Project report 2019

Improving Nutrition Through Modernizing Agriculture in Sri Lanka

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Abbreviations and acronyms

ARPA	-	Agriculture Research and Product Assistant
ASC	-	Agrarian Service Centres
BMI	-	Body Mass Index
BMR	-	Basal Metabolic Rate
CKD	-	Chronic Kidney Disease
CKDU	-	Chronic Kidney Disease of Unknown Origin
CSIAP	-	Climate Smart Irrigated Agriculture Project
CVA	-	Cerebrovascular accident
CVD	-	Cardiovascular Disease
DL	-	Dyslipidaemia
DO	-	District Officer
EDO	-	Economic Development Officers
FGD	-	Focus Group Discussion
HDL	-	High Density Lipoprotein
HT	-	Hypertension
IHD	-	Ischaemic Heart Disease
INMAS	-	Improving nutrition through Modernizing Agriculture in Sri Lanka
LDL	-	Low Density Lipoprotein
MMN	-	Moderate Malnutrition
MO	-	Morbid Obesity
MS	-	Metabolic syndrome
SAFANSI	-	South Asian Food And Nutrition Security Initiative
SLGOV	-	Sri Lankan Government
WHO	-	World Health Organization

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Executive summary

Improving Nutrition through Modernizing Agriculture in Sri Lanka (INMAS) study, aimed to evaluate nutrition promotion activities through the Climate Smart Irrigated Agriculture Project (CSIAP) in three districts of Sri Lanka.

The Department of Agriculture and the Department of Agrarian Development that come under the Ministry of Agriculture, Rural Economic Affairs, Irrigation and Fisheries & Aquatic Resources Development (MOA) was identified as key implementing agencies responsible for several non- health related interventions. There are several agriculture projects to improve livelihoods of farmers and agriculture outputs in Sri Lanka implemented in collaboration with the MOA, and the CSIAP is one of the main agriculture development projects in the country. The main objectives of the project include identifying the pathways to promote nutrition and health of farmers and farming communities with multiple stakeholders. The INMAS study aimed to explore the pathways of improving nutrition and health of the community using the CSIAP project

The INMAS study measured outcomes using of quantitative and qualitative methods. First stage included development of and implementing a training program to stakeholders of the CSIAP and selected communities. A specialized team of experts used strict scientific methodology and principles of medical education to carry out a need assessment, curriculum development and implementation. It also developed a set of tools for the short term and longer term evaluation which could be used throughout the project. The qualitative component included a study to assess real-world outcome of component one.

Executive summary cont.

This report presents the outcomes of the INMAS study. The curriculum that was developed was tested in several pilot studies and further adjustments were made. The final acceptance of the final interventional tool was satisfactory. The study team was unable to administer the curriculum to staff of the CSIAP project which did not complete recruitment of its community level staff or established local project offices and staff. The study team further developed the curriculum as a self-administered workbook and recommend this to be used in training of the project staff as they recruit new staff members

The qualitative and quantitative studies revealed moderate amount of lifestyle related risk factors and nutritional problems that are compatible with similar studies carried out in Sri Lanka and regional countries. Interventions improved the knowledge and attitudes of the participants towards nutrition and lifestyle related risk factors for cardiometabolic and lifestyle related diseases. However, we recommend long term outcome measures in additional studies.

The outcomes of this project contribute to the evidence base that more local and national-level policy makers should consider health and nutritional impacts when making decisions. The study team call for intersectoral collaborations and whole of government approaches to improve nutrition and health along with agriculture and other sectors in an integrated manner, particularly in developing countries.

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Introduction and literature review

Background

Development is not merely economic development but an uplifting of overall quality of human livelihood. This includes aspects such as education, health and spiritual development. Improvements in socioeconomic status result in better health outcomes. Nutrition plays a pivotal role in good health and is determined by factors such as to food affordability, availability and dietary hobbits (Behrman, Deolalikar et al. 1988, Brug, Kremers et al. 2008). Hence it is important address the determinants or "causes of causes" (Marmot 2005) in improving nutrition of a community that will in-return influence health and human development. Development, impacts on nutrition and health both in positive and negative ways. Connecting health and development goals is challenging, particularly in the context of a country experiencing rapid changes in socioeconomic status.

Policy makers often ignore the health outcomes when targeting to achieve development indicators in the decision-making process, mainly due to lack of awareness on its impacts on nutrition. There is a consensus that increasing the availability and access to healthy food is an essential step to improve nutrition. Improvements in socioeconomic status also result in better nutritional and health outcomes. Although agriculture and development programs have a direct impact on health, policy makers do not link these in the design of policies and programs. Therefore, these different indicators are not considered in the decision-making process or results frameworks. This is the case especially in developing countries where there is a disconnect between different aspects of governments and development sectors.

Sri Lanka which earlier fell under the category of lower-income countries recently graduated to the economic status of a lower-middle-income country as the country has maintained high level of growth in the post-conflict era (Publications 2017). Nevertheless, Sri Lanka is currently undergoing demographic, epidemiological and social transition with rapid urbanization and development facing the double burden of under- nutrition and

over-nutrition with rapidly emerging non-communicable diseases (NCDs). Despite the certain development achievements and improvements in many health indicators, malnutrition, anemia and other micronutrient deficiencies prevail in the county - and there are many other nutritional challenges that require urgent attention. This, in fact, stresses on the need to integrate nutrition in future development programmes and policies.

In Sri Lanka, Ministry of Agriculture and agriculture development programs have been identified as key responsible agencies to implement several non- health related interventions. There are several agriculture projects to improve livelihoods of farmers and agriculture outputs in Sri Lanka and Climate Smart Irrigated Agriculture Project (CSIAP) is one of the main agriculture development projects in the country.

Improving Nutrition through Modernizing Agriculture in Sri Lanka (INMAS) study aims to implement and evaluate nutrition promotion activities through the CSIAP in two districts of Sri Lanka. The main objectives of the project include identifying the pathways to promote nutrition and health of farmers and farming communities with multiple stakeholders. Also this project aims to explore the pathways of improving nutrition and health using the CSIAP project, and quantifying their relative contributions on food and nutrition security related outcomes. It is believed that these agriculture programs have an impact on multiple health related behaviors and outcomes, in this study we focus on for nutritional outcomes, but include several others which main concerns for farming communities in these areas.

Conceptual framework

Nutrition like most other health parameters are influenced by many factors. The roles of social, economical and cultural determinants are in fact more prominent in malnutrition than other health outcomes. This is explained in the following conceptual framework (figure 1) proposed by the United Nations International Emergency Children's' Fund (UNICEF) (Black, Laxminarayan et al. 2016).

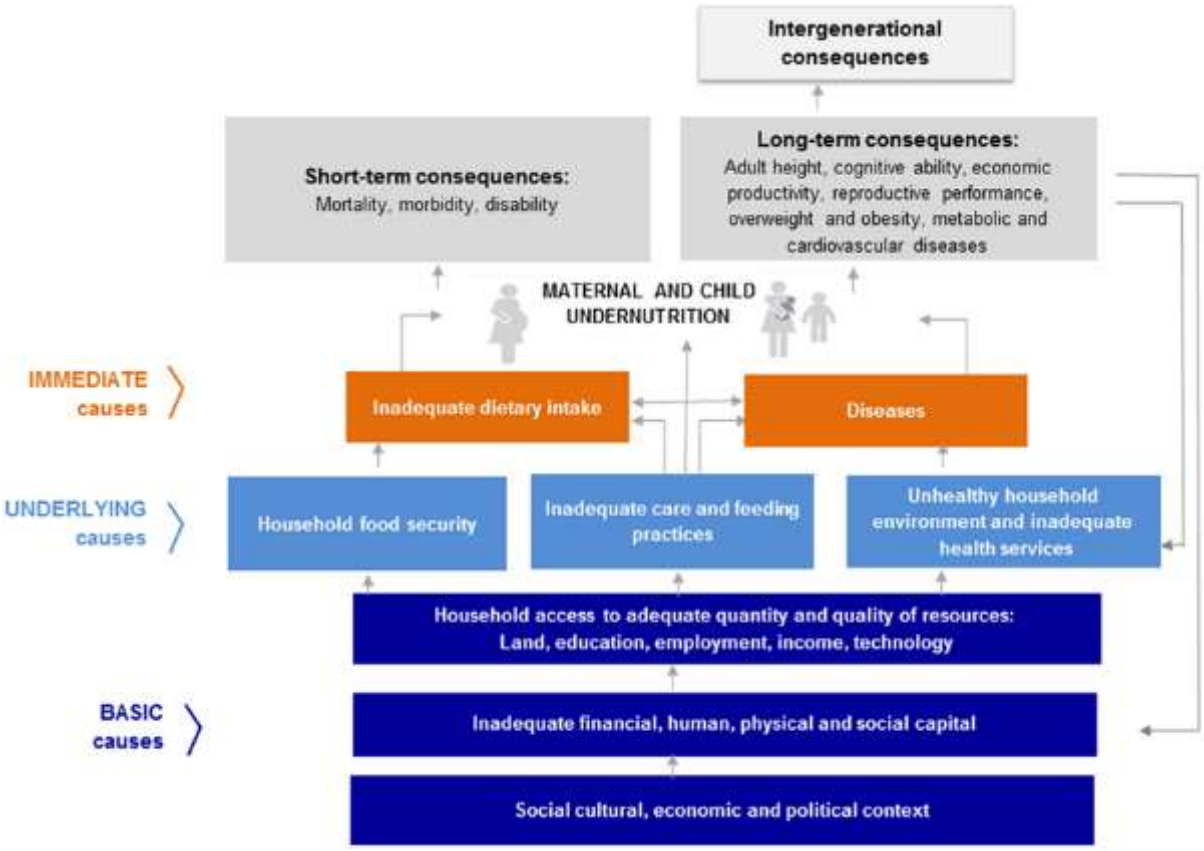


Figure 1. Conceptual Framework of Determinants of Undernutrition1

Further, in a publication in 2013 titled "Improving nutrition through multisectoral approaches", the World Bank identified that nutrition is a multi-sectoral problem which requires multi-sectoral solutions (The World Bank 2013).

Vast majority of the rural poor globally are engaged in farming. Therefore improving their knowledge, economy and livelihoods will compliment good healh and nutrition. One such strategy is to promote microneutrient rich crops which hold promise as complementary strategies to improve both livelihoods and nutritional status (Burchi, Fanzo et al. 2011). Some recent systematic reviews (Girard, Self et al. 2012, Masset, Haddad et al. 2012, Ruel, Alderman et al. 2013) supported the fact that the most appropriate multi-sectoral programs are not yet clear. Hence there is a need to identify potential frameworks and working strategies to prioritise multisectoral actions that will work in the realworld.

Literature review : Need for Building Evidence on Nutritional Impacts of Agricultural Policies and Programmes

The world, especially the developing regions, persistently face nutritional challenges that impacts on the country's development goals. The nutritional status of certain parts of the world shows challenging figures. Studies indicate that stunting affected an estimated 22.2 per cent (150.8 million) children under 5 globally, wasting continued to threaten the lives of an estimated 7.5 per cent (50.5 million) children under 5 globally and an estimated 5.6 per cent (38.3 million) children under 5 around the world were overweight in 2017 (Levels and Trends in Child Malnutrition, 2019). Sri Lanka is among the regions that showed very high figures of stunting and wasting among children under 5.

Sri Lanka that suffered from undernutrition in the past is currently facing a double burden of undernutrition and overnutrition as societies undergo nutrition transition which is a result of economic, demographic, and epidemiological changes. In the latest available data, in Sri Lanka, prevalence of underweight among under five was 21% (Department of Census and Statistics, 2009) while 25% of the adults were overweight and 9% were obese (Katulanda et al., 2010). "Over the past 20 years, a global overweight/obesity epidemic has emerged, initially in industrial countries and now increasingly in low- and middle-income countries, particularly in urban settings, resulting in a triple burden of undernutrition, micronutrient deficiency, and overweight/obesity" (Townsend, 2015, p. 11).

There is a consensus that agricultural activities largely impact nutrition of the community. Agriculture determines food diversity, accessibility, household food security, dietary quality and economic incentives of those in the food value chain affecting their food affordability and consumption. Development in agriculture has the potential to improve nutrition status of a community even though in many cases, the outcomes may not be measurable whereas in some, evidence may be more conclusive (Pandey, Mahendra Dev & Jayachandran, 2016).

Agricultural production growth and income growth may give people better access to nutrient rich food, thus resulting in improving nutrition status. While agriculture has immense potential to improve nutrition, it is noted that standalone nutrition specific interventions do

not have the capacity to meet global targets for improving nutrition, and multisectoral collaborations are hence required to influence underline determinants of nutrition outcomes (Ruel, Quisumbing & Balagamwala, 2018). It is, therefore, necessary to understand the contribution of each dimension of development on nutrition and the pathways in which they influence health and nutrition of a community. If these dimensions are understood, such knowledge can be used to plan effective interventions and adjust existing interventions in order to maximize agricultural, socioeconomic, health and nutrition goals.

Our study, Improving Nutrition through Modernizing Agriculture in Sri Lanka (INMAS), aims to evaluate nutrition promotion activities through the Climate Smart Irrigated Agriculture Project (CSIAP) in three districts of Sri Lanka. The Department of Agriculture and the Department of Agrarian Development that come under the Ministry of Agriculture have been identified as key implementing agencies responsible for several non- health related interventions. There are several agriculture projects to improve livelihoods of farmers and agriculture outputs in Sri Lanka implemented in collaboration with the Ministry of Agriculture, and the CSIAP is one of the main agriculture development projects in the country. The main objectives of the project include identifying the pathways to promote nutrition and health of farmers and farming communities with multiple stakeholders. Our study aims to explore the pathways of improving nutrition and health of the community using the CSIAP project and quantifying their relative contributions on food and nutrition security related outcomes.

This paper reviews some literature on nutrition and agriculture to explore and establish the direct contribution of agricultural development programmes on food and nutrition security related outcomes, and as to how such programmes can possibly address nutritional challenges, especially in rural parts of the developing world. The paper also aims to identify possible pathways to promote nutrition with multiple stakeholders. The findings of this review will be shared to help shape the agricultural interventions of the CSIAP project to ensure better nutrition related outcomes.

Existing problems related to nutrition and reasons identified:

Malnutrition is a global challenge that restricts development. According to Global Nutrition Report (2018), undernutrition explains around 45% of deaths among children under five, mainly in low and middle-income countries, and the health consequences of overweight and obesity contribute to an estimated 4 million deaths (7.1% of all deaths) and 120 million healthy years of life lost (disability-adjusted life years or DALYs) across the global population.

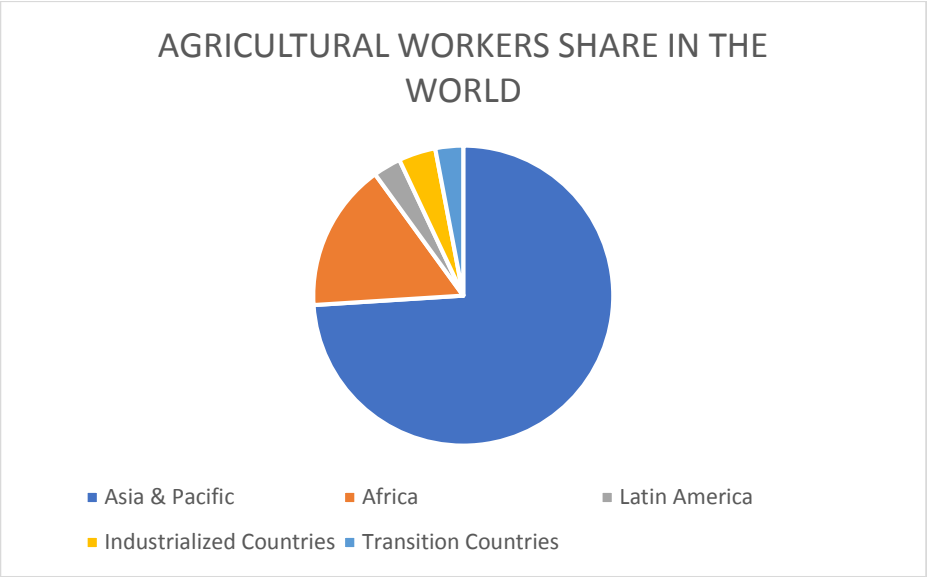
While South Asia is home to nearly half of the undernourished population on earth, food insecurity remains high globally, with around 23% of the population having no access to satisfactory calorie intake (Maestre, Poole, & Henson, 2017). Poverty is seen as a key barrier to addressing undernutrition, and the majority of the poor people live in rural areas. Affordability is a major factor that determines access to safe and nutritious food. Hence, despite the availability of nutritious foods in the market, such foods are not sufficiently consumed by the poor due inaccessibility in terms of lack of physical availability and/or high prices - and extremely sidelined households may not have adequate calories year-around or periodically or may consume foods that are low in quality or unsafe (Maestre, Poole, & Henson, 2017). It is observed that 'lack of sufficient nutrition among children below two years of age and in pregnant women has irreversible generational health and developmental consequences for individuals and society' (Maestre, Poole, & Henson, 2017, p. 31).

Micronutrient malnutrition is said to affect billions of people and entail 'huge human costs and large economic costs (up to 5% of GDP by some estimates)', and it is not possible to address this issue only 'by food fortification and capsule supplements' (Haddad, 2000, p.371). Haddad insists that in order to find sustainable solution to the micronutrient malnutrition, agriculture and food-based approaches are required to play a central role.

Identifying the vulnerable community

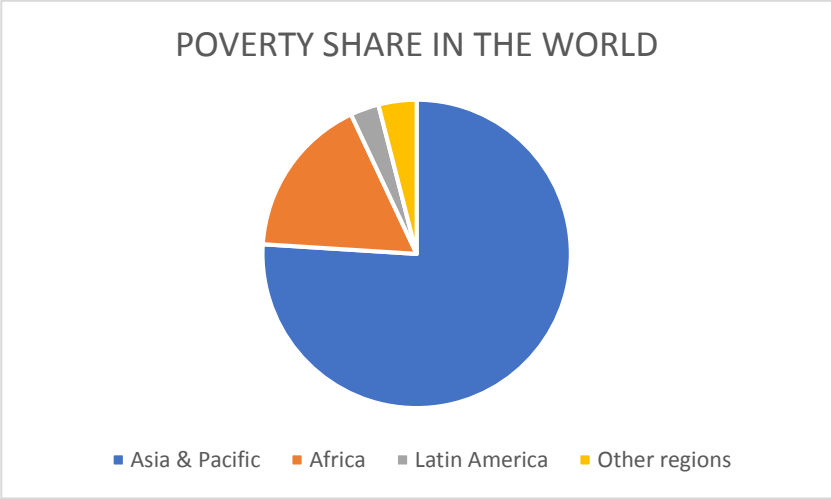
The majority of poor people in the world live in rural areas, most depending on agriculture for livelihood. According to Townsend (2015), the global figures in 2010 indicated that 'over 900 million poor people (78 percent of the poor) lived in rural areas, with about 750 million working in agriculture (63 percent of the total poor)' (p.6). The agriculture sector employs

60% of the total global workforce, making agriculture the main source of livelihood for many ((Maestre, Poole, & Henson, 2017).



Data Source: International Labour Office (2011)

According to International Labour Office (ILO), available data indicates that the share of agricultural workers in the world is proportionate to the share of poverty in the world.



Data Source: International Labour Office (2011)

The rural economy of developing countries such as Sri Lanka largely depends on cultivation, distribution and consumption related to agricultural activities on which a significant number

of the community depends. As estimated (Department of Census and Statistics, 2017a), nearly 30% of the rural economy of Sri Lanka depends on agriculture, and in the first quarter of 2017, 27% of employed population in Sri Lanka are employed in the agriculture sector (Department of Census and Statistics, 2017b).

Establishing the link between Agriculture and Nutrition:

Based on several studies, Ruel, Quisumbing and Balagamwala (2018) assert that without the contribution of other sectors nutrition specific interventions alone, even if implemented on a large scale, do not have the capacity to meet global targets for improving nutrition. Among other sectors, agriculture-led growth has immense potential to influencing the underlying determinants of nutrition outcomes and is said to be more effective in reducing poverty (Ruel et al., 2018; Shekar, 2015); and the underline determinants include 'global food availability and access and through enhancing household food security, dietary quality, income, and women's empowerment' (Ruel et al., p.128). The Food and Agriculture Organization (FAO) of the United Nations (2013) also agrees that agriculture is of fundamental importance to human nutrition, 'both as a direct determinant of household food consumption and through its role in livelihoods and food systems' ((p.1).

Pathways in which Agriculture can improve nutrition include:

- Agriculture as a source of food: This is the most direct route to improving the diet (quantity and quality) is to ensure year-round access to adequate, safe, nutrient-rich food, and is based on two assumptions: (i) increases in production of a range of foods, including dairy, fish, fruits, grains, livestock, root crops and vegetables, enhance food availability and access to a diverse diet; and (ii) increased food availability and access will lead to greater intake and improved nutrition outcomes at the individual level.
- Agriculture as a source of income: This is based on the assumption that an increase in income from agriculture-related activities (including processing and sale of agricultural products or wages earned) can be used to access health services or purchase higher-quality, nutrition-rich food that is consumed by individual household members.

- Agriculture as a driver of food prices: Increased availability of food through more efficient production techniques, improved technologies (for postharvest storage, processing and distribution) and domestic and trade policies affects a range of supply and demand factors and influences the price of food (fresh and processed). This in turn affects the income and purchasing power of households.
- Agriculture to empower women: Initiatives that both educate women and enhance their involvement in agriculture-based activities can strengthen women's capacity, increase their access to, and control over, resources and assets, consequently augmenting their power to make decisions on the purchase and allocation of food, health and care within their households.
- Agriculture to contribute to macroeconomic growth: Agriculture is the dominant productive sector in many developing countries. Increasing agricultural productivity raises national revenue, increasing the funds available to invest in improving essential basic social services, such as education, health, safe water supply, sanitation and safety-net programmes, which have been shown to improve nutrition outcomes.
- Agriculture to ensure sustainable food and nutrition security and resilience: Protecting and promoting biodiversity is essential to support dietary diversity and the preservation of ecosystems. Agricultural practices that promote the sustainability of natural resources (biodiversity, forestry, soil and water) ensure the long-term future of agricultural production and the sustainability of livelihoods and build resilience to climate change (Nutrition Sensitive Agriculture,2015, pp.3-4)

Pandey, Mahendra Dev and Jayachandran (2016) present testable hypotheses that are similar to the link established above but focuses on the nutritional outcomes of those who engaged in agriculture for livelihood. The presented hypotheses include: agricultural produce by the farmers is used as a source of food for their own household affecting nutrition outcomes of the family; agriculture generates income that may be allocated for food enabling households engaged in agriculture to access nutrient-dense food available in the market; the socioeconomic status of women in agriculture may give women intra-household decision making and resource allocation power influencing the nutritional status of the

mothers and their children; and the involvement of mothers in agriculture may influence their ability to manage child care and feeding.

While Ruel et al., (2018) also discuss the above pathways through which agricultural interventions can impact nutrition outcomes of the community engaged in agriculture, they note that the impacts may not always be positive. For instance, women's time allocation to agricultural activities may compromise their own nutrition and that of their children; and women's engagement in agriculture may also expose them to various toxins and create disparity between their energy intake and expenditure resulting in poor health and nutrition.

Expanding on the same line of argument, Haddad (2000) recognizes specific effects and generic effects of agriculture in addressing nutrition related issues such as malnutrition. Specific effects include nutritional impact of food prices, food consumption on own production, post-harvest activities such as storage, commercial processing, in-home processing, preparation, nutrient availability, and plant-breeding targeting nutritional outcomes. Generic effects include effects of increased agricultural productivity on income, changing time allocation patterns to give more care for children, changes in household decision-making, impacts on nutrient requirements and health, energy and nutrient expenditures, and health environment effects of agricultural production. However, these agricultural activities can also generate negative effects if not implemented with a comprehensive understanding of the nutrition outcomes.

Need for policies related to agriculture and nutrition

It is believed that nutrition objectives can be achieved through agricultural policies, programs, and projects if they are designed targeting positive nutrition outcomes. However, it is necessary to establish that the agriculture sector is not expected to substitute primary healthcare delivery - but given the difficulties in the healthcare sector to reach every household, especially in rural areas, 'maximizing the nutrition effects of agricultural policies, programs, and projects already in place seems to be an attractive alternative for improving nutrition' (Kennedy and Bouis,1993, p.18).

Even though it may not be evident 'how agricultural policies and programs influence the health and sanitation environment and nurturing behaviors' (Kennedy & Bouis, 1993, p.5), the correlation between them is increasingly recognized as central to delivering nutrition outcomes. Kennedy and Bouis give examples of how the unrestrained use of certain types of pesticides may have negative health effects, whereas certain agricultural policy and program changes may influence the time allocation within the household for agricultural activities, resulting in changes in the time dedicated to caregiving and nurturing.

Kennedy and Bouis (1993) identify three main pathways through which agricultural policies and programs influence the nutritional status of individuals:

> (I) increased incomes and lower food prices, which permit increased food consumption; (2) effects on the health and sanitation environment at the household and community levels, which may increase or reduce morbidity; and (3) effects on time-allocation patterns, particularly of mothers, which may increase or reduce time spent on nurturing activities—time that is often related to women's control over household income and is an important determinant of women's nutritional status. (p.2)

According to these two authors, if effects on food prices and household income, morbidity, and time allocation, especially in association with nurturing activities are properly established, it will help understanding 'the net effect of agricultural policies and programs on nutrition' (p.5). Pandey, Mahendra Dev and Jayachandran (2016) also observe that policies can affect the relative prices and affordability of various marketed food and non-food crops.

Studies of Shankar, Poole and Bird (2018) show that 'breeding of high yielding varieties of crops, especially cereals, accompanied by policies promoting the use of fertilizers and pesticides, has revolutionised production since the 1970s' (p.1) in South Asia. They assert that investments and policies such as the ones that 'focused on the green revolution package of inputs have been instrumental in raising productivity of South Asian staples, alleviating poverty, boosting food security and reducing hunger' (p.1).

Nevertheless, it is noted that production and/or production diversity and/ income do not necessarily influence adequate nutrient intake of farming communities for a healthy living or effect better nutrition outcomes. It is observed that in some regions in South Asia, farmers tend to sell more expensive, more nutritious produce on the market, retaining less lucrative foods such as cereals for self-consumption (Rao & Pingali, 2018). Therefore, drawing a set of policies and programmes targeting nutrition outcomes through agricultural activities is required to ensure effective outcomes both in terms of agriculture and nutrition.

Since agriculture is a major employer, especially of women in developing countries, improvements in agricultural activities can elevate income for women, leading to influence the intra-household allocation of food and other decision making related to improving nutrition of the family. However, 'heavy agricultural workloads and exposure to toxins and disease through agricultural activities can deleteriously affect women's health and nutrition and also have negative consequences for lactation and child-care' (Rao and Pingali, 2018, p.2). Hence, focusing on gender sensitive policy frameworks and programmes are required to mitigate negative impacts of agricultural activities.

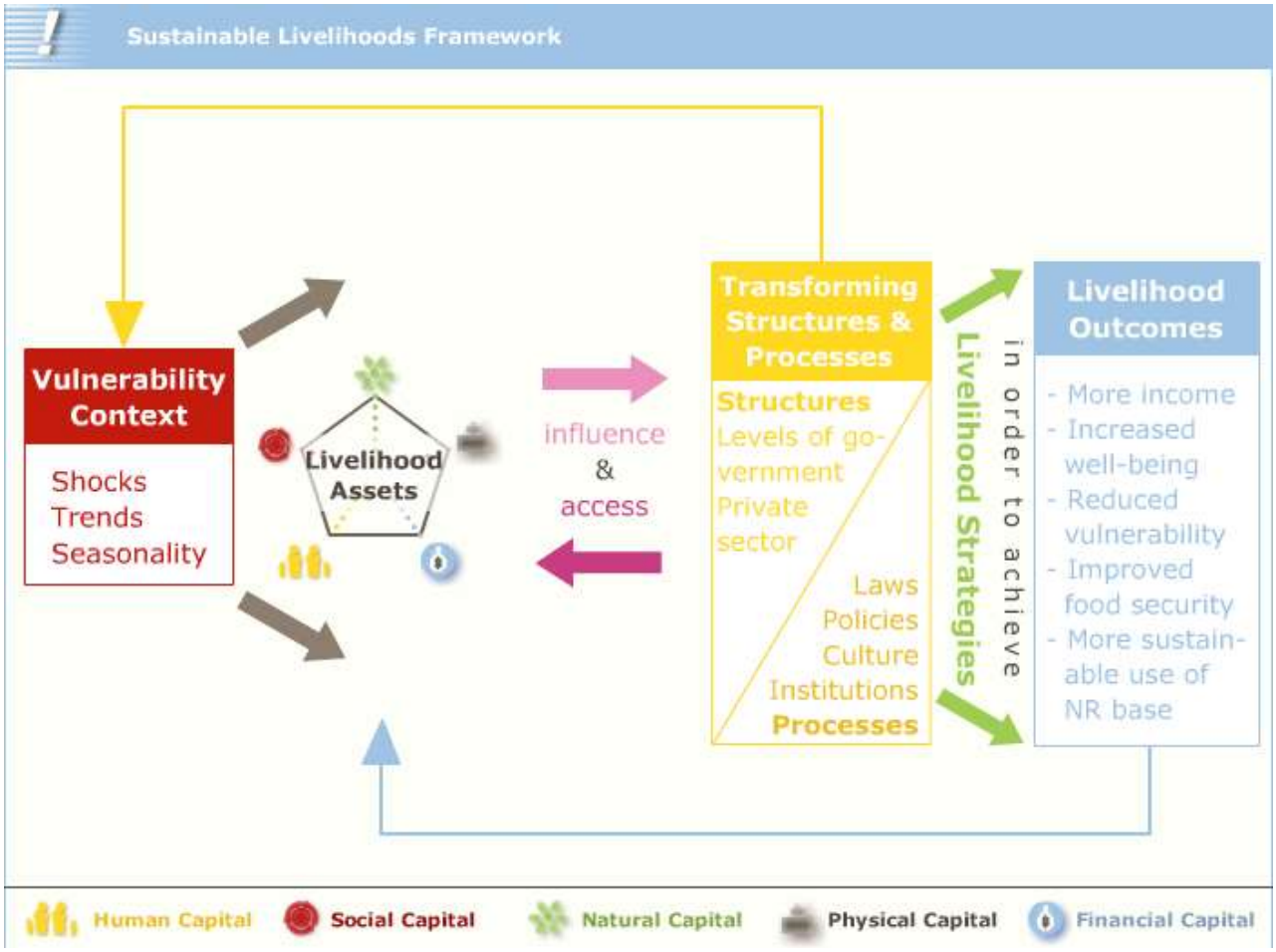
Food safety is another vital factor that determines the delivery of the desired nutrition outcomes, and to ensure that, there are series of requirements for the value chain to operate successfully from processing, storage, distribution, preparation till consumed (Maestre, Poole, & Henson, 2017). It is therefore necessary to have comprehensive agricultural and nutritional policies to guarantee that communities have access to nutrient rich safe foods as well as have education and knowledge to make healthy food choices.

Agricultural outputs generate impacts beyond the sector. According to Haddad (2000), while increases in agricultural outputs have direct impacts on those who are engaged in agriculture, it can generate greater second-round effects that impact the rural economy. "These effects arise in the sectors that supply the agricultural sector with goods and services and via the demand from those rural non-farm sectors that need further goods from agriculture. In some cases, these second-round effects are larger than the initial growth in agricultural output" (p.370). Therefore, multiple stakeholders are required when designing

policy frameworks to ensure the effective delivery of targeted nutrition outcomes through agricultural activities.

Planning effective interventions

3.4.1 Data Source: DFID's Sustainable Livelihoods Approach and its Framework (2008)*:*



Agricultural interventions for improved nutrition

The Sustainable Livelihoods Framework, which is a conceptual design presenting central factors that influence people's livelihoods, and the correlation between them, identifies five types of assets that can be 'supported and strengthened in any development intervention' - these include: physical, financial, social, human and natural 'capital' (Berti, Krasevec, & FitzGerald, 2004, p.600). These assets can be developed during agricultural interventions to ensure improved food security and nutrition outcomes.

Out of 30 agricultural interventions reviewed by Berti et al., (2004) that measured nutritional impact included home gardening, livestock, mixed garden and livestock, cash cropping, and irrigation. Their review assessed whether those projects invested in human, physical, financial, social and natural 'capital' as stated in the Sustainable Livelihood Framework, and whether such investments resulted in positive nutrition outcomes. According to their findings, most agricultural interventions increased food production, without necessarily enhancing nutrition or health of participants, but:

> Those agriculture interventions that invested broadly in different types of capital were more likely to improve nutrition outcomes. Those projects which invested in human capital (especially nutrition education and consideration of gender issues), and other types of capital, had a greater likelihood of effecting positive nutritional change (p.599)

"Synthesis of Guiding Principles on Agriculture Programming for Nutrition" (2013) published by the Food and Agriculture Organization of the United Nations (FAO) claims 'agricultural investments targeted to smallholder farmers are more likely to succeed if they address the human capital constraints due to malnutrition' (p.1)

As stated by the FAO, several best practiced principles when planning agriculture interventions targeting nutrition outcomes are:

> Incorporating explicit nutrition objectives into agricultural projects, programmes and policies; assessing the context to identify nutritional problems and groups most at risk; avoiding unintended negative consequences through a process of identifying potential harms, developing a mitigation plan, and setting in place a well-functioning monitoring system for timely detection of negative effects; measuring impact through programme monitoring and evaluation; maximizing opportunities through multisectoral coordination; maximizing impact of household income on nutrition through concerted design efforts; increasing equitable access to productive resources through policies and programmes; targetting the most vulnerable groups, including smallholder farmers, women and poor/ food- insecure households; empowering women, the primary caretakers in households; incorporating nutrition education to improve consumption and nutrition effects of interventions; managing natural resources for improved productivity, resilience to shocks, adaptation to

climate change, and increased equitable access to resources through soil, water and biodiversity conservation; diversifying production and livelihoods for improved food access and dietary diversification, natural resource management, risk reduction, improved income and other purposes; increasing production of nutrient-dense foods, particularly locally-adapted varieties rich in micronutrients and protein, chosen based on local nutrition issues and available solutions; reducing post-harvest losses and improve processing to increase and prolong access to and consumption of diverse foods among both producers and consumers, to preserve or increase nutrient content of food, to increase income and profit margins and to improve food safety; increasing market access and opportunities to improve smallholder incomes (especially for women) and consumer diets; reducing seasonality of food-insecurity through diversification throughout the year, improved storage and preservation, and other approaches; improving policy coherence supportive to nutrition, so that one policy does not work against another policy or programme; improving good governance for nutrition, including leadership and commitment at the highest levels of governments and donors, implemented by drawing up a national nutrition strategy and action plan; building capacity in ministries at national, district and local levels, and increase nutrition staff; Communicate and continue to advocate for nutrition ("Synthesis of Guiding Principles on Agriculture Programming for Nutrition", 2013, pp. 7-9)

The papers reviewed by Pandey, Mahendra Dev and Jayachandran (2016) indicate that homestead gardens are central to influencing fruit and vegetable consumption; and an increased food production is often linked with a decrease in the number of underweight children and decrease in the prevalence of low BMI. However, they are unsure if this result is owing to the pathway of direct food consumption by infants and mothers or the income pathway. These authors also report that increased food supplies have encouraged the calorie intakes and enhanced diet diversity; and the increase in food production, particularly that of staple grains, pulses and vegetables, has shown 'more conclusive evidence on improving the nutrient intake and nutritional outcomes, compared with the overall agricultural growth rates' (p.36).

Ruel, Quisumbing and Balagamwala (2018) present several studies showing evidence that 'agricultural development programs that promote production diversity, micronutrient-rich crops (including biofortified crops), dairy, or small animal rearing can improve the production and consumption of targeted commodities, and some evidence that such improvements lead to increases in dietary diversity at the household and sometimes the maternal and child level' (p.129)

Supporting evidence generated above, Maestre, Poole and Henson (2017) identify different potential pathways that propose ways in which post-farm gate value chain interventions can enable improved nutrition among the poor. Those two pathways include: overall dietary diversity increases 'by enhancing access to, and consumption of, foods that are naturally rich in micronutrients' such as fresh fruits and vegetables, meat, fish, dairy products, and pulses; and by increasing the supply and consumption of nutrient-dense foods through 'the production and distribution of foods with increased nutritional value' (p.34).

3.4.2: Challenges when planning agricultural interventions targeting nutrition outcomes

Ensuring food safety and preserving their nutrients along the value chain till consumption is seen as a challenge. "There is potential for loss of nutrients along the value chains during processing, storage, distribution and/or preparation due to spoilage, adulteration, inappropriate handling or preparation methods" (Maestre, Poole & Henson, 2017, p.36). High costs involved, absence/want of surveillance programs, and limited opportunities to build employee awareness and education are seen as some of the barriers to maintaining an effective food safety system, especially in the developing world (Weinroth, Belk & Belk, 2018).

In certain instances, access to nutritious food also depends on gender biases and favoritism within each household. Nutritious food should reach 'not only households but also individuals within households', and 'food must be consumed in adequate amounts by each individual on a sustained basis to bring about the desired nutritional outcomes' (Maestre et al., 2017, p.36).

Majority of employed women in South Asia depend on agriculture for livelihood. Even though financial empowerment of women through their involvement in agriculture may result in better nutrition outcomes through allocation of funds on nutrient-dense food, Pandey, Mahendra Dev, & Jayachandran (2016) observe that the maternal nutritional outcomes and health of both the mother and child may be compromised due to mothers' involvement in agriculture. Finding a fine balance without compromising financial independence of women engaged in agriculture would also be a challenged when designing agricultural interventions targeting nutrition outcomes.

Increased production or production diversity of nutrient-dense foods do not always encourage sufficient nutrient intake of farming families resulting improved nutrition outcomes within households. As observed in certain areas of South Asia, farmers are inclined to trade costly produce with high nutritional value for financial gains, keeping less lucrative foods with less nutritional value for their own consumption (Rao & Pingali, 2018). Owing to such habits, agricultural interventions to improve production and production diversity may not necessarily result in improving nutrition of the agricultural households.

Owing to a better income, communities undergoing nutrition transition may have changed their diet and physical activities, not necessarily resulting in positive outcomes but leading to nutrition issues such as obesity – and at the same time, deploying modern machineries in agricultural activities may have improved the yield but not necessarily nutrient-rich food, as farmers opt to fewer varieties of high-yielding cash crops as oppose to traditional subsistence farming that produced a variety of crops needed for a well-balanced diet (Nutrition Sensitive Agriculture, 2015). Therefore, modernizing agriculture can pose certain challenges if not implemented with clear objectives.

There is sufficient evidence to believe that agriculture-led growth has potential to influence the underlying determinants of nutrition outcomes - and 'overall, growth originating from agriculture has been two to four times more effective at reducing poverty than growth originating from other sectors' (Ending Poverty, 2015, p.7). Reduction of poverty also in return determines affordability without households, often leading to influencing improved allocation of funds for food expenses, which may result in better nutrition outcomes.

However, growth in agricultural production and/or production diversity and income growth do not necessarily result in improved nutrition outcomes of families engaged in agriculture. This may be due to varied reasons such as lack of education on nutrient rich foods and nutrition outcomes, determining which crops and vegetables to grow based on market prices rather than based on their nutritional value, selling more expensive nutrient-dense produce without retaining for own consumption for financial gains, and lack of decision-making power for women within households etc. It is, therefore, necessary to design sustainable agricultural interventions and programmes targeting required nutrition outcomes to eradicate reasons that prevent households from achieving individual nutrition requirements. For this purpose, it is required to understand the contribution of multisectoral stakeholders on nutrition outcomes and assess each determinant of nutrition outcomes.

Even though a multisectoral approach has been recognized and recommended by many to promote nutrition through agricultural interventions, there is limited evidence on agricultural interventions implemented with multisectoral partners targetting nutrition outcomes.

To do so, with the help of the above findings, the INMAS study aims to formulate an evidence based, scientific multisectoral action plan with the involvement of health, nutrition, agriculture and development stakeholders from community, government and non-governmental organizations; and undertake nutritional and health impact assessment and evaluation in order to build better evidence to demonstrate the link between nutritional and health outcomes and their upstream determinants such as agriculture, education, and income.

Objective

1. To formulate an evidence based, scientific multisectoral action plan with the involvement of health, nutrition, agriculture and development stakeholders in the community, government and non-governmental organizations.
2. Develop nutritional and health impact assessment and evaluation plan demonstrating the link between nutritional and health outcomes and their upstream determinants such as agriculture, education, and income.

Description of activities

1. Methods of literature review

A systematic literature search was performed using PubMed (https://www.ncbi.nlm.nih.gov/), https://www.embase.com, the Chocrane library (https://www.cochranelibrary.com) and google scholar (https://scholar.google.com). We used key terms that includes but not limited to the following.

"Malnutrition"[Mesh] "Protein-Energy Malnutrition"[Mesh] "Infant Nutrition Disorders"[Mesh] "Child Nutrition Disorders"[Mesh]
"Nutrition Policy"[Mesh] "Diet, Food, and Nutrition"[Mesh] AND "Nutritional Status"[Mesh] "Nutritive Value"[Mesh] "Nutritional Requirements"[Mesh]
"Agriculture"[Mesh]
"Intersectoral Collaboration"[Mesh]

Our search derived a total of 2351 results. Out of these 107 were considered relevant and fully reviewed. This search, in additoin to finding background data were able to locate other similar studies conducted elswhere (Annexure -3) (Vie, Scheier et al. 2015, Cole, Levin et al. 2016, Debray, Mas et al. 2016, Hanachi-Guidoum 2016, LeBovidge, Elverson et al. 2016, Aryeetey, Holdsworth et al. 2017, Ballou, Wiseman et al. 2017, Kaufman, Boren et al. 2017, Knoblock-Hahn, Murphy et al. 2017, Laar, Aryeetey et al. 2017, Lewis, Gardner et al.

2017, Li, Rasooly et al. 2017, Myotoku 2017, Sagner, McNeil et al. 2017, Tomlinson, Jordans et al. 2017, Roblin, Truscott et al. 2018, Roche, Bury et al. 2018, Sumi, Hasegawa et al. 2018).

2. The background assessment

Listing of key stakeholders

Identification of key stakeholders at central and policy making level, middle level and grassroot level were conducted separately. Qualitative methods were primarily used. Key informant interviews, study of policy documents and proposals were used.

We observed that, the local authorities, newly recruited/to be recruited project staff (CSIAP) as well as grass root level workers and community members did not have a good understanding of the proposed project. This is mainly because the CSIAP is a novel concept running as a new program. Due to local political and many other challenges at the level of program designing and implementation the CSIAP is yet to be fully operational. Our study team identified the importance of obtaining as much data as possible about the organisational structure and how the CSIAP will be operated once in full vigour. This information is vital to map the pathways which other organisations can contribute. Further the staff and stakeholder awareness program on nutrition promotion needed to be catered to this framework.

Several key informant interviews were conducted with the officers who are involved in planning of the program as well as potential grass root level workers. Further clarity and focused discussions are needed to facilitate the designing of the intervention once the project is fully operational. Basic food availability and market survey by way of field visits and review of sales records in selected local food vendors and grocery shops were conducted to obtain a basic understanding of the food availability and consumption patterns. We observed a high variability within districts and across districts. Health records with medical officers or selected MOH areas as well as centrally available data were reviewed.

Development of an action plan.

a. Expert group meetings were held with agriculture, health promotion, nutritional and medical education experts from local and central levels. Potential target areas for health promotion and education program were identified. These include:
   i. Identification of nutritional needs within families, localities and in the region
   ii. addressing food availability and dietary choices for consumers at local and regional level
   iii. consumer awareness on food selection and food preparation
   iv. identifying pathways of linking healthy crop selection at the farmers and consumer demand

Curriculum development

outcome-based approach is a need-based approach at the cutting edge of curriculum development, which offers a powerful and appealing way of reforming and managing education. It helps curriculum planning and offers a framework for teachers designing to plan and implement education programmes and to assess participants' performance. Previous work including a similar project titled INPARD (Integrating Nutrition Promotion through Rural Development) has identified that curriculum development in Sri Lanka needs rigorous planning to identify community needs, develop course outcomes and competencies, identify content areas and plan teaching/learning and assessment. Hence the first step in our approach was to identify the exit outcomes.

A stakeholder survey was used to identify outcomes and core competencies. Health needs, nutritional requirements and food patterns were studied. Experts on crop management and agriculture provided inputs. Workshops were conducted with specialists in nutrition, health services delivery, agriculture and education. Previous material were studied in similar interventions and training.

After triangulation of the data which were collected by qualitative and quantitative methods, core competencies and outcomes were developed through a series of meetings using expert inputs from a range of different fields. The course content was developed to achieve these core competencies and outcomes.

Exit outcomes that were developed are

- Identifying common nutrition issues of the area and their health implications
- Nutrition related implications of farming, agricultural produce and rural development interventions in the area
- Planning and implementing health promotional activities including health education
- Working effectively in collaboration with health and other sectors
- Promoting community empowerment in order to improve basic nutritional needs.

Training of stakeholders

Previous training programmes related to similar projects were identified and reviewed. Through integration of existing materials and further revisions programme that was developed was mainly contained three modules.

- Module one - Linking agriculture, rural development and nutrition
- Module two - Health promotion
- Module three – Inter-sectoral collaboration

Content areas for first second exit outcomes are as follows. Several common nutritional issues such as malnutrition, micronutrient deficiencies, misconceptions on nutrition, controlling the use of alcohol and tobacco and nutrition related implications were identified. Nutritional assessment, dietary supplementation, breast feeding and supplementary feeding etc. were also recognized as health implications. Positive and negative impacts were taken into consideration for critically evaluating nutrition related implications of rural development interventions in the area. Positive impact on nutrition included increased food production, improved quality of life due to increased income and new self-employment options. Negative impact on nutrition included low quality of food due to mass production, environmental pollution due to fertilizers and wastage of excess food.

Based on these, the need for an upward reporting mechanism for multi-sectoral action is also being identified. Under the attitude towards collaboration, the need for collaboration is identified by all the sectors based on minimizing waste, sharing knowledge and resources. Meantime, the capacity of non-health sector is constantly being questioned by experts of the health/ nutrition sector. In the training and development stage, understanding the role

of the health sector and other sectors and programme objectives in nutrition promotion are being highlighted. The emphasis is also given on not duplicating the roles in the process but supplementing the roles to get a better outcome. While operational guidelines should promote inter-sectoral collaboration, the existing structure at the grass root level should be put into practice.

Content area for intersectoral collaboration module is as follows. Regarding planning and implementing health promotional activities, the stakeholders involved in nutrition promotion such as ministry of health, ministry of agriculture, district secretariats, ministry of education etc. played a major part. Programmed cycle consisted of strategy setting, programme development, resource mobilization, implementation monitoring and evaluation. Leadership skills, team working skills and interpersonal communicational skills were recognized as skills required for effective collaboration.

Stakeholders in Vantharamullai, Batticaloa

Promotion of nutrition sensitive agriculture, community empowerment in order to improve basic nutritional needs is the last content area of the programme. Developing self-awareness

about their community, identification of causes and Solutions, getting knowledge about laws and legislations to create a supportive environment and vision plan to achieve the targets for basic nutritional needs were the main components of the above objective. The participants, of identified sectors were taught how to collaborate to promote nutrition. These leaders were trained to play a key role in designing and delivering interventions in their setting.

Several teaching and learning methods such as lectures, group discussions, demonstrations, workshops and case scenarios were used for all three modules to convey the massages to stakeholders. Lectures were used to convey critical information, background information and theories. Lectures were conducted in the nutrition module were about common nutrition issues of the area and their health implications as under nutrition and over nutrition and risk factors for obesity and Non Communicable Diseases.

Group discussions allowed active involvement by everyone. Participants learnt from each other, using two way discussions which are almost always more creative than individual thoughts. Discussions in the nutrition module were done about the ways of eliminating misconceptions about dietary practices, identifying ways to reduce quality of food due to profit oriented mass production etc. Discussions in the intersectoral collaboration module were about how to be a good team worker, skills of a team worker, completion of the intervention within an allocated time and budget etc. Discussions in the rural development module were about creating a vision plan to achieve the targets for basic nutritional needs.

Demonstrations involved showing by reason or proof, explaining or making clear by use of examples or experiments. Demonstrations in the nutrition module were organized to recognize the importance of dietary supplementation such as to identify common clinical signs of malnutrition, common micronutrient deficiencies, new agricultural techniques of increasing food availability, health services available on local hospitals etc.

Workshops are a popular format for creative meetings that elicit participants' creative drive and motivation. Workshops and some demonstrations in the nutrition module were held about acquiring the skills of collecting anthropometric data and calculating BMI, recognizing quality food, family income management and related increased food production with food availability. Workshops in intersectoral collaboration module were conducted on bringing

people together in groups to address common issues, encouraging groups to participate and influence decision making.

Case scenarios and role play provided opportunities for discussing the purposes of particular activities, for reflecting on the specific needs of learners and for developing new teaching skills in a comfortable non-threatening learning environment. Dramas included the skills of appropriate responding with understanding and attitude development.

Stakeholders trained to understand the impact of their decisions on nutrition (e.g. introduction of a new crop). Multi-sectoral committees discussed how each sector could contribute to address identified nutritional problems and achieve common goals. Nutrition related technical knowledge was provided by the local health staff.

Evaluation framework

- Development of evaluation framework was started via expert groups on health information systems development, health statistics, nutrition and anthropometry. Evaluation framework was discussed in several key expert meetings before the initial draft framework was formulated. The key concerns identified were:
    a. Scientific evaluation of the inputs, outputs, outcomes and impact
    b. Time factor in achieving the above indicators and facility to measure these in the given timeframe
    c. Quantitative and qualitative methods to be used
- Finalizing tools for evaluation (annexed)
- Quality maintenance and checks
- Pilot study to check and adjust data collection tools
- Obtaining ethical clearance
- Identification of study population (still underway as many areas in INMAS project are yet to formulate a comprehensive list of its implementation areas/households yet)
- Development of the databases
- Development of the analysis framework
- Recruitment of suitable data collectors

- Training of data collectors and development of a quality control plan
- Development of qualitative study plan and instruments
    b. World Health Organization STEPS tool including anthropometric assessment
    c. Limited food frequency questionnaire

The tools were pilot tested and data collectors with a medical background have already been recruited from localities. They are currently being trained on maintaining quality data collection and anthropometric techniques. Data collection was done with real time data entry to improve accuracy. The database and data entry system have been developed and pilot tested.

2.1: Data Collection

Sampling and selection of households from the selected districts and Grama Niladhari dividsions were carried out using a systematic method. Sample size calculations were carried out using standard methods to estimate a prevalence of 5% with a 95% confidence, 5% margin of error. We used an arbitrary 5% as a safe value that is lower than the prevalence of all metabolic risk factors that we measure in this study. Kurunagala district was used as the control population. We used an unmatched control population. Results were adjusted using standard power calculations using the population of each Grama Niladhari division. Further adjustments were made based on age and sex distribution.

2.1.1: Quantitative Data Collection

Sampling frame : Adults and children aged 12-18 in households residing in each district.

Sample size : Calculated to detect a change of 5% from a baseline prevalence of 5% (arbitrarily low values) with 95% confidence interval and a power of 80 - the total sample size is 484. We proposed to round up this number to 500, and to obtain 250 from each district.

Sampling strategy : Stratified cluster sampling

Districts - Divisional secretaries - Grama Niladari Divisions - random selection of a household from the electoral list and sample from there onwards to select a total of 15 households from each village. Out of the eligible adults in each household, a randomly selected two adults and two children (ages 5-15 years) were recruited. We expected to obtain 25 adults and 25 children from each village and take 10 GN divisions from each district.

During the post-intervention survey, quantitative data were collected from the same sample taken for the baseline data collection. Outcome measures includes health behaviours (i.e. diet, physical activity, alcohol, and smoking), anthropometrics (height and weight), demographics and area-level measures related to food access (e.g. food availability, price and poverty indicators).

Quantitative data related to nutrition and other lifestyle risk factors were collected at the village level and school level by trained data collectors using tools that were developed and translated into both Sinhala and Tamil during the baseline survey. Data collection was mostly conducted by pre-intern medical officers who were trained in scientific method and anthropometric data collection. Data from adults and children below 12 years were collected through interviewer-administered questionnaires at the village level. Area level information on food availability, price and market trends were assessed by researchers visiting localities and shops in the villages.

2.2: Tools

Tools that were developed during the baseline survey have been reviewed and revised according to the feedback received from the community. The revised tools have been translated into both Sinhala and Tamil.

1. World Health Organization STEPWISE tool – translated to Sinhala and Tamil
2. Short form food frequency questionnaire
3. Qualitative assessment – scripts to be developed based on the background assessment

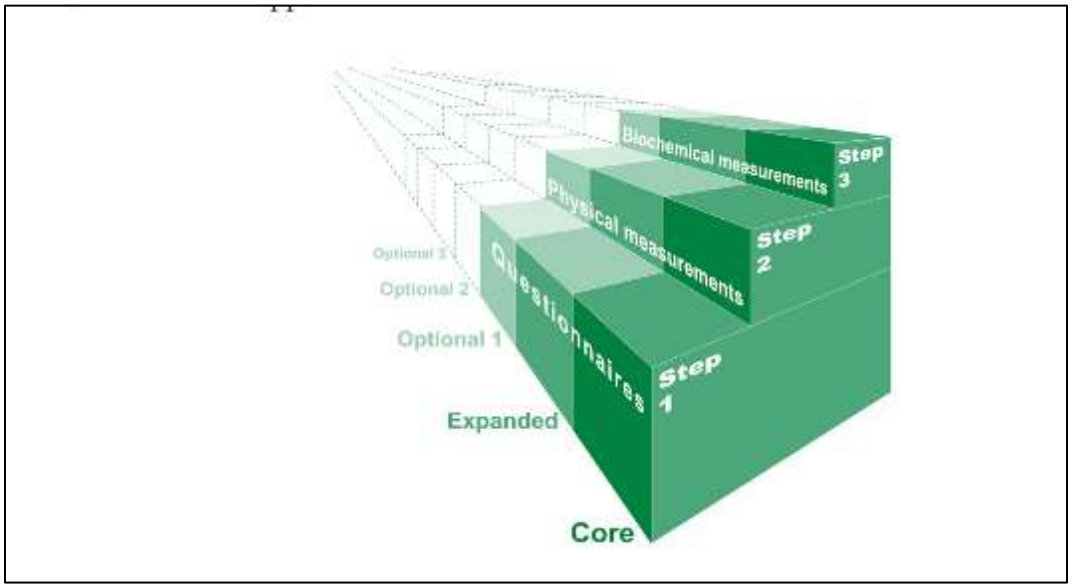


Figure 1 : STEPS approach, courtesy of World Health Organization, STEPS surveillance mannual, 2017

Qualitative Data Collection

Qualitative data collection included key informant interviews and focus group discussions (FGD). The aim of these interviews and FGDs was be to understand the dietary changes and changes in attitude, behaviour and practices related to food and nutrition due to the project intervention.

FGDs was conducted with, community members and grassroot level officers who took part in the first round of FGDs. Each FGD included not more than eight individuals. Grassroot level offers include CRPs, Economic Development Officer, Divi Neguma Development Officer, Midwife, Agriculture Instructor, School representatives (teacher/ Principal), Grama Sewaka and VDO Officer – and the FGDs was conducted in combined clusters.

The majority of poor people in the world live in rural areas, most depending on agriculture for livelihood. According to Townsend (2015), the global figures in 2010 indicated that 'over 900 million poor people (78 percent of the poor) lived in rural areas, with about 750 million working in agriculture (63 percent of the total poor)' (p.6). As estimated (Department of Census and Statistics, 2017a), nearly 30% of the rural economy of Sri Lanka also depends on agriculture, and in the first quarter of 2017, 27% of employed population in Sri Lanka are employed in the agriculture sector (Department of Census and Statistics, 2017b). According to International Labour Office (ILO), available data indicates that the share of agricultural workers in the world is proportionate to the share of poverty in the world. Reducing poverty being a key component of policies related to ensuring food security, the INMAS study focuses on exploring current dietary habits, attitude, behaviour and practices related to food and nutrition of the community involved in agriculture for livelihood.

The pre intervention qualitative data collection includes focus group discussions (FGD) with community members engaged in agriculture in control areas and the CSIAP intervention areas in Anuradhapura, Batticaloa and Kurunegala districts. Change of dietary practices will be assessed after the intervention through a round of post-intervention FGDs with the same community.

Based on several studies, Ruel, Quisumbing and Balagamwala (2018) assert that without the contribution of other sectors nutrition specific interventions alone, even if implemented on a large scale, do not have the capacity to meet global targets for improving nutrition. Among other sectors, agriculture-led growth has immense potential to influencing the underlying determinants of nutrition outcomes and is said to be more effective in reducing poverty (Ruel et al., 2018; Shekar, 2015); and the underline determinants include 'global food availability and access and through enhancing household food security, dietary quality, income, and women's empowerment' (Ruel et al., p.128).

However, the agriculture sector interventions require multisectoral collaboration to maximize benefits to the community and to ensure sustainability of such programmes. Even though a multisectoral approach has been recognized and recommended by many to promote nutrition through agricultural interventions, there is limited evidence on agricultural interventions implemented with multisectoral partners targeting nutrition outcomes. Therefore, the INMAS study aims to explore the current collaborations to promote nutrition at grassroot level through agriculture activities and to understand the knowledge on nutrition among grassroot level officers.

Figure 2: Focus group discussion in Karadiyanaru, Batticaloa

The pre intervention qualitative data collection includes focus group discussions (FGD) mainly with ARPA/KUPANESA, the grassroot officers of the Department of Agriculture. The

focus group will also comprise Samurdhi Officers (SO) of the Department of Samurdhi Development and/or Economic Development Officers where possible. These FGDs will be conducted in the CSIAP intervention areas in Anuradhapura, Batticaloa and Kurunegala districts. Change of collaborations, practices and attitudes towards collaborations will be assessed after the intervention through a round of post-intervention FGDs with the grassroot officers in the same areas.

Methods in detail

Investigator will be meeting adults in the project intervention and control areas with the help of Agrarian Development Officers (ADOs) or Divisional Officers of Agrarian Service Centres and Agriculture Research & Product Assistant (ARPA/KUPANESA). Discussions will be conducted using FGD guides by experienced FGD facilitators in the mother tongue of the participants, focusing on understanding current agriculture related activities, knowledge, attitudes and practices of diets and the factors influencing dietary habits of the community. Participants will be given a chance to clarify queries related to the discussion. A written consent will be taken from each participant agreeing to take part in the discussion.

Pre intervention qualitative data collection will include FGDs with sample of male and female participants in CSIAP intervention areas and control areas.

Table 1: Focus group discussions conducted

Focus Groups (Minimum 6 in a group)	**Anuradhapura District**		**Batticaloa District**		**Kurunegala District**		**Total**
	CSIAP Intervention Area	Control Area	CSIAP Intervention Area	Control Area	CSIAP Intervention Area	Control Area	
Women	2	1	2	1	1	1	8
Men	2	1	2	1	1	1	8
Total FGDs with the community (all three district)							16

Table 2: Timetable for qualitative group discussion

	Approximate duration (min)	Purpose
Welcome and Introduction to the participants	5 minutes	Brief introduction
Consent from the participants	5 minutes	Consent
Self-introduction by the participants	5 minutes	Ice breaking
Discussion (according to the guideline)	35 minutes	Collecting data in order to explore participants' activities related to agriculture, dietary practices and related socio-cultural determinants
End of the discussion	10 minutes	Participants feed backs or queries (If any) and thanking for participation

Figure 3:Focus group discussion, Maho

INMAS proposed outcome indicators and tools used for each indicator

Table 3: Tools developed for the study and outcome measurements

Age group/ Level	Outcome category	Outcome indicator	Tools used to collect data
Adults			
	Diet	Proportion of adults meeting SL food-based standards.	WHO STEPwise Approach to Chronic disease Risk Factor Surveillance (STEPS) and short form FFQ
	Anthropometric	Proportion of adults classified as underweight, healthy weight, overweight and obese	Anthropometric measurements taken by trained researchers following standard protocol
	Physical Activity	Proportion of adults meeting recommendations of 150 min/week	STEPS
	Smoking	Proportion of current smokers (WHO definition)	STEPS
	Alcohol	Proportion of adults who consume alcohol (current/ever)	STEPS
Area level measures			
	Village	Food availability and access (price and the presence of food items available for purchase in village)	Food availability and price data collected by researchers

Results

Qualitative survey

Data collection, entry and initial data cleaning was completed. Data collection was supplemented by random checks with double entry in 10% of the data collected to ensure high quality and accuracy. The outlier rate in these checks was 3.6% which is a satisfactory value in community level data collection. Data cleaning and preliminary analysis is presented here. Advanced analysis including explanatory analyses will be included in further scientific communications.

Table 4 :Summary of quantitative data collection

	Batticaloa		**Anuradhapura**		**Kurenagala**		**Total**
	Female	Male	Female	Male	Female	Male	
CSIAP	165	93	147	114	-	-	519
Control	56	52	88	35	119	101	451

Sample included more females (figure).

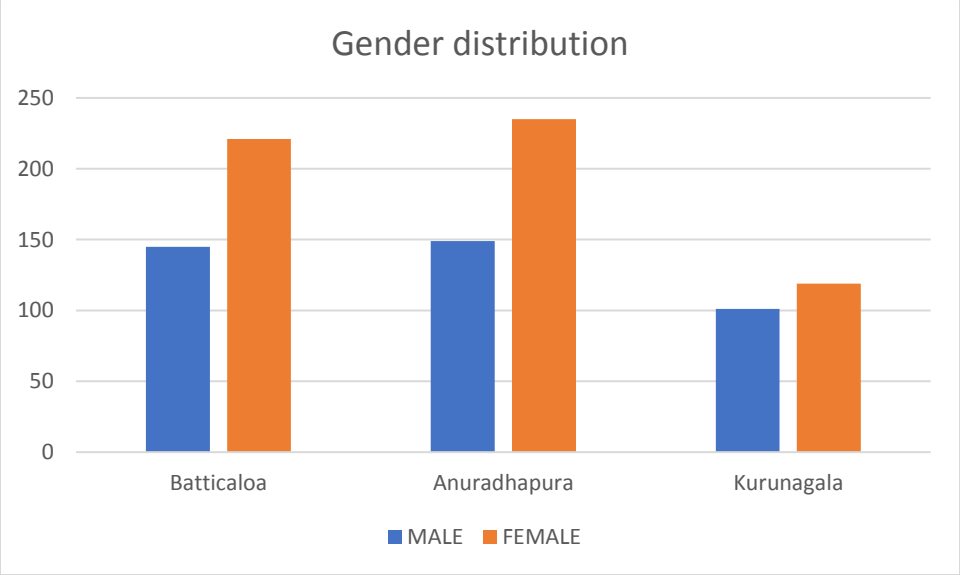
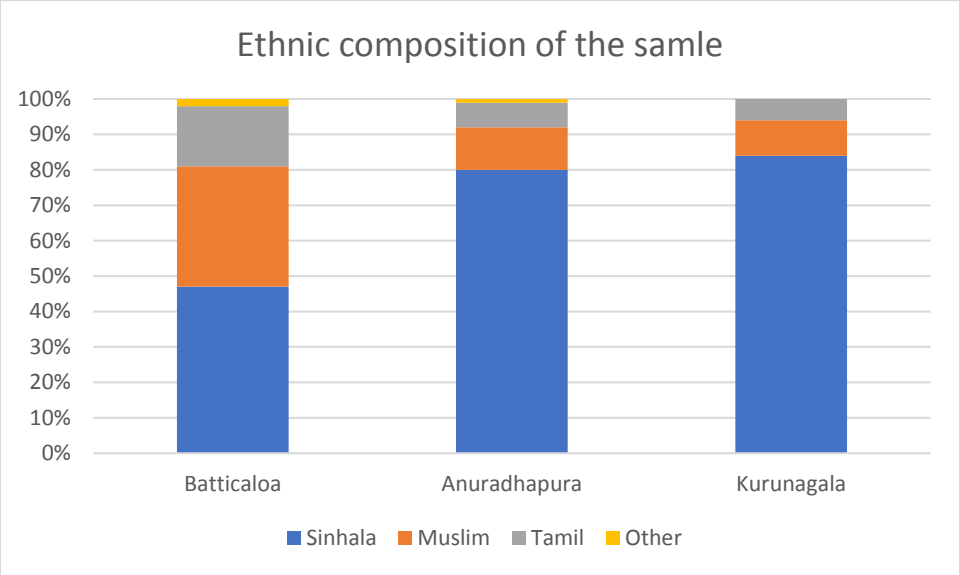


Figure 4 : Gender distribution of the sample

Ethnic composition did not show a significant difference between the controls and intervention groups.



Alcohol and tobacco use was similar in control and interventional groups (P.0.05). However higher rates and fruit and vegetable consumption was noted in the control groups, a change driven by higher consumption in Kurunagal District (figures below)

Table 4.2 Behavioural measures at baseline

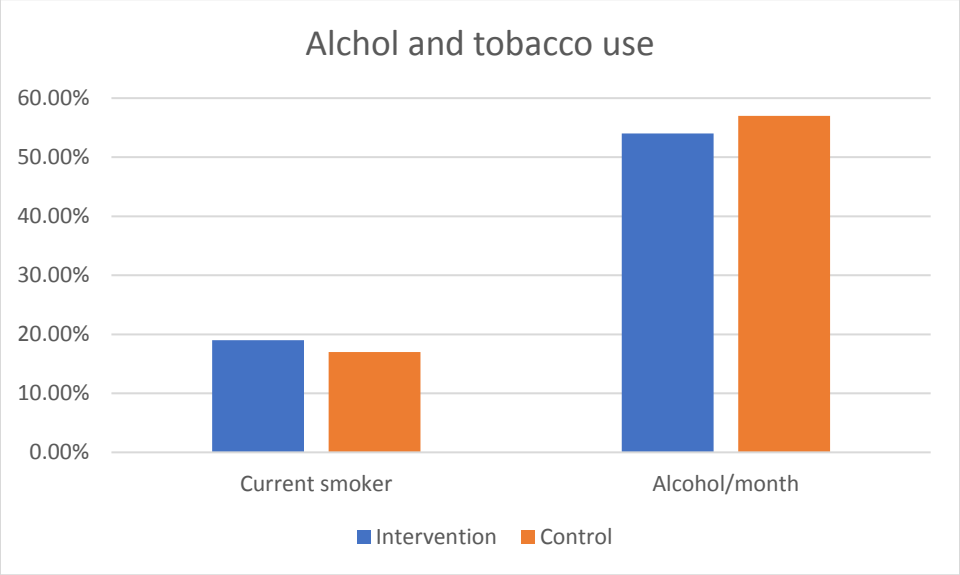


Figure 5: Alcohol and tobacco use

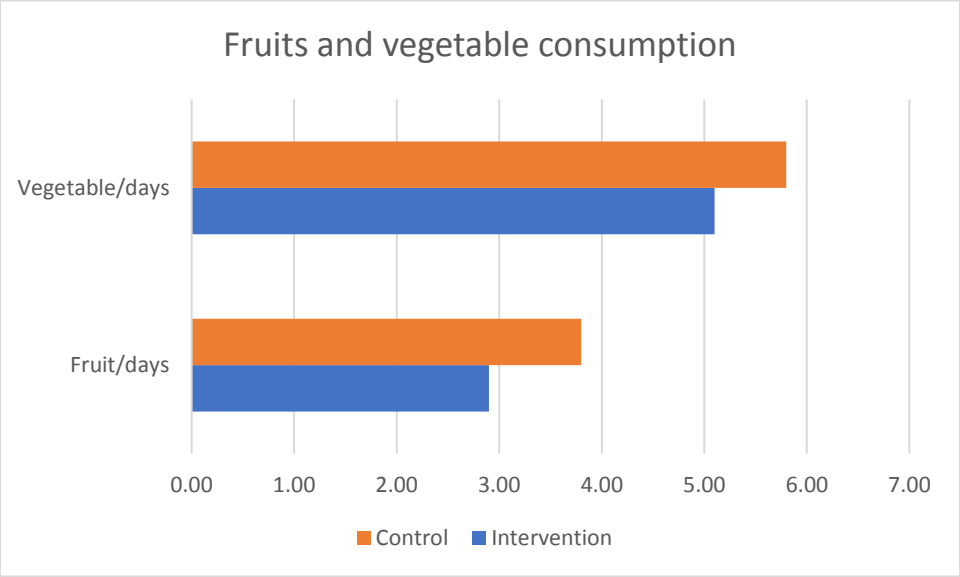


Figure 6 : Fruit and vegetable consumptino, mean portions per day

Medical measures collected through the STEPwise survey also demonstrated similar distributions between intervention and control areas at baseline (Table)

Table 5 : Medical measures at baseline

	Intervention	Control
BMI (kg/m-2)	21.5	22.1
Waist in cm	80	79
Hip in cm	88	89
Any NCD*	24%	26%
Diabetes *	7.3%	7.1%
Hypertension*	12%	12%

*self reported values

Multisectoral action plan and key recommendations

Key messages:

1. Ensuring the nutritional needs of vulnerable groups is an ongoing challenge in Sri Lankan communities. It is important to Identify these vulnerable groups within families and communities. There is a role to be played by all sectors who interact directly with local communities in this as many such individuals with these needs may not actively seek help or be visible to the health sector.

2. Identifying their key nutritional challenges: with different nutritional issues co-exists, reorganizing them by primary healthcare workers and also community members (e.g obesity and micronutrient deficiencies among children or young women)

3. Multi disciplinary training for different stakeholders in the community which enables them to understand the goals and targets of different sectors and entry points for collaboration

4. Regular focussed group discussions with communities and stakeholders will help to constantly improve the interventions and approaches in a relevant and sensitive manner.

5. Design the evaluation frameworks for agriculture projects including nutrition indicators and initiate interactions among different stakeholders (agriculture, irrigation, education, planning and health) throughout the project time to get their inputs and also to encourage them to use relevant results for their work.

3. Key Activities and Deliverables

Annexure 01: Key activities and deliverables of Phase 01

Serial No:	World Bank Listing/activity	Key Activities	Deliverables
A1	Workshops to finalize the study program - expert consultation and stakeholders	Literature review	Report
		Review of relevant policies and programs in Sri Lanka	Prioritized list of strategic partners, their roles and responsibilities (report_
		Identification of potential collaborative programs	
		Finalization of tasks and strategic partners	
		Finalization of the monitoring plan	
A2	Workshop to develop operational plan (Project staff and operational staff)	Introduction to CSIAP project	Workshop/awareness program
		Introduction of INMAS to CSIAP staff	Workshop/awareness program
		Development of the communication strategy between the CSIAP team and the study team	Communication strategy
		Development of an activity guide for village level	Guideline for team members (workbook)
A3	Development of educational material/manual for CSIAP staff	Needs assessment	Finalized teaching learning material in the native language of the end-user (training workshops and workbook)
		Literature review	
		Curriculum outcome development	
		Curriculum content development	
		Development of teaching/learning material	
		Development of assessment	
		Pilot training	
		Evaluation	

		Compiling the final report		
		Pre-testing, validation and adjustments		
A4	Development of educational material/manual for Healthcare workers	Needs assessment	Finalized teaching learning material in the native language of the end-user	Activities completed.
		Literature review		
		Curriculum outcome development		
		Curriculum content development		
		Development of teaching/learning material		
		Development of assessment		
		Pilot training		
		Evaluation		
		Consultancy		
		Facilitation/supportive staff		
		Compiling the final report		
		Pre-testing, validation and adjustments		
A6	Development of educational material/manual for Media/public	Needs assessment		Activities completed
		Literature review		
		Curriculum outcome development		
		Curriculum content development		
		Development of teaching/learning material		
		Development of assessment		
		Pilot training		Activities complied
		Evaluation		
		Consultancy		
		Facilitation/supportive staff		

		Compiling the final report		
		Pre-testing, validation and adjustments		
A7	Development of educational material for agriculture and rural development sectors	Needs assessment		Activities completed
		Literature review		
		Curriculum outcome development		
		Curriculum content development		
		Development of teaching/learning material		
		Development of assessment		
		Pilot training		Activities underway
		Evaluation		
		Consultancy		
		Facilitation/supportive staff		
		Compiling the final report		
		Pre-testing, validation and adjustments		
A8	Workshop to pilot the training program and educational material - in community workers and public	Evaluation of the training program and the manual, conducting the workshop, pre and post knowledge assessment, feedback from stakeholders		Activities completed

A9	Health and nutrition Promotion workshop at village level	Facilitate village level planning meeting by with health, agriculture sectors	Workshops/awarenes s sessions. Facilitator/trainer reports and evaluation of participants	Activities completed
		Identifying and arranging resource persons		Activities completed
		Resource material		

A12	Awareness program for females/mothers, using local agriculture products for nutrition promotion	Teaching learning material, Organizing workshops - academic/supportive staff and providing logistics	Workshops/awarenes s sessions. Facilitator reports and evaluation of participants	Activities completed
A13	Training for other Agricultural workers and related staff	Provision of teaching learning material Conducting workshops for the staff	Workshops/awarenes s sessions. Facilitator reports and evaluation of participants	Activities completed
A14	Training of healthcare workers - village level public health workers and doctors in health education	Training for healthcare staff - village level/primary care public health Training of doctors/nurses at central levels	Workshops/awarenes s sessions. Facilitator reports and evaluation of participants	Activities completed
A15	Advocacy training for top and middle level staff	Provision of teaching learning material Organizing workshops Providing facilitators and faculty	Workshops/awarenes s sessions. Facilitator reports and evaluation of participants	Activities completed
A16	Workshop to review the interventions	Consultancy, facilitation, support staff and logistics support (Field workshop -1, central workshop - 1)	Workshops/reports/re vised interventions plan	Activities completed

A17	Workshop for journalists	Teaching/educational material	Final report	Activities completed
		Academic/supportive staff/logistics support		Activities completed

Annexure 02

Key activities and deliverables for Phase 02

Serial No:	Task	Key Activities	Deliverables	Current status
A201	Workshops to design evaluation plan	Consultation with investigators and content experts	Workshop/awareness program/draft evaluation plan	Activities completed
		Consultation with operational/field level workers		Activities completed
		Development of the evaluation plan	Draft evaluation plan	Activities completed
		Pilot testing		Activities completed
		Finalizing the evaluation strategy	Final evaluation plan	Activities completed
A202	Workshops to train evaluation team (3 districts)	Development of the training program	Formation of trained evaluation teams; establishment of an operational plan and monitoring strategy for each district; training modules; and workshop report.	Activities completed
		Training the evaluation team		Activities completed
		Development of a strategic plan for data collection and monitoring		Activities completed
		Feedback and workshop report		Activities completed
A203	Evaluation process review	Organizing and conducing Random reviews	Reports and revised/approved protocol.	Activities completed
		Field level meetings with staff, participants and investigators		
		Protocol review meeting – investigators Obtaining institutional review board and clinical trials registry approvals	Reports	Activities completed

A204	Data collection (base line data collection) - household survey	Finalizing tools	Double entered and cleaned databases	Activities completed
		Data collection - field		Activities completed
		Designing databases		
		Data double entry and cleaning		Activities completed
		Interim analysis		Activities completed
		Monitoring of data collection team and random check-ups quality check-ups		Activities completed

A206	Interim analysis - Knowledge and attitude assessment of participants (March) and dietary changes	Assessment plan and tools development - consultation	Interim analysis report	Activities completed
		Pilot study and finalizing tools		Activities completed
		Sampling		Activities completed
		Data collection		Activities completed
		Data entry and cleaning		Activities completed
		Interim analysis and report writing		Activities completed
				Activities completed
A207	Qualitative data collection- village level agriculture staff	Identification/sampling of participants	Report on qualitative output	Activities completed
		Conducting Focus group discussions		Activities completed
		Data analysis		Activities completed
		Report writing		
A208	Qualitative data collection- school children in farming communities	Identification/sampling of participants	Report on qualitative output	Activities completed
		Conducting Focus group discussions		Activities completed
		Data analysis		Activities completed
		Report writing		Activities completed
A210		Identification/sampling of participants	Report on qualitative output	Activities completed

	Qualitative data collection - Health Care workers	Conducting Focus group discussions		Activities completed
		Data analysis		Activities completed
		Report writing		Activities completed
A211	Qualitative data collection- general community	Identification/sampling of participants	Report on qualitative output	Activities completed
		Conducting Focus group discussions		Activities completed
		Data analysis Report writing		Activities completed
				Activities completed
A212	Qualitative data collection- development workers	Identification/sampling of participants	Report on qualitative output	Activities completed
		Conducting Focus group discussions		Activities completed
		Data analysis		Activities completed
		Report writing		Activities completed
A213	Qualitative data collection- local level policy makers	Identification/sampling of participants	Report on qualitative output	Activities completed
		Conducting Focus group discussions		Activities completed
		Data analysis		Activities completed
		Report writing		Activities completed
A214		Identification/sampling of participants	Final report on qualitative output	Activities completed

	Qualitative data collection-CSIAP staff	Conducting Focus group discussions		Activities completed
		Data analysis		Activities completed
		Report writing		Activities completed

Bibliography

Aryeetey, R., M. Holdsworth, C. Taljaard, W. A. Hounkpatin, E. Colecraft, C. Lachat, E. Nago, T. Hailu, P. Kolsteren and R. Verstraeten (2017). "Evidence-informed decision making for nutrition: African experiences and way forward." Proc Nutr Soc **76**(4): 589-596.

Ballou, J., C. Wiseman, L. Jackson, R. Godfrey and D. Cagle (2017). "Lactation Skills Workshop: A Collaboration of the City of Dallas WIC and Local Hospitals." J Nutr Educ Behav **49**(7 Suppl 2): S202-S206.e201.

Behrman, J. R., A. B. Deolalikar and B. L. Wolfe (1988). "Nutrients: impacts and determinants." The World Bank Economic Review **2**(3): 299-320.

Berti, P. R., J. Krasevec and S. FitzGerald (2004). "A review of the effectiveness of agriculture interventions in improving nutrition outcomes." Public health nutrition **7**(5): 599-609.

Black, R., R. Laxminarayan, M. Temmerman and N. Walker (2016). Disease Control Priorities, Third Edition (Volume 2): Reproductive, Maternal, Newborn, and Child Health, World Bank Publications.

Brug, J., S. P. Kremers, F. Van Lenthe, K. Ball and D. Crawford (2008). "Environmental determinants of healthy eating: in need of theory and evidence: Symposium on 'Behavioural nutrition and energy balance in the young'." Proceedings of the Nutrition Society **67**(3): 307-316.

Burchi, F., J. Fanzo and E. Frison (2011). "The role of food and nutrition system approaches in tackling hidden hunger." International journal of environmental research and public health **8**(2): 358-373.

Cole, D. C., C. Levin, C. Loechl, G. Thiele, F. Grant, A. W. Girard, K. Sindi and J. Low (2016). "Planning an integrated agriculture and health program and designing its evaluation: Experience from Western Kenya." Eval Program Plann **56**: 11-22.

De Onis, M. and M. Blössner (2003). "The World Health Organization global database on child growth and malnutrition: methodology and applications." International journal of epidemiology **32**(4): 518-526.

De Onis, M., M. Blössner, E. Borghi, R. Morris and E. A. Frongillo (2004). "Methodology for estimating regional and global trends of child malnutrition." International journal of epidemiology **33**(6): 1260-1270.

Debray, D., E. Mas, A. Munck, M. Gerardin and H. Clouzeau (2016). "[Liver disease, gastrointestinal complications, nutritional management and feeding disorders in pediatric cystic fibrosis]." Arch Pediatr **23**(12s): 12s15-12s20.

Girard, A. W., J. L. Self, C. McAuliffe and O. Olude (2012). "The effects of household food production strategies on the health and nutrition outcomes of women and young children: a systematic review." Paediatric and Perinatal Epidemiology **26**: 205-222.

Haddad, L. (2000). "A conceptual framework for assessing agriculture–nutrition linkages." Food and Nutrition Bulletin **21**(4): 367-373.

Hanachi-Guidoum, M. (2016). "[Treating the somatic complications of anorexia]." Soins Psychiatr **37**(307): 34-37.

Herforth, A. (2012). "Synthesis of guiding principles on agriculture programming for nutrition." Draft, September.

Jaenicke, H. and D. Virchow (2013). "Entry points into a nutrition-sensitive agriculture." Food Security **5**(5): 679-692.

Katulanda, P., M. Jayawardena, M. Sheriff, G. Constantine and D. Matthews (2010). "Prevalence of overweight and obesity in Sri Lankan adults." Obesity reviews **11**(11): 751-756.

Kaufman, A., J. Boren, S. Koukel, F. Ronquillo, C. Davies and C. Nkouaga (2017). "Agriculture and Health Sectors Collaborate in Addressing Population Health." Ann Fam Med **15**(5): 475-480.

Keding, G. B., K. Schneider and I. Jordan (2013). "Production and processing of foods as core aspects of nutrition-sensitive agriculture and sustainable diets." Food security **5**(6): 825-846.

Kennedy, E. T. and H. E. dBouis (1993). Linkages between agriculture and nutrition: implications for policy and research, Intl Food Policy Res Inst.

Knoblock-Hahn, A., A. Murphy, K. Brown and L. Medrow (2017). "Integrative Nutrition and Health Models Targeting Low-Income Populations: A Pilot Intervention in Three Food Banks." J Acad Nutr Diet **117**(1): 128-131.

Laar, A. K., R. N. O. Aryeetey, R. Annan, P. A. Aryee, F. K. Amagloh, R. Akparibo, M. E. Laar, P. Amuna and F. B. Zotor (2017). "Contribution of scaling up nutrition Academic Platforms to nutrition capacity strengthening in Africa: local efforts, continental prospects and challenges." Proc Nutr Soc **76**(4): 524-534.

LeBovidge, J. S., W. Elverson, K. G. Timmons, E. B. Hawryluk, C. Rea, M. Lee and L. C. Schneider (2016). "Multidisciplinary interventions in the management of atopic dermatitis." J Allergy Clin Immunol **138**(2): 325-334.

Lewis, S. J., M. Gardner, J. Higgins, J. M. P. Holly, T. R. Gaunt, C. M. Perks, S. D. Turner, S. Rinaldi, S. Thomas, S. Harrison, R. J. Lennon, V. Tan, C. Borwick, P. Emmett, M. Jeffreys, K. Northstone, G. Mitrou, M. Wiseman, R. Thompson and R. M. Martin (2017). "Developing the WCRF International/University of Bristol Methodology for Identifying and Carrying Out Systematic Reviews of Mechanisms of Exposure-Cancer Associations." Cancer Epidemiol Biomarkers Prev **26**(11): 1667-1675.

Li, X. M., A. Rasooly, B. Peng, JianWang and S. Y. Xiong (2017). "An analysis on intersectional collaboration on non-communicable chronic disease prevention and control in China: a cross-sectional survey on main officials of community health service institutions." BMC Health Serv Res **17**(1): 711.

Maestre, M., N. Poole and S. Henson (2017). "Assessing food value chain pathways, linkages and impacts for better nutrition of vulnerable groups." Food Policy **68**: 31-39.

Marmot, M. (2005). "Social determinants of health inequalities." The lancet **365**(9464): 1099-1104.

Masset, E., L. Haddad, A. Cornelius and J. Isaza-Castro (2012). "Effectiveness of Agricultural Interventions that Aim to Improve Nutritional Status of Children: Systematic Review', BMJ 344: d8222, doi: 10.1136/BMJ." D8222 (accessed 8 December 2017).

Myotoku, M. (2017). "Importance of Pharmaceutical Training and Clinical Research at Medical Facilities." Yakugaku Zasshi **137**(1): 13-16.

Pandey, V. L., S. M. Dev and U. Jayachandran (2016). "Impact of agricultural interventions on the nutritional status in South Asia: A review." Food policy **62**: 28-40.

Pinstrup-Andersen, P. (2013). "Nutrition-sensitive food systems: from rhetoric to action." The Lancet **382**(9890): 375-376.

Pistolesi, A. Safety and Health in Agriculture. Geneva, Switzerland: International Labour Office.

Publications, U. N. (2017). World Statistics Pocketbook 2017, United Nations Publications.

Rao, T. and P. Pingali (2018). "The role of agriculture in women's nutrition: Empirical evidence from India." PloS one **13**(8): e0201115.

Roblin, L., R. Truscott and M. R. Boddy (2018). "The Development of a Provincial Food and Nutrition Strategy through Cross-Sector Collaboration." Can J Diet Pract Res **79**(1): 28-34.

Roche, M. L., L. Bury, I. N. Yusadiredja, E. K. Asri, T. S. Purwanti, S. Kusyuniati, A. Bhardwaj and D. Izwardy (2018). "Adolescent girls' nutrition and

prevention of anaemia: a school based multisectoral collaboration in Indonesia." Bmj **363**: k4541.

Ruel, M. T., H. Alderman, Maternal and C. N. S. Group (2013). "Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?" The lancet **382**(9891): 536-551.

Ruel, M. T., H. Alderman, Maternal and C. N. S. Group (2013). "Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?" The lancet **382**(9891): 536-551.

Ruel, M. T., H. Alderman, Maternal and C. N. S. Group (2013). "Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?" The lancet **382**(9891): 536-551.

Ruel, M. T., A. R. Quisumbing and M. Balagamwala (2018). "Nutrition-sensitive agriculture: What have we learned so far?" Global Food Security **17**: 128-153.

Ruel, M. T., A. R. Quisumbing and M. Balagamwala (2018). "Nutrition-sensitive agriculture: What have we learned so far?" Global Food Security **17**: 128-153.

Ruel, M. T., A. R. Quisumbing and M. Balagamwala (2018). "Nutrition-sensitive agriculture: What have we learned so far?" Global Food Security **17**: 128-153.

Sagner, M., A. McNeil, P. Puska, C. Auffray, N. D. Price, L. Hood, C. J. Lavie, Z. G. Han, Z. Chen, S. K. Brahmachari, B. S. McEwen, M. B. Soares, R. Balling, E. Epel and R. Arena (2017). "The P4 Health Spectrum - A Predictive, Preventive, Personalized and Participatory Continuum for Promoting Healthspan." Prog Cardiovasc Dis **59**(5): 506-521.

Shankar, B., N. Poole and F. A. Bird (2019). "Agricultural inputs and nutrition in South Asia." Food Policy **82**: 28-38.

Shekar, M., R. Heaver and Y.-K. Lee (2006). Repositioning nutrition as central to development: A strategy for large scale action, World Bank Publications.

Sumi, M., C. Hasegawa, H. Morii, N. Hoshino, Y. Okunuki, K. Kanemoto, M. Horie, H. Okamoto, N. Yabuta, M. Matsuda, T. Kamiya, M. Sudo, K. Masuda, Y. Iwashita, K. Matsuda, Y. Motooka, D. Hira, S. Y. Morita and T. Terada (2018). "[Evaluation of a Two-day Hospital On-site Training Program for Community Pharmacists: Approach to Facilitate Collaboration among Community Healthcare Professionals]." Yakugaku Zasshi **138**(5): 715-722.

The World Bank (2013). Improving Nutrition Through Multisectoral Approaches, Washington, DC.

Tomlinson, M., M. Jordans, H. MacMillan, T. Betancourt, X. Hunt and C. Mikton (2017). "Research priority setting for integrated early child development and violence prevention (ECD+) in low and middle income countries: An expert opinion exercise." Child Abuse Negl **72**: 131-139.

Townsend, R. (2015). "Ending poverty and hunger by 2030: an agenda for the global food system." Washington, DC: World Bank Group.

Townsend, R. (2015). "Ending poverty and hunger by 2030: an agenda for the global food system." Washington, DC: World Bank Group.

Vie, L. L., L. M. Scheier, P. B. Lester, T. E. Ho, D. R. Labarthe and M. E. Seligman (2015). "The U.S. Army Person-Event Data Environment: A Military-Civilian Big Data Enterprise." Big Data **3**(2): 67-79.

Webb, P. and E. Kennedy (2014). "Impacts of agriculture on nutrition: nature of the evidence and research gaps." Food and Nutrition Bulletin **35**(1): 126-132.

Weinroth, M. D., A. D. Belk and K. E. Belk (2018). "History, development, and current status of food safety systems worldwide." Animal Frontiers **8**(4): 9-15.

Annexures

Focus Group Discussion Guide for Adults

Introduction

Thank you very much for accepting our invitation to participate in the focus group discussion. The discussion is to collect the information related to agriculture activities you are engaged in and to assess current knowledge, attitude and practices related to your diets and other main lifestyle related risk factors such as physical inactivity, smoking and alcohol.

You may respond in any way you are comfortable. It is perfectly fine with us if you do not respond at all. At any point if you are not clear about the questions, feel free to clarify it with us and ask us to explain further. The information obtained during the group discussion will be kept confidential and will be shared only with the research team. “We would like to tape record this discussion, the recording will be kept confidential. Is it okay with you that we tape this discussion?”

Respondent register

Date: Place: Time:

Name of the moderator:

Name of the note taker:

Participants' Details:

No	Name	Age	Gender	Details of respondent
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Theme - factors influencing dietary patterns and other related behaviours

1. **Component:** Influence of agriculture related activities on nutrition

1a. Question – What are the type of agriculture related activities that you are involved in?

Probe:
What are the types of crops you grow?
How many hours of the day you spend on those activities?
Do you engage in agriculture related activities throughout the year? Or is it seasonal?
Is this the main source of income? Or do you do other jobs?

1b. Question – Do you use/ keep a portion of your harvest for family consumption?

Probe:
Do you sell all your produce? Where do you sell your harvest? Is there a middle man?
After deducting cultivation cost and other related costs, what is your profit?
What do you do with the money you earn from agricultural activities?
What types of food you keep for family consumption?

2. **Component:** Knowledge and attitude on healthy diets and maintaining a healthy weight

2a. Question – What is your view on the relationship between health and nutrition?

Probe:
What do you mean by being healthy?
How do you find nutrition is an important factor in health? What do you mean by "nutrition"?
What are the important determinants of nutrition?
What are the differences between under nutrition and over nutrition?
How do we identify and prevent malnutrition?
What is healthy weight? How do you know whether your weight is healthy?

2b. Questions – What do you know about balanced healthy diet?

Probe:

What is a healthy diet? Do you think your diet meet those recommendations? Is it important to have a healthy diet? What are the negative impacts of an unhealthy diet? How can we prepare a healthy diet? How can we use locally available food sources? What are the difficulties at home/ workplace to have a healthy diet?

3. **Components:** Knowledge about the risk factors

3a. Question – What are the health risk related to diet?

Probe: Do you know of any ingredient that you add to your diet that may increase the rink of non-communicable diseases? What amount of salt, sugar and oil do you add to your meals and beverage? Do you think you use healthy amounts?

3b. Question – Do you consume frizzy drinks and instant food varieties?

Probe: What are the types of frizzy drinks you have? How often? How often do you consume instant/ fast food? What time of sauces do you add to your food? How often do you add sauces to your meal? Do you check the ingredients and nutrition information when you buy food from shops?

3c. What is your attitude towards consuming alcohol, smoking and exercise?

Probe: Do you actively try to increase your physical activity and avoid smoking/alcohol? What are the main factors that support you to achieve those goals? What factors influence you to be more physically inactive, to smoke or to consume alcohol? What are the main barriers and how do you think we could collectively address them? Do you know how to modify your life style so that you will be doing more exercises?

3d. Question – Special dietary requirements

Probe: Do you have any special dietary requirement? Who do you think need special dietary requirements? How would you prepare meals for a pregnant mother? How to do complementary feeding? What would you give for primary school children to eat? Do you know how to prepare above meals using locally available food sources? Do teenagers need the same amount of food as adults?

4. **Component:** Influences on choice of food

4a. Question – What factors influences your diet?

Probe: What factors influence your dietary choices at home, in schools or outside? Do advertisements on TV, newspapers and bill boards have a role? (Talk about examples with sweets, soft drinks and milk products) Have you stopped/limited buying any food items recently due to the price? Have you changed your dietary habits due to health education messages? any examples? Have you eaten anything you don't think healthy, but due to cultural issues or due to peer pressure ?

5. **Components:** Changing habits to prevent risk factors

5a. Question – Do you have anything you could do to improve your diet with the resources you have now?

Probe: Have you thought about changing your food purchasing patterns? If yes how? Is it important do home gardening as a family? Do boys and girls both get involved in gardening and cooking? How can we encourage this? Will home gardening and preparing your meals at home save money?

5b. Question – What can you do to improve your / your family members diet?

Probe: What would you want to add to your diet? Would you consider cultivating different types of crops considering nutrition value? What types of crops can you grow? Would you consider keeping some produce for family consumption?

6. **Component:** Contributing to improving nutrition state of the local community

6a. Question – Do you think you have the capacity to contribute to improving the nutrition state of the local community?

Do you have facilities to sell your produce in local shops? What types of produce you can sell locally? Do you have the capacity to increase your production and increase the variety of crops and vegetables you grow? Do you think that there is a demand for locally grown food and vegetables? How can you improve the nutritional benefits of your produce? Do you use pesticides/ weedicides or other chemicals to keep your produce fresh? What are those substances?

7. **Component:** Obstacles sell products locally

7a. Questions – What are the individual level (your income, skills etc) and environmental (societal norms, culture, advertisements, policy, prices etc.) that may stand as a barrier to selling your prodcuts locally and contributing to improving diet of the local community?

Probe: What are the attitudes and perceptions of the community that may present this from happening? How can you overcome those obstacles? What help do you need from agriculture sector or other sectors to overcome such barriers?

End of the discussion.

Chapter 02

Focus Group Discussions – Garssroot Officers

(Pre Intervention)

2.1: Method

Investigator will be meeting grassroot level officers in the CSIAP project intervention and control areas with the help of District Officers (DOs) of the Department of Agriculture and Agrarian Development Officers (ADOs) of Agrarian Service Centres. The INMAS study team has already built links with relevant Dos and ADOs with the support of provincial level CSIAP Deputy Project Directors (DPD). Discussions with the FGD participants will be conducted using the FGD guide by experienced FGD facilitators in the mother tongue of the participants, focusing on understanding their current role, their involvement in nutrition promotion activities, their knowledge on nutrition and current collaborations between various sectors targeting nutrition promotion. Participants will be given a chance to clarify queries related to the discussion. A written consent will be taken from each participant agreeing to take part in the discussion.

2.1.1: Sample

Pre intervention qualitative data collection will include FGDs with sample of grassroot level officers including ARPA/KUPANESA and Samurdhi Officers and/or Economic Development Officers in CSIAP intervention areas and control areas.

Focus Groups (Minimum 6 in a group)	**Anuradhapura District**		**Batticaloa District**		**Kurunegala District**		**Total**
	CSIAP Intervention Area	Control Area	CSIAP Intervention Area	Control Area	CSIAP Intervention Area	Control Area	
Grassroot Officers (KUPANESA, Samurdhi Officer and/or Economic Development Officer)	3	1	3	1	1	1	10
Total FGDs with the grassroot level officers (all three district)							10

2.1.2: Timeline

FGDs with the grassrot officers of the selected sample will be conducted on the first two weeks of June, 2019 and the transcripts will be submitted before the end of June, 2019.

2.1.3: Timetable for each discussion

	Approximate duration (min)	Purpose
Welcome and Introduction to the participants	5 minutes	Brief introduction
Consent from the participants	5 minutes	Consent
Self-introduction by the participants	5 minutes	Ice breaking
Discussion (according to the guideline)	35 minutes	Collecting data in order to explore grassroot officers' role related to nutrition promotion activities, their knowledge on nutrition and related socio-cultural determinants as well as multisectoral collaboration targeting nutrition promotion
End of the discussion	10 minutes	Participants feed backs or queries (If any) and thanking for participation

2.1.4: Focus Group Discussion Guide for Grassroot Level Officers

Introduction

Thank you very much for accepting our invitation to participate in the focus group discussion. The discussion is to collect information on your role related to promoting nutrition activities within your official capacity, your understanding of consumption habits of the local community and to assess your current knowledge on nutrition.

You may respond in any way you are comfortable. It is perfectly fine with us if you do not respond at all. At any point if you are not clear about the questions, feel free to clarify it with us and ask us to explain further. The information obtained during the group discussion will be kept confidential and will be shared only with the research team. "We would like to tape

record this discussion, