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## **General Information**

'CURATIO' is a peer-reviewed students' journal which is named on a term of latin origin which translates to cure, care and treatment which are fundamental principles in the field of medicine, published by the Faculty of Medical Sciences, University of Sri Jayewardenepura (FMS, USJ).

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## *Cover Pager*: Chanduni Nallaperuma (Student-30<sup>th</sup> Batch, FMS, USJ)

Cover story: Medicine undoubtedly goes hand in hand with research. It is sensible to explore on how research initially commences at basics filling into applied sciences. Medicine has not yet been fully comprehended leaving blanks in between which research would fill in. The human mind that kindles at the medical faculty keenly intends to look into the greater world beyond.

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## Honorary Editorial

Medical education and training have transformed from times of rote learning to problem-based learning. Ability to gather information, critically analyse them and apply such information to given situations, be it to present a basic science theory or to solve a clinical problem constitute the process of training medical students in the present era. In this process, the ability to put the pen to paper and present an idea with clarity is an important art to learn for both students and academics. This is learnt with repeated practice of writing which undoubtedly helps the understanding of the science and the art of medical practice and the ability to articulate ideas with clarity.

A clear understanding of the basic research methodology from the stage of learning to write clinical case reports, proceeding to conduct and publish more elaborate scientific research to conduct double-blind control clinical trials and systematic reviews would be the expectation of the research competence of a quality clinician who will eventually develop the excellence in clinical practice with evidence-based approach. The an same approach is true for research competence basic of science academics. Communication skills. empathic approach, and commitment to the care of patients are also the most important attributes to be learned by medical students who would leave the faculty armed with clinical, procedural and research skills, the ability to articulate concepts and ideas and place it on a paper with clarity and an empathic approach and genuine commitment to the care of patients. Such students would fit into any global competition.

I am therefore pleased to contribute to the inaugural edition of the new Medical Journal of the Faculty of Medical Sciences. This Journal is expected to stimulate the students and staff to advance their clinical and basic science research by providing a quality platform for the submission of their work.

I congratulate the Dean and the academic staff of the faculty for initiating the long-awaited Journal of the Faculty of Medical Sciences of the University of Sri Jayewardenepura.

#### Mohan de Silva.

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## Leading Article

# Physician, the finest flower of civilisation

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## Of flowers and physicians

The Scottish poet and essayist Robert Louise Stevenson penned the following: 'There are men and classes of men that stand above the common herd... The physician is the finest flower of civilisation'. A flower can be as a sweet smelling rose which is intricate and a thing of beauty: an eternal joy. A flower could also be a pungent *Rafflesia*, the largest flower in the world that emanates an odour equal to a dying corpse.

Such is the varied behaviour of doctors. There are countless hosts of doctors who demonstrate selfless service. Carlo Urbani was a doctor who fought the battle against SARS in the epicentre. He sacrificed his life in Hanoi while investigating and 'unknown managing the then contagious disease' by 'staying close to victims'. Salk who discovered the oral polio vaccine did not patent it but made it widely available globally to combat the dreaded disease which affected children. In contrast, there have been individuals who have caused much harm to humanity. Harold Shipman is considered a prolific serial killer by murdering patients with unlawful administration of diamorphine. The scientists who were interrogated in the Nuremberg

Trials and the Tuskegee trials committed crimes against humanity in the spirit of advancement of science.

## The role of a doctor and a patient

They that are whole have no need of the physician but they that are sick (Luke 5:31). It is essential that any doctor understand what his role is and who a patient is. The word doctor derives from the Latin root docere which translated means 'I teach'. Thus, a doctor has a role in being a guiding figure, a role model in changing the lives of those he encounters. Principles Harrison's of Internal Medicine begins by saying 'No greater opportunity, responsibility or obligation can fall to the lot of a human being than to become a physician'. This threefold duty is essential in realizing the service requirement to humanity. In contrast, the word patient originates from the Latin word patiens that denotes suffering. Indeed, as Harrison presents it ' The patient is no mere collection of symptoms, signs disordered functions, damaged organs and disturbed emotions. He is human, fearful and hopeful, seeking relief, help and reassurance.

Doctors need to understand the rights of patients as well. The WHO Declaration on Promotion of Patient's Rights is based on the provision of services such as high-quality medical service, privacy and confidentiality, information, autonomous choice and dignity (treatment as a human being). Patients are entitled to good standards of practice and care from their doctors. Essential elements in this process included professional competence, good relationships and observance of professional ethical obligations (Good Medical Practice, GMC UK). The physician has a threefold interaction in carrying out this duty. It involves patients, *fellow* physicians and the public (society and health system)

## Morality and Ethics

Morality and ethics are not laws but standards of conduct definina honourable behaviour. Morality is the belief in the existence of right and wrong. Ethics on the other hand is choosing the right action when doing so may involve doing harm. Medical ethics is based on the pillars of non-maleficence. beneficence. and justice. autonomy Nonmaleficence ensures the sanctity of life in the Hippocratic teaching of primum non nocere (First doing no harm). Non maleficence limits the chances of a doctor using enthusiasm or opinion by harming a patient while treating. Beneficence engages in doing good in the best interests of patient balancing benefits and risks while protecting and defending rights of others. Autonomy is allowing space for the patient to choose or refuse treatment after free, informed consent. This allows space for dignity and respect. There may be constraints with autonomy as mental capacity and incompetence may limit its potential. However, there is complementation with non-maleficence and beneficence as they allow a paternalistic (physician based) approach. Justice is impartial treatment without bias and social responsibility for the greater good of the society. Veracity (Duty of candour) and (maintenance of) confidentiality are also important auxiliary principles of medical ethics.

## Medicine as a Profession.

A profession is entitled to three rights. The field of medicine also holds these rights.

- The right for acquisition and application of a body of knowledge and technical skills. This is ensured by the place of education, examination and apprenticeship (internship and postgraduate training).
- Membership, bound together by shared commitment. Codes of ethics (e.g., Hippocratic code, SLMC code of ethics) and service to society are threads which binds doctors with each other
- Power of self-regulation is another right. This allows doctors to maintain regulatory bodies such as the Sri Lanka Medical Council to hold power to admit and discipline members. Furthermore, it allows renumeration of gains in fairness for service provision (accountable monopoly).

However, all of this is noblesse oblige. It is important to understand privilege entails obligation. Medical professionals are not aware of the enormous burden of responsibility of healing, preserving lives and preventing suffering. Professionals are provided with prestige and privilege on the understanding that they will be altruistic, regulate well, be trustworthy and address concerns of the society. The practice of medicine is an art, not a trade; a calling not a business. A calling in which your heart will be exercise equally with your head (William Osler).

Professionalism needs to be considered reverently and soberly. Doctors must understand that they are regulated by professional bodies. Furthermore, they cannot evade law whether it may be civil or criminal. Professionalism is clinically important of the need of trust to build a good therapeutic doctor patient relationship. Therefore, professionalism is the basis of medicine's contract with society. Professional status is not inherited but is granted by the society. This is constantly earned bv meetina obligations expected of a profession. It is essential to note that if medicine fails to meet these requirements that the society could change its' status. Our profession is under siege. This is due to abuse of power, arrogance, avarice, misinterpretation, impairment, lack of conscientiousness and conflicts of interest. These attempt to shatter the strong foundations in the society. Our resistance to these need professionalism be to and professionalism alone.



*Figure 1:* The Doctor (Sir Luke Fildes, 1891). A worried, caring, vigilant doctor pensive in caring for a dying patient (Tate Gallery, London, United Kingdom)

*Figure 2: Hippocrate (Marc Haumont, 2018) - Medicine represented as Hippocrates is threatened by the vile of humanity (Eve) and by the profession itself (caducean serpent). www.artmajeur.com* 







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Figure 4: Physicianship



*Figure 5: Code of Conduct for Students of Medicine* 

We therefore stand at the temple of professionalism. This temple is founded upon the principles of clinical competence (knowledge and skills of medicine), communication skills and ethic legal comprehension. Furthermore, it is supported by pillars of clinical excellence, humanistic approach, accountability and integrity, and altruism.

A doctor has a dual role in society. These are that of healing and being professional. This twofold role intersects to produce a new role. This is that of Physicianship has emerged.

#### Codes of Ethics

Hippocrates is well known for his sustained appreciation for limits of medicine and allowing need to prevent unnecessary iatrogenic harm. Codes of ethics have been in existence before his time and many have been developed since. In recent times the Good Medical Practice consensus of the General Medical Council, UK states four key domains. These include

- a) Knowledge, skills and performance
- b) Safety and quality
- c) Maintaining trust
- d) Communication, partnership and teamwork.

of The American Board Internal 2007 Medicine in released А Physicians Charter: Medical Professionalism in the New Millennium. This is based on the principles of medical ethics but elaborates on 10 commitments.

- Professional competence of lifelong learning in maintaining medical knowledge, clinical and team skills
- Honesty with patients in empowering decision making, acknowledge reporting and analysing medical errors
- 3) Patient confidentiality to earn trust and confidence
- Maintaining appropriate relations with patients. (There is Inherent vulnerability and dependency of patients.)
- 5) Improving quality of care by collaboration to reduce error, increase safety, minimize overuse, optimize outcomes and routine assessment
- 6) Improving access to care by providing uniform and adequate standard of care (reduce barriers for equity). Furthermore, it promotes public health, preventive medicine and public advocacy

- Just distribution of finite resource by wise and costeffective management of limited resources and scrupulous avoidance of superfluous tests and procedures,
- Scientific knowledge (setting scientific standards, promoting research, creating knowledge and integration).
- 9) Maintaining trust by managing conflicts of interest.
- 10)Professional responsibilities by collaboration, respectfulness, self-regulation (remediation and discipline).

In our own shores the Sri Lanka Medical Council produced a document in 2009 as a guideline on ethical conduct. Some colleges such as the College of Surgeons of Sri Lanka have too followed this path in producing similar documents.

The Faculty of Medical Sciences, University of Sri Jayewardenepura was commenced in 1993. The pioneer batch was encouraged to compile a code of conduct for themselves. This was the first of such codes to be developed in the country. It is noteworthy that the process was facilitated by the medical teachers of the pioneer Department of Family Medicine of the island, established at the same institution.

All these codes and documents are mere collections of words and abstract thoughts if they are not deeply embedded upon the soul of a doctor. Can this be done by didactic teaching? Can we as doctors preach one and practice another to influence our juniors, peers or even superiors? They best method however, is to understand that example is better than precept. Such things are implicitly learned and practiced rather than are explicitly taught (a hidden curriculum) or enforced upon. Learners; pattern on role models and on those who they can respect and trust.

## Yet another flower?

Can a physician thus become a fine flower to the civilization and society. The author invites the reader to meditate yet of a blooming of another flower? The lotus is a symbol of purity blossoming form the murky waters of attachment and desire.

