia. *American journal of obstetrics and gynecology*, 191, 964-968.
8. Viswanathan, M., Siega-Riz, A. M., Moos, M. K., Deierlein, A., Mumford, S., Knaack, J., Thieda, P., Lux, L. J. & Lohr, K. N. 2008. Outcomes of maternal weight gain. Evidence report/technology assessment, 1-223.
9. Adepoju, A. & Adeleke, K. 2010. Ordinal Logistic Regression Model: An Application to Pregnancy Outcomes. *Journal of Mathematics and Statistics*, 6.
10. S K Lwanga & S Lemeshow 1991. Sample Size Determination in Health Studies, World Health Organization.
11. Jananthan, R., Wijesinghe, D. & Sivananthawerl, T. 2009. Maternal anthropometry as a predictor of birth weight.
12. Sun, Y., Shen, Z., Zhan, Y., Wang, Y., Ma, S., Zhang, S., Liu, J., Wu, S., Feng, Y. & Chen, Y. 2020. Effects of pre-pregnancy body mass index and gestational weight gain on maternal and infant complications. *BMC pregnancy and childbirth*, 20, 1-13.

Ongoing postgraduate research projects and thesis submitted during 2022 from projects registered at the Board of Study in Medicine, Faculty of Medicine, University of Ruhuna and Faculty of Graduate Studies, University of Ruhuna

MPhil Degrees

MPhil studies (Thesis defended)

- 1. Development of effective sunscreen formulation from medical plant in Sri Lanka: An in vitro study**

Candidate: CE Liyanarachchi, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. MT Napagoda, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Co-Supervisors:

Prof. L Jayasinghe, Natural Products Research Division, National Institute of Fundamental Studies, Kandy

Dr. S Witharana, Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa

Funding: NSF Research Grant No: RG/2017/BS/05

MPhil studies (ongoing)

- 1. Effect of sarcopenia and frailty on clinical outcomes and burden on caregivers of patients with hip fracture**

Candidate: MPMK Dias, Department of Medicine, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Snr. Prof. Sarath Lekamwasam, Department of Medicine, Faculty of Medicine, University of Ruhuna

Co-Supervisors:

Dr. RHMPN Rathnayake, Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna

Mr. TUW Abeygunasekara, Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna

Funding: Pending

PhD studies (Thesis submitted)

1. **A one health approach: the epidemiology of methicillin-resistant *Staphylococcus aureus* isolated from humans, animals and animal products in southern Sri Lanka**

Candidate: MRP Kurukulasooriya, Duke, Faculty of Medicine, University of Ruhuna, Karapitiya, Galle

Principal Supervisor: Prof. A de S Nagahawatte, Department of Microbiology, Faculty of Medicine, University of Ruhuna

Co-Supervisors:

Prof. WMDGB Wijayaratne, Department of Microbiology, Faculty of Medicine, University of Ruhuna

Dr. LG Tillekeratne, Duke Global Health Institute (DGHI), Durham, USA

Prof. CK Bodinayake, Department of Medicine, Faculty of Medicine, University of Ruhuna

Prof. CW Woods, Duke Global Health Institute, Duke University, USA

Prof. T Ostbye, Duke Global Health Institute, Duke University, USA

Dr. D de Silva, Sir John Kotelawala Defence University, Rathmalana

Funding: UGC Block Grant No: RU/PG-R/16/03 and NRC Grant No: 19-099

PhD studies (Ongoing)

1. **Delusional disorder (Jealous type): Frequency of presentation to mental health services and web-based community survey on psychological mechanisms and psychosocial correlates of abnormal jealousy in intimate relationships**

Candidate: MKOK De Silva, Department of Clinical Sciences, Faculty of Medicine, General Sir John Kotelawala Defence University, Ratmalana

Principal Supervisor: Prof. IH Rajapakse, Department of Psychiatry, Faculty of Medicine, University of Ruhuna

Co-Supervisors:

Dr. MC Rajasuriya, Department of Psychiatry, Faculty of Medicine, University of Colombo

Dr. NFJ Fernando, Department of Clinical Sciences, Faculty of Medicine, General Sir John Kotelawala Defence University, Ratmalana

Funding: Self-funded

2. **Cardiovascular and psychological comorbidity among patients with plaque psoriasis**

Candidate: PLAN Liyanage, Department of Community Medicine, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. S Lekamwasam, Department of Medicine, Faculty of Medicine, University of Ruhuna

Co-Supervisors: Prof. PV De Silva, Department of Community Medicine, Faculty of Medicine, University of Ruhuna
Prof. S Imafuku, Department of Dermatology, Fukuoka University, Japan

Funding: Financial assistance by UGC for Higher Studies - 2020 (UGC/ VC/ DRIC/ PG2020/ RUH/01)

3. **Development, characterization and bioactivity assessment of nano-encapsulated antidiabetic herbal drug leads from Sri Lankan flora**

Candidate: WND de Silva, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. AP Attanayake, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Co-Supervisors: Prof. DN Karunaratne, Department of Chemistry, Faculty of Science, University of Peradeniya

Dr. KMGK Pamunuwa, Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University

Dr. LDAM Arawwaala, Industrial Technology Institute, Colombo

Funding: Accelerating Higher Education Expansion and Development Program Development Oriented Research (AHEAD-DOR 15)

4. **Formulation of evidence-based rehabilitation protocol for anterior shoulder pain: Evaluation of the effectiveness of myofascial release and kinesio taping in bicipital tendinopathy in patients attending the Sports Medicine Clinic, Teaching Hospital, Karapitiya**

Candidate: YHS de Silva, Department of Physiology, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. S Gunawardene, Department of Physiology, Faculty of Medicine, University of Ruhuna

Co-Supervisors: Prof. TP Weeraratna, Department of Medicine, Faculty of Medicine, University of Ruhuna

Prof. MB Samarawickrama, Department of Anatomy, Faculty of Medicine, University of Ruhuna

Funding: Self-funded

5. Antidiabetic effects of nanoparticle based herbal nanoceutical formulations in Wistar rats induced with diabetes mellitus

Candidate: WASD Wickramasinghe, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. AP Attanayake, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Co-Supervisor: Dr. P Kalansooriya, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Funding: Accelerating Higher Education Expansion and Development Program Development Oriented Research (AHEAD-DOR 15)

6. An interventional study on the implication of integrated non-conventional therapeutic measures in the assessment of functional and psychological outcomes in athletes with iliotibial band syndrome

Candidate: S Thebuwanarachchi, Department of Physiology, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. S Gunawardene, Department of Physiology, Faculty of Medicine, University of Ruhuna

Co-Supervisors: Prof. AS Dissanayake, Department of Medicine, Faculty of Medicine, University of Ruhuna

Prof. MB Samarawickrama, Department of Anatomy, Faculty of Medicine, University of Ruhuna

Funding: Self-funded

7. Promoting spontaneous reporting of adverse drug reactions in Teaching Hospital Karapitiya using manual reporting process and a mobile application

Candidate: MT Madushika, Department of Pharmacology, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. S Jayasinghe, Department of Pharmacology, Faculty of Medicine, University of Ruhuna

Co-Supervisors: Prof. PLGC Liyanage, Department of Pharmacology, Faculty of Medicine, University of Ruhuna

Dr. JA Jeewani, Department of Computer Science, Faculty of Science, University of Ruhuna

Funding: Faculty Research Grant

8. Characteristics of *Candida* species isolated from oral flora of cancer patients and the anti-candida activity of selected medicinal plants in Sri Lanka

Candidate: AMDN Wanigasekara, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. MT Napagoda, Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Co-Supervisor: Prof. WMDGB Wijayarathne, Department of Microbiology, Faculty of Medicine, University of Ruhuna

Funding: NSF Research Grant No: RG/2019/BS/02

9. Effects of herbal extracts; *Psidium guajava*, *Garcinia gummigata*; *Eryngium foetidum* and *Cinnamomum verum* on hyperglycaemia in Diabetes induced mouse models

Candidate: GMUD Wijenayake, Department of Pharmacology, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. S Jayasinghe, Department of Pharmacology, Faculty of Medicine, University of Ruhuna

Co-Supervisors: Prof. VP Bulugahapitiya, Department of Chemistry, Faculty of Science, University of Ruhuna

Prof. PLN Lakshman, Department of Food Science and Technology, Faculty of Agriculture, University of Ruhuna

Funding: Accelerating Higher Education Expansion and Development Program Development Oriented Research (AHEAD-DOR 05)

10. Dietary intake, eating behaviours, body image perception and their impact on nutritional status of adolescent school children in Galle district

Candidate: PARI Kulathunga, Department of Community Medicine, Faculty of Medicine, University of Ruhuna

Principal Supervisor: Prof. C.J. Wijesinghe, Department of Community Medicine, Faculty of Medicine, University of Ruhuna

Co-Supervisor: Prof. PV De Silva, Department of Community Medicine, Faculty of Medicine, University of Ruhuna

Funding: Pending

Recipients of 'Research Publication Awards' for the year 2021

Name of the recipient	Number of publications in indexed journals*
Prof. Sarath Lekamwasam	10
Prof. Ajith Nagahawatta	06
Prof. Champica Bodinayake	06
Prof. Anoja Attanayake	06
Prof. Kamani Jayatilaka	05
Prof. Vijitha De Silva	05
Prof. Gaya Wijeratne	04
Prof. Madhu Wickramathilake	04
Mrs. Hasanga Rathnayake	04
Prof. Thilak Weeraratna	03
Prof. Sudheera Jayasinghe	03
Prof. Lanka Dassanayake	03
Dr. Achala Liyanage	03
Prof. Lakmini Mudduwa	02
Prof. Janaka Lenora	02
Prof. Ruwani Hewawasam	02
Prof. Arosha Dissanayake	02
Prof. Champa Wijesinghe	02
Dr. Eric de Zoysa	02
Dr. Pabasara Kalansuriya	02
Prof. Manjula Hettiarachchi	01
Prof. Gayani Alwis	01
Prof. Gayani Liyanage	01
Prof. Harshini Rajapakse	01
Dr. Champa Wijewickrama	01
Dr. Chandana Wickramaratne	01
Dr. Nayani Weerasinghe	01
Dr. ILAN Darshana	01

* Indexed in Science Citation Index Expanded /Social Science Citation Index

Dean's awards

Dean's awards are awarded annually to the students with the best overall performance in each faculty. They are funded by the University and administered by the Deputy Vice Chancellor's Office in consultation and collaboration with the faculties and assisted by the Division of Examinations and Student Affairs.

Dean's awards for the year 2022 were awarded to the following students.

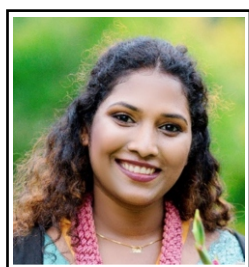
Best 3rd MBBS Student of 2022



Miss S.D. Kumarasinghe

Miss Sinali Dulara Kumarasinghe completed her primary and secondary education at Southlands College Galle. She passed her GCE O/L with 9As in 2013 and her GCE A/L with 3As in 2016 in her first attempt. She entered the Faculty of Medicine, University of Ruhuna in 2017 and passed the 2nd MBBS examination with first-class honours with distinctions in Anatomy and Biochemistry. She passed the 3rd MBBS examination with first class honours with distinctions for all six subjects. She shared the Ruhuna Medical School Alumni Association award for the best performance in 3rd MBBS examination in 2022. Being an internationally rated chess player since 2009, she represented the faculty and university and won places in both national and international chess tournaments. She has also participated in faculty level competitions in swimming. As a member of the Physiology quiz team, she participated and won places at national and international competitions. She was awarded the certificate of excellence for the best painting in "World Mental Health Day 2021" competition, organized by the Cultural Centre of the Faculty of Medicine. She was also an office bearer in the Sports Club, Resuscitation Club and the Anatomical Society of Faculty of Medicine in 2021/2022 and is a member of the Philosophy & Ethics Hub and Drawing and Painting Club under the Cultural Center of the Faculty of Medicine.

Best Final MBBS Student of 2022



Dr. L.V.T. Gunaratna

Dr. L.V.T. Gunaratna had her primary education at Sacred Heart Convent, Galle and secondary education at Ladies' College, Colombo. She entered the Faculty of Medicine, University of Ruhuna in 2015 and passed 2nd MBBS examination with 2nd class (Upper Division) honours with a distinction in Physiology and 3rd MBBS examination with 2nd class (Upper Division) honours with distinctions in Pathology and Community Medicine. At the final MBBS examination, she obtained 1st class honours with distinctions in Surgery and Psychiatry. She was awarded the Caroline Mohotti Memorial Gold medal for highest aggregate mark for final MBBS examination and the RUMSAA award for best final MBBS graduate. She excelled both in her studies and in sports and built a strong swimming team in University of Ruhuna. She was the captain of the Faculty and University Girls' Swimming teams from years 2017 - 2020 and led the swimming team to many victories. She held new Ruhuna University records in freestyle, butterfly individual events and in the medley relay for women and was consequently selected the best female player in swimming in years 2017-2019. She participated in inter-university and SLUG games from years 2017-2019. She won places in shot putt, discuss throw, 1500m running in athletics and basketball at inter batch events. She organized the inaugural inter-batch swimming tournament which continued on the following years. The presentation of her research team was selected as the best poster presentation in the FMAS in year 2020.

Dean's Awards and Dean's List 2022

Following students were selected for the Dean's List in the year 2022 for their outstanding performance in both academic and extra-curricular activities.

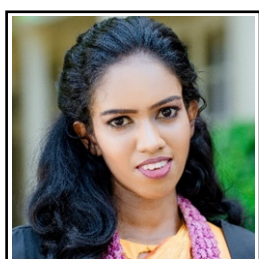
Dean's List (3rd MBBS) for the year 2022



Mr. P.B.A. Supun Madhawa

Mr. P.B.A. Supun Madhawa received his education at Sujatha Kanishta Vidyalaya, Rambukkana and Pinnawala Central College, Kegalle. He passed his GCE O/L with 9As and GCE A/L in his first attempt and entered the Faculty of Medicine, University of Ruhuna in 2017. He passed the 2nd MBBS examination with first class honours with distinctions in all three subjects and passed the 3rd MBBS examination with first class honours with distinctions in all six subjects. He has won several places under poems, short stories and Sinhala prosody categories in inter-faculty and inter-university Literature and Dancing Competitions. He was placed 1st runner-up in the inter-university Neurology Quiz 2023, organized by the Association of Sri Lankan Neurologists. As a member of the Eastern dancing troupe of the Faculty of Medicine, he represented the faculty in many university and faculty affiliated events. He is the founder and current president of the Anatomical Society and a past president of the Literature Society. As an active member of the Resus Club, Ethics & Philosophy Hub and the Literature, Dancing and Poetry subcommittees of the Cultural Center, Faculty of Medicine, he volunteered in organizing Basic Life Support programs and Mental Health Day and Suicide Prevention Day programs for the undergraduates, faculty staff and the general public. He has represented faculty in volunteering groups at national and international level with Ceylon College of Physicians Student Forum in 2021 and 2022.

Dean's List (Final MBBS) for the year 2022



Dr. H.G.G.I. Manthika

Dr. H.G.G.I. Manthika received her primary and secondary education from Sanghamitta Balika Vidyalaya, Galle and entered the Faculty of Medicine, University of Ruhuna in 2014. She passed the 2nd MBBS examination with First Class honours with distinctions in Physiology and Biochemistry and won the RUMSAA award for the highest aggregate of marks in 2nd MBBS examination in 2018. At the 3rd MBBS examination, she obtained first class honours with distinctions for all six subjects. She passed the Final MBBS examination with first class honours with distinctions in Medicine, Surgery, Paediatrics and Psychiatry. She was awarded the Caroline Mohotti Memorial Gold medal for the highest aggregate of marks in Final MBBS and won the Gold medals in Medicine, Paediatrics, Physiology, Pharmacology and Community Medicine. She represented Faculty of Medicine, University of Ruhuna at Prof Carlo Fonseka Physiology Quiz and won the award for the best new team at the 16th inter-medical school Physiology Quiz held at Malaysia in 2018. The team led by her secured 2nd runners-up in inter-medical school Paediatric Quiz 2022. She also took part in the inter-university Neurology Quiz in 2021 and 2022. She has presented her research in the 3rd National Undergraduate Symposium organized by the University of Ruhuna in 2018. She has also published her research work in FMAS 2020 and Ruhuna Quality Assurance sessions 2022.

Lung functions and respiratory symptoms of people living in the vicinity of a tyre factory

DC Wijewickrama¹, KAC Wickramaratne¹, IU Samarasinghe², KG Somasiri¹,
MG Karunadasa³

¹ Senior Lecturer, Faculty of Medicine, University of Ruhuna

² Additional Medical Officer of Health, Weligama

³ Medical Officer of Health, Weligama

Corresponding author:

D C Wijewickrama, Department of Physiology, Faculty of Medicine, University of Ruhuna
Phone: +94714482008, Email: dew@med.ruh.ac.lk

Abstract

Background: Despite the fact that rubber manufacturing emissions produce adverse effects on the respiratory system of exposed workers, information is scarce about the prevalence of respiratory symptoms and the lung functions of people living in the vicinities of tyre factories.

Materials and methods: A comparative, cross sectional study was carried out on people living in the vicinity of a tyre factory and on age and gender matched people in about eight kilometers away from the factory. Details on the respiratory symptoms were obtained by an investigator administered questionnaire. Respiratory system was examined by medically qualified investigators. Lung functions {Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1), FEV1/FVC ratio and peak expiratory flow rate (PEFR)} were assessed between 9 a.m. and 12 noon using the spirometer (spirolab III) while the subjects were in standing position.

Results: There were 199 and 209 individuals aged between 12-70 years in the study and the control groups respectively. The prevalence of respiratory symptoms was significantly higher in the study group compared to the control group ($p < 0.05$). FVC in both males and females and PEFR in females in the study group were significantly higher compared to those in the control group ($p < 0.05$).

Conclusion: Significantly higher prevalence of respiratory symptoms was observed in people living in the vicinity of the tyre factory. Long term follow-up studies are needed to determine the cause and effect relationship for this.

Key words: Lung function tests, respiratory symptoms, respiratory system, tyre industry

Introduction

The tyre industry plays an important role in economic development in many countries. Tyres are made from natural and synthetic rubber polymers; oil fillers; sulfur and sulfur compounds; phenolic resins; clay; aromatic, naphthenic, and paraffinic oils; carbon black; zinc oxide; titanium dioxide; fatty acids etc. (1, 2). Emissions containing

particulate matter of raw materials used in the tyre manufacturing process have been found to be ecotoxic and hazardous to health (3).

Carbon black and talc powder used in the tyre manufacturing are well known to produce adverse effects on the respiratory system (4-6). These include rhinitis, asthma, chronic productive cough, radiographic changes

analogous to pneumoconiosis and decrease in lung functions (6-10). Apart from these, exposure to airborne carbon black particles have been found to cause of irritant, fibrotic, or carcinogenic pulmonary effects (10, 11).

Although many have demonstrated occupational health hazards of carbon black, there is dearth of knowledge on the effects of particulate matter emitted during tyre manufacturing process on the respiratory system of people living in the vicinity of tyre factories.

Therefore, this study was designed in order to detect the impact of particulate matter emitted during tyre manufacturing process on lung function, and on the prevalence of respiratory symptoms among the people living in the vicinity of a tyre factory situated in Weligama, Southern province of Sri Lanka.

Materials and methods

Ethical approval to carry out the study was obtained by the Ethical Review Committee of Faculty of Medicine, University of Ruhuna. The permission to carry out the study was obtained from the relevant authorities of the area where the factory was situated and the control group was selected.

According to literature, occupational exposure is an established risk factor for respiratory diseases accounting for about 5-25% in Sri Lanka (12, 13). Thus, for a p value of 15%, the sample size calculated was 200. Therefore, a comparative, cross sectional study was carried out on 200 individuals aged between 12-70 years living in the vicinity (within 400m) of a tyre factory (constructed about 30 years back) and on another age and gender matched 200 individuals living about 8 km away from the factory at sea level where there were no factories. Individuals with diagnosed congestive cardiac failure, pulmonary tuberculosis and those who were having

chest deformities or have had major trauma/surgeries to chest and those who were working in the tyre factory were excluded from the study.

After obtaining informed written consent, socio demographic data, duration of residence in the present address, distance from house to the factory, health related data with special attention to respiratory system were obtained from all the study and control subjects using a questionnaire with both open and closed ended type of questions (Questionnaire based on the MRC (UK) Respiratory Questionnaire 1986) by trained interviewers.

Respiratory system was examined by medically qualified investigators and the findings were documented. Height to the nearest centimeter was measured using the same meter ruler.

The procedure for the lung function test was carefully explained to the subjects and were allowed to make trial maneuvers before the readings were taken. Lung functions {Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV1), FEV1/FVC ratio and peak expiratory flow rate (PEFR)} were assessed between 9 a.m. and 12 noon using the spirometer (spirolab III) by a trained person while the subjects were in standing position.

All the data were documented and analysed with IBM SPSS statistics software package version 25. The Fisher exact probability test and the independent sample t-test were applied in grouped analysis appropriately. A p value of <0.05 was considered as statistically significant.

Results

The number of participants in the study group was 199 and in the control group it was 209. Of the participants in the study group, 69 (34.6%) were males and 130 (65.3%) were females. In the control group 72 (34.4%) were males and 137 (65.5%)

males and 137 (65.5%) were females. There were 42 smokers in the study group while there were 32 in the control group.

There were no statistically significant difference between the mean ages and the heights of males and females in the study groups and the control groups ($p>0.05$) (Table 1). The mean duration of living of the study population (in the vicinity of the factory) was 18.8 ± 23 years. The mean duration of living of the control group in the present living area was 29.8 ± 8 years.

FVC was significantly higher in both males and females in the study group compared to the control group and PEFR was significantly higher in females of the study group compared to those in the control group ($p<0.05$). The rest of the lung function tests of the two groups were not significantly different ($p>0.05$) (Table 1).

Respiratory symptoms were significantly higher in the study group compared to the control group ($p<0.05$) (Table 2). Examination of respiratory system revealed rhonchi and crepitation at the lung bases in 12 (6.0%) in the study group and 4 (1.9%) in the control group.

Discussion

This paper describes the results of a descriptive cross-sectional study designed to assess the respiratory health of people living in the vicinity of a tyre factory.

The higher prevalence of respiratory symptoms in the study group compared to the control group may be attributed to the presence of fine dust or byproducts emitted during the tyre manufacturing process in the environment of the study area which was within 400m from the tyre factory. Nonperformance of dust sampling, measuring of either respirable or inhalable dust fractions and measuring of air quality index in the study areas which would link

the epidemiological data to the clinical manifestations is a limitation in this study. The finding of high prevalence of respiratory symptoms in the study group may have been influenced by the recall bias during the assessment of present and past respiratory symptoms or could be related to over anxiety associated with fear of living closer to a factory and being exposed to dust and chemicals. A long-term follow-up study of exposed and non-exposed individuals with regular air quality measurements would provide clear insight to the unanswered questions related to symptomatology.

A study carried out on employees of a carbon black plant has shown an association between cough, sputum production, symptoms of chronic bronchitis and exposure to carbon dust. There had been small opacities in nearly one fourth of the chest radiographs of workers exposed to carbon dust demonstrating a strong association of lung pathologies and dust exposure (14). Presence of sputum production in most of the days of three months a year by a significant number of subjects in the study population indicates high prevalence of bronchitis in the study population. Radiological evaluation of symptomatic individuals could have provided objective comparison of symptoms and lung pathology thus, nonperformance of radiological evaluation of chest of symptomatic individuals is a drawback of this study.

Carbon black comprises 20–40% of the tyre by weight and is known to produce adverse effects on the respiratory system. The literature show evidences on the detrimental effects of carbon black on lung functions. Several studies have shown reduced lung functions in workers exposed to emissions of rubber manufacturing (15-19). In some studies, it is postulated that ultrafine carbon black causes oxidative stress-mediated proliferation of airway epithelium leading to

Table 1. Demographic characteristics and lung function tests of the study and the control groups

	Males			Females		
	Study (n=69)	Control (n=72)	<i>p</i>	Study (n=130)	Control (n=137)	<i>p</i>
Age	38.4±15.9	38.8±16.3	<i>p</i> >0.05	35.5±16.2	162.4±9.5	<i>p</i> >0.05
Height	162.9±15.1	162.4±9.5	<i>p</i> >0.05	153.2±7.3	152.6±6.2	<i>p</i> >0.05
FVC	2.5±0.7	2.2±0.7	<i>p</i> =0.012	1.9±0.4	1.7±0.5	<i>p</i> =0.034
FEV1	2.1±0.7	1.9±0.7	<i>p</i> >0.05	1.6±0.4	1.5±0.5	<i>p</i> >0.05
FEV1/ FVC	84.4±8.0	84.5±10.7	<i>p</i> >0.05	83.3±9.3	84.2±10.9	<i>p</i> >0.05
PEFR	393±97	363±113	<i>p</i> >0.05	308±83	286±84	<i>p</i> =0.033

FVC - Forced vital capacity, FEV1 - Forced expiratory volume in 1 second, PEFR - peak expiratory flow rate

impaired lung functions (20-21). In contrast to these, some studies failed to show any association between exposure to carbon black dust and increased prevalence of bronchial hyper-reactivity (14).

There was no significant difference of lung functions between the study and the control groups except for FVC and PEFR. Compared to the control group, FVC was significantly higher in both males and females and PEFR was significantly higher in the females of the study group. Although the reason for the observation of higher FVC and PEFR values in this study is not clear, a possible assumption is that the individuals in the study group may have performed lung function tests several

times in the past when they were assessed at routine medical checkups or when seeking medical advice for their frequent respiratory ailments and knew how to perform it better.

Studies in Germany and Poland have shown impaired lung function in chronic smokers exposed to carbon black (10,14,22). In this study, we could not compare the effect of smoking on respiratory symptoms due to the small number of smokers in the study and the control groups. The findings in this study could have been strengthened if other potential confounding factors such as outdoor and indoor air pollution due to bio mass fuel and burning of solid matter were assessed.

Table 2: Respiratory symptoms of the study and the control groups

Respiratory symptoms	Study (n=199)	Control (n=209)	<i>p</i>
Troubled by shortness of breath when walking	98 (49.2%)	29 (13.8%)	<i>p</i> <0.05
Coughing while running/ climbing stairs	52 (26.1%)	12 (5.7%)	<i>p</i> <0.05
Wheezing while running/ climbing stairs	48 (24.1%)	18 (8.6%)	<i>p</i> <0.05
Sleep is disturbed by wheeze	33 (16.6%)	10 (4.8%)	<i>p</i> <0.05
Woke up in the morning with wheeze	33 (16.6%)	09 (4.3%)	<i>p</i> <0.05
Improve wheeze when away from home	09 (4.5%)	00 (0%)	<i>p</i> <0.05
Cough as the first thing in the morning	51 (25.6%)	18 (8.6%)	<i>p</i> <0.05
Has cough in most days for as much as 3 months/year	44 (22.1%)	10 (4.8%)	<i>p</i> <0.05
Bring up phlegm as the first thing in morning	83 (41.7%)	17 (8.1%)	<i>p</i> <0.05
Bring up phlegm in most days of 3 months/year	43 (21.6%)	6 (2.8%)	<i>p</i> <0.05
Past history of wheezing	56 (28.1%)	41 (19.6%)	<i>p</i> <0.05

Conclusion

Long term follow-up studies and regular air quality assessments are needed to determine the cause and effect relationship for the significantly higher prevalence of respiratory symptoms observed in people living in the vicinity of the tyre factory.

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References

01 Haines GMM, Wong R. End-of-life tire

management LCA: A comparative analysis for Alberta recycling management authority. The Pembina Institute 2010.

02 MA. H. Risk assessment of atmospheric toxic pollutants over Cairo, Egypt. Air Pollution XVII [Internet]. 2009; 123:[353–63 pp.].

03 Shanbag AMS. Life Cycle Assessment of Tyre Manufacturing Process. J sustain dev energy water environ syst. 2020;8(1):22-34.

04 Karkhanis VS, Joshi JM. Combined pulmonary fibrosis and emphysema in a tyre industry worker. Lung India. 2012;29(3):273-6.

- 05 Negri E, Piolatto G, Pira E, Decarli A, Kaldor J, La Vecchia C. Cancer mortality in a northern Italian cohort of rubber workers. *Br J Ind Med*. 1989;46(9):624-8.
- 06 Weiland SK, Mundt KA, Keil U, Kraemer B, Birk T, Person M, et al. Cancer mortality among workers in the German rubber industry: 1981-91. *Occup Environ Med*. 1996;53(5):289-98.
- 07 Parkes HG, Veys CA, Waterhouse JA, Peters A. Cancer mortality in the British rubber industry. *Br J Ind Med*. 1982;39(3):209-20.
- 08 Peters JM, Monson RR, Burgess WA, Fine LJ. Occupational disease in the rubber industry. *Environ Health Perspect*. 1976;17:31-4.
- 09 Baur X, Barbinova L. Latex allergen exposure increases exhaled nitric oxide in symptomatic healthcare workers. *Eur Respir J*. 2005;25(2):309-16.
- 10 Gardiner K, Trethowan NW, Harrington JM, Rossiter CE, Calvert IA. Respiratory health effects of carbon black: a survey of European carbon black workers. *Br J Ind Med*. 1993;50(12):1082-96.
- 11 Samet JM BMA SR. Air quality guidelines: global update 2005: particulate matter, ozone, nitrogen dioxide, and sulfur dioxide. World Health Organization,; World Health Organization,; 2006.
- 12 Uragoda CG. Asthma and other symptoms in cinnamon workers. *British journal of industrial medicine*. 1984;41(2):224-7.
- 13 Uragoda CG. Respiratory disease in tea workers in Sri Lanka. *Thorax*. 1980;35(2):114-7.
- 14 Küpper HU, Breitstadt R, Ulmer WT. Effects on the lung function of exposure to carbon black dusts. Results of a study carried out on 677 members of staff of the DEGUSSA factory in Kalscheuren / Germany. *Int Arch Occup Environ Health*. 1996;68(6):478-83.
- 15 Oleru UG, Elegbeleye OO, Enu CC, Olumide YM. Pulmonary function and symptoms of Nigerian workers exposed to Carbon black in dry cell battery and tire factories. *Environ Res*. 1983;30(1):161-8.
- 16 Fine LJ, Peters JM, Burgess WA, Di Berardinis LJ. Studies of respiratory morbidity in rubber workers. Part IV. Respiratory morbidity in talc workers. *Arch Environ Health*. 1976;31(4):195-200.
- 17 doPico GA, Rankin J, Chosy LW, Reddan WG, Barbee RA, Gee B, et al. Respiratory tract disease from thermosetting resins. Study of an outbreak in rubber tire workers. *Ann Intern Med*. 1975;83(2):177-84.
- 18 Nuorteva P, Assmuth T, Haahtela T, Ahti J, Kurvonen E, Nieminen T, et al. The prevalence of asthma among inhabitants in the vicinity of a polyurethane factory in Finland. *Environ Res*. 1987;43(2):308-16.
- 19 Rafeemanesh E, Esmaily H, Ahmadi F, Sardar M, Ghooshchi G. The Effect of Exposure to Rubber Production Emissions and Physical Activity on Pulmonary Function Indices among Tyre Manufacturing Employees in Iran. *Indian J Occup Environ Med*. 2021;25(1):17-21.
- 20 Tamaoki J, Isono K, Takeyama K, Tagaya E, Nakata J, Nagai A. Ultrafine carbon black particles stimulate proliferation of human airway epithelium via EGF receptor-mediated signaling pathway. *Am J Physiol Lung Cell Mol Physiol*. 2004;287(6):L1127-33.
- 21 Shwe TT, Yamamoto S, Takeyama M, Kobayashi T, Fujimaki H. Effect of intratracheal instillation of ultrafine carbon black on proinflammatory cytokine and chemokine release and mRNA expression in lung and lymph nodes of mice. *Toxicol Appl Pharmacol*. 2005;209(1):51-61.
- 22 Szozda R. Pneumoconiosis in carbon black workers. *Journal of UOEH*. 1996;18(3):223-8.

Clinical utility of bone turnover markers in Sri Lanka: The way forward

Mrs. Hasanga Rathnayake

Department of Biochemistry, Faculty of Medicine, University of Ruhuna

Introduction

Bone mineral density (BMD) is the gold standard in diagnosing osteoporosis. Together with other clinical risk factors, BMD is used in treatment monitoring and assessing the fracture risk (1). Although widely used, there is no parallelism between BMD change and treatment efficacy and BMD does not detect early treatment response (2). Cost and limited availability of dual X-ray absorptiometry (DXA) are additional limitations of using BMD (3). Further, use of BMD reference data provided by the manufacturer instead of local reference data is questionable for accurate estimation of osteoporosis prevalence in a country.

Bone turnover markers (BTMs) provide information on bone metabolism beyond BMD. BTMs in serum and urine exhibit the metabolic activity of osteoblasts and osteoclasts in bone remodelling (4). Hence, the pattern of BTMs at a given time would depend on the state of bone metabolism determined by factors such as age, menopausal state, prevalent disease and drug usage. Studies have shown that BTMs capture the efficacy of anti-resorptive treatment much earlier than DXA. The behavior of BTMs is determined by country-specific factors such as ethnicity, geography, genetics, and epigenetics, hence, varies between countries (5). One of our systematic reviews showed that there is a substantial variability in BTMs reference data among Asian countries also (6).

Procollagen type I N-propeptide (PINP) and cross-linked C-telopeptide of type I collagen (CTX) have been recommended by the International Osteoporosis Foundation (IOF)

and International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) as the standard bone formation and bone resorption markers, respectively for the clinical utility –(7). In Sri Lanka, BTMs are not used in clinical decision-making, partly due to unavailability of BTM reference values for the local population. Further, despite the availability of central DXA technology almost for two decades, Sri Lanka still lacks country-specific BMD reference data. Hence, this study was mainly designed to establish age-specific reference values for serum BTMs and BMD among Sri Lankan adult women. Furthermore, this study was focused to assess the effect of anti-resorptive treatment and other factors such as serum vitamin D, serum calcium and serum phosphorous on BTMs, since these data are not known for the local population. These data would provide important information for the clinical utility of BTMs and BMD in the local population.

Phase I

Method

A descriptive cross-sectional study was conducted during 2017-2020 in Bope-Poddala MOH (Medical Officer of Health) area in Galle District, Southern Province, Sri Lanka. Women in the age range of 20-70 years were recruited using multistage stratified random sampling technique. Menopausal status was defined as the presence of amenorrhea for more than 12 consecutive months due to natural causes (8). Women with diseases (clinically evident) which could affect bone metabolism such as, hyperthyroidism, hyperparathyroidism, renal failure, malabsorption, alcohol dependence, chronic inflammatory diseases or malignancy and

who were on medications that could affect bone metabolism such as, glucocorticoids, hormonal contraceptives, thyroxin, thiazide diuretics, pharmacological doses of vitamin D were excluded from the study. Eligible women were categorized into 5 age groups from 20-29 to 60-70 years where each group consisting of minimum of 60 participants. Ethical approval for the study was received from, Ethics Review Committee, Faculty of Medicine, University of Ruhuna (Reference number: 09.03.2016: 3.17).

BMD and BMC of the total body (TBBMD), spine (LSBMD), hip (THBMD) and femoral neck (FNBMD) were measured using a DXA (dual X-ray absorptiometry) scanner (Hologic Discovery, Bedford, MA, USA) adhering to the manufacturer's protocols. Blood samples were collected between 0800 and 0900 h after an overnight fast. Enzyme-linked immunosorbent assay (ELISA) was used to estimate serum CTX (Elabscience®, USA) and intact PINP (Elabscience®, USA), serum vitamin D (25(OH)D) (DRG, Diagnostics GmbH, Germany) calcium and phosphorous levels were measured using standard spectrophotometry based assay kits. All the biochemical tests were performed adhering to the manufacturer's protocol and laboratory quality control (QC) procedures.

Results

Age related trends and reference intervals of BTMs

The highest CTX level was observed in the age group of 60-69 years while the lowest level was seen in the age group of 40-49 years (Fig 1). Mean CTX levels remained unchanged between 20 and 49 years. However, after the age of 50 years, mean CTX level increased significantly until the age of 69 years (43% difference, $p < 0.001$). The highest mean PINP level was seen in the age group of 20-29 while the lowest was seen in the age group of 40-49 years (Fig 1). However, PINP gradually declined between 20-49 years and after 50 years a marginal elevation was seen. Reference intervals of CTX for the age groups

of 20-29, 30-39, 40-49, 50-59, and 60-70 years were 0.19-0.97 ng/mL, 0.18-0.95 ng/mL, 0.20-1.29 ng/mL, 0.17-2.20 ng/mL, and 0.17-2.85 ng/mL respectively. Reference intervals of PINP for the same age groups were 118-810 pg/mL, 119-772 pg/mL, 116-645 pg/mL, 108-684 pg/mL, and 108-715 pg/mL respectively (9).

Age related trends and reference intervals of BMD

The highest mean FNBMD and THBMD, however, were seen in women aged 40-49 years (Fig 2). At the age of 20-29 years women had reached 93% of the FNBMD and THBMD. LSBMD did not change significantly between 20 and 49 years but there was a rapid decline (0.013 g/cm² or 1.4% per year) after 50 years. FNBMD declined at the rate of 0.012 g/cm² or 1.6% per year after 50 years and the corresponding figures for the THBMD were 0.011 g/cm² or 1.2% per year. Age specific reference ranges of BMD was given in table 1. BMDs and TBS values observed in women aged 20-30 years were considered as the young normal reference values. A significant difference was found in the comparison of Asian reference data provided by the Hologic manufacturer and the reference data found in this study (Table 2). Furthermore, a significant variation was found in the prevalence of osteoporosis among postmenopausal women in the study group when the two reference datasets were used. While 37% of postmenopausal women were detected to have osteoporosis (T score equal or lower than -2.5 in the spine, femoral neck, or total hip) based on the manufacturer's reference data, only 17.6% qualified for the diagnosis of osteoporosis, when the T-scores calculated from local reference data were used ($p = 0.001$) (10).

Association of BTMs with BMD/BMC, serum 25(OH)D, calcium and phosphorous

In premenopausal women ($n = 207$), CTX showed significant negative correlations with BMDs and BMCs of total body ($r = -0.22$ and -

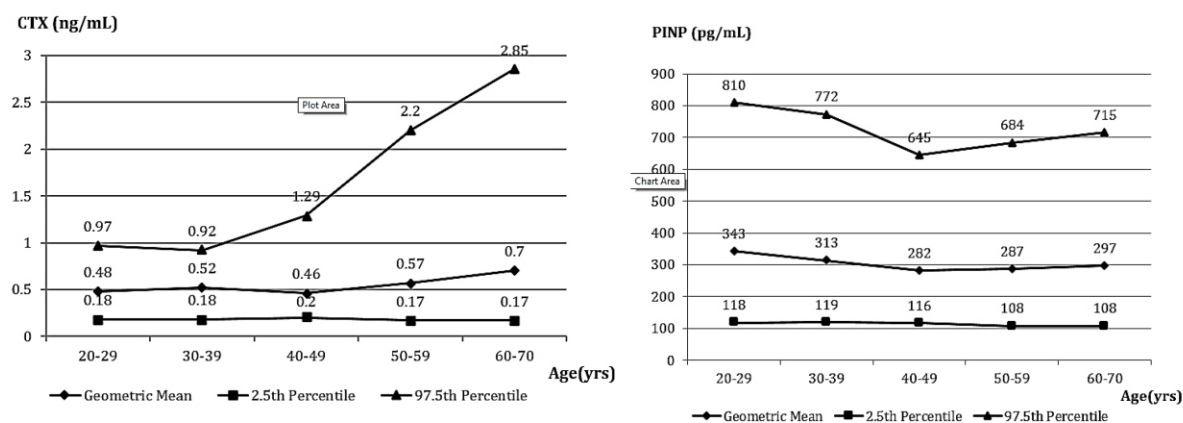


Figure 1. Age trends of CTX and PINP in adult women

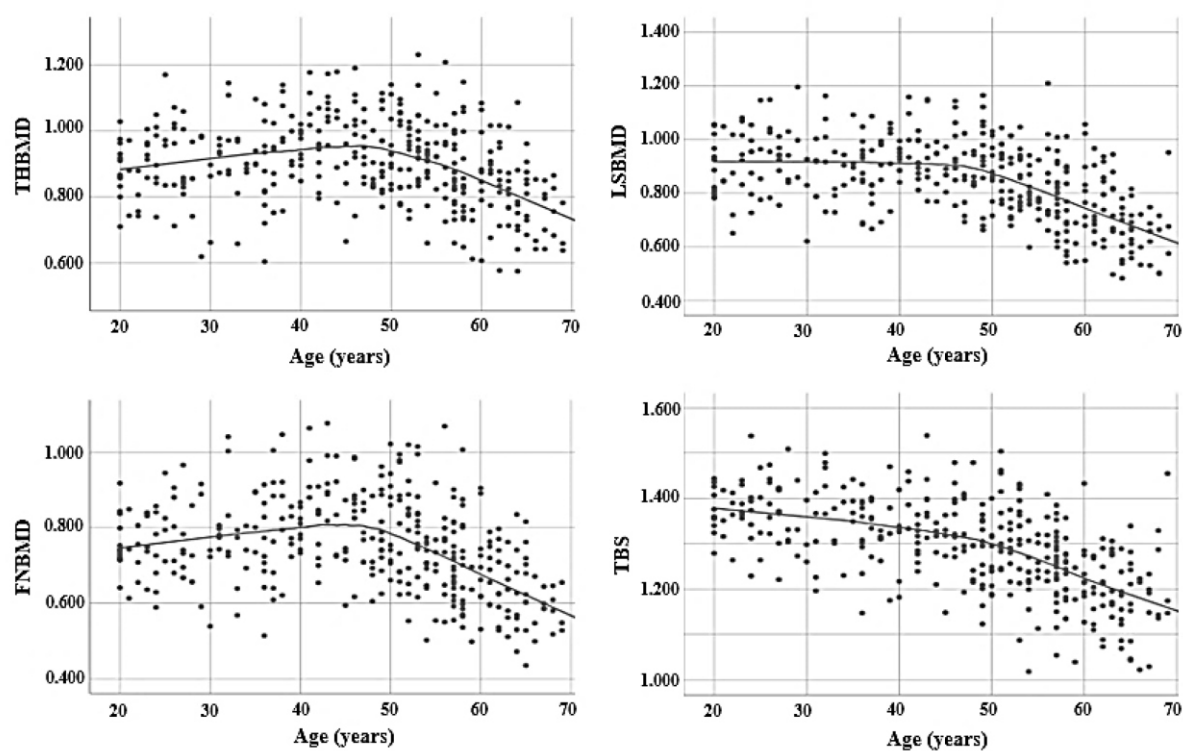


Figure 2. Age trends in THBMD, FNBMD, LSBMD and TBS

Table 1. Mean (SD) BMD and TBS values in different age categories

Measure	20-29 years (n = 65)	30-39 years (n = 66)	40-49 years (n = 68)	50-59 years (n = 76)	60-69 years (n = 72)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
THBMD (g/cm ²)	0.898 (0.107)	0.916 (0.121)	0.962 (0.113)	0.907 (0.119)	0.816 (0.120)
FNBMD (g/cm ²)	0.763 (0.094)	0.780 (0.119)	0.818 (0.105)	0.745 (0.125)	0.643 (0.099)
LSBMD (g/cm ²)	0.928 (0.118)	0.891 (0.124)	0.922 (0.118)	0.816 (0.126)	0.714 (0.135)
TBS	1.371 (0.066)	1.342 (0.077)	1.323 (0.083)	1.269 (0.088)	1.199 (0.087)

Table 2. Comparison of reference data provided by the manufacturer and observed in this study

Regional BMD (g/cm ²)	Manufacturer's reference data Mean (SD)	Reference data from the current study (peak BMD) Mean (SD)	Difference of the two mean values
THBMD	0.851 (0.115)	0.962 (0.113)	+ 0.111
FNBMD	0.803 (0.107)	0.818 (0.105)	+ 0.015
LSBMD	1.006 (0.115)	0.928 (0.118)	- 0.078

THBMD; total hip bone mineral density, FNBMD; femoral neck bone mineral density, LSBMD; lumbar spine bone mineral density, TBBMD; total body bone mineral density, TBS; trabecular bone score

0.19, $p < 0.01$), spine ($r = -0.24$ and -0.15 , $p < 0.05$), TBS ($r = -0.21$, $p = 0.002$), serum 25(OH)D ($r = -0.18$, $p = 0.012$) and significant positive correlation with serum calcium ($r = 0.17$, $p = 0.016$). The correlations between CTX and BMDs and BMCs of total hip and femoral neck. PINP showed weak but significant negative correlations with spine BMD ($r = -0.14$, (0.042) and serum 25(OH)D ($r = -0.15$, $p = 0.032$). The correlations between PINP and BMDs of other sites and BMCs of all sites, TBS were not significant. In postmenopausal women ($n = 140$), CTX showed significant negative correlations with BMDs and BMCs of all sites ($r = -0.34$ to -0.19 , $p < 0.05$), TBS ($r = -0.30$, $p = 0.001$), serum 25(OH)D ($r = -0.27$, $p = 0.002$) and significant positive correlations with serum calcium ($r = 0.23$, $p = 0.008$). Further, PINP did not show significant correlations with BMDs, BMCs, TBS, serum 25(OH)D. Observed significant correlations in postmenopausal women were relatively greater than the correlations seen in pre-menopausal women (11-13).

Phase II

Method

Double-blind, randomized, controlled trial (six months) was conducted. This study sample was recruited from the descriptive study (phase I of the study) in Bope-Poddala MOH area. Post-menopausal women with osteoporosis and high fracture risk based on FRAX algorithm validated for Sri Lanka (<https://www.sheffield.ac.uk/FRAX/tool.aspx?country=45>) were recruited to the clinical trial. Women with major fracture risk $> 9\%$ and/or hip fracture risk $> 3\%$ was considered to have a high fracture risk (14). Total of 60

were recruited and they were randomly assigned into the treatment group ($n = 30$) and control group ($n = 30$). Treatment group received 70 mg/week dose of oral alendronate (ALN) with 1000 IU/day dose of oral vitamin D3 (VitD3) as recommended by the European guidance for the diagnosis and management of osteoporosis in postmenopausal women in 2012 (15). Control group received a placebo (PLB) similar to alendronate tablet along with VitD3 of 1000 IU per day. The clinical trial was approved by Sri Lanka Clinical Trial Registry (SLCTR/ 2018/ 038).

The data were analysed by SPSS version 20. Reference ranges of PINP and CTX were defined as the central 95% range between 2.5th and 97.5th percentiles for different age categories. Reference ranges of BMD and TBS were expressed as mean (SD). One-way ANOVA with *Bonferroni's* multiple comparison test was used to compare the means between age categories. Partial correlation adjusted for possible confounders was used to assess correlations. BTMs values before and after the treatment was compared by paired t-test. Significant level was defined as p values < 0.05 .

Results

Degree of response of BTMs for alendronate treatment

Each group had one dropout in the clinical trial after six months. Significant reductions of mean CTX (60%) and PINP (39%) from the baseline values were observed in the treatment group after six months of treatment with ALN and VitD3. No

Table 3 Percentage reduction of BTMs during the 6-months intervention

BTMs	Treatment group				Control group			
	n=29				n=29			
	Baseline	6 months	Mean difference (% difference)	p	Baseline	6 months	Mean difference (% difference)	p
CTX (ng/mL)*	3.12 (1.84-5.3)	1.24 (0.60-2.56)	-1.88 (-60%)	<0.001	2.66 (1.49-4.75)	3.01 (1.82-4.96)	0.34 (13%)	0.43
PINP (pg/mL)*	262 (133-518)	159 (076-336)	-103 (-39%)	0.005	409 (303-554)	412 (302-560)	003 (0.01%)	0.97

significant mean differences were observed in CTX or PINP before and after treatment in the control group (Table 3). Between group differences (treatment versus control groups) of CTX ($p=0.36$) and PINP ($p=0.06$) were not significant ().

Discussion

According to the findings of the current study there was a delay in achieving the PBM (peak bone mass) in certain anatomical regions of the body. The discrepancy in timing of PBM in different populations is well known. The PBM is influenced by genetics, epigenetics and environmental factors (17). Age related decline of BMD and TBS after menopause is a common occurrence. A similar trend is seen in TBS indicating the deterioration of bone microarchitecture following menopause and aging (18). BMD reference data varies between countries and also among different ethnicities in the same country (19). Previous studies also report that the use of local reference data instead of manufacturer's data leads to variation in the prevalence of osteoporosis similar to the findings of the present study (20).

The highest mean PINP between 20-29 years is a reflection of the rapid bone formation at young age. In previous studies a rapid bone growth is seen from puberty to young age (21). The lowest mean CTX and PINP values were seen between 40-49 years and this probably is due to the gaining of skeletal maturity at this age. In many

populations total skeletal maturity is achieved between 30-40 years (22). Rapid elevation of CTX after 50 years is an indication of the rapid bone loss that occurs following menopause. A marginal elevation of PINP along with CTX is possible since bone resorption and formation are highly synchronised processes hence, rapid bone resorption after menopause induces bone formation to a certain extent. However bone resorption overtakes bone formation at this age resulting net bone loss (23). Findings of the present study are congruent with previous studies conducted in Australia, Saudi-Arabia and China showing a similar age trend of CTX and PINP among adult women (24-26). However, reference ranges for CTX and PINP show large variations between countries which indicate the necessity of establishing country-specific reference data. Asian countries such as China, Japan, south-Korea and Thailand have included serum CTX and PINP in their health care policy guidelines and medical insurances (27). Findings of the present study would be helpful in the assessment of bone health and monitoring of treatment in Sri Lankan adult women since normative data are useful in predicting bone turnover.

According to the findings of the present study CTX and PINP showed significant associations with BMD, serum 25(OH)D and calcium among women. However, most of these correlations are not strong but, they indicate the possible differential effect on BTMs.

The primary objectives of the use of bisphosphonates are to increase BMD while decreasing the fracture risk. ALN along with VitD3 is a widely accepted treatment option for many forms of osteoporosis worldwide including Sri Lanka. The findings reported in the present study are consistent with the available literature. Literature shows 50-70% reduction of CTX and PINP upon treating with oral ALN after 3 to 6 months (28-30). Countries such as Japan use VitD3 monotherapy for treating osteoporosis since they are cheap and associated with minimal adverse effects (31). According to the present findings CTX and PINP would be helpful in assessing the response to ALN treatment for Sri Lankan postmenopausal women in future.

Summary

Prevalence of osteoporosis was significantly lower when the local BMD reference values were used instead of data provided by the manufacturer of DXA machine. However, multi-center studies covering the entire country are required to check the reproducibility of the findings. BTMs data of this study indicate the age related trends in bone metabolism among adult women. This information has a direct relevance in understanding the age-related trends of BTMs in relation to the pathophysiology of osteoporosis and more importantly in making treatment decisions. Therefore, there is a possibility to use these normative data as preliminary reference intervals for Sri Lankan adult women and as a platform for future research in this area. Increased CTX and PINP levels are associated with lower BMD, BMC and TBS in adult women of the present study. The associations of CTX and PINP with BMD indicates that these two BTMs can be used to assess the degree of bone turnover. The association between CTX and TBS shows the effects of bone resorption on bone microarchitecture. Increased CTX and PINP levels are associated with lower levels of serum 25(OH)D which possibly indicate the

increased bone turnover in the presence of vitamin D deficiency in this group of women. Therefore, serum vitamin D status, might have an importance when interpreting the serum CTX and PINP levels. Combined ALN and VitD3 treatment significantly reduced the serum level of CTX and PINP while VitD3 alone did not show significant effect on them. These two markers would be helpful in monitoring the early therapeutic response among Sri Lankan postmenopausal women with high fracture risk.

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References

1. Kanis JA, Cooper C, Rizzoli R, Reginster JY. European guidance for the diagnosis and management of osteoporosis in postmenopausal women. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis

- and the National Osteoporosis Foundation of the USA. 2019;30(1):3-44.
2. Bergmann P, Body JJ, Boonen S, Boutsen Y, Devogelaer JP, Goemaere S, et al. Evidence-based guidelines for the use of biochemical markers of bone turnover in the selection and monitoring of bisphosphonate treatment in osteoporosis: a consensus document of the Belgian Bone Club. International journal of clinical practice. 2009;63(1):19-26.
3. Blake GM, Fogelman I. The role of DXA bone density scans in the diagnosis and treatment of osteoporosis. Postgraduate medical journal. 2007;83(982):509-17.
4. Wheeler G, Elshahaly M, Tuck SP, Datta HK, van Laar JM. The clinical utility of bone marker measurements in osteoporosis. Journal of translational medicine. 2013;11:201.
5. Lee DY, Yang JH, Ki CH, Ko MS, Suk KS, Kim HS, et al. Relationship between Bone Mineral Density and Spinal Muscle Area in Magnetic Resonance Imaging. Journal of bone metabolism. 2015;22(4):197-204.
6. Rathnayake H, Lekamwasam S, Wickramatilake C, Lenora J. Variation of urinary and serum bone turnover marker reference values among pre and postmenopausal women in Asia: a systematic review. Archives of osteoporosis. 2020;15(1):57.
7. Vasikaran S, Cooper C, Eastell R, Griesmacher A, Morris HA, Trenti T, et al. International Osteoporosis Foundation and International Federation of Clinical Chemistry and Laboratory Medicine position on bone marker standards in osteoporosis. Clin Chem Lab Med 2011;49(8):1271-4.
8. Sherman S. Defining the menopausal transition. The American journal of medicine. 2005;118 Suppl 12B:3-7.
9. Rathnayake H, Lekamwasam S, Wickramatilake C, De Zoyza E, Lenora J. Age-related trends and reference intervals of cross-linked C-telopeptide of type I collagen and procollagen type I N-propeptide from a reference population of Sri Lankan adult women. Archives of osteoporosis. 2021;16(1):164.
10. Rathnayake H, Lekamwasam S, Wickramatilake C, Lenora J. Trabecular bone score and bone mineral density reference data for women aged 20-70 years and the effect of local reference data on the prevalence of postmenopausal osteoporosis: a cross-sectional study from Sri Lanka. Archives of osteoporosis. 2019;14(1):91.
11. Rathnayake H, Lekamwasam S, Wickramatilake C, Lenora J. Association of Serum Vitamin D with Bone Turnover Markers, Trabecular Bone Score and Bone Mineral Density in a Group of Community Living Adult Women in Bope Poddala MOH Area. 18th Academic Sessions, University of Ruhuna 2021.
12. Rathnayake H, Lekamwasam S, Wickramatilake C, De Zoysa E, Lenora J. Association of bone turnover markers with trabecular bone score and bone mineral density among pre and postmenopausal women: A study from Sri Lanka; World congress on osteoporosis, osteoarthritis and musculoskeletal diseases (WCO-IOF-ESCEO) 2021.
13. Rathnayake H, Lekamwasam S, Wickramatilake C, Lenora J. Age related trends in trabecular bone score and its correlation with spine bone mineral density in Sri Lankan adult women, 25th Annual Scientific Meeting of the International Society for Clinical Densitometry (ISCD), Malaysia 2019.
14. Lekamwasam S. Sri Lankan FRAX and country-specific intervention thresholds. Archives of osteoporosis. 2013;8:148.

15. Kanis JA, McCloskey EV, Johansson H, Cooper C, Rizzoli R, Reginster JY. European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA*. 2013;24(1):23-57.
16. Rathnayake H, Lekamwasam S, Wickramatilake C, Lenora J. Effect of alendronate and vitamin D3 treatment on bone turnover markers in postmenopausal women with high fracture risk: A double-blind, randomized controlled trial. *Galle Medical Association (GMA) Annual Academic Sessions 2021*.
17. Zhu X, Zheng H. Factors influencing peak bone mass gain. *Frontiers of medicine*. 2020;15(1):53-69.
18. Iki M, Tamaki J, Sato Y, Winzenrieth R, Kagamimori S, Kagawa Y, et al. Age-related normative values of trabecular bone score (TBS) for Japanese women: the Japanese Population-based Osteoporosis (JPOS) study. *Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA*. 2015;26(1):245-52.
19. Kaptoge S, da Silva JA, Brixen K, Reid DM, Kröger H, Nielsen TL, et al. Geographical variation in DXA bone mineral density in young European men and women. Results from the Network in Europe on Male Osteoporosis (NEMO) study. *Bone*. 2008;43(2):332-9.
20. Lee S, Choi MG, Yu J, Ryu OH, Yoo HJ, Ihm SH, et al. The effects of the Korean reference value on the prevalence of osteoporosis and the prediction of fracture risk. *BMC musculoskeletal disorders*. 2015;16:69.
21. Troy KL, Mancuso ME, Butler TA, Johnson JE. Exercise Early and Often: Effects of Physical Activity and Exercise on Women's Bone Health. *International journal of environmental research and public health*. 2018;15(5).
22. Berger C, Goltzman D, Langsetmo L, Joseph L, Jackson S, Kreiger N, et al. Peak bone mass from longitudinal data: implications for the prevalence, pathophysiology, and diagnosis of osteoporosis. *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research*. 2010;25(9):1948-57.
23. Ji MX, Yu Q. Primary osteoporosis in postmenopausal women. *Chronic diseases and translational medicine*. 2015;1(1):9-13.
24. Ardawi MS, Maimani AA, Bahksh TA, Rouzi AA, Qari MH, Raddadi RM. Reference intervals of biochemical bone turnover markers for Saudi Arabian women: a cross-sectional study. *Bone*. 2010;47(4):804-14.
25. Hu WW, Zhang Z, He JW, Fu WZ, Wang C, Zhang H, et al. Establishing reference intervals for bone turnover markers in the healthy shanghai population and the relationship with bone mineral density in postmenopausal women. *International journal of endocrinology*. 2013;2013:513925.
26. Jenkins N, Black M, Paul E, Pasco JA, Kotowicz MA, Schneider HG. Age-related reference intervals for bone turnover markers from an Australian reference population. *Bone*. 2013;55(2):271-6.
27. Wu CH, Chang YF, Chen CH, Lewiecki EM, Wuster C, Reid I, et al. Consensus Statement on the Use of Bone Turnover Markers for Short-Term Monitoring of Osteoporosis Treatment in the Asia-Pacific Region. *Journal of clinical densitometry : the official journal of the*

- International Society for Clinical Densitometry. 2019;24(1):3-13.
28. Sakai A, Ito M, Tomomitsu T, Tsurukami H, Ikeda S, Fukuda F, et al. Efficacy of combined treatment with alendronate (ALN) and eldecalcitol, a new active vitamin D analog, compared to that of concomitant ALN, vitamin D plus calcium treatment in Japanese patients with primary osteoporosis. *Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA*. 2015;26(3):1193-202.
 29. Olmos JM, Hernández JL, Llorca J, Nan D, Valero C, González-Macías J. Effects of 25-hydroxyvitamin D3 therapy on bone turnover markers and PTH levels in postmenopausal osteoporotic women treated with alendronate. *The Journal of clinical endocrinology and metabolism*. 2012;97(12):4491-7.
 30. Brown JP, Prince RL, Deal C, Recker RR, Kiel DP, de Gregorio LH, et al. Comparison of the effect of denosumab and alendronate on BMD and biochemical markers of bone turnover in postmenopausal women with low bone mass: a randomized, blinded, phase 3 trial. *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research*. 2009;24(1):153-61.
 31. Orimo H, Nakamura T, Hosoi T, Iki M, Uenishi K, Endo N, et al. Japanese 2011 guidelines for prevention and treatment of osteoporosis--executive summary. *Archives of osteoporosis*. 2012;7(1-2):3-20.

FMAS 2022
Winners of the free paper sessions

Best oral presentation (Open category)

A novel polyherbal formulation for the management of oxidative stress and inflammation in doxorubicin-induced nephrotoxicity

Amarasiri AMSS, Attanayake AP, Jayatilaka KAPW, Mudduwa LKB

Best oral presentation (Undergraduate category)

Pre-gravid physical activity and unhealthy eating behavior: Are they risk factors for pregnancy induced hypertension and gestational diabetes mellitus?

Rasara GHM, Ranasinghe MM, Ranasinghe VS, Ranawelle RLAAM, Rashani WAKK, Darshana ILAN

Best poster presentation (Open category)

Diagnostic accuracy of preterm babies using maternal anthropometric parameters: A single center study in Galle district

Darshana ILAN, Wijesinghe CJ, Kulatunga PARI, Abeynayake NR

Emotional and behavioral problems, daily stressors and school performance of adolescents in Galle

Ponnamperuma TT, Kulathunga PARI

Best poster presentation (Undergraduate category)

Post vaccination side effects of COVISHIELD vaccine among Medical Officers of Teaching Hospital Karapitiya

Wijesinghe UMC, Wijesinghe WAHL, Wijesinghe RT, Yakgghawita TT, Priyaranjan SADC, Sanjana APY, Ponnamperuma TT

Free papers (Undergraduate category) - Commended by judges

Junk food consumption among school going adolescents in Galle Municipality

Subasinghe HP, Thalaspitiya TRDC, Thamaritha RJHT, Thejani RVK, Udayangani WGT, Udeshika KPS, Hettiarachchi M

Psychological distress among public health staff during Covid-19 pandemic in selected MOH areas of Galle District

Senevirathna DU, Senevirathna UGDS, Senevirathna DAW, Sewwandi PAD, Siriwardana THCR, Sooriyaarachchi IC, Ponnamperuma T

Abstracts

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OP 1

Aegle marmelos L. fruit extracts encapsulated alginate nanoparticles and their in vitro antidiabetic activity

De Silva WND^{*1}, Attanayake AP¹, Karunaratne DN², Pamunuwa KMGK³, and Arawwawala LDAM⁴

¹Department of Biochemistry, Faculty of Medicine, University of Ruhuna, Sri Lanka

²Department of Chemistry, Faculty of Science, University of Peradeniya, Sri Lanka

³Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Sri Lanka

⁴Industrial Technology Institute, Sri Lanka

<Corresponding author: nayomi@med.ruh.ac.lk>

Background

Aegle marmelos L. (Family: Rutaceae) has been widely employed as a herbal medicine in the management of diabetes mellitus. The successful encapsulation of ethanol, 50% ethanol, and 50% acetone extracts of *A. marmelos* extracts into an alginate matrix was confirmed through characterization techniques including scanning electron microscopy, and Fourier transform infrared spectroscopy analysis.

Objectives

This study aimed to evaluate the antidiabetic activity of ethanol, 50% ethanol, and 50% acetone extracts encapsulated alginate nanoparticles using α -amylase, α -glucosidase, dipeptidyl peptidase IV (DPP-IV) and glucose adsorption assays *in vitro*.

Methods

Evaluation of *in vitro* antidiabetic activity was done for their α -amylase, α -glucosidase, and DPP-IV inhibitory potentials and glucose adsorption capacity. Acarbose was the reference compound for both α -amylase and α -glucosidase assays. Diprotein A and metronidazole were the standard compounds of DPP-IV and glucose adsorption assays respectively.

Results

The inhibitory potential against the α -amylase enzyme was preserved in all three extracts upon encapsulation. The highest significant inhibitory potential for α -glucosidase ($IC_{50} = 7.43 \pm 1.02$ mg/mL) and DPP-IV ($IC_{50} = 1.61 \pm 0.07$ mg/mL) enzymes was achieved by 50% ethanol extract encapsulated alginate nanoparticles compared to its crude extract, whereas the standard compounds acarbose and diprotein A were more effective in the respective assays with lower IC_{50} values of 1.81 ± 0.61 mg/mL and 0.02 ± 0.00 mg/mL. However, 50% ethanol extracts encapsulated alginate nanoparticles gained significantly higher glucose adsorption capacity of 1.95 ± 0.30 mmol/g (at 200 mM) than the crude extract (0.48 ± 0.03 mmol/g) and standard compound metronidazole (0.40 ± 0.00 mmol/g) ($p < 0.05$).

Conclusion

The 50% ethanol extract of *A. marmelos* encapsulated alginate nanoparticles significantly increased antidiabetic activity *in vitro* and the results could be a token for the development of novel antidiabetic drug leads targeting the management of diabetes mellitus.

Keywords

Aegle marmelos L., alginate nanoformulation, antidiabetic, *in vitro*

OP 2**Risk factors for breast cancer among women attending breast cancer clinics in the Apeksha hospital Maharagama: A case-control study**Chathurangika PH¹, Lenora J²¹Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna²Department of Physiology, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka

<Corresponding author: lenora@med.ruh.ac.lk>

Background

Breast cancer (BC) is one of the leading causes of women's deaths because of its high incidence rates. Identification of risk factors for BC helps to prevent development, complications, improve the quality of life and increase the survival period.

Objectives

To identify the risk factors for BC among women attending BC clinics in Apeksha Hospital Maharagama (AHM).

Methods

One to one age (35–65 years) matched case-control study was carried, using 150 female BC patients, attending clinics in AHM and 150 women controls without BC who were attending well-woman clinics in 5 MOH areas in Colombo district. Data was collected using an interviewer-administered questionnaire. Univariate conditional logistic regression analysis was performed to identify various BC risk factors. Adjusted odds ratios (ORs) and 95% confidence intervals (CI) were calculated using multiple logistic regressions. Ethical clearance was obtained from Ethical Review Committee, Faculty of Allied Health Sciences, University of Ruhuna.

Results

Multivariate analysis showed that those women who have children are at a lower risk of developing BC than nulliparous women, with statistically significant odds ratios for women with three children (OR=0.079;95%CI=0.011-0.56) and two children (OR=0.057;95%CI=0.0041-0.78). The other significant factors associated with increased risk of BC are: spontaneous abortion (OR=4.17; 95%CI=0.257-67.61); regular consumption of artificial fruit juice (OR=19.52; 95%CI=4.89-77.73); regular consumption of carbonated drinks (OR = 2.71; 95%CI = 1.39 - 8.18) and regular consumption of fried rice or Koththu (OR=10.64; 95%CI=3.09-36.6).

Conclusion

Having more children has an inverse relationship BC development. History of spontaneous abortion, consumption of artificial fruit juice, carbonated beverages, and fried foods on a regular basis also increases the risk of developing BC. Educational programmes should focus on these factors with the aim of reducing the incidence of BC.

Keywords

Apeksha Hospital Maharagama, Breast cancer, Case-control study, Risk factors, Women

OP 3

Antenatal anxiety following the COVID - 19 vaccination program in pregnant women attending antenatal clinics of Teaching Hospital Mahamodara

De Silva BVS^{*1}, Kulathunga PARI¹, Punchihewa Gd², Yapa SR³, DGM Dilshan³

¹*Department of Community Medicine, Faculty of Medicine, University of Ruhuna*

²*Department of Psychiatry, Faculty of Medicine, University of Ruhuna,*

³*Asiri Hospital, Matara*

<Corresponding author: bvsdesilva@med.ruh.ac.lk>

Background

The COVID-19 pandemic created a plethora of adverse outcomes for the pregnant population and the psychological impacts included increased anxiety levels. The novel vaccination campaign aimed at preventing infection could affect anxiety either way due to the safety concerns raised.

Objectives

The study attempted to assess antenatal anxiety and risk factors related to COVID-19 for anxiety, after the initiation of the vaccination campaign for COVID-19.

Methods

The study was conducted among 224 pregnant women attending antenatal clinics in Teaching Hospital Mahamodara, as a descriptive cross-sectional study, sixteen months after the initiation of the vaccination campaign. Complicated pregnancies were present in 84 (37.5%) women, a majority, (94.6%) had received a COVID-19 vaccine and 84.8% reported that spouses were also vaccinated for COVID-19. The anxiety levels were measured using the validated Sinhala version of the Perinatal Anxiety Screening Scale (PASS-S) and questions were directed to determine associated risk factors and psychological support received.

Results

Clinical anxiety among pregnant women was detected to be 17.9%, which was similar to anxiety levels during the pandemic in Sri Lanka (17.5% vs 17.9%). A majority (63.4%), were asymptomatic followed by 33.5% having mild to moderate anxiety and 3.1% with severe anxiety. Maternal age, parity, gestation, presence of complications, education level, income, or a family member getting infected with COVID-19 were not associated with antenatal anxiety. No significant association was detected with the vaccination status of the pregnant women or of their spouses, with anxiety. Newspapers and television were the sources accessed by a majority to gain information and 36.6% were concerned about the health effects on the fetus.

Conclusion

Antenatal anxiety was high and similar to recorded anxiety levels before the initiation of the COVID-19 vaccination program in Sri Lanka. Antenatal anxiety did not demonstrate a significant association with the COVID-19 vaccination status.

Keywords

Perinatal anxiety, COVID-19, vaccination, PASS-S

OP 4**Evaluating the Efficacy of School Sexual and Reproductive Health Education in Preventing Teenage Pregnancies: A Case Study of Egodaunya MOH Area, Colombo RDHS, during the COVID-19 Pandemic in 2021**

Withanage SJW¹, Lakshima WDS^{1,2}, Karunanayake A³, Kumara RADD⁴, Chandrasiri WGMMSD¹, Dharmasena KPD¹

¹Medical Officer of Health Office, Egodaunya, Moratuwa

²Postgraduate Institute of Medicine, University of Colombo

³Department of Physiology, Faculty of Medicine, University of Ruhuna

⁴National Institute of Cancer, Maharagama

<Corresponding author: sankha06@hotmail.com>

Background

Egodaunya Medical Officer of Health (MOH) area has reported the highest teenage pregnancy rate in Colombo health region in 2021 amidst the devastating COVID-19 pandemic.

Objectives

The study aimed to evaluate the effectiveness of school sexual and reproductive health education (SSRHE) in reducing teenage pregnancies in Egodaunya MOH area.

Methods

The methodology employed in this study involved the implementation of SSRHE programs in 12 high-risk schools. The target population consisted of students in grade 10 and above, with program delivery occurring during the latter part of 2021 and early 2022.

Results

The results of the study indicate that in 2021, a total of 75 teenage mothers were registered within the area. Among these, 34 individuals (45.3%) belonged to Group 1, comprising teenage mothers attending schools and residing in the area, while the remaining 41 individuals (54.7%) were classified under Group 2, encompassing nonresident teenage mothers. The age distribution revealed that 44 teenage mothers were aged 18-19 years, 28 were in the 16-17 age group, and three were under 16 years old.

In 2022, the number of registered teenage pregnancies decreased to 68. Within this cohort, 17 individuals (26.5%) were classified as belonging to Group 1, while 51 individuals (73.5%) were categorized under Group 2. The age distribution revealed that 48 teenage mothers were aged 18-19 years, 16 were in the 16-17 age group, and four were under 16 years old. There was a statistically significant reduction in teenage pregnancies within Group 1 when compared to 2021 ($p=0.014$). Conversely, Group 2 experienced a substantial increase ($p=0.0000$) in teenage pregnancies.

Conclusion

A study highlights the value of inclusive sex education programs in reducing teen pregnancies. School-based initiatives prove effective, but additional support is necessary for nonresident teen mothers. Eased restrictions in 2022 may have led to more nonresident teen mothers relocating to areas with better healthcare accessibility.

Keywords

SRH-Sexual and reproductive health, teenage pregnancies, COVID-19, Sri Lanka

OP 5

Impact of leprosy on affected people's lives: a qualitative study

Liyanage A^{*1}, Darshana ILAN¹, Akarawita J², Gunasekara C², Kahawita I², Liyanage G¹, Senadheera C¹

¹*Faculty of Medicine, University of Ruhuna*

²*National Hospital of Sri Lanka*

<Corresponding author: achalaliyanage@yahoo.com>

Background

Leprosy is a neglected research field in Sri Lanka, especially studies on impact of leprosy on affected people's lives are scarce. Purpose of this study was to learn psychological and social consequences of the illness and the coping used by a group of leprosy patients.

Materials and Methods: This qualitative study involved patients attending leprosy clinic in National Hospital, Colombo. A total of 25 adults who consented were interviewed using a semi-structured interview guide. These in-depth interviews were transcribed verbatim and later were analysed using grounded theory approach.

Results

Of 25, median (IQR) age was 39 (32-47) years, 15 were males and 16 were employed. Multibacillary leprosy was reported in 92% and 48% were currently on multidrug treatment. Pain and numbness were identified as the main limitations for attending personal activities and fulfilling one's responsibilities which evoked in them negative feelings like fear, sadness and suicidal feelings. They engaged in activities such as using screens, having conversations and sleeping to cope with those feelings. One participant reported taking psychiatric treatment. Fear of being stigmatized was a major theme running in a large majority of our participants' talk. They employed different strategies to hide the illness from their close associates, community and the larger society, in few cases even from their own family. These strategies included conveying to others their illness as 'a disease of the nervous system', avoiding social situations, being home-bound, and covering. Some of them perceived it as their responsibility to take precautions not to infect others.

Conclusion

Physical consequences of leprosy caused psychological distress in our study participants. They used distraction as a strategy to cope with distress. Stigma of leprosy made an impact on their social life. Patients will benefit from use of holistic approach in leprosy treatment services and interventions targeting reduction of stigma related to leprosy thereby would minimize impact of illness on social life of affected people.

Keywords

Leprosy, stigma

Acknowledgment

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OP 6**Perceptions of medical students regarding the usefulness of generic - personal skills for clinical training**

Jayawardene AJPM^{*1}, Bodinayake C¹, Wijesekara WADMS¹

¹*Medical Education Unit, Faculty of Medicine, University of Ruhuna*

Background

Basic medical sciences taught in the first two years form the solid foundation for medical training. It has a significant impact on clinical reasoning. There is a debate on how much of basic sciences training is required and the depth and extent that should be taught.

Objectives

The main objective of this study was to identify medical students' perceptions on generic skills and attitudes that need to be developed during basic sciences to prepare for future clinical training.

Methods

Ruhuna Medical Undergraduates who completed their basic sciences training and embarked on clinical training were selected as the study sample. The students were asked to write up a self-reflective journal on what qualities, skills and attitudes should be developed during basic sciences to support their clinical training. 240 students participated in the study.

Their reflective journals were submitted to the researchers and thematic analysis was conducted using grounded theory.

Results

Four themes emerged from student reflections: 1) Development of personal qualities such as patience, positive thinking, self-reflection, learning from mistakes, having good friends and self-confidence; 2) Using successful study methods such as self-directed learning, peer learning, group discussions, doing practice questions ;3) Time management to balance academic and personal life including prioritizing time and scheduling day to day activities; 4) Managing stress including balancing relationships, engaging in extracurricular activities and self-talking/self-reflection.

Conclusions

Self-reflections of medical students showed that generic skills and attitudes important for clinical training have been identified by them. The importance of nurturing these generic skills during basic sciences/pre-clinicals to lay a solid foundation for clinical training was highlighted by them.

Keywords

Basic medical sciences, clinical training, generic-skills, medical students, self-reflections

PP 1

Exploring the Knowledge, Attitudes, and Establishment of Breastfeeding in Primigravida Women: at a Tertiary Care Maternity Hospital in Southern Province of Sri Lanka

Wijerathne RNIP^{*1}, Dasanayake L²

¹BSc Degree Programme, Dept. of Nursing, Faculty of Allied Health Science, University of Ruhuna

²Department of Obstetrics & Gynaecology, Faculty of Medicine, University of Ruhuna

<Corresponding author: pprashadi3@gmail.com>

Background

Breastfeeding (BF) is the single most important low-cost intervention to reduce child morbidity and mortality worldwide. Proper breastfeeding practice is a huge economical investment to a country, especially in low resource setting regions in the world. However, successful establishment of breastfeeding can be challenging for primigravida women due to lack of knowledge, negative attitudes, and insufficient support. This research project aims to identify those strategic areas which need further strengthening to optimize the outcome of breastfeeding practices in the country.

Objectives

To explore the knowledge, attitudes and establishment of breastfeeding in primigravida women at a tertiary care maternity hospital in southern province of Sri Lanka.

Methods

A descriptive cross sectional study was conducted among 170 primigravida women who gave birth at Teaching Hospital Mahamodara, Galle. The data were collected using validated structured interviewer-administrated questionnaire in two stages: within the first 24 hours of birth and on the 7th postnatal day.

Results

The study revealed that most of the participants (n=86, 50.6%) had satisfactory knowledge about breastfeeding. Majority of primigravida women (n = 101, 59.4%) had positive attitudes towards breastfeeding of their newborn babies. Vast majority of postnatal women (n=164, 96.5%) had achieved high establishment of breastfeeding rate at 7th day after the delivery. Overall complications (latching problems, breast pain, cracked nipple) related to breastfeeding were 51.7% (n=88). There was a statistically significant association between younger age and non-establishment of breast feeding (p<0.001) comparing to advance age.

Conclusion

Awareness of primigravida women regarding breastfeeding is satisfactorily high. Majority of women have positive attitudes for the breastfeeding. Their establishment of breastfeeding is very high at 7 days after the delivery, even though the complications related to breastfeeding are significantly high. When the woman is younger establishment of breast feeding is low.

Keywords

Breastfeeding, primigravida, postnatal, newborns

PP2**Effect of Body Mass Index and health related lifestyle factors on academic performance among Allied Health undergraduates in University of Ruhuna**Ambepitiya ADDV¹, Alwis G^{*2}¹*Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna*²*Department of Anatomy, Faculty of Medicine, University of Ruhuna*

<Corresponding author: galwis@med.ruh.ac.lk>

Background

University life is one arena where students' lifestyles change. Body mass index (BMI) based nutritional status has become one important parameter to assess healthy lifestyle. Healthy lifestyle practices such as regular physical activity, healthy dietary habits and adequate sleep have shown an impact on academic performance of undergraduates.

Objectives

To assess the effect of BMI and other health related factors on academic performance among Allied Health undergraduates of University of Ruhuna.

Methods

This descriptive cross-sectional study was conducted with the participation of 204 undergraduates of second and third years (52 males and 152 females) in the Faculty of Allied Health Sciences. A pre-tested self-administered questionnaire was used for data collection. Height and weight were measured and BMI was calculated adhering to standard protocols. Academic performance was assessed using the results of the last examination they sat in the academic year. Data analysis was performed with SPSS.

Results

Mean (SD) age of undergraduates was 24.4 (1.0) years. BMI based nutritional status of participants were normal weight 139 (68.1%), underweight 42 (20.6%) and overweight 23 (11.3%). A majority 111 (54.4%) had passed and 24 (11.8%) had failed the recent exam, whereas 69 (33.9%) had second class or above. BMI status, having regular breakfast, watching TV, usage of computer, usage of social media and sleep were not associated with academic performance. Increase age ($p=0.035$), higher monthly income ($p=0.046$), higher participation in extracurricular activities ($p=0.043$), higher consumption of milk ($p<0.001$), and higher consumption of water ($p=0.017$) were significantly associated with academic performance.

Conclusion

Participation in extracurricular activities, consumption of water and milk, and age appear to have a positive impact on academic performance of undergraduates whereas BMI appears no impact on academic performance of Allied Health undergraduates.

Keywords

Academic performance, BMI, extracurricular activities, sleep, undergraduates

PP3**Case study of congenital chylothorax**

Igalagamage LR^{*1}, Sanjeeva MAGA¹, Withanaarachchi K¹, Gunathilake G¹

¹*Teaching Hospital, Karapitiya*

<Corresponding author: lakmalihalagamage@gmail.com>

Introduction

Congenital chylothorax is one of the commonest causes of neonatal pleural effusion. Majority of cases are idiopathic with high mortality rate.

Case history

Day one old baby presented with respiratory distress since birth with left sided reduced breath sounds. Rest of the neonatal examination revealed no abnormality. Baby was delivered by normal vaginal delivery at term with a birth weight of 2.850 kg. Antenatal history was uneventful. There was a left sided massive pleural effusion in the chest x ray taken at two hours of age. Baby was given high flow humidified oxygen therapy and kept nil by mouth. Ultrasound guided thoracocentesis of yellowish turbid fluid done on day two revealed a transudate and non chyle with pleural fluid triglyceride level of 24mg/dl. Then breast feeding was commenced, and the repeat ultrasound scan done after 24 hours revealed worsening of pleural effusion, needing insertion of an intercostal tube. Pleural fluid analysis was suggestive of chylothorax with high triglyceride levels (516mg/dl) and low cholesterol level (46mg/dl). Breast feeding was withheld and infant formula with medium chain fatty acids was introduced. Intravenous octreotide infusion was started and titrated. Plural effusion improved gradually on subsequent scans. There after octreotide infusion was tailed off and breast feeding was restarted gradually on day 21, while weaning off the formula with medium chain fatty acids.

Conclusion

In congenital chylothorax, short term withholding of breast feeding along with introducing a formula with medium chain fatty acids and intravenous Octreotide is an effective treatment modality.

PP4

Prevalence and associated factors of Chronic Widespread Pain among pregnant mothers in Galle

Chandana GJ¹, Jayasekera P², Narangoda S², Wijetunga T², De Silva PV¹

¹*Department of Community Medicine, Faculty of Medicine, University of Ruhuna*

²*Faculty of Medicine, University of Colombo*

<Corresponding author: janakagode@gmail.com>

Background

Chronic Widespread Pain (CWP) is defined as “pain reported in at least two sections of two contralateral limbs and in the axial skeleton and have been present for at least three months”. Chronic pains in multiple sites are common during pregnancy.

Objectives

This study was conducted to assess the prevalence and associated factors of CWP among pregnant mothers in Galle district.

Methods

A sample of mothers attending randomly selected antenatal clinics from Bope-Poddala Medical Officer of Health area was interviewed by a trained data collectors using an interviewer administered questionnaire and a diagram of body to locate sites of pain. Data was analysed using descriptive statistics and statistical tests through SPSS version 25, and 0.05 was used as the cut off p-value for significance testing.

Results

Three hundred mothers (response rate 85.8%) have participated in the study ages ranged from 19 to 43 (median = 28/ IQR = 9). Nearly one third were in first pregnancy (35.7%) or having a living child (36.7%) and they were in second (49.3%) and third (50.7%) trimester. Nearly one fifth of mothers (20.3%) had complained of pain lasting more than three months, however only 15.3% of mothers met with the criteria for CWP. Lower back was the commonest site of pain (48.7%) and around 20% of mothers complained pain in different sites of lower limbs. Majority (87.3%) were aware of the pain during pregnancy and Public Health Midwife (42.3%) and friends and relatives (35.3%) were the commonest sources of information. While 68.0% of mothers relieved their pain through resting 12.7% have sought treatments from a doctor. CWP was significantly higher in third trimester ($p < 0.05$). None of the other factors like age, education level, socioeconomic status, occupation, BMI, parity, or mode of delivery in previous pregnancy was associated with CWP.

Conclusions

Though higher prevalence of pain in pregnancy was noted in prevalence of CWP is relatively low. Lower back and lower limbs have been the commonest sites of pain possibly due to mechanical changes (posture and weight) during the pregnancy. More attention needs to be paid for pains during the pregnancy as majority is not seeking medical treatment.

Keywords

Chronic Widespread Pain, Pregnancy, Awareness, Health seeking

PP5

Antifungal sensitivity of Candida isolates colonized in a cohort of ICU patients from the Teaching Hospital Karapitiya

Thabrew H^{*1}, Wijerathne WMDGB¹, Nagahawatte A de S¹

¹*Department of Microbiology, Faculty of Medicine, University of Ruhuna*

<Corresponding author: harshani@med.ruh.ac.lk>

Background

Candida colonization has been identified as a significant risk factor preceding the development of candidaemia.

Objectives

The aim of this study was to determine the colonizing Candida species and their sensitivity pattern against commonly used antifungals in ICU patients at risk of development of candidaemia.

Methods

Candida colonization in the oral cavity, rectum, urine, and on central venous catheters was assessed in 100 consecutive patients admitted to ICUs of Teaching Hospital Karapitiya from 1st December 2015 to 30th March 2016.

Colonization was assessed from admission and repeated every 3rd day until discharge from ICU, death or development of Candidaemia. Antifungal sensitivity was performed on the initial colonizing Candida species.

Results

Total of 208 Candida isolates were cultured from 100 patients admitted to ICUs during the study period. Ten of the colonized patients developed Candidaemia.

Candida albicans was the commonest colonizing isolate found on 66 patients (66/ 100, 66%). It was isolated from the oral cavity in 47 patients, and rectum in 34. Two isolates (2/ 208, 0.96%) from rectum and mouth of two patients with no previous history of antifungal administration demonstrated resistance to both fluconazole and voriconazole.

Candida tropicalis (42/100, 42%) was the next commonest isolate found to colonize patients. It was isolated from the oral cavity in 24, and in the rectum in 24 patients. One rectal isolate from an azole naïve patient was found to have resistance to fluconazole.

Eight of the 10 isolates from Candida glabrata colonized patients (10/ 100, 10%) demonstrated resistance to fluconazole while one isolate demonstrated resistance to voriconazole as well.

Conclusion

Antifungal resistance, even though rare, is seen in azole naïve patients. Cross resistance of fluconazole and voriconazole is alarming further limiting the already limited available treatment options.

PP6**Factors affecting weight gain during pregnancy in pregnant women admitted to a tertiary care facility in Southern Sri Lanka**

Kulathunga PARI¹, De Silva BVS¹, Amaradasa WPH², Mendis WPM², Rathnayake MK², Weliwita DD³, Priyadarshana PNSL³, Wijesinghe CJ¹

¹Department of Community Medicine, Faculty of Medicine, University of Ruhuna

²Teaching Hospital Karapitiya, Galle,

³National Hospital Sri Lanka, Colombo

<Corresponding author: ruwanthikulathung1993@med.ruh.ac.lk>

Background

Weight gain during pregnancy is an important indicator in the prediction of morbidity and mortality in infants and mothers.

Objectives

This study aimed to assess the patterns of weight gain and the factors affecting weight gain during pregnancy among pregnant women admitted for delivery at a tertiary care facility in Southern Sri Lanka.

Methods

A cross-sectional study was conducted in a consecutive sample of 300 pregnant women admitted to Teaching Hospital, Mahamodara for delivery whose period of gestation was 37-40 weeks with documented evidence on weight gain during pregnancy. An interviewer-administered questionnaire was used for data collection. Pre-pregnancy nutritional status was categorized according to Body Mass Index (BMI) and recommended weight gain for each BMI category was considered in determining the adequacy of weight gain. Pre-pregnancy BMI was calculated using pre-pregnancy weight and height data extracted from the pregnancy record. Level of stress during pregnancy was determined using a score calculated based on responses given to a Likert-type scale. Chi square test and multivariate analysis were used in data analysis.

Results

According to pre-pregnancy BMI, only 3.8% of the pregnant women belonged to underweight category (BMI<18.5), 52.1% to normal category (BMI=18.5-24.9), 32.1% to overweight category (BMI=25-29.9) and 9% to obese category (BMI≥30). Of the women, 48.3% had an optimum weight gain, 48.3% had inadequate and 3.14% had excessive weight gain during pregnancy. Over 40% of the women had adequate diet during pregnancy and no statistically significant association was found between the dietary intake and adequate weight gain during pregnancy. Pre-pregnancy BMI (p=0.001) and physical activity level (p=0.023), adequate rest (p=0.031), lack of stress (p=0.0317) and availability of family support during pregnancy (p=0.003) were positively associated with adequate weight gain during pregnancy.

Conclusion

Proper pre-pregnancy care, activity level, maternal psychological status and adequate support during pregnancy affect weight gain during pregnancy. Interventions are needed to improve those aspects in existing health care system. Further longitudinal follow up studies are recommended in this area to minimize recall bias regarding pre-pregnancy factors.

Keywords

Weight gain, pregnancy, dietary intake, physical activity, stress

PP7

The usage patterns of web browsers and internet access among the staff Faculty of Medicine, University of Ruhuna

Jayasuriya D¹, Rukmal PGGR¹, Chathuranga WGI¹, Sumanasekara TPGMT¹, Galpoththawala DA¹, Karunanayake A²

¹*IT unit, Faculty of Medicine, University of Ruhuna*

²*Department of Physiology, Faculty of Medicine, University of Ruhuna*

<Corresponding author: ddarshana@med.ruh.ac.lk>

Background

With the rapid advancement of digital technology, understanding how staff members utilize the internet is crucial for optimizing resources and enhancing productivity.

Objectives

This research aims to identify key trends, preferences, and potential areas for improvement in the internet usage of the staff by conducting a comparative analysis.

Methods

This study targeted staff members who accessed the internet through the servers located in the IT unit of the Faculty of Medicine. The data extraction process employed pfSense, a software package built on the FreeBSD operating system and utilised Squid, a caching and forwarding HTTP web proxy. Data from January 2 to May 10, 2023, were collected for analysis.

Results

Bing was the most frequently used web browser (including the Automated popping ups), accounting for 42.5% of the total usage, followed by Google with 37.3% and Yahoo with 12.8%. The most accessed faculty-related websites were the library website, the Learning Management System (LMS), and the faculty website. Furthermore, the analysis identified March as the month with the highest number of internet accesses 8,422 (31.38%), while February had the lowest number, with 3,488 (12.99%). On average, there were 5,367 accesses per month.

In terms of data consumption, January recorded the maximum usage, amounting to 383.2MB (31.38%), whereas February exhibited the minimum usage, with 101.9MB (12.99%). The average monthly data consumption was found to be 180.56MB.

The results indicated that YouTube was the most accessed social media platform, with 41,218 accesses, followed by Facebook with 30,199. January registered the highest number of monthly social media accesses.

Conclusion:

The monthly number of internet access, monthly data consumption, and social media usage were not uniform. Further research and analysis would help to understand the underlying factors driving trends in web browsing habits, internet access patterns, and social media usage and their implications.

PP8**The profile of congenital heart diseases in neonates and infants referred to Paediatric Cardiology Unit, Teaching Hospital, Karapitiya**

Kariyawasam JP¹, Ragunathan LR², Liyanage UB¹, De Silva PV³

¹*Paediatrics Unit, Teaching Hospital, Karapitiya*

²*Paediatric Cardiology Unit, Teaching Hospital, Karapitiya*

³*Faculty of Medicine, University of Ruhuna*

<Corresponding author: pvijithadesilva123@yahoo.com>

Background

Congenital Heart Disease (CHD) is the commonest structural abnormality in children, representing 25% out of all congenital malformations, with an incidence of 4-6/1000 live births for serious defects worldwide. CHD causes significant morbidity and mortality and thus, warrants early diagnosis and intervention.

Objectives

This study describes the profile of congenital heart diseases in neonates and infants referred to Paediatric Cardiology Unit, Teaching Hospital, Karapitiya

Methods

A descriptive cross-sectional study was done analyzing 400 neonates and infants referred to the pediatric cardiology unit, THK with different indications for echocardiogram from 1/6/2021 to 31/12/2021.

Results

Out of 400 infants, the majority (54.8%) were males, 72%, 16.5% and 10.5% were referred from Galle, Matara, and Hambanthota districts respectively. The median age of referral is 55 days with an interquartile range of 11.5 to 122.75 days. Of those referred with an asymptomatic murmur (n=320), 13% had significant cardiac lesions while 37.5% had small ASD and 16.3% had PFO which are hemodynamically stable. All the neonates referred urgently after birth with hemodynamic instability had significant cardiac defects.

The commonest acyanotic CHD was ASD (44%) and Cyanotic CHD was TOF (2%). Of those referred with saturation difference, 93.3% were positive for heart diseases. Out of the 74 babies born to mothers with diabetes 15 were positive for heart disease. Only 1% had antenatally detected CHD.

Conclusion

Newborns with hemodynamic concerns, saturation defects, antenatally detected heart diseases and poorly controlled chronic diabetes should be given priority over asymptomatic murmurs in postnatal cardiac evaluation in our setup.

PP9

A Rare Anatomical Variation of Renal Vasculature with the Presence of a Portosystemic Anastomosis

Samarawickrama MB^{*1}, Rodrigo PM¹, Nanayakkara PGCL¹

¹*Department of Anatomy, Faculty of Medicine, University of Ruhuna*

<Corresponding author: samaramb@gmail.com>

Background

Anatomical variations of renal vasculature are not uncommon. Abnormal venous communications and arterial branches and anastomoses are reported in literature. Knowledge of these variations are important in evaluation of renal imaging and transplant surgeries. We report a case with a rare tributary of the renal vein and an anomalous arterial branch occurring in the same kidney of a female cadaver.

Case report

We encountered anatomical variations of both renal artery and renal vein in a female cadaver during routine educational cadaveric dissections. This case was identified in a 59-year-old female cadaver during the dissection of the posterior abdominal wall. Her right renal vasculature was normal while the abnormal anatomy was observed on the left side. There was a single renal artery which gives the origin to the left ovarian artery which normally originate from the abdominal aorta. There was a single renal vein which was formed by union of two main tributaries. The larger tributary drained the upper pole and the small one drained the lower pole. These two veins communicated anterior to the renal artery. The left ovarian vein joined the inferior tributary while the superior tributary draining an abnormal vein which communicate with the left gastric vein. This communicating vein drained the supra renal vein.

Discussion

Ovarian artery originating from the renal artery is reported in 5-6% of cases. However, the communication of the left renal vein with the left gastric vein is not reported in normal people without portal hypertension. It has been reported in patients with portal hypertension as an open collateral pathway. There is no clinical evidence to suggest portal hypertension in this woman before death. Her liver function was normal before death and there was no evidence of dilated portal vein or its tributaries during dissection. Presence of such anomalous vasculature may result inadvertent bleeding during renal surgeries and misinterpretation of radiological imaging.

Conclusion

It suggests the presence of portosystemic anastomosis (PSA) between left gastric and left renal veins in addition to the textbook description sites of PSA. Knowledge of such variation is important in preventing mishaps during surgeries and misinterpretation of radiological imagines.

Keywords

Renal artery, renal vein, gonadal vessels, portal vein, left gastric artery

PP10**Knowledge, attitudes, practices and risk perception on COVID-19 among medical undergraduates in a state university in Sri Lanka during the first wave of COVID-19 pandemic**Wickramasinghe SS¹, Pathirana MD¹¹*Department of Microbiology, Faculty of Medicine, University of Ruhuna*

<Corresponding author: subodhawick@med.ruh.ac.lk>

Background

Coronavirus disease 2019 (COVID-19) pandemic has significantly affected the world population. Medical undergraduates are at a higher risk of contracting it during their clinical training as well as their contribution is necessary to combat the disease.

Objectives

This study was carried out to determine the knowledge, attitude, practices (KAP) and risk perception on COVID-19 among medical undergraduates in the Faculty of Medicine, University of Ruhuna.

Methods

A descriptive cross-sectional study was conducted among 208 medical undergraduates during the first wave of COVID-19 pandemic in August to November 2020. Data were obtained using a self-administered questionnaire and analyzed using SPSS (version 26). Chi-square and Fisher's exact tests were used to identify the associated factors at the significance level of <0.05 .

Results

The mean age of the study population was 23.1 years ($SD \pm 1.7$) and 54.8% ($n=114$) were females and 32.2% were in first-year of medical education. Among them, only 5 students had been working in a ward with COVID patients. Nearly half of them (51.2%) were afraid to get infected with COVID. Mean scores of KAP were 98.5 (95% CI 96.5-100.4), 58.2 (95%CI 55.7-60.7) and 43.2 (95%CI 38.2-48.3) respectively. Of all, 96.6% had better knowledge, 73.1% had positive attitudes whereas only 38.9% had good practices. Those who had better knowledge significantly had positive attitudes ($p=0.02$). The participants with positive attitudes significantly adhered to good practices ($p=0.000$). No significant association was found with the age, gender, year of study and working in a COVID ward.

Conclusions

The overall knowledge and attitudes regarding COVID-19 among medical undergraduates were satisfactory whereas practices towards prevention and control were not acceptable. Additional awareness and training programs are paramount to inculcate good practices among them.

Keywords

Attitude, COVID-19, knowledge, practices, risk perception

SOP1

Assessment of Postpartum bladder care on first-time mothers at Teaching Hospital Mahamodara

Dissanayaka DMSS¹, Edirisinghe DK¹, Diwyanjale WSM¹, Ediriweera TW*¹, Epa MS¹, Dasanayake DLW²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Obstetrics & Gynaecology, Faculty of Medicine, University of Ruhuna

<Corresponding author: thushed1@gmail.com>

Background

The bladder is often affected by pregnancy and childbirth, and the changes can persist several weeks or months after delivery. Postpartum bladder is an essential aspect of maternal care that can affect the health and wellbeing of the mother. Worldwide postpartum bladder care is one of the neglected aspects. Postpartum bladder dysfunction is a significant category of preventable causes of morbidity among postpartum mothers.

Objectives

This study was designed to assess postpartum bladder care in relation to maternal knowledge, their satisfaction, determine the prevalence of postpartum bladder dysfunction and association of their knowledge with selected demographic factors of first time mothers during postnatal period at Teaching Hospital Mahamodara.

Methods

A descriptive cross-sectional study was conducted among 238 first time postpartum mothers in postnatal wards of teaching hospital Mahamodara. Data was collected using structured questionnaire and interviews with participants and using bed head tickets. The descriptive data was presented as frequencies, proportions and means. Chi squared test was used to assess the association between the dependent and the independent variables.

Results

The overall proportion of bladder dysfunction among postpartum mothers during the hospital stay was 2.1% (n=5) and at 2 weeks was 0.61% (n=1). The most common symptom of bladder dysfunction was difficulty to start urination (1.26%, n=3). The educational level ($p < 0.05$) was associated with knowledge of bladder care among postpartum mothers. Majority of the mothers 76.9% (n=183) had insufficient knowledge regarding bladder care. The significant number of mothers 61.3% (n=146) were not satisfied about the bladder care given during the hospital stay.

Conclusion

The postpartum bladder dysfunction was significantly low and the frequent symptom was difficult to initiate urination among postnatal mothers. The level of knowledge on bladder care was significantly inadequate in vast majority of the mothers.

Keywords

First time mothers, proportion, postpartum, bladder dysfunction, Mahamodara

SOP2**Perceptions on COVID-19 vaccination programme among Public Health Inspectors and Nurses working in MOH Settings in Galle.**

De Silva PDVS¹, De Zoysa TSPM¹, Dewanmini SDLV*¹, Dewappriya PUSD¹, Dhanushka PAT¹, Perera B²

¹41st batch Faculty of Medicine, University of Ruhuna

² Department of Community Medicine, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka.

<Corresponding author: vinduladewanmini96@gmail.com>

Background

Public health inspectors and nurses are instrumental in making the COVID-19 vaccination programme a success. Their perceptions on the progress of COVID-19 vaccination programme in Sri Lanka is useful to improve future vaccination programs in controlling infectious disease outbreaks in the country.

Objectives

To explore perceptions of Public health inspectors and nurses on the effectiveness of COVID 19 vaccine program delivered by the government in Galle during the years 2021 -2022.

Methods

A qualitative phenomenological study was carried out among four nurses and sixteen PHIs working in 4 MOH areas in Galle. Data were analysed using thematic analytical technique. Audio-recorded interviews were thematically analysed after transcription and translation into English.

Results:

All the participants were exposed to COVID-19 vaccination program carried out in Galle during the years 2021-2022. Five themes related to their perceptions on COVID-19 vaccination program were identified. Supportive health care system, excess work load, misuse of health services by politicians, community support for the vaccine and preparation for future infection out breaks were the 5 themes identified. The participants strongly believed that the assistance given by the existing health care system in the country and the public in COVID-19 vaccination program were very impressive, and such a support had encouraged them to work hard with strong determination to control the pandemic. Unnecessary and provocative interference made by local politicians on healthcare professionals was a major threat that adversely affected the smooth functioning of the vaccination program.

Conclusions:

There is a need to develop emergency preparedness program considering the resource limitations to face future outbreaks effectively. Inter sectorial cooperation without political influence is vital in this type of outbreak vaccination program to achieve its' objectives.

Keywords:

COVID-19 vaccination program, qualitative research, Public health inspectors, Nurses, Sri Lanka

SOP 3

Preference for shared maternity care by the public and private sectors among pregnant women at Teaching Hospital Mahamodara, Galle.

Jayasooriya DASC^{*1}, Jayathissa EATM¹, Jayawardhana EAHM¹, Jayawardhana MWDYR¹,
Nishshanka PU¹, De Silva BVS²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: sumaalyachai@gmail.com>

Background

Shared maternity care, provided by the private and public health sectors in Sri Lanka is a contributive factor in maintaining optimal antenatal care. However, the Sri Lankan shared care system is not a partnership agreed upon between private and public sectors, but rather a certain right of the mother to pursue whichever care she prefers.

Objectives

The study attempted to assess the shared care provision by the private and public healthcare sectors and identify the sociodemographic, pregnancy-related, and cultural factors contributing to the preference for shared care.

Methods

A descriptive cross-sectional study was conducted among 408 pregnant mothers, aged 18-42 years, admitted for confinement in the antenatal wards of Teaching Hospital Mahamodara during the period of April - November 2022. An interviewer-administered questionnaire was employed and systematic random sampling was used for data collection.

Results

The preference for shared care was 81.6%. Maternal age ($\chi^2 = 8.521$, $p = 0.004$), education ($\chi^2 = 17.539$, $p = 0.000$), occupation ($\chi^2 = 28.661$, $p = 0.000$), monthly income ($\chi^2 = 19.553$, $p = 0.000$), having children at home ($\chi^2 = 17.790$, $p = 0.000$), primiparity ($\chi^2 = 9.329$, $p = 0.002$), early booking visit ($\chi^2 = 4.058$, $p = 0.044$), current twin pregnancy ($\chi^2 = 4.241$, $p = 0.039$) and history of subfertility ($\chi^2 = 6.070$, $p = 0.014$) were significantly associated with the preference of shared care. Chronic illness, family history of chronic illness, previous and current complicated pregnancies, and previous history of miscarriages had no association with a preference for shared care.

Conclusion

A majority of pregnant women preferred shared maternal care and the decision to opt for shared care was affected by age, education, occupation, income, parity, a twin pregnancy, subfertility history, and early booking visit.

Keywords

Shared care, antenatal care, pregnancy, preference

SOP4**Linguistic validation of Sinhala translation of International Prostate Symptom Score (IPSS) and assessment of quality of life in men with benign prostatic hyperplasia: A hospital-based study**

Vindula JMO¹, Vishmintha WV¹, Wannigama IS*¹, Wasalasooriya TWHB¹, Weerakoon AHNI¹, Goonasinghe SK², Yahathugoda TC³

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Urology, Teaching Hospital, Karapitiya

³Department of Parasitology, Faculty of Medicine, University of Ruhuna

<Corresponding author: Vindula JMO vindula10@gamil.com>

Background

Benign Prostatic Hyperplasia (BPH) is prevalent among men aged more than 60 years. BPH affects the physical, psychological and sexual aspects of the lives of men with BPH. However, an appropriate tool has not been developed to assess the severity of symptoms and quality of life (QoL) of BPH patients in Sri Lanka.

Objectives

To evaluate the quality of life of Patients with BPH who are treated and followed up in Teaching Hospital Karapitiya.

Methods

IPSS was translated into the Sinhala language using international guidelines include forward translation, produce reconciliation version, backward translation, and patient testing. The severity of LUTS was assessed using the validated IPSS. The WHOQOL-BREF Questionnaire Sinhala version, available in the Department of Physiology, Faculty of Medicine, University of Ruhuna, was used to assess the quality of life among patients with BPH.

A hospital-based comparative cross-sectional study used the IPSS and WHOQOL-BREF as interviewer-administered questionnaires. All patients registered recently in the Genito-Urinary clinic of Teaching Hospital Karapitiya with the diagnosis of BPH were enrolled.

Results

Over three months, 365 BPH patients were enrolled, with symptom severity as follows: mild (5.7%), moderate (28%) and severe (28.6%). They all were above 60 years old. Out of them, 70.6% had physically better QoL. Patients with severe IPSS (n=53) reported poor QoL in psychological domain (n=96), whereas patients with mild-moderate IPSS (n=197) had better QoL in the same domain (n=182). Most (n=239) BPH patients with a better QoL in psychology domain (n=168) reported a good sexual life, whereas patients (n=111) who reported a poor QoL in psychology domain were not satisfied with their sexual lives (n=58).

Conclusion:

Linguistically validated IPSS can be used to assess the severity of LUTS. The degree of impact of BPH on physical and psychological health depends on the severity of LUTS.

Key Words:

BPH, LUTS, IPSS, QoL, WHOQoL-Bref, sexual satisfaction

SOP 5

Screen use behavior, parental awareness of screen time recommendations, and associations of screen time with child behavior among preschool children in Galle Municipality Area

Chathurangi WJKAP¹, Dayanadee WAAVR*¹, De Alwis KVR¹, Abeynayake S¹, Bandara JMSV¹, Liyanarachchi N²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Paediatrics, Faculty of Medicine, University of Ruhuna

<Corresponding author: vidyadayanadee1998@gmail.com>

Background

Screentime is the time used on electronic devices with a screen. The screen usage of children has immensely increased due to technological advancement. Age below 5 years old is crucial in child development. A proper understanding about the impact of screen usage on children is important.

Objectives

To describe the screen use behaviour, identify the prevalence of screen overuse and parental awareness of screentime recommendations issued by the World Health Organization (WHO) and the association of screentime with child behavior among preschool children in Galle Municipality Area (GMA).

Methods

A descriptive cross-sectional study was carried out among 398 children from 10 selected preschools of GMA. A self-administered questionnaire was given to parents to determine the screen use behavior and awareness. Data entry and analysis were done using the Statistical Package for the Social Sciences (SPSS).

Results

Out of the 398 children, 47.3% have exceeded the recommended screentime by WHO which is 2 hours. The average screentime of the population was 1.61 hours. The main reason to use the screen was for entertainment followed by feeding the children and avoiding annoyance. In the study population, 57.3% of the children did not prefer screen usage over other activities. Majority, (68.1%) of the parents were not aware of the WHO recommendations for screen usage of children. There was no association between screen overusage and the psychosocial and personal behavior of the children in the population but there was an association between screen overusage and eating behavior.

Conclusion

A considerable proportion of the preschool children in the GMA were using screens more than the WHO recommended time. The majority of the parents were not aware of the WHO recommendations for screentime. There is a positive association between screen overusage and the eating behavior of children. This association has not resulted in the obesity of children. Initiatives should be taken to improve parental awareness. There is a necessity of creating national guidelines for screen usage of children.

Keywords

Screen over usage, preschool children, WHO recommendations, parental awareness

SOP 6**Prevalence of occupational exposure to blood and body fluids and its associated factors among healthcare professionals in Teaching Hospital, Karapitiya**

Wickramanayake GWSS¹, Weerasekara NK¹, Welikanna WMSM¹, Wickramasinghe WHT¹, Wickramasuriya MS¹, Wickramasinghe SS².

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Microbiology, Faculty of Medicine, University of Ruhuna

<Corresponding author: wsenuri@gmail.com>

Background

Occupational exposure to blood and body fluids (BBFs), is a significant concern for healthcare professionals, as it can transmit infections due to blood-borne pathogens such as HBV, HCV, and HIV.

Objectives

This study was carried out to determine the prevalence of occupational exposure to BBFs and its associated factors among healthcare professionals in Teaching Hospital, Karapitiya.

Methods

A descriptive cross-sectional study was conducted among 332 healthcare professionals at Teaching Hospital Karapitiya. Data regarding occupational exposure to BBFs and its related factors were collected using a self-administered questionnaire and analyzed using SPSS (version 26). Chi-square test and logistic regression were used to identify the factors associated with BBFs exposure and the significance level was obtained at a p value of < 0.05 and 95% confidence interval (CI).

Results

A total of 102 (30.7%) doctors and 230 (69.3%) nurses included in the study. The mean age of the study population was 35.7 years (SD $\pm$ 7.8) and the majority (81.6%) were females. Among them 30.4% worked in the surgical units. Of all, 73.5% (n=244) completed hepatitis B vaccination. The prevalence of occupational exposure to BBFs was 65.4% (n=217) and the commonest was needle prick injuries (55.1%). Of all, 86.7 % had good knowledge about transmission of blood borne infections while 74.8% adhered to good safety practices. The factors associated with occupational exposure to BBFs were use of gloves when handling BBFs [adjusted odds ratio (AOR) 2.63, 95% CI 1.22-5.6] and recapping needles after blood withdrawal (AOR 0.52, 95% CI 0.29 - 0.95). Following an exposure to BBFs, only 67.7% had regularly informed the hospital authorities.

Conclusion

A high prevalence of occupational exposure to BBFs among healthcare professionals was observed. Regular training programmes and adherence to safety precautions need to be encouraged to minimize the problem (p= 0.002)

Keywords

blood and body fluids, healthcare professionals, occupational exposure, Teaching Hospital Karapitiya

SPP 1

Impact of breakfast habits on health and academic performance among undergraduates of University of Ruhuna

Rathnayaka ASS¹, Rathnayaka IPWDD¹, Rathnayake RMIM¹, Rathnayake RMVS¹, Raxzana JF¹, Hettiarachchi M²

¹41st batch, Faculty of Medicine, University of Ruhuna

²Nuclear Medicine Unit, Faculty of Medicine, University of Ruhuna

<Corresponding author: ashhashikala22@gmail.com>

Background

Breakfast plays an important role in the human life as it makes them physically and mentally fit. However, the prevalence of breakfast skipping is high among Sri Lankan undergraduates and it may affect the health status and subsequently academic performances.

Objectives

This study was performed to assess the impact of breakfast habits on health and academic performances among medical and engineering undergraduates of the University of Ruhuna.

Methods

A descriptive cross-sectional study was conducted among 259 participants who were randomly recruited by multi stratified sampling technique. We assessed breakfast habits, most preferred food items, how skipping breakfast affects their health status and academic performance in the last main examination using a self-administered questionnaire. Chi square test was employed for the analysis at 5% significance interval.

Results

There were 156 (60%) participants were medical undergraduates while the remainder from the Faculty of Engineering. The response rate was 86%. There were 160 (62%) female participants. Three out of five individuals (n=162, 63%) had regular breakfast. Majority of them stayed in hostels or private boarding places (n=242, 93%) while the others stayed at home (day-scholars). Almost all the day-scholars (94%) consumed breakfast regularly. Among the participants, 50% of participants who had regular breakfast with rice followed by short eats (19%). Anaemia, gastritis and migraine were the most complained diseases among breakfast skippers. Reduced ability to concentrate (n=152, 59%) and reduction of ability to stay awake (n=183, 70%) in lectures or clinical training after skipping breakfast were the main complaints. Twenty percent of undergraduates who skipped breakfast got referred in the last main examination while the referred rate among regular breakfast intakes was 9%. There was a significant association between gastritis and skipping breakfast (p=0.01).

Conclusion

Breakfast habits were varying between day-scholars and hostellers or those who are staying in boarding places. Male undergraduates skip breakfast more frequently than female undergraduates. Undergraduates who consume the breakfast regularly are more likely to have good academic performance.

Keywords

Breakfast habits, accommodation, health status, academic performance

SPP2**Nutritional status among children in 6-59 months of age with congenital heart diseases attending to the paediatric cardiology clinic, Teaching Hospital, Karapitiya.**

Nawarathna NVC^{*1}, Muthugala MRSG¹, Munasinghe MARL¹, Nadeeshani KR¹, Nanayakkara NHWE¹, Kankanararachchi I²

¹41st batch, Faculty of Medicine, University of Ruhuna

²Department of Paediatrics, Faculty of Medicine, University of Ruhuna

<Corresponding author: vimodnawarathna@gmail.com>

Background

Childhood is a crucial period of growth and development. Children with congenital heart diseases are more vulnerable population to malnutrition. So, their nutritional assessment is critical and optimum nutrition is essential for the speedy recovery following the surgical interventions.

Objectives

To describe the nutritional status, dietary practices and associated factors among children aged 6-59 months with congenital heart disease attending the paediatric clinic, Teaching Hospital, Karapitiya.

Methods

A descriptive, cross-sectional study was conducted among a convenient sample of 135 children in 6-59 months of age with congenital heart diseases, attending the paediatric cardiology clinic, Teaching Hospital, Karapitiya. An interviewer administered questionnaire was used to collect data.

Results

Majority of the sample were malnourished (n=84, 62.22%). Among them, the majority were underweight (37.8%). General prevalence of underweight, wasting, stunting and severe wasting were 37.8%, 30.4%, 15.6% and 16.3% respectively. Chi square values for the associations between operative status and wasting ($X^2 = 4.726$, $df = 1$, $p = 0.03$), operative status and severe wasting ($X^2 = 10.202$, $df = 1$, $p = 0.01$) and operative status and underweight ($X^2 = 7.636$, $df = 1$, $p = 0.006$) were statistically significant, indicating a higher prevalence of malnutrition (underweight, stunting and wasting) among the preoperative group than the postoperative group.

Conclusion

The study showed association between operative status and the malnutrition. This reveals the medical interventions for correction of congenital heart diseases have positive impact on nutritional status of these children.

Keywords

Congenital heart diseases, nutritional status, children in 6-59 months of age

SPP3

Occupation -Related Health Issues Among Fishermen in Hikkaduwa Fisheries Harbour

Sasinga WPM¹, Sasna MJF¹, Sandupama KHY^{1*}, Sashindra KT¹, Seedeve RB¹, Ruban J²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Parasitology, Faculty of Medicine, University of Ruhuna

<Corresponding author: yahanisandupama3@gmail.com>

Background

Fishers are a relatively unexplored group population in Sri Lanka. However, there is positive research evidence for Occupation Related Health Issues (ORHI) in other parts of the world. Therefore, this research study aimed to explore ORHI in fishers in Southern Sri Lanka.

Objectives

To assess the Occupation related health issues among fishermen in the Hikkaduwa fisheries harbor.

Materials and methods

A descriptive cross-sectional study was conducted among a convenient sample of 244 fishermen in Hikkaduwa fisheries harbor using an administrator-guided self-administered questionnaire. The questionnaire mainly consisted of questions on demographic data, injuries, non-communicable diseases, four questions related to perceived psychosocial burden, injuries due to oceanic animals and medical seeking patterns. The data were analyzed using statistical software.

Results

Most fishermen were 40-50 years old and married. 76% of fishers had experienced injury or multiple injuries. The main complaints were vision impairment (77.9%) and back pain (65.2%): Others were sunburns, cuts, smoke inhalations, dehydration, and jellyfish contacts. Most injured individuals have sought western medicine, others self-treatment and local remedies, and a few have taken Ayurveda treatment. Fishermen wearing safety clothes has indicated a significantly low risk of injuries when comparing with fishermen who do not wear safety clothes. (with $\alpha = .05$), χ^2 (N=245) = 28.7, $p < .001$ with medium effect = .34 Ø. Moreover, fishermen indicated high Psychosocial burden (16.7%) and moderate Psychosocial burden (65.3%).

Conclusion and Recommendations

A high incidence of visual impairment has to be reasoned out and intervened with contrasting age-related causes. Since back pain is higher than the normal population level according to published data, it is worth exploring the causes. Enforcing safety instructions and education is recommended. Regular medical examinations of fishermen would help to manage other chronic medical conditions. Further validation of Psychosocial burden with a validated tool is also recommended.

Keywords

Fishermen, Health Issues, Hikkaduwa, Injuries, Harbour

SPP4**Clinical profile and risk factors for lower limb cellulitis among patients admitted to Teaching Hospital Karapitiya(THK)**

De Silva ASC¹, De Silva HAU^{1*}, De Silva HPC¹, De Silva KSD¹, De Silva MPHP¹, Liyanage PLAN²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: ashaniudeshikadesilva@gmail.com>

Background

Cellulitis is a common superficial skin infection mostly affecting the lower limbs with significant morbidity which could even lead to limb loss. Data on risk factors for lower limb cellulitis (LLC) in the local setting is sparse. Identification of risk factors is imperative to prevent LLC thereby reducing the health care burden.

Objectives

To evaluate clinical profile and risk factors for LLC among patients admitted to Teaching Hospital, Karapitiya (THK).

Methods

A case-control study was conducted among the hospitalized, consenting patients who were aged more than 18 years of age with a clinical diagnosis of LLC as cases and patients with acute illness other than cellulitis as controls. Each patient with cellulitis was paired to age and gender-matched control patients with a ratio of 1:2. Patients under intensive care, severely debilitated patients were excluded. All patients were interviewed using an interviewer based questionnaire and examined for risk factors for LLC. Data were analyzed using the statistical package for the social sciences (SPSS).

Results

There were 55 patients with LLC and 110 patients as control group. The mean (SD) age of patients with LLC was 58 (10.8) years and 54.5% were males. First episode of LLC was reported by 51% and the median (IQR) recurrence rate was 2(4-6). Presence of corns and calluses of foot (OR=8.4 (3.1-22.8); p<0.05), varicose veins (OR=6.6 (2.8-15.5); p<0.05), toe nail dystrophy (OR=4.8 (1.7-13.7); p<0.05) and toe web intertrigo (OR=2.7 (1.2-5.7); p<0.05) were significant local risk factors. In the history, previous episodes of LLC (OR=46.9 (16.1-136.0); p<0.05), leg ulcers (OR=3.6 (1.7-7.8); p<0.05) and lower limb surgery (OR=2.6 (1.2-5.3); p<0.05) were significant.

Conclusion

Presence of local factors disrupting the skin barrier and recurrent cellulitis attacks were found as major risk factors for the development of LLC. Health education on foot hygiene practices, early identification and treatment of risk factors will reduce the health care burden and morbidity associated with LLC.

Keywords

cellulitis, clinical profile, risk factors

SPP5

Prevalence of occupational stress and associated factors among doctors in Teaching Hospitals in Galle district

Perera UNN^{*1}, Perera KDKG¹, Perera KHN¹, Perera HNT¹, Perera GTPM¹, De Silva PV¹

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: nipunaperera123@gmail.com>

Background

Occupational stress is a progressing stress which occur due to the responsibilities, conditions, environment or other pressure of the workplace. The severity of the occupational stress depends on the individual employee, their role and the company culture. Health sector is one of an identified stressful occupation. The Doctors, Nurses and other staff members in hospitals may have face for stressful moments during their occupational period. The medical practice is not only characterized by an immense level of personal and professional fulfilment, but also with a lots of work anxiety and psychological distress.

Objective

To assess the prevalence of occupational stress and associated factors among doctors of teaching hospitals in Galle district.

Methods

Two Hundred five doctors were recruited in Teaching Hospital Karapitiya and Maternal hospital Mahamodara during two months period of study from 02nd of July to the end of August. Data collection was done by providing a content related validated questionnaire to measure work stress. This questionnaire includes associated factors like gender, age, marital status, religion, designation, working station, working experience, working hours, frequency of night shifts, and engagement of private practice. In our research we categorized the stress level into 3 stages as too low stress, safe level stress and too high stress. Data entry and analysis was done using Statistical package for social sciences (SPSS) program, version 20.0.

Results

Out of the 205 doctors, 98 (47.8%) doctors had too little stress. 102 (49.8%) doctors were in the safe level of stress and the rest of the doctors which was 5 (2.4%) were in the high level of stress range. There are statistically significant associations with occupational stress and age, gender, living place, having major life events with a negative impact, designation, having children, less work experience and frequency of night shifts. Indicated p value is 0.05.

Conclusion

Majority of the doctors which is 49.8% are in the safe level of stress.

Key words

Occupational stress, associated factors, doctors, Teaching hospital, Galle district

SPP6**Adherence to the medication regimen among patients with rheumatoid arthritis attending rheumatology clinics of Teaching hospital Karapitiya (THK)**

Abeyrathna HMRDB^{1*}, Adikari AMNG¹, Abeygunawardhana WHS¹,
 Abeysirigunawardhana NH¹, Aiyapperuma AHMRS¹, Liyanage GC²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Pharmacology, Faculty of Medicine, University of Ruhuna

<Corresponding author: ruwan2054831@gmail.com>

Background

Rheumatoid arthritis (RA) is a chronic inflammatory disease which leads to reduced life expectancy. Poor adherence to drug regimens remains a significant barrier to improve clinical and treatment outcomes in RA.

Objectives

To assess the prevalence of adherence to the medication regimen, the prevalence of alternative medication seeking behaviour and to determine the factors affecting the degree of adherence to the medication regimen among patients with RA attending rheumatology clinics of Teaching hospital Karapitiya (THK).

Methods

Descriptive cross-sectional study was conducted among 206 patients with RA using consecutive sampling based on convenience. The Sinhala version of validated Morisky Green Levine medication adherence scale questionnaire was used to determine the degree of adherence to medication regimen. Data entry and analysis was done using Statistical package of social sciences (SPSS) programme. Associated factors were assessed using chi square test.

Results

Among 206 patients attending rheumatology clinics of THK good, medium and low adherence to medication regimen showed in 59.2%, 34% and 6.8% respectively. Adherence to the medication regimen among patients with RA was associated with the duration of the disease ($\chi^2 = 17.57$, $P = 0.001$). None of the other socio-demographic factors were associated with medication adherence. Feeling uncomfortable, increase frequency, difficulty in taking medicine, thought of having side effects were associated with drug adherence. The prevalence of alternative seeking behaviour of the patients with RA attending rheumatology clinics of THK was 28.1%. Behaviour of seeking alternative medicine was associated with adherence to medication regimen ($\chi^2 = 7.82$, $P = 0.020$).

Conclusion

Prevalence of good adherence to the medication regimen among patients with RA attending rheumatology clinics of THK is much higher compared to the worldwide prevalence of adherence. Optimal achievement of appropriate levels of adherence is important to gain the maximum benefit of the medication regimen through tailored multifaceted interventions.

Keywords

Rheumatoid arthritis, drug regimen, adherence, association, prevalence

SPP7

Home-environmental risk factors for childhood asthma among the children receiving at paediatric care at Teaching Hospital Karapitiya, A case control study

Gamage RL^{*1}, Gamage DSH¹, Gamage KY¹, Gayara PMHA¹, Gallage PGAS¹, Darshana ILAN²

¹41st Batch, Faculty of Medicine, University of Ruhuna

² Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: rakindulakwin1998@gmail.com>

Background

Childhood asthma is a major public health problem causing significant morbidity among children. Home-environmental risk factors are considered as one of main preventable causes triggering childhood asthma.

Objectives

To assess home-environmental risk factors for childhood asthma among children who arrived at paediatric care at Teaching Hospital Karapitiya. (THK).

Methods

Hospital based case control study was conducted among 142 children (case: control is 1:1) attending for paediatric care at THK. Children who managed as asthma during the study period was defined as a case. Children attending for paediatric care at THK but not having any respiratory illness were defined as a control. Data was collected using an interviewer administered questionnaires. Odd ratio (OR) with 95% CI were used to identify household activities related (Firewood burning, burning incense sticks inside houses, Usage of Hair sprays, Usage of body spray), household hygiene related (Uncleanness of floor, Dusty condition of roof and walls, uncleanness of bed covers & pillow covers) and behaviour related (Smoking inside the house, raising indoor pets with furs, occupations at home which leads to indoor air pollution) risk factors.

Results

A majority of children had permanent residence and only 9.9% of the sample live in temporary residence. Hygiene of bed linen (OR=3.34, CI=1.59 - 7.00) and cloths (OR=2.19, CI=1.82- 2.64), having domestic pets with fur (OR= 3.39, CI=1.65 -6.96), sharing bed with pets (OR= 5.55, CI=1.949-15.8), presence of construction site near to residence (OR=3.8, CI=1.55- 9.28), use of incense sticks (OR=4.59, CI=0.20- 1.01) and mosquito repellent coils (OR =2.85, CI=1.43- 5.62) inside home and playing with sand (OR 3.68, CI=1.686- 8.056) and with fur baring animals (OR=8.59, CI=3.285- 22.463) were identified as risk factors while having good household ventilation system (OR= 0.215, CI=0.04 - 1.05) was identified as a protective factor (OR= 0.215, CI=0.04 - 1.05).

Conclusion

Home-environmental risk factors for childhood asthma is common among study sample. Study recommended to aware parents to ensure safe home-environment to avoid triggers for bronchial asthma.

Keywords

Home-environmental, risk factors, childhood asthma

SPP8**Patterns, causes and factors associated with injuries due to accidents among the elderly population admitted to Emergency Treatment Unit of Teaching Hospital Karapitiya**

Amarasekare ALAPR^{1*}, Alagiyawanna AMSV¹, Amandi WO¹, Amarasinghe NPA¹, Ambalakanda ASD¹, Warushahennadi J²

¹41st Batch, Faculty of Medicine, University of Ruhuna

² Department of Forensic medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: pramodaanarasekara@gmail.com>

Background

The World Health Organization defines accidents as an event independent of human will, caused by an outside force, acting rapidly resulting in bodily or mental injury. Accidents play a major role in morbidity and mortality among the elderly population. Current world is experiencing a development in the proportion and size of the elderly population which will also increase the proportion of accidents among them. This increases the health care expenditure and produces a negative impact on country's economy as well as the family's economy. Long term hospitalization, economical loss can affect a person's mental health as well. Ultimately it can affect the person's quality of life. Due to the increase in the older population, this group deserves serious concern and should be given priority by public health providers as far as injury prevention, medical care of injuries and rehabilitation are concerned.

Objectives

This study was carried out to determine the patterns, causes and factors associated with injuries due to accidents, to obtain an overview of different categories of injuries, to identify circumstances and consequences of injuries in the home environment among the elderly population admitted to Emergency Treatment Unit of Teaching Hospital Karapitiya.

Methods

A descriptive cross-sectional study was conducted among elderly population (above 60 years old) attending to Emergency Treatment Unit of Teaching Hospital Karapitiya. Unconscious patients, patients who cannot communicate or who have no family member available to collect reliable information were excluded. A sample of 218 was included for the study. The study sample was interviewed by investigators according to the questionnaire. Data were collected after obtaining a written informed consent. Data was analyzed using SPSS software version 25.

Results

The most common accident type reported was falls (n=141, 64.7%) followed by injuries due to RTAs (n=50, 22.9%) and assaults (n=9, 4%). High prevalence in accidents among males (n=123, 56.4%) was observed compared to females (n=95, 43.6%). Most of the accidents were reported in the 60-69 (n=96, 44.1%) age group while lowest accidents were reported in the age group 80-89 (n=48, 22%). In the sample majority of victims were unemployed. Most of the victims were living with their children (n=150, 68.8%). Most of the accidents due to falls had happened during the morning while RTAs had happened in the evening. There were significant associations among vision impairment, hearing impairment, nutritional status, memory impairment and physical disabilities with injuries due to accidents. They were identified as risk factors. Some patients were suffering from multiple risk factors.

Conclusion

The study identified common patterns, causes and associations for injuries due to accidents among elderly. To minimize accidents among elderly, programs to increase the awareness about accidents and screening programs to detect the risk factors can be conducted among elderly population.

Keywords

Patterns, causes, injury, elderly, falls

SPP9

Quality of life and coping practices of patients with Chronic Kidney Disease attending Teaching Hospital, Karapitiya

Ariyasena MAAD*¹, Ariyarathna DKMD¹, Athukorala WAADSD¹, Bandara MBMHN¹, Bandara SVS¹, Wijesinghe CJ²

¹ 41st Batch, Faculty of Medicine, University of Ruhuna

² Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: ayanka97@gmail.com>

Background

Chronic Kidney Disease (CKD) is a disease of high prevalence all over the world, which has a significant impact on Quality of Life (QOL) of affected individuals. Patients with CKD rely on different coping strategies and support mechanisms to improve their QOL.

Objectives

This study aims to assess the QOL of patients with CKD attending Teaching Hospital, Karapitiya (THK), in relation to socio-demographic factors, coping practices and availability of support.

Methods

A cross-sectional study was conducted among 225 patients with CKD attending the Nephrology clinic of THK. Validated Sinhala versions of Kidney Disease Quality of Life-Short Form (KDQOL-SF™) and Brief-COPE questionnaires were used to assess QOL and coping practices. An interviewer-administered questionnaire was used to collect data on socio-demographic characteristics and the availability of support. Data were analysed using SPSS software.

Results

Majority of the patients were males (59.6%), aged above 60 years (60%). Overall QOL was low (Mean=149.75, SD=46.10) and 50.6% scored below the cut-off for satisfactory QOL. A high coping score (adaptive: mean=34.7, SD=6.1, maladaptive: mean=29.8, SD=6.0) and a satisfactory level of physical (84.7%), psychological (88%) and social (88.3%) support was observed in this sample, however, financial support was not satisfactory in a majority (58.2%). Associations of QOL with socio-demographic factors, coping practices and level of support were not statistically significant.

Conclusion

The overall QOL was low among patients with CKD despite having high level of adaptive coping and psycho-social support. Financial assistance is recommended to support patients in need. Further research is required to explore the reasons for low QOL.

Keywords

Quality of life, chronic kidney disease, coping, social support, Sri Lanka

SPP 10**Utilization of contraceptives among women of reproductive age in Bope-Poddala Medical Officer of Health area**

Fernando WMS^{*1}, Fernando WAM¹, Fernando MBSS¹, Firosa SL¹, Gamaarachchi TN¹, Kumarathunga RSD¹, De Silva BVS²

¹ 41st Batch, faculty of Medicine, University of Ruhuna

² Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: meleshafernando@gmail.com>

Background

Family planning is the practice that helps individuals or couples to avoid unwanted pregnancies, regulate the interval between pregnancies, and control the time at which births occur in relation to the age of the mother. Thus, it helps to prevent maternal morbidities and mortalities.

Objective

The study was carried out to assess the utilization of contraceptives and the sociocultural factors affecting the utilization of contraceptives among women of reproductive age in the Bope-Poddala MOH area.

Methods

A community-based study was conducted with 374 women aged 25-49 years, of reproductive age in Bope-Poddala, MOH area. Interviewer-administered and self-administered questionnaires were used and the study instrument consisted of questions related to the use of contraceptives, sociodemographic, and cultural factors affecting the utilization and the sources of knowledge on contraceptives.

Results

Contraceptive usage was 72.9% among the women and the majority were using oral contraceptive pills (28.6%). The prevalence of long-acting reversible contraceptive methods usage was 30.1%. The age ($\chi^2 = 14.303$, $p = 0.000$), marital status ($\chi^2 = 35.906$, $p = 0.000$), partner support ($\chi^2 = 125.69$, $p = 0.000$), partner's employment status ($\chi^2 = 21.232$, $p = 0.000$) and having at least one child ($\chi^2 = 20.788$, $p = 0.000$), were significantly associated with utilization of contraceptives in the study population. Educational level and monthly income were not associated with the use of contraceptives. The Public Health Midwife (PHM) was accessed by 73.1% for information on contraception.

Conclusion

The prevalence of utilization of contraception in the Bope-Podalla area was higher than the national prevalence. Age, marital status, support from the partner & partner employment, and having children contribute to the decision to use contraception, and PHMs were the main source of information. Thus, it is important to train PHMs to provide information comprehensively for clients to make an informed decision on contraception.

Keywords

Contraceptives, reproductive-age, Galle, contraceptive prevalence

SPP11

Types of chronic wounds, their complications and related socioeconomical problems among patients attending to medical and surgical units in Teaching Hospital Karapitiya (THK)

Tilakaratne SR¹, Thathsarani YKGP¹, Thennakoon TMS¹, Udugama UGPN¹, Umar SA¹, Kulathunga PARI^{2*}

¹ 41st Batch, Faculty of Medicine, University of Ruhuna

² Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: ruwanthikulathunga1993@med.ruh.ac.lk>

Background

Chronic wounds (> 4 weeks) impose a significant burden on the healthcare system.

Objectives

This study was aimed to assess types of chronic wounds, their complications, related socioeconomical problems and the preference for limb amputation as a treatment option among the patients of surgical and medical units in THK.

Methods

A descriptive cross-sectional study was conducted among 350 patients at medical and surgical units in THK using self- developed, pre-tested, interviewer administered questionnaires.

Results

Mean age of the patients was 58 years. Majority (56%) were males. Commonest type of wounds was diabetic ulcers (39.1%). Majority (76.57%) of the wounds were complicated. Cellulitis was the commonest complication (47.1%). Pain was the commonest complain (82.3%). There was statistically significant association between the presence of wound complications and gender ($p=0.005$). There was no significant association between wound complications with age ($p=0.380$) and level of education ($p=0.740$). Over 60% of the participants were willing to undergo limb amputation as a treatment option. Majority (44.9%) of the patients refused limb amputation due to fear of being dependent on someone for their daily activities. A logistic regression was performed to ascertain the effects of age, gender, presence of complications and having pain on choosing limb amputation as a treatment option. The logistic regression model was statistically significant, $\chi^2(4) = 27.402, p < .0005$. The model explained 3.4% (Nagelkerke R^2) of the variance in choosing limb amputation and correctly classified 61.4% of cases. Females were 1.6 times more likely to choose limb amputation than males. Age, presence of complications and having pain have no significance on choosing limb amputation as a treatment option.

Conclusion

Gender of the patient is associated with the presence of complications and choosing limb amputation as a treatment option. Interventions are needed to alleviate the fear among patients towards amputation.

Keywords

amputation, chronic wound, Diabetes mellitus, Sri Lanka

SPP 12**Quality of life among patients with asthma aged between 10-14 years attending Teaching Hospital Karapitiya**

Wijenayake JDS^{*1}, Wickramasuriya PSM¹, Wijepala WDW¹, Wijerathna BARP¹, Wijesinghe WMDK¹, Jayawardana P²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Pediatrics, Faculty of Medicine, University of Ruhuna

<Corresponding author: Donsamwen@gmail.com>

Background

Asthma is the most prevalent chronic disease in the pediatric age group. It influences physical, emotional and social wellbeing of the child affecting the quality of life of the children affected. Thus in recent years more focus has been on the quality of life (QOL) in these patients rather than the duration of these illness.

Objectives

To assess the QOL among patients with asthma aged between age 10-14 years who admit to pediatric wards and visiting pediatric clinics at Teaching Hospital Karapitiya (THK) and asthma clinic at Faculty of Medicine, University of Ruhuna (FOM/UOR).

Methods

A cross-sectional study was conducted among all patients with asthma between 10-14 years of age who admitted to the pediatric wards at THK and attended to the asthma clinic at the FOM/UOR. Quality of life was assessed according to the Goteborg Quality of Life instrument under the 3 parameters; physical wellbeing, mental wellbeing and social wellbeing. Chi square test was used to determine the associations of QOL at 5% significance level. Common symptoms were assessed using a symptom scale.

Results

Out of 264 respondents, 187 (70.8%) were males and 77 (29.1%) were females. On evaluation of physical wellbeing, mental wellbeing and social wellbeing, 53% had a good mental health, 69.7% had a poor physical wellbeing and 66.7% had a poor social wellbeing. There was no effect on mental wellbeing of pediatric asthma patients due to asthma. However there was great influence on social and physical aspects of asthma pediatric patients. Association between gender and QOL was not significant ($p=0.543$). There was a significant association with parent's income ($p=0.000$) and parents' education ($p=0.000$) with a negative impact on QOL of pediatric asthma patients. Sleeping disturbances, shortness of breath, coughing, loss of appetite and loss of weight, dizziness, impaired concentration, restlessness and back pain were the common symptoms. There is a significant effect on school absenteeism. There was poor QOL among pediatric asthma patients (72.7%) due to asthma.

Conclusion

Subjects with clinically verified asthma had a lower health related QOL with a higher prevalence of respiratory and non-respiratory symptoms and lower scores on the wellbeing scales.

Keywords

Asthma, children, pediatrics, health related quality of life

SPP13

Prevalence and factors associated with pruritus among pregnant women attending antenatal clinic at Teaching Hospital Mahamodara

Romini HAU¹, Vidyarathna NVLC^{1*}, Umayangana KDSK¹, Uthpala OVE¹, Liyanage PLAN²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding author: lakshithachandee97@gmail.com>

Background

Although the pruritus during pregnancy may lead to poor quality of life, still it has not been evaluated adequately in local setting.

Objectives

The aim of this study was to determine prevalence, severity, quality of life and factors associated with pruritus among pregnant women attending to antenatal clinic at Teaching Hospital Mahamodara.

Methods

A cross sectional study was conducted among pregnant women attending to the antenatal clinic at Teaching Hospital Mahamodara, recruiting every other pregnant woman according to the registration book which was maintained at the clinic until the total sample of 275 were obtained. Sociodemographic data were obtained through interviewer administered questionnaire. Both severity of pruritus and quality of life data were obtained through self-administered questionnaire. Severity of itch was assessed using 10 points visual analog scale and quality of life was assessed by Sinhala validated Dermatology Life Quality Index questionnaire.

Results

Of 275, mean (SD) age was 29 (6) years. Among participants, majority were Sinhalese (88%). Most of them studied up to secondary educational level (81%) and belong to lower social class (56%). Their median (IQR) parity was 2 (1-3). Majority belong to third trimester (54%) and 96% of them have singleton pregnancies. The prevalence of the pruritus was 21.5% and median (IQR) severity was 3 (2-4). The quality-of-life was affected in 63% and median (IQR) was 3 (1-6). Presence of pruritus was associated with ethnicity other than Sinhalese (X^2 3.64, df 1, p 0.022), lower social class (X^2 3.19, df 1, p 0.046) and trimester (X^2 1.51, df 1, p 0.036).

Conclusion

Although the pruritus during pregnancy is rated at a low severity and mild impairment on their quality of life, detailed evaluation of possible causes and gravity of pruritus needs to be further evaluated.

Keywords

Prevalence, pruritus, factors associated, pregnancy, Sri Lanka

SPP 14**Knowledge and Compliance to Warfarin Therapy among patients treated and followed up at hematology clinic Teaching Hospital Karapitiya**

Samarajeewa RSN¹, Ruwanpura SWDN¹, Ruwandika KLGS¹, Sandamali TPGP¹, Rimla NMRF¹, Ponnampuruma T²

¹41st Batch, Faculty of Medicine, University of Ruhuna

² Department of Community Medicine, Faculty of Medicine, University of Ruhuna

<Corresponding Author: shineynayanathara@gmail.com>

Background

Warfarin is a commonly prescribed oral anticoagulant drug with narrow therapeutic index and many complications. Therefore, it requires close monitoring and adequate patient education when used in the outpatient setting and on long term basis.

Objectives

Assess the knowledge and compliance to warfarin therapy among patients treated and followed up at hematology clinic at Teaching Hospital Karapitiya.

Methods

A descriptive cross-sectional study was conducted among 427 patients, who are treated and followed up at hematology clinic at Teaching Hospital Karapitiya. All the patients who attend to the hematology clinic, who are on Warfarin therapy on the day of data collection were selected using convenience sampling method until the required sample size is achieved. The study used a self-administered questionnaire which measures knowledge, life style modifications and compliance to warfarin therapy. Compliance of the medication was assessed using the Morisky Medication Adherence Scale.

Results

In the sample 69% had good Knowledge about the warfarin therapy and 45% had good compliance to treatment. A majority of the participants 64% had modified their lifestyle correctly for the warfarin therapy. Knowledge was related to young age ($\chi^2=20.247$, $p < 0.001$) and level of education ($\chi^2=13.418$, $p = 0.004$) but not with gender ($t=-0.870$, $p=0.38$) and employment status ($\chi^2=2.051$, $p=0.152$). Compliance was associated with employment status ($\chi^2=28.210$, $p=0.001$) but not with level of education ($\chi^2=6.053$, $p=0.109$). Patient's compliance showed strong positive significant correlation with knowledge ($r=0.221$, $p=0.000$).

Conclusion

Knowledge and compliance to the warfarin therapy among patients are not adequate. Compliance correlate with knowledge and therefore increasing knowledge on warfarin therapy would increase compliance of the patient. Education on therapy should be given to all but special attention should be paid to older patients.

Keywords

Warfarin, knowledge, compliance, life-style modifications

SPP15

Dietary habits and related factors associated with growth parameters of children aged less than five years

Ranaweera RASP^{*1}, Rajarathna NASP¹, Ranasinghe KDT¹, Ranaweera SU¹, Randima MKN¹, Rathnayake H²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Biochemistry, Faculty of Medicine, University of Ruhuna

<Correspondence: raspranaweera@gmail.com>

Background

Dietary habits and socio-economic status is the foundation for the holistic growth in children.

Objectives

This study was conducted to assess the association of dietary habits and related factors with growth parameters of children aged less than five years in Bope-Poddala MOH area.

Methods

A cross-sectional study was carried out at the child welfare clinics of Bope-Poddala MOH area. Consecutive sampling was done to collect data. An interviewer-administered questionnaire was used to collect data on socio economic and dietary habits. Child health development records (CHDR) were used to collect data on growth parameters such as weight for age (W/A), height or length for age (H/A or L/A) and weight for height or length (W/H or W/L). Descriptive statistics and Chi-square test were used to analyse the data.

Results

The majority of the mothers were Sinhalese (n=332, 91.46%) and the majority were educated up to G.C.E. O/L (n=205, 56.47%). In the exclusive breastfeeding group (n=114), 89% had satisfactory W/A (above -2SD), 85% had satisfactory H/A or L/A and 81% had satisfactory W/H or W/L. Monthly income was significantly associated with W/A (p=0.03) while the level of education was significantly associated with W/H or W/L (p=0.02). In complementary feeding group (n=159), 88% had a satisfactory W/A (above -2SD) and 91% had satisfactory W/H. Monthly income and level of education were not significantly associated with growth parameters. Intake of non-vegetarian diet was significantly associated with W/A (p=0.03) and W/H or W/L (p=0.04). In adult-diet group (n=90), 64.4% had satisfactory W/A (above -2SD), 73% had satisfactory H/A and 81% had satisfactory W/H. Monthly income and the level of education were significantly associated with H/A or L/A (p=0.04) while the dietary habits and other nutritional parameters were not significantly associated with growth parameters.

Conclusion

Majority of children aged less than five years in this study group has satisfactory level of growth. Knowledge in meal preparation and its components among mothers should be improved.

Keywords

Dietary habits, growth parameters, children aged less than 5 years, Bope-Poddala MOH area

SPP 16**Knowledge and Practices on Menstrual Hygiene Management Among Female Undergraduates of University of Ruhuna**

Premchandra JSM^{*1}, Punchihewa NT¹, Primali KGN¹, Rajapaksha MSM¹, Lenora RSJ²

¹41st Batch, Faculty of Medicine, University of Ruhuna

²Department of Physiology, Faculty of Medicine, University of Ruhuna

<Correspondence: shashithamaduhasa@gmail .com>

Background

Knowledge of menstrual hygiene management is very important for good menstrual hygiene practices, and it helps to prevent chronic or recurrent infections of the genitourinary system and other complications such as pelvic inflammatory diseases. It also plays a major role in health related social issues of the female community. Indirectly good menstrual hygiene practices could contribute to safer pregnancy and less risk of fetal loss. There is no research evidence on the knowledge and practices on menstrual hygiene of university undergraduates of Sri Lanka.

Objectives

To assess Knowledge and practices on menstrual hygiene management among female undergraduates of University of Ruhuna

Methods

Descriptive cross sectional study was conducted among 270 female undergraduates from three faculties of University of Ruhuna (Faculty of Science, Engineering and Humanities and Social sciences). Data were collected using a self-administered questionnaire as a Google form. The questionnaire consisted of socio-demographic data, knowledge on menstruation among participants and menstrual hygiene practices of participants.

Results

Out of the total sample of 270, majority were students from the Faculty of Science (n=270) and were studying in the 4th year. Age range of the sample was 10 years. 66.3% had a good knowledge on menstruation. There was an association between knowledge on menstruation and Faculty of study ($p < 0.001$). There was no association between practices of menstrual hygiene management and Faculty of study ($p = 0.463$). There is an association between knowledge on menstruation and practices of menstrual hygiene management ($p < 0.000$) There is an association between menstrual hygiene and presence of health care professional in the family ($p < 0.031$).

Conclusion

Most of the female undergraduates have a good knowledge on menstruation and good menstrual hygiene practices.

Keywords

Knowledge on menstruation, menstrual hygiene management, practices on menstruation



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