

**Food Commercialization, Hidden Hunger and
Malnutrition:
A Study of Food and Nutrition Security
focusing on the Marginalized Society in Sri
Lanka**

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Written by
W.A. Permani Chandika Weerasekara
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The Faculty has approved this work of Organic Agricultural Sciences of the University of Kassel as a thesis for acquiring the academic degree of Doctor of Agricultural Sciences (Dr. agr.). Prof. Dr. Chandana Rohana Withanachchi, Rajarata University of Sri Lanka, has been part of the supervisor team and co-author of all three publications.

First Evaluator: Prof. Dr. Angelika Ploeger, University of Kassel, Germany.

Second Evaluator: Dr. Christian Hülsebusch, DITSL, University of Kassel, Germany.

Examiner: Prof. Dr. Claudia Neu, University of Kassel and the University of Göttingen, Germany.

Examiner: Prof. Dr. G.A. Sanjeewanie Ginigaddara, Rajarata University of Sri Lanka.

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Prof. Dr. Chandana Rohana Withanachchi, Rajarata University of Sri Lanka war Mitglied im Betreuungsteam in Sri Lanka und Co-Autor der drei Publikationen.

Erste Gutachterin: Prof. Dr. Angelika Ploeger, Universität Kassel, Deutschland.

Zweiter Gutachter: Dr. Christian Hülsebusch, DITSL und Universität Kassel, Deutschland.

Prüferin: Prof. Dr. Claudia Neu, Universität Kassel und Universität Göttingen, Deutschland.

Prüferin: Prof. Dr. G.A. Sanjeewanie Ginigaddara, Rajarata University of Sri Lanka.

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Frequently used abbreviations

FAO	Food and Agriculture Organization
MDD-W	Minimum Dietary Diversity of Women of reproductive age
WRA	Women of Reproductive Age
WHO	World Health Organization
NCDs	Non-Communicable Diseases
DD	Dietary Diversity
KAP	Knowledge Attitude Practices
DS	Divisional Secretariat
GN	Grama Niladari
ERC	Ethical Review Committee
BMI	Body Mass Index
VIF	Variance Inflation Factor
UN	United Nations
IFAD	International Fund for Agricultural Development
WFP	World Food Programme
USDA	United States Department of Agriculture
UNICEF	United Nations International Children's Emergency Fund
ECDPM	European Centre for Development Policy Management
LTTE	Liberation Tigers of Tamil Eelam
GDP	Gross National Products
Hb	Hemoglobin
IFPRI	International Food Policy Research Institute
ADB	Asian Development Bank
FRAC	Food Research Action Center
MSG	Monosodium Glutamate
WDDS	Women Dietary Diversity Score
EAR	Estimated Average Requirements

Preface

The basis for this research stemmed from my background and experiences. The Research study was funded by the “Katholische Akademische Ausländer Dienst (KAAD)”, Germany and the “Verein zur Förderung einer natur- und sozialverträglichen Ernährungs- und Landschaftskultur e.V.” in Germany, and DAAD STIBET programme in Germany. This doctoral study mainly investigates food commercialization, hidden hunger and malnutrition in marginalized societies in Sri Lanka. The dissertation comprises three published paper in peer-reviewed international journals. The list of the published articles referring to the chapters in the thesis is provided below.

Chapter 04

- Weerasekara, P. C., Withanachchi, C. R., Ginigaddara, G. A. S., & Ploeger, A. (2018). Nutrition transition and traditional food cultural changes in Sri Lanka during colonization and post-colonization. **Foods**, 7(7), 111. <https://doi.org/10.3390/foods7070111>

Chapter 05

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Chapter 06

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Summary

From 2016 to 2019, a collaborative research project between the Rajarata University of Sri Lanka and the Department of Organic Food Quality and Food Culture, University of Kassel, Germany, was carried out to investigate the food commercialization, hidden hunger, and malnutrition in marginalized societies in Sri Lanka.

Consuming a healthy diet, maintaining good health, and chronic diseases is a challenge for those struggling with poverty and food insecurity for various reasons in Sri Lanka, including limited financial access. Unhealthy food increases the adverse outcomes experienced by the food insecurity of individuals. The commercialization of the food system has led to issues of nutritional problems in Sri Lanka. Sri Lanka is moving from traditional diets based on nutrient foods to highly processed, low nutrient food. Simultaneously, rapid demographic, social, and economic changes are underway, leading to increased urbanization and changes in food systems. This transition refers to recent global shifts in a dietary pattern such as higher intakes of saturated fats, sugars and refined foods, and lower intakes of fiber-rich foods, driven by technological advances that have made energy-dense, micronutrient-poor foods cheaply available on the global food markets. This nutrition transition leads to diet-related diseases, such as undernutrition, micronutrient deficiencies, obesity, and non-communicable diseases. Thus, a comprehensive study was done to examine the Sri Lankan food and nutrition and health situation, especially food transition and nutritional problems. This study intends to fill the existing knowledge and policy gaps for food and nutrition governance in Sri Lanka, especially in marginalized societies. This study could empower the Sri Lankan food system by moving towards sustainability and contributes to the existing scientific work globally in the context of food and nutrition governance. This research study's overall thematic objective is to address the connection between food system commercialization, hidden hunger, and malnutrition. Notably, the focus is on food security and nutrition security in marginalized societies in Sri Lanka, with special attention being given to food culture and governance.

This research used an interdisciplinary mixed-method approach. As a first step, identified parameters that have underpinned the dietary change in Sri Lanka based on literature data and the current situation. In this survey, found that colonial and postcolonial dynamics had a significant impact on cultural changes. This has directly impacted Sri Lankan food culture and nutrition status and is connected to current nutrition problems. Changes in traditional diets towards a more Western diet, promoting as higher fat and sugar content, are expected to result in higher incidence of dietary-related non-communicable diseases, as well as micronutrient deficiencies. Thus, the dissemination of traditional knowledge and popular campaigns must continue. As a second step was investigated food and nutrition-related knowledge, attitude, and practice (KAP) on nutrition status according to FAO guidelines. The research results clearly showed that reproductive-age women have a low level of nutritional knowledge and most women have a positive attitude about receiving nutritional knowledge but have low-level practice about a healthy diet. Furthermore, knowledge, practices, and attitudes of women largely affect their BMI status and household food security. As third step, was used MDD-W according to FAO guidelines first time in Sri Lanka. In this survey identified these societies had poor diets with imbalanced macronutrients and alarmingly low intakes of some key micronutrients. These results also confirmed the posed hypothesis, which showed that urban slum women reported higher levels of food insecurity than women from remote rural areas. Furthermore, monotonous diets are rice-based, with little consumption of fruits and vegetables. Moreover, this study provided a better understanding of women's determinants of dietary behaviour and valuable information on planning programs to prevent the risk of reproductive-aged women in marginalized areas (MDD-W). This study found that MDD-W is higher in rural households than in urban households. Women's meal patterns are inadequate, and food choices are characterized by highly refined cereal products, high sugar, and high-fat products compared to healthier food choices (mostly unprocessed foods). Furthermore, this research finding helps to understand the diversity of food and the food transition. The study further confirmed that low dietary diversity impacts nutrition status and health. Based on the results of this research, there is a need to enhance nutrition education about diet diversity as well as food security among reproductive women. Further studies can be conducted to investigate the

strategic nutrient intake and micronutrition problems in these areas among women and children. The study demonstrated that food and nutrition policies change due to changes in political regimes. Thus, this study found that local governments play a role in increasing access to healthy foods and reducing access to unhealthy food. The study identified that the food transition and socioecological patterns are important factors in the politics of policymaking.

Zusammenfassung

Von 2016 bis 2019 führten die Rajarata University von Sri Lanka und das Fachgebiet für Ökologische Lebensmittelqualität und Ernährungskultur der Universität Kassel ein gemeinsames Forschungsprojekt durch. Das Ziel des Projektes war es, die Kommerzialisierung des Ernährungssystems, das Phänomen der Mikronährstoffdefizite (sogenannter "hidden hunger") und andere Aspekte der Fehlernährung in marginalisierten Bevölkerungsgruppen in Sri Lanka zu untersuchen. Für die Personengruppen, die von Armut und Nahrungsunsicherheit betroffen sind, stellen eine gesunde Ernährungsweise, Aufrechterhaltung der Gesundheit und der Umgang mit chronischen Erkrankungen eine immense Herausforderung dar. Dieses hat verschiedene Gründe, unter anderem mangelnder Zugang zu finanziellen Ressourcen. Ungesunde Lebensmittel verschärfen negative Auswirkungen auf die Ernährungssicherheit von betroffenen Personen. Die Kommerzialisierung des Ernährungssystems in Sri Lanka führt zu einer Anzahl von Problemen bezüglich der Ernährungsweise. Die Gesellschaft von Sri Lanka hat traditionelle Ernährungsweisen, die auf nährstoffreicher Kost beruhten, weitgehend durch hochgradig verarbeitete Kost ersetzt. Außerdem sind rapide demographische, soziale und ökonomische Veränderungsprozesse zu verzeichnen, die beschleunigte Urbanisierung und veränderte Ernährungssysteme zur Folge haben. Diese Übergangsprozesse gehen einher mit tiefgreifenden, global auftretenden Verschiebungen in Ernährungsmustern, so etwa mit dem erhöhten Konsum von gesättigten Fettsäuren, Zucker und verarbeiteten Lebensmitteln, und dem verminderten Genuss von ballaststoffreicher Kost. Diese Verschiebung der Ernährungsweise wird getrieben von technologischen Entwicklungen; aufgrund dessen können sehr energiereiche Lebensmittel, die aber nur wenig Mikronährstoffe aufweisen, zu niedrigen Preisen auf den Weltmarkt gebracht werden. Der Übergangsprozess - "nutrition transition" - führt zu ernährungsbedingten Erkrankungen wie Unterernährung, Mikronährstoffdefiziten, Adipositas und anderen nichtübertragbaren Krankheiten. Darum wurde eine umfassende Studie unternommen, um die Ernährungs- und Gesundheitslage in Sri Lanka zu untersuchen, besonders in Bezug auf veränderte Ernährungsweisen und Ernährungsprobleme vulnerabler Gruppen.

Es ist dringend notwendig, Lebensmittelqualität unter Berücksichtigung der Belange der Bevölkerung umfassend zu evaluieren. Diese Studie hat die Absicht, die bestehenden Lücken in Kenntnisstand bezüglich der Governance von Ernährung in Sri Lanka herauszustellen und zu beseitigen, besonders in Bezug auf marginalisierte Bevölkerungsteile. Die Studie möchte auf das Ernährungssystem von Sri Lanka einwirken mit dem Ziel nachhaltigen Entwicklung. Außerdem leisten die gewonnenen Erkenntnisse einen Beitrag zur existierenden Literatur zur Governance von Ernährung und Lebensmitteln.

Das übergreifende thematische Ziel der Studie ist die Verbindung zwischen der Kommerzialisierung des Ernährungssystems, dem Phänomen von „hidden hunger“ und der Fehlernährung zu untersuchen. Ein besonderer Fokus wird hierbei auf Ernährungssicherheit innerhalb marginalisierter Bevölkerungsgruppen gelegt, wobei Ernährungskulturen und Governance einen Schwerpunkt der Untersuchung bilden. Auf Grundlage von Literatur anlesen und aktuellen Erkenntnissen identifizierte die erste, im Jahr 2017 unternommene Studie, Faktoren, welche den Wandel der Ernährungsweise in Sri Lanka von der frühen Besiedlung bis hin zur post-kolonialen Epoche im Jahr 2017 auszeichneten. Unsere erste Sondierung identifizierter Parameter, die die „nutrition transition“ in Sri Lanka ausmachen. Die zweite Forschungsphase im Jahr 2018 bestand darin, kontextspezifisches Wissen, sowie Einstellungen und Praktiken in Bezug auf Ernährung zu erheben. Dafür haben wir Frauen im gebärfähigen Alter ausgewählt, da für die Auswirkungen von Mangel- und Fehlernährung das reproduktive Alter besonders relevant sind. Dazu haben wir eine Querschnittserhebung durchgeführt. Dadurch konnten wir die Auswirkung von fehlendem Wissen in Ernährungsfragen auf den Prozess der „nutrition transition“ verstehen.

Daher bestand unser dritter Schritt darin, das aktuelle Ernährungsmuster sowie die Gesundheits- und Ernährungssituation in Sri Lanka zu verstehen. Eine Querschnittserhebung wurde unter Verwendung des MDD-W-Indikators (Minimum Dietary Diversity for Women of Reproductive Age) gemäß den Richtlinien der Ernährungs- und Landwirtschaftsorganisation der Vereinten Nationen (FAO) durchgeführt. Diese Bevölkerungsgruppen zeichneten sich aus durch unausgewogene Ernährung mit unausgeglichenen Makronährstoffen sowie einer alarmierend geringen Aufnahme wichtiger Mikronährstoffe. Diese Ergebnisse bestätigten die aufgestellte Hypothese, dass Frauen in urbanen Slums ein höheres Maß an Ernährungsunsicherheit verzeichnen als Frauen aus abgelegenen ländlichen Gebieten. Außerdem ergaben die Untersuchungen, dass einseitige Ernährungsweisen auf der Grundlage von Reis dominierten, mit wenig Gemüse und seltenem Konsum von Obst. Darüber hinaus lieferte diese Studie ein besseres Verständnis der Determinanten des Ernährungsverhaltens von Frauen, und damit wertvolle Informationen für Programme, die Risiken für Frauen im gebärfähigen Alter in marginalisierten Gebieten zu vermindern suchen. Eine „doppelte“ Fehlernährung (Mangelernährung und hohes Übergewicht) in Verbindung mit einem Mangel an Ernährungsvielfalt konnte ermittelt werden. Die Studie ergab, dass MDD-W in ländlichen Haushalten höher ist als in städtischen Haushalten. Wie in der Forschungsstudie kurz erwähnt, beeinflusst eine unausgewogene Ernährung die Ernährung und den Gesundheitszustand künftiger Generationen. Die Ernährungsgewohnheiten von Frauen sind unzureichend, und die Auswahl an Lebensmitteln ist, im Vergleich zu gesünderen, unverarbeiteten Lebensmitteln, gekennzeichnet durch hochverarbeitete sowie zuckerreiche und fettreiche Produkte. Ausgehend von den Ergebnissen dieser Studie wird die Notwendigkeit von Bildungsprogrammen deutlich, die das Bewusstsein für Ernährungsvielfalt und Ernährungssicherheit bei Frauen im gebärfähigen Alter zu verbessern.

Die Studie stellt heraus, dass der Prozess der „nutrition transition“ und sozio-ökologische Muster wichtige Faktoren für die Politikgestaltung sind. Die Ergebnisse unterstreichen auch die Notwendigkeit, Ernährungsmaßnahmen einzubeziehen, die sowohl Probleme der Ernährungsunsicherheit als auch begrenztes Wissen über gesunde Ernährung im reproduktiven Alter bearbeiten, wie von der WHO empfohlen. Wegen der Bereitstellung des Grenzwerts für fünf Lebensmittelgruppen ist der MDD-W ein wertvolles Instrument zur Identifizierung und Charakterisierung von Bevölkerungsgruppen mit einem erhöhten Risiko von unzureichender Nährstoffaufnahme. Diese Studie weist weiterhin darauf hin, dass die kommunale Regierungsebene eine Rolle dabei spielen muss, den Zugang zu gesunden Lebensmitteln zu verbessern und den Zugang zu ungesunden Lebensmitteln zu verringern. Nach unseren Erkenntnissen, und gestützt auf bestehende Literatur, liegt das Augenmerk bislang auf Strategien, die Ernährungspraxis verbessern sollen, als auf solchen, die in marginalisierten Bevölkerungsgruppen den Zugang zu ungesunden Lebensmitteln verringern könnten. Die kommunale Regierungsebene sollte sich jedoch auch auf Strategien konzentrieren, die den Zugang zu ungesunden Lebensmitteln regulieren

Chapter 01

1. Introduction

1.1 Background of the study

A healthy diet is essential for good health and wellbeing (WHO,2010; FAO,2012). Also, access to healthy food ensures the food security of society. A healthy diet helps prevent all forms of malnutrition and non-communicable diseases (NCDs), including diabetes, heart disease, and cancer (FAO,2018). Food security is explicitly associated with health and nutrition problems. Thus, an inadequate micronutrient or lack of dietary diversity is a global challenge, and it is the impact of the inability to get nutritiously enough, well-balanced food. Consequently, every country in the world is affected by one or more forms of malnutrition. Consuming a healthy diet and maintaining good health and chronic diseases can be a challenge for those struggling with poverty and food insecurity for various reasons, including limited financial access (FRAC,2017). On the other hand, reducing poverty is a key element in a policy for food security. Hence, food insecurity is when a person or a household lacks regular access to enough nutritious food for a healthy and active life (FAO,2010). Food insecurity is an essential but often overlooked factor affecting the health of a significant segment of the developing world, such as Sri Lanka. It is not only an individual problem; it is an issue that impacts the whole household as well as the whole society. Unhealthy food increases the negative outcomes experienced by food insecure individuals.

Consequently, more than 2 billion people worldwide are affected by deficiencies in vitamins and minerals, and more than double the 805 million population do not consume enough calories in their diet (FAO, IFAD; WFP,2014). Malnutrition impairs physical, cognitive and psychological growth and leads to increased child morbidity and mortality. Among adults, effects include lethargy and poor health, decreased cognitive function, and a loss of learning potential. These adverse are often irreversible. Also, around one-third of the world's population suffers from micronutrient deficiencies, also known as "hidden hunger" (WHO,2014). Hidden hunger is a growing problem, not only in Sri Lanka but also around the world. Hidden hunger, or micronutrient deficiency, is a major public health problem in developing countries caused by a lack of essential vitamins and minerals (e.g., vitamin A, zinc, iron, iodine) in the diet. Hidden hunger is not so obvious because even an average eating person (a person eating 1800 kcal/day) in developed countries may suffer from this nutrition problem; thus, we cannot merely point at the poor for having nutrition problems. These micronutrient deficiencies affect mainly women and children. Over 623 million women of reproductive age are affected by anaemia. About 2 billion adults are overweight, and 672 million are obese (FAO, 2014; WHO,2014). These are risk factors for many NCDs and some cancers, which bring additional economic costs associated with high treatment costs. All of the aforementioned nutritional problems give cause for great concern and pose significant challenges.

Additionally, some studies show a gender-disaggregated assessment of commercialization effects on women's nutrition (Braun von,1995; Fischer & Qaim,2012). Export crops have often been blamed as a cause of poor nutrition (Kennedy et al.,1992; Longhurst,1988). In developed countries, most lands and other inputs are dedicated to export (UN,2008). Whether of staple or nonstaple foods or inputs for manufacture, whether sent abroad or to other regions of the same country, this production often coexists with significant malnutrition. A theme emerging across South Asia is that agricultural production is moving beyond just supplying basic food needs (Joshi et al.,2007; Mittal & Sethi,2009). Food production in South Asia, such as Sri Lanka today, has to match consumers' demands, especially the increasing number of urban consumers with their higher incomes and changing dietary habits (Pingali,2007).

Common trends across the sub-continent include a static or even declining consumption of cereals. Significant increases are generally occurring in the consumption of animal proteins (milk, eggs, chicken, fish, etc.), fruits, vegetables, condiments, vegetable oils, and sugar (Pingali,2007). Processed foods are becoming more prevalent, resulting in agribusinesses becoming bigger buyers of raw materials from farmers. Sales through formal retail stores and fast-food outlets are all projected to increase rapidly. A sustainable food system of the community is a collaborative network that integrates sustainable food production, processing, distribution, consumption and waste management. Farmers, consumers and communities are partners to create a more autonomous local food-based economy (Paarlberg,2013). Sri Lanka, as a civilization based on agriculture, had to be self-sufficient in historical times. But after the green revolution, agricultural chemicals have led to increased environmental and human health risks in Sri Lanka. Commercialization of agricultural systems may lead to greater market orientation, progressive substitution out of non-traded inputs for purchased inputs, and the decline of an integrated farming system (Pingali,2001). The specialization and commercialization of farming households within a more diversified economy are part of the development process. But there are concerns that the process by-passes the poor (Braun von,1995). The present-day lifestyle and the people's related food habits have changed to a greater extent, and people are highly addicted to fast food with fewer nutrient levels (Mattsson & Helmersson,2007; McIntosh,2013). The rapid establishment of fast-food restaurants, such as MacDonald, KFC, Burger Kings, and Pizza Hut, all over the country is evidence for the popularity of fast food among Sri Lankans (Patabandige et al.,2016; Weerasekara et al.,2018). At the same time, poverty negatively impacts nutritional health and impacts life longevity, mental acuity, and quality of life (Butler,2014). In addition to negatively impacting human biology, poverty and malnutrition damage socioeconomics (Stein,2010). The improvement of a food-deficient status and a malnourished person has to come about by an improvement in the ability to acquire more diversity food or better-quality food, or both (Babu et al.,2014). Accordingly, diet diversity is an important element of diet quality associated with an increased probability of sufficient micronutrient intake (Johns,2003). Also, the nature of the malnutrition burden facing the world is complex. It is a result of poverty as well as food and nutrition transition. Many developing countries are moving from traditional diets based on nutrient foods to highly processed, low nutrient-dense foods. At the same time, rapid demographic, social, and economic changes are underway in many developing countries, leading to increased urbanization and changes in food systems. This transition refers to recent global shifts in a dietary pattern, such as higher intakes of saturated fats, sugars and refined foods, and lower intakes of fibre-rich foods, driven by technological advances that have made energy-dense, micronutrient-poor foods cheaply available on the global food markets. This nutrition transition leads to obesity and diet-related diseases, also called the triple burden of malnutrition. This triple burden of malnutrition is undernutrition, micronutrition deficiencies and obesity (Pinstrup-Andersen,2007). On the other hand, the commercialization of the food system has led to issues of nutritional problems. The commercialization leads to income-induced diet diversification, dietary globalization, and Westernization. In developing countries, poor people spend 80% of their income on food (Goodland, 2001), yet they are often malnourished due to inadequate access to food (Popkin,1998; Goodland,2001). Not only malnutrition but also NCDs, such as cancer, occur as the Western diet displaces the traditional diet due to the surplus of some harmful substances in processed foods and the lack of essential nutrients in Western foods. Thus, food system commercialization may affect changing attitudes and changing dietary patterns.

Accordingly, food security is essential to maintain an optimal nutritional status. Therefore, ending food insecurity, malnutrition, and hunger is a pressing global ethical priority (Braun von, 2010). But a growing number of people are deprived of the basic right to food, which is essential for all other rights (Alston & Tomaševski,1984). Moreover, the food and nutrition crisis has deepened in recent years, as

increased food price volatility and global recession affected the poor (Braun von,2008). A diet described by insufficient intake of calories, vitamins, minerals and proteins will contribute to undernutrition and consequently to a higher risk of low birth weight. But the policies related to these driving forces will greatly influence the nature and the speed of the agricultural commercialization process (Jaleta et al.,2009). These, in turn, will largely determine the impact on households' income and their nutritional status and could result in significant outcomes for the household. Various population groups are adapting differently to the process of commercialization, depending on the resources available to them and government policies or knowledge.

In such a scenario, one needs to shift the household food system and practice towards good health and sustainability (Bowdren and Santo,2019; Irz et al.,2019) and food security for all. Thus, a comprehensive study to examine the Sri Lankan food, nutrition and health situation, in particular food transition and nutritional problems, is needed to assess the importance of inclusive food quality with attention to people's concerns. This study intends to fill the existing knowledge and policy gaps for food and nutrition governance in Sri Lanka, especially in marginalized societies. This study could empower the Sri Lankan food system by moving towards sustainability. This study could also contribute to the existing scientific work globally in the context of food and nutrition governance.

1.2 Theoretical background

1.2.1. The causes of malnutrition and micronutrient deficiencies in society

Improved definitions and multiple causal pathways of different concepts that lead to food insecurity and nutrition insecurity and valid indicators to measure these constructs are important to inform programs and policies able to address them effectively. The causes of food and nutrition insecurity are interrelated and are rooted in poverty, and are affected by social, economic and political structures and cultural factors that vary by context (Reul,2013). The UNICEF distinguished three levels of determinants of undernutrition: the basic structural causes at the society level, underlying causes at the household level, and immediate causes at the individual level (see Figure 1.1).

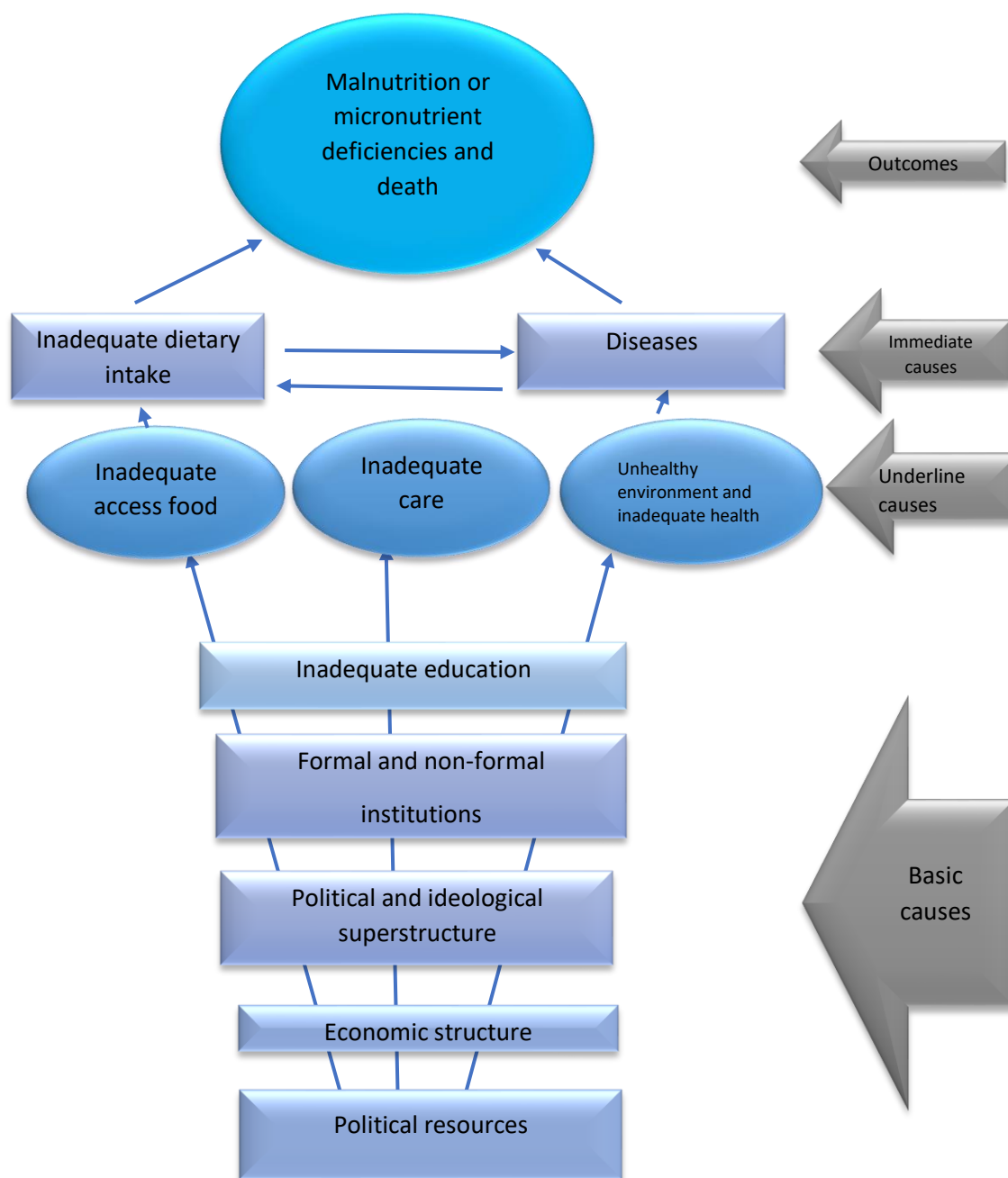


Figure 1.1.: Cause of malnutrition and micronutrient deficiencies (UNICEF,2010)

This framework serves as a guide in assessing and analysing the causes of nutrition problems. Immediate causes of nutrition status at the individual level are dietary intake and health status. The dietary intake should meet a certain threshold in terms of quantity and quality, and nutrient intake should be balanced in terms of macronutrients and micronutrients. These two factors are interlinked (Weingärtner,2010). Other characteristics, such as habit and knowledge about food processing and eating practices, influence the diet composition of the individual level. A monotonous diet from single sources, such as eating rice, can cause undernutrition. This may lead to a lack of education or knowledge about proper nutrition or from having access to a single food source (Burchi et al.,2011). Additionally, household food insecurity, inadequate care, lack of health services, and an unhealthy environment are important at the individual level. Household food security is a direct requirement for adequate dietary intake at the individual level. Social and political context interact together with economic context. These factors are recognized as the basic drivers of undernutrition. A strong political commitment and concerted social action are needed to solve the multicausal problems. In Sri Lanka, a wide range of nutrition programs have been in place for several years. There are some active programs called *Thiposha programme*, *Samurdhi*

programme, micronutrient supplementation programmes and *poshana malla programme*. The "*Thripasha*" programme is a major food supplementation programme of the government targeting and caters to the energy protein and micronutrient requirements of pregnant and lactating women and infants aged 6-11 months (Weerahewa et al.,2016). It began in 1970 and is still active today. The "*Samurdhi*" programme was introduced in 1995 as a poverty alleviation programme (Weerahewa et al.,2016). Meanwhile, the "*Poshana Malla programme* ", which started in 2006, targeted pregnant and lactating women in low-income families by providing packages containing nutritious foods. Also, micronutrient supplementation programmes for pregnant and lactating women were initiated in 1995 and a health promotion programme in 2009 (Weerahewa et al.,2016). Sri Lankan food security and nutrition policies have evolved under five different political regimes after independence (1948-1955: period noninterventionist free-market policies; 1956-1976: the period of import substitution policies (closed economy); 1977-2004: open economic policy; 2005-2014: the period of back to protectionism; 2015-2019: the period of good governance and open economy) (Weerahewa et al.,2016). But, at the same time, malnutrition and micronutrient are continuing public health problem. The wide array of context-specific causal factors of food and nutrition insecurity need to be considered.

1.2.2. Food systems commercialization

Urbanization, free trade, and changing diets are trends creating very dynamic food systems as a result of commercialization, with significant restructuring occurring in developing countries, such as Sri Lanka, that will continue over the upcoming decades. These differences create both systematic risk and transformational opportunities that demand a deeper understanding of food systems (ECDPM,2017). Extending agro-food production has only partly translated into less hunger and has not accompanied a reduction in malnutrition. While there are currently millions of people are suffering a different form of malnutrition, 1.9 billion adults are overweight or obese. Around 45% of deaths among children under 5 years of age are linked to undernutrition, mainly due to dietary insufficiencies or low-quality diets (WHO,2020). The perspective of food systems is increasingly considered as a useful framework for understanding these changes and shaping transformative action at the interface of science and policy. Food systems are considerably broader than only agriculture and food value chains. Thus, food systems are essentially multidimensional, including sociocultural, economic, environmental and political aspects (see Figure 1.2). Also, inclusive economic development in developing countries, such as Sri Lanka, is highly interrelated with the food economy. In particular, the food and agriculture sector remains the dominant areas of employment with large distributional effects through the informal food economy, which is growing rapidly with globalization. This will largely impact poverty reduction, but poor nutrition and food quality undermine productive capabilities.

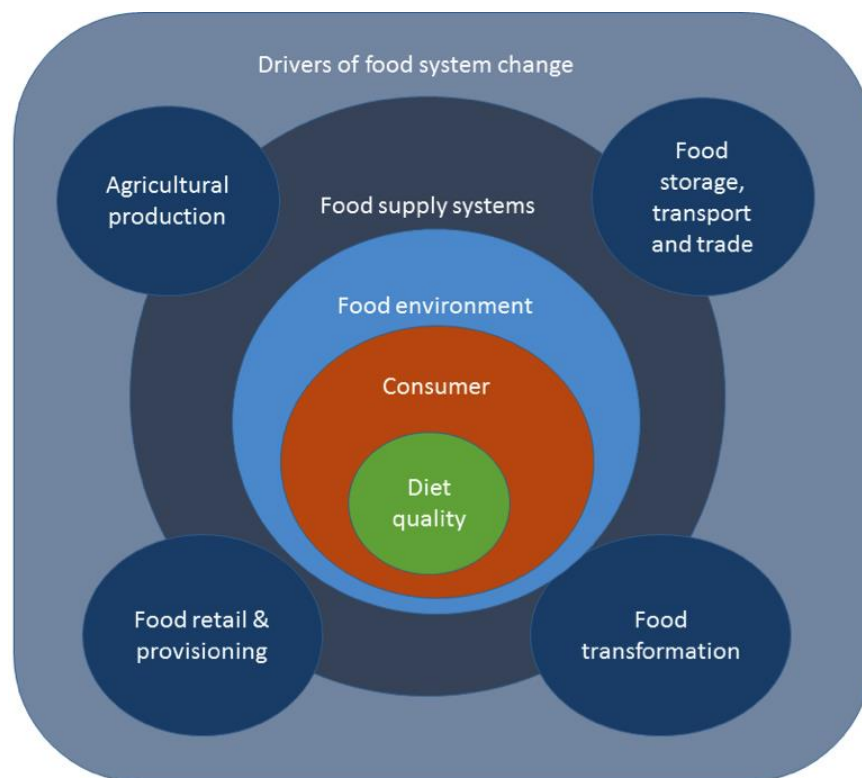


Figure 1.2: Drivers of food system changes (GLOPAN, 2016).

On the other hand, nutrition deficiencies are not only resulting in low food quantities but also low-quality dietary diversity. Over the last 50 years, agriculture modernization has contributed to narrowing the global production pattern with a focus on a limited number of major crops. Literature has analyzed the effect of agriculture commercialization on household welfare. But many studies focus on income, asset ownership or poverty (Tipraqsa and Schreinemachers,2009; Muriithi and Matz,2015; Ogutu and Qaim,2019) and not nutrition. However, commercialization may affect nutrition through various channels, including changes in income, availability of own-produced foods, household food security as well as consumer behaviours and attitudes. Few studies have explicitly analyzed the effect of commercialization on nutrition, and those studies look at nutrition primarily in terms of calorie consumption (Braun and Kennedy,1994; Carletto et al.,2017) rather than dietary quality. Thus, food system commercialization is seen as a particularly promising way out of poverty and to improve smallholder productivity. However, the commercialization of the food system can lead to a decline in crop production diversity at the farm household level. On the other hand, the commercialization of food systems has become inevitable, mainly due to population growth, while the diversification of diets trends away from traditional food varieties. Hence current food consumption pattern moves towards a more western diet and lower nutrient-dense diet. As a result, households are becoming less self-sufficient and more dependent on local food markets.

1.2.3. Healthy food for a healthy life and a sustainable diet

Food is the single most powerful lever to optimize human and animal health and environmental sustainability (Eat forum,2019). The food contains nutrients such as proteins, fats, carbohydrates, vitamins and minerals that people need to be healthy (Bowdren ,2019). A healthy diet is essential for good health, nutrition and wellbeing. A healthy diet consists of a combination of different foods, such as staple or starchy, tubers or roots, legumes, fruits, vegetables and animal sources. These foods are protected against many diseases (WHO,2020). However, nowadays, the supply of food is threatening both people and the planet. A huge challenge facing humanity is to supply a growing world population with healthy diets from sustainable food systems (Eat forum,2019). While global food production has generally kept pace with population growth, more than 820 million people worldwide still lack sufficient food, while more

people consume low-quality diets (FAO,2016). Therefore, currently, food systems and food environments are challenged in producing healthy and nutritious food. In addition, consumers are not making choices that are consistent with nutrition and health, and a poor diet is the number one risk factor for death and disability worldwide. However, the food system is shaped by consumer preferences and food culture. Yet, consumer demand for food is affected by food supply as well as beliefs and food values are influenced by food producers and food quality and choices (FAO,2016). Therefore, the world is facing two types of challenges that reflect the rapid transition in diet and activity patterns and rapidly growing nutrition problems, such as undernourishment, micronutrition deficiencies, obesity and NCDs (Lim et al.,2012). These two challenges are linked as global food systems do not provide appropriate nutritious, diverse and safe food for healthy lives (FAO,2016). A study (Siegel et al.,2014) shows that the current supply of fruits and vegetables in most countries in the world is inadequate to meet the dietary needs of the population. On the other hand, the supply of cereals at 154% exceeds the global need and red meat produced at 568% of the global population needed for a healthy, low-risk diet (Murray,2014; FAO,2016). In this situation, a food system must be evaluated and changed. The development of food systems has many negative results nowadays. These results include food choices beyond local staples, consumers' satisfaction performance in terms of taste and form of quality, highly processed and high caloric and low nutritious food, and limited access to small scale producers. However, this transformation has significant challenges with potentially wide-reaching consequences for the state of food and nutrition security (FAO,2018). Accordingly, the food system plays a crucial role in human nutrition health and supporting environmental sustainability, yet currently, both are threatening. Healthy and sustainable diets may look different from country to country and will need more evidence on what drives and challenges various populations' diets. Thus, nationally and internationally, efforts are needed to transform diets and food production collectively.

1.2.4. Food insecurity and nutrition problems

Food security is a flexible concept that is reflected in many efforts at definition and policy usage (Maxwell,1996). According to the World Food Summit of 1996, food security is when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for active and healthy life (FAO,1996). Accordingly, there are four dimensions of food security:

- Availability - availability means that there is enough food. Enough nutritious food of sufficient quality needs to be available to people for their consumption. Therefore, availability can be affected by production, distribution and exchange.
- Access - Access means that a person has the resources necessary to purchase or to acquire food. A person or household must be able to acquire sufficient food to eat a healthy, nutritious diet or have access to adequate sources needed to grow their food. Access can be affected by allocation, preference, and affordability (FAO,2008).
- Utilization – Utilization means that people must have access to a sufficient quantity and diversity of foods to meet their nutritional requirements. Utilization can be affected by nutritional value, health status, preparation and consumption and food safety. The nutritional value is contributed by the food that is consumed as measured in calories, vitamins and minerals, protein and micronutrition. Diseases affect health status. Food safety contributed to access to food free from food spoilage (FAO,2008).
- Stability - Stability means food may be available and accessible to people who can utilize it effectively but to avoid increases in malnutrition and for people not to feel insecure, this state of affairs needs to be enduring rather than temporary.

On the other hand, four levels of food security help determine the severity of the food insecurity someone or a group of individuals might be experiencing (see Figure 1.3).

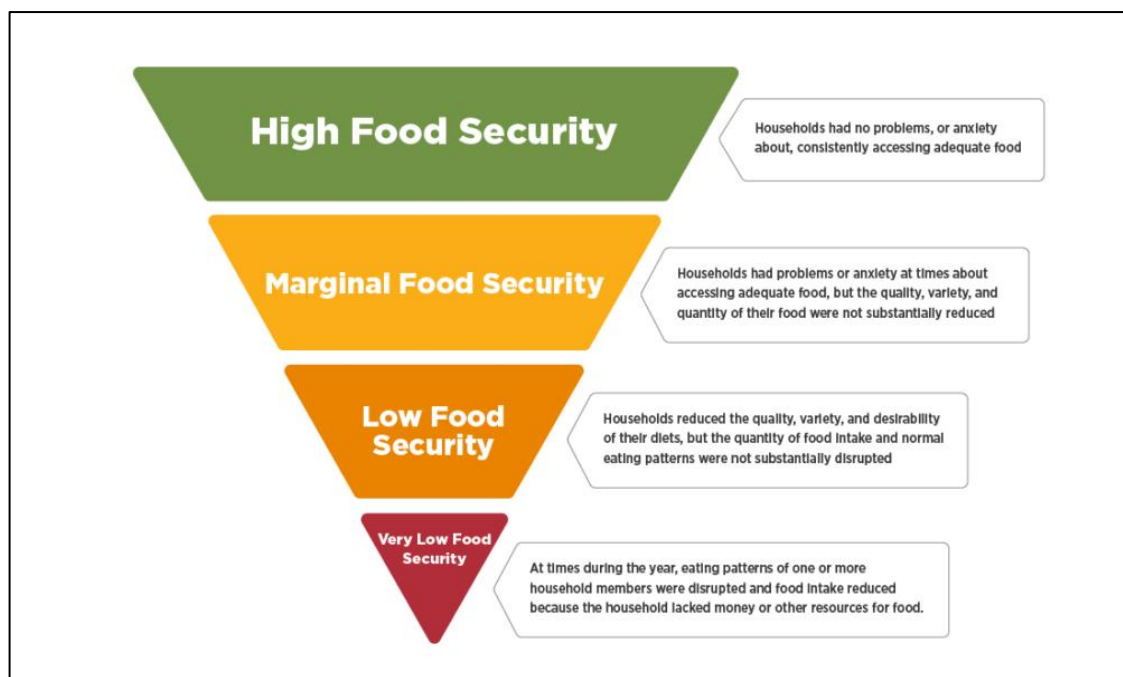


Figure1.3: Level of food security (FAO,2008)

According to figure 1.3, Level 1 is labelled as *high food security* and means all people have easy access to nutritious food. Level 2 is called *marginal food security*. At this level, people are worried about the ability to obtain food. Those at this level rarely seek some help and will often change their habits. Level 3 is *low food security*, which implies moderate food insecurity. At this level, the quality and verity of food are compromised and will likely begin decreasing the quality of the food they buy to ensure that they do not go hungry. Level 5 is *very low food security* and means severe food insecurity. At this level, people will purposely miss meals. At the moderate food insecurity, purchasing food is a real concern. They are buying low-quality food because of hunger, and they are not thinking about nutrition. Severe food insecurity is a serious level of food security. At this level, they will purposely miss meals because they do not have the resources. Accordingly, food insecurity is a key issue of economic stability. The risk of food insecurity increases with poverty. Thus, poverty, disease, human rights violations, climate change and food shortage are combined with ever-soaring food prices that have contributed significantly to food insecurity. Hence, these issues are major problems themselves, and by addressing these problems, we can address the root problems of food insecurity (FAO,2008). Accordingly, food insecurity depends on poverty, malnutrition and hunger. Thus, it is essential to understand the relationship between these three concepts and food insecurity (FAO,2008). Hunger is an uncomfortable or painful sensation caused by insufficient food consumption—malnutrition results from macro and micronutrition deficiencies. At the same time, poverty is undoubtedly a cause of hunger. Lack of adequate nutrition is caused by poverty.

Figure1.4 illustrates details of the connection between food access and nutritional outcomes, underlying causes of food insecurity and nutrition problems. A diet described by insufficient intake of calories, vitamins, minerals, and proteins will contribute to undernutrition and, consequently, to a higher risk of low birth weight.

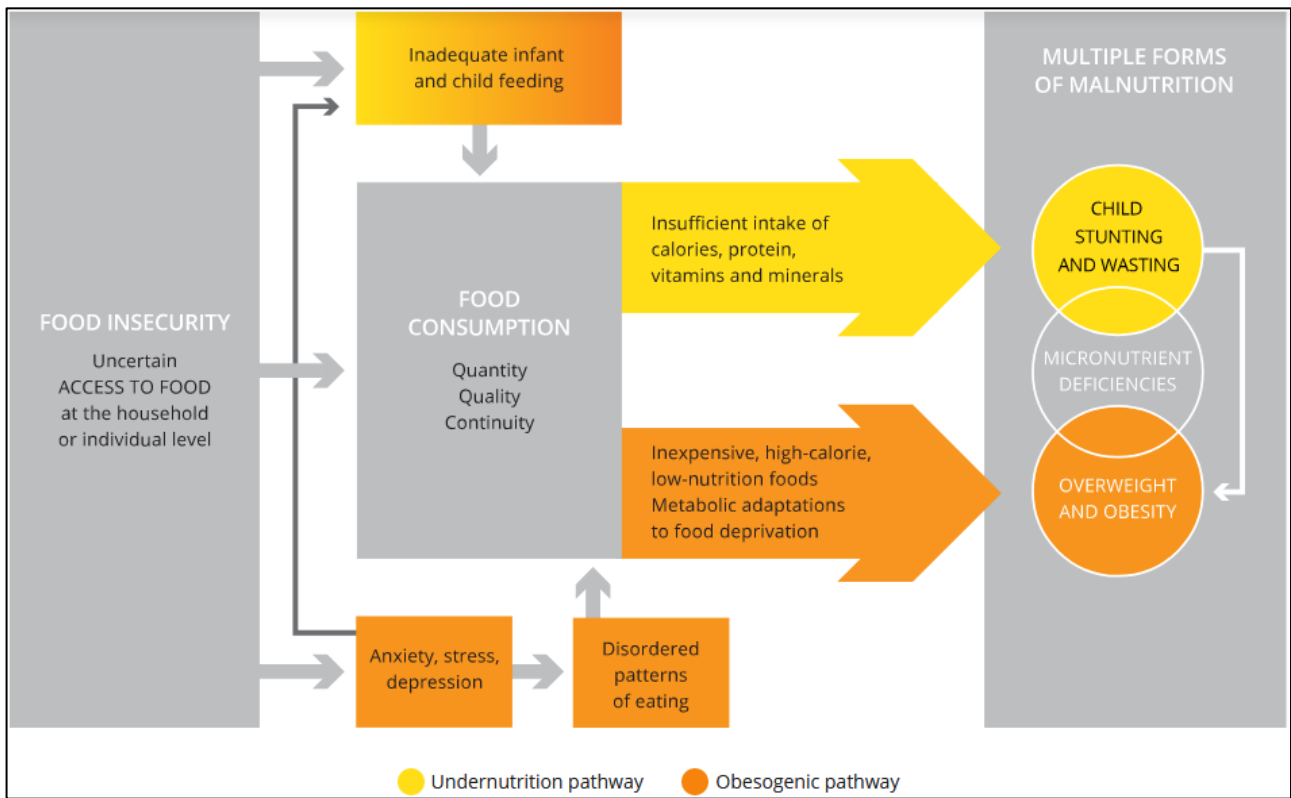


Figure 1.4: Connection between food access and nutritional outcomes, underlying causes of food insecurity and nutrition problems (FAO,2018)

Household food security is important to determine wellbeing. Although it may not encapsulate all dimensions of poverty, the inability of households to obtain access to enough food for an active, healthy life is surely an important component of their poverty (Hoddinott et al.,2002). In this situation, an underlying food and nutrition situation is one of many challenges in achieving sustainable food production. Thus, ensuring healthy lives and promoting well-being at all ages is essential to sustainable development and reduce global maternal mortality and live births. Food security and nutrition security are essential factors for the development of any country. The concepts of food security, optimal nutrition and lack of hunger and undernutrition are interlinked but not synonymous. Figure 1.5 illustrates the differences and overlaps between hunger, food insecurity, nutrition insecurity and undernutrition.

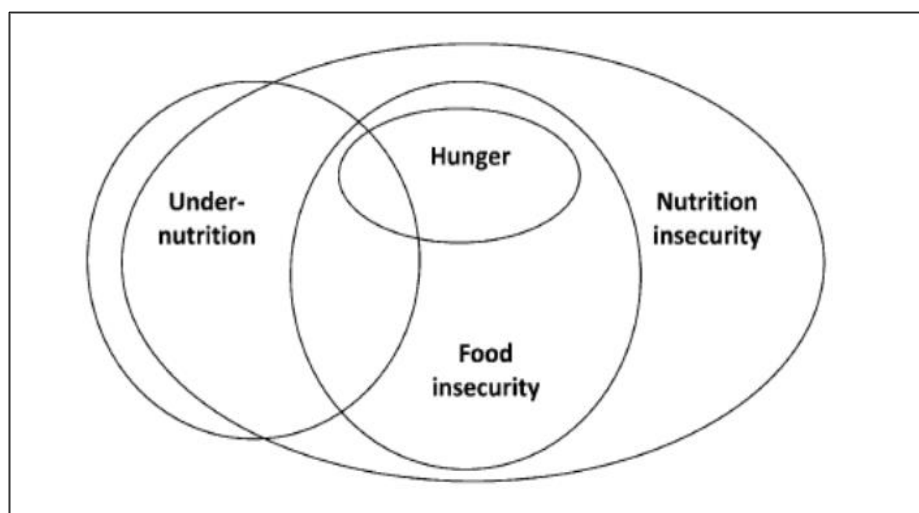


Figure 1.5: Distinctions and overlaps between hunger, food insecurity, nutrition insecurity and undernutrition (Ghattas,2014).

Furthermore, the nature of the malnutrition burden facing the world is complex. It is the result of poverty as well as food and nutrition transition. Many developing countries are moving from traditional diets based on nutrient foods to highly processed, low nutrient food. Simultaneously, rapid demographic, social, and economic changes are underway in many developing countries, leading to increased urbanization and changes in food systems. This transition refers to recent global shifts in dietary patterns such as higher intakes of saturated fats, sugars and refined foods and lower intakes of fibre-rich foods, driven by technological advances that have made energy-dense, nutrient-poor foods cheaply available on the global food markets. This nutrition transition leads to obesity and diet-related diseases, also called the triple burden of malnutrition.

1.2.5. Nutrition transition

In developing countries, such as Sri Lanka, diet patterns are significantly changing day by day. This is called the "nutrition transition". Nutritional transition is a shift in food consumption and energy expenditure that coincides with economic, demographic, and epidemiological changes. In particular, the term is used by developing countries to switch from traditional diets, which are high in cereals and fibre to western-style diets with high sugar, fat, and animal source food (Popkin,1994). The nutrition transition model was first proposed by Barry Popkin, in 1993. According to Popkin, this theory concerns broad changes in the human diet pattern that have occurred across time and space (Popkin,1993). He proposed five broads of the nutritional transition pattern (Popkin,2002):

- i. Pattern 1: *Collecting food*
This pattern, which represents the hunter-gatherer population, is high in fiber and carbohydrates and low in fat, especially saturated fat. Foods are mostly rich in fibrous plants and high in protein from sources of lean wild animals.
- ii. Pattern 2: *Famine*
In this stage, the variety of food becomes much less diverse.
- iii. Pattern 3: *Receding famine*
The consumption of vegetables, fruits, and animal protein increases, and starchy staples become less important in the diet.
- iv. Pattern 4: *Degenerative diseases*
High-calorie foods, leading to increased nutrition-related non-communicable diseases such as obesity and obesity-related chronic diseases (diabetes and heart disease).
- v. Pattern 5: *Behavioral change towards a healthy and balanced diet*
A response to increased rates of obesity and obesity-related chronic diseases and promoting individual change in their behaviour and communities.

Currently, the vast majority of people in the world survive on pattern 3 or pattern 4. Consequently, many developing countries are experiencing a swift expansion in the prevalence of overweight and obesity (Vaezghasemi,2017). Nevertheless, the underweight remains a major public health problem in South Asia and Central and East Africa with a double burden of malnutrition. On the other hand, this transition is accompanied by a hectic lifestyle. Especially, this nutrition transition is seen in the emerging markets of developing countries, and most urban areas are largely a product of globalization. International food trade, commercialization of food system, investment and marketing are highly impacting the availability and access to energy-dense but nutrient-deficient foods are causing the from traditional diet (Hawkes,2007). Furthermore, urban populations are more susceptible to current trends due to increased transportation, commercial food distribution and marketing and changes in household eating habits and

structure (Popkin,1993). The forces of globalization are highly impacting many lifestyle changes in developing countries. Significant changes in economic structure from agricultural economies to industrialized economies are reducing physical activity levels in occupations around the world (Popkin,2001). While increased food security is a key benefit of the global nutrition transition, and there are also negative health and economic consequences.

1.2.6. Food and nutrition situation in Sri Lanka

Sri Lanka is an agricultural country. Its traditional farming systems have developed over many years to suit farmers' production systems. The 46 agro-ecological regions, based on variations in soil, annual rainfall and altitude, support a wide range of crops and their wild relatives in a multitude of agricultural systems ranging from traditional rice fields, monoculture plantation crops to home gardens (FAO,2016). Sri Lanka has a high diversity of traditional varieties of rice, vegetables and cash crops that are resistant to diseases and insect pests and are well suited for varied conditions of soil and climate in the island. The diversity of these plants can be described in rice, other cereal crops, pulse and oilseed crops, root and tuber crops, fruits and vegetables, spices and condiments, fumitory and masticator crops, plantation crops, ornamental plants, medicinal plants, agroforestry and timber trees. Accordingly, Sri Lanka has had self-sufficiency with rich biodiversity. Therefore, important to understand the relationship between DD, diet quality, nutritional status and food security.

In addition, Sri Lanka continues to experience strong economic growth following the end of the 26-year conflict with the Liberation Tigers of Tamil Elam (LTTE). The government continued the reconstruction and development of major projects in its efforts to stimulate growth in war zones and disadvantaged regions to develop small and medium-sized enterprises and increase agricultural productivity (Central Bank,2013). Most agricultural and rural development programs are intended, directly or indirectly, to improve the nutritional status of disadvantaged populations, but the gap between intent and accomplishment is often wide. Although there is some evidence that direct health and nutrition interventions can significantly improve the poor's nutritional status at minimal cost (Gwatkin et al.,1979), there is growing uncertainty about the impact of indirect means of raising nutritional status. Such indirect approaches-including employment generation, development of infrastructure, land reform, and raising the productivity of smallholder agriculturalists-have, in the past, been thought to have a generally positive effect on nutrition among the poor majority by raising income and improving food consumption. Recently, there is renewed interest in agriculture's role to improve nutrition, especially for the poorest and vulnerable (World Bank,2008; IFPRI,2015). The interest in agriculture nutrition linkages is not new and dates to the early 1980s with the International Food Policy Research Institute (IFPRI) and World Bank publications. However, the renewed interest has been fueled by the recent food and financial crises that increased for the first time in years the number of undernourished people.

Agriculture has a crucial role to play in improving nutrition. Agriculture is the primary source of food and essential nutrients as well as an important source of income, especially for the many poor. About two-thirds of the poor in developing countries live in rural areas and depend directly or indirectly on agriculture for their livelihoods (World Bank,2008). Further, agriculture plays an important role in reducing rural Poverty as it is a source of livelihood for many rural poor and because agricultural growth benefits the poor most. Despite agriculture's great potential to improve nutrition, most of the world's malnourished are rural people who find themselves in a situation of low productivity agriculture, poor health, and poverty (FAO,2018). According to Goyal and Singh (2007), fast-food consumption results from the influence of Western culture. As a result, increased food consumption is one of the new trends in today's society, leading to an increase in caloric intake by people. In some Western cultures like America, an increase in dependence on food eaten away from home is one of the largest changes in food habits. As

a response to these changes in food habits, individuals and institutes interfere with the food consumption of people for a wide range of reasons, such as hospitality, to decrease food costs, to decrease food waste (public policymakers), and to reduce overconsumption and under consumption, as is the case with health and nutritionists, among other reasons (Wansink,2004). Taste is a sense that gives an appetite for hunger and thirst and which is sensible only for one flavour at a time (Brillat Savarin,2012). Taste buds are not the only influencer for the generation of taste. Other senses collectively contribute to the taste of humans (Sutton,2010). The taste of food affects the consumption volume of food. However, a research study conducted by Wansink et al. (2004) identified the impact of external cues and perceived taste over the consumption volume in a sample of moviegoers concerning popcorn and soft drink consumption and discovered that container size affects the consumption volume regardless of perceived taste.

The marketer's responsibility towards the food products they sell goes up day by day, though they pay less attention to promoting the nutrition value of food in prime-time advertisements (Avery et al.,1995). Similarly, in Sri Lanka, people tend to eat foods without thinking about nutrition value. Commercialization can influence household nutrition in a positive, negative, or neutral way. Commercialized agricultural production may entail higher output of food crops or higher incomes to secure nutritional needs or both. However, there is evidence of situations where productivity increases have been realized at the expense of the nutritional status of the farming population or by increased maldistribution of wealth at the regional, community, and household levels, or both (Maxwell,1996).

Unhealthy consumption patterns, such as low consumption of fruits, vegetables and whole-grain products, were much higher among adults living in urban areas than in the rural sector. Sugary Food consumption was highest in the urban sector. Matara, Kegalle, Galle, Kandy and Matale also showed a high proportion of women consuming sugary foods (UNICEF,2011). In comparison, a study conducted among 15 to 19-year-old out of school adolescent girls (De Lanerolle et al., 2015). Those urban girls reported higher consumption of processed food, animal food, bread and deep-fried food with lower consumption of micronutrient-rich food such as fruits and dark green leafy vegetables. Compared with rural girls, snacks and eating meals from street vendors and food are high in the urban areas. Outlets were common among urban girls, while it was reported that rural girls mainly consumed home-cooked meals. High consumption of rice and rice products as well as drinking tea during and after meals were commonly seen in rural areas. Both urban and rural girls had inadequate knowledge and negative attitudes towards the importance of good nutrition. The adolescent girls were not aware of micronutrients' importance, such as Iron, Folate, vitamins A and B12 and Zinc. Their mothers and health volunteers also displayed limited knowledge.

On the other hand, malnutrition remains a severe problem for Sri Lankan children and Sri Lankan generally (UNICEF and WFP,2010). Overall, the nutritional status of under five years in Sri Lanka has not improved in the past ten years, where 19.2 per cent of children were stunted, and 21.6 per cent were underweight in Sri Lanka. Even the children of relatively rich suffer from high rates of malnutrition at a rate of 11.9 per cent. This supports the perception that while inadequate food access is critical, poor infant and child feeding is practised and plays a significant role in youth's nutritional status. Also, Sri Lanka has reported high levels of anaemia at 25.2 per cent among children, 22.2 per cent women, and 16.7 among pregnant women (UNICEF and WFP,2010). A household survey was conducted to assess anaemia's magnitude among children of less than 5 years in 9 DS divisions across 5 districts (UNICEF,2011). Anaemia was defined as Hb level <11 g/dl. Overall, 52% of the children were anaemia, and 18% were severe. Another study focused on assessing anaemia and micronutrient deficiencies [iron, zinc (Zn), folate, calcium, caeruloplasmin, iodine, vitamins A and D] among 248 pre-schools 3-5-year-old children. In a cross-sectional study in the district of Galle (Hettiarachchi & Liyanage,2004). Wickramasinghe (2004)

reported that 66% of obese children and 43.5% of overweight children were from high-income categories (> Rs. 20,000). The results demonstrate that the nutrition transition is evident at least in the urban areas. In the estate sector (tea plantations) it's 1 in 3. This is particularly shocking data from the institute for policy studies from 2006. Despite Sri Lanka's decent healthcare and education (by Asian/African standards), persistent inequality means that kids and mothers are still going hungry. Also, nearly 2 million of the country's population is suffering from any type of diabetes, accounting for 10% of the total population. According to recent facts and figures, every 10 seconds, two people develop diabetes. It has also reported that more young persons are at risk (Katulanda et al, 2016).

Furthermore, the double burden of malnutrition refers to the dual burden of under- and overnutrition occurring simultaneously within a population. Underweight and obesity are two of the top ten leading risk factors in the global burden of disease (WHO, 2002; FAO,2006). The current double burden of malnutrition is seen in many developing countries as the risk factors of a coupling. Progress in improved water and sanitation systems has been slow and the development of sound public health systems has been undermined by weak, thwarting efforts. At the same time, increasing urbanization and changing dietary patterns and lifestyles are contributing to a rapid rise in overweight and diet-related chronic diseases. Although there is clear evidence of a double burden of malnutrition and disease at the global level, it is not clear how much of the issue is at the national level and what the developing countries need to be concerned about under seemingly incongruous problems and overnutrition and infectious and chronic disease.

These kinds of diseases are increasing because of the bad food habits of the modern food system. These lessons and regulations could help to install Food commercialization, nutrition issues and hidden hunger. Considering these researches, there are many diseases, and lots of bad influence came to Sri Lankan society and population because of above evidence Food commercialization, nutrition issues, and hidden hunger are a very important topic to discuss.

1.3. Research profile

From 2016 October to 2020, a collaborative research project between the Rajarata University of Sri Lanka and the University of Kassel, Germany was carried out to better understand the causes of hidden hunger and malnutrition in the context of food and nutrition insecurity in Sri Lanka.

Sri Lanka is a tropical island of 65 000 km². Agro-ecological zones spanning 66,000 square kilometres of Sri Lanka are diverse, has two agro-climatic zones: the *wet area* and the *dry area*. The wetland covers the southwest quadrant of the island, including the Central Highlands. Precipitation is well distributed throughout the year, raining from 2,000 to 5,000 millimetres per year. Although representing only 25 per cent of the land area, the wetland supports about 60 per cent of the island's 20 million-strong population, with approximately 75% of the population of 18.5 million living in rural areas. The country's share of the urban population is 18.2%, while the estate population is 4.4%. Urbanization is relatively high in the Western Province (38.8%), while urbanization is very low in the North Central (4.0%). However, there is a high concentration of the non-poor population that lives just over or near the poverty lines. This group remains in a highly vulnerable situation (Department of the census,2016). Populations are also in the process of transitioning from rural to urban lifestyles. The transition process results in an increasingly urban population that turns to informal settlements, known as urban slums, that are neglected parts of cities (UN-Habited,2004). Low-income residents living in urban slum and shanty area suffer from malnutrition, poverty and social and health-related problems, inadequate living spaces, unsanitary conditions, and high unemployment rates. Many of the vulnerable people in Sri Lanka are living in urban slums or remote rural areas (ADB,2009). The highest rural population is reported from North Central

Province (96.0%). Almost half of the population depends on agriculture for their living. Although the country is moving towards industrialization, the agricultural sector remains an important sector in the country and contributors to foreign exchange earnings and GDP. Although Sri Lanka is a small island, it is one of Asia's most biologically diverse countries (Braatz,1992). It is one of the biodiversity hotspots that is home to a huge biodiversity of edible species, including traditional nutrient-rich varieties of fruits and vegetables, wild plants and food crops. The long history of agriculture in the country was coupled with the farmers' selection and cultivation of plant species. Diverse agricultural ecosystems all contributed to rich agricultural biodiversity. Many indigenous and traditional crops were reproduced for their nutritional and medicinal or health food qualities (Jackson et al.,1993). Unfortunately, the agriculture sector is presently facing challenges associated with the expanding market-oriented open economy. (Jackson et al.,1993). At the same time, malnutrition and micronutrition deficiencies (hidden hunger) are major issues due to food insecurity (low economic impact of the agriculture sector, high staple food consumption, low dietary diversity, climate change risk and increasingly unhealthy dietary patterns). According to the United Nations Food and Agriculture Organization (UN-FAO), 4.7 million of the 21 million people of Sri Lanka do not have enough food to sustain a healthy life (IPS,2017). About 4.1% of the population lives below the national poverty line, and the proportion of the employed population below \$ 1.90 purchasing power parity a day is 0.8% (ADB,2009). Also, 17% of newborn babies have a low birth weight, and one-sixth of women have a low body mass index [UNICEF,2018]. The prevalence of anaemia is 16.2% among pregnant women and 19.6% among lactating women (Rajapajaska,2011; Jayathissa and Hossaine,2010] 32.6% of women of reproductive age have anaemia (Global nutrition report,2019). Vitamin A deficiency is observed in approximately 15 % of mothers with children aged 6–60 months (Liyanage,2016). Other micronutrient deficiencies such as iron, iodine, Zn and vitamin D are reported in different age groups (FAO,2016; Liyanage,2016; Department of the census,2018). According to WHO (WHO,2018), for Sri Lanka, NCDs such as cancer, chronic respiratory diseases, cardiovascular diseases and diabetes, are estimated to account for 83% of all deaths (WHO,2002; WHO,2014). These data suggest that Sri Lanka still has a long way to go in terms of current challenges, ensuring availability, accessibility, utilization, and sustainability of nutritious food. Therefore research-based information needs to solve this challenged.

Accordingly, the current study selected two different marginalized areas based on the cross-case characteristics method (Seawright et al.,2008). This study was conducted in two different marginalized areas due to the most affected area of the problems of food insecurity and malnutrition. In the first phase of research, the focus was given to the national level to examine Sri Lankan traditional food culture and how it changes and especially focused on the impact of colonization. Thus, some interviews were conducted data from the local level has been collected. The second and third phase of research mainly focuses on Anuradhapura remote rural area and Colombo slum and shanty areas. In the north-central province, the district of Anuradhapura was selected as a remote rural study site. The main income of the people is from agriculture, and the main crops are paddy (Department of Census,2019). In Anuradhapura, two divisional secretaries (DS) divisions (Kebithigollewa and Horowpothana) were selected for the study (see Figure 1.6).

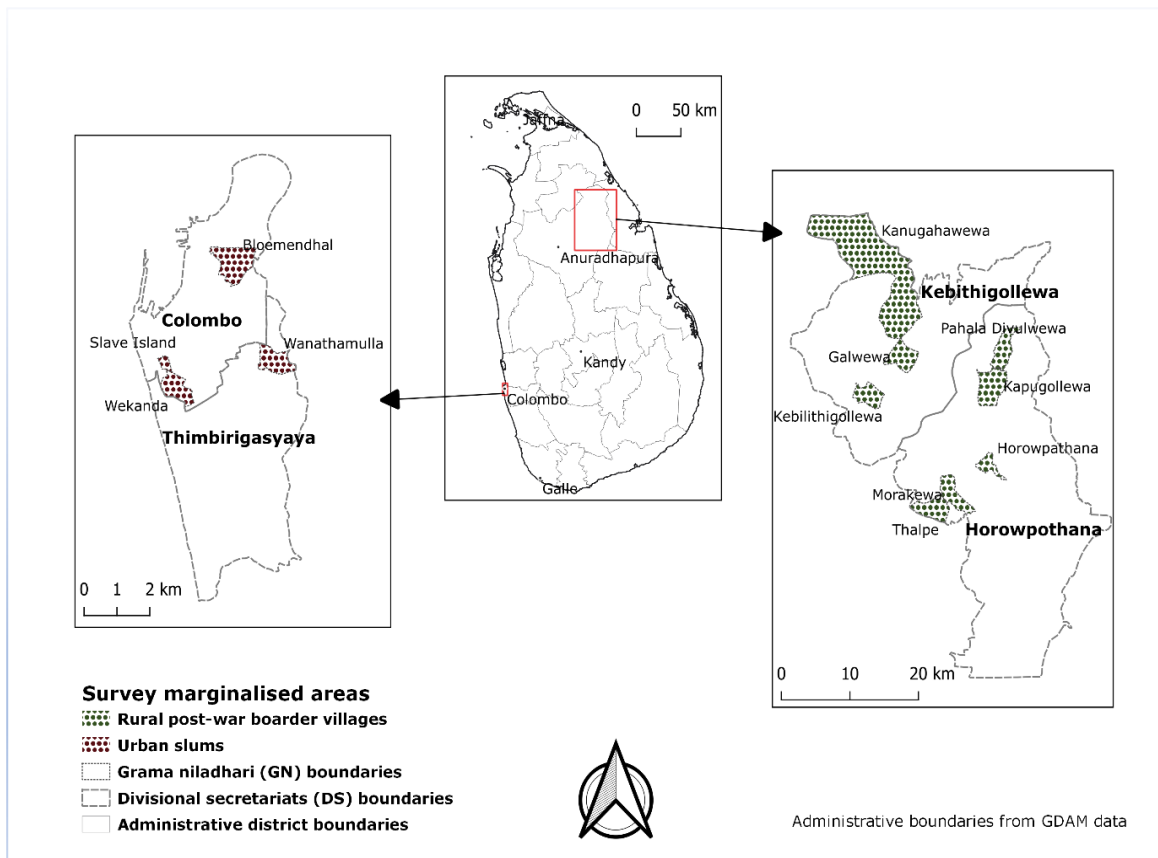


Figure 1.6: Study area map (Author's illustration)

In KEBITHIGOLLEWA, two *Grama Niladhari* (GN) divisions (Kanugahawewa and KEBITHIGOLLEWA), and in HOROWPATHANA, five GN divisions (HOROWPATHANA, Pahala Divulwewa, Kapiigollewa, Morawewa, Kalpe) (Table 1.1) were selected for the present study (Department of Census and Statistics, 2019). All divisions of residents are engaged largely in small-scale agriculture as their main source of income. Because of the consequences of 30 years of war (war-border areas), these people are still suffering from poverty and malnutrition, water problems (dry-zone areas), and kidney diseases because of water pollution with heavy metal.

In the western province, the district of Colombo was selected as the urban area. In Colombo, three GN divisions (Colombo 02 (Slave Island), Colombo 08 (Borella–Wanathamulla), and Colombo 13 (Blumendale suburb)) were selected for this study (Figure 1.6). Low-income residents who live in these areas suffer from malnutrition, social and health problems, poverty, inadequate living space, unsanitary conditions, and high unemployment rates.

Table 1.1: Population by GN division (According to the Department of census and statistics, 2012)

	Total	Male	Female
Anuradhapura District	860,575	420,100	440,475
Kebithigollewa DS Division	22,325	11,098	11,227
-Kanugahawewa	845	438	407
-Galwewa	967	461	506
-Kebithigollewa	2,1831	1191	1064
Horowpothana	36,990	18,251	18,739
-Horowpathana	1,886	1,037	849
-Pahala Divulwewa	638	324	314
-Kapugollewa	1,008	497	511
-Morawewa	951	496	455
-Kalpe	834	377	457
Colombo District	2,324,349	1,140,472	1,183,877
Colombo DS Division	323,257	162,798	160,459
-Blumandhal	13,802	6740	7062
-Slave island	3795	1868	1927
Thimbirigasyaya DS division	238,057	118,660	119,397
-Wanathamulla	17355	8547	8808

Sources: Department of census and statistics

1.4 Research gap

This doctoral research identified three major research gaps related to the nutrition problems and dietary practice of marginalized societies in Sri Lanka. The unhealthy eating pattern results in health and nutrition problems. Therefore, everyone has to practice consuming and producing food within sustainability that ensure food and nutrition security. Thus, the dietary guidelines for the development and policing of traditional foods in Sri Lanka are among the most promising healthy diets among the population. However, growing evidence clarifies that multiple complex factors beyond personal decisions strongly influence dietary choices and patterns.

Interventions attempting to relieve nutrition problems, particularly malnutrition and micronutrient deficiencies, had been for a long time focused on single components within the food and not paid attention to the food items themselves. Micronutrient deficiencies interact and do not happen in isolation. Hence strategies that need to simultaneously address multiple micronutrients are considered to be more effective in alleviating these problems on a long-term basis. Also, agrobiodiversity comprises many plants and animals, including those cultivated and wild species that are rich sources of nutrients.

Food-based strategies aimed at promoting the re-introduction and utilization of local agrobiodiversity into staple-based diets are considered cost-effective and sustainable on a long-term basis, improving dietary diversity and quality, providing non-dietary elements important for good health. Thus, local agrobiodiversity could be used to complement and improve the quality of existing diets, particularly the complementary diets of women in resources poor settings. However, lack of knowledge of the locally available nutrition-rich food and how best to utilize them in the diet has resulted in them being underutilized and neglected. Accordingly, integrated food-based and educational strategies focusing on increasing the utilization of local agrobiodiversity to improve diet quality and diversity are necessitated, particularly among marginalized communities.

However, developing tools or other supportive strategies to close the gap has not been previously accomplished. This requires theoretical and practical innovations that support people's behaviour change (Rothman,2004). Thus, this doctoral research is going on new paths of research strategies to understand how integrated food-based and educational strategies focus on increasing the utilization of local agrobiodiversity to improve diet quality and diversity. This doctoral study attempts to develop solutions to the dilemma of the policy gap, theoretical gap and the data gap.

Chapter 02

2. Objectives and structure of the thesis

2.1. Objectives

A healthy diet is essential for good health and wellbeing. Better health leads to human happiness and wellbeing and also to economic progress. Accordingly, nutrition is a crucial part of health and development (WHO, 2020). This research study's overall thematic objective is to address the connection between food system commercialization, hidden hunger, and malnutrition. Particularly, the focus will be on food security and nutrition security in marginalized societies in Sri Lanka, with a special focus on food culture and governance. This research will also disseminate analysed data about nutrition adequacy and minimum dietary diversity, and food practice. These, in turn, will largely determine the impacts of the process on household income and nutritional status. These thematic objectives are addressed with the following research questions:

1. What are the main changes in the traditional food system and the main problems in Sri Lanka food and nutrition security?
2. What are the main reasons for hidden hunger, malnutrition, and nutrition problems in Sri Lanka?
3. How is the impact of the food system commercialization on nutrition and food security in a marginalized society?
4. Hidden hunger and malnutrition are a matter of food culture changes, or the impact of food commercialization?

To address these research questions and the overall research objectives, there are specific objectives. This thesis is composed of three research papers that elaborate on the above questions as well as the following objectives:

1. To understand the main changes in food commercialization and to discover the theoretical framework of the colonial and postcolonial dynamic and cultural change concerning the food and nutritional transition in Sri Lanka. (Chapter 4).
2. To analyse the Sri Lankan traditional food system and how it changed in the colonial and postcolonial periods and identify factors that affect changing the food system and identifying their impacts on current nutritional problems (Chapter 4).
3. To identify the factor influencing food and nutrition-related knowledge attitude and practice on nutrition and health situation nutrition system. (Chapter 5).
4. To understand the perception of food quality and risk in Sri Lanka and the main reason for nutrition problems (Chapter 5).
5. Investigate dietary diversity and micronutrition adequacy impact on food and nutrition security and health (Chapter 6).
6. To determine the factors that affect marginalised communities' dietary diversity and to understand differences in the diversity of food and food patterns in marginalized societies (Chapter 6).

2.2. The structure of the thesis

The structure of the thesis is as follows:

- **Chapter 1** introduction of the research study, which focuses on the background of the study and the literature on food and nutrition security and nutrition problems as well as commercialization of food systems, are discussed. Moreover, this chapter discusses the research gap of the study and the research profile.
- **Chapter 2** particularize the objectives, description of the research questions and hypotheses of the study. Also, this chapter briefly discusses the structure of the research study.
- **Chapter 3** provides a general outlook regarding the methodology of the research study.
- **Chapter 4** discusses factors that underpin the dietary changes in Sri Lanka from its early colonization to the post-colonization period. This chapter discusses the Sri Lankan traditional food system and how it changed after the colonial period, including the main changes and their impact on current micronutrient deficiencies and non-communicable diseases.
- **Chapter 5** presents the results of a field study investigating nutrition-related knowledge, attitude and practice. Sri Lanka is in a phase transforming its traditional food systems toward the western diet as well as an unhealthy eating pattern. The best tool to avoid this situation is to spread attitudes through food and nutrition knowledge. Thus, it is important to the understanding of food and nutritional knowledge of women in marginalized areas in Sri Lanka. This chapter investigated the association between nutritional knowledge and demographic factors with nutrition status as well as the perception of food quality.
- **Chapter 6** investigates dietary diversity, health and food and nutrition security in these areas, and micronutrient adequacy of women's diets. Besides, this chapter examines the biodiversity of food and how it changes after agriculture and food commercialization.
- **Chapter 7** delivers an overall discussion by understanding the results of the completed studies in a broader context. which means reflecting the questions and hypothesis as well as the results with literature or goals such as the empowerment of people or health and nutrition policy. Thus, the limitations, future research possibilities and the theoretical and policy contributions to the food quality scholarship are discussed.
- **Chapter 8** presents the conclusion of the study.
- **Chapter 9** presents the Bibliography of the thesis,
- **Chapter 10** presents the appendix of the study, includes ethical certificate, questionnaire, supplementary data and selected pictures from the field study.

Chapter 3

3. Methods and materials

This research study seeks to support improving nutritional health through food culture and food systems by moving towards Sri Lankan food system sustainability. Therefore, this research study was conducted with an interdisciplinary mixed research approach (Jim et al.,1978). The interdisciplinary mixed research approach is conducting research that involved together with qualitative and quantitative research. It consists of applying social science research methods to understand the field for analysing the food system commercialization, nutrition and nutrition governance, agriculture policy, hidden hunger, malnutrition, dietary diversity, and other contextually relevant socio-economic data. This research conducted three phases. The first phase followed the integrated concept of ethnological and sociological study approaches. The study addressed a pragmatic and complex problem in which social factors played a role. The integrated design comprised qualitative data as the primary source, and quantitative content analysis was used as the baseline data. Information and data were collected through field interviews, historical references, and modern research studies. There is a lack of updated data in some indexes, particularly food and nutrition-related. Therefore, in the second and third phase, a cross-sectional study was conducted for this study. Chapters 4 through 6 include detailed descriptions of each method and the materials based on the nature of the research question and the study's objective. Table 3.1 presents the method and material used for this research.

3.1. The summarization of methods and materials in this research

Methods and materials	Chapter
Coding interview	4,5
Historical data and references	4
Focus group discussions (FGD)	4,5,6
In-depth expert interviews	4
Individual interviews	4,5,6
Descriptive statistical analysis	5,6
Correlation matrix	5,6
ANOVA	5,6
Questionnaire-based survey	5,6
KAP survey	5
MAXQDA	5
MDD-W questionnaires	6
SPSS	5,6
Scientific literature	1,2,3,4,5,6,7 and 8
Multiple linear regression model	5,6
VIF	5
24 h diet recall	6
Dietary intake	6
t-test, Mann-Whitney	5,6
Nonparametric tests	6

This project was accepted in 2015, but due to no financial support, we started in 2016 October. Starting in 2016, we examined the literature on food and nutrition security and traditional food culture in both Sinhala and English scientific literature. Thus, we focus on the best method. Based on literature and the current situation, this research investigated in 2017 factors that have underpinned the dietary change in Sri Lanka from its early colonization to the post-colonization period in 2017. The research followed the integrated concept in ethnological and sociological study approaches. The study examined literature and

conducted several interviews with field experts and senior people in marginal areas in Sri Lanka. Thus, our first survey results were identified factors that have underpinned the dietary change in Sri Lanka. Then we decided to investigate food and nutrition-related knowledge, attitude and practice on nutrition status in 2018. For this, we selected reproductive age women because reproductive age is the most nutritionally vulnerable stage of life. We conducted a cross-sectional survey for this. Thus, we understood the low level of Knowledge impact on this transition. Therefore, our third step was to understand the current food pattern and the health and nutrition situation. A cross-sectional survey was conducted using the MDD-W indicator, according to FAO Guidelines. Chapters 4 through 6 include detailed descriptions of each method and the materials based on the nature of the study's research objective and questions.



Article

Nutrition Transition and Traditional Food Cultural Changes in Sri Lanka during Colonization and Post-Colonization

Permani C. Weerasekara ^{1,*}, Chandana R. Withanachchi ², G. A. S. Ginigaddara ³ and Angelika Ploeger ¹

¹ Specialized Partnerships in Sustainable Food Systems and Food Sovereignty, Faculty of Organic Agricultural Sciences, University of Kassel, 37213 Witzenhausen, Germany; a.ploeger@t-online.de

² Department of Archaeology and Heritage Management, Faculty of Social Sciences and Humanities, Rajarata University of Sri Lanka, Anuradhapura 50000, Sri Lanka; chandanawithanachchi@gmail.com

³ Department of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura 50000, Sri Lanka; sanjeewanieg@gmail.com

* Correspondence: permani@uni-kassel.de; Tel.: +49-157-7372-5360



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Abstract: Sri Lanka was a colony of the Portuguese, Dutch, and British. The simplification of Sri Lankan food culture can be seen most clearly today, including how the diet has been changed in the last 400 years since the colonial occupation began. Therefore, greater efforts must be made to uncover the colonial forces that have undermined food security and health in Sri Lanka. Also, traditional eating habits, which are associated with countless health benefits, have been gradually replaced by the globalized food system of multinational corporations and hidden hunger, a system inherent in the emergence of non-communicable diseases, such as cancer, diabetes, cholesterol, and kidney disease epidemics, in Sri Lanka. This article discusses factors that have underpinned the dietary change in Sri Lanka from its early colonization to the post-colonization period. The research followed the integrated concept in ethnological and sociological study approaches. The study examined literature and conducted several interviews with field experts and senior people in marginal areas in Sri Lanka. This study examines the Sri Lankan traditional food system and how it changed after the colonial period, including the main changes and their impact on current micronutrient deficiencies and non-communicable diseases.

Keywords: food transition; food habit; westernization; dietary patterns; health impact

1. Introduction

Today, the estimated world population of undernourished people with respect to dietary energy supply is almost 842 million [1]. This persists globally, even though there is enough food for all. Furthermore, 26% of children experience stunted growth, and 30% of the world's population suffers from micronutrient deficiencies. This issue is particularly critical in developing countries, which account for nearly 98% of the world's chronically hungry people [1]. According to the United Nations Children's Fund (UNICEF) report (2017) for South Asia, about 39% of children under the age of five have experienced

stunted growth, and nearly three-quarter of people with micronutrient deficiencies live in Asia [2]. In Sri Lanka, nearly every fourth (22%) pregnant woman is considered underweight at the time of registration for pregnancy. This increases the risk of intrauterine growth retardation and low birth weight. More than one in five households are affected by food insecurity, which is defined as unreliable access to calories [1–3]. However, many families are unlikely to have access to a variety of diets throughout the year. Micronutrient deficiencies are common in populations who consume poor-quality diets lacking diversity. Vitamin A deficiency accounts for 29.3% of children in Sri Lanka, while 2.3% of these children have a severe deficiency. A total of 35% of pre-school children and 23% of pregnant women have a vitamin A deficiency [1]. Nearly 15% of mothers with children from 6 to 60 months of age have vitamin A deficiency (1). Also, non-communicable diseases (NCDs) are increasing day by day. Sri Lanka has been witnessing in the past few decades a rapid upsurge of NCDs, which includes epidemics of diabetes, various cancers, and increased blood cholesterol levels, claiming 103,500 lives each year. In general, 75% of all deaths are due to NCDs in Sri Lanka [1,4,5]. These are all problems related to food habits. Therefore, food transition could be considered to be a severe public problem within the country.

The fundamental issues to be dealt with regarding food transition in Sri Lanka involve income-induced diet diversification, dietary globalization, and Westernization. Westernization is a process by which societies come under or adopt the Western culture in areas such as industry, technology, law, politics, economics, lifestyle, diet, cloth, language, religion, philosophy, and values [6]. As urbanization and globalization begin to exert their influence, we can see the adoption of markedly different diets that no longer conform to traditional local habits. The new dietary habits reflect Western patterns and could be quite unlike the habits that developed locally over many generations. Large urban markets have space for establishing a supermarket chain as they attract foreign investment and advertising from global corporations [7]. The traditional food supply chain cannot meet the rapid diversification of the diet. It requires, in effect, the modernization of the food retail sector and the vertical integration of the food supply chain, including the diversification of agricultural systems in Sri Lanka. The above quantitative, qualitative, and organizational changes in the urban food supply drive the processes of commercialization and diversification of domestic production systems [7]. However, the nutrition transition is not just a result of the growth of supermarkets, as research has shown the wide availability of processed and unhealthy foods in modern retail in Sri Lanka [6]. Thus, it is a result of colonization. Not only colonial policies but also their cultural values and lifestyle patterns, have directly and indirectly affected the Sri Lankan lifestyle.

Since the 1500s, when the imperial powers of Europe sought to expand their empires through the colonization of Sri Lanka, the presence of ancient indigenous knowledge, including an incredible wealth of experience about food habits, health, and longevity, has progressively waned. Food was always a fundamental tool in the process of colonization. Colonization is a violent process that fundamentally altered the ways of life of the colonized. However, it should not be forgotten that the colonization practice has always been a contested matter, as the colonized groups have negotiated a space within this process. The history of food and eating habits in different contexts can help us to realize that methods of eating are inherently complex [8]. Since the time of liberation from the colonial powers, the culture of South Asia has coincided with the incorporation of a significant amount of cultural values transferred to them mainly from the British and the Europeans. After independence, the Sri Lankan government preferred to continue with the colonial economic structure. For example, urbanization has shown to have a positive effect on wheat consumption and a negative impact on rice consumption in Sri Lanka. Along with the growth of supermarkets, Sri Lanka has, over the last decade, observed a rapid increase in the number of Western fast-food chains serving the big cities, which are increasingly spreading to smaller towns [7,9,10]. Even today, the influence of Europeans, though older than 500 years, is an integral part of the local culture of Sri Lanka.

Thus, after the Europeans left the South Asian region in the formal political sense, they supported their influence through neo-colonization followed by neoliberalism [11–13]. Some critics have argued that post-colonization is the continuation of colonization, in the sense the colonies get freedom only from the political rule. It is worth noting that an unhealthy diet is a trend dominating the health profile of an increasingly large number of people in developing, postcolonial countries [14]. In developing countries, poor people spend 80% of their income on food [15], yet they are often malnourished due to inadequate access to food [14,15]. Not only malnutrition but also NCDs, such as cancer, occur as the Western diet displaces the traditional diet, due to the surplus of some harmful nutrients and the lack of some essential nutrients in Western foods. The world has reached a historic milestone. The “traditional” diet is used to mean food that is mainly plant-based, rich in grains, legumes, vegetables (plus their oils), and fruit, with little or no animal products. There is evidence that the traditional foods of Sri Lanka, including a broad range of indigenous cereals, roots, tubers, green leaves, fruits and vegetables, spices, animal fats, and fish, are linked with various health benefits, including protection from non-communicable diseases. The ‘Western’ diet is an evolving concept [15] Today’s Western diet has adverse effects on health, equity, and the environment in Sri Lanka as can be seen in Sri Lanka’s food production and the population who consumes an increasingly Western diet [15].

The paper structure is as follows: Section 2 deals with the theoretical framework of the colonial and postcolonial dynamic and cultural change with respect to the nutrition transition in Sri Lanka. The following sections discuss the Sri Lankan traditional food system and how it changed in the colonial and postcolonial periods, including the main changes and their effects on current micronutrient deficiencies and non-communicable diseases. The paper also explains the factors that underpinned Sri Lanka’s changing diet, from early colonization to the post-colonialization period.

2. Theoretical Framework

In this section, the conceptual framework is presented with ‘the colonial and postcolonial dynamics on food culture’ as the central approach. Based on the literature, the main themes of this discourse focus on food and the nutrition transition and their impact on human health. Human history is characterized by a series of changes in food and nutritional status. Throughout human existence, diet and nutritional status have undergone a series of major shifts among the broad patterns of food use, as reflected in changes in stature, body composition, and patterns of disease. Today, a marked worldwide shift towards a diet that is high in fat and processed foods and low in fiber, with corresponding increases in degenerative diseases, is evident [16]. NCDs are currently responsible for almost 70% of global deaths, the majority occurring in developing countries [17]. In indigenous communities, the nutritional change, characterized by the rapid Westernization of diet and lifestyle, is associated with an increasing prevalence of chronic diseases [18,19]. In Sri Lanka, approximately 75% of deaths in the country are caused by cardiovascular diseases, such as cancer, chronic respiratory diseases, diabetes, and other NCDs [17]. Figure 1 shows a downfall profile of deaths caused by diseases in Sri Lanka. It can be observed that 40% of deaths can be attributed to cardiovascular disease, followed by cancer, other NCDs, respiratory diseases, and diabetes.

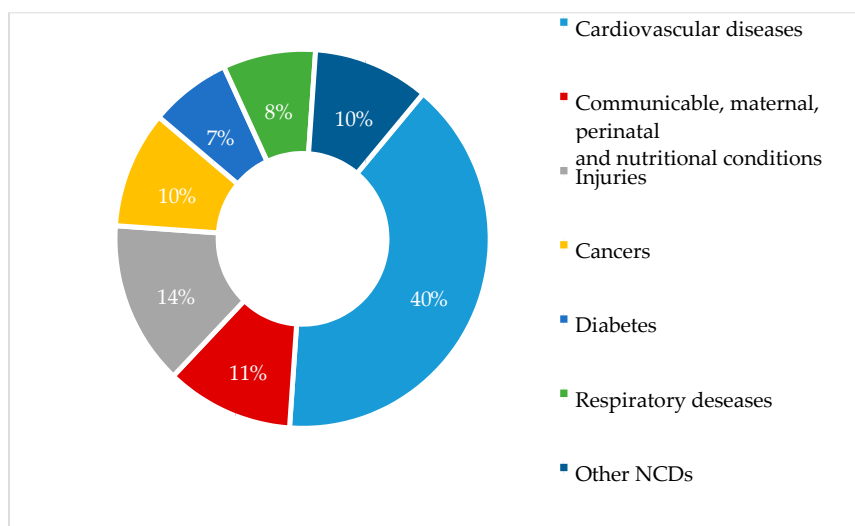


Figure 1. Percentage mortality by cause in Sri Lanka (2014). Source: World Health Organization [17].

NCDs: non-communicable diseases.

Furthermore, contemporary food ways and identities are, in large measure, a product of a long history of colonial encounters [15]. Along with the loss of regional food itself, even more serious is the loss of traditional knowledge of production, harvesting, processing, preparation, and food uses the experience that sustained groups of people in their home region for thousands of years [18–21]. Colonialism has had a long-lasting impact on the lives of people [22]. The intimate links between food practices and the embodiment of identity between commensality and politics have made food a central arena for the development of colonial battles of several types. The fact is that colonialization had a direct impact on the cultural food habits in Sri Lanka. Therefore, a focus on food holds great analytical promise for archaeologists trying to understand ancient colonial situations and their transformative effects on identity [22,23]. Colonialism is the acquisition, establishment, maintenance, and expansion of authority over one area of people (the colony) by another people from a different area. The colonizers use the resources of the colonies and impose their culture on these colonies [24,25].

Colonialism has had a long-lasting impact on people’s lives [22]. Countries under colonial domination experience a distinctly separate way of developing and maturing, and ultimately, the inheritance of subsistence will continue to affect their survival and performance [21,25]. The situation becomes more complicated when the retreat of colonial rule does not lead to independence, but rather is replaced by another dominant power [26,27]. Even today, the impact of more than 500 years of influence by Europeans is an integral part of the local culture of Southeast Asia. Indeed, as noted above, after the Europeans left the South Asian region in the formal political sense, they supported their influence through neo-colonialism, followed by neoliberalism [28,29].

Over the centuries, the methods implemented to excise this indigenous knowledge have generally shifted from the use of overt force (e.g., slavery, religious conversion, seizure of arable land, and food supply) [30] to the implementation of a neo-colonial, political, and economic structure inherently designed to oppress through the creation of economic dependence [31]. However, there is limited scientific data about this factor. Still, it is essential to discuss traditional food culture and the changes in food culture after the colonization period. According to historical sources, modern research studies, and field interviews, it could be possible to identify two main groups that impact food habits and nutritional changes in this research study: colonial and postcolonial dynamics (Figure 2).

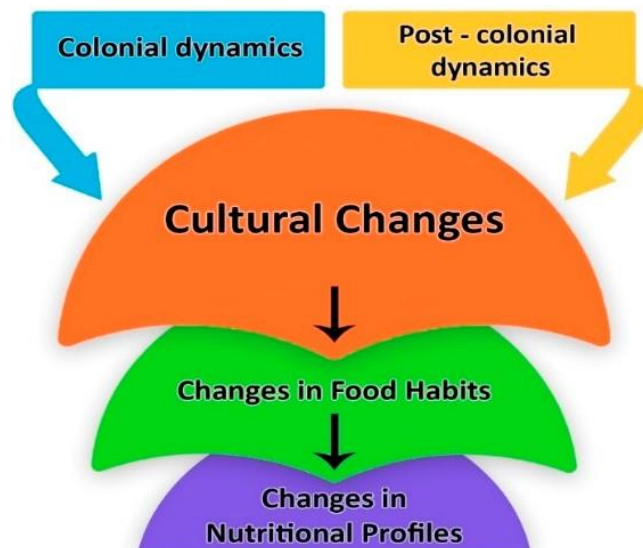


Figure 2. The conceptual framework for the colonial and postcolonial dynamics of food culture (authors' illustration).

Colonialism should be understood as a dynamic intercommunicate in the context in which the colonial empires and individual colonies massively influenced the historical development of their European mother countries and vice-versa. Therefore, colonial and postcolonial dynamics directly impact cultural changes in colonies.

Based on the literature, different characteristics of cultural changes reflect colonial and postcolonial dynamics (Table 1). These characteristics either directly or indirectly impact cultural and food habit changes to the Western diet. During the colonial period, a colonial power was defined by the building and maintaining of a number of colonies in a territory by people from another region [32]. On the one hand the colonizers rejected cultural compromises with the colonized population [33,34]. On the other hand, in the post-colonization period, the former colonial powers and the colonized people had to learn to deal with a previous colonial society while still moving forward, which impacted cultural and food habit changes [34].

Table 1. Colonial and postcolonial dynamics.

Period	Dynamics
Colonial	Policy and practice of power/control over weaker peoples or areas [31]
	The system or policy of a nation seeking to extend or retain its authority over other people or territories [32]
	Contributions to colonial aspirations of power and control over the territory; the government response was to impose environmental and social control [33]
	Cultural superiority [34]
	Colonial powers into the culture [35]
	Control by one power over dependent areas or peoples [36,37]
	Invest their identity to the colony [38]
Postcolonial	The colonizers are convinced of their greatness and their ordained mandate to rule [39]
	Postcolonialism represents an ideological response to colonialist thought [40]
	Moving toward the development of a more cross-culturally oriented system [41]
	Dealing with previously colonized societies [41]

3. Materials and Methods

This research was conducted in two different marginal areas in Sri Lanka, a remote rural area in Kabithigollawa and an urban slum area in Colombo. Kabithigollewa is a village located in the north-central province whose residents engage largely in agriculture as their main source of income. The people of Kabithigollawa, along with the consequences of 30 years of war, suffer from poverty and malnutrition. This is also true, in particular, for the low-income residents living in the urban slum area of Colombo. These residents not only suffer from malnutrition but also other social and health-related problems. Historically, these issues can be seen as a result of urbanization alongside colonization.

The research followed the integrated concept of ethnological and sociological study approaches. The study addressed a pragmatic and complex problem in which social factors played a role. The integrated design comprised of qualitative data as the primary source, while quantitative content analysis was used as the baseline data. Information and data were collected through field interviews, historical references, and modern research studies. Because oral history is a form of human communication, this research study conducted interviews and group discussions as the main qualitative data collection method for the primary data [42,43]. Oral history is a collection of stories and reminiscences of a person or persons who have first-hand knowledge of any number of experiences [44,45]. Therefore, the interviewers carried out discussions with older people over the ages of 80–110 years ($N = 50$) who had experience with the postcolonial period. The expert interviews were independent of each other in terms of the questions and area of the subject field. The experts were selected based on the nature of the research questions. Furthermore, there were open interviews and questions with local farmers. These were mainly incorporated to capture orally any historical production-related changes in the farming systems and dietary patterns in the dry zone and the urban area. The interview questions were slightly altered based on factors related to location but were always fixed according to the main thematic areas of the research. The gathered data from the field interviews were analyzed using descriptive statistics [46].

4. Results

Based on the data, the results can be divided into two sections: ancient food culture and food transition influenced by colonization.

4.1. Ancient and Traditional Food Habits and Food Culture in Sri Lanka

When the agriculture is the cornerstone of Sri Lanka's economy, with more than 70% of the population living in rural areas [47], the ancient concept of agriculture, especially rice farming, was based on "the tank, field, temple, and village" [48,49]. These four components of agrarian culture have been woven together to lead to prosperity. Food production was based not only on culture and religious rituals [49] but also on astrology and biotic and abiotic components in the environment [49]. In ancient Sri Lanka (before colonialization), there were no farmers as defined today, because people never owned farms or farming based on money. Agriculture was not a revenue-generating process, and at the same time, it was not considered to be a business or an industry. Agriculture was essentially everybody's service, and it was the public's responsibility to use and maintain the land for the sake of the nation [16]. That being said, Sri Lanka is an island with high biodiversity, and access to food was never a problem [47,48]. This is well documented in the old chronicles by Robert Knox (1681) and Emerson Tennent (1860). Most of the foods that the Sri Lankan elders enjoyed were not grown by them [27,50–52]. They were found everywhere, growing naturally. According to several interviews, during the post-colonization period, there were not only edible plants but also useful medicinal plants. Until the last few centuries, food was not produced for sale, but rather consumed and shared. In the Kebithigollewa area, most people had public lands called 'Chena', which were devoted to agricultural purposes [51,52]. There is evidence that the livelihoods of the

old people came from the Chena cultivation, which was mainly done in the 'Maha season'. The cultivation of Chena was based on the relocation of cultivated lands from one place to another. The primary farming methods were those that did not use irrigation methods or chemical fertilizers. The 'Chena' cultivation periodically reduced the number of trees of a small jungle land and set the woody growths on fire to create suitable land for cultivation. This virgin land was best suited for cultivation because of its rich soil. The farmers cultivated various crops in the Chena for the food needs of their families [53], such as 'tala' (sesame), 'kurakkan' (finger millet), 'meneri' (millet), 'badairingu' (corn), 'mung' (green gram), 'bajiri' (*Echinichloa glabrescens*), and various varieties of vegetables. The most commonly cultivated nine varieties of foods were called 'nawadali' [54,55].

Chena farmers did not change their dwellings when they selected new lands, because they became sedentary as far as their homes were concerned. They built a hut in the 'chena' to protect the crops from wild animals, such as wild elephants, that roamed in search of food [55]. 'Chena' cultivators did not have the concept of private land ownership. Very often, these jungle lands belonged to the state, and the farmers who cleared the land, planted the crops, and got the produce for their labor did not seek to claim these lands for themselves. As was a common practice among Chena farmers, nobody had the right to plant a plot of land (Chena) that had been cleared by someone else [55,56]. According to the Department of Ayurveda's data various research and oral interviews as shown in Tables 2 and 3 some of the traditional Sri Lankan food had many nutritional benefits, and the Sri Lankan diet consisted of green leaves, which they used in many ways. In particular, green leaves were the main source of vitamins and other therapeutic values. Protein was mainly derived from vegetable sources, such as wing beans, velvet beans, drumsticks, kidney beans, and leafy vegetables with high protein content. Many vegetables were used for nutritional benefits and therapeutic values. Most leafy vegetables and legumes were collected from the home garden, rice fields, and nearby forests. There were many types of delicious mushrooms collected from the forest.

Table 2. Traditional wild fruit in Sri Lanka.

Vernacular Name	Botanical Name	Food Use	Nutritional and Therapeutic Value	Edible Parts
Katu-attha/Weli-attha (<i>Annona</i>)	<i>Annona muricata</i> / <i>Annona reticulata</i>	Ripened fruits was eaten fresh	Leaf infusion used as sudorific; antispasmodic; emetic flowers are antispasmodic. The ripened fruit is antiscorbutic; the unripe fruit was used for dysentery. Fresh leaves were used as topicals, applied to the stomach of children suffering from indigestion	Fruit
Thal Palmyra Palm	<i>Borassus flabellifer</i> L.	The inflorescence is tapped for toddy, vinegar, and jaggery. Young nut water (liquid endosperm) was drunk.	Ripened fruit is rich in vitamins A and C. The toddy is beneficial for inflammatory ailments and dropsy. It is a diuretic prescribed for chronic gonorrhoea and amoebiasis.	Fruit and germinating seed root.
Divul (Wood Apple)	<i>Feronia limonia</i> L.	Mature and ripe fruit was eaten fresh and drunk	The pulp of the unripe fruit along with other ingredients were used for chronic diarrhea and dysentery. The	Fruit.

Table 2: Cont.

			ripe fruit was useful in hiccups and ailments of the gums and throat and was applied externally on bites of venomous insects.	
Bel fruit (Slime Apple)	<i>Aegle marmelos</i> (L.) <i>Corrêa</i>	Ripened fruits were eaten fresh. The shell and flowers drunk were as a beverage.	This fruit used for fever, hypochondria, melancholia, palpitation of the heart, diarrhea, and gastric troubles in children. The leaves were given for jaundice and anasarca.	Fruit and flower

Sources: [57–63].

Table 3. Traditional food items in ancient Sri Lanka.

Food Varieties	Vernacular Name	Botanical Name	Nutritional Value
Yams	<i>Raja ala</i> (Greater yam)	<i>Dioscorea alata</i>	Moisture 76 g, Energy 87 kcal, Protein 1.9 g, Fats 0.2 g, Carbohydrates 20 g, Calcium 38 mg, Iron 1.9 mg
	<i>Heen-gotukola</i>	<i>Centella asiatica</i>	Moisture 84.5 g, Energy 37 kcal, Proteins 2.1 g, Fats 0.5g, Carbohydrates 6.0 g, Calcium 224 mg, Phosphorus 32 mg, Iron 68.8 mg
	<i>Pethi-thora</i> (Fetid cassia)	<i>Cassia tora</i>	Moisture 85.7 g, Energy 45.0 kcal, Protein 4.0, Fat 0.5 g, Carbohydrates 6.1 g, Calcium 397.0 mg, Iron 83.0 mg, Carotene 25.0 meg, Vitamin C 99.0 mg
Green leaves	<i>Heen sarana</i> (Horse purslane)	<i>Trianthema portulacastrum</i>	Moisture 93.4 g, Energy 21.0 kcal, Protein 2.1 g, Fat 0.3 g, Carbohydrate 2.3 g calcium 50 mg, Phosphorus 28 mg, Iron 2.4 mg, Vitamin A 495 mg
	<i>Iramusu</i>	<i>Hemidesmus indicus</i>	Moisture 92.1 g, Energy 26 kcal, Proteins 2 g, Fats 0.7g, carbohydrates 2.9 g, Calcium 73 mg, Phosphorus 21 mg, Fe 10.9 mg, Carotene 5.586 mg
	<i>Kathuru-murunga</i>	<i>Sesbania grandiflora</i>	Moisture 73.1 g, Energy 93 kcal, Proteins 8.4 g, Fats 1.4 g, Carbohydrates 11.8 g, Calcium 1130 mg, Phosphrus 80 mg, Iron 3.9 mg, Carotene 5400 meg, Vitamin C 169 mg
Cereal	<i>Undu gram</i> (Black gram)	<i>Phaseolus mungo</i>	Moisture 10.9 g, Energy 347 kcal, Proteins 24 g, Fats 1.4 g,

Table 3: Cont.

			Carbohydrates 59.6 g, Calcium 154 mg, Phosphorus 385 mg, Iron 9.1 mg, Carotene 38 g
<i>Kollu</i> (gram)	(Horse)	<i>Dolichos biflorus</i>	Moisture 11.8 g, Energy 321 kcal, Proteins 22 g, Fats 0.5 g
<i>Mun-eta</i> (gram)	(Green)	<i>Phaseolus aureus</i>	Moisture 10.1 g, Energy 348 Kcal, Proteins 24.5 g, Fats 1.2 g, Carbohydrates 59.9 g, Calcium 75 mg, Phosphorus 405 mg, Iron 8.5 mg, Carotene 49 meg

Sources: [58–64].

Individually, most of the food was obtained from natural sources and the majority of proteins from plant sources. The types of traditional foods, preparations, and consumption habits were more diverse than today. Traditional people consumed food not only for “nutrition” but also for “therapeutic purposes” (Tables 2 and 3) [8,57].

They cultivated everything in their home gardens, including vegetables, fruits, spices, condiments, and even basic medicinal herbs for home remedies. The cooking oil was extracted from coconut (*Cocos nucifera*), Mee (*Madhuca longifolia*), Sesame (*Sesamum indicum*) [8,57,59]. They maintained a small backyard system that provided high-quality animal protein sources, such as eggs and milk. Meat was rarely eaten, and the animals that they raised were rarely slaughtered. Instead, Sri Lankan people ate “game meat” (wild meat), such as porcupine, jungle fowl, hare, wild boar, and so on. There was no shortage of any sources of “game meat” in the past, and the slaughtering of wild animals for meat (game) was allowed with restrictions. Game meat was appreciated less frequently. Some of the people reared goats, and goat milk was in high demand for domestic consumption. Goat’s milk was considered as a therapeutic food for allergies and asthma. As a result, goat’s milk is still in demand today. All these animal products were produced in the backyard without external input or expense. Important sources of animal protein were freshwater fish and milk, which were freely available. Consumption of fresh milk was not common among adults [8]. They understood that the nutrients derived from milk (protein and calcium) could also be obtained from vegetable sources. Therefore, they allowed the calf to drink its milk amply.

Different foods had distinctive and unique preparation systems. All the ingredients were natural, though some types of food were prepared only for a few occasions or purposes. Some types of food were specially prepared for special people. The food that was prepared and brought to the rice field to serve the people was called “*Ambula*” consisting of local vegetables and rice. The curries of *ambula* were made sour by using tamarind (*Siaymbala*) or garcinia (*Goraka*), in order to make it enriched with vitamin “C”. Another special preparation was sour fish curry (*Malu Ambul thiyal*), a unique spicy fish preparation with thick gamboge “*Goraka*” paste [8]. This shows, with diverse foodstuffs, how varieties of delicious dishes were prepared [8] Robert Knox recorded in his book, *An Historical Relation of the Island Ceylon in the East-Indies*, that this was relished in daily diets only by the noble people of Sri Lanka. The ordinary and the poor used them occasionally during special meals. The excess milk was always processed and conserved [8]. The most important processed and preserved dairy products were milk, cottage cheese, cream, whey, and ghee. These were popularly known as the five essential milk products. These five milk-based foods were considered to be noble foods.

Many traditional Sri Lankans have always been concerned about the type of food that they choose, including the quantity and the quality of their food. Food security and food availability in traditional Sri Lanka was so rich that it was consumed according to the type of person (child, adult, elder), physiology

(sick, pregnant, nursing), degree of activity (less active, energetic), and the type of meal (breakfast, lunch, dinner). Rice was considered the staple food, as it was eaten three times per day. Various rice varieties were served to pregnant and lactating women, as well as to sick people and the monks [8,47]. For example, pregnant mothers were fed with '*maa wee*' varieties, and small children and senior people who couldn't easily digest other varieties were fed with "*heenaty*". There are records that in ancient Sri Lanka, there were more than 2442 different varieties of rice [8,58]. They had detected compatible foods. Incompatible foods have always been avoided. If the food had any harmful effects, it was always omitted in an ordinary meal. For example, they did not drink milk but rather ate milk in the fermented form as curd. Today, scientific evidence has proven curd contains many beneficial bacteria. Cultivated and wild vegetables, especially wild green leaves and other wild plant food types were important ingredients for the sauces that accompanied the carbohydrate staples. The seeds were naturally hybridized and fertilized. The availability of food was plentiful. The choice of food was dependent on the need. For children to overcome the burden of intestinal worms, a '*mellun*' prepared from '*Eth thora*' (*Cassia alata*) or '*Erabadu*' (*Erythrina indica*) was used; as for diabetic patients, a curry of bitter melon (*Mormodica charantia*) was given. Similarly, there were many other dietary recommendations that could be used for therapeutic and treatment purposes [8,57,61]. The data were collected by interviewing the senior members of the society in the research areas. According to these individual interviews, 96.8% of respondents mentioned that the vegetables they cooked were obtained from natural sources. The average age of the sample was 90 years old. This age group experienced the aforementioned social transitions and traditional cultural values during their lifespan. The villagers defined "naturally grown vegetables" as edible plants grown without special care without the use of pesticides, herbicides, and fertilizers and that are not grown using commercial seeds or for commercial purposes [8]. The vegetables were picked daily around the houses, preferably before cooking. They further mentioned that freshly picked vegetables made their food tastier. The villagers would share these food items, such as wild plants, mushrooms, and venison, in their hamlets when large amounts were collected.

4.2. Nutrition Transition after Colonization

Many developing countries are experiencing a rapid dietary change characterized by the double burden of diseases, in which chronic diseases are more common, while infectious diseases remain undefeated. Food habits in Asia began to shift dramatically at the onset of European colonial occupation. According to ancient literature, Sri Lanka had experienced the rule of three colonial nations: first, the Portuguese; then, the Dutch; and finally, the British. They introduced new aspects to and changed the food habits of the Sri Lankans.

During the Portuguese period, not only the above food types were introduced (Table 4), but also new food tastes, such as red chilies, were added in food preparations, which were not used very often in ancient Sri Lanka [64]. Sri Lankans had their supply of local varieties, which were in abundance and different. In the dry zone, people did not use peppers; rather, they used their own varieties of local and wild chilies. Then, the Dutch influenced the Sri Lankan culinary pattern. Lamprais is an enhanced version of traditional rice and curry [64]. The rice is boiled in stock and accompanied by *sambols* (hot chilies '*Capsicum annum*' and coconut). Up to now *sambols* were more popular in every part of Sri Lanka. The product is moistened with coconut milk, wrapped in a banana leaf to enhance the flavor, and baked to produce a meal for special occasions [64]. Also, they introduced bread, variety of foods (Table 5) different types of cake with plums and sultanas, which were traditionally used at Christmas. *Kokis* (from the Dutch *koekje*,) is a crispy textured sweet made from rice flour and coconut milk, deep-fried in a wheel or flower shaped "mold", and until now, was eaten to celebrate Sinhala and the Tamil New Year. The simple stew also seems to have been introduced by the Dutch [64].

Table 4. New variety of food introduced by Portuguese.

Vernacular Names	Botanical Name	Edible Parts	Distribution	Therapeutic Value
<i>Emberella.</i>	<i>Spondias pinnata</i>	Fruits	Native of Polynesia	The juice of the leave is used for earaches. The fruit is an antiscorbutic, and the acidic and astringent pulp is used for bilious dyspepsia.
<i>Katu-attha,</i> (Soursop)	<i>Annona muricata</i>	Fruits	Native of the west Indies	Leaf infusion is used as sudorific; antispasmodic; emetic flowers are antispasmodic. The ripe fruit is antiscorbutic; the unripe fruit is used for dysentery.
<i>Annasi,</i> (pineapple)	<i>Ananas comosus</i>	Fruits	Tropical America	Good source of vitamins A, B, and C and calcium and iron. The fruit juice of the leaves was a powerful anthelmintic and vermicide.
<i>Mangnokka,</i> <i>Maiyokka,</i> (Cassava, Manioc)	<i>Manihot esculentus</i>	Roots and young leaves	Mexico and parts of Guatemala, northeastern Brazil	Pounded leaves are applied as a compress to the head in fevers and headaches. A decoction of the bark of the trunk is considered antirheumatic. Bark decoction is anthelmintic.
<i>Miris, Malu miris,</i> (Chilly, Capsicum)	<i>Capsicum annum</i>	Fruits	Central and South America	The fruits are acrid, bitter, thermogenic, digesting carminative, laxative, expectorant, sialagogue, stimulant, and cardiotoxic.

Sources: [57–63].

Table 5. A new variety of food introduced by the Dutch.

Vernacular Names	Botanical Name	Edible Parts	Distribution	Nutritional and Therapeutic Value
<i>Bathala,</i> (Sweet potato)	<i>Ipomoea batatas</i>	Roots and tender leaves	Endemic to Central America	Sweet potato tops, particularly the purplish ones, are used for diabetes. The leaves are applied for boils, carbuncles, and pimples. Boiled sweet potato is good for diarrhea.
<i>Gadu guda,</i>	<i>Baccaurea metleyana</i>	Fruits	Southeast Asia.	-

Table 5: Cont.

<i>Bada iringu,</i> (corn, maize)	<i>Zea mays</i>	Grains	South America	-
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Sources: [57].

Sri Lanka's traditional agricultural farming, food systems, and food culture were challenged for the first time during the British colonial period (19th century). The emphasis then was on plantation agriculture, which included the cultivation of tea, rubber, and coconut on a massive scale. The British brought South Indian Tamils to Sri Lanka to work as estate laborers. Thereafter, rice was also imported to fulfill the dietary requirements of their workers. As a result of the promotion of plantation agriculture, traditional agriculture was changed [65].

The unsuccessful *Uva Wellasa* uprising in 1918, just three years after the British captured power in Sri Lanka, also influenced the traditional agriculture adversely. The British rulers who managed to suppress the uprising nevertheless realized that the strength of the "rebels" lay in the prosperity of *Uva Wellassa* ("Wellassa" means one lakh of paddy fields) [66–68]. In order to prevent a further uprising, the present families were annihilated, the paddy fields and grain silos were burnt, and the tanks and other irrigation systems destroyed. In a short time, the whole of the *Magama* and *Uva Wellassa* regions were ruined [59]. The British did not encourage traditional farming for a considerable length of time, hoping to break the backbone of the traditional farmers. This seriously affected traditional food varieties and farming systems. Meanwhile, British colonialism destroyed the country's biodiversity. Large forest areas were opened for monoculture and many new plant species were introduced into the country as crops [65]. The result of these practices led to gradual erosion of the island's biodiversity. However, this condition did not affect the dry zone as they expected, and therefore, the biodiversity of the dry zone still remains rich. Today, because of "modernization", most of the traditional food varieties have been lost, and many types of local fruits have been dried out [65].

European food habits (the Western diet) also had serious implications for Sri Lankan traditional food and farming systems. The Europeans introduced high intake of fats, salt, sugars, and processed foods, as well as food plants familiar to them in Europe, to satisfy their food requirements. Consequently, vegetables, such as cabbage, potatoes, carrots, beans, beetroot, and leeks, were grown in the hill country areas where the agro-ecological conditions are favorable for such crops [8]. The Sri Lankan elite imitated the British, and with time, these varieties of vegetables became popular among the common people as well. Even today, these vegetables are popularly known as "upcountry vegetables", as they are cultivated in the highlands of Sri Lanka. For example, according to the experience of the elderly people in present Sri Lanka, some areas in Sri Lanka were promoted for some foods, such as wheat flour, tea, and alcohol by British people. In the past, people did not drink alcohol, and they did not have experience with alcohol other than '*Raa*' (toddy made by coconut, palm/Palmyra). After the British had been expelled from the Sri Lankan subcontinent and also during their reign, the British not only influenced Sri Lanka politically, economically, and socially, but also influenced their spirit and culture to deep degrees. Besides, Western culture and its symbols are valued over native customs, leading to a kind of colonization in the mind. Still today, this colonization of the mind is one of the main causes of the identity crisis in Sri Lanka. It is accompanied by other factors, such as globalization, technological progress, and the disillusionment of youth with the indigenous powers and the increasing influences of Western culture.

Globalization has been strongly associated with a significant increase in the concentration of corporate ownership across the entire food chain from production to processing, supply, and retail [7]. There is growing evidence that globalization and trade liberalization have played a key role in the dietary and nutritional transition in Sri Lanka. This includes food retail sectors and rapidly expanding

supermarkets in Sri Lanka since the post-colonization period. Additionally, globalized food chains have the largest comparative advantage in supplying processed foods high in sugar, salt, and oil that are cheaper to produce and transport and have longer shelf lives than raw, unprocessed foods [7,9]. As a result, Sri Lanka has enjoyed a huge influx of processed food products, which have remarkably transformed the scenario of the food market and people’s food choices. The situation has changed. Supermarkets and groceries are taking the lead, selling cheap junk foods, such as cookies, chips and soft drinks.

5. Discussion

The impact of colonial dynamic and postcolonial dynamic on Sri Lankan culture, as well as cultural changes and their impact on food and nutritional changes, have been discussed. In ancient times, health conditions in the villages remained good due to the consumption of indigenous food and the use of indigenous medical methods [54]. The increase in food consumption has been accompanied by a change in dietary patterns. However, after the late 1970s, during the postcolonial period, this was used by literary critics to discuss the various cultural implications of colonization [21]. The consumption of indigenous traditional foods has also been used to prevent and cure many diseases. But globalized food chains have the largest comparative advantage in supplying processed foods high in sugar, salt, and oil that are cheaper to produce and transport and have a longer shelf life than raw unprocessed foods [7]. As a result, Sri Lanka has enjoyed a huge influx of processed food products, which has remarkably transformed the scenario of the food market and people’s food choices.

According to Figure 3, Sri Lankans have recently spent more money on condiments and other food items, namely sauces, tinned or package stuff, soup cubes, chutneys, and prepared food bought from outside, than ever before. Over the period between 1940 and 2001, the consumption of traditional food varieties, such as root and yams, green leaves, and green vegetables, has decreased. It is believed that Sri Lanka was influenced mainly by fast food during the colonial era.

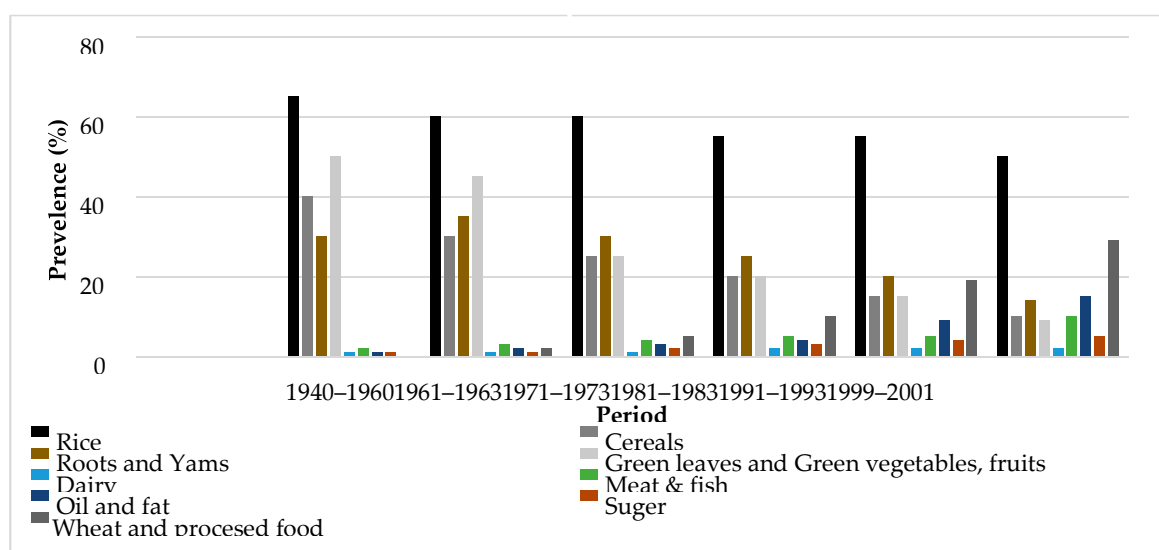


Figure 3. Growth in total food consumption in Sri Lanka. Source: Central Bank Reports from 1950 to 2001 [69].

In 1902, Perera & Sons Bakers started its journey as a local fast food service provider in Sri Lanka [70]. After that, Royal Bakers and many others came to the area. Apart from local fast food providers, multinational fast food service providers started catering to Sri Lankan customers, such as McDonald’s (1998), KFC (1995), and Pizza Hut (1993) [70] with the advancement of globalization, facing what has become one of the biggest issues today relates to the link between child malnutrition and fast food. The

reason for this is because postcolonialism represents and feeds an ideological response to the colonizer's thoughts [34,36] regarding Sri Lankan culture. In addition, below, Figures 4 and 5 help to clarify the child micronutrient deficiency and female malnutrition rates after the post-colonialization period. According to Figure 4, the number of children who are underweight and wasting (when part of the body becomes progressively weaker) increases steadily each year. Stunted growth and female malnutrition remain a big problem in Sri Lanka. Plant-based diets generally contain multivitamins, such as iron calcium, zinc, and vitamin A. Zinc deficiency contributes to stunted growth. According to a World Health Organization report, 4 mg of zinc can be met by traditional diets mixing whole grains, legumes, soy, and vegetables [15,71]. Therefore, it can be an effect of the traditional food diet change in Sri Lanka. The process of these nutrition changes and related health impacts have accumulated over a substantial period of time. Therefore, further research is required to deeply examine local communities to better understand these nutritional problems. The development and policing of the diet guidelines for traditional food in Sri Lanka is important for promoting healthy diets among the population. To be successful, the guidelines need to be understood and adopted by the majority of people in the country.

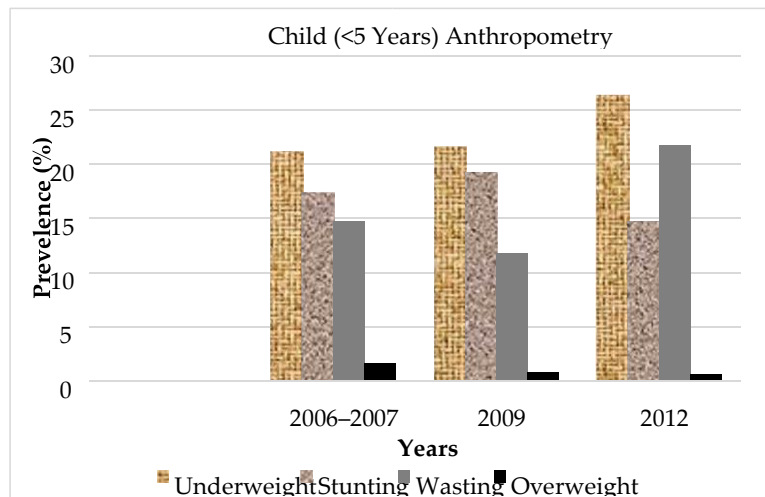


Figure 4. Child micronutrient deficiency in Sri Lanka. Sources: World Health Organization [71,72].

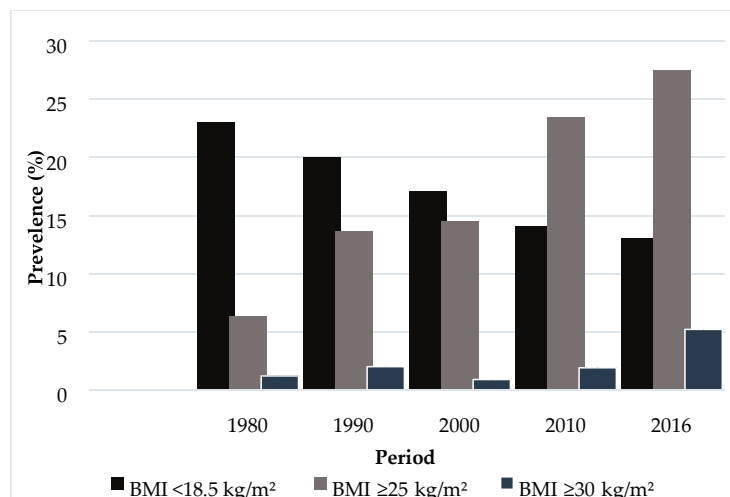


Figure 5. Female malnutrition based on body mass index (BMI) Sources: World Health Organization [71].

5.1. Destruction of the Traditional Farming Systems

In the past, Chena farmers cultivated a variety of crops to fulfill the food requirements of their families. After that, Chena farmers grew several crops specifically for the market in place of meeting the needs of their families [55]. Over the past three decades, Chena farmers have been trying to modify the

Chena culture to make a profitable business in the market-driven economy. As a result, today's Chena culture has deviated hugely from the traditional Chena culture. Thus, it clearly coincides with postcolonial dynamics that farmers now use machines to cut down the forests [55].

Even during postcolonial times, some state agencies used the land and directly influenced traditional farmers and the traditional varieties of food and seeds, which they used. As a government policy, a decision was made to allow the subsidization of fertilizers for the cultivation and purchase of Chena products at a high price on the open market, which reduced the organic fertility by more than 95% [73]. On the other hand, some farmers lost their cultivated areas due to the restriction of lands by the government to be used for development programs.

5.2. Disparities of Socioeconomic Status and Development of the Government Policy

Since independence, the manufacturing and service sectors have also developed with the food and agriculture sectors. However, the relative performance of each sector has been mixed; the manufacturing and service sectors have posted robust growth relative to the food and agriculture sectors [48]. There have been many significant changes in the structure of the Sri Lankan economy since the Western colonial powers ruled the country [48]. According to Munasinghe (2015) [74], this industrial booming in the colonial period is mainly due to the British change in social structure [74]. People from villages who were farmers have migrated to the Colombo to work in the harbor, railway, and other factories. This shift had a direct impact on the local social setting and the food system. Since the independence from British rule in 1948, several governments have taken many steps to promote activities in these two sub-sections (rice/other crops and plantations) in the areas of production, processing, and marketing.

5.3. Creation of Cash-Crop Economies

The British exploitation of the 1950s led to the creation of "cash crop economies" in Sri Lanka. From the beginning, rural communities were encouraged by the British to grow food crops for export in order to earn enough money to improve their standard of living under a new economic system [75]. Nutritional habits were also radically altered by the introduction of new farming techniques that were assimilated into cash crop production. These techniques have favored the introduction of monocultures with higher yields of maize, rice, and other varieties. Monocultures have displaced traditional Sri Lankan food crops grown using traditional farming techniques, including "shifting cultivation" and "intermediate farming", which have been historically adapted to local agricultural conditions. Traditional farming methods protected the soil, reduced weeds, provided communities with a variety of foods, and reduced the risk of crop failures, pests, and plant diseases. However, monocultures did not provide any of these benefits. The shift to monocultures and the reduction of dietary diversity have also resulted in a loss of knowledge about old agricultural practices and traditional food varieties.

5.4. Ecological Destruction

Various forest ecosystems were quickly cleared for growing crops. This ecological elimination has destroyed many native plant varieties and food varieties. Some native crops and wild food plants have been cut from traditional diets, which have affected the taste and nutritional value of ordinary dishes [75,76]. Monocultures have displaced the traditional crop cultivation methods, including shifting cultivation and intermediate crop production, to a commercialized system [7,76,77]. Overall, the introduction of new farming methods has brought economic benefits to the Western powers and caused incredible ecological destruction and human suffering in Sri Lanka.

5.5. Nutrition-Related Propaganda (i.e., Advertising)

Marketing strategies are often deliberately tailored to existing cultural aspects regarding nutrition-related propaganda [78]. Clear contradictions and unusual connections are abundant in these advertising campaigns. For example, McDonald's uses its resources and popularity to promote the United Nations Children's Fund and its mission to eradicate child malnutrition [70]. This perhaps suggests that children should be "fed healthily" with McDonald's food.

Advertising is now recognized as an important contributor to regime change and general acceptance of globalized food culture. Even today, mass marketing of packaged foods is ubiquitous, and the negative impact of these advertising campaigns is well documented. The best example of such propaganda was the mass marketing of and the sale of artificial milk powder. Many people in Sri Lanka sell their fresh milk and buy formula milk for infants, children, and the elderly. The use of milk formulas reduces the extent of breastfeeding and increases death rates caused by intestinal infections [1].

5.6. Disruption of the Family Unit

Economic reforms in Sri Lanka have disrupted the family unit by imposing higher pressure on women to work outside the house. Increasingly, women are forced to enter the urban labor market to improve the earning potential of the family [78,79]. This involves long hours of work to meet basic needs. The absence of women in family units has increasingly eliminated traditional foods that take a long time to prepare as compared with the preparation of imported cereals and high-calorie and nutrient-dense fast foods. With the entry of women into the economic employment sector, the breastfeeding of toddlers has declined. Reduced lactation periods are associated with poorer nutritional status and increased susceptibility to diseases, including diarrhea and measles in infants and children [72–78]. The consequences of the urbanization of Sri Lanka has led to a move away from high-fiber, home-cooked foods towards the consumption of a ready-made, prepared, packaged, and processed foods. The increased intake of *trans* fats, refined sugars, refined flours, and preservatives, and the low consumption of essential fibers and micronutrients have resulted in adverse effects on the health of the urban population. The extent to which global eating habits are being used in rural cities has not yet been studied effectively. However, recent evidence suggests that Western dietary habits are infiltrating rural Sri Lanka. Many urban residences are typically characterized by small living spaces, poorly equipped kitchens or outdoor cooktops, and limited access to natural energy sources and clean water, which disrupt traditional nutritional practices. Yet, there are still chances to develop and promote traditional dietary patterns for the Sri Lankan community [80].

6. Conclusions

Over the past 400 years, multiple regime changes have taken place in Sri Lanka, which have been driven by both open and covert methods of control from colonization to the postcolonial period. But during that colonization period, both indigenous knowledge and the environment were destroyed and suppressed until the country's independence, presenting economic independence; yet, even after independence, neo-colonialism caused further destruction of Sri Lanka's traditional culture and landscape. Forced rapid urbanization contributed to the destruction of the family unit and the introduction of a more globalized food system. All in all, colonial and postcolonial dynamics had a significant impact on cultural changes. This has directly impacted Sri Lankan food culture and nutrition status and is related to current nutrition problems. However, the rapid transformation of diets and changes in food systems at all levels (production, processing, distribution, and retail) pose several important additional challenges to food security and food policy, smallholder welfare, and agricultural research and development priorities. Sri Lanka is observing a dramatic transformation in its food supply systems in response to rapid urbanization, dietary diversification, and liberalization of foreign direct

investment in the food sector. Supermarkets tend to replace central food markets, neighbourhood stores, and street food sellers in urban areas. The observed changes are in the retail sector, as well as in the production sector. Supermarkets and fast-food chains arise from and reinforce the Westernization of demand that results from economic development and urbanization. Changes in traditional diets towards a more Western diet, promoting as higher fat and sugar content, are expected to result in higher incidence of dietary-related non-communicable diseases, as well as micronutrient deficiencies. Thus, the dissemination of traditional knowledge and popular campaigns must continue. Ultimately, the individual, the family, and the local community must come together to regain their birth rights, so that they can grow and consume their local foods according to their traditional practices. In this study, it was identified that the food transition and socioecological patterns are important factors in the politics of policy-making. Dietary changes associated with urbanization are related to the fact that rural dwellers tend to be more self-reliant in obtaining food and also tend to eat traditional diets that are high in grain and fruit and vegetables and low in fat. In summary, it must be said that more must be done to expose the colonial and postcolonial forces that have undermined food security in Sri Lanka.

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Article

Food and Nutrition-related Knowledge, Attitudes, and Practices among Reproductive-age Women in Marginalized Areas in Sri Lanka

Permani C. Weerasekara ^{1*} , Chandana R. Withanachchi ² , G. A. S. Ginigaddara ³ and Angelika Ploeger ¹

¹ Specialized Partnerships in Sustainable Food Systems and Food Sovereignty, Faculty of Organic Agricultural Sciences, University of Kassel, 37213 Witzenhausen, Germany; a.ploeger@t-online.de

² Department of Archaeology and Heritage Management, Faculty of Social Sciences and Humanities, Rajarata University of Sri Lanka, Anuradhapura 50000, Sri Lanka; chandanawithanachchi@gmail.com

³ Department of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura 50000, Sri Lanka; sanjeewanieg@gmail.com

* Correspondence: permani@uni-kassel.de; Tel.: +491-577-372-5360



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Abstract: Nutrient deficiencies are a public health problem in Sri Lanka. Achieving food security is a major challenge due to unhealthy eating patterns. The nutritional status of a woman and her knowledge is a powerful indicator of the nutritional security of her children and household food security. Nutrition-related knowledge and attitude are necessary for dietary changes towards a healthier dietary pattern. For that reason, food and nutrition-related Knowledge, Attitude and Practice (KAP) is one of the key factors to achieving household food and nutritional security. The main objective of this study is to assess the food and nutrition-related KAP among reproductive-age women and understanding of household food and nutritional security in Sri Lanka as an example for marginalized societies. Thus, a cross-sectional survey was conducted using the KAP model questionnaire administered on 400 reproductive age women (18–49 Years) in marginalized areas in Sri Lanka. Data were collected using a random sampling method. The research results clearly showed that the reproductive age women have a low level of nutritional knowledge in the areas being investigated. Most women have a positive attitude towards receiving nutritional knowledge but have low-level practice about a healthy diet. Furthermore, knowledge, practices, and attitudes of women largely affect their BMI status, as well as household food security. Multiple linear regression analysis was used to analyze the influential factors. There was a highly significant positive correlation between nutritional knowledge, attitude score, and BMI level and a significant difference was found in the area, age, family size, monthly income, educational level, attitudes towards nutrition, food and nutrition practices across the reproductive women ($R^2:467, p < 0.01$). The research results showed that KAP largely determines women's nutrition and household food security. Based on the results of this research, there is a need to enhance nutritional education in reproductive-age women in marginalized areas in Sri Lanka.

Keywords: food-and nutrition-related knowledge; attitudes and practices; reproductive-age women; marginalized society; nutrition and health problems; food and nutrition security; Sri Lanka.

1. Introduction

Food insecurity is a global problem that contributes to poor health and nutritional deficiencies. It can affect health either directly or indirectly through nutritional status as indicated by undernutrition or overnutrition [1] and it is related to macro- and micronutrient deficiencies and lack of dietary [1,2]. Also,

women's nutritional status has been identified as an indicator of the overall well-being of society [3–5] and the nutritional security of children [6,7]. Hence, Reproductive-age women's nutritional status is the single most important criterion influencing pregnancy outcomes [8]. Inadequate and improper dietary-intake patterns in women of reproductive age result in the deficiency of essential nutrients [9]. According to the World Health Organization (WHO), many women do not get enough micronutrients in their diets during their reproductive-age period [10], which influences future generations. Unhealthy eating habits [11,12], such as consuming nutrient-deficient food [13,14], skipping meals [15,16], and a lack of proper eating patterns [17], are understood to cause various health problems and nutritional deficiencies [18]. Therefore, knowledge about healthy food choices is a factor for maintaining a healthy diet [13,19].

In Sri Lanka, 17% of newborn babies have a low birth weight, and one-sixth of women have a low body mass index [20]. The prevalence of anaemia is 16.2% among pregnant women and 19.6% among lactating women [21,22] 32.6% of women of reproductive age have anaemia [23] Vitamin A deficiency is observed in approximately 15% of mothers with children aged 6–60 months [24]. Other micronutrient deficiencies such as iron, iodine, zinc and vitamin D are reported in different age groups [24–26]. According to WHO 2018 for Sri Lanka, Non-Communicable Diseases (NCDs) such as cancer, chronic respiratory diseases, cardiovascular diseases and diabetes, are estimated to account for 83% of all deaths [27,28]. This nutrition statistics indicate problems associated with low-quality food intake and unhealthy eating patterns in Sri Lanka. If women are aware of healthy nutrition, they can help minimize the occurrence of many nutritional problems. Hence, women's education is associated with positive effects on family nutritional status [29–31]. Previous studies suggested that women's nutritional knowledge of traditional food could also impact the nutritional status of the family [14,32,33]. Improving women's food- and nutrition-related knowledge has a positive influence on health [34,35]. Women's low level of nutritional knowledge impact on nutritional problems [36] and a healthy diet and nutrition education programs help to improved health outcomes among reproductive women [37]. Also, studies suggested that a proper nutrition knowledge impact on good nutrition status [38]. Insufficient nutrition-related knowledge of women is an underlying cause for the high prevalence of undernutrition and micronutrient deficiencies [39–41], as women's nutritional knowledge affects attitudes and eating behaviour [14]. One of the studies suggested that women's inadequate nutrition knowledge and their food intake did not meet all the nutritional requirements of pregnancy [42]. Sufficient women's diet-related knowledge is needed for an individual to evaluate the quality of their own and their family's diet [43]. A study indicated that women with higher education levels have the highest level of nutritional knowledge related to folic acid and iodine deficiencies during pregnancy [32,44]. Likewise, the role that women play in terms of household food security is not very different from that in many other developing countries compared to the cultural context of Sri Lanka, where women are predominantly assigned the role of food preparation and food management within the household [45]. Women have played a key role in food preparation in Sri Lankan culture since ancient times. Studies suggest that in addition to knowledge for maintaining good health practices [46], nutritional status is affected by positive attitudes and practices [47–49]. Therefore, in Sri Lanka, women's lack of knowledge impacts dietary practice [50] and women's nutritional knowledge impact on healthy lifestyle [51]. Thus, women's nutrition knowledge is a key factor in maintaining health and nutrition [51].

In such a context, women's nutritional knowledge, behavioral attitudes and practices are essential because women mostly control and oversee their entire family's food consumption in Sri Lanka. Therefore, women's food and nutrition-related knowledge are important factors to enhance household food security as well as nutritional status. In this situation, achieving an effort to improve nutrition and measuring their impact requires more useful indicators and tools for [52], especially vulnerable societies

and food and nutrition-related KAP must be better understood. Hence, KAP surveys reveal misconceptions or misunderstandings that may impede behaviour and conduct barriers to behaviour change [52]. Sri Lanka is in a phase transforming their traditional food systems toward the western diet as well as an unhealthy eating pattern. The best tool to avoid this situation is to spread attitudes through food and nutrition knowledge [53]. Thus, it is important to the understanding of food and nutritional knowledge of women in marginalized areas in Sri Lanka. However, a systematic study of the reproductive age women's food and nutrition-related knowledge, attitude practice and their perception of food security and food quality has not been conducted in marginalized societies in Sri Lanka yet. Thus, studies that evaluate and analyse women's food and nutrition -related KAP are a useful method for gaining such an insight into women's determinants of their dietary habits. Thereby, this research will help policymakers or responsible authorities to plan appropriate nutrition care programs [52] for vulnerable people living in marginalized areas. These results could be empowering sustainable food and nutrition system they can provide valuable inputs for effective programs and projects. This study examines the following questions: (a). How knowledge attitude and practice among women and is its impact on the nutrition and health situation? (b). What factors influence women's food and nutrition knowledge? (c). What is the women's perception of food quality and perceived risk in these areas? Therefore, the main objective of this study is to identify food and nutrition-related KAP among reproductive-age women and to understand the impacts of KAP on household food and nutritional security in marginalized societies in Sri Lanka. For that reason, a cross-sectional survey was conducted using the KAP model questionnaire administered in marginalized areas in Sri Lanka.

2. Materials and Methods

2.1. Study Area

The research study was conducted in 2017–2019 in two different marginal areas based on the cross-case-characteristics method [54]. This research is part of a collaborative project investigating nutritional transition and traditional food cultural changes in Sri Lanka during colonization and post-colonization [53]. The study was conducted in a remote rural area (Anuradhapura district), and urban slum and shanty areas (Colombo district) due to the entire population being below or near the poverty line. These two different groups were selected based on a high vulnerable status due to low income, and nutritional, social, and health-related problems in different ways. In the north-central province, the district of Anuradhapura was selected as a remote rural study site. The main income for people comes from agriculture, and the main crops are paddy [55]. In Anuradhapura, two divisional secretaries (DS) divisions (Kebithigollewa and Horowpothana) were selected for the present study (see Figure 1).

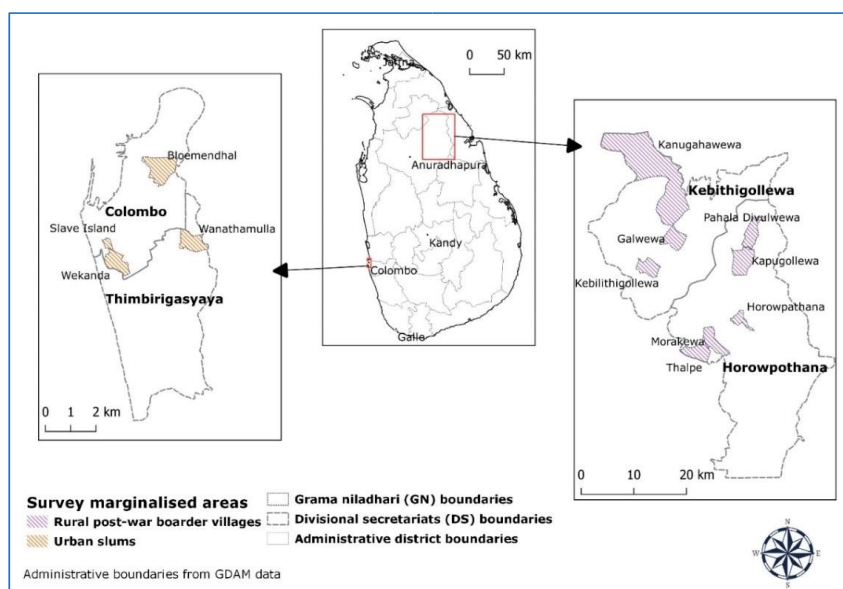


Figure 1. Study map (authors' illustration).

All divisions' residents engage largely in small-scale agriculture as their main source of income. In these rural remote areas people suffer from the consequences of 30 years of war (war-border areas) as well as poverty and malnutrition, water problems (dry-zone areas), and kidney diseases. In the western province, the district of Colombo was selected for the urban areas. In Colombo, three GN divisions were selected for this study (see Figure 1). Low-income residents who live in these areas suffer from malnutrition, social and health problems, poverty, inadequate living space, unsanitary conditions, and high rates of unemployment (55).

2.2. Study Design and Data Collection

Ethical approval was obtained from the Ethical Review Committee (ERC) of the Faculty of Applied Science of Rajarata University of Sri Lanka (ref: ERC/09/19) for this research project. A cross-sectional survey was conducted using the KAP model questionnaire administered on 400 reproductive age women (18–49 Years) in marginalized areas in Sri Lanka. The study was conducted in December 2018–February 2019. The self-designed questionnaire used in this study was based on the KAP model [52]. Well-trained field workers collected data. Enumerators were trained on how to conduct an interview using questionnaires. Anthropometric measurements were taken for all women in both areas ($N = 400$). All interviews were conducted in the official language (Sinhala) in Sri Lanka. The sample was selected based on gender and age. According to a feasibility study, women are a powerful indicator of household food security in the area, since they are main income holders, but also suffer from nutritional problems. Selected sample size is 400 as it implies in a confidence interval of $\pm 2.5\%$ (total = 5%). Within both areas, 400 reproductive age women (18–49 years old) were randomly selected from the electoral divisional secretariats (DS) list based on women's age (18–49 years), comprising 200 rural household's and 200 urban household's reproductive-age women. One woman per household was selected. In case a household's selected candidate refused to participate or no women were available for an interview, then the nearest house's women were interviewed. All women participated in the survey ($N = 400$, 100%). Incorrect data did not find because questionnaires were filled by the enumerators through face-to-face interviews. No monetary incentive was the provider for the participant. Furthermore, current research tried to understand food and nutrition-related behaviours, perception of food, and women's perception of food quality and perceived risk. For these purposes, randomly selected women of reproductive age ($N = 40$) were interviewed in the same sample ($N = 400$) from both areas. The interviews were conducted in Sinhala and then translated into English. Interview data were transferred to an Excel datasheet. MAXQDA 2018

was used for coding the interviews. Interview data were also transferred to the datasheet before conducting quantitative statistical analysis. The interview questions were slightly altered based on research location and position. However, it remained connected to the research objectives.

2.3. Questionnaire

The self-designed questionnaire was used based on the KAP model and Sri Lankan dietary guidelines. The questionnaire was divided into the following sections:

(1). Demographic Characteristics

Demographic characteristics were based on socioeconomics factors such as type of residence (rural/urban), age (18–49 years old), marital status (married/single/separated/widowed), family size based on the household members (small family/big family), main occupation (unemployed/agriculture/hard job/government job), monthly family income, food expenditure and level of education (non-education/primary/secondary/higher education), residence period (from birth/immigrated from somewhere).

(2). Anthropometric Measurements

Anthropometric measurements were taken using a stadiometer and electronic weighing scale. Height was measured to the nearest centimetre by using a height scale following the standard anthropometric technique for weight and height measurements. Participants were asked to remove their shoes and wear light clothing [56]. Body mass index (BMI) was calculated by dividing weight (kilograms) with height in meters squared (kg/m^2). Evaluation of nutrition status (undernutrition, overnutrition, and obesity) using BMI was based on the following WHO criteria [57]: BMI < 18.5, underweight (malnourished); BMI = 18.5–24.99, normal weight; BMI = 25–29.99, overweight; and BMI > 30, obesity [58]. The calculation of BMI will help better to understand the nutrition situation of the research areas

(3). Food and Nutrition-related Knowledge, Attitude and Practice (KAP)

Food and nutrition-related KAP data were collected using a questionnaire according to FAO guidelines [52,59,60]. A nutrition-related-knowledge questionnaire that contained seven parts and 50 questions and nutrition-related attitude questionnaire that contained five-part and 20 questions were used to comprehensively assess the level of women’s food and nutritional knowledge (see Table 1).

Table 1. The study questions of food and nutrition-related knowledge and attitude.

Dimension	Total Number of Items	Description	References
Dietary fiber-related knowledge	7	Which foods that contained high fibre?/Eating adequate amounts of dietary fibre can prevent and treat diseases? Which diseases can prevent and treat dietary in fibre?/Fast-food consumption, in general, contributes to our dietary fibre intake?/Regular consumption of dietary fibre may reduce blood cholesterol levels?/Dietary fibre Can help maintain our body-weight/Dietary fibres have calorie	Macías et al. [52] Deniz et al. [61] Guiné et al. [62] Bookari et al. [63]
Micronutrients-related knowledge	9	Micronutrient deficiency-related health problem/knowledge about micronutrients food: Fe, vitamin A, vitamin C, folic acid, B vitamins, vitamin E and vitamin B12/Have you ever heard	Macías et al. [52] Bookari et al. [63] Augustine et al. [64]

Table 1: Cont.

		or read that vitamin folic acid can help and prevent birth deceases	
Iron-related knowledge	7	What are the health risks of a lack of iron in the diet?/What causes anaemia?/How can anaemia be prevented?/Can you list examples of foods rich in iron?/When taken during meals, certain foods help the body absorb and use iron?/What are those foods some beverages decrease iron absorption when taken with meals, Which ones?/Have you heard about iron-deficiency anaemia? If Yes: Can you tell me how you can recognize someone who has anaemia?	Macías et al. [52]
Fat-related knowledge	5	Which food in high fat?/Do you know the risk of consuming high-fat food?/What is the risk of consuming a high-fat food? Which fat good for the body?/How much do you daily consuming oil and which type of oil are you using?	Macías et al. [52] Stafleu et al. [65]
Food and nutrition diseases	6	Knowledge of high blood pressure, cholesterol/Knowledge about micronutrition deficiencies is low nutrition food consumption salty snack is harmful health/Is fast food contains low nutrition or not?/Unhealthy eating patterns are the risk of future health/Do you know eating nutritious food can live a healthy life	Macías et al. [52]
Vitamins and mineral-related knowledge	7	Why vitamin and mineral are essential?/What are the most important vitamin and minerals for your body?/Which vitamin and minerals are good for bone development?/Which vitamin and minerals are good for energy production and immune function?/Why is protein important for humans? Which vitamin and minerals are good for healthy eyes and general growth and development ?/What are daily essential vitamins for your body.	Macías et al. [52]
Healthy food-related knowledge	9	What is a balanced diet?/Why is a balanced diet important? Do you know the food pyramid?/What foods are healthy? What food should you eat every day?/Which foods are the healthiest?/Which foods should not eat or unhealthy?/Which cooking method is protecting nutrition in vegetables/How well do you think it is to have different types of foods at meals?	Macías et al. [52]
Healthy food attitude	8	The food I eat must keep me (healthy/nutritious/contains vitamins and minerals)/I always follow a healthy and balanced diet/I eat what I like and I do not worry about the healthiness of food/The healthiness of food has little impact on my food choices/Ranking of food choice motives (Taste, Convenience, Health & Nutrition, Price)/What I eat and what I don't care about is the healthiness of food_?	Macías et al. [52] Naughton et al. [66]

The score of nutrition-related knowledge and attitude were calculated using preliminary analysis. Each question has been judged as yes or no. The women in the study were asked to assess their attitudes towards good diet practices and if they were concerned about what they were eating. Eating habits like eating in front of the TV, eating with other family members, eating breakfast, and dietary practices were also used to assess the influence of the home environment on diet practices. Women were asked if they

were concerned about what they were eating to assess attitudes towards good diet practices and the aforementioned eating habits like eating in front of the TV and with other family members. Dietary-practice data were collected using a questionnaire to include the number of meals consumed daily, meal patterns, snacking habits, food flavours, food quality.

(4). Knowledge about Food Quality and Perceived Risk

These questions were based on women’s knowledge of food quality and perceived risks, especially since both areas are facing the problem of food quality. Basic knowledge about food quality such as what is recommended as healthy or unhealthy food by governmental associations are not known.

2.4. Data Analyses

Data were analysed using SPSS Statistics Version 21.0 (IBM, Armonk, NY, USA). Invalid or missing data were excluded and all data entries were double-checked to prevent errors. Descriptive statistics, such as frequency and percentage were used to analyse demographic factors. *t*-tests, ANOVA, Mann Whitney were used to compare differences in variables. Multiple-linear-regression models were established to evaluate factors that influenced nutrition-related knowledge. VIF is used for diagnosing multicollinearity or collinearity. High values signify that it is difficult to impossible to assess accurately the contribution of predictors to a model. A VIF < 5 implies no multicollinearity [73]. All statistics were checked using a two-sided test. Statistical significance was fixed at *p* < 0.05. A significant relationship between nutrition-related KAP and BMI status was determined by using the chi-squared test, correlation.

3. Results

3.1. Demographic Characteristics of Reproductive-Age Women

In the study sample, most women were 15–35 years old (70.6%). Most women were married (82%), and 91.3% of the participants were educated, of which most had at least primary education (58.5%), while 60.5% were housewives without incomes. According to Sri Lankan socio-economic data, median female age was 34.4 years [74,75] while female literacy rate was 91% [76,77]. The average monthly household median income was between 15,000–18,313 LKR. [78,79] which is compared with this sample found a low percentage and It was 25% (15,001–25,000 LKR). However, according to the study sample, many of the monthly household income was between 5000–25,000 LKR. Regarding the nutritional status of reproductive age women, 43.5% were underweight, and 74% of the interviewed women have lived in their respective villages since birth or for at least a decade. The study found that, in urban areas, about 50% of the participants were underweight, 20% overweight, and 5.5% obese. On the other hand, 42.5% of the examined women in rural areas had normal weight compared with 24.5% of those in urban areas. The study found that fewer than 50% of the women had normal weight, and more than 50% of the women had nutritional problems such as under- and overnutrition. The nutritional status of rural women was significantly better than that of urban women (see Table 2).

Table 2. Demographic characteristics of reproductive-age women (*N* = 400).

Variables	Category	<i>N</i>	%
Type of residence	Rural	200	50.0
	Urban	200	50.0
Age	15–25	141	35.3
	26–35	141	35.3
	36–49	118	29.5
Marital status	Married	328	82.0
	Single	30	7.5
	Separated	18	4.5

Table 2: Cont.

	Widowed	24	6.0
Family members *	Small family	260	65.0
	Big family	140	34.5
Level of education	No education	37	9.3
	Primary	234	58.5
	Secondary	125	31.3
	Higher	4	1.0
Main occupation	Unemployed	241	60.5
	Agriculture	68	17.0
	Hard job	79	19.8
	Government job	11	2.8
Monthly family income ¹	Less than 5000	17	4.3
	5000–15000	138	34.5
	15001–25000	100	25.0
	25001–35000	71	17.8
	35001–50000	57	14.3
	More than 50,000	17	4.3
BMI	Underweight	174	43.5
	Normal weight	134	33.5
	Overweight	77	19.3
	Obese	15	3.8
Residence in the study area	From birth	296	74.0
	Immigrated from somewhere	104	26.0

* According to the “small family is golden” family-planning concept in Sri Lanka. In this case, “small family” means a father, a mother, and two children (minimum four family members), “Big family” means a father, a mother and more children (more than four family members) [80]. ¹ Sri Lankan rupees per month.

3.2. Food and Nutrition-Related Knowledge

The average score of food and nutrition-related knowledge of reproductive women based on age, area, household size, marital status, main occupation, monthly income, level of education and BMI. The mean score of nutrition-related knowledge was 0.40 ± 0.507 . The lowest average score was “Nutrient and food-related diseases” and the highest average score was “Dietary fibre related knowledge”. The statistically significant difference was found between age, household size, area, monthly income, main occupation, marital status, education and BMI ($p < 0.05$). The average score of participants aged more than 25 years old was highest in each part. The average scores of married women were higher than the other participants. The average scores of normal-weight participants were lower than others categorised as underweight, overweight and obese. The average scores of those with education were higher than the non-education score. The average scores of employed women were higher than unemployed women.

The mean score of participant women aged more than 35 years old was high, whereas the mean average score of participant women aged 18–25 years old was lower. The average score of the big family participants was higher than for small family participants. The average score of knowledge for women living in rural areas was higher than those living in urban areas. The average score of hard job participants was higher than those of government job participants. The average score of the higher education knowledge level was higher than those with secondary and primary education. The average score of underweight women was the highest, and the score of women who were overweight was the lowest. Meanwhile, the average score of women who have normal weight and related micronutrients knowledge,

nutrient and food-related diseases and healthy food-related knowledge were higher than women who had to suffer from undernutrition and overnutrition as well as obesity (see Table 3).

Table 3. Each dimension of the average score indifference (knowledge) variables (Mean, SD) ($N = 400$).

Variables	1	2	3	4	5	6	7
Age							
15–25	0.72 ± 0.449	0.33 ± 0.473	0.02 ± 0.145	0.94 ± 0.830 *	0.72 ± 0.449	0.91 ± 0.280 *	0.98 ± 0.145
26–35	0.77 ± 0.420	0.29 ± 0.473	0.06 ± 0.245	0.73 ± 0.933 *	0.77 ± 0.420	0.67 ± 0.471 *	0.93 ± 0.258
36–49	0.81 ± 0.398	0.21 ± 0.410	0.04 ± 0.202	0.44 ± 0.801 *	0.81 ± 0.398	0.83 ± 0.377 *	0.97 ± 0.182
Area							
Rural	0.70 ± 0.462	0.40 ± 0.490 *	0.06 ± 0.229	1.02 ± 0.905 *	0.70 ± 0.462 *	0.65 ± 0.480 *	0.95 ± 0.218
Urban	0.84 ± 0.372	0.17 ± 0.377 *	0.03 ± 0.171	0.42 ± 0.746 *	0.84 ± 0.372 *	0.97 ± 0.184 *	0.97 ± 0.184
Household size							
Small family	0.64 ± 0.480 *	0.40 ± 0.491 *	0.07 ± 0.248 *	0.96 ± 0.908 *	0.64 ± 0.480 *	0.72 ± 0.452 *	0.93 ± 0.248 *
Big family	0.99 ± 0.085 *	0.06 ± 0.246 *	0.00 ± 0.000 *	0.26 ± 0.607 *	0.99 ± 0.085 *	0.97 ± 0.167 *	1.00 ± 0.000 *
Marital status							
Married	0.72 ± 0.448	0.32 ± 0.468 *	0.05 ± 0.209	0.80 ± 0.894 *	0.72 ± 0.448 *	0.77 ± 0.421	0.95 ± 0.209
Single	0.93 ± 0.254	0.20 ± 0.407 *	0.07 ± 0.254	0.73 ± 0.907 *	0.93 ± 0.254 *	0.90 ± 0.305	0.93 ± 0.254
Separated	0.94 ± 0.236	0.06 ± 0.236 *	0.00 ± 0.000	0.00 ± 0.000 *	0.94 ± 0.236 *	1.00 ± 0.000	1.00 ± 0.000
Widowed	1.00 ± 0.000	0.00 ± 0.000 *	0.00 ± 0.000	0.17 ± 0.482 *	1.00 ± 0.000 *	0.09 ± 0.302	1.00 ± 0.000
Main Occupation							
Unemployed	0.69 ± 0.465 *	0.37 ± 0.468 *	0.02 ± 0.143 *	0.88 ± 0.908 *	0.69 ± 0.465 *	0.74 ± 0.437	0.98 ± 0.143 *
Agriculture	0.90 ± 0.465 *	0.18 ± 0.384 *	0.04 ± 0.207 *	0.69 ± 0.815 *	0.90 ± 0.306 *	0.91 ± 0.286	0.97 ± 0.170 *
Hard job	1.00 ± 0.000 *	0.00 ± 0.000 *	0.00 ± 0.000 *	0.05 ± 0.273 *	1.00 ± 0.000 *	1.00 ± 0.000	1.00 ± 0.000 *
Government Job	0.82 ± 0.405 *	1.00 ± 0.000 *	0.82 ± 0.405 *	2.00 ± 0.000 *	0.00 ± 0.000 *	0.09 ± 0.302	0.09 ± 0.302 *
Monthly income							
>5000	1.00 ± 0.000 *	0.00 ± 0.000 *	0.00 ± 0.000 *	0.41 ± 0.795 *	1.00 ± 0.000 *	1.00 ± 0.000 *	1.00 ± 0.000 *
5000–15,000	0.96 ± 0.205 *	0.05 ± 0.220 *	0.00 ± 0.000 *	0.20 ± 0.511 *	0.96 ± 0.205 *	0.96 ± 0.180 *	1.00 ± 0.000 *
15,001–25,000	0.83 ± 0.378 *	0.21 ± 0.409 *	0.00 ± 0.000 *	0.64 ± 0.785 *	0.83 ± 0.378 *	0.94 ± 0.239 *	1.00 ± 0.000 *
25,001–35,000	± 0.495 *	0.54 ± 0.503 *	0.04 ± 0.203 *	1.04 ± 0.948 *	0.59 ± 0.495 *	0.75 ± 0.438 *	0.97 ± 0.167 *
35,001–50,000	0.56 ± 0.501 *	1.00 ± 0.000 *	0.11 ± 0.310 *	1.42 ± 0.801 *	0.56 ± 0.501 *	0.44 ± 0.501 *	0.89 ± 0.310 *
Education level							
Non-education	1.00 ± 0.000 *	0.00 ± 0.000 *	0.00 ± 0.000	0.19 ± 0.397 *	1.00 ± 0.000 *	1.00 ± 0.000 *	1.00 ± 0.000 *
Primary	0.76 ± 0.430 *	0.27 ± 0.447 *	0.03 ± 0.158	0.67 ± 0.869 *	0.76 ± 0.430 *	0.83 ± 0.373 *	0.97 ± 0.158 *
Secondary	0.71 ± 0.455 *	0.38 ± 0.488 *	0.09 ± 0.284	0.96 ± 0.928 *	0.71 ± 0.455 *	0.69 ± 0.465 *	0.91 ± 0.284 *
Higher	0.75 ± 0.500 *	0.25 ± 0.500 *	0.00 ± 0.000	1.00 ± 0.816 *	0.75 ± 0.500 *	1.00 ± 0.000 *	1.00 ± 0.000 *
BMI							
Underweight	0.87 ± 0.333 *	0.18 ± 0.389 *	0.00 ± 0.000 *	0.54 ± 0.742 *	0.87 ± 0.333	0.99 ± 0.076 *	1.00 ± 0.000 *
Normal weight	0.66 ± 0.477 *	0.38 ± 0.487 *	0.09 ± 0.287 *	0.93 ± 0.943 *	0.66 ± 0.477	0.65 ± 0.479 *	0.91 ± 0.287 *
Overweight	0.71 ± 0.455 *	0.34 ± 0.476 *	0.05 ± 0.223 *	0.77 ± 0.972 *	0.71 ± 0.455	0.62 ± 0.488 *	0.95 ± 0.283 *
Obese	0.73 ± 0.458 *	0.26 ± 0.458 *	0.07 ± 0.258 *	0.60 ± 0.910 *	0.73 ± 0.425	0.93 ± 0.258 *	0.93 ± 0.258 *
Average mean score	0.77 ± 0.425	0.28 ± 0.451	0.04 ± 0.202	0.72 ± 0.880	0.77 ± 0.425	0.81 ± 0.397	0.96 ± 0.202

(1) Dimensions: 1- Iron-related knowledge, 2- Micronutrients related knowledge, 3- Nutrient and food-related diseases, 4- Healthy food-related knowledge, 5- Fat-related knowledge, 6- Vitamins and mineral-related knowledge, 7- Dietary fibre related knowledge (2) Abbreviation: SD (Standard Deviation) (3) * statistical significance ($p < 0.05$) (4) ANOVA, t -test, Mann Whitney U test was used to compare differences.

Of the 400 women, the majority (71.75%) did not know about vitamins and minerals. Most of the women (80.5%) responded incorrectly to food and nutrition diseases, and the majority (57.2%) did not know what a balanced diet was. Three-quarters of the women (75%) did not know that diets low in iron cause anaemia, while 94.6% did not know which minerals and vitamins were good for bones and brain development (see Table 4).

Table 4. Knowledge level of reproductive-age women in urban and rural areas in Sri Lanka regarding nutrition ($N = 400$).

Knowledge Level *	Rural Areas ($N= 200$; %)	Urban Areas ($N= 200$; %)	Total ($N= 400$; %)
Knowledge about vitamins and minerals Yes	79 (39.5)	34 (17)	113 (28.2)
Do not know	121 (60)	166 (83)	287 (71.8)
Knowledge about fat and diet Yes	61 (30.5)	33 (16.5)	94 (23.5)
Do not know	139 (69.5)	167 (83.5)	306 (76.5)
Knowledge about iron-related food Yes	61 (30.5)	33 (16.5)	94 (23.5)
Do not know	139 (69.5)	167 (83.5)	306 (76.5)
Knowledge about micronutrients Yes	31 (15.5)	31 (15.5)	62 (15.5)
Do not know	135 (67.5)	161 (80.5)	42 (10.5)
Not well	34 (17)	8 (4)	296 (74)
Knowledge about food and nutrients No	80 (40)	147 (73.5)	227 (56.8)
Not well	37 (18.5)	22 (11)	59 (14.8)
Yes	83 (41.5)	31 (15.5)	114 (28.5)
Knowledge about dietary fibre No	189 (74)	194 (97)	383 (95.8)
Yes	11 (5.5)	6 (3)	17 (4.2)
Knowledge about water and food consumption Yes	122 (61)	72 (36)	194 (48.5)
No	78 (39)	128 (64)	206 (51.5)
Knowledge about food and nutrition-related diseases Yes	71 (35.5)	7 (3.5)	78 (19.5)
No	129 (64.5)	193 (96.5)	322 (80.5)

* According to Preliminary analysis.

3.3. Food and Nutrition-Related Attitudes

The highest average score of “Willing to get nutrition information” and “Prefer to eat healthy food” was found compared to other attitude related food and nutrition. About 46% of reproductive women “prefer to eat nutrition food”. About 63% of reproductive women were willing to get information about nutrition. About 57% of reproductive age women would like to buy healthy nutritious food, but only 33% of women paid attention to nutritious food. A statistically significant difference was found among healthy food attitudes for women based on area, a residential period of the study area, family size, family income and level of education ($p < 0.05$). In this result, all attitude scores were higher for monthly income (see Table 5).

Table 5. The average score of food and nutrition-related attitude (mean, SD).

Variables	1	2	3	4	5
Area	0.37 ±0.484 *	0.25 ±0.436 *	0.13 ±0.340 *	0.27 ±0.445 *	0.50 ±0.501 *
Residential period	0.34 ±0.475 *	0.50 ±0.502 *	0.64 ±0.484 *	0.43 ±0.497 *	0.26 ±0.439 *
Age	0.81 ±0.821 *	0.85 ±0.766	1.02 ±0.695	0.93 ±0.789	0.44 ±0.804 *

Table 5: Cont.

Family size	1.21 ±0.406 *	1.05 ±0.210 *	1.10 ±0.300 *	1.10 ±0.303 *	1.35±0.478 *
Marrital status	0.44 ±0.898	0.05 ±0.258 *	0.02 ±0.128 *	0.01 ±0.120 *	0.35 ±0.823
Main occupation	0.73 ±0.922	0.31 ±0.822 *	0.49 ±1.045 *	0.31 ±0.733 *	0.65 ±0.887
Family income	2.51 ±1.316 *	3.19 ±1.229 *	3.51 ±1.233 *	3.12 ±1.209 *	2.16 ±1.274 *
Level of education	1.45 ±0.567 *	1.33 ±0.588 *	1.48 ±0.536 *	1.36 ±0.626	1.24 ±0.623 *
BMI level	1.78 ±0.737	1.98 ±0.718	2.23 ±0.643	2.10 ±0.840 *	1.83 ±0.867 *
Average score of attitudes	2.35 ±1.039	1.34 ±0.470	1.99 ±0.655	1.66 ±0.476	2.54 ±1.316
Percentage of women	46	33	57	35	63

1. Prefer to eat a healthy food attitude, 2. Attention to prepare nutritious food, 3. Willing to buy nutritious food, 4. Satisfaction about eating practice 5. Willing to get nutrition information, Abbreviation: SD (Standard Deviation) * statistically significant ($p < 0.05$).

3.4. Food and Nutrition-Related Practices

The study showed that a high number of rural women preferred traditional Sri Lankan dietary patterns. Over half of the rural participants (58.5%) claimed to like to buy fresh food. However, most of the women in both areas (57.5%) did not care about the quality of food. Most urban women (41.5%) preferred to buy processed foods, but rural women avoided them. The majority of marginalised women usually cared about food prices (90.75%) and food taste (95.5%). Of urban women, 77.5% cared about the food-preparation method when they were buying food, which is a much higher percentage as compared with rural women. From the mean percentage of positive responses on the three attitude subscales, the study found that rural women expressed favourable attitudes towards traditional Sri Lankan foods. More than 50% of reproductive-age women like to eat traditional Sri Lankan food, while women who had a high level of education expressed more positive attitudes about nutrition in general. Two-thirds of participants (66%), most of them rural women (97%), stated that they usually eat breakfast. Just over half of participants (51.3%), majority urban (63.5% of urban women), usually skip lunch. All participants typically eat dinner in the evening. Just 45.5 % reported eating all three meals regularly. Statistically significant differences were found in “Type of diet practice”, “What do you usually eat for your main meal?” and “prefer to buy fresh food” ($p < 0.05$) (see Table 6).

Table 6. Reproductive-age women’s food practices in rural and urban areas of Sri Lanka ($N = 400$).

Variables	Rural	Urban	Total	Mean ± SD
Type of diet practice				
• Traditional Sri Lankan diet	187	23	210	0.11 ±0.313 *
• Fried food	13	162	175	0.93 ±0.263 *
• Wheat products	0	15	15	1.00 ±0.000 *
What do you usually eat for your main meal?				
• Different choices	0	3	3	1.00 ±0.000 *
• Mostly rice and curry	33	19	52	0.37 ±0.486 *
• Depends on daily income	73	174	247	0.66 ±0.476 *
• Only rice and curry	94	4	98	0.04 ±0.196 *
Do you use traditional food flavours?				
• Yes	167	63	230	0.25 ±0.447 *
• No	33	137	170	0.81 ±0.393 *
What type of food do you prefer to buy?				
• Fresh food	83	5	88	0.06 ±0.233 *

Table 6: Cont.

• Anything	117	112	229	0.49 ± 0.501
• Processed food	0	83	83	1.00 ± 0.000
Daily eating patterns •				
Usually, eat breakfast	194	70	264	0.27 ± 0.442 *
• Usually, eat lunch	122	73	195	0.37 ± 0.485 *
• Usually, eat dinner	200	200	400	0.50 ± 0.501
• Usually, eat three times	116	66	182	0.36 ± 0.482 *
Eating habits				
• Eating in front of the TV	89	40	129	0.37 ± 0.242 *
• Eating with family members	10	11	21	0.07 ± 0.285
• Eating on the way	25	66	91	0.39 ± 0.501
• Not a special	66	83	149	0.50 ± 0.480 *

Abbreviation: SD = standard deviation; * statistically significant ($p < 0.05$).

3.5. Multiple Linear Regression to Identify Factors That Affect Food and Nutritional Knowledge

In multiple-linear-regression models, a significant difference was found in the area, age, family size, monthly income, educational level, attitudes towards nutrition and nutrition practices across the reproductive women ($R^2: 0.467$; $p < 0.01$). In this sample, reproductive women acquire more nutrition knowledge as they grow older. Women who live in rural areas had more knowledge of nutrition than those living in urban areas because of their traditional nutritional knowledge. Additionally, this sample found more women over 25 years of age residing in rural areas than urban areas. Women who had the highest education level had better knowledge about nutrition. Women who paid attention to nutrition practice and attitude had more knowledge than those who did not pay attention to nutrition. There was no statistical significance between marital status, residency period of living area, nutrition-related behaviour, and perception of food quality in reproductive-age women in marginalised areas. In this sample women who have born in the residential area were 74% and 26% of women migration from the same province that they are living. Therefore, the residency period in the living area did not impact on knowledge level (see Table 7).

Table 7. Multiple linear regressions to identify factors that affect food and nutritional knowledge of reproductive-age women in rural and urban areas of Sri Lanka ($N = 400$).

Variables	β	SE	VIF	t	p -Value
Age	0.256	0.050	1.388	5.091	0.000 *
Area	0.062	0.095	2.258	1.125	0.049 **
Marital status	-0.127	0.012	3.574	-2.391	0.115
Family size	0.542	0.089	1.809	6.092	0.000 *
Main occupation	0.352	0.049	1.970	-2.335	0.029 **
Monthly income	0.406	0.040	1.417	2.007	0.001 *
BMI	0.118	0.011	1.534	2.391	0.027 **
Residency period in living area	-0.002	0.022	2.433	-0.242	0.966
Educational level	0.469	0.141	1.505	3.330	0.001 *
Attitudes towards nutrition	0.049	0.086	2.510	-0.573	0.000 *
Food and nutrition practice	0.208	0.128	1.216	-1.627	0.020 **
Nutrition-related behaviour	-0.689	0.144	2.596	-4.773	0.273
Perception of food quality	-0.105	0.303	2.916	-0.346	0.495

Abbreviation: β -Beta weights, SE-Std. Error, ** Correlation significant at 0.01 level (two-tailed); * correlation significant at 0.05 level (two-tailed), VIF: variance Inflation Factor.

3.6. Risk-Factor Analysis

Knowledge, Attitudes, and Practices (KAP) questions were scored as appropriate and compared to BMI levels. A correlation matrix is used for risk-perception studies [81]. In this study, the correlation coefficient was computed to elucidate any possible relationship between variables; Table 8 shows the analysis results.

Table 8. Correlation analysis between the knowledge level of reproductive-age women in Sri Lanka and BMI levels.

Variables	Mean	SD	Correlations	<i>p</i> -Value
BMI level ¹	1.83	0.867		
Nutrition-knowledge score	0.04	0.190	0.129 **	0.005
Attitude score	1.55	0.758	-0.283 **	0.000
Practice score	0.33	0.500	0.117*	0.020

** Correlation significant at 0.01 level (two-tailed); * correlation significant at 0:05 level (two-tailed). 1 BMI [underweight (undernutrition), normal weight, overweight (overnutrition), obese (obesity)].

There was a highly significant positive correlation between nutritional knowledge, attitude score, and BMI levels. This indicates that self-awareness regarding serious nutritional problems and knowledge regarding micronutrition deficiencies, the importance of including vitamin-rich foods in the diet, maintaining a balanced diet, and an understanding of good nutrition and food preparation resulted in better nutritional levels. A significant positive correlation was found between the eating-practice scores of women and BMI levels. Practices like eating three times a day, consuming vitamin-rich foods, frequency of eating fruits and vegetables, daily consumption of water, and food-preparation methods resulted in better nutritional levels for these women. Furthermore, there was a highly significant positive correlation between socioeconomic and environmental factors and BMI levels, but the residential area was not significantly correlated with BMI level (see Table 9).

Table 9. Correlation analysis between socioeconomic and environmental factors and BMI.

Variables	Mean	SD	Correlations	<i>p</i> -Value
BMI	1.83	0.867		
Monthly income	2.16	1.274	0.172 **	0.001
Age	0.94	0.804	0.278 **	0.000
Main occupation	0.65	0.889	-0.109 *	0.000
Family size	1.35	0.479	0.178 **	0.000
Residential area	0.50	0.501	-0.026	0.604

** Correlation significant at 0.01 level (two-tailed); * correlation significant at 0.05 level (two-tailed).

3.7. Correlation Analysis between BMI Level and Women's Knowledge about the Perception of Food Quality

In the survey, women's knowledge about the perception of food quality, perceived risk and issue attributes, and perception of the food were examined. The food-choice score of the subjects was significantly correlated with their BMI level (Table 10). This indicated that their food choices significantly impact their BMI.

Table 10. Correlation analysis between BMI levels and reproductive-age women's perception of food choices.

Variables	Mean	SD	Correlations	p-value
Perception of food choices	1.10	0.324	0.158 *	0.002
BMI levels	1.83	0.867		

* Correlation significant at 0.01 level (two-tailed).

However, the attention-to-food-quality score was highly significantly correlated with their BMI level. This indicates that paying attention to the quality of food when purchasing or eating food can impact their nutrition (see Table 11).

Table 11. Correlation analysis between BMI levels and reproductive-age women's perception of food quality.

Variables	Mean	SD	Correlations	p-value
Perception of food quality	1.55	0.758	-0.283 *	0.000
BMI levels	1.83	0.867		

*Correlation significant at 0.01 level (two-tailed).

4. Discussion

The aim of this study was to identify the food and nutrition-related KAP among women of reproductive age in marginalised areas in Sri Lanka. According to the basic principle of the KAP model, improving knowledge leads to changes in attitudes and behaviours that reduce the human and economic burden of diseases [59,82,83]. Also, the KAP model emphasizes the beneficial influence of nutrition on health promotion, diseases management and risk reduction [84]. According to the WHO, women play the main role in achieving a healthy nutrition policy both in the family and society as a whole. Furthermore, the health and status of women of reproductive age has a large impact on the health of their children and future generations [85]. Therefore, reproductive-age women are important guiders who can influence the nutrition of their household.

This survey showed that reproductive women had a limited grasp of food and nutrition-related knowledge. For these results, knowledge may be the main factor in starting changes in dietary behaviour [63]. If women have an insufficient nutrition background, they cannot prevent family nutrition problems. A study on nutrition knowledge of women in Bosnian on dietary iron intake shows low level of knowledge impact the occurrence of anaemia [36]. Upadhyay et al. [86], Charlton et al. [87] and Shahzad et al. [88] found a low level of nutritional knowledge impact on a nutritional problem such as iron and iodine deficiencies. Compared to other research, this study more accurately measured the degree of nutritional related knowledge among women. However, any interpretation of these results should consider that this study used broad standards of nutrition knowledge of reproductive-aged women. The outcomes show that most low average scores in food and nutrition-related knowledge were among undernutrition women. Also, this study sample shows a low level of knowledge about food and nutrition-related diseases. This may imply that there are misunderstandings for a range of nutrition-related knowledge. Therefore, a low level of nutrition knowledge is an issue that may impede women's ability to consume a well-balanced diet, which will result in poor dietary intake.

Furthermore, results showed that only 33.5% of the participating reproductive-age women had normal weight, and most of the participants (more than 50%) had a nutritional problem such as under or overnutrition, or even obesity; many of them were undernourished. This showed that most reproductive-age women suffer from nutritional problems in the examined areas of Sri Lanka. Unhealthy food practices can directly or indirectly affect the quality of life and health through poor nutritional status [70,89,90]. For example, similar research in Sri Lanka found that insufficient nutrition-related knowledge is an underlying cause for the high prevalence of undernutrition and micronutrient deficiencies [39]. Food insecurity in low-income families is associated with a significantly higher percentage of diabetes in community samples, especially among women [1,91,92]. Food security requires nutritional adequacy [93,94]. This means that, in the broadest sense, any individual who is undernourished or has micronutrient deficiency can be seen as food insecure. These deficiencies show the importance of understanding the dynamics of both household and individual food security, and an unbalanced distribution of adequate amounts of food within the household, which may result in deficiencies [95]. On the other hand, reproductive-age women are at particular risk of poor health due to undernutrition and micronutrient deficiencies in general and during pregnancies. Reproductive-age food insecurity has also been associated with poor pregnancy outcomes, including low birth weight and gestational diabetes [96,97]. This study demonstrated a significant correlation between the level of nutritional knowledge of reproductive-age women and BMI status. Most of the reproductive-aged women's education level scored higher than their nutritional knowledge. The study found that women with a higher education level had better knowledge about nutrition [70] and were mindful about their food and nourishment. This study indicated that, through nutritional knowledge, women can change their food behaviour. It may help eliminate nutritional problems in these areas. Furthermore, women being are a key factor of the household food and nutrition security especially in developing countries so that women's health and knowledge should be given significant consideration which will assist in attaining Millennium Development Goals (MDGs). Many studies have supported encouraging healthy behavioural practices among women [37,98].

The study results show that many women "prefer to eat nutritious food" and are "willing to get information about nutritious food". Also, more than 50% of women are willing to buy nutritious food. This means there is a positive approach to running nutrition education programs in these areas. But attention to eating and preparing nutritious food scores was low-level. Poverty may affect attitude and practice. This study showed that the attitude scores of women were also significantly correlated with their BMI level in these areas. A similar research study found that there was a relationship between positive attitude and healthy eating practices [99]. More than 50% of women stated in the survey that they liked traditional food and food flavours, but most of them were not interested in nutrition at all. However, this study proves once more that food practices have an impact on the BMI status of women. Many urban women prefer to eat processed food than taste traditional fresh food. For example, one of the women (interviewee in a metropolitan slum area) stated that her husband was working in a Middle Eastern country. When she receives money from her husband, she goes to a McDonald's restaurant with her child. Unfortunately, she had first-stage cancer. She may not understand that processed food may affect her health situation, but she does not change her food practices. This is one example of the current situation of food attitudes in Sri Lanka. Poverty is especially a problem for marginalised societies. Results in these observed areas help to better understand personal determinants of food habits and detect relevant nutritional problems. This may impact nutritional status and the health situation of families in this region. According to the current study, reproductive-age women suffer from a double burden of malnutrition that can increase the risk of cancer, diabetes, high blood pressure, and cholesterol. The reason for these problems can be viewed as a result of a low level of nutritional knowledge. After the Green Revolution, there was a replacement of vegetable-based foods in Sri Lankan food culture with animal-based foods,

and increased consumption of sugar, salt, and alcohol, surpassing the recommended intake. A plant-based diet reduces the risk of developing obesity, diabetes, cardiovascular diseases, and some forms of cancer [100,101]. Unfortunately, in Sri Lanka, people do not understand or know less about traditional food culture. Hence, nutritional status is influenced by multiple and inter-related factors. For this purpose, KAP studies help to evaluate and investigate people's KAP relating to nutrition, diet, food, and health issues [102].

Food and nutrition-related behaviours directly have an impact on their knowledge level. This study shows the perception of food quality was low scoring in the study sample. Some of the participants understood the perceived risks of unhealthy food. Still, most were unconcerned about such risks because marginal societies suffer from poverty or they have barriers to eating healthy food. This study demonstrated that, in slum areas, most women do not prepare food themselves. Many of them said that preparation of food at home is costlier than buying prepared foods because in these areas, they can easily buy cheap unhealthy food (including fats, especially of animal origin), "fast" food (that is low in fibre and vitamins), foods high in salt and tropical oils (e.g., patties, rolls and sauces). Although this food is not nutritious (adding more essence of taste, "ajino moto") it was regarded as tasty. It was also observed that most of them had very small kitchens that were hygienically unsafe (poor sanitation, low spaces, and no cleaning). This also may be the results of low-level food and nutrition knowledge and practice.

In addition to education, having a low socioeconomic status puts the family at risk of having poor diet, which can subsequently compromise their growth and development, especially for vulnerable groups such as children and women. Family income, a frequently used indicator of socioeconomic status, has been consistently shown to influence diets. A study result shows that high income may associated with a better quality of diet [103]. A higher income could mean stronger purchasing power for better quality of foods, while a limited income restricts access to nutrient-dense foods. In this study, 4.3% of participants had a monthly income of less than Rs 5000 (1 United States dollar = 185 Sri Lankan rupees). Most of them were part of rural households. More than 50% were low-income dwellers. This indicates a positive correlation between income and BMI (correlation = 0.172, p -value = 0.001). However, a monthly income of more than Rs 35,000 might indicate undernutrition problems for women, too. Previous studies showed that low socioeconomic status impact on lacked knowledge of healthy nutrition [104].

By employing multiple-linear-regression models, a significant difference was found among the factors of age, family size, monthly income, educational level, attitudes towards nutrition, and food and nutrition practices across reproductive women. Another notable point is that most women aged 35–49 years or older gained nutritional knowledge from their elders, which means that traditional indigenous knowledge is important for nutritional status. Even today, older people are well-aware of their food-security risks [53]. Local natural-food knowledge and resources still exist [105]. There is a gap of acknowledgement and acceptance of traditional and local knowledge between generations. Field results revealed that most women in marginalised rural areas use their traditional knowledge and diverse food resources to improve their own nutrient status. However, this knowledge is not documented and creates a knowledge gap between older and younger generations about nutritional values. Therefore, this knowledge must be secured for the future [106]. Previous study about women's nutritional traditional of food could also impact the nutritional status of the family [29]. Therefore, knowledge may be a powerful indicator [107] to maintain household nutritional security.

This KAP study provided a better understanding of women's personal determinants of dietary behaviour and valuable information on planning programmes to prevent the risk of reproductive-age women in marginalised areas. These results could be used to plan culturally appropriate diet- and lifestyle-counselling programs for the management of women with nutritional problems. The findings of

this study may be important for future nutrition policymakers. Research that focuses on reproductive-age women may play an important part in health promotion and the prevention of nutrition-related health problems, but it requires education. Some suggestions exist for improving the nutrition-related knowledge of reproductive-age women to improve and meet the health-education demands of households. First, training for nutrition-related teaching, especially traditional-food and nutrition-related knowledge, should be strengthened in women and be part of the national educational curriculum. If rural and urban women have space for a garden, knowledge about plants and their nutritional benefits might be helpful as well. School gardens might inspire boys and girls to learn about food [108]. Second, with regard to women who are younger and are underweight, it would be beneficial to adopt corresponding protocols for the screening and education of these groups living in urban and rural areas by a nutritionist or dietitian. Third, the media network can be used as a new way to spread traditional indigenous knowledge to women. For example, showing traditional nutritional food-preparation methods, introducing ways to prevent some health problems with traditional food (traditional Sri Lankan food has more benefits to prevent noncommunicable diseases), and different harvesting and storage methods. It would be beneficial not only for improving family nutrition, but also in promoting an overall more sustainable and health-supporting food system in Sri Lanka.

There are several limitations to this study. The study uses the KAP model which is a first-generation approach in health behavior research. These days third-generation theory-based approaches or fourth-generation multi-theory-based approaches are being used in health behavior research. This model comprises predefined questions that capture information on critical knowledge, attitude and practice related to the most common nutritional issues [103]. This model emphasizes the beneficial influence of nutrition on health promotion, disease management and risk reduction. Data obtained through a cross-sectional survey did not permit to determine the causality. Both areas were big, and the sample size was relatively small which may have impacted the accuracy and reliability. Hence, the investigators received training for the control of data. This research investigated two different marginalised communities. In this case, a marginalised community means vulnerable people in Sri Lankan society. Reproductive-age women are a good indicator of the overall well-being of society. Furthermore, because the study was examined in two different marginalised areas of reproductive-age women, the KAP results cannot be generalised to other settings. Therefore, the study sample was confined to reproductive-age women. They are vulnerable because they have had nutritional problems and health and social issues. Furthermore, the evaluation of this study among reproductive-age women was self-reported. This study investigated the association between nutritional knowledge and demographic factors with nutrition status that was represented by BMI. This research did not investigate the nutritional status.

5. Conclusions

This study on reproductive-age women in Sri Lanka living in urban and rural marginalised areas is the first to use the KAP model. In this study, we examined the influence of dietary knowledge, attitudes, and practices (KAP) among reproductive-age women in marginalised areas in Sri Lanka. The research results clearly showed that the reproductive age women have a low level of nutritional knowledge in marginalized areas in Sri Lanka. Most women have a positive attitude about receiving nutritional knowledge but have low-level practice about a healthy diet. Furthermore, knowledge, practices, and attitudes of women largely affect their BMI status, as well as household food security. On the basis of multiple-linear-regression analysis, residency period of living area, nutrition-related behaviour, and perception of food quality in reproductive-age women in marginalised areas did not show a significant relationship with any of the tested risk-perception domains in the model. According to our study, in these areas, most of the reproductive age women have nutritional problems (under- or overnutrition, or obesity)

and this may affect future nutritional insecurity, as well as the unborn children and the health condition of these women. The establishment of dietary guidelines is not sufficient to ensure that women are equipped with the knowledge necessary to optimize their diets for the health of reproductive-age women and their unborn babies. Healthcare or nutrition information providers have an important role in promoting knowledge of healthy eating. On the basis of the results of this research, there is a need to enhance nutritional education in reproductive-age women. The finding will help policymakers or responsible authorities to plan appropriate nutrition care programs for vulnerable people living in marginalized areas and these results could be empowering sustainable food and nutrition system in Sri Lanka and they can provide valuable inputs for effective programme and project. Further studies should be conducted to investigate the strategic nutrient intake and micronutrient adequacy of reproductive-age women, and their dietary diversity for nutrition and health in marginalized societies in Sri Lanka.

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Article

Understanding Dietary Diversity, Dietary Practices and Changes in Food Patterns in Marginalised Societies in Sri Lanka

Permani C. Weerasekara ^{1, *}, Chandana R. Withanachchi ², G.A.S. Ginigaddara ³ and Angelika Ploeger ¹

¹ Specialized Partnership in Sustainable Food Systems and Food Sovereignty, Faculty of Organic Agricultural Sciences, University of Kassel, 37213 Witzenhausen, Germany; a.ploeger@t-online.de

² Department of Archaeology and Heritage Management, Faculty of Social Sciences and Humanities, Rajarata University of Sri Lanka, Anuradhapura 50000, Sri Lanka; chandanawithanachchi@gmail.com

³ Department of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura 50000, Sri Lanka; sanjeewanieg@gmail.com

* Correspondence: permani@uni-kassel.de; Tel.: +491-577-372-5360

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Abstract: Micronutrient malnutrition is a serious public health problem in developing countries, including Sri Lanka. Most frequently, micronutrient malnutrition is experienced by the poorest households due to cereal-based, monotonous diets that lack dietary diversity. Sri Lankan traditional food system is changing day by day. In parallel, nutrition deficiencies, malnutrition, and noncommunicable diseases are the most significant problems today in Sri Lanka. Therefore, understanding dietary diversity and dietary changes in Sri Lanka must be studied to address related public health issues. This study investigates nutrition adequacy, dietary diversity, dietary practice, and traditional food pattern changes in different marginalised areas in Sri Lanka. A cross-sectional survey was done using 24 h food recall and an administrative questionnaire for 400 women of reproductive age (WRA) (18–49 years old) in marginalised areas in Sri Lanka. The random sampling method was used for data collection. The research confirmed that different areas had poor dietary practices, with macronutrient imbalance and alarmingly low intakes of micronutrients. Interestingly, the diversity of food was higher in rural areas than in urban areas. Approximately 83% of women in urban areas did not meet minimum dietary diversity (MDD-W). Overall, about 63% of reproductive age women did not meet MDD-W and food security. The mean MDD-W for both areas was low. Significant differences in MDD-W levels were found in the two areas ($F = 90.483$, $p < 0.05$). The sample showed a significant positive correlation between MDD-W and area, monthly income, educational level, food source, BMI level and health status ($R^2 = 360$; $p < 0.01$). This sample did not find that the consumption of traditional varieties of foods and agrobiodiversity are decreasing. Additionally, the study confirmed that low dietary diversity impacts nutrition status and health. The results highlight that the leading causes for low diet diversity are decreased dependence on own production, increased purchasing food at markets, lack of suitable lands to cultivate, agro-commercialisation, less knowledge of food and nutrition, loss of traditional food culture, low income and high prices of food. Inappropriate food patterns, nutrition policies and governance in Sri Lanka are the main factors to the nutrition findings. The study finding will help the decision-making authorities or policymakers to design suitable nutrition programs for vulnerable people in marginalised areas and to use these to strengthen a sustainable food and nutrition system in Sri Lanka.

Keywords: dietary diversity; food insecurity; traditional food pattern changes; nutrition and health; food practices; women of reproductive age; marginalised areas

1. Introduction

Proper nutrition is an essential aspect of a healthy lifestyle and disease prevention [1]. An inadequate micronutrient intake or lack of dietary diversity is a global challenge, and it is a direct outcome of the inability to obtain nutrient-rich, well-balanced food [2]. As a result, many people worldwide suffer from one or more forms of malnutrition [3–6]. Malnutrition exists in various forms, including micronutrient deficiencies, undernutrition, overweight, obesity and noncommunicable diseases. The reasons for not eating a healthy diverse diet are complex and multifaceted. However, they include a lack of access to foods, a lack of knowledge on diverse diet composition, cultural norms, traditions, poverty, and food and nutrition governance. International and national level food policy may contribute to the erosion of local crops and varieties that underpin traditional dietary diversity [7]. Many individual crops are locally valuable but are neglected by policymaking [7,8]. Thus, Dietary Diversity (DD) is internationally recognised as a vital element of healthy diets [9] as it is a measurement of diet quality [10].

Dietary Diversity (DD) is defined as the number of different food groups or foods consumed in a given period [10]. Diverse foods are a good source for various macro and micronutrients and best ensure nutrient adequacy [10]. Increased risk of chronic diseases and malnutrition are associated with dietary factors, and international and local guidelines recommend improving dietary diversity [10]. Therefore, DD is needed to meet energy requirements and other necessary nutrients, especially for those at risk for nutritional deficiencies and chronic diseases [10]. More so, DD is a key measure of sustainable diets and is currently being considered as one of the principal sustainable diet indicators for the United Nations' Sustainable Development Goals (SDGs) [11]. Understanding dietary diversity may be a convenient pathway to evaluate inadequate micronutrient and household-level food security [12–14], sustainable dietary practices and food pattern changes [12]. For those reasons, improving DD has been proposed as one approach to micronutrient deficiency and food insecurity by the Food and Agriculture Organization (FAO) [12]. Some studies have shown that dietary diversity can promote a healthy weight [15–17], improve nutritional status [18,19], and foster a healthier lifestyle [20,21]. It has also been shown to improve food security [15,22], and it is associated with high agrobiodiversity and high food self-sufficiency [23]. Although DD is universally recognised as a vital component of healthy foods, DD is not yet used as a dimension of diet quality [10,12], and there is a lack of consensus to operate and evaluate it [24].

Sri Lankan traditional diets have had a rich diversity [25] and offer various health and nutritional benefits, including protection from noncommunicable diseases (NCDs) and micronutrient deficiencies. Usually, these foods have been obtained from natural sources, and proteins have been available from different plant varieties. The types of traditional foods, preparations, and consumption habits were more heterogeneous than today [25]. Traditional Sri Lankan food has many nutritional benefits, and the Sri Lankan diet consists mainly of green leafy vegetables [25]. Green leaves were a major source of vitamins and other therapeutic values [25]. However, the Sri Lankan traditional food system is changing day by day.

Today, many health and nutritional problems in Sri Lanka are due to unhealthy eating patterns and low-quality food intake [9,26,27]. In parallel nutrition deficiencies, malnutrition and noncommunicable diseases are the most significant problems facing Sri Lanka [28]. The low birth rate is 17%, and one-sixth of women have low BMI levels [29]. The prevalence of anaemia is 19.6% among lactating women, 16.2% among reproductive women [30,31]. Overall, 32.6% of WRA suffer from anaemia [32]. Vitamin A deficiency has been found in around 15% of mothers with children (6–60 months) [33]. Other micronutrient deficiencies such as iodine, iron, zinc and vitamins A, D and B are reported in different age groups in Sri Lanka [34,35]. As mentioned by World Health Organization (WHO) 2018, noncommunicable diseases (NCDs) including diabetes, cancer, heart disease and chronic diseases account for 83% of all deaths in Sri Lanka [28,36]. These data illustrate the problems associated with unsustainable eating patterns and a low-quality diet in Sri Lanka. Women of reproductive age (WRA) are especially vulnerable

to nutritional deficiencies, however inadequate nutrient intakes during reproductive age can affect both women and their infants [37]. With this understanding, dietary diversity and dietary changes in Sri Lanka are important to be studied. However, a systematic study of DD, nutrient adequacy, dietary practices and changes in traditional food patterns in different marginalised areas have not been conducted in Sri Lanka. Accordingly, a cross-sectional survey using an administrative questionnaire and a 24 h food recall was conducted among 400 WRA (18–49 years old) in the marginalised areas of Sri Lanka. The minimum dietary diversity of women of reproductive age (MDD-W) was used as the main measure for DD and dietary changes. Data were gathered using a random sampling method. This study seeks to understand the food transition, current sustainable dietary practices, policies and governance among the sample population. It supports evaluating micronutrient adequacy and assessing the impact of DD on nutrition and health conditions. Sub-objectives of the study are to understand the changing agrobiodiversity, food and nutrition governance, sustainable dietary practices, and micronutrition problems and food transition in rural-urban marginalised areas, and to assess household food security. This research study seeks to improve nutritional health through food systems by moving towards a more sustainable Sri Lankan food system.

2. Materials and Methods

2.1. Study Areas

The study is part of a collaborative project investigating food system commercialisation and hidden hunger and malnutrition in Sri Lanka [25,38]. Based on the feasibility and previous research experience carried out in Sri Lanka in August 2016, the agro-environmental zone for rural areas was selected for this project. This study was conducted in marginalised areas (urban slums and remote rural areas) in Sri Lanka due to socioeconomic and health-related problems. The district of Anuradhapura in the North-Central province of Sri Lanka was chosen as the remote rural area. People in this area are mainly engaged in small-scale agriculture [39]. The region has endured 30 years of war (war border villages), and inhabitants also face water scarcity, poverty, malnutrition, as well as chronic kidney diseases [39]. The urban slum and shanty area selected was the Colombo district where two divisional secretariats were selected. Residents are classified as low-income and suffer from malnutrition, social and health problems, poverty, inadequate living space, poor living conditions and high unemployment rates [39].

2.2. Study Sample

Ethical approval for this research project was obtained from the Ethics Review Committee (Ref: ERC/09/19) of the Faculty of Applied Sciences at Rajarata University, Sri Lanka. Each woman gave written informed consent before enrolment. A cross-sectional survey was delivered from December 2018 to March 2019 to assess the socio-demographic characteristics, health, nutrition and dietary diversity of 400 of WRA in marginalised areas of Sri Lanka. DD data were collected by administering a questionnaire survey to randomly selected households of WRA in both areas. All of the interviews were led in the Sri Lankan official language. Enumerators were trained on how to carry an interview. According to a feasibility study, women are a strong indicator in these areas; they help improve food security and suffer from nutrition-related problems and health issues while most women are the main income holders. Thus, in both areas, 400 WRA (18–49 years old) were randomly selected from the electoral division's list of divisional secretariats by age. In contrast, 200 rural households and 200 urban households were selected for the WRA. The sample size 400 was selected, indicating a confidence gap of $\pm 2.5\%$ (total = 5%). One woman from each household was chosen. Where a woman refused to participate in a survey, or no woman was available from the selected household, then a WRA from the next nearest household was chosen. All women took part in this study ($n = 400$; 100%). No erroneous data were found; the Enumerators completed the questionnaires through interviews. No monetary compensation was paid to the participants.

2.3. Minimum Dietary Diversity of WRA (MDD-W)

The Minimum Dietary Diversity for WRA (MDD-W) can be applied as a proxy indicator of high micronutrient adequacy, one of the critical components of food quality [37,40]. Therefore, it could be used to measure household access to a micronutrients rich diet [10,37,41]. Furthermore, MDD-W is remarked as a traditionalist evaluation of micronutrient adequacy of women's diet and household nutritional security [10,37,42]. Thus, in this study, MDD-W was used to understand the dietary diversity in these areas. DD was recognised by using the approved 24 h recall method adopted from food and agriculture organisation (FAO) [37]. Women were first asked to recall all dishes, drinks, snacks and other food they had consumed from the time they woke up the following day. All participants were encouraged to remember all food and beverages consumed within the previous 24 h. Women were also instructed to describe all of the ingredients in the mixed dishes, the source of the ingredients (purchase, collection or donation, cultivation), and the method of preparation. All ingredients were directly coded by a well-trained researcher and classified into a predefined list of 10 food groups [37]. Ten food groups were added as proposed by the FAO, MDD-W Guidelines [37] that consist of (1) all starchy food (grains, white roots, tuber and plantation); (2) beans and peas; (3) nuts and seeds; (4) dairy products (milk, yoghurt, and cheese); (5) meat products (fish, meat, poultry, liver or organ meats); (6) eggs; (7) dark green leafy vegetables; (8) vitamin A-rich fruits and vegetables; (9) other vegetables; (10) other fruits. Each group was designed with a score of 1 if consumed and score 0 if not consumed. These food groups were reviewed across 11 notable micronutrients (vitamins B12, B6, A and C, calcium, iron, zinc, thiamine, riboflavin, niacin and folate) [11] and excluded components of fats and oils because they are not considered micronutrients [37,41]. A woman was classified as having food insecure or inadequate dietary diversity if she had consumed less than five food groups. A woman who consumed five or more food groups reached MDD-W with good diet variety and food security [37,41].

2.4. Assessment of Food and Nutrient Intakes

Nutrient Intake was calculated and used to compare daily recommended nutrient intakes. Since MDD-W only takes micronutrients into account, calculating nutrient intake provides insight into micro- and macro-nutrient intakes [10,37]. Food intake was evaluated using a multiple pass 24 h diet recall conducted by well-trained field workers [10]. Women were asked to describe all food and beverages they had consumed during the preceding 24 h, including cooking methods, time of consumption, and portion size [37,41]. Several visual aids were used to estimate the portion sizes, including standard pots, plates, bowls, and spoons. The Sri Lankan food consumption table [43] and the Nutri-survey for Windows software [44] were used to calculate dietary intake of macronutrients (fat, protein, and carbohydrate) as well as micronutrients (iron, zinc, calcium, vitamins A, B6, B12 and C, thiamine, niacin, riboflavin and folate). The Estimated Average Requirements (EAR) as proposed by the WHO/IMPMUS [45,46] and the National Academy of Science were used to calculate the probability of adequacy for each nutrient.

2.5. Health Condition

In this sample, self-reported health conditions were examined. Women were asked to report their health condition for the last seven days.

2.6. Biodiversity and Dietary Practices and Food Patterns

According to 24 h open recall and list-based recall, we examined the diversity of food in both areas. Food pattern transition was examined by the administered questionnaires and some interviews about the traditional food.

2.7. Anthropometric Measurements

Anthropometric measurements were made using a stadiometer and electronic weighing scale using trained enumerators. The height was measured to the nearest centimetre. Participants were asked to wear

light clothes and remove shoes [47]. The Body Mass Index (BMI) was calculated by dividing weight (kg) with height in metres squared (kg/m²). The nutritional status was assessed using the BMI according to the criteria of the World Health Organization [48].

2.8. Statistical Analysis

The data were entered using an Excel sheet, and all statistical analyses were done using SPSS statistical version 21.0 (IBM, Armonk, NY, USA). All data were double-checked to prevent errors. Demographic and socioeconomic characteristics data were presented as Mean and standard deviations and percentages. The ANOVA, *t*-test, Mann–Whitney, and Spearman’s rho (*r*) correlations were performed to compare variables. The MDD-W statistical differences between the two areas were tested using ANOVA and nonparametric tests. The multiple linear regression model was used to understand the associations between MDD-W and selected socioeconomic indicators. All statistics were checked using two side tests, and significance was used at $p < 0.05$, $p < 0.001$. Nutrition intake was calculated using Nutri-Survey software [44] and the Sri Lankan food consumption table [43].

3. Results

3.1. Demographic and Socioeconomic Characteristics

The sample included 400 WRA between the ages of 18 and 49 years old. The majority was between 26–35 years old and 36–49 years old (68%) and more than half had some level of education (58.5%). Most of the women sampled came from low-income households, and about 60.5% were housewives without an income. In rural areas, the main occupation was agriculture. In contrast, urban slum women occupied hard jobs such as domestic workers or labourers on road and building construction. About 50% of families spend less than USD 55 a month on food expenditures. Those without income relied on *Samurdhi* aid [49,50] from the government amounting to only USD 13 per month (Rs.1 = 0.0054 Dollars). More than half of the women suffered from nutritional problems such as overweight, obesity and underweight. In general, food sources obtained by households in both areas were purchased. However, in rural areas, more than 70% of women produced their food, 14% collected wild fruit and vegetables, and 2.5% received some donations from the government or non-government organisations (NGOs) (collected and donated 16.5%). In comparison, more than 90% of women in urban areas purchased food from different sources and did not report producing their food. In urban areas, only 1.5% also reported collecting donations from the government (see Table 1).

Table 1. Demographic and socioeconomic characteristics of women in the reproductive age group ($n = 400$).

Characteristic n=400	Rural (%)	Urban (%)	Total value (%)
Age (years)			
18-25	72 (36)	55 (27.5)	127 (31.8)
26-35	72 (36)	64 (32)	136 (34)
36-49	56 (28)	81 (40.5)	137 (34.3)
Monthly income (Rs)			
1-5000	32 (16)	4 (2)	36 (9)
5001-10000	5 (3.5)	40 (20)	45 (36.2)
10001-20000	67 (33.5)	82 (41)	149 (37.3)
20001-30000	45 (22.5)	51 (25.5)	96 (24)
30001-40000	35 (17.5)	17 (8.5)	52 (13)
40001-50000	15 (7.5)	4 (2)	19 (4.8)
50000<	1 (0.5)	2 (1)	3 (0.8)

Table 1: Cont.

Food Expenditure (Rs)			
1-5000	100 (50)	22 (11)	122 (30.5)
5001-10000	14 (7)	70 (35)	84 (21)
10001-20000	80(40)	80 (40)	160 (40)
20001-30000	6 (3)	24 (12)	30 (7.5)
30001-40000		4 (2)	4 (1)
Family Size*			
Small family	117 (58.5)	84 (42)	201 (50.3)
Big family	83 (41.5)	116 (58)	199 (49.8)
Main Occupation			
Unemployed	123 (61.5)	119 (59.5)	242 (60.5)
Agriculture	68 (34)	-	68 (17)
Labor job***	5 (2.5)	74 (37)	79 (19.8)
Government Job	4 (2.0)	7 (3.5)	11 (2.8)
BMI level			
Underweight	74 (37)	100 (50)	174 (43.5)
Normal weight	85 (42.5)	49 (24.5)	134 (33.5)
Overweight	37 (18.5)	40 (20)	77 (19.3)
Obese	4 (2)	11 (5.5)	15 (3.8)
Education level			
Non-educated	16 (8)	21 (10.5)	37 (9.3)
Primary	86 (43)	148 (74.)	234 (58.5)
Secondary	95 (47.5)	30 (15)	125 (31.3)
Junior secondary**	55 (27.5)	28 (14)	83 (20.75)
Senior secondary	40 (20)	2 (1)	42 (10.5)
Higher	3 (1.5)	1 (0.5)	4 (1)
Sources of the food			
Own production	141 (70.5)	-	141 (35.5)
Purchase	25 (12.5)	197 (98.5)	222 (55.5)
Collected & donated	33 (16.5)	3 (1.5)	36 (9)

* According to the concept of family planning in Sri Lanka: A small family is a father, a mother and two children, and a large family is a father, a mother, and three or more children [51], *** They work as casual workers. ** Up to 9th grade (age 14): Under Sri Lankan law, all children must go to school up to 9th grade.

3.2. Dietary Diversity

Minimum dietary diversity for women of reproductive age (MDD-W) was calculated from 10 food groups using a 24 h recall. The first group (all starchy staple foods) were consumed by 100% of women in both areas with the highest intakes. The majority of foods consumed by women include rice, rice flour products (string hoppers, hoppers, *pittu*, noodles) and wheat flour products (bread, bun, *koththu*, noodles). More than 50% of women in urban areas consumed meat, poultry, and fish, pulses and dairy. Over 80% of women in urban areas had consumed animal sources of food in the last 24 h. In rural areas, women consumed starchy staple food, and about 90% of women consumed pulses, beans, peas and lentils (Group 2), nuts and seeds (Group 3) and other vegetables (Group 9). More than 60% of women in rural areas consumed vitamin A-rich foods, while in urban areas, women did not consume dark green leafy vegetables (Group 7) and vitamin A-rich fruits and vegetables (see Figure 1).

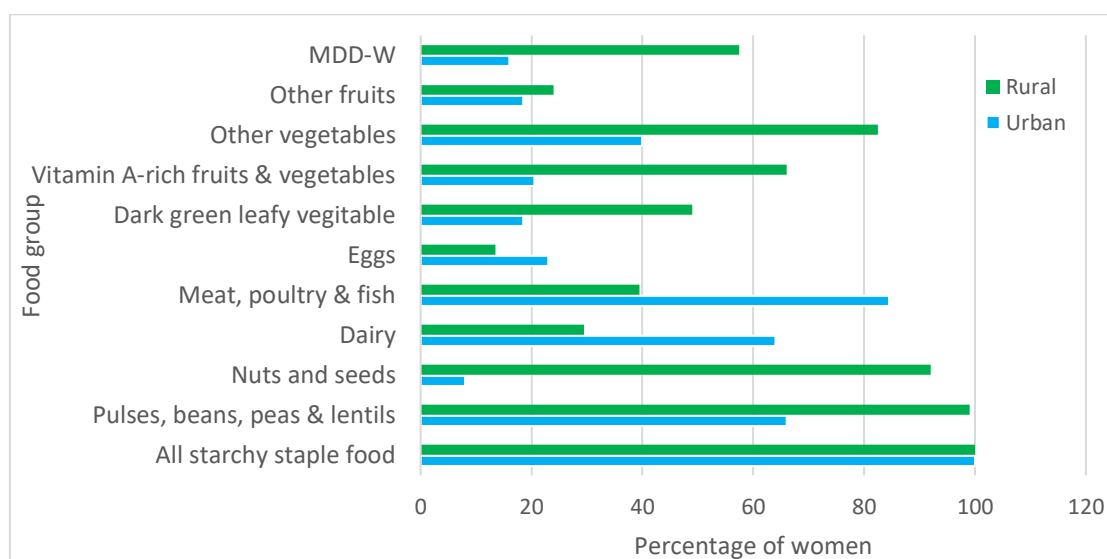


Figure 1. MDD-W 10 food groups of women of reproductive age in urban and rural areas.

3.3. Agro-Biodiversity, Dietary Practices and Traditional Food Patterns

Diet diversity was richer in rural areas than in urban areas. There was a significant positive correlation between the areas and food groups 2 to 9 ($p < 0.01$). There was no significant correlation between areas and food group 10 (other fruits) as both areas had low consumption of fruits. Furthermore, in both areas, 100% of participants reported eating starchy staple food, but the variety of grains, tubers, white roots, and plantation foods were wider in a rural area. In the study, sample results revealed that most of the women were consuming a low percentage of animal protein. Rural women were consuming wider varieties of dark green leafy vegetables. Additionally, the rural area was higher in participants with food self-sufficiency. Nevertheless, study results revealed that women of reproductive age (WRA) were not consuming the traditional variety of foods such as healthy wild plants. Different food and drink items are listed in the following table (see Table 2)

Table 2. The types of food that are consumed in reproductive-age women in marginalized areas

Food Groups	Correlation	p-Value	Urban Area		Rural Area	
			Mean \pm S.D.	Food Items	Mean \pm S.D.	Food Items
01. Starchy staple foods (grains, white roots and tubers plantation s)	-	-	1.00 \pm 0.000	Rice (<i>Oryza sativa</i>), wheat (<i>Triticum aestivum</i> L.), potatoes (<i>Soanum tuberosum</i> L.)	1.00 \pm 0.000	Rice (<i>Oryza sativa</i>), wheat (<i>Triticum aestivum</i> L.), jackfruit (<i>Artocarpus heterophyllus</i>), <i>Katu ala</i> (<i>Dioscoreapentaphylla</i>), breadfruit (<i>Artocarpus</i>), cassava (<i>Manihot esculentum</i>), sweet potatoes (<i>Ipomoea batatas</i>), <i>Kiri ala</i> (<i>Xanthosomasagittifolium</i>), lotus root (<i>Nelumbo nucifera</i>), bananas/unripe (<i>Musa</i>), potatoes (<i>Solanum tuberosum</i> L.)

Table 2: Cont.

02. Pluses, beans peas and lentils	-0.336 **	0.00 0 **	1.35 ± 0.478	Long bean (<i>Vigna subterranea</i> n), bean (<i>Vigna angularis</i>), chickpea (<i>Cicer arietinum</i>), lentil/dal (disambiguation). Soya (textured soy protein/TS P)	1.08 ± 0.264	Mung bean (<i>Vigna radiata</i>), cowpea (<i>Vigna unguiculata</i>), long bean (<i>Vigna subterranea</i>), bean (<i>Vigna angularis</i>), chickpea (<i>Cicer arietinum</i>), winged bean (<i>Psophocarpus tetragonolobus</i>), lentil/ dal (disambiguation). Soya (textured soy protein/TSP)
03. Nuts and seeds	-0.840 **	0.00 0 **	1.42 ± 0.272	Peanut (<i>Arachis hypogaea</i>), coconut palm (<i>Cocos nucifera</i>)	1.08 ± 0.272	Peanut (<i>Arachis hypogaea</i>), cashew (<i>Anacardium occidentale</i>), coconut palm (<i>Cocos nucifera</i>)
04. Dairy product (e.g., milk, yoghurt and cheese)	0.292 **	0.00 0 **	1.62 ± 0.494	Milk powder, yoghurt, curd	1.77 ± 0.457	Milk powder
05. Meat (all meat fish, chicken and liver or organ meat)	0.537 **	0.00 0 **	1.16 ± 0.363	Chicken, red meat, fresh or dried seafood, canned fish (sardines)	1.69 ± 0.466	Chicken, fresh or dried fish (seafood or freshwater fish/tank fish)
06. Eggs	0.130 **	0.00 9 **	1.77 ± 0.422	Chicken eggs	1.87 ± 0.337	Chicken eggs
07. Dark green leafy vegetables	0.492 **	0.00 0 **	1.85 ± 0.358	<i>Sarana</i> (<i>Trianthem a portulacast rum</i>), Kankung (<i>Ipomoea aquatica</i>) Gotukola (<i>Centella</i>	1.37 ± 0.487	Kankung (<i>Ipomoea aquatica</i>), Gotukola (<i>Centella asiatica</i>), Mukunuvanna (<i>Alternanthera sessilis</i>), manioc leaves (<i>Maniot esculenta</i>), Kathurumurunnga (<i>Sesbania grandiflora</i>), pumpkin leaves (<i>cucurbita maxima</i>), Japan batu (<i>Sauropus</i>

Table 3: Cont.

Wood Apple/ <i>Divul</i>	Fruits	<i>Feronia Limonia</i> L.	The unripe fruits were used for chronic diarrhoea and dysentery. It contains protein, carbohydrates, iron, fat, calcium, vitamin C, and B.
Bel fruit/ <i>Beli</i>	Fruits	<i>Aegle Marmelos</i> L.	This fruit was used for fever, hypochondria, melancholy, heart palpitations, diarrhoea and gastric disorders. The leaves were used for jaundice and anasarca. Dried leaves, flowers and fruit petals were used to cool the body as well as in traditional medicine. It contains Beta-carotene, protein, riboflavin, niacin, carotene, calcium, potassium, fibre and healthy fats.
Ash Pumpkin/ <i>Puhul</i>	Vegetables	<i>Benincasa hispida</i>	The fruit contains a fixed oil, starch, resin, proteins and vitamins B and C. It is used for insanity, epilepsy and other nervous diseases. The cortical part of the fruit is given to diabetics.
Horse purslane/ <i>Heen sarana</i>	Green leafy Vegetables	<i>Trianthema portulacast rum</i>	This plant was used for jaundice, anaemia, asthma, liver disorders, dysuria, constipation, swelling. The plant contains protein, energy, fat, calcium, phosphorus, iron, vitamin A.
<i>Tel kola</i>	Green leafy Vegetables	<i>Ipomoea</i>	Internally, this plant helps as a cardiac, stomachic, expectorant and diuretic and is useful for chronic dyspepsia, bronchitis and renal and hepatic dropsy. The leaves contain vitamin A and iron.
Black gram/ <i>Udu</i>	Grains	<i>Phaseolus mungo</i>	The seed contains moisture, energy, proteins, fats, carbohydrates, calcium, phosphorus, carotene, thiamine, riboflavin and niacin This was used in the treatment of fever, piles, cough and liver diseases.
Tamarind/ <i>Siyabala</i>	Condiments and Seasonings	<i>Tamarindus indica</i>	The fruits contain energy, protein, moisture, fats calcium, carotene, riboflavin, and niacin. It was used in the treatment of fever, piles, cough and liver diseases.
Drumstick/ <i>Mur unga</i>	Vegetables	<i>Moringa oleifera</i>	The fruits contain energy, iron, moisture, protein, fats, carbohydrates, calcium, phosphorus, carotene, thiamine, riboflavin, niacin and vitamins C and B. It was used for insanity, epilepsy and other nervous diseases. The cortical parts of the fruit are given for diabetes. Leaves and antidote bark of the tree are used in food preparation.
Palmyra Palm/ <i>Thal,</i>	Fruits	<i>Borassus flabellifer</i>	This fruit was used to prepare for toddy, jaggery and vinegar. Young nut water was consumed. The fruit contains vitamins B and C, iron, zinc, potassium, calcium, phosphorus, riboflavin and thiamine. This fruit was used to prevent diabetes.
<i>Maa-dan</i>	Fruits	<i>Syzygium caryophyllum</i>	Fruits contain moisture, energy, protein, fat, carbohydrates, calcium, phosphorus, carotene, thymine, riboflavin, niacin, iron and vitamin C.
<i>Kekatiya</i> regarded as threatened species (IUCN red list)	Vegetables	<i>Aponogeton crispus</i>	This plant was eaten as a vegetable and was used for the burning sensation of the body, heart disease, injury, excessive thirst and vomiting.
Wild Asparagus/ <i>Haat haviya</i>	Beverages	<i>Asparagus racemosus</i>	This plant was used traditional medicine to treat ailments such as urinary difficulties, menopausal symptoms, to increase lactation, and reduce the risk of cancer.
Finger millet/ <i>Kurakkan</i>	Grains	<i>Eleusine coracana</i>	This cereal contains protein, fibre, iron and is fortified with vitamins and minerals. It has a wide range of benefits and helps to reduce weight, cholesterol, to control diabetes and to cool the body. This cereal improves digestion and makes bones stronger.

Table 3: Cont.

Honey tree/Mee	Oil	<i>Madhuca loggifolia</i>	Flowers, seeds, and seed oils had traditional medicinal value. Mee oil was used not only as a massage oil but also as cooking oil. The oil is considered a good remedy for swelling, broken bones, itching and snakebites. It is given internally to treat diabetes and chronic tonsillitis.
Jack Seeds	Nuts and seeds	<i>Arto Carpus heterophyllus</i>	It has a high content of vitamin A, vitamin C, niacin, calcium, thiamine, riboflavin, potassium, iron, magnesium. Jack seeds are a great source of iron. It helps to prevent mental stress and skin diseases.
Lotus Seeds	Nuts and seeds	<i>Nelumbo nucifera</i>	These seeds are low in cholesterol and saturated fat. Lotus seeds are good for the heart and have high magnesium, potassium, protein and phosphorus content.
Kohila	Green Leaf Vegetables	<i>Lasia Spinosa</i>	Kohila is used as a vegetable. There are several varieties kohila such as Kiri kohila, well kohila, guru kohila, Kalu kohila and goda kohila. The tubers, roots and leaves are used as medicine. It contains lots of fibre, calcium and vitamin C.

Sources: [28,55-59].

The table shows some of the traditional food variety in rural areas. For example, traditional people ate “Finger millet/*Kurakkan*” daily, and it was one of the main staple foods available to them. They also used jack seeds kept under the sand as they believed this helped reduce the possible harmful effects with consumption. Most green vegetables and leaves listed contain high amounts of minerals and vitamins that play a significant role in boosting the immune system. These foods were and are still often available in the forest area or home gardens. Unfortunately, in this sample, the consumption of these foods was not found. A notable point of this study is that this population’s consumption of traditional food varieties or diversity of food has been rejected, which could be contributing to micronutrition deficiencies. However, since urban area households consume mostly bought food from the market. The results show that DD among both groups differed significantly, even when both did not report eating traditional food varieties. Our findings indicate, nonetheless, that agrobiodiversity is decreasing.

3.4. Minimum Dietary Diversity

The mean minimum dietary diversity for WRA was 1.37 ± 0.483 . About 57.5% of women in rural areas consumed ≥ 5 food groups. Approximately, 16% of women in urban areas consumed ≥ 5 food groups. In both areas, 36.75% of women consumed >5 food groups, while 63.25% of women failed to meet the minimum food diversity and food security. Overall, the mean MDD-W for both areas was low. Significant differences were found in MDD-W among the two areas ($F = 90.483, p < 0.05$) (see Table 4).

Table 4. Minimum dietary diversity score of women of reproductive age (MDD-W).

Areas	Mean \pm S.D.	Women of Reproductive Age (%)	
		<5 Food Groups	≥ 5 Food Groups
Urban	1.16 ± 0.368	84	16
Rural	1.58 ± 0.496	42.5	57.5
Total	1.37 ± 0.483	63.25	36.75

S.D: standard deviation.

These data showed a clear pattern of rural-urban integrity in the diets of women. The lowest MDD-W was seen in urban areas. On the other hand, this study examines the low percentage of WRA consuming foods from specific food groups and subgroups and thus provides a good qualitative description of the diet. The study found that WRA were consuming a high percentage of low-nutrient density food groups (see Figure 2).

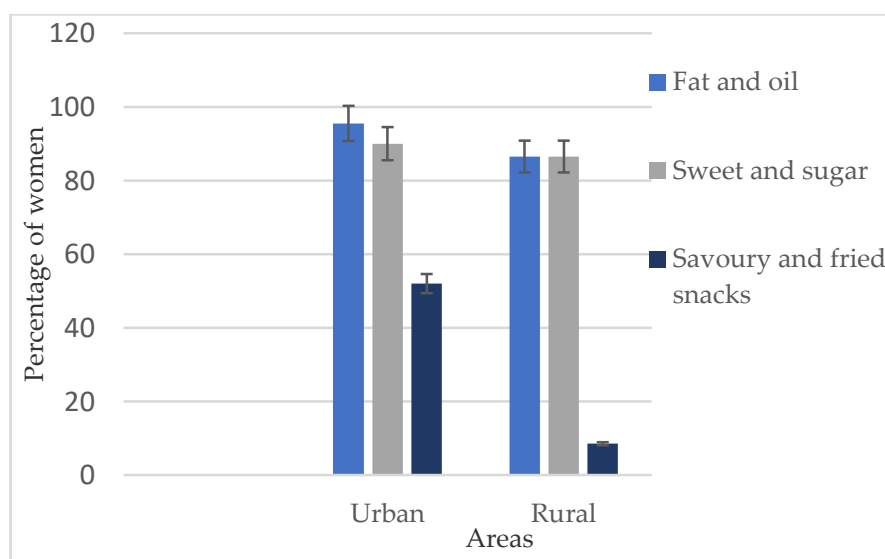


Figure 2. Percent consuming low nutrient density food groups.

WRA consumed more than 80% of fat, oil and sweets in both areas, while more than 50% of urban women consumed savoury (salty, pleasant, appetizing) and fried snacks. There were no significant differences in both areas ($P > 0.001$).

3.3. Associations between MDD-W with Socioeconomic Indicators

A significant positive correlation was found between the MDD-W and area, monthly income, education level, source of food, and BMI level in the study sample (correlation is significant at the 0.001 level). There was no significant correlation between MDD-W and age, food expenditure, household size, marital status, and main occupation (see Table 5).

Table 5. Associations between MDD-W and selected socioeconomic indicators

Indicators	Spearman correlations	P-value	Mean \pm S.D.	β	S.E.	t
Area	0.430**	0.000**	1.50 \pm 0.501	0.444	0.047	9.023
Age	-0.042	0.398	2.03 \pm 0.813	-0.010	0.028	-0.210
Monthly income	0.148**	0.003**	2.47 \pm 1.137	0.040	0.025	0.673
Food expenditure	-0.033	0.505	1.58 \pm 0.674	-0.019	0.042	-0.321
Family size	-0.012	0.815	1,50 \pm 0.501	0.058	0.046	1.219
Sources of food	-0.136**	0.007**	2.03 \pm 0.393	-0.143	0.057	-3.086
Marital status	0.043	0.394	0.35 \pm 0.823	-0.001	0.028	-0.015
BMI level	0.147**	0.003**	1.83 \pm 0.667	0.057	0.026	1.255
Main occupation	0.019	0.704	0.065 \pm 0.889	-0.028	0.031	-0.532
Education level	-0.144**	0.004**	1.24 \pm 0.623	0.037	0.000	0.010
Health condition	-0.203**	0.000**	1.76 \pm 2.101	-0.136	0.010	-3.415

Abbreviation: β -Beta weights (standardized beta coefficient), SE-Std. Error ** Statistical significance $p < 0.01$ (two-tailed).

In multiple linear regression models, a significant difference was found in monthly income, study area, education level, source of food, and BMI level among reproductive women (R^2_{360} ; $p < 0.01$). In this

sample, rural women had more dietary diversity than urban area women. Women who had the highest education level had better dietary diversity. Besides, women who had good nutrition status had dietary diversity. Women who had high-income had dietary diversity than lower-income women. Also, women who consumed their production had dietary diversity than other women.

There was a significant positive relationship between MDD-W and BMI status. Study results showed that underweight women had low dietary diversity, and women who had an average weight had minimal dietary diversity. The study results revealed that health conditions such as heart diseases, diabetes, cancer, kidney diseases, high blood pressure, and eyesight problems were prevalent in reproductive-age women in the study area. Spearman's rho (r) correlation was examined to establish the association between MDD-W and the study sample's health condition. A significant positive relationship founded between MDD-W and the health condition of the study sample.

3.6. Respondents Health Conditions

In this study, the self-reported health condition was investigated. About 30% of the participants reported having experienced bad health status, while 60% reported being healthy. The study results suggest that conditions such as heart disease, diabetes, and high blood pressure are more common in urban women than in rural women. Additionally, the study results showed that other diseases such as being overweight or obese, tooth decay, high cholesterol, stroke, depression, anaemia, eating disorders and swollen legs were more common in urban women than in rural women (see Table 6).

Table 6. Self-reported health conditions.

Type of conditions	Urban n (%)	Rural n (%)	Total n (%)
Cancer	10 (5)	3 (1.5)	13 (3.25)
Diabetes	23 (11.5)	3 (1.5)	13 (3.25)
Heart diseases	2 (1)	-	2 (0.5)
High blood pressure	12 (6)	7 (3.5)	19 (4.5)
Chronic kidney diseases	-	5 (2.5)	5 (1.25)
Thyroid	5 (2.5)	1 (0.5)	6 (1.5)
Eyesight problems	5 (2.5)	6 (3)	11 (2.75)
Other diseases	47(23.5)	20 (10)	37 (11.8)

3.7. Nutrition Intake and Nutrients Adequacy of Women

According to Nutri-Survey software and Sri Lankan food consumption table data, the mean energy intake was 1.04 ± 0.196 . There is no statistically significant difference in macronutrient intake for reproductive women between urban areas and rural areas. Overall, the mean energy consumption was 2230 kcal/day, with 80% coming from carbohydrates, 9% from proteins and 11% from fat. While 96% of women met the daily recommended carbohydrate intake, only 27% met daily recommended protein intake. In this sample, it was found that women in both areas did not meet the minimum daily micronutrient intake recommendations. Less than the mean EAR for eight micronutrients, but not for thiamine, niacin, and riboflavin. Additionally, the consumption of water was low among reproductive-age women in these areas. This data indicates that the study sample had a high risk of micronutrient deficiencies for example, for vitamin A, vitamin C, calcium and low levels of other nutrients crucial for reproductive-age women such as iron, vitamin B and protein (see Table 7).

Table 7. Selected macro and micro vitamins and minerals intake

Selected Vitamin and Mineral Intake	SD	EAR¹	Mean Intake	P-value
Carbohydrate/g	0.196	130	300	0.126
Fat/g	0.809	69	58	0.000
Protein /g	1.246	46	23.4	0.000
Iron /mg	0.805	8.1	7.2	0.000
Vitamin A / μg	1.227	500	180	0.000
Calcium / mg	1.230	800	220	0.000
Zinc /mg	0.479	6.8	1.2	0.021
Thiamine/mg	0.496	0.9	0.98	0.076
Riboflavin/mg	2.182	0.9	0.99	0.082
Folate / μg	0.906	320	48.6	0.000
Niacin /mg	0.823	11	11.6	0.671
Vitamin B6/mg	0.818	1.1	0.96	0.000
Vitamin B12 / μg	0.808	2.0	0.86	0.000
Vitamin C/mg	1.158	60	24.4	0.000
Water/L	0.912	2.7	2.0	0.000

¹ EAR: estimated average requirements per day [45,46]. SD: standard deviation.

4. Discussion

The WRA for minimum dietary diversity (MDD-W) is a flexible tool that can be used to compare and categorise women's dietary diversity within and across different settings [37]. Due to the emerging use of MDD-W, few studies have reported MDD-W prevalence values [41,42,57]. A developing country, such as Sri Lanka, is undergoing a rapid epidemiological and nutrition transition [25] attributed to low levels of food and nutrition-related knowledge [38]. These food patterns are associated with an increased risk of micronutrient deficiencies and health problems [40,58]. Additionally, a monotonous diet along with household food insecurity [59-61] are most frequently experienced by the poorest households [61-63].

Sri Lanka has a rich and wide variety of edible food species [64]. According to our recent study, Sri Lanka had a rich dietary diversity in the past [25]. Yet today, urbanisation, food preferences and lifestyles have led to changes in food production, eating habits and food systems leading to growing health and nutritional problems. Food variety and dietary diversity scores are positively related to socioeconomic factors [14,19]. Therefore, understanding dietary diversity may be a more accessible pathway to evaluating household-level food security [13]. It can further help understand health and nutrition status, food, agrobiodiversity, healthier lifestyle, food transition and micronutrient adequacy [24,65]. Our study results helped to understand food security, nutrition and diversity of food, sustainable dietary practices and the overall health situation in marginalised areas of Sri Lanka. It allows us to differentiate women at different levels of vulnerability [40]. Furthermore, it deepens the understanding of the diversity of diets and the agrobiodiversity of households.

4.1. Dietary Diversity and Micronutrients Adequacy

In the study sample, MDD-W was classified as less than five groups of foods consumed by women. This research outcome increases their vulnerability to food and nutrition insecurity. Previous studies found the lowest levels of dietary diversity in different areas among Sri Lankan populations [26,66,67]. However, no research was found considering female reproductive age besides this investigation in marginalised societies. Compared with other Asian countries, Sri Lanka records a higher percentage of MDD [68]. In the rural study area, some endemic vegetables and fruits may be helping to achieve food

security. Common vegetables and fruit in these areas have a variety of nutritional benefits that include leafy greens consumed as part of their regular diets and used in various ways [25].

Since most of the households partake in small scale agriculture, they are provided with better food security. Some of their food proportions, especially vegetable legumes, different kinds of mushrooms, nuts, seeds and leafy greens from the wild, are considerably higher than in urban areas. Wild foods can support households who experience financial difficulties and are important contributors to food security [25]. Unfortunately, many did not report eating these types of wild foods. It has become customary to buy food from markets, and many are unaware of the nutritional benefits found in these foods [25,38]. Select literature regarding food security notes that wild food is consumed as a form of food security in Sri Lanka [25,56]. Research shows that wild food such as fruits, leafy vegetables, mushrooms, tubers and honey increase dietary diversity and greater micronutrient consumption among the rural Sri Lankan communities resulting in improved food and nutrition security [25]. Local edible foods are rich in nutrients, and wild fruit, nuts, seeds and vegetables are good sources of vitamin A and fibre [41].

Urban slum women mainly consume food from the market. Most have low diet diversity due to food prices and low-nutrient food consumption, which is often not prepared by the women themselves. Many of them said that preparing food at home is more expensive than just buying food. People of these areas can easily be accessible for cheap, unhealthy foods (fats, especially foods of animal origin, fast foods (low in fibre and vitamins), salty and oily foods (patties, rolls)). Commonly bought foods are “*Kottu*” fried rice, “*rotie*”, bread, “*hoppers*”, “*string hoppers*”. We observed that this food is not nutritious (with the taste of monosodium glutamate (MSG)) and many households are or have switched to similar cheap and low nutritious foods.

The study sample of WRA showed imbalanced macronutrient intake, including a high mean intake of carbohydrate and low mean intake of fat and protein. This means 96% of women met or exceeded the daily recommended carbohydrate intake, while about 83% of women could not reach daily recommended protein intake. High carbohydrate intake can lead to weight gain, poor metabolic health, increased risk of heart disease and type 2 diabetes. On the other hand, white rice is the primary energy source for marginalised Sri Lankan women. Low dietary diversity and grossly inadequate micronutrient intakes have been associated with white rice consumption [69]. Most of the women in the rural study area were eating white rice three times a day. The rice portions are often large and consumed with a small portion of curries (vegetables or meat or fish). While rice is a protein source containing various vitamins (vitamin B, thiamine and niacin) and minerals (zinc and phosphorous), many of are lost during the polishing and milling processes of white rice production. White rice still provides some micronutrients such as riboflavin, folate and niacin, but unprocessed, brown rice has more nutritional benefits [69]. According to the results, monotonous diets were rice-based with a small portion of vegetables, and seldom consumed fruits. As one study in Bangladesh reported, rice is a staple food that contributes to low micronutrients [70]. Additionally, monotonous diets lack essential micronutrients and contribute to malnutrition. Studies by Kennedy et al. [71], Hamlin et al. [72], Chakona et al. [41] reported similar findings.

The study found that women in urban slums had limited micronutrient intake. Nuts, seeds and pulses contain protein, vitamin B, unsaturated fatty acids, fibre and minerals, which have unique health benefits and are rarely consumed by people in urban slums. On the other hand, women in rural areas consumed pulses and beans, nuts and seeds and other vegetables, along with a limited intake of dairy, meat, poultry, fish and eggs. Protein and calcium-rich foods are rarely consumed in this sample. The MDD-W was lower for five food groups consumed by women in urban areas than in rural areas. Previous studies have shown that people of urban areas consume more diverse foods than the rural areas, but the present results reject this finding [73].

4.2. Dietary Diversity and Sociodemographic Factors

Several socioeconomic and demographic factors are significantly associated with MDD-W. One such factor is women’s education. A woman with higher education is more likely to be economically

independent. It has been well-documented that financial independence has a positive impact on women's nutrition [74]. A significant positive association was found between maternal education and dietary diversity [75]. This research is comparable to previous studies in Bangladesh and Vietnam. Comparison, along with the urban-rural context showed that the level of food security was higher in rural areas where women with high MDD-W consumed nut and seed, green leafy vegetables, fruits. Savy et al. [76] showed that dietary diversity was related to socioeconomic status. The results show that rural women are better off than their urban counterparts as agriculture is their main source of income and food is easily available in rural areas and often the only limitation is financial access. Therefore, vulnerable people are more likely to have suffered from food shortfalls. Women in urban slums were more food insecure due to high levels of poverty, with a high percentage of the population living in extreme poverty in urban areas. Households living in poverty consume unhealthy food and change their consumption patterns to suit their income. Additionally, urban households have limited access to land (many of the lands are occupied illegally), which can cause them to be more vulnerable to food insecurity than rural households with land access. Dietary diversity was strongly correlated with access to the use of land in this study. A household engaged with the land and its products improved the quality of diets and helped increase food security in low-income households.

4.3. Dietary Diversity and Micronutrient Deficiencies

All micronutrients are essential for the proper functioning of the human body. They can act as antioxidants, which may protect against cell damage associated with specific diseases [77]. They are important for a healthy digestive system, and they play an important role in shaping the gut microbiota [78,79]. This research found that the number of daily dietary intake was not sufficient. Other vitamins and minerals such as iron, fat, folate, zinc, thiamine, riboflavin, niacin, and vitamins A, B6, B12, C intakes were less than halfway met. The study results revealed that 72.5% of women did not consume the daily recommended protein intakes. In this sample, 82% of women did not meet daily recommended vitamin A intakes, and more than half did not meet daily recommended riboflavin and vitamin C intakes. Also, this sample results show a high percentage of reproductive-age women are high risk for folate deficiencies. Therefore, these results show that the study area has a high-level risk of micronutrient deficiencies.

Although most women had unhealthy nutritional status, the results revealed that 33.5% of the women involved had a healthy weight. This sample had 43.5% of underweight women, about 19% overweight women and 3.8% obese. Most of the women in study sample were undernutrition. However, the study results demonstrated that rural women's nutrition status was better than urban women. Nevertheless, this study shows that most of the reproductive-age women in the study area have nutritional problems, and unhealthy diets can have direct or indirect effects on living standards and health [80]. Moreover, some studies have shown that low-income families' food insecurity is significantly linked to a higher percentage of diabetes [81-83]. Some studies have found that nutrition is essential for food security [84,85]. This means that any person suffering from malnutrition or inadequate micro-nutrients can be identified as food unsafe. These shortcomings underscore the importance of knowing household dynamics and individual levels of food security [86].

4.4. Diversity of Food Varieties, Agro-Biodiversity, Consumption Patterns, and Health

Reproductive age women are generally at health risk from malnutrition, micronutrient deficiencies during the pregnancy. In the reproductive age, food and nutritional insecurity has been connected with outcomes of poor pregnancy, including low birth weight and gestational diabetes [87,88]. Women were found to be consuming a high amount of carbohydrates while at high-risk for nutritional problems such as diabetics. There was a significant positive relationship between self-reported health status and dietary diversity. In urban areas, women suffer from nutrition-related health problems more than in rural areas. Some studies have shown that dietary diversity is positively associated with nutritional adequacy [89] and also associated with decreased chronic diseases [90], type 2 diabetes [91] and several types of cancer [92-94].

This study also showed that indigenous fruits and vegetables were not so popular in both areas, helping to understand the diversity of food and food transition. WRA were not consuming the traditional variety of foods such as healthier wild plants. The notable point is that dairy consumption was low, and women consumed only milk powder. In ancient times people in the area drank goat milk as therapeutic food for allergies and asthma. In these rural areas, people were accustomed to *Mee* oil and sesame oil (see Table 3), but the study revealed that women use coconut oil, vegetable oil and palm oil. In Sri Lanka, there have been several regime changes over the past 400 years and up to now. The process of these changes has accumulated over a substantial period [25]. Food commercialisation, which may impact changing attitudes and dietary patterns, has also disregarded these traditional food sources, especially in agriculture development [95]. This has been evident in Africa, where a decreased agricultural biodiversity has led to a decrease in the variety of food plants grown by household due to agriculture commercialisation [96]. However, when and if available, these conventional varieties can inexpensively increase food security and nutrition security among marginalised societies.

The financial situation plays a major part in obtaining the correct variety of seeds to be planted in the rural areas, fertilisers and protection/safeguarding from aggressors and crop destruction need to be costed to ensure there is sufficient food. Dietary diversity, founded on diverse farming systems, delivers better nutrition and good health, with additional benefits for human productivity and livelihoods. This study proves that agriculture diversity will also be essential to a healthy, sustainable food system, and secure food production. Accordingly, the evidence base for the role of biodiversity in food and nutrition security is growing. For example, a significant positive relationship was found between crop diversity and dietary diversity [97]. The diversification of agricultural production towards fruits, vegetables and aquaculture was seen to improve diet diversity and the intake of specific nutrients [98]. However, this result shows that the biodiversity of plants is vital for humanity's capacity to meet sustainability challenges. Therefore, to improve food security, the rigorous integration of plant, environmental, social and health is required and should be integrated into policymaking.

All participants' food preparation methods included long cooking times. However, in the past, different foods had different preparation methods and preservation [25]. Food processing can alter the nutrient quality of foods [99,100] and may have an impact on nutrition problems in these areas. Traditional household food processing and preparation methods can enhance the bioavailability of micronutrients [100] and may be a further topic for investigation. Results show that many women frequently skipped breakfast but fasting for short periods at certain times is not advisable for women of reproductive age. These findings raise a significant concern because of the possible negative impacts their already poor diets may have on maternal health and pregnancy and birth outcomes [101]. The government should pay extra cost for food security and nutrition policies through nutrition supplement for maternal health due to low dietary diversity and inadequate nutrition [102]. The findings also highlight the need to incorporate nutrition interventions that address both food insecurity problems and limited knowledge regarding healthy diets during reproductive age, as recommended by WHO. By providing the cut-off point of five food groups, the MDD-W is a valuable tool to identify and characterise populations with a higher risk of inadequate nutrient intake. Nevertheless, it is important to continue investigating the composition of diets by analysing individual food groups' consumption. This result will prove the identification of ignored food groups whose production should be promoted to achieve greater diversity. This information is necessitated to assist in designing efficient interventions to improve diet quality. A decreased dependence on self-production and agrobiodiversity, purchasing food at markets, low-income, lack of suitable land, less knowledge about food and nutrition, and reduced diversity of local varieties are the main reasons for food insecurity. Accordingly, food security programs should concentrate on developing among rural and urban marginalised communities. There is a need to enhance the diet and food diversity for women of reproductive age in marginalised areas by training production through home gardening. Consuming a diverse diet is difficult for most Sri Lankan people due to high poverty levels, high unemployment rates, abandonment of agriculture, and increasing food prices. It has been reported that price increases on whole food that contains high nutritional values have an influence on food consumption among vulnerable

societies. As a result, many families are switching to cheaper and low nutritious foods that prevent hunger but affect the quality of the food. Households may also decrease the diversity of diets in response to the frequency of meals and decreasing portion size.

Based on these research results, there is a need to enhance traditional food culture and farming systems. Our results enable policymakers or competent authorities to develop appropriate nutrition programs for vulnerable people in marginalised areas and to strengthen sustainable food and nutrition systems in Sri Lanka. Further studies should be conducted to continue investigating the composition of diets by analysing individual food groups' consumption, micronutrition deficiencies and dietary diversity. In the preliminary analyses presented in this article, list-based and open methods were applied to avoid the concern that both MDD-W and nutrient intake came from the same 24-h recall. Repeating the analyses using MDD-W derived from the 24-h dietary intake data did not change our finding that the MDD-W performed poorly in identifying individuals portion size with micronutrient intake among reproductive-age women. The recall of food group intake through the list-based and open methods was done on the same day as the multiple-pass 24-h recall. The advantage of the MDD-W derived from the list-based method was similar to the 24-h open recall of the data.

There are several strengths connected with this study. One of the key forces is the representational nature of the data used in the analysis. This means that the findings of the study cannot be generalised to all reproductive women in Sri Lanka. To the best of our knowledge, this is the first study in Sri Lanka using nationally representative data to investigate MDD-W in marginalised communities. There are several limitations to this study. This model indicates the advantages effects of nutrition on health promotion, disease management and risk reduction. The data determined from the data of a cross-sectional survey did not allow us to determine causality. If both areas were significantly larger, and the sample size was relatively small, this may have affected accuracy and reliability. Therefore, the sample size 400 was selected, indicating a confidence gap of $\pm 2.5\%$ (total = 5%) and the testers were trained to check the data. This study examined two different marginalised communities. Therefore, a marginalised community is the people in Sri Lankan society who are at risk from existing nutritional, health and other social problems. Women of reproductive age are a good indicator of the general well-being of the community. The study examined two different marginalised areas with WRA. These results could not be generalised to other settings but should be restricted to WRA in marginalised areas.

In addition, the evaluation of this study was self-reporting in WRA. The BMI symbolised the relationship between MDD-W and demographic factors of nutritional status. This research did not investigate the nutritional status and relied upon self-reported health conditions without health examinations. Additionally, the study estimated only one 24 h recall per woman dietary intake. Although this is appropriate to measure populations' mean intakes, it is inadequate to capture the day-to-day variation in intakes. Therefore, for further investigation, it is recommended to utilise a different kind of dietary questionnaire to collect and capture intakes, such as a food frequency questionnaire or 7-day dietary recall [103]. Using a dichotomous indicator could be less sensitive in identifying the relation with potential determinants compared with a continuous indicator such as WDDS. Still, our findings invalidated this hypothesis for our sample. WDDS indicator was to be used as a continuous variable (ranging from 0 to 9 food groups consumed) and averaged to generate a mean value for populations. It did not allow us to assess the percentages of the population with low or adequate dietary diversity. WDDS failed to identify a single, universal cut-off point that would accurately classify women into those with low dietary diversity and those with minimum dietary diversity across the different contexts. For this reason, FAO developed the minimum dietary diversity in women (MDD-W) indicators in 2014. When the MDD-W indicator is at the population level, the indicator is a good proxy for predicting micronutrition, but it does not perform well in individual women. By providing the cut-off point of five food groups, the MDD-W is a valuable tool to identify and characterise populations at greater risk of inadequate nutrition intakes.

5. Conclusions

In conclusion, this study observed that women of reproductive age had poor diets with imbalanced macronutrients and alarmingly low intakes of some important micronutrients. Study results showed that women in urban slums reported higher food insecurity than women in rural areas. Additionally, monotonous diets were rice-based, with little vegetables and rarely consumed fruits. This sample did not find any consumption of a traditional variety of foods, and agrobiodiversity is decreasing. Sri Lankan food patterns are changing toward low dietary diversity and low-quality diets such as high fat and carbohydrates. There is a need to improve traditional food culture, farming methods and nutrition education. Study results proved that dietary diversity and food security are correlated with income and level of education, but food expenditure, household size and main occupation were not. Furthermore, double-burden malnutrition is related to dietary diversity. Reproductive age women's diets revealed a higher MDD-W within the rural areas, and the lower MDD-W were seen in the urban areas. As briefly noted in the research study, imbalanced nutrition will impact future generation's nutrition and health status. Marginalised society is at high risk for nutritional deficiencies, heart disease, diabetes, cancer, kidney disease, high blood pressure and eyesight problems in reproductive women, all associated with dietary diversity. This research finding helped to understand the diversity of food and food transition and revealed that indigenous fruits and vegetables were not so popular in both areas. We conclude that there is a need to enhance nutrition education about diet diversity and food security among reproductive women.

Further studies can investigate the strategic nutrient intake and micronutrition problems in these areas among women and children. Accordingly, every country needs strong governance to address the nutrition challenge successfully. The study demonstrated that food and nutrition policies change due to changes in political regimes. Local governments play a role in increasing access to healthy foods and reducing access to unhealthy food. According to our finding and reflected in literature, to date, there is more access to enhancing strategies than those that might reduce access to unhealthy food in marginalised societies. However, the local government should also focus on strategies that reduce access to unhealthy foods. Local governments can have a strong and direct impact on people's health and well-being.

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Chapter 7

7. General discussion

The overall objective of this doctoral study was to research food and nutrition security, problems and solutions in Sri Lanka. It was sensed that now it is time to change the dietary pattern towards a sustainable diet due to nutrition and health problems in Sri Lanka. Therefore, this research wanted to better understand traditional food culture and how it changes dietary diversity and knowledge attitude and practice on nutrition status and health. To achieve this, we wanted to show a new pathway to a new sustainable food practice strategy. The increase in food consumption has been accompanied by a change in dietary patterns. Sri Lanka has enjoyed a huge influx of processed food products, which has remarkably transformed the scenario of the food market and people's food choices. We guessed these changes result from colonialization. Thus, one hypothesis of the study was colonialization had been destroyed by Sri Lankan traditional food culture. Another one is the commercialization of the food system's impact on nutrition transition.

7.1. Nutrition transition and food governance

The first step was understanding nutrition transition and traditional food cultural changes in Sri Lanka during colonization and the post-colonization period. Study results showed that the impact of colonial dynamic and postcolonial dynamics on Sri Lankan culture and cultural changes is high. The reason for this is because postcolonialism represents and feeds an ideological response to the colonizer's thoughts regarding Sri Lankan culture. This has directly impacted Sri Lankan food culture and nutrition status and is related to current nutrition problems. On the other hand, the development and policing of dietary guidelines based on traditional food in Sri Lanka would be necessary for promoting healthy diets among the population. To be successful, the guidelines need to be understood and adopted by the majority of people in the country. The following issues were impacted due to colonialization: the destruction of the traditional farming systems, disparities of socioeconomic status and development of the government policy, creation of cash-crop economies, ecological destruction, nutrition-related propaganda, disruption of the family unit. These issues are directly or indirectly connected with the food and nutrition transition in Sri Lanka. Also, the child and female micronutrient deficiency and malnutrition rates increased after the post-colonialization period. Accordingly, the study results prove the main factor of these problems is inappropriate governance in Sri Lanka. Nutrition challenges and food security continue to evolve in Sri Lanka. According to the Food and Agriculture Organization, governance has been identified as a critical factor for the success of whole nutrition policymaking (FAO,2014). The key to effective governance is assuring appropriate training information resources and support to the civil society (Helern,2011). We must understand how governance work to enhance nutrition outcomes in the country and how nutritionist's development actors and donors, civil societies and the private sector can support government officials in sustaining commitments. Hence, every country needs strong governance to address the nutrition challenge successfully. Studies demonstrated that food and nutrition policies change due to changes in political regimes (Resnick et al.,2015; Reich,1995). In Sri Lanka, over the past 400 years and until now, multiple regime changes have taken place. The process of these nutrition changes and related health impacts has accumulated over a substantial period. Therefore, further research is required to examine local communities to better understand these nutritional problems more deeply. Our study demonstrates the development and policing of the dietary guidelines for traditional food in Sri Lanka are essential for promoting healthy diets among the population. Therefore, to be successful, the guidelines

need to be understood and adopted by the majority of people in the country. However, growing evidence makes it clear that multiple complex factors beyond personal decisions strongly influence dietary choices and patterns. This shows the figure 7.1.

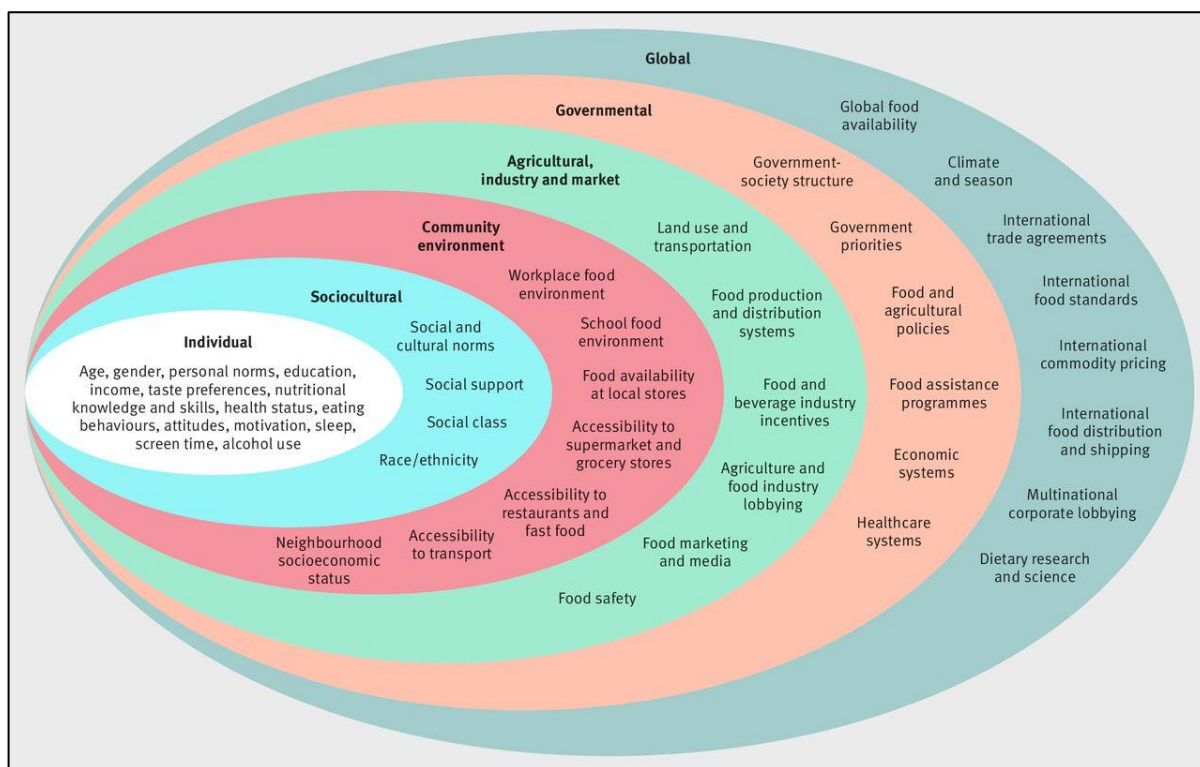


Figure 7.1: Multiple complex factors beyond personal decisions strongly influence dietary choices and patterns (Sources: Mozaffarian et al.,2018)

Dietary habits are determined by personal performance at the individual level, which impacts age, gender, culture, education, income, health status, knowledge, and skills (Brug,2008; Mozaffarian et al.,2018). Psychological influences or behaviour include the attitude to food and health incentives, values and motivation (van't Riet et al.,2011; Mozaffarian et al.,2018;). Food performance influenced by early-life exposures such as diet during pregnancy shape food consuming early childhood or infant feeding practices (Nehring et al.,2015). These individual determinants are influenced by much broader drivers of food choices such as globalization, food industry formulation, farming policy, trade agreements, and ecosystem influences. Thus, strong government policy is the key to achieving a healthy, profitable, equitable, and sustainable food system that benefits all (Mozaffarian et al.,2018).

7.2. Traditional food culture and its changes

On the other hand, Sri Lanka is agricultural, in ancient Sri Lanka (before colonialization), there were no farmers as defined today because people never owned agricultural land, farms, or farming based on money. Sri Lanka had a wide variety of traditional rice, vegetables, and cash crops resistant to diseases and insect pests and are well suited for the varied conditions of soil and climate in Sri Lanka. In 1950, agriculture accounted for 46.3% of GDP and engaged around half of the labour force. Now it contributes only 7% of GDP and 25% of the labour force. These data show how the Sri Lanka food system achieved food security. These numbers have indicated Sri Lankan food policies weakside. Thus, a self-sufficient

economy may benefit the people in many ways, health and nutrition as well. This study demonstrates Sri Lanka had experienced a traditional sustainable food culture before colonization. In the field interviews (see figure 7.2) old people expressed that many people had always been concerned about the type of food that they choose, including the quantity and the quality of their food. Some types of food were specially prepared for special people. Also, food security and food availability in traditional Sri Lanka were so rich that it was consumed according to the type of person (child, adult, elder), physiology (sick, pregnant, nursing), degree of activity (less active, energetic), and the type of meal (breakfast, lunch, dinner). Thus, in ancient times, Sri Lanka had been rich in traditional food culture. But unnecessary planning (agriculture) and policy (food) destroyed it. As a result, Sri Lanka has to enjoy a huge influx of processed food products.



Figure 7.2: Field interviews and survey near Kebithigollawa in Anuradhapura with senior people, photo credit: Inoka Damayanti

However, during that colonization period, both indigenous knowledge and the environment were destroyed. Yet, even after independence, neocolonialism causes further destruction of Sri Lanka's traditional culture and landscape. Forced rapid urbanization contributes to the destruction of the family unit and the introduction of a more globalized food system. All in all, colonial and postcolonial dynamics had a significant impact on cultural changes. This has directly impacted Sri Lankan food culture and nutrition status and is related to current nutrition problems. However, the rapid transformation of diets and changes in food systems at all levels (production, processing, distribution, and retail) pose several important additional challenges to food security and food policy. These are the challenges for smallholder welfare, agricultural research and development priorities. Supermarkets tend to replace central food markets, neighbourhood stores, and street food sellers in urban areas. Supermarkets and fast-food chains arise from and reinforce the Westernization of food demand that results from economic development and urbanization. Changes in traditional diets towards a more Western diet, promoting a higher fat and sugar content, are expected to result in a higher incidence of dietary-related non-communicable diseases, as well as micronutrient deficiencies. However, recent evidence suggests that Western dietary habits are infiltrating rural Sri Lanka. Yet, there are still chances to develop and promote traditional dietary patterns for the Sri Lankan community. In this study, we identified that the food transition and socioecological patterns are important factors in policymaking politics. Hence, it is essential for integrated policy

approaches for promoting traditional sustainable food culture (Morley et al., 2014). Policy actions should target sustainable food production and establish sustainability standards for targeted subsidies with high availability of sustainable food products (Chkanikova and Mont,2015; Kearney,2010; Morley et al.,2014).

7.3. Understand food and nutrition-related knowledge attitude and practice.

Moreover, politicians need to pay attention to consumers' demand to improve healthier food consumption patterns (Kearney, 2010). Without knowledge, it is difficult to make attitude and behaviour changes towards a sustainable diet. Proper nutrition knowledge impact on good nutrition status (WHO,2018). Insufficient nutrition-related knowledge is an underlying cause for the high prevalence of undernutrition and micronutrient deficiencies (Nelson,2012; Rathnayaka & Weerahewa,2011), as nutritional knowledge affects attitudes and eating behaviour (Thomas and Farthing,1990). Sufficient diet-related knowledge is needed to evaluate the quality of his/her own and their family's diet (Glanz et al.,1994; Heerman et al., 2017). As a next step, this study was to identify food and nutrition-related knowledge, attitude, and practice (KAP). According to a feasibility study, women are a powerful indicator of household food security in the area since they are the main income holders and suffer from nutritional problems. For that reason, we selected a sample of reproductive-age women (abbreviation to include). Thus, the influence of dietary KAP among reproductive-age women in marginalized areas in Sri Lanka was examined. One of the study hypotheses indicates that a low level of food and nutrition-related knowledge has an impact on this transition. Nutrition knowledge practice, motivation, belief may influence food choices and eating patterns. Consumer characteristics determine consumer food choices. These determinants include demographics (e.g. gender, age) and psychographics (e. g. knowledge, attitude). Demographic variables that turn out to be important in food choice are age, gender, income, and education. Examples of general food choices for psychographic determinants include several food-related motives such as price, taste, health, involvement with food, food neophobia, and openness to new foods. More specifically, determinants of a sustainable food choice include food knowledge, attitudes toward sustainable food consumption, social and personal norms, and perceived effectiveness of sustainable behaviour (Aertsens, et al., 2009; Arvola et al., 2008).

The research results clearly showed that reproductive-age women have a low level of food and nutrition-related knowledge in marginalized areas in Sri Lanka. Most women have a positive attitude about receiving nutritional knowledge but have low-level practice about a healthy diet. This survey showed that reproductive women had a limited grasp of food and nutrition-related knowledge. These results point out that knowledge may be the main factor in starting changes in dietary behaviour. Therefore, a low level of knowledge may impact nutrition problems as well as nutrition changes. If women have an insufficient nutrition background, they cannot prevent family nutrition problems. Hence, this study more accurately measured the degree of nutritional related knowledge among women compared to other research. However, any interpretation of these results should consider that this study used broad standards of nutrition knowledge of reproductive-aged women. The outcomes show that most low average scores in food and nutrition-related knowledge were among undernutrition women. Also, this study sample shows a low level of knowledge about food and nutrition-related diseases. This may imply that there are misunderstandings for a range of nutrition-related knowledge. Therefore, a low level of nutrition knowledge is an issue that may impede women's ability to consume a well-balanced diet, which will result in poor dietary intake. Most of the reproductive-aged women's education levels scored higher than their nutritional knowledge. The study found that women with a higher education level had better knowledge about nutrition and were mindful of their food and nourishment. This result indicated that,

through nutritional knowledge, women could change their food behaviour. It may help eliminate nutritional problems in these areas. This study shows the perception of food quality was low scoring in the study sample. Some of the participants understood the perceived risks of unhealthy food. Still, most were unconcerned about such risks because marginal societies suffer from poverty or they have barriers to eating healthy food. By employing multiple-linear-regression models, a significant difference was found among the factors of age, family size, monthly income, educational level, attitudes towards nutrition, and food and nutrition practices across reproductive women. Another notable point is that most women aged 35–49 years or older gained nutritional knowledge from their elders, which means that traditional indigenous knowledge is important for nutritional status. Even today, older people are well-aware of their food-security risks (Weerasekara et al.,2018). Local natural-food knowledge and resources still exist (Kuhnlein,2003). There is a gap of acknowledgement and acceptance of traditional and local knowledge between generations. Field results revealed that most women in marginalised rural areas use their traditional knowledge and diverse food resources to improve their nutrient status. However, this knowledge is not documented and creates a knowledge gap between older and younger generations about nutritional values. Therefore, knowledge may be a powerful indicator (FAO,2010) to maintain household food and nutritional security.

7.4. Understanding dietary diversity and micronutrient adequacy in Sri Lanka

Another hypothesis was micronutrient deficiencies higher in urban areas than in rural areas. Thus, the next step was to understand the dietary diversity of both areas. In Sri Lanka, there are many health and nutritional problem, and at the same time continuing an unhealthy eating pattern. Many studies suggested that dietary diversity is beneficial to a healthy weight (De Oliveira Otto et al.,2018; Salehi-Abargouei et al.,2016; Kennedy,2004), nutrition status (Arimond et al.,2004; Savy et al.,2006), healthier lifestyle (Azadbakht et al.,1996; Kant,1996) and food security (Ruel & Marie,2003; Hoddinott et al.,2002). As dietary factors are linked with increased risk of chronic diseases and undernutrition, local and international guidelines recommend improving the diversity of the diet. Therefore, dietary diversity is important to meet the requirement for energy and other essential nutrients, especially for those who are at risk of chronic diseases and risk of nutrition deficiencies. According to the world health organization, a healthy diet contains fruit, vegetable, legumes, nuts and whole grains. Thus, different food groups are a good source of various micro and macronutrients. Hence, understanding dietary diversity may be an easier pathway to evaluate inadequate micronutrient and household-level food security (Abris et al.,2018; Thornton & Amy,2016). The study aims to understand the MDD-W and micronutrient adequacy in marginalized areas in Sri Lanka. According to data, 57.5% of women in the rural area consumed ≥ 5 food groups. About 16% of women in urban areas consumed ≥ 5 food groups. About 36.75% of women in both areas consumed more than 5 food groups, and they are more likely to have higher micronutrient intakes than 88% of women who did not meet minimum dietary diversity. This data shows dietary diversity impact their health and nutrition. The study revealed that more than 50 % of women were suffering from nutritional problems such as underweight, overweight and obesity. Also, this result show there was a significant positive relationship was found between dietary diversity and health condition and BMI status of women.

These study results confirmed the posed hypothesis, which showed that although urban slum women would report higher levels of food insecurity than women from remote rural areas. Also, monotonous diets are rice-based, with little vegetables but rarely consumed fruits. The results confirmed that MDD-W

and food security are associated with income and education level, but food expenditure, household size, and main occupation were not associated. Furthermore, double-burden malnutrition is related to dietary diversity. Reproductive women's diets along the rural-urban continuum revealed a clear pattern of highest minimum dietary diversity within the rural areas and the lowest MDD-W were seen in the urban areas. As briefly noted in the research study, imbalanced nutrition will impact future generation's nutrition and health status. A notable point of this study is that this population has rejected the consumption of this traditional food variety or food diversity. This may be an impact on increase micronutrition deficiencies. But urban areas did not find any differences because, in slum areas, people are consuming buying food.

In conclusion, marginal areas people face a triple burden of malnutrition and some food and nutrition-related health issues. Also, this area's people are changing their food culture due to the commercialisation food system's impact. Thus, food transition impacts people's nutrition and health, especially triple burden malnutrition. The findings also highlight the need to incorporate nutrition interventions that address both problems of food insecurity and limited knowledge regarding healthy diets during reproductive age, as recommended by WHO. This study highlights that increased dependence on own decrease production, purchasing food, lack of suitable land, limited access to food due to lack of income, and high food prices are the main causes of food insecurity and low dietary diversity in reproductive-age women living in marginalized areas. Therefore, food security programs should focus on developing both rural and urban communities, especially marginalized societies. There is a need to increase diets and dietary diversity for women of reproductive age in Sri Lanka by practising their production through gardening. Consuming a more diverse diet is beyond the reach of most poor people in Sri Lanka because of high poverty levels due to high unemployment, increasing food prices, and abandonment of agriculture, leading to over-dependence on purchasing food from markets. It has been reported that the increase in food prices, especially nutritious food, has an impact on food consumption among vulnerable households. In this case, most households switch to cheaper and less nutritious foods that satisfy hunger but compromise the food's quality. Households may also decrease dietary diversity in response by reducing portion sizes and the frequency of meals.

Chapter 08

8. Conclusion

8.1. Scientific contribution

This research study contributes to theoretical discussion regarding food and nutrition security with special attention to marginalized society. This research study is also a part of this extensive academic discussion to understand the diet quality and nutritional problems as the central approach. Based on the literature, this discourse's main themes focus on food and the nutrition transition and their impact on human health. The key theoretical contributions are the developments of

1. Theoretical outlook to understand the colonial and postcolonial dynamics on food culture and impact on food and nutrition transition.
2. Knowledge attitude and practice on nutrition and health.
3. Understand dietary diversity in food and nutrition security.

Chapter 4 presents the theoretical framework presented with 'the colonial and postcolonial dynamics on food culture' as the central approach. Based on the literature, this discourse's main themes focus on food and the nutrition transition and their impact on human health. Human history is characterized by a series of changes in food and nutritional status. Based on the literature, different characteristics of cultural changes reflect colonial and postcolonial dynamics. These characteristics either directly or indirectly impact cultural and food habit changes to the Western diet. This study extends the theoretical arguments observed that during that colonization period, both indigenous knowledge and the environment were destroyed and suppressed until the country's independence, presenting economic independence; yet, even after independence, neo-colonialism caused further destruction of Sri Lanka's traditional culture and landscape. All in all, colonial and postcolonial dynamics had a significant impact on cultural changes. This has directly impacted Sri Lankan food culture and nutrition status and is related to current nutrition problems. However, the rapid transformation of diets and changes in food systems at all levels (production, processing, distribution, and retail) pose several important additional challenges to food security and food policy, smallholder welfare, and agricultural research and development priorities. Thus, the dissemination of traditional knowledge and popular campaigns must continue. Ultimately, the individual, the family, and the local community must come together to regain their birthrights so that they can grow and consume their local foods according to their traditional practices. This research identified that the food transition and socioecological patterns are important factors in the politics of policymaking.

In chapter 5, the data analysis was used to collect data on knowledge attitude practice on nutrition and health. A cross-sectional survey was conducted using the KAP model questionnaire administered in marginalized areas in Sri Lanka. A systematic study of the reproductive age women's food and nutrition-related knowledge, attitude practice and their perception of food security and food quality has not been conducted in marginalized societies in Sri Lanka; therefore, this study is the first study. Thus, studies that evaluate and analyze women's food and nutrition-related KAP are useful for gaining such an insight into women's determinants of their dietary habits. Thereby, this research will help policymakers or responsible authorities to plan appropriate nutrition care programs for vulnerable people living in marginalized areas.

In chapter 6, The minimal information regarding food security and nutrition as well as individual dietary diversity along the rural-urban context provides the foundation for this research. Research-based information concerning women's dietary diversity is lacking. Therefore, the study's main objective was to use the MDD-W indicator to determine the dietary diversity of WRA in marginalized communities and

the rural-urban level in Sri Lanka. The MDD-W is a flexible tool that could be applied to categorize and compare the dietary diversity of women of reproductive age within and across different contexts. The recommended 10-point food group indicator based on women's dietary diversity was published only recently, and few studies have reported MDD-W prevalence values.

8.2 Policy contribution and recommendation.

This study has a strong connection with policy and governance. The study identified that the food transition and socioecological patterns are important factors in the politics of policymaking. The findings also highlight the need to incorporate nutrition interventions that address both problems of food insecurity and limited knowledge regarding healthy diets during reproductive age, as recommended by WHO. By providing the cut-off point of 5 food groups, the MDD-W is a valuable tool to identify and characterize populations with a higher risk of inadequate nutrient intake. Thus, this study found that local governments play a role in increasing access to healthy foods and reducing access to unhealthy food. According to our finding and reflected in the literature, to date, there is more access to enhancing strategies than those that might reduce access to unhealthy food in marginalized societies. However, the local government should also focus on strategies that reduce access to unhealthy foods. Local governments can have a strong and direct impact on people's health and well-being and are well-positioned to positively change food environments in communities. Thus, local governments can provide strategic leadership such as using zoning laws to change the local food environments, providing improved access to healthy food in marginalized areas, serving a catalyst for community change by offering healthier food or offering the opportunity to organic home gardening. Thus, local governments can and should provide opportunities to change the community food environment to impact individual food decisions positively.

Moreover, this study provided a better understanding of women's determinants of dietary behaviour and valuable information on planning programs to prevent the risk of reproductive-age women in marginalised areas. These results could be used to plan culturally appropriate diet- and lifestyle-counselling programs to manage women with nutritional problems. The findings of this study may be important for future nutrition policymakers. Research that focuses on reproductive-age women may play an important part in health promotion and the prevention of nutrition-related health problems, but it requires education. Some suggestions exist for improving the nutrition-related knowledge of reproductive-age women to improve and meet households' health-education demands.

- Training for nutrition-related teaching, especially traditional-food and nutrition-related knowledge, should be strengthened in women and be part of the national educational curriculum. If rural and urban women have space for a garden, knowledge about plants and their nutritional benefits might be helpful as well. School gardens might inspire boys and girls to learn about food.
- Concerning women who are younger and are underweight, it would be beneficial to adopt corresponding protocols for the screening and education of these groups living in urban and rural areas by a nutritionist or dietitian.
- The media network can be used as a new way to spread traditional indigenous knowledge to women. For example, showing traditional nutritional food-preparation methods, introducing ways to prevent some health problems with traditional food (traditional Sri Lankan food has more benefits to prevent non-communicable diseases), and different harvesting and storage methods.

Local authorities and other relevant NGOs could support the establishment of nutritional related healthy food programs and assist in maintaining the programme by networking. Overall, this study strongly proposes improving marginalized areas' family nutrition and promoting an overall, more sustainable and health-supporting food system.

8.3. Insight for future research

Several insights raise potential future research possibilities. An immediate next step following this study would be conducted on the nutritional values of traditional food and how it uses to prevent nutrition-related deficiencies as well as micro nutritional deficiencies of women and children can be conducted in the next step. Our preliminary data showed that traditional foods help food and nutrition security. An investigation of current health impacts could follow this study due to unhealthy food. Either a public health study or clinical study could be conducted. An overview of the current major health and nutritional problems in the region could be a primary observation for such a research study.

This study observed the current nutrition situation and food pattern, knowledge, behaviour. However, this was just a preliminary observation. Thus, a study that can find the problems behind these causes is future research prospects. Furthermore, research can be conducted for the nutritional values of traditional food and how they help to prevent different diseases.

8.4. Limitations

Withing this research study, there are limitations for each research contribution listed in chapters 4,5 and 6. Generally speaking, one of the biggest limitations concerns the choice of participants and study sample as well as the geographical limitation. With the first study (chapter 4), we might have selected only very older people with traditional food experiences. Selecting participants for the second (chapter 5) and the third (chapter 6) study was only based, reproductive-age women. Reproductive-age women are a good indicator of the overall well-being of society. They are vulnerable because they have had nutritional problems and health and social issues, and the evaluation of this study among reproductive-age women was self-reported.

This research investigated two different marginalized communities. In this case, a marginalized community means vulnerable people in Sri Lankan society. Furthermore, because the study was examined in two different marginalized areas of reproductive-age women, the results cannot be generalized to other settings. This study investigated BMI represented nutrition status. This research did not investigate the nutrition status.

09. Erratum

The following are errata for the original article entitled, Chapter 6 “*Understanding Dietary Diversity, Dietary Practices and Changes in Food Patterns in Marginalised Societies in Sri Lanka*” by food journal.

* Table 1. (in Page 74) column 4, line 1,3,4,7 should be corrected to following Table 1.

Table 1. Demographic and socioeconomic characteristics of women in the reproductive age group

Characteristic n=400	Rural (%)	Urban (%)	Total value (%)
Age (years)			
18-25	72 (36)	55 (27.5)	137 (31.8)
26-35	72 (36)	64 (32)	136 (34)
36-49	56 (28)	81 (40.5)	137 (34.3)
Monthly income (Rs)			
1-5000	32 (16)	4 (2)	35 (9)
5001-10000	5 (3.5)	40 (20)	45 (36.2)
10001-20000	67 (33.5)	82 (41)	149 (37.3)
20001-30000	45 (22.5)	51 (25.5)	96 (24)
30001-40000	35 (17.5)	17 (8.5)	52 (13)
40001-50000	15 (7.5)	4 (2)	19 (4.8)
50000<	1 (0.5)	2 (1)	3 (0.8)
Food Expenditure (Rs)			
1-5000	100 (50)	22 (11)	122 (30.5)
5001-10000	14 (7)	70 (35)	84 (21)
10001-20000	80(40)	80 (40)	160 (40)
20001-30000	6 (3)	24 (12)	30 (7.5)
30001-40000		4 (2)	4 (1)
Family Size*			
Small family	117 (58.5)	84 (42)	201 (50.3)
Big family	83 (41.5)	116 (58)	199 (49.8)
Main Occupation			
Unemployed	123 (61.5)	119 (59.5)	242 (60.5)
Agriculture		-	68 (17)
Labor job***	68 (34)	74 (37)	79 (19.8)
Government Job	5 (2.5)	7 (3.5)	11 (2.8)
	4 (2.0)		
BMI level			
Underweight	74 (37)	100 (50)	174 (43.5)
Normal weight	85 (42.5)	49 (24.5)	134 (33.5)
Overweight	37 (18.5)	40 (20)	77 (19.3)
Obese	4 (2)	11 (5.5)	15 (3.8)
Education level			
Non-educated	16 (8)	21 (10.5)	37 (9.3)
Primary	86 (43)	148 (74.)	234 (58.5)
Secondary	95 (47.5)	30 (15)	125 (31.3)
Junior secondary**	55 (27.5)	28 (14)	83 (20.75)
Senior secondary	40 (20)	2 (1)	42 (10.5)
Higher	3 (1.5)	1 (0.5)	4 (1)
Sources of the food			
Own production	141 (70.5)	-	141 (35.5)
Purchase		197 (98.5)	222 (55.5)
Collected & donated	25 (12.5)	3 (1.5)	36 (9)
	33 (16.5)		

10. Bibliography of the thesis

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Appendix 01

Ethical certificate



**Ethics Review Committee
Faculty of Applied Sciences
Rajarata University of Sri Lanka**

Ethics Review Committee

Chairperson

Dr. Lalith Senarathna

Secretary

Dr.(Mrs) T. V. Sundarabarathy

Committee members

01. Dr. Manoj S. Fernando
02. Dr. Ranjith Edirisinghe
03. Dr. Naleen Jayarathna
04. Dr. Kaushalya Premachandra
06. Dr. Kanishka Ukuwela
07. Mr. Ravendra Jayarathna
08. Mr. Ranjan Dissanayake
09. Ms Parween Reyah
10. Ms.T. Irugalbandara
11. Mr. Chamil Senevirathna
12. Ms. Anupama Gunathilake

Contact:

Telephone: +9425-2266131

Fax: - 025-2266130

Email: : ethics@as.rjt.ac.lk

Web: www.rjt.ac.lk/aps/

Mailing Address:

Faculty of Applied Sciences,
Rajarata University
Mihintale
50300
Sri Lanka.

18th November 2019

Ref: ERC/09/19

Dear Prof. G.A.S. Ginigaddara

Ethical Clearance for the research “Food System Commercialization, Hidden Hunger and Malnutrition: a study of nutritional governance and food culture in Sri Lanka after the Green Revolution.”.

The Ethical Review Committee (ERC) of the Faculty of Applied Science of Rajarata University of Sri Lanka reviewed the application for above titled study and the committee discussed reviewers comments during the committee meetings held on the 30th October 2019 . Based on the recommendations from the reviewers the Ethics Review Committee decided to approve the referenced protocol subject to the following conditions:-

- This certificate is valid until 30.10.2020, when an extension is required; Protocol Extension Submission Form should be submitted one month before the termination date.
- The study to be conducted in compliance with the approved protocol; failing to oblige may terminate approval.
- Requests for amendment or deviations to this study protocol should be submitted. Any such amendments should not be implemented until it is reviewed and approved by the ERC
- Upon completion of the research, a final report should be submitted to the ERC of the Faculty of Applied Sciences of Rajarata University of Sri Lanka.
 - Copies of future publications result from this research should be submitted to the ERC of the Faculty of Applied Sciences of Rajarata University of Sri Lanka.

.....
Dr. Lalith Senarathna
Chairperson

Appendix 02

Consent form



Informed Consent Form

This informed consent form is for reproductive-age women (18–49 Years) and who are living in marginalized (Rural remote and urban slum areas) areas in Sri Lanka, and who we are inviting to participate in research on Dietary Diversity and Micronutrient Adequacy in marginal areas in Sri Lanka, The title of our research project is " **Food System Commercialization, Hidden Hunger and Malnutrition in Sri Lanka**"

Name of Principal Investigator: Permani Chandika Weerasekara

Supervision: 1. Prof. Dr Angelika Ploeger (Dr. agr. Dr. h.c. mult.)

2. Prof. Dr Chandana R. Withanachchi

3. Prof. Dr. G.A.S. Ginigaddara

Name of Institutions: University of Kassel, Germany

Rajarata University of Sri Lanka

Name of Sponsors:

- Verein Zur Förderung einer natur- und sozialverträglichen Ernährungs- und Landschaftskultur e.V in Germany
- Katholische Akademische Ausländer Dienst (KAAD), Germany

Introduction

I am Permani Chandika Weerasekara. I am doing a Ph.D. degree at the University of Kassel, Germany. This research study is a part of the collaborative research project investigating food system commercialization, hidden hunger, and malnutrition in Sri Lanka. This research topic is Dietary Diversity and Micronutrient Adequacy on nutritional and health problems which are very common in this country and this region. I am going to give you the information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research.

This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or another researcher.

Purpose of the research

Malnutrition and micronutrient deficiencies are big problems in your community. This may lead to unhealthy eating patterns and low-quality food intake. We believe reproductive-aged women are the most vulnerable to these problems. We want to find ways to stop this from happening. We believe that you can help us by telling us what you know both about the dietary practice and eating patterns and health problems in your region. We want to learn the diversity of food and food patterns in your region. We want to learn about health and nutrition situation, food security, agrobiodiversity, healthier lifestyle, and micronutrient adequacy in your region. We also want to know more about Local food practices because this might help us to learn how to better control nutrition problems in this community.

Type of Research Intervention

The research will consist of two phases. In the first phase validated demographic and socio-economic characteristics will be used to gather information. In this phase, we will collect anthropometric measurements as well as will be asked a health condition in the last 7 days.

We will collect anthropometric measurements using a stadiometer and electronic weighing scale. Height will estimate the nearest centimetre. For this, you have to wear light clothes and remove shoes. In the second phase, the

dietary diversity will be evaluated using a standardized 24h open recall and list-based method assumed from FAO. In this phase, you will be asked to record your dietary intake for the second visit, and you have to remember or noted all food and drinks consumed the last 24hrs. We will introduce in the first visit how to remember 24 h recall and will provide all the details and measures. 24 h recall Interviews will be recorded on a voice recorder and separately will be filling MDD-W questionnaires.

Participant Selection

You are being invited to take part in this research because we feel that your experience as a responsible citizen can contribute much to the food and nutrition security in Sri Lanka.

Voluntary Participation and Confidentiality

Your participation in this research is entirely voluntary. Please note that the responses you provide are completely anonymous and confidential. The research outcome and report will not include the reference to any individuals. All information gathered is solely for research purposes and the research is conducted for the completion of doctoral research. You may change your mind later and stop participating even if you agreed earlier.

Benefits

This study will provide a better understanding of the determinants of dietary behaviour and valuable information on planning programs to prevent the risk in your region. This study will empower the Sri Lankan agriculture and food system by moving towards sustainability.

Costs or Payments

There will be no costs involved in taking part in this research study. No participant will receive any payment to participate in this research project.

Duration

The research takes place over 2 days/ or 3 days in total. During that time, we will visit you 2 times for interviewing you and each interview will last for about one hour each.

Certificate of Consent

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked to have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of Participant _____

Signature of Participant _____

Date _____
Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

- 1.
- 2.
- 3.

I confirm that the participant was allowed to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Researcher/person taking the consent _____

Signature of Researcher /person taking the consent _____

Date _____
Day/month/year

Appendix 03

Field questionnaire 1

U N I K A S S E L | O R G A N I C
V E R S I T Ä T | A G R I C U L T U R A L
S C I E N C E S



Understanding the Components of Hidden Hunger in Two Different Marginalized Social Settlement (Urban Slum and War-Tone Border Village) In Sri Lanka: As a Matter of Food Culture

SECTION A; GENERAL INFORMATION

1. Interview number.....
2. Village
3. Sex.....
4. Age:
5. Marital status:
6. Number of people in the family:
7. How many children under 18 years of age are living in your household?.....
None
8. How many of those are 5 and under?.....
None-----
9. Job.....
10. Monthly income.....

SECTION B: Educational level

9. Have you ever attended school? Yes No

If yes, continue asking:

- 9.1 What is the highest level of school you attended?

Primary school

Secondary school

Higher.....

SECTION C: physical examination

10. Body Weight.....
11. Height.....
12. Body Mass Index.....
13. Do your family members have any problem with undernutrition?

YES NO

IF YES What.....

SECTION D-Eating habits

There are no right or wrong answers to the questionnaire please put a capital 'X' in the space provided

14. Do you think that the traditional diet of your home region is.....

- i. healthy
- ii. unhealthy

In the past, the main staple food items in my home region were... (list below)

15. Do you think that the majority of people in Sri Lanka still eat the traditional Sri Lankan diet?

- I. Yes
- II. No

16. Have any members of your family suffered from an eating disorder?

- I. Yes
- II. No

17. Are you satisfied with your eating patterns?

- I. Yes
- II. No

18. How often do you eat fried food?

- I. Daily __
- II. 1-3 times a week__
- III. Less than once a week __
- IV. Never__

19. What type of milk do you use most often?

- I. None__
- II. Skimmed__
- III. Full fat__
- IV. Soya__
- V. Other_____

20. How often do you add salt to food when cooking?

- i. Usually__
- ii. Sometimes_____
- iii. Rarely__
- iv. Never__

21. What do you eat for breakfast most days?

- i. High fibre cereal__
- ii. Rice & curry__
- iii. Bread __
- iv. Eggs__
- v. Fruit__
- vi. Yoghurt_____
- vii. Nothing_____
- viii. Other_____

22. What do you usually eat for your main meal of the day?

- i. Meat / fish / chicken / vegetarian option__
- ii. Rice dish__
- iii. Other_____

23. How often do you eat fruit and vegetables?

- i. Daily__

- ii. 2/3 times a day___
- iii. 5 times a day___
- iv. Sometimes___
- v. Never__

19. How often do you eat snacks between meals?

- I. Never___
- II. 2/3 times a week___
- III. Daily___
- IV. 2/3 times daily___

20. How many times a week do you eat fast food / takeaways?

- i. Never___
- ii. 2/3 times a week___
- iii. 5/6 times a week___
- iv. daily___

21. How often do you eat bread / wheat?

- i. Never___
- ii. 1/2 times a day___
- iii. 3/4 times a day___
- iv. 5/6 times a day___

22. How often do you consume dairy products (milk, yoghurt, cheese)?

- i. Never___
- ii. 1/2 times a day___
- iii. 3/4 times a day___

23. How well do you know the guidelines of Food Pyramid?

- i. Very well___
- ii. Fairly well___
- iii. Not well___
- iv. Never heard of it___

24. How often do you eat fried food away from home?(e.g., french fries, fried chicken, fried fish)

- i. Less than once a week
- ii. 1-3 times per week
- iii. 4-6 times per week
- iv. Daily
- v. None

25. How many teaspoons of sugar do you add to your beverages or food each day?.....

- I. 3-4
- II. 4-5
- III. 5-6
- IV. 6-8
- V. 8-10
- VI. More

26. How often does a member of your household:

a. Compliment your attempts to eat a healthy diet?

- I. Often
- II. Sometimes
- III. Seldom
- IV. Never

27. Do you skip any meals more than once a week? Select all that apply, why?.....

- i. Breakfast
- ii. Lunch
- iii. Dinner
- iv. Usually, I do not skip meals

Section D-Nutrition-related questionnaires

Food habits questionnaire

28. Do you currently follow a special diet?

- i. Yes
- ii. No
- a. If yes, for how many years?
- b. If yes, what kind of diet do you follow? (Select more than one if necessary.)
 - i. Weight reduction (low calorie)
 - ii. Diabetic
 - iii. Low cholesterol
 - iv. Low fat
 - v. High potassium
 - vi. Low sodium
 - vii. Other.....

29. How much do you agree or disagree with the following statements?

Agree Disagree

- i. I can't get vegetables in restaurants
- ii. Members of my household won't eat vegetables
- iii. The fruit is available where I work
- iv. I like most vegetables
- v. I don't like fruit
- vi. I think vegetables are expensive
- vii. I don't have time to prepare vegetables
- viii. I usually keep fruit at home
- ix. I usually buy lots of vegetables
- x. I can't afford to buy fruit
- xi. I can't buy vegetables where I work

29. What type of diet you prefer?

- I. traditional Sri Lankan diet
- II. Chinese diet
- III. western diet
- IV. Indian diet
- V. Other _____

30. Where do you use to buy food (you can choose more than one answer)

- I. on markets
- II. in supermarkets
- III. in small shops
- IV. in organic food shops
- V. in the home garden
- VI. other _____

31. What type of food do you preferentially buy (you can choose more than one answer)

- I. Pre-cooked foods
- II. fresh foods
- III. frozen foods
- IV. canned foods
- V. other _____

32. What are you usually doing while you are eating?

Please select all that apply:

- I. Sitting
- II. Standing

- III. Walking
- IV. Watching TV
- V. Reading
- VI. Working
- VII. Driving

33. Do you have a home garden?

- I. yes
- II. No

IF YES what are you growing

.....

If not,

why.....

.....

34. Is diet high in fat related to high blood cholesterol?

- I. yes
- II. No

35. Is diet low in iron-related to anaemia?

- I. yes
- II. No

36. Do You know food pyramid

- I. yes
- II. No

37. Do you know balanced diet

- I. yes
- II. No

38. Remarks.....

Appendix 04

Field questionnaire 1 (Sinhala version)

U N I K A S S E L | **ORGANIC**
V E R S I T A T | **AGRICULTURAL**
S C I E N C E S



ආහාර ගැනීමේ හැසිරීම, පෝෂණ දැනුම ආකල්ප හා ආහාර ගැනීමේ පුරුදු සහ ශ්‍රී ලංකාවේ ප්‍රජනක වයසේ කාන්තාවන් අතර පෝෂණ තත්ත්වය කෙරෙහි බලපෑම.

කොටස A; සාමාන්‍යය තොරතුරු

1. සම්මුඛ පරීක්ෂණ අංකය
 1. ගම
2. ස්ත්‍රී පුරුෂභාවය.....
3. වයස:
4. විවාහක අවිවාහකබව:
5. පවුලේ සාමාජිකයන් ගණන:
6. දරුවන් ගණන.....
7. රැකියාව.....
8. ආදායම.....

කොටස B: අධ්‍යාපන මට්ටම

9. ඔබ කවදා හෝ පාසැල් ගොස් තිබේද? ඔව් නැත
- ඔව් නම්, දිගටම විමසන්න:
- 9.1 ඔබ ඉගෙන ගත් ඉහළම අධ්‍යාපන මට්ටම කුමක්ද??
- ප්‍රාථමික
- ද්විතියික
- උසස්

කොටස C: ශාරීරික පරීක්ෂණය

10. ශරීර බර.....
 11. උස
 12. ශරීර ස්කන්ධ දර්ශකය
 13. ඔබගේ පවුලේ සාමාජිකයින්ට පෝෂණය පිළිබඳ ගැටලුවක් තිබේද?
- ඔව් නැත
- ඔව් නම්

කොටස D-ආහාර පුරුදු

14. ඔබේ නිවසේ කලාපයේ සාම්ප්‍රදායික ආහාර ගැනීම තවමත් අනුභව කරන්නනෙ යැයි ඔබ සිතනවාද?
- I. ඔව්
- II. නැත
15. ශ්‍රී ලංකාවේ බහුතරයක් දෙනා තවමත් සාම්ප්‍රදායික ශ්‍රී ලාංකික ආහාර අනුභව කරන බව ඔබ සිතනවාද?
- I. ඔව්
- II. නැත
- III.
16. ඔබේ ආහාර රටාවන් ගැන ඔබ සැහීමකට පත්වේද?
- IV. ඔව්
- V. නොමැත
17. ඔබ කොපමණ වාරයක් බැඳපු ආහාර අනුභව කරනවාද?
- I. දිනපතා __
- II. සතියකට 1-3 වතාවක් __
- III. සතියකට වරක් අඩු __
- IV. නැත __
19. ඔබ බොහෝ විට භාවිතා කරන්නේ කුමන වර්ගයේ කිරිද?

- I. කිසිවක් නැත ___
 - II. සම්පූර්ණ මේදය ___
 - III. සෝයා ___
 - IV. වෙනත් _____
20. පිසීමේදී ඔබ කොපමණ වාරයක් ආහාරයට ලුණු එකතු කරනවාද?
- I. දිනපතා ___
 - II. සමහර විට _____
 - III. කලාතුරකින් ___
 - IV. කවදාවත් නැත ___
21. බොහෝ දිනවල ඔබ උදේ ආහාරය සඳහා කන්නේ මොනවාද?
- I. ඉහළ තන්තු ධාන්ය ___
 - II. සහල් සහ ව්‍යංජන ___
 - III. පාන් ___
 - IV. බිත්තර ___
 - V. පළතුරු ___
 - VI. යෝගට්
 - VII. කිසිවක් නැත _____
 - VIII. වෙනත් _____
22. ඔබේ දවසේ ප්‍රධාන ආහාරය සඳහා ඔබ සාමාන්‍යයෙන් කන්නේ මොනවාද?
- I. මස් / මාළු / කුකුල් මස් / නිර්මාංශ විකල්පය
 - II. බත් සහ ව්‍යංජන
 - III. වෙනත් _____
23. ඔබ කොපමණ වාරයක් පළතුරු සහ එළවළු අනුභව කරනවාද?
- I. දිනපතා ___
 - II. දිනකට 2/3 වතාවක් ___
 - III. දිනකට 5 වතාවක් ___
 - IV. සමහර විට _____
 - V. කිසි විටෙකත් නැත ___
24. ඔබ කොපමණ වාරයක් ආහාර වේලේ අතර සුලු ආහාර අනුභව කරනවාද?
- I. කවදාවත් නැත ___
 - II. සතියකට 2/3 වතාවක් ___
 - III. දිනපතා ___
 - IV. දිනකට 2/3 වතාවක් ___
25. ඔබ සතියකට කී වතාවක් ක්ෂණික ආහාර අනුභව කරනවාද?
- I. කවදාවත් නැත ___
 - II. සතියකට 2/3 වතාවක් ___
 - III. සතියකට 5/6 වතාවක් ___
 - IV. දිනපතා ___
21. ඔබ කොපමණ වාරයක් පාන් / තිරිඟු අනුභව කරනවාද?
- I. කවදාවත් නැත ___
 - II. සතියකට 2/3 වතාවක් ___
 - III. සතියකට 5/6 වතාවක් ___
 - IV. දිනපතා ___
22. ඔබ කිරි නිෂ්පාදන (කිරි, යෝගට්, චීස්) කොපමණ වාරයක් පරිභෝජනය කරනවාද?
- I. කවදාවත් නැත ___
 - II. සතියකට 2/3 වතාවක් ___
 - III. සතියකට 5/6 වතාවක් ___
 - IV. දිනපතා ___
23. ආහාර පිරමීඩයේ පලිබදව ඔබ දන්නේද?
- I. නැත _____
 - II. ඔව්
 - III. තරමක් දනිමි
24. ඔබ නිවසින් බැහැරව බැඳපු ආහාර කොපමණ වාරයක් අනුභව කරනවාද? (උදා: ප්‍රංශ ෆ්‍රයිස්, ෆ්‍රයිඩ් චිකන්, ෆ්‍රයිඩ් මාළු)
- I. සතියකට වරක්
 - II. සතියකට 1-3 වතාවක්
 - III. සතියකට 4-6 වතාවක්

- IV. දිනපතා
- V. නැත

25. ඔබ දිනකට සීනි තේ හැඳි කීයක් ඔබේ බීම හෝ ආහාර වලට එකතු කරනවාද?

- I. 1-2
- II. 3-4
- III. 4-5
- IV. 5-6
- V. 6-8
- I. 8-10

26. ඔබේ නිවසේ සාමාජිකයෙක් කොපමණ වාරයක්:සෞඛ්‍ය සම්පන්න ආහාර වේලක් ගැනීමට උත්සාහය කරන්නේද?

- I. බොහෝ විට
- II. සමහර විට
- III. කලාතුරකින්
- IV. කවදාවත් නැත

27. ඔබ සතියකට එක් වතාවකට වඩා ආහාර වේලේ මහඟරිනවාද? අදාළ වන සියල්ල තෝරන්න, ඇයි?

- I. උදෑසන ආහාරය
- II. දිවා ආහාරය
- III. රාත්‍රී ආහාරය
- IV. සාමාන්‍යයෙන් මම ආහාර ගැනීම අතපසු නොකරමි
- V.

D කොටස පෝෂණය හා සම්බන්ධ ප්‍රශ්නාවලිය

28. ඔබ දැනට විශේෂ ආහාර වේලක් අනුගමනය කරනවාද?

- I. ඔව්
 - II. නොමැත
- ඔව් නම්, අවුරුදු කීයක්ද?

ඔව් නම්, ඔබ අනුගමනය කරන්නේ කුමන ආකාරයේ ආහාරයක්ද? (අවශ්‍ය නම් එකකට වඩා තෝරන්න.)

- I. බර අඩු කිරීම (අඩු කැලරි)
- II. දියවැඩියා
- III. අඩු කොලෙස්ටරෝල්
- IV. මේදය අඩු
- V. ඉහළ පොටෑසියම්
- VI. අඩු සෝඩියම්
- VII. වෙනත්.....

29. පහත දැක්වෙන ප්‍රකාශ සමඟ ඔබ කොපමණ එකඟද?

- | | | |
|------|--|---------|
| | එකඟයි | එකඟනොවේ |
| i. | ii. මගේ පවුලේ සාමාජිකයන් එළවළු කන්නේ නැත | |
| ii. | මා වැඩ කරන තැන පලතුරු ලබා ගත හැකිය | |
| iii. | මම බොහෝ එළවළු වලට කැමතියි | |
| iv. | මම පලතුරු වලට කැමති නැත | |
| | VI. මම හිතන්නේ එළවළු මිල අධිකයි | |
| | VII. මට එළවළු සකස් කිරීමට වෙලාවක් නැත | |
| | VIII. මම සාමාන්‍යයෙන් ගෙදර පලතුරු තබමි | |
| | IX. මම සාමාන්‍යයෙන් එළවළු ගොඩක් මිලදී ගන්නවා | |
| | X. මට පලතුරු මිලදී ගැනීමට දරාගත නොහැක | |
| | XI. මට වැඩ කරන තැන එළවළු මිලදී ගත නොහැක | |

30. ඔබ කැමති ආහාර වර්ග මොනවාද?

- i. සාම්ප්‍රදායික ශ්‍රී ලංකා ආහාර වේලක්
- ii. චීන ආහාර
- iii. බටහිර ආහාර
- iv. ඉන්දියානු ආහාර
- v. වෙනත් _____

31. ආහාර මිලදී ගන්නේ කොතැනින්ද (ඔබට පිළිතුරු එකකට වඩා තෝරා ගත හැකිය)

- I. වෙළඳපොලවල්
- II. සුපිරි වෙළඳසැල් වල
- III. කුඩා සාප්පු වල
- IV. කාබනික ආහාර සාප්පු වල
- V. ගෙවත්තේ

i. වෙනත් _____

32 බ කැමති කුමන වර්ගයේ ආහාරද? (ඔබට පිළිතුරු එකකට වඩා තෝරා ගත හැකිය)

- I. පෙර පිසූ ආහාර
- II. නැවුම් ආහාර
- III. ශීත කළ ආහාර
- IV. ටින් කළ ආහාර
- V. වෙනත් _____

33 ඔබ ආහාර ගන්නා අතරතුර සාමාන්‍යයෙන් කරන්නේ කුමක්ද?

කරුණාකර අදාළ වන සියල්ල තෝරන්න:

- I. වාඩි වීම
- II. ස්ථාවර
- III. ඇවිදීම
- IV. ටීව් එක බලමින්
- V. කියවීම
- VI. වැඩ
- VII. රිය පැදවීම

කොටස D දැනුම සම්බන්ධ

34. අධික මේද සහිත ආහාර අධික රුධිර කොලෙස්ටරෝල් හා සම්බන්ධද?

- I. ඔව්
- II. නොමැත

35. යකඩ අඩු ආහාර රක්තභීතතාවයට සම්බන්ධද?

- I. ඔව්
- II. නොමැත

36. ඔබ ආහාර පිරමිඩය දන්නවාද?

- I. ඔව්
- II. නොමැත

37. සමබර ආහාර වේලක් ඔබ දන්නවාද?

38. ඔබට ගෙවත්තක් තිබේද?

- I. ඔව්
- II. නොමැත

ඔව් නම් ඔබ වගා කරන්නේ මොනවාද?

එසේ නොවේ නම්, ඇයි

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43. වෙනත්

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A: Foods made from grains

These foods provide energy, varying amounts of micronutrients (e.g. certain B vitamins provided by grains) and varying amounts of anti-nutrients, such as phytates

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
Rice	<i>Oryza sativa</i>	Poaceae	Seed
Millet (Meneri)	<i>Pennisetum typhoides</i>	Poaceae	Seed
Finger millet	<i>Eleusine coracana</i>	Poaceae	seed
Urad dal (Whole) / Ulundhu	<i>Vigna mungo</i>	Fabaceae	seed
Sesame	<i>Sesamum indicum</i>	Pedaliaceae	seed
Corn (maize)	<i>Zea mays</i>	Poaceae	Seed
Sorghum	<i>Sorghum bicolor</i>	Poaceae	seed
Barley	<i>Hordeum vulgare</i>	Poaceae	Seed
Thana haal (Fox tail millet)	<i>Setaria italica</i>	poaceae	Seed
Water lily seed	<i>Nymphaea odorata</i>	Nymphaea:	seed

B: White roots and tubers and plantains

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
Bananas (green/unripe)	<i>Musa</i>	Musaceae	Starchy fruit
Breadfruit	<i>Artocarpus</i>	Moraceae	Starchy fruit
Cassava (yuca, manioc, mandioca)	<i>Manihot esculentum</i>	Euphorbiaceae	Tuberous root
dandinnala	Tuberous root	Dioscoreaceae	Tuberous root
goonala	<i>Dioscorea spicata</i>	Dioscorea ceae	Tuberous root
iniala	<i>Dioscorea alata</i>	Dioscorea ceae	Tuberous root
jackfruit	<i>Artocarpus heterophyllus</i>	Moraceae	Starchy fruit
Katu ala	<i>Dioscorea pentaphylla</i>	Dioscoreaceae	Tuberous root
Sweet potatoes	<i>Ipomoea batatas</i>	Convolvulaceae	Tuberous root
kiriala	<i>Xanthosoma sagittifolium</i>		
Lotus root	<i>Nelumbo nucifera</i>	Nelumbonaceae	Spongy root

C: Pulses (beans, peas and lentils)

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
bean	<i>Vigna angularis</i>	Fabaceae	Mature seed
maa (long bean)	<i>Vigna subterranea</i>	Fabaceae	Mature seed
Broad bean (<i>fava bean, faba bean, horse bean, field bean, tic bean</i>)	<i>Vicia faba</i>	Fabaceae	Mature seed
Chickpea (<i>chana dal</i>)	<i>Cicer arietinum</i>	Fabaceae	Mature seed
Cluster bean (<i>guar</i>)	<i>Cyamopsis tetragonoloba</i>	Fabaceae	Mature seed
Common bean (<i>black bean, kidney bean, pinto bean, others</i>)	<i>Phaseolus vulgaris</i>	Fabaceae	Mature seed
Coral bean (<i>wing bean</i>)	<i>Erythrina herbacea</i>	Fabaceae	Mature seed

Cowpea (<i>black-eyed pea, catjang, yardlong bean, southern pea, zombi pea</i>)	<i>Vigna unguiculata</i>	Fabaceae	Mature seed
Horse gram	<i>Macrotyloma uniflorum</i>	Fabaceae	Mature seed
Hyacinth bean	<i>Lablab purpureus</i>	Fabaceae	Mature seed
Jack bean	<i>Canavalia</i>	Fabaceae	Mature seed
Lentil (<i>dal, pulses</i>)	<i>Lens culinaris</i>	Fabaceae	Mature seed
Lima bean	<i>Phaseolus limensis</i>	Fabaceae	Mature seed
Lupin (<i>lupini, tarwi, tarhui, chocho</i>)	<i>Lupinus sp.</i>	Fabaceae	Mature seed
Moth bean	<i>Vigna aconitifolia</i>	Fabaceae	Mature seed
Mung bean (<i>green gram</i>)	<i>Vigna radiata</i>	Fabaceae	Mature seed
Pea	<i>Pisum sativum</i>	Fabaceae	Mature seed
Soybean (<i>soya bean</i>)	<i>Glycine max</i>	Fabaceae	Mature seed
Sweet pea	<i>Lathyrus odoratus</i>	Fabaceae	Mature seed
Urad bean (<i>black gram</i>)	<i>Vigna mungo</i>	Fabaceae	Mature seed
Velvet bean (<i>cowitch</i>)	<i>Mucuna pruriens</i>	Fabaceae	Mature seed
Winged bean (<i>Goa bean</i>)	<i>Psophocarpus tetragonolobus</i>	Fabaceae	Mature seed

D: Nuts and seeds

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
Peanut/groundnut	<i>Arachis hypogaea</i>	Fabaceae Pod	seed
Tree nuts			
Kaju (Cashew)	<i>Anacardium occidentale</i>	Anacardium	Nut
Kottamba(country-almond)	<i>Terminalia catappa</i>	Combretaceae	nut
Seed			
Jack seed	<i>Artocarpus heterophyllus</i>	Moraceae	seed
Sesame seed	<i>Sesamum indicum</i>	Pedaliaceae	Seed
Uluhal (Fenugreek)	<i>Trigonella foenum-graecum</i>	Fabaceae	seed
lotus seed	<i>Nelumbo nucifera</i>	Nelumbo	seed

Dark green leafy vegetables

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
Thampalaa (Amaranth greens)	<i>Amaranthus</i>	Amaranthaceae	Leave
Nivithi (spinach)	<i>Basella alba</i>	Basellaceae	leave
Sarana (Horse Purslane)	<i>Trianthema portulacastrum</i>	Aizoaceae	leave
Man(g)nokka (Manioc leaves)	<i>Maniot esculenta</i>	Euphorbiaceae	leave
Kathurunga (vegetable hummingbird)	<i>Sesbania grandiflora</i>	Fabaceae	leave
Kiri Anguna (Green milkweed climber)	<i>Wattakaka volubilis</i>	Asclepiadaceae	leave
Mukunuvanna (<i>Alternanthera sessilis</i>)	<i>Alternanthera sessilis</i>	Amaranthaceae	leave
Kankung (Water spinach)	<i>Ipomoea aquatica</i>	Convolvulaceae	leave

Gotukola (Centella asiatica)	Centella asiatica	Apiaceae	leave
Welpenela (balloon plant)	Cardiospermum halicacabum	Sapindaceae	leave
Kirihanda (plumed cockscomb)	Celosia argentea	Amaranthaceae	leave
Wattakka(pumkin)	cucurbita maxima	Cucurbitaceae	leave
Kohila (Lasia)	Lasia spinosa	Araceae	leave
Japan batu / Mella dumkola / Singappuru kola	Sauropus androgynus	Euphorbiaceae	leave
Elabatu (Egg plant)	Solanum melongena	Solanaceae	leave
Thebu (Crepe Ginger)	Costus speciosus		leave
Koppa (Shield Aralia)	Polyscias scutellaria		leave
Akkapana (Air Plant)	Kalanchoe pinnata		leave
Passion Fruit Leaves	Passiflora edulis		leave
Genda (Purslane)	Portulaca oleracea		leave
Thumba (Ceylon Slitwort)	Leucas zeylanica		leave
Kurigngnan leaves			
Kowakka (Ivy gourd)	Coccinia grandis	CUCURBITACEAE	leave
Monarakudumbiya	Vernonia cinerea	ASTERACEAE	leave
Mustard greens	Sinapsis alba	Brassicaceae	leave
Drumstick greens (moringa)	Moringa oleifera	Moringaceae	leave
Cowpea greens	Vigna unguiculata	Papilionaceae	leave
Beetroot	Beta vulgaris		leave
Radishes	Raphanus raphanistrum subsp. sativus	Brassicaceae	leave

Vitamin A-rich vegetables, roots and tubers

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
Carrot	Daucus carota	Umbelliferae	Tuberous root
Pumpkin	Cucurbita pepo	Cucurbitaceae	fruit
Carrot	Daucus carota	Umbelliferae	Tuberous root
Sweet potato (orange- or dark yellow-fleshed only)	Ipomoea batatas	Convolvulaceae	Tuberous root

Vitamin A-rich fruits

Common name (regional common names)	Binomial name OR genus	Family	Edible part of the plant
Mango (ripe, fresh and dried)	Mangifera indica	Anacardiaceae	Fruit
Papaya (ripe, fresh and dried)	Carica papaya	Caricaceae	Fruit
Passion fruit (ripe)	Passiflora edulis	Passifloraceae	Fruit
Laulu (Canistel)	Scientific classification	Sapotaceae	fruit
Beli (golden apple)	Aegle marmelos	Rutaceae	fruit

Appendix 06

Field questionnaire 2 (Sinhala version)



ශ්‍රී ලංකාවේ ආන්තික ප්‍රදේශවල ක්ෂුද්‍ර පෝෂක ප්‍රමාණවත් බව සහ ආහාර අනාරක්ෂිතතාවය අධ්‍යයනය කිරීම: ප්‍රජනක වයසේ කාන්තාවන්ගේ අවම ආහාර විවිධත්වය මැනීම

ඔබ සපයන ප්‍රතිචාර සම්පූර්ණයෙන්ම නිර්නාමික සහ රහස්‍ය බව කරුණාවෙන් සලකන්න. ඔබ සපයන තොරතුරු පර්යේෂණ වාර්තාවක් හෝ ප්‍රකාශන සඳහා යොදා ගත හැකි වුවද එයින් කිසිසේත්ම ඔබව හඳුනා ගත නොහැක. සපයන ලද තොරතුරු වල රහස්‍යභාවය පිළිබඳ මූලික පරීක්ෂකයන් වගකියනු ඇත.

සම්මුඛ පරීක්ෂණ අංකය: වයස: දිනය: සතියේ දිනය:

	ආහාර කාණ්ඩ	අනුවර්තනය කළ යුතු විස්තරය	පරිභෝජනය බව = 1 නැත = 0
A	ධාන්‍ය වලින් සාදන ලද ආහාර	සහල්, කැඳ, පාන්, නුඩල්ස්, නූල් ආප්ප (නිරිඟු හෝ සහල් පිටි වලින් සාදන ලද), පිට්ටු හෝ ධාන්‍ය වලින් සාදන ලද වෙනත් ආහාර	
B	මුල් වර්ග අල වර්ග සහ කෙසෙල්	අර්තාපල්, සුදු අල, මඤ්ඤොක්කා, බතල, දේශීය අල වර්ග, මදුළු සහිත මුල් හෝ බීජ අල වලින් සාදන ලද වෙනත් ආහාර හෝ කෙසෙල්	
C	මාංශ හෝග (බෝංචි, කඩල සහ පරිප්පු)	මේරු බෝංචි හෝ ඇට (නැවුම් හෝ වියලූ බීජ), පරිප්පු හෝ බෝංචි / කවිපි නිෂ්පාදන, ටෝෆු සහ ටෙම්පේ ඇතුළු	
D	ඇට වර්ග සහ බීජ	ආහාරයට ගත හැකි ශාකමය ඇට වර්ග, රටකපු හෝ සමාන බීජ වර්ග, ඒවායින් සාදාගන්නා "බටර්" හෝ ජේස්ට්	
E	කිරි සහ කිරි නිෂ්පාදන	කිරි, යෝගට් හෝ වෙනත් කිරි නිෂ්පාදන නමුත් බටර්, අයිස්ක්‍රීම්, ක්‍රීම් හෝ ඇඹුල් ක්‍රීම් ඇතුළත් නොවේ	
F	පෝෂණීය සත්ව ඉන්ද්‍රිය මස්	අක්මාව, වකුගඩු, හෘදය හෝ වෙනත් ඉන්ද්‍රිය මස් හෝ දඩ මස් ඇතුළුව රුධිරය පදනම් කරගත් ආහාර	
G	මස් සහ කුකුළු මස්	හරක් මස්, උතුරුමස්, එළු, හා, දඩ මස්, කුකුල් මස්, තාරා හෝ වෙනත් කුරුල්ලන්ගේ මස්	
H	මාළු සහ මුහුදු ආහාර	නැවුම් හෝ වියලි මාළු, බෙල්ලන් හෝ මුහුදු ආහාර	
I	බිත්තර	කුකුළු බිත්තර	
J	තද කොළ පැහැති එළවළු	තද කොළ පැහැති එළවළු, කැලෑ කොළ වර්ග	
K	විටමින් A බහුල එළවළු, මුල් සහ අල	ඇතුළත කහ හෝ තැඹිලි පාට එළවළු වට්ටක්කා, කැරට්, බතල	
L	විටමින් A පොහොසත් පලතුරු	ඇතුළත කහ හෝ තැඹිලි ඉදුණු අඹ, ඉදුණු පැපෝල්	
M	වෙනත් එළවළු	අනෙකුත් එළවළු වර්ග සඳහා උදාහරණ ලැයිස්තුගත කරන්න	
N	වෙනත් පලතුරු	වෙනත් පලතුරු සඳහා උදාහරණ ලැයිස්තුගත කරන්න	

	ආහාර කාණ්ඩ	අනුවර්තනය කළ යුතු විස්තරය සහ පහත උදාහරණ ආහාර සමීක්ෂණ ප්‍රදේශය තුළ බහුලව පරිභෝජනය කරන අයිතම සමඟ ආදේශ කරන්න.	පරිභෝජනය ඔව් = 1 නැත = 0
O	පොල් තෙල්	පොල් තෙල්	
P	වෙනත් තෙල් හා මේද	ගෙඩි, පලතුරු සහ බීජ වලින් ලබාගත් තෙල් ද ඇතුළුව ආහාර සඳහා එකතු කරන ලද හෝ පිසීමට භාවිතා කරන මේද හෝ බටර්;	
Q	පැණි රස නොවන කෙටි රස කෑම සහ බැදපු කෑම	හැපෙනසුළු හා විජස්, බැදපු ඇතු හෝ වෙනත් බැදපු කෑම	
R	රසකැවිලි	වොකලට් වර්ග පැණි රස බිස්කට් සහ කේක්, පැණිරස ජේස්ට්‍රි හෝ අයිස්ක්‍රීම් වැනි සීනි සහිත කෑම වර්ග	
S	පැණිරස බීම වර්ග	පැණිරස බීම වර්ග සහ සිසිල් බීම / රසවත් බීම, වොකලට් බීම, මෝල්ට් බීම, යෝගට් බීම හෝ සීනි සමඟ පැණිරස තේ හෝ කෝපි	
Required			
T	කුළුබඩු සහ ආහාරයට රසය එකතු කිරීම සඳහා භාවිතා කරන ද්‍රව්‍යය	මිරිස්, කුළුබඩු, ඖෂධ පැළෑටි, මාළු කුඩු, තක්කාලි ජේස්ට්‍රි, රසයන් සඳහා භාවිතා කරන කුඩා ප්‍රමාණයේ අමුද්‍රව්‍ය	
U	වෙනත් බීම සහ ආහාර	සීනි රහිත තේ හෝ කෝපි සහ වෙනත් බීම වර්ග	

Appendix 07

Field questionnaire 3

**U N I K A S S E L
V E R S I T Ä T**



Micronutrient Adequacy and Food Insecurity in marginal areas in Sri Lanka: 24-hour Diet and Activity Recall Form

Interview number:

Name of the interviewer:

Please note that the responses you provide are completely anonymous and confidential. The research outcome and report will not include reference to any individuals. All information gathered is solely for research purposes and the research is conducted for the completion of doctoral research

- Complete this from accurately as possible, using the examples as a guide.
- Use only one form per day. Do not put anything on this form that pertains that another day
- Record all foods and beverages, including water, consumed from the time wake up to the time go to bed

Basic information

Date:.....Age.....Family members:.....

Village;.....Income:.....

Is this typical day: yes No:

Time	Food and beverage consumed	Type	Quantity/amount of consumed	Method of preparation and brand name	Where consumed?
Ex: 6.00 a.m.	Milk	1.5 % fat	200 ml	Hot, fresh milk highland	At home, in front of the Tv

Appendix 08

Field questionnaire 3 (Sinhala version)

**U N I K A S S E L
V E R S I T Ä T**



ශ්‍රී ලංකාවේ ආන්තික ප්‍රදේශවල ක්ෂුද්‍ර පෝෂක ප්‍රමාණවත් බව සහ ආහාර අනාරක්ෂිතතාවය අධ්‍යයනය කිරීම: පැය 24 පුරා ආහාර හා ක්‍රියාකාරකම් සිහිපත් කිරීමේ ආකෘතිය

සම්මුඛ පරීක්ෂණ අංකය:

ඔබ සපයන ප්‍රතිචාර සම්පූර්ණයෙන්ම නිර්නාමික සහ රහස්‍ය බව කරුණාවෙන් සලකන්න. ඔබ සපයන තොරතුරු පර්යේෂණ වාර්තාවක් හෝ ප්‍රකාශන සඳහා යොදා ගත හැකි වුවද එයින් කිසිසේත්ම ඔබව හඳුනා ගත නොහැක. සපයන ලද තොරතුරු වල රහස්‍යභාවය පිළිබඳ මූලික පරීක්ෂකයන් වගකියනු

- මාර්ගෝපදේශයක් ලෙස උදාහරණ භාවිතා කරමින් හැකි තරම් නිවැරදිව මෙය සම්පූර්ණ කරන්න.
- දිනකට එක් පෝරමයක් පමණක් භාවිතා කරන්න. තවත් දිනකට අදාළ වන මෙම පෝරමයට කිසිවක් ඇතුළත් නොකරන්න
- උදෑසන අවදි වූ වේලාවේ සිට නින්දට යන වේලාව දක්වා පරිභෝජනය කරන ජලය ඇතුළු සියලුම ආහාර පාන වර්ග සටහන් කරන්න

මූලික තොරතුරු

දිනය:..... වයස..... පවුල් සාමාජිකයන්.....

ගම:.....

ආදායම:.....

මෙය සාමාන්‍ය දිනයද: ඔව් නැත

වේලාව	පරිභෝජනය කරන ලද ආහාර හා පාන වර්ග	වර්ගය	පරිභෝජනය කළ ප්‍රමාණය	සකස් කිරීමේ ක්‍රමය සහ වෙළඳ නාමය	පරිභෝජනය කළ ස්ථානය
උදාහරණ 6.00 a.m.	කිරි	1.5 % මේදය	200 ml	උණුසුම්, නැවුම් කිරි highland	නිවසේදී, ටෙලිවිෂන් ඉදිරිපිට

Appendix 09

Selected pictures from the fieldwork



01. Advising to research assistant before field work at Anuradhapura (Photo credit: Dhanushaka Disanayaka)



02. 24 hrs data recall advising to the women in Horowpathana with area midwife (Photo credit: Chathushka)



03. Advising to women in Kebithigollawa (Photo credit: Dhanushaka Disanayaka)



04. Advising to women Colombo 13 (Photo credit: Dhanushaka Disanayaka)



05. Urban kitchen in Colombo 13 (Photo credit: Dhanushaka Disanayaka)



06. Rural kitchen in Kebithigollawa (Photo credit: Dhanushaka Disanayaka)



07. Physical examination in slum area (Photo credit: Dhanushaka Disanayaka)



08. Collecting data at Colombo slum areas (Photo credit: Dhanushaka Disanayaka)



09. Recording data at Kebithigollawa (Photo credit: Dhanushaka Disanayaka)



10. Collecting data at Colombo slum areas (Photo credit: Dhanushaka Disanayaka)



11. Unsafe drainage system in urban area (Photo credit: Dhanushaka Disanayaka)



12. Poor house in rural area at Horowpathana (Photo credit: Dhanushaka Disanayaka)



13. Public pipeline in urban slum areas (Photo credit: Dhanushaka Disanayaka)



14. Data collecting at kebithigollawa with underage women (Photo credit: Nilantha)



15. Undernutrition women and her children at Horowpathana (Photo credit: permani Weerasekara)



16. Living condition in urban areas (Photo credit: Dhanushaka Disanayaka)

Appendix 10

Selected pictures of traditional food in Sri Lanka



17. Diet diversity in Sri Lanka (photo credit: srilankafoundation.org)



18. Sri Lankan traditional breakfast (Photo credit: selectsrilankabloger.blogspot.com)



19. Herbal plant of porridge in Sri Lanka (Photo credit: herbleplantsrilanka.blogspot.com)



20. Biodiverse produce and foods (Photo Credit: Biodiversity International/D. Hunter)



21. Assorted local vegetables, Sri Lanka. (Photo Credit: Bioversity International/S.Landersz)



22. Sri Lankan herbal food spices (Photo credit: serendib.btoptions.lk)



23. Traditional food serving method with banana leaves, Sri Lanka. (Photo Credit: Tom Fakler)