To be a doctor means much more than to dispense pills or to patch up or repair torn flesh and shattered minds. To be a doctor is to be an intermediary between man and GOD (Felix Marti-Ibanez, *To Be a Doctor*)

(An extract of a talk done at the SLMA Regional Meeting held in collaboration with the Faculty of Medical Science, University of Sri Jayewardenepura on 10<sup>th</sup> November, 2021)

#### Original/Article

Attitudes among midwives towards mothers with post-partum depression, a descriptive study in Matara district, Sri Lanka

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#### Abstract

**Background:** Postpartum Depression (PPD) occurs in 10-20% of post-partum women but less than half of the cases are detected. PPD can have significant consequences for the wellbeing of mother and infant. Screening for PPD is done as part of maternity care program in Sri Lanka. Public health midwifes (PHMs) are the main category of health staff involved in this screening program. Hence, assessing their capacity of performance will justifiably be important for evaluating this screening program.

**Objective:** To assess the capacity of PHMs in screening PPD as part of the national maternity care program in Matara district.

**Methods:** A community based descriptive cross-sectional study was carried out in the Matara district, from March 2016 to August 2017 with the participation of all (260) PHMs. A pretested self-administered questionnaire was used to assess five specific objectives. Socio

demographic and work-related factors, organization related factors, attitude and associated factors of these two were assessed.

**Results:** Supervision given by the supervising public health midwives and medical officer of health are satisfied. Clinic Facilities were low. Overall attitude was good. PHMs emphasized, need of in-service training and inclusion of mental health into their basic training. Statistically significant associations between good attitude and time taken to arrive at the working station and field experience were found.

**Conclusion:** There are gaps in and attitude. Giving up-to-date information and periodical in service training specially aiming at PPD will help to fill these gaps.

**Key words:** Post-Partum Depression, Public Health Midwives, Medical Officer Mental Health, Edinburgh Postpartum Depression Scale.

#### Introduction

Major depression is one of the leading causes of disease burden globally (3). PPD occurs among 10-20% of women who have delivered a baby but less than half of them is detected (1). PPD can have significant consequences on the wellbeing of both the mother and infant (2).

In Southeast Asian countries, mental health has received a low priority. Lack of attention, low investment in mental health and huge work force deficiencies are causes for poor mental health outcomes (4). In PPD, the first symptom usually appears between the fourth and sixth week postpartum. PPD is a severe form of mental illness that reflects characteristics such as low energy levels, depressive mood levels and in severe cases even suicidal tendencies in most mothers following childbirth (12).

In Sri Lanka, all maternal suicides during pregnancy and up to 1 year after termination of pregnancy are notified to national maternal mortality surveillance system (NMMSS) (5). A dramatic increase in maternal suicides over years 2002-2010 signals need for multi- faceted approach in prevention (6).

EPDS is used as a screening tool globally. This self-administered questionnaire contains 10 questions and can be used in PPD screening (7). Since 2012, as part of the national maternity care program of Sri Lanka, all mothers attending MOH clinics are screened by the EPDS (13). Mothers fill the forms under the guidance of PHMs (8).

Health care professionals involved in maternal care inquire into risk factors and psychological wellbeing of pregnant and post-partum mothers (9). However, in the Sri Lankan setting, maternal depression is still heavily under diagnosed (10).

PHM member of the is а multidisciplinary team providina maternal care, who more has information about the pregnant women and their family. Therefore, PHMs are the most important category of staff in this screening (11).

This study was done to assess the capacity of PHMs in screening PPD as part of the national maternity care program in Matara district. Sociodemographic and work-related factors of PHMs were studied. Organizational related factors affecting the performance of PHMs in screen PPD were assessed. Furthermore, the attitudes and the factors associated attitudes of PHMs with about screening programs were described.

## Methodology

A Descriptive cross-sectional study was conducted from December 2016 to August 2017 in all 17 MOH offices in Matara district enrolling all 260 PHMs attached to 17 MOH offices after obtaining informed written consent. Two hundred forty-four PHMs responded in the study

Α structured self-administered questionnaire was designed to achieve the specific objectives after consulting the supervisor, relevant experts in the field of Psychiatry, Psychology and through an extensive literature review. Each stem was marked separately and each of the correct answer was given 1 mark, whereas wrong answer was given a zero mark. Total mark for attitudes on PPD was calculated and the score out of 100 was calculated. The overall mark was calculated by taking average mark. The respondents were categorized into two groups according to their level of scores in each of the subsections. Favourable attitude-score: above at or 50% unfavourable attitude-score: less than 50%

Ethical clearance was obtained from Postgraduate Institute of Medicine, University of Colombo. Statistical

## Results

Socio demographic factors

Out of the study population, 91.4% (223) were married.81.6% (199) had GCE A/L qualification, 3.3% (8) were diploma holders and 2.5% (6) were Degree holders. 56.6% (138) trained in NTS Galle.

67.7 % (165) had worked in current station for more than 12 years. 39.3% (96) had two children. 8.36% (204) had taken less than 1 hour to arrive at working place. 66.8% (163) lived within nuclear family.

## Organization related factors

Among our study population, 75.4 % (184) had opportunity to participate only 1-4 in-service training programs.

75.4 % (184) has correctly recognized (SPHM) as the supervising officer. 91.8% (224) satisfied with the supervision given by the MOH. 60.2 % (147) gathered information by attending to in- service training. 65.6% (160) not satisfied with facilities available for clinics.

Considering the level of documentation facilities, 49.6% (121) respondents were satisfied whereas 45.9% (112) were not satisfied. 33.2% (81) stated that the pregnant mothers'

package for social science (SPSS) version 21 was used to analyse data.

need support of PHMs to fill the EPDS whereas 29.9% (73) stated that pregnant mothers don't need.

59% (144) stated that they did not get much support from MOMHs conducting outreach clinics in their region. 79.9% (195) PHMs took screening of PPD as part of their duty list.

Only 55.7% (136) satisfied with the service of MOMH. 84% (205) had experienced about preventable deaths due to PPD.

## Attitude towards screening PPD

Majority (158) strongly agreed about importance of in-service training about EPDS. Regarding attitude towards time consumption of screening PPD with other relevant duties, all-together 73.8% agreed that they have enough time. 46.3% (113) agreed that they must have adequate training about the programme.

Regarding adequate time to be with postpartum mothers in the clinic, all together 127 PHMs agreed. Regarding attitude towards prevention of suicidal maternal deaths due to PPD, majority agreed. All-together 93.8% of the respondent's attitude was that most of the suicidal deaths due to PPD are preventable.

Attitude towards importance of maintaining a record of suicidal potential for each mother,

Altogether, 150 agreed, regarding attitude towards mothers' ability to understand EPDS, agreed and disagreed percentages were equal.

Attitude towards their work burden, alltogether 22.5% agreed that they have a work burden. Total attitude marks 50 Positive Attitude =26 >

## Association between sociodemographic factors and attitude

	Normal Attitude	Good Attitude	Total	р
Age				
20yrs - 29yrs	0	3	3	
30yrs - 39yrs	1	65	66	
40yrs - 49yrs	1	37	38	0.159
50yrs - 59yrs	12	107	119	
Over 60yrs	1	14	15	
Marital Status				
Married	1	3	4	
Unmarried	13	210	223	
Divorced	0	15	15	0.017
Widowed	1	1	2	
Education level				
Passed GCE (O / L)	2	27	29	
Passed GCE (A / L)	13	186	199	0.804
Degree Holder	0	6	6	
Diploma Holder	0	8	8	
Training Centre				
de SOYSA	0	1	1	
NTS Ampara	0	2	2	
NTS Anuradhapura	0	4	4	
NTS Badulla	1	10	11	
NTS Colombo	4	45	49	
NTS Galle	8	130	138	0.976

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NTS Jayewardenapura	0	2	2		
NTS Kadana	0	5	5		
NTS Kalutara	0	4	4		
NTS Kandy	1	3	4		
NTS Kurunegala	0	5	5		
NTS Rathnapura	0	5	5		
Panadura	0	1	1		
Number of children					
One Child	6	63	69		
Two Children	5	91	96	0.799	
Three Children	3	41	44		
Four Children	0	3	3		
Time taken to arrive at workplace					
Less than 1 hr	11	193	204		
2hrs - 3hrs	4	23	27	0.042	
3hrs or more	0	5	5		
Live with					
Nuclear family	11	152	163		
Extended family	4	76	80	0.595	

Since P value was greater than our chosen significant level ( $\alpha = 0.05$ ) we conclude that there is not enough evidence to suggest and association between following variables.

These variables are age and attitude, marital status and attitude, education level and attitude, PHM training centre and attitude, number of children and attitude, family support and attitude.

Since P value was less than 0.05, we conclude that there is enough evidence to suggest that there is an association between time taken to arrive at working station and attitude

#### Association between work related factors and attitude

Table 2 – Associatior	i between work re	lated factors and	attitudes
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	Normal Attitude	Good Attitude	Total	р
Field Service				
< 5yrs	1	32	33	
6yrs - 10yrs	0	27	27	
11yrs - 15yrs	0	16	16	0.024
16yrs - 20yrs	0	29	29	
21yrs - 25yrs	7	37	44	
26yrs <	5	56	61	
Number of working ho	ours			

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6hrs	0	1	1	
6hrs - 8hrs	5	97	102	0.823
9hrs - 11hrs	5	101	106	
More than 12hrs	0	17	17	
Number of training program				
not attended	7	29	36	
2 -4 programs	7	177	184	0.004
5 - 8 programs	1	19	20	
9 - 12 programs	0	4	4	

Since P value was greater than our chosen significant level ( $\alpha = 0.05$ ) we conclude that there is not enough evidence to suggest that there is an association between number of working hours and attitude.

Since P value was less than 0.05, we conclude that there is enough evidence to

Suggest that there is an association between following variables.

They are associations between number of training program and attitude, field experience and attitude.

## Discussion

Cross-sectional descriptive study was conducted to assess the capacity of Public Health Midwives in screening post-partum depression as part of the national maternity care program in Matara district. Socio demographic factors, work related factors, attitudes of public health Midwives on screening Post-Partum Depression were assessed. Majority of respondents 48.8% (119) were between 50 years and 59 years.

The overall attitudes were favourable towards screening program but considerable proportion were not satisfied with the time consumption screening PPD. However almost all were enthusiastic about gaining more knowledge screening and PPD. Attitude towards record keeping was not favourable. It is and alarming issue to the organization. Attitudes towards allocated time to be with postpartum mothers in the clinics was not favourable. Organization has to consider with this issue. According to respondents attitude most suicidal maternal deaths due to PPD are potentially favourable.

#### Recommendations

There are gaps in attitude although the overall attitude is satisfactory. Giving up-to-date information and periodical in service training programmes specifically aiming at Post-Partum Depression will help fill these gaps. Capacity building in the form of simulation exercises is of utmost importance. Limitations Since all the Public Health Midwives have similar educational back ground and able to read write and respond, a Self-administered guestionnaire was more reliable to ensure confidentiality in assessment. The questionnaire was distributed among participants describing the benefit of the study and requesting them to fill them without causing disturbance to their routine work. A reasonable time was given to fill and return the guestionnaire. The principal investigator visited MOH offices on in services days and monthly conference days to aet maximum participation.

#### Conflict of Interest

Authors declare that there is no conflict of interest.

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#### Original/Article

Impact of COVID-19 on the economy of tea plantation owners in Balangoda, Sri Lanka and its association with the prevalence of acute diseases during the lockdown and access to healthcare services.

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#### Abstract

**Background:** COVID-19 pandemic has affected the economy of tea plantation sector and access to healthcare services for other diseases.

**Objective:** To describe the impact of COVID-19 on the economy of tea plantation owners in Balangoda, Sri Lanka and its association with the prevalence of acute diseases during the lockdown and access to healthcare services.

**Method:** In this cross-sectional study, 85 tea plantation owners belonging to a Tea Estate Development Society in Sri Lanka, were selected using simple random sampling. Data was collected using self-administered questionnaire consisting of participant's sociodemographic information, effect of COVID-19 on economy, acute diseases and difficulties in accessing health care services during the lockdown.

Results: Majority (n=47, 56.0%) had a positive effect on economy. Most had common cold (n=19, 22.4%). Statistically significant associations were found between presence of common cold (p=0.015), gastritis and negative effect of (p=0.040) COVID-19 on economy. Among those with acute diseases 90.5% (n=19) faced difficulties in accessing healthcare services durina the lockdown such as transport issues (n=12, 57.1%), unavailability of medicines (n=1, 4.8%), fear of contracting COVID-19 (n=7, 33.3%) and inaccessibility of hospitals (n=1, 4.8%). Transport was the major problem in 57.1% (n=12) of patients. Among those with acute diseases who faced difficulties in accessing healthcare services, 63.2% (n=12) had a negative effect on economy due to COVID-19. Statistical significance was observed between those with acute diseases who faced transport issues and effect of COVID-19 negative on economy (p=0.032).

**Conclusion:** Even though majority of those with acute diseases, who faced difficulties in accessing healthcare services had a poor effect on economy due to COVID-19, access to health care in terms of lockdowns should be made more operative.

**Key words**: COVID-19, tea plantation, economy, health care services, lockdown

## Introduction

COVID-19 is a highly transmissible infection which is caused by the 2019 novel coronavirus, SARS-CoV 2. It has become the fifth documented pandemic since the 1918 flu pandemic'. In December 2019, at Wuhan, Hubei Province, China, а cluster of cases of pneumonia were reported. The symptoms of these patients included fever, malaise, dry cough and dyspnoea among others and was diagnosed as viral pneumonia. It was termed as "Wuhan pneumonia" bv the press because of its geographical origin and nature of symptoms. This was later found out to be due to the novel coronavirus. The first recorded case of the disease outside China was confirmed in Thailand on 13th January 2020. The disease was termed "COVID-19" on 12th February 2020 by the WHO. The virus was named "SARS-CoV-2" by the International Committee on Taxonomy of Viruses (ICTV). On 11th March 2020, COVID-19 was characterized as a pandemic by the  $WHO^2$ .

COVID-19 is the current global health crisis and the greatest challenge we are facing. Since its emergence in China in 2019, the virus has spread to many countries around the world including Sri Lanka. The first case of the virus was confirmed in Sri Lanka on 27 January 2020, after a 44-year-old Chinese woman from Hubei Province in China was admitted to the National Institute of Infectious Diseases. The first local COVID-19 case was reported in Sri Lanka on March 11th 2020.

The pandemic has had a negative

impact on the economy around the world. As one of the main exports of Sri Lanka, tea export reduced by 50.3% in March 2020 compared to March 2019 due to COVID-19 outbreak (author based on Sri Lanka export development board)<sup>3</sup>. So, it is important to study the impact of COVID-19 on the economy of the tea plantation owners of Sri Lanka.

Low income is associated with 2.67 times more negative perception of health<sup>4</sup>. The prevalence of acute respiratory infections is more in rural areas compared to urban areas and is associated with poor economy<sup>5</sup>. Thus, it is necessary to study about the prevalence of acute diseases during the pandemic and to find its association with the economic impact of COVID-19.

In addition to immediate direct health impacts, access to healthcare services for other diseases too have been affected. Thus, the objective of this study was to describe the impact of COVID-19 on the economy of tea plantation owners in Balangoda, Sri Lanka and its association with the prevalence of acute diseases during the lockdown and access to healthcare services.

## Method

#### Study Design and setting

This cross-sectional study was conducted from November 2020 to January 2021, at Tea estates in Balangoda, Sri Lanka.

#### Study participants

Tea estate owners belonging to the Galgoda EKAMUTHU Small Tea Estate Development Society were selected.

All the tea plantation owners of tea estates in Balangoda area were listed. All the tea plantations owners belong to a Development Society. Therefore, on the grounds of feasibility, it was decided to randomly take one group of tea estate owners belonging to one development society. Therefore, the tea estate owners belonging to the Galgoda EKAMUTHU Small Tea Estate Development Society of Balangoda This were selected. Galgoda EKAMUTHU Small Теа Estate Development Society of Balangoda, consists of a list of 93 tea estate owners. Although this was used as a sampling frame, as there were 93 tea estate owners, all tea estate owners, who fulfilled the

inclusion criteria of being above 20 years of age were selected.

## Sample size

Sample size calculation for the study was computed using the following formula by Lwanga & Lemeshow (1991):  $n = Z^2 p (1 - p) / d^2$ . The critical value was set at 1.645 corresponding to 90% confidence level. Desired precision was set at 0.1%. Estimate of the proportion of tea plantation owners affected by COVID-19 was considered as 50% (0.5). A final sample of 74 was deemed appropriate, considering possible non- responders.

## Study instrument

A self- administered questionnaire was used to collect sociodemographic information, effect of COVID-19 on the economy, prevalence of acute diseases from March to August 2020 and problems in accessing health care services during the lockdown.

The effect on economy was calculated as positive/negative based on the change in average monthly sales, income, expenses, market price and number of tea workers from March to August 2020 compared to 2019. The prevalence of acute diseases during March to August 2020 such as asthma exacerbation, common cold, food poisoning, gastritis, dental problems and snake bite were considered. Problems in accessing healthcare services during the lockdown in those with acute diseases such as inaccessibility of hospitals, transport issues, unavailability of medicines and fear of contracting COVID-19 were considered.

## Method

Ethical approval was obtained from

the Ethics Committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura. Prior to proper data collection, the guestionnaire was pretested among tea plantation owners from another set of selected tea estates to assess the clarity of words. flow of questions, interpretation of words and the problems encountered were discussed and final alterations were done to the guestionnaire. The auestionnaires were distributed to participants along with an information sheet explaining the purpose of the research and informed written consent was obtained. Participants were also informed that participation is voluntary he/she may withdraw from and answering the questionnaire at any possible time. All questionnaires were collected in sealed envelopes and collected into a closed box for confidentiality.

## Data analysis

Data was analysed usina SPSS software using descriptive statistics. Gathered data was manually checked data collection sheets were and checked for deficiencies and mistakes on the collection date. All data was managed using a database. The change in average monthly sales, income, expenses, market price and number of workers were categorized as increase/decrease/no change. The effect of COVID-19 on economy was categorized as positive and negative effect, based on the total scores obtained. The mean was obtained (4.73) and those who scored above the mean were categorized as having a Positive effect on economy. The change in average monthly sales, income, market price and number of tea workers were scored as 2 for "Increase", 1 for "No change" and zero for "Decrease". The change in average monthly expenses was scored as 2 for "Decrease", 1 for "No change" and zero for "Increase". The Total score gave out of 10.Data pertaining to the above 4 sections was described as frequency distributions. Chi squared test and Fisher's exact test were used to test for association between qualitative variables.

#### Results

Out of the 93 tea estate owners invited to participate, 85 (91.3%) returned completed questionnaires.

*Sociodemographic factors* The table below shows the sociodemographic characteristics of the study population.

Majority of the study population were males (n=60, 70.6%). The predominant age group was between 51 and 65

years (n=30, 35.3%). Most of the participants were married (n=76, 89.4%). In the study population, 62.4% (n=53) had less than 4 members in the family. Most of the participants (n=29, 34.9%) had completed A/L.

Monthly income of 65.9% (n=56) of the study population was below Rs 40000/=.In the study population, 91.8% (n=78) had no additional means of income.

Table 1: Total frequency distribution of sociodemographic factors of study population

	Frequency (n=85)	Percentage (%)
Age Groups (years)		
21-35	13	15.3
36-50	28	32.9
51-65	30	35.3
66-80	14	16.5
Gender		
Male	60	70.6
Female	25	29.4
Marital status		
Unmarried	8	9.4
Married	76	89.4
Widow	1	1.2
No. of family members		
1-4	53	`62.4
5-8	32	37.6
Education Level *		
Below O/L	20	24.1
Below A/L	25	30.1
A/L	29	34.9
Degree	9	10.8

Monthly income (Rupees)		
Below 40,000	56	65.9
40,000-45,000	9	10.6
45,001-50,000	11	12.9
Above 50,000	9	10.6

Other sources of income		
Farming	1	1.2
Employment	3	3.5
Business	2	2.4
Pension	1	1.2
None	78	91.8

\*n=83, Missing data=2

*Effect of COVID-19 on Estate Economy in March to August 2020 when compared to 2019* 

The table below shows the effect of COVID-19 on various parameters of estate economy in March to August 2020 when compared to 2019 among the tea plantation owners.

Majority of the study population (n=35, 41.7%) had no change in average monthly sales. Most of the participants (n=38, 45.2%) experienced a decrease in the average monthly income. Around 39 participants (46.4%) experienced an increase in average monthly expenses. In the study

population, 48.8% (n=41) reported an increase in the average market price of tea. Majority of the study population (n=48, 57.1%) had no change in the average number of tea workers.

The table below shows the overall effect of COVID-19 on estate economy which has been calculated using the change in average monthly sales, income, expenditure, market price and number of tea workers in March to August 2020 when compared to 2019. Majority of the study population (n=47, 56.0%) had a positive overall effect on the estate economy.

Table 2: Total frequency distribution of the effect of COVID-19 on various parameters of estate economy among the study participants and overall effect of COVID-19 on the estate economy of the study participants

	Frequency (n=84)	Percentage (%)		
Average monthly sales in March to August 2020 compared to 2019				
Decrease	31	36.9		
No change	35	41.7		
Increase	18	21.4		
Average monthly income in	March to August 2020 com	pared to 2019		
Decrease	38	45.2		
No change	19	22.6		
Increase	27	32.1		
Average monthly expenses in March to August 2020 compared to 2019				
Decrease	21	25.0		
No change	24	28.6		
Increase	39	46.4		
Average market price in March to August 2020 compared to 2019				
Decrease	10	11.9		
No change	33	39.3		
Increase	41	48.8		

Average no. of tea workers in March to August 2020 compared to 2019			
Decrease	24	28.6	
No change	48	57.1	
Increase	12	14.3	
Overall Effect of COVID-19 on estate economy *			
Negative Effect	37	44.0	
Positive Effect	47	56.0	

\*n=84, Missing data=1

Association between Overall Effect of COVID-19 on Estate Economy and Presence of Acute Diseases

The table below shows the association between the presence of acute diseases from March to August 2020 and the overall effect of COVID-19 on estate economy.

Out of the study population, 21 had acute diseases from March to August 2020 and majority of them (n=13, 61.9%) experienced a negative effect of COVID-19 on estate economy. Majority of those with common cold (n=13, 68.4%) experienced a negative effect of COVID-19 on estate economy, with а statistically significant difference (p=0.015). In the study population, most of the 7 participants gastritis (n=6, who had 85.7%) experienced a negative effect on estate economy due to COVID-19. Therefore, a statistically significant difference was observed between the presence of a gastritis and the overall effect on estate economy (p=0.040).

Table 3: Association between the presence of acute diseases from March to August 2020 and the overall effect of COVID-19 on the estate economy of tea plantation owners

	Negative	Positive				
	effect on	effect on	Total	2	df	Р
	estate	estate		-		
	economy	economy				
Presence of Acute diseases from March to August 2020						
	24(38.1%	39(61.9%				
No	)	)	63(100.0%	) 3.623	1	0.057
	13(61.9%			а	1	0.037
Yes	)	8(38.1%)	21(100.0%	)		
Acute diseases						
	24(36.9%	41(63.1%				
Without Common cold	)	)	65(100.0%	) 5.919	1	
	13(68.4%			а	1	0.015
With Common cold	)	6(31.6%)	19(100.0%	)		
Without Dental	35(43.2%	46(56.8%				
Problems	)	)	81(100.0%	)		0.000 *
With Dental Problems	2(66.7%)	1(33.3%)	3(100.0%)			
Without Gastritis	31(40.3%	46(59.7%	77(100.0%	)		0.040

		)	)			*
With Gastritis		6(85.7%)	1(14.3%)	7(100.0%)		
Without Asthma		37(44.0%	47(56.0%			
exacerbation		)	)	84(100.0%)		
With Asthma						
exacerbation		0	0	0		
		37(44.0%	47(56.0%			
Without Food Poisoning		)	)	84(100.0%)		
With Food Poisoning		0	0	0		
		37(44.0%	47(56.0%			
Without Snake bite		)	)	84(100.0%)		
With Snake bite 0		0	0			

\*Fishers exact test p value

Association between Overall effect of COVID-19 on Estate Economy and problems in accessing healthcare services

The table below shows the association between the problems encountered in patients with acute diseases during the lockdown and the overall effect of COVID-19 on the estate economy of tea plantation owners.

Among the 19 participants with acute diseases who faced problems in

accessing healthcare services, 63.2% (n=12) experienced a negative effect on estate economy. When considering a subsample of those with acute diseases from March to August 2020, 83.3% (n=10) of those who faced transport issues had a negative effect on estate economy. There was a statistical significance between facing transport issues and those who had a negative effect on estate economy (p=0.032).

Table 4: Association between the problems encountered in patients with acute diseases during the lockdown and the overall effect of COVID-19 on the estate economy of tea plantation owners

Problems in those with acute diseases	Negative Effect on estate economy	Positive Effect on estate economy	Total	Fishers exact test p value			
Faced problems in obtaining medications/visiting the hospitals during the pandemic							
No	0(0.0%)	1(100.0% )	1(100.0%)	0.400			
Yes	12(63.2%)	, 7(36.8%)	19(100.0%)				
Problems faced by those with acute diseases							
No Transport Issues Faced transport issues	3 (33.3%) 10 (83.3%)	6 (66.7%) 2 (16.7%)	9 (100.0%) 12 (100.0%)	0.032			

Obtained medicines with no	12 (60.0%)	8 (40.0%)	20 (100.0%)	
issues				1.000
Unavailability of Medicines	1 (100.0%)	0 (0.0%)	1 (100.0%)	
No Fear of contracting COVID-	11 (78.6%)	3 (21.4%)	14 (100.0%)	
19				0.056
Fear of contracting COVID-19	2 (28.6%)	5 (71.4%)	7 (100.0%)	
Hospital facilities available	12 (60.0%)	8 (40.0%)	20 (100.0%)	1 000
Unavailability of Hospitals	1 (100.0%)	0 (0.0%)	1 (100.0%)	1.000

#### Discussion

According to the research done among the vegetable farmers in India over 80% of farms reported some decline in sales, and over 20% of farms reported devastating declines<sup>6</sup>. Price reductions were reported by 80% of farmers. These results differ from our research. This may be due to information bias in the research done in India, as a telephone survey was used to collect information.

In a study carried out in Assam, 40% of people in India depend on tea plantation industry for their livelihood and were negatively affected due to closure of tea industries during the first phase of nationwide lockdown imposed from 24th March 2020 to 14th April 2020. However, in our research, majority of the tea plantation owners experienced a positive overall effect of COVID 19 on the estate economy. A possible reason for this difference might be due to the Sri Lankan government giving permission to continue work in the tea plantation sector even at lockdown areas.

In our research, majority of the participants with common cold (68.4%) had a negative effect on estate economy due to COVID-19, with a statistically significant difference (p=0.015). Possible reasons for this

may have been poor living conditions, poor personal hygiene and financial difficulties in practicing proper preventive measures. In another study conducted in India. the overall prevalence of acute respiratory infections was found to be 52%. The difference in the percentage may have arisen as the study conducted in India was done in 2012. The study found a significant association between acute respiratory infections and social class (p<0.001) similar to our research<sup>°</sup>.

Our study showed that the majority of the participants who had gastritis (85.7%) experienced a negative effect on estate economy due to COVID-19, statistically significant with а difference (p=0.040). This may have arisen due to increased stress owing to the poor economic state experienced by the study participants during the pandemic, skipping of meals and irregular timing of meals as a result of financial difficulties. In a study conducted in West Cameroon, the prevalence of gastritis due to Helicobacter pylori infection was 43.4% with a statistically significant association with source of income'. Even though the results are similar to our research findings, a significant difference in the percentage can be observed which may be due to considering only those with gastritis secondary to Helicobacter pylori infection, in the above study.

In a study conducted in Nigeria, most of the people with acute and chronic diseases had transport issues due to lockdown (36.0%). Similarly, transport problems were the domineering issue among those with acute diseases in our research<sup>8</sup>.

Of the participants 73.9% who had chronic or acute illnesses had a negative effect on income. This is similar to our research and it would have contributed to the transport issues that they faced during the pandemic.

Due to the novelty of the COVID-19 pandemic, no previous studies were done on our research topic to refer to when designing the instruments. The sample size was considerably reduced as access to population with tea plantation owners was restricted due to the prevailing COVID-19 pandemic in Sri Lanka and can be considered as the limitations of our study. As the participants had to recall the changes in average monthly sales, income, expenses, market price and number of tea workers from March to August 2020 compared to 2019, there could have been a recall bias.

In conclusion, even though majority of those with acute diseases, who faced difficulties in accessing healthcare services had a poor effect on economy due to COVID-19, access to health care in terms of lockdowns should be made more operative. Since most of the study participants had poor knowledge of COVID-19, we recommend that awareness of COVID-19 should be improved by using mass media. As majority of the participants with diseases faced difficulties in accessing healthcare during the pandemic, an effort should be made to improve the healthcare services provided to them, especially addressing the transport issues during the lockdown.

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#### Conflicts of interest

The authors declare that they have no conflicts of interest.

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## Original/Article

#### Online teaching as a Platform for Teaching of Medical Students: Faculty of Medical Sciences, University of Sri Jayewardenepura.

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## Abstract

Background- Due to the COVID-19 pandemic in 2020 government closed temporarily universities. colleges and other educational institutions as a precaution to stop the community spread of COVID-19. As a online teaching result. was commenced for the undergraduate medical students of University of Sri Jayewardenepura as this was the only option available for continuation of education during lock down period. We evaluated the effectiveness of online teaching with regard to enhancing knowledge and communication among final year medical students. An online questionnaire based cross-sectional study was conducted in post lockdown period.

**Results** – One hundred final year students (71.42% response rate) participated and all of them strongly agreed that webinars offer flexibility and convenience. The simplicity of online teaching was confirmed by most students (90%) who have also have found it to be a very useful and appropriate tool for their learning needs and also has expanded the access to medical education. Most (80%) preferred online teaching over to traditional face-to-face tutorial or lectures and felt that it was more efficient and provided a them more comfortable learning experience.

Conclusions \_ This studv has demonstrated that focused online teaching as an effective alternative in enhancing medical students' teaching for final year students. However further improvements such as improving the widespread access of internet, providing free internet connection, provision of laptops of tablet devices with minimum cost to students, improved video and audio qualities will ensure this mode of teaching to remain a viable method.

#### Keywords: Covid-19 pandemic,

Continuation of education, Final year Medical Education, Electronic devices for teaching, Asian country education

#### Introduction

The COVID-19 (new corona viral infection) was first detected at Hubei province in China had spread to many countries and continents as a global pandemic<sup>3</sup>. As a result, the WHO declared a Public health Emergency of International concern (PHIC) on 30 January 2020 and a Global pandemic on 11 March on 2020 by World Health Organization<sup>4,56</sup>.

The COVID-19 pandemic affected economic states of many governments including health and

educational systems worldwide<sup>3</sup>. As a result most governments around the world temporarily closed schools, colleges universities, and other educational institutions as а precaution to stop the community spread of COVID-19<sup>1,3</sup>. This situation has impacted on 98.5 percent of the world's student population (approximately 1.725 billion learners) by  $7^{th}$  of June 2020<sup>1,7</sup>.

School closures impact not only students, teachers, and their families but have caused economic and societal consequences<sup>8,9</sup> .The impact was more severe for part of the interruption society, causing of learning. compromised nutrition. childcare problems, and consequent economic crisis<sup>5</sup><sup>6</sup>.

To prevent such consequences the Sri Lankan government had taken rapid and strong actions from the beginning including closure of international airport and total lock down. The introduction of the online teaching to schools and universities was considered as an alternative<sup>10</sup>.

Universities provided unlimited access to online communication methods such as Zoom which was given free as the data charges were waived off by the internet providers in Sri Lanka. The Faculty of Medical Sciences University of Sri Jayewardenepura made use of this opportunity and started using online methods to teach the medical students for the first time in order to prevent the delay in completing the medical course and passing out as doctors.

## Methodology

Department of Medicine of Faculty of Medical Sciences, University of Sri Jayewardenepura organized regular teaching sessions for the final year medical students via online teaching on week days during the 3 months lock down period from April to June 2020. These sessions consisted of lectures, tutorials, discussion of multiple-choice questions and structured essay questions in medicine which were otherwise conducted in the traditional face to face manner.

This novel teaching method was introduced for the first time in this university as this was the only teaching option available due to countrywide lock down. During the last week of this teaching, we set out to evaluate these teaching sessions. No incentives were offered for completing the questionnaire, nor did it affect their attendance to the online teaching. Students were told that the purpose of guestionnaire-based evaluation the was only for purpose assessment of the of the teaching sessions view to measure its usefulness and to identify any problems that may need to be resolved in the future.

It was a questionnaire based crosssectional study. Inclusion criteria were all final year medical students of University of Sri Jayewardenepura who attended the online teaching session. The questionnaires were emailed out via the mailing list of final year medical students. We used Google Forms as our online questionnaire platform, which stores data in a Google Sheets encrypted database. Students were given 1 week to complete the questionnaire.

The questionnaire collected data on student demographics, their broad views and beliefs regarding online teaching sessions of department of medicine and some aspects of technical qualities of online teaching itself. A 5-point psychometric Likert scale (1 = strongly disagree, going up to 5 = strongly agree) was used in this questionnaire (Table 2).

## Results
A total of 140 final year students signed up for the online teaching sessions which consisted lectures, tutorials and multiple-choice question discussions. Only 100 (71.42% response rate) students filled out the feedback questionnaire. Seventy-three (73%) were females and 72% attended more than 75% of teaching sessions. Eighty-two (82%) of those accessed were from the western province. Own devices were used by 99 % of the students which included smart phones (62,62%), tablets (24%) and laptops (12%). Fifty (50%) used their own routers and 48% used smart phone data to access the internet. The quality of the internet connection was be either good or perceived to excellent for 69% of respondents.

Sixty-three (63%) of the students stronaly agreed and further 30% agreed that online teaching was easy to use and 93.9% stated that online learning sessions was useful for their learning. Furthermore 62% strongly agreed and 27% agreed that these sessions were enjoyable and they (90%) would recommend it to others. Seventy-seven (77%) stated they are more likely to participate if online teachings are to be continued. Ninetyone (91%) of the students said online teaching is more preferable over traditional face-to-face teaching. Seventy-five (75%) said its more efficient than the traditional face-toface learning.

Seventy-five (75%) of the students felt that online teaching helped them to communicate more effectively with their peers. Sixty (60%) agreed and 14% strongly agreed that online teaching helped them to studv together with their batch mates. Eighty -five (85%) of the students felt their real social presence during these online teaching classes. Fifty-one (51%) strongly agreed and 29% agreed that teaching offers online more comfortable and provided a flexible environment than the traditional face

to face teaching, Seventy -three (73%) said they were able to participate more actively and ask questions more freely online teaching than the traditional teaching sessions.

Nighty-seven (97%) of students said online teaching sessions were either very good (51%) or extremely good (46%). Sixty nine (69%) were moderately or slightly satisfied with the audio quality, 70% were satisfied with the video quality and 52% were satisfied with the screening sharing quality.

Students also mentioned that online teaching helped to attend their classes remotely (89%), prepare for their exams (89%), and make efficient use of their time and able to be in control of their learning (87%). Technical difficulties in accessing and running were encountered by 67% of the students.

### Discussion

Universities worldwide are undergoing a transition from traditional face to face teaching to online or а combination (blended) teaching'. As the world was facing a pandemic of COVID-19 many universities were forced to shut down indefinitely and forcing social distancing leaving the students in a chaotic situation. To our knowledge, this is the first time that the online teaching(zoom) has been used as the only live form of teaching program for medical graduates in Sr Lanka during the lock down period. It was a really a challenge as there was not much time and technical expertise available to suddenly implement a full online teaching. However, with a

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support of the faculty administrative authorities and the enthusiasm of the teachers and students we were able to start an online learning program within a very short period of time. In the past clinical training of medical students, only consisted of face-to-face clinical teaching, tutorials, and lectures with some learning materials such as lectures and handouts were made available on Learning Management System portal for online access to students. medical Most of the students participated in this first live online medicine teaching sessions. Although it was not compulsory majority have attended over 75% of the total allocated teaching sessions. Such high percentage of participation amidst the chaotic situation in the country which was in a total lock down state is very encouraging for the staff academic and shows the overwhelming enthusiasm of the students and their appreciation towards this novel teaching program. Furthermore, there were problems of internet access in certain regions of the country where the students were living in their home during the lock down. Observed usage of portable devices such as hand phones and tablets suggest that the learning has become more flexible and can be achieved while on the move without sitting in a class room.

The simplicity of online teaching was confirmed by most students (90%) who have also have found it to be a very useful and appropriate tool for their learning needs and also has expanded the access to medical believed education. Thev these sessions offered more flexibility and convenience in learning, compared to traditional teaching. Further online teaching is considered as a useful tool in widening the access to medical education.

Almost all students found using online teaching really enjoyable and most would also recommend to others. Majority (77%) of students would like to participate in online teaching classes in the future even if the traditional teachings recommence. Furthermore, most students actually prefer online teaching over the traditional teaching and felt that this helps them to communicate better with each other and also with their teachers. These views suggests that a hybrid educational system combining both face to face and online teaching is probably the best way forward in future medical education.

believed that they can Students communicate and collaborate more effectively with their colleagues via online teaching methods and feel more of their social presence (81%). also think online teaching They provides more relaxed, comfortable and flexible environment than the traditional teaching sessions. Additionally, when compared to traditional teaching, they were able to participate more actively and ask questions more liberally during these sessions.

These 3 months online teaching sessions arranged within a very short period was given very high rating by almost all students as either extremely good or very good. The overall quality of functional the online teaching has been satisfactory in terms of audio video and screen sharing gualities. We felt that optionally switching off the video function of the online teaching and using mainly audio improved the quality of online access with less disruption and distortion of voice quality.

However, the results of this survey may not be generalizable since the

study sample size was small which is inherited limitation of crossan sectional studies. The Medical faculty administration ensured that the online teaching was accessible to almost all final year medical students at no data cost. This we felt was an important factor in the success of this program as many students find difficult to pay for the data cost. The trend observed in the successive waves of the pandemic suggests that this situation of lockdown and prolonged closure of the universities are going to be a common occurrence in the future. As such this form of teaching which has been shown to be

very effective and highly appreciated is probably has established a definite place in university education. However further improvement in the technical aspect of software and the hardware is needed if online teaching classes to improve in the long term. Some measures such positive as are providing excellent quality internet connection and devices with minimum cost to students will make this a success.

**Conflicts of Interest:** The authors declare none.

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Nitric Oxide and Superoxide Radical Scavenging Activities of Sri Lankan Low Grown Orthodox Orange Pekoe Grade Black Tea (*Camellia sinensis* L.): *In Vitro* Study

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## Abstract

**Background:** Tea is the most consumed beverage in the world besides water, and Sri Lankan tea which is known as Ceylon tea, is the world's finest tea and reported to have an array of health benefits. Although antioxidant properties of Sri Lankan low grown orthodox Orange Pekoe (OP) grade black tea are scientifically proven, its nitric oxide (NO) and superoxide radical scavenging activities (RSA) are not reported to date.

**Method:** The present study evaluated NO and superoxide RSA of Sri Lankan low grown orthodox OP grade black tea. Freeze-dried hot water tea extracts were evaluated for NO (7.81, 15.63, 31.25, 62.50, 125.00 µg/ml) and superoxide (37.5, 75.0, 150.0, 300.0, 600.0 µg/ml) RSA using internationally accepted high-throughput screening assays *in vitro* (n=3 each).

**Results:** Hot water extract of orthodox OP grade black tea showed both NO and superoxide RSA in a concentration -dependent manner. However, the observed NO radical scavenging activity (IC<sub>50:</sub>  $7.47\pm0.01 \mu g/ml$ ) was significantly high (p<0.05) compared to the superoxide radical scavenging (IC<sub>50:</sub> 75.58±1.92 activitv ua/ml). Further, observed NO (IC<sub>50</sub> rutin:17.62±0.01 µg/ml) and superoxide (IC<sub>50</sub> guercetin:17.62±0.01 µg/ml) RSA were potent and moderate, respectively. compared to the reference drugs used in this study.

Conclusion: Orthodox OP grade black possesses potent NO and tea moderate superoxide radical This is the 1<sup>st</sup> scavenging activity. report of NO and superoxide RSA of orthodox OP grade black tea. Further studies should be conducted to assess its potential use in managing oxidative stress associated with chronic diseases.

**Keywords:** Black tea, nitric oxide and superoxide radical scavenging activity, Orange Pekoe tea, Sri Lankan tea.

## Introduction

Tea is the most widely consumed beverage in the world besides water.<sup>1,2,3</sup> Sri Lankan tea which is known as the Ceylon tea, is the world's finest tea.<sup>1,2</sup> It has high demand in international trade due to its aroma and flavor.<sup>1,2,3</sup> At present, the country produces a variety of tea, including black tea, and Sri Lanka remains as the second main black tea exporter and the main orthodox black tea exporter in the world.

Ceylon tea is reported to have an array of beneficial pharmacological properties. namelv anti-diabetic. antioxidant (Abeywickrama et al.. 2005), anti-bacterial (Ratnasooriya et al., 2016), anti-fungal (Ratnasooriya et al., 2017), thrombolytic (Ratnasooriya anti-hyaluronidase et al.. 2008), (Ratnasooriya et al., 2014), antityrosinase (Ratnasooriya et al., 2014), cholesterol micellization inhibitory (Ratnasooriya et al., 2015), pancreatic lipase inhibitory (Ratnasooriya et al., 2015), cholesterol esterase inhibitory (Ratnasooriya et al., 2015). anti-(Ratnasooriya inflammatory and Fernando, 2009), gastro protective (Ratnasooriva and Fernando, 2009). gastric ulcer healing (Ratnasooriya and Fernando. 2009), anti-pyretic (Ratnasooriya et al., 2007), and antinociceptive (Ratnasooriya and Fernando, 2011) activities in various in vitro and in vivo models. Although antioxidant properties of Sri Lankan low grown orthodox OP grade black tea are scientifically proven, its nitric oxide (NO) and superoxide radical scavenging activities (RSA) are not reported to date. The present study

evaluated NO and superoxide RSA of Sri Lankan low grown orthodox OP grade black tea *in vitro*.

## **Materials and Methods**

#### Sample collection

The topmost immature leaves and unopened buds of *Camellia sinensis* L. plucked from the plantation of St. Joachim's tea estate of the Tea Research Institute, Hedallana, Ratnapura, Sri Lanka (low grown) were used to process the Orthodox Orange Pekoe grade (OP grade) black tea by orthodox-rotovane technique at the tea factory.

### Chemicals and reagents

Phenazine methosulfate (PMS), nicotinamide adenine dinucleotide (NADH), nitroblue tetrazolium (NBT), sodium nitroprusside, sulfanilamide, 1% *N-(1-Naphthyl)ethylenediamine* dihydrochloride, quercetin and rutin were purchased from Sigma-Aldrich Preparation of buffers and (USA). other necessary solvents were performed with the use of analytical grade chemicals from Sigma-Aldrich (USA).

### Preparation of tea brew

Black tea brew was made according to the ISO standards (ISO 3103) by adding 2 g of OP grade black tea to 100 mL of boiling water and allowed to brew for 5 min. Then, the tea brew was filtered and freeze dried. The freeze-dried samples were used in studying NO and superoxide RSA *in vitro*.

*Nitric oxide radical scavenging activity* The NO radical scavenging assay was carried out according to the method of Andrade et al., 2005 with some modifications using 96-well microplates. Briefly, a reaction volume of 100 µl containing 50 µl of different concentrations (7.81, 15.63, 31.25, 62.50, 125.00 µg/ml) of Ceylon black 10 tea extracts, mΜ sodium nitroprusside in 0.1 M phosphate buffer were incubated at 25 C in 96 well microplates for 120 min. After the incubation period, equal amounts of 1% sulfanilamide and 1% N-(1-Naphthyl)ethylenediamine dihydrochloride were added to each

well, mixed and again incubated at 25 <sup>o</sup>C for 30 min. Finally,

absorbance readings were taken at 550 nm using a 96 well microplate reader (SpectraMax Plus<sup>384</sup>, Molecular Devices, USA). Rutin was used as the positive control. Results were expressed as % inhibition and IC<sub>50</sub> values.

NO radical scavenging activity (%) =  $[(A_c - A_s) / A_c] *100$ 

where,  $A_c$  is the absorbance of the control and  $A_s$  is the absorbance of the sample.

Superoxide radical scavenging activity The superoxide radical scavenging activity was performed according to the method of Liu and Ng, 2000 with some modifications using 96-well microplates. Superoxide anions were generated in а non-enzymatic phenazine methosulfate (PMS)nicotinamide adenine dinucleotide (NADH), PMS-NADH system through the reaction of PMS, NADH and oxygen. The generation of superoxide anions was assayed by the reduction of nitroblue tetrazolium (NBT). Reaction volume of 200 µl containing 0.2 mM NADH, 0.08 mM NBT and different concentrations of black tea extracts (37.5, 75.0, 150.0, 300.0, 600.0 µg/ml) in 100 mM phosphate buffer were preread at 560 nm using a 96 well microplate reader (SpectraMax Plus<sup>384</sup>. Molecular Devices, USA). Then, 0.008 mM of PMS were added and incubated for 10 min at room temperature (25 °C), and the absorbance readings were taken at 560 nm (n=3 each). Quercetin was used as the positive control. Results were expressed as % inhibition and IC50 values.

Superoxide radical scavenging activity (%) =  $[(A_c - A_s) / A_c] *100$ 

where,  $A_c$  is the absorbance of the control and  $A_s$  is the absorbance of the

sample.

# Statistical analysis

Results are presented as mean ± SD (n = 3 each). Minitab version 16 was used in the statistical analysis of data. One-way analysis of variance (ANOVA) was used in statistical analysis.

# Results

# Nitric oxide and superoxide radical scavenging activities

NO and superoxide RSA of Sri Lankan orthodox OP grade black tea are given in Tables 1, 2 and 3. Results clearly revealed that hot water extract of orthodox OP grade black tea possesses both NO and superoxide RSA in a concentration-dependent manner. However, it showed significantly higher (P<0.05) NO radical scavenging activity (IC<sub>50:</sub> 7.47±0.01 µq/ml) than superoxide radical scavenging activity (IC<sub>50:</sub> 131.18±10.9  $\mu$ g/ml). Interestingly, the observed NO, and superoxide RSA were potent and moderate, respectively, compared to the reference drugs used in this study studied (IC<sub>50:</sub> Rutin and Quercetin: 17.62±0.01 and 75.58±1.92 µg/ml, respectively).

# Discussion

Free radicals include reactive oxygen species (ROS) and reactive nitrogen species (RNS), which are generated in living organisms by various endogenous systems, exposure to different physicochemical conditions and pathophysiological states (Valko *et al.*, 2007). ROS include free radical species, namely hydroxyl radical (OH), superoxide  $(O_2 \quad \dot{} )$  and hydrogen peroxide.

Table 1: Dose-response relationship of Orange Pekoe (OP) grade Sri Lankan black tea for nitric oxide radical scavenging activity

Concentration (µg/ml)	% Inhibition				
7.81	45.32±0.00				
15.62	68.37±0.09				
31.25	76.94±0.09				
62.50	80.32±0.09				
125.00	96.13±0.09				

Data represented as mean ± SD (n=3 each)

Table 2: Dose response relationship of Orange Pekoe (OP) grade Sri Lankan black tea for superoxide radical scavenging activity

	Concentration (µg/ml)	% Inhibition				
37.5		16.64±4.02				
75.0		39.23±4.17				
150.0		51.25±1.42				
300.0		78.17±3.80				
600.0		81.37±2.62				

Data represented as mean ± SD (n=3 each)

Table 3: IC<sub>50</sub> values of nitric oxide and superoxide radical scavenging activities of Orange Pekoe (OP) grade Sri Lankan black tea

Sample	Nitric oxide radical scavenging activity (IC50: µg/ml)	Superoxide radical scavenging activity (IC₅₀: µg/ml)		
Orange Pekoe (OP) grade Sri Lankan black tea	7.47±0.01	131.18±10.9		

Data represented as mean ±

(H<sub>2</sub>O<sub>2</sub>), while RNS include NO and its derivative, the peroxynitrite (ONOO<sup>-</sup>) (Valko *et al.*, 2007). Among these free radicals, superoxide and NO are considered as important free radicals generated in living organisms due to their beneficial and harmful effects (Valko *et al.*, 2007).

The free radicals generated in lining organisms are neutralized through various mechanisms and maintain radical concentration below harmful level. However, when the production of free radicals exceeds its neutralization process by the antioxidant defence system, it leads to a condition widely known as the 'oxidative stress' (Valko et al., 2007). It is now very well proven that oxidative stress causes to damage cellular macromolecules leading to many health hazards (Valko et al., 2007). Thus, the consumption of food and beverages having high antioxidant properties via multiple pathways might play a vital role in alleviating oxidative stress induced health hazards (Valko *et al.*, 2007). Tea is a widely consumed beverage in the world next to water and has received much due its beneficial attention pharmacological attributes including wide array of excellent antioxidant properties (Annual Report, Sri Lanka Tea Board, 2017; Khan and Mukhtar, 2013; Modder and Amarakooon, 2002). However, NO and superoxide RSA tea especially black tea have not been studied to a greater extent.

In this study, Sri Lankan (Ceylon) orthodox black tea was used as currently Sri Lanka is one of the largest producers of orthodox black tea in the world. Further, OP grade black tea was used as it's a commercially important orthodox black tea grade in the Moreover, low grown OP country. grade tea was studied as low grown tea remains as one of the main tea growing region in the country (Annual Report, Sri Lanka Tea Board, 2017). Findings of the present study clearly showed that hot water extract of orthodox OP grade Ceylon black tea possesses potent NO (IC<sub>50</sub>: 7.47±0.01  $\mu$ g/ml) and moderate superoxide (IC<sub>50:</sub> 131.18±10.9 µg/ml) RSA compared to the reference drugs (IC50: Rutin and Quercetin: 17.62±0.01 and 75.58±1.92  $\mu q/ml$  respectively) used in the study.

Indeed, NO radical scavenging ability tea has been of demonstrated previously in few studies (Padmini et al., 2008; Tsai et al., 2007; Lin et al., 2006; Łuczaj and Skrzydlewska, 2005; Nakagawa and Yokozawa. 2002: Paquay *et al.*, 2000). The reported studies have been focused on green tea (Tsai et al., 2007; Lin et al., 2006; and Nakagawa Yokozawa, 2002: Paquay et al., 2000), black tea, flavored black tea (Padmini *et al.*, 2008; Łuczaj and Skrzydlewska, 2005; Nakagawa and Yokozawa, 2002; Paguay et al., 2000) and herbal teas (Tsai et al., 2007). Among these reported studies, most of the studies have shown that NO scavenging activity of black tea is less compared to green tea (Lin et al., 2006; Nakagawa and Yokozawa, 2002; Paguay et al., 2000). Further, Tsai et al., 2007 has shown that NO inhibitory activity of green tea is much greater than the studied herbal teas. The lower activity of black tea compared to green tea has been explained via the reduction in polyphenolic content caused by fermentation (Lin et al., 2006). However, NO inhibitory activity of Ceylon OP grade black tea observed in the present is much greater (nearly 19-fold higher compared to green tea) than NO inhibitory activity of green tea (IC<sub>50</sub>: 144  $\mu$ g/ml) and several herbal teas (IC<sub>50</sub>: 200-730 µg/ml) published by Tsai et al., 2007 and black tea and black tea with mint (IC50: 45 µg/ml at highest activity) published by Padmini et al., 2008. Comparison of findings of the present study with the rest of the reported above stated studies makes quite difficult as presentation of results is different from the present study. It is reported that globally 80% of tea manufactured annually is

consumed as black tea (Lin *et al.*, 2006). Thus, observed potent NO radical scavenging activity of Sri Lankan low grown OP grade black tea definitely add value to Ceylon black tea in the international trade.

Additionally, superoxide radical

scavenging activity of Sri Lankan low grown OP grade black tea sample was moderately potent compared to the reference drug used in the present study. However, the observed activity was moderate compared to the superoxide radical scavenging activity of tea published by Padmini *et al.*, 2008.

The NO and superoxide RSA of tea includina black tea have been explained *via* the presence of variety of phenolic antioxidative compounds in tea (Łuczaj and Skrzydlewska, 2005; and Yokozawa, Nakagawa 2002; Paguay et al., 2000). Catechins, particularly Epigallocatechin gallate (EGCG), Gallocatechin gallate (GCG) and Epicatechin gallate (ECG) are known to be the main constituents of tea that are responsible for NO and superoxide RSA (Nakagawa and Yokozawa, 2002; Paquay et al., 2000). Thus, observed NO and superoxide RSA of selected Ceylon tea might be the presence of due to such antioxidative compounds in the tea sample. However, the exact compounds and their mode of actions in mediating NO and superoxide RSA of Ceylon OP grade black tea have to be investigated in detail in future research studies. Considering all. enhanced consumption of Sri Lankan low grown OP grade black tea might be useful in alleviating oxidative stress associated chronic diseases.

## Conclusion

In conclusion, orthodox OP grade black tea possesses potent NO and moderately potent superoxide RSA. This is the 1<sup>st</sup> report of NO and superoxide RSA of orthodox OP grade black tea. Further studies should be conducted to assess its potential use in managing oxidative stress associated with chronic diseases.

# Conflicts of Interest

Authors declares no conflicts of interest.

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## Original/Article Dietary habits and associated factors

#### among Advanced level students in

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## COVID-19 pandemic in Colombo district, Sri Lanka

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## Abstract

**Introduction:** Lack of nutrition awareness, poor eating habits and increased availability of unhealthy foods contribute to the development of non-communicable diseases (NCD).

**Objective:** To describe dietary habits and associated factors among Advanced level students in COVID-19 pandemic in Colombo district, Sri Lanka.

Methods: А descriptive, crosssectional study was conducted using convenient sampling technique among 480 A' level students using a selfadministered guestionnaire. Three-day dietary recall was used to assess dietary diversity usina the food pyramid and the Dietary Diversity Score (DDS). Consumption of  $\geq$ 4 food groups from the six main groups mentioned in the Food Based Dietary Guidelines was considered as а nutritionally adequate diet.

BMI was calculated using height and weight reported by the students and General Health Status (GHS) and wellbeing were evaluated using the PedsQL 3.0 general well-being module. Data were analyzed using IBM SPSS V26.0. P value <0.05 was considered as significant. Chi square test and independent t test were used to find the associations.

of **Results**: Consumption ≥3 vegetables was 67.5%. ≥2 types of fruits was 30.2% and consumption of ≥1 proteins, dairy products and nuts and seeds per day were 71.7%, 25.8%, 21.3% respectively. High percentage of starchy food consumption was reported (97.1%). According to the DDS. the students who had consumed  $\geq$ 4 types of food were 50.6%. Students who skipped breakfast ≥1 time per week (46.6%) was higher than the other two main meals. Consumption of a nutritionally adequate diet was significantly associated the with general well-being. GHS and monthly income of the family are significantly associated with meal skipping.

**Conclusions:** Consumption of a variety of food types and a balanced diet was low, although the nutritional adequacy was satisfactory. The association between consumption of a nutritionally adequate diet and the general wellbeing was significant.

## Introduction

The nutritional status of a population determines the overall health status which ultimately affects the health and well-being of a society. According to the World Health Organization (WHO) report 2002, the most important risk factors of noncommunicable diseases (NCDs) are high pressure, blood hiah concentrations of cholesterol in blood, inadequate intake of fruits and vegetables, being overweight or obese, physical inactivity and tobacco use. Poor quality of diet, or unhealthy dietary habits, is a key risk factor for the development of various chronic diseases such as obesity, diabetes, cardiovascular diseases and in children and adolescent.<sup>2</sup> A healthy diet is one that consists of a balanced intake of fruits, vegetables, fish, whole grains, and other foods which are known to be beneficial to health.

Adolescents become more independent and have increased access to food choices, apart from those available at home as they increase their social interactions with peers and develop individual eating habits. The health of young people is critically linked to the health-related behaviours they choose to adopt as unhealthy habits picked up at this age generally persist in adult life. Therefore, it is important to understand the dietary habits of adolescents and it is necessary to do research to assess the present situation in this area.

The aim of the present study was to describe the dietary habits during COVID-19 pandemic among Advanced Level students, in Colombo district. It was also our intent to examine the factors associated with the diet.

## Methodology

A descriptive cross-sectional study was conducted using convenient sampling technique (due to the COVID- 19 pandemic situation) among 480 GCE Advanced Level students (Grade 12 and 13) of schools in the Colombo district. Local Advanced level students irrespective of study stream who were schooling, who intended to sit the Advanced Level examination in 2021 and 2022 in Sinhala, English and Tamil mediums were eligible to participate. The students who were facing London Advanced level and EDEXCEL were excluded.

The questionnaire was prepared as a Google form and the link was shared in social media groups of tuition classes in the Colombo district that could be accessed by the researchers. Advanced level students who are members of these sites were invited to participate in the study till the sample number was achieved.

The questionnaire consisted of sections on socio-demographic factors and personal information, skipping meals, dietary history, height, and weight to calculate the BMI and GHS and general well-being.

In this study, frequencies of meal skipping per week, three-day dietary recall of what they had for main meals were considered as reflection of their dietary habits. The students who skipped one or more than one meal per week were considered as individuals who skipped meals and had those who consumed that particular meal for all seven days were considered as never skipped.

Following methods had been used to determine whether an individual had a healthy and a nutritionally adequate diet.

# 1. The Food Based Dietary Guidelines

According to the Food Based Dietary Guidelines for Sri Lanka, six types of food had been used to determine a balanced diet. Consuming ≥1 portion of starchy foods per meal and the daily consumption of  $\geq$ 3 types of vegetables,  $\geq$ 2 types of fruits, at least one portion of proteins, dairy products, nuts, and seeds were considered to determine a balanced diet.

## 2. Dietary Diversity Score

Consumption of ≥4 different food groups was considered as a nutritionally adequate diet.

Height and weight of an individual were requested to calculate the BMI. GHS has been assessed based on PedsQL 3.0 General well-being module, a standard and validated questionnaire to analyse GHS of adolescents.<sup>3</sup>

GHS was evaluated by a direct single question and the general well-being was analyzed by six questions. Responses were scored based on PedsQL scoring material and the percentages were calculated to grade the population accordingly.

### Pretesting and piloting

The data collection instrument was pretested prior to the research. Responses were reliable and response rate was satisfactory. Necessary modifications were made considering the feedback before commencing the study.

### Study implementation

Participants were selected from the setting entirely on a voluntary basis. They were given all necessary information about the study and the goals and methods of the study were explained in the information sheet provided to the participants. The volunteers had the right to withdraw from the study and refrain from answering a particular question by selecting the "I do not wish to answer" option at any time. Weekly reminders were provided until the target sample size had been achieved.

## Data analysis

Data entry and analysis were done by the investigators, by using the IBM SPSS V.26.0. Questionnaires were precoded for the convenience of data entry. All variables were individually checked for range checks and relevant variables were cross tabulated to check for inconsistencies. Descriptive statistics presented were as percentages, mean and SD and the inferential statistics were presented using chi square test for categorical variables and independent t test for continuous data.

Consent and assent of the participants Consent was obtained before recruitment after providing details about the study. If the participant was under 18 years old, consent of the parents/guardian and the assent of the participant was obtained. Overall consent was obtained before proceeding into age categorization to participate in this research.

### Privacy and confidentiality

No harm was done to the participants physically, mentally, or socially at any point of the research.

#### Study period

This study was conducted for eight months (October 2020 to June 2021). Data was collected in the month of January 2021.

#### Results

Most of the students were in the

Colombo educational zone, which was 74.9% of the total study population. The majority were Sinhalese (n=470, 98.9%) and Buddhists (n=435, 91.4%). Female population was 325 (68.4%). The majority (n=342, 71.2%) were learning Biological and Physical sciences. The income of the family was between Rs 50,000-100.000 in most of them(n=245,51%). The frequency of students who skipped any main meal is given in Table 1. Lunch was the meal skipped by the least number of students (n=175, 36.8%). Frequency of skipping breakfast was 222 (46.6%).

Table 2 represents the dietary habits of the study population. The choice of the six food groups was based on Food Based Dietary Guidelines for Sri Lanka.<sup>4</sup> According to that, six types of food had been used to determine a balanced diet. In the present study, consuming one or more than one portion of starchy foods( per meal) and consumption of  $\geq$  3 of vegetables,  $\geq$ 2 of fruits, at least one type of proteins, dairy products, nuts, and seeds was considered as a balanced diet.

In the selected population, 466 students (97.1%) reported eating  $\geq$ 1 portion of starchy foods per meal, 71.7% (n=344) reported eating at least one portion of proteins (meat, fish, poultry, eggs, and pulses) per day and 67.5% (n=324) reported having  $\geq$ 3 portions of vegetables per day.

Table 3 depicts the dietary diversity of the study population. Dietary diversity was defined as the number of different foods or food groups consumed over a given reference period. Food Based Dietary Guidelines and DDS had been whether used to determine an individual had a healthy and а diet.5 nutritionally adequate The participants were given а score according to the consumption of at least one portion from each food group that they had consumed per day. Therefore, one point was given for each food group consumed per day

and the maximum score was six. Consumption of four or more than four groups from the six main food groups in the food pyramid was considered as a nutritionally adequate die. According to the DDS, 50.6% of students had consumed a nutritionally adequate diet.

Table 4 demonstrates the factors associated with the nutritional adequacy of diet. The proportion of females who consumed a nutritionally adequate diet was higher (n=171,52.6%) compared to males (n=70,46.7%) (Table 4.1). A higher tendency of consuming a nutritionally adequate diet by the students who have high income compared to the low -income groups was observed, Students who were educating in the biological science stream were having a more nutritionally adequate diet compared to other streams (56.1%) There were no statistical significance between the association of nutritional adequacy of the diet with gender, A/L stream, income nor BMI (p>0.05).

There was a statistical significance observed in the association between nutritional adequacy of the diet and the general well-being (p<0.05) (Table 4.2). The mean value of general wellbeing score was high (76.4) in the students who were consuming a nutritionally adequate diet whereas the students who were not consuming a nutritionally adequate diet had scored a low mean value in general well-being score (70.2).

## Table 1: Frequency of the students skipping meals (Per week)

Meal skipping frequency	Breakfast		Lunch		Dinner	
	n	%	n	%	Ν	%
Skipped one or more than one meal	222	46.6	175	36.8	197	41.4
Never skipped	254	53.4	301	63.2	279	58.6
Total	476	100.0	476	100.0	476	100.0

Missing/ Students who did not wish to answer=4

#### Table 2: Distribution of students according to their dietary habits (Per day)

Food type	Adequate food cons	umption	Inadequate consumption	food
	Ν	%	Ν	%
<sup>1</sup> Starchy foods ( $\geq$ 1)	466	97.1	14	2.9
<sup>2</sup> Vegetables (≥3)	324	67.5	156	32.5
<sup>2</sup> Fruits (≥2)	145	30.2	335	69.8
<sup>2</sup> Proteins (≥1)	344	71.7	136	28.3
<sup>2</sup> Dairy products (≥1)	124	25.8	356	74.2
<sup>2</sup> Nuts and seeds (≥1)	102	21.3	378	78.8

<sup>&</sup>lt;sup>1 –</sup> per

#### Table 3: Distribution of students based on the Dietary Diversity Score

Nutritional adequacy	Frequency	Percentage %
Nutritionally adequate Good Dietary Diversity Score (≥4 food groups	243	50.6
Nutritionally inadequate Poor Dietary Diversity Score (<4 food groups	237	49.4
Total	480	100.0

Meal<sup>2</sup>-per

# Table 4: Factors associated with the nutritional adequacy of diet

#### Table 4.1

Variable			a	Nutritior dequate	nally diet	Nutritio inadequate	nally diet	Significance			
				n		%	n	%			
Gender (r	n=475	5) <sup>a</sup>	Male	70	46.7	80	53.3		x <sup>2</sup> =1.453 df=1 p=0.228		
			Female	171	52.6	154	47.4				
Income	(in	SL	<50 000	50	46.7	57	53.3		$x^2 = 0.985 df = 2$		
(n=480)					50 000 -100 000	125	51.0	120	49.0		p=0.611
			>100 000	68	53.1	60	46.9				
Subject	stream		<b>Biological Science</b>	110	56.1	86	43.9		$x^2 = 4.112 df = 2$		
(11=480)			Physical Science	67	45.9	79	54.1		µ=0.128		
			Others	66	47.8	72	52.2				
\BMI kg/m <sup>2</sup> (n=427) <sup>b</sup>			Underweight < 18.5	50	51.0	48	49.0		x <sup>2</sup> =1.689 df=3 p= 0.639		
			Normal 18.5-22.9	87	48.1	94	51.9				
			Overweight 23-24.9	33	52.4	30	47.6				
			Obese >25	48	56.5	37	43.5				

Missing/Students who did not wish to answer- a=5; b=5

#### Table 4.2

		General well being					
		Ν	Mean	Standard Deviation	Std. Error Mean	Significance	
Diet (n=480)	Nutritionally adequate	243	76.4	17.3	1.11	p<0.001 t=3.736 df=3.731	
	Nutritionally inadequate	237	70.2	19.2	1.25	-	

## Table 5 : Factors associate with meal skipping

#### Table 5.1

			General health status					
			n	Mean	Standard Deviation		Std. Error Mean	Significance
Skipping meals (n=476) <sup>⁵</sup>	Breakfast Never skipped		254	44.2	21.1		1.32	p<0.001, t=3.902
	Skipped at least one mea		222	36.5	21.9	21.9 1.48		uI=474
	Lunch Never skipped		301	42.4	21.8		1.26	p=0.015 t=2.430 df=474
	Skipped at least one mea		175	37.4	21.6		1.63	
	Dinner Never skipped		279	43.5	21.3	1.28 p=0.001 t= df=474		p=0.001 t=3.443 df=474
	Skipped at least one mea		197	36.5	21.9		1.56	
Table 5.2								
Meals		<50 000 Rs.		50 000 - 100000 Rs.		>100 000 Rs.		Significance
		n	%	Ν	%	n	%	
Breakfast (n=476)	Never skipped	45	17.7	136	53.5	73	28.7	x <sup>2</sup> =6.544 df= 2
	Skipped at least one meal	61	27.5	106	47.7	55	24.8	p= 0.038
Lunch (n=476)	Never skipped	58	19.3	165	54.8	78	25.9	x <sup>2</sup> =6.146 df= 2
	Skipped at least one meal	48	27.4	. 77	44.0	50	28.6	p= 0.046
Dinner (n=476)	Never skipped	57	20.4	146	52.3	76	27.2	$x^{2} = 1.348$ df = 2
	Skipped at least one meal	49	24.9	96	48.7	52	26.4	μ- 0.510

Factors associated with meal skipping are represented by the Table 5. A statistically significant association was observed with GHS and meal skipping of the students (p values for all three meals < 0.05) (Table 5.1). Students who had not skipped meals had obtained higher mean general health scores (44.2, 42.4, 43.5) in comparison with the students who skipped at least one meal across the week (36.5, 37.4, 36.5). There was a significant association of skipping breakfast and lunch with the monthly income level of the family of the student (p< 0.05) (Table 5.2). There was no statistical significance in the association of dinner skipping with the income (p> 0.05).

### Discussion

#### Dietary habits

During the COVID-19 pandemic dietary habits were notably changed due to lock downs. Our study indicates dietary habits of Advanced level students in Colombo district. Respondents were asked about the frequency of meals they consumed, and meals skipped in the considered week. Skipping breakfast was higher than other meals and the absence of schools and change in the time they wake up could be the reasons for this.

More than 50% of students never skipped any main meal. Skipping breakfast was also observed in the cross-sectional study conducted amongst adolescents aged 15-18 vears from schools in Bahrain regarding dietary and lifestyle habits.<sup>6</sup> They have recruited 735 students and the results showed 55.9% skipped breakfast. This can be due to dieting, lack of time and low accessibility to food due to busy schedules in the above study population.

Our study revealed a satisfactory daily consumption of vegetables, starchy foods, and proteins while fruits, dairy products and nuts and seeds have consumed less commonly (Table 2). Similar research was done on dietary and physical activity patterns of school children in seven schools in Colombo district.<sup>7</sup> Nutritional status, dietary and physical activity patterns of 8-12 aged students was assessed. Socioeconomic standard was the main factor that might have influenced the nutritional status and related behaviour of this study population as well as ours.'

Another cross-sectional study done on dietary habits of 927 school children in Mansoura, Egypt showed 89.6%, 71% and 58.9% of students consumed rice/bread. plant protein and vegetables, respectively. About 64.6% and 19.6% of students consumed fast foods and carbonated drinks. respectively.<sup>8</sup> All the findings except fast food consumption, are similar to our study which could be due to unavailability of fast-foods due to travel restrictions in the present study population.

According to our study, only 23 (4.8%) students out of 480 had a balanced diet. According to the DDS, only 29 (6.0%) students had consumed all six varieties of food. A study done among Sri Lankan adults showed that a substantial proportion does not consume a balanced diet, which is linked with the nutrition-related NCDs.<sup>9</sup> In our study, consumption of four or more than four groups were considered as a nutritionally adequate according previously diet to а published study (5). Most of the (n=243,50.6%) students were consuming a nutritionally adequate diet.

A study done among Sri Lankan adults showed relatively low DDS values in people who live in estate areas compared to urban areas. Also, there was a connection between higher educational level and increased dietary scores.<sup>10</sup> The difference observed between the reported study and ours might be due to the age difference of the populations, also most of the participants of our study had a better socio-economic status.

# Factors associated with the nutritional adequacy of diet

Majority of female students (52.6%) were taking a nutritionally adequate diet compared to males although not statistically significant. A research done in the Maharagama educational division, also observed that the female students had healthy dietary habits (n=181,52.2%) compared to males (n=94,32.8%.<sup>11</sup> The reason behind this might be females are more concerned about the nutritional value whereas males are concerned about having more servings of food.

An increasing tendency of consuming nutritionally adequate diet bv а students from high income families compared to the low-income groups was also observed. That might be due to availability of food in households even in a pandemic situation and the affordability of various types of food items. Aforementioned research done in Maharagama educational zone had found that knowledge on NCDs was associated with being a student of science stream (OR=3.3; 95% CI: 2.1-5.2).<sup>11</sup> Also, in biological science students were having a nutritionally adequate diet compared to others and their knowledge regarding nutrition and healthy food might have affected this.

There was no association between BMI and nutritional adequacy of diet. However, a Sri Lankan study done with adults, had mentioned that obese people (BMI ≥25.0 kg/m<sup>2</sup>) had the highest DDS and the BMI was gradually increasing parallel to DDS.<sup>10</sup> In comparison, a study conducted among children and adolescents in Iran stated that inadequate intake of all selected food items, except for fruits, was seen more in all BMI groups, which was similar to our findings.<sup>12</sup> General well-being of the population the perception represents of optimistic thoughts about oneself. The mean value of general well-being score was high (76.4) in the students who consuming were а nutritionally adequate diet whereas the students who were not consumina а nutritionally adequate diet had scored a low mean value in general well-being score (70.2). The reason behind this also might be the idea of having a nutritionally adequate diet brings them a positive perception on their lives compared to others.

A significant association was observed with GHS and meal skipping of the students. In our study, students who had not skipped meals had obtained higher mean general health scores in comparison with the students who skipped at least one meal across the week.

There was a statistically significant association between skipping breakfast and lunch and the monthly income level of the family, although this was not observed regarding dinner skipping.

# Conclusions

Consumption of a variety of food types and a balanced diet was low, although nutritional the adequacy was satisfactory. The percentage of students who skipped breakfast was higher than the ones who skipped the other two main meals. The students who were consuming a nutritionally adequate diet had a better general well -being compared to the others.

The students who had not skipped meals had obtained higher mean general health scores compared to students who skipped at least one meal across the week and also an association between skipping breakfast and lunch and the monthly income level of the family was observed.

## Limitations

Since the study design was descriptive cross sectional, causality cannot be established. The causes behind the behaviour can only be postulated as they were not inquired in the study. Being a self-administered questionnaire, it is possible that the findings were affected by desirability to response and recalling capacity. Quantitative measures about calorie intake, servings and portion sizes were not asked in the questionnaire.

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CURATIO

## **Brief Report**

Touch-free autopsy: the future is here...!

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Once a dead-body is referred for forensic-pathological/medico-legal examination, the forensic-pathologist is expected to examine and record the scientific findings and report the same in a method easily understandable by professionals. the legal other stakeholders of the criminal justice system as well as the general public. In addition to conventional methods, cutting-edge technologies could be used appropriately to record and illustrate the scientific data, making understandable them more and reproducible. The concept 'VIRTOPSY' is an attempt to implement new imaging techniques in radiology to fulfil the above objectives.<sup>2</sup> The VIRTOPSY<sup>®</sup> project had been launched in the year 2000 by Professor Richard the University Dirnhofer of of Bern, Switzerland.<sup>3</sup> The term was coined to eliminate the subjectivity attached with the traditional term 'autopsy'. As such, VIRTOPSY (or the 'virtual-autopsy') is meant to be a tool objective documentation and for analysis of physical findings. The term 'virtual' originating from Latin means 'useful'. 'Autos' in Greek means 'by

oneself' and 'opsomei' means to 'see with eyes'. Thus, the word 'autopsy' has a meaning of 'observing with one's own eyes'.

Radiological techniques including CT and MRI are the principal sources of extraction of information in VIRTOPSY. Though forensic radiology is as old as radiology itself, use of new imaging techniques in forensic pathology has become popular only within the past fifty years. The first-recorded CT imaging in forensics took place in 1977 in a fire-arm injury to the head.<sup>4</sup> Today, Multi-Slice Computerized Tomography (MS-CT) and Magnetic Resonance Imaging (MRI) are being used centres of excellence in includina Victorian Institute of Forensic Medicine (VIFM), Australia and Forensic Pathology Unit in Ontario, Canada. 2D and 3D reconstructions. magnifications and improvements in contrast and resolution are available with these techniques making them far superior in reproducibility.<sup>[2]</sup> CT-guided angiography post-mortem is an extremely useful minimally-invasive procedure enabling the diagnosis of vascular lesions without interfering with the original anatomy specially in which are difficult to be sites demonstrated by dissection.<sup>5</sup> In contrast to clinical CT imaging, postmortem CT can achieve better imagequality since exposure to radiation is not a limiting-factor.

Incorporation of newer techniques such as photogrammetry, three-dimensional surface scanning and robotics have certainly expanded the boundaries of virtual autopsy. A three-dimensional model with natural colours could be reconstructed using 2D photographs obtained in different angles by photogrammetry. The accuracy

of the dimensions of this 3D model is enhanced by incorporation of optical surface-scanning technique. In cases where the diagnosis is mainly histologic, minimally invasive image-guided biopsy may be used to obtain histopathological evidence. The most recent advancement of virtual autopsy is the integration of robotics in autopsy techniques which is termed 'VIRTOBOT'-a multi-tasked robot designed optical to perform surface-scans, photogrammetry and even image-guided post-mortem biopsies."

Thus, via virtual-autopsy, one may arrive at cause of death and other medico-legal opinions in a 'touch-free' fashion evading an invasive autopsy dissection. In its cutting-edge, entire procedure would be fully automated to be regulated by a trained autopsytechnician. The autopsy-pathologist and the autopsy-radiologist ('necroradiologist') will be chiefly responsible for interpretation of such digitallycollected data. Digital imaging techniques are superior in detecting certain pathological entities including air embolism, fractures, foreign bodies and vascular pathologies compared to traditional autopsy dissection. Early ischaemic changes, soft tissue trauma (cerebral trauma in non-accidental children) and cerebral iniuries in parenchymal pathologies are more accurately visualized with MRI compared to conventional methods.<sup>2</sup> histopathologic Virtual autopsy invariably acts as a method of digital storage. The reproducibility of data greatly eliminates subjective-bias and enhances the ease of obtaining a second-opinion from across the globe. also allows a great research lt potential across time and geographical areas of this small world. Easy access otherwise non-accessible sites, to minimal disfiguration of the body, cultural acceptance and bio-safety (as in cases of COVID and CJD) are other advantages.<sup>1, 2, 3</sup> Establishing a facility with virtual-autopsy is extremely costly. In addition to expensive instruments

and infra-structure, it also needs man-power specialized includina autopsy-pathologists and radiologists well-aware of post-mortem imaging artefacts and trained technicians and soft-ware operators. Maintenance of such unit and maintaining the confidentiality and integrity of digitalinformation are other challenges.' Yet, once established, the relative cost per virtual-autopsy would be substantially less than for conventional autopsy. In complicated cases, the accuracy and precision of findings of virtual-autopsy would be much higher. Presently, these techniques are used in several high-end centres of excellence in the world, though this approach is being readily incorporated in to their systems in many other developed and middleincome countries today.

In Sri Lanka, access to post-mortem Xray alone is a luxury. Extremely limited cases had been subject to postmortem CT scans. Currently there is dedicated CT scanner sinale no maintained by a medico-legal unit in Sri Lanka. With the increasing number of natural and traumatic cases and of challenges emergence new including COVID-19 pandemic, the of integration of forensic need radiology with routine autopsy-work is imperative.

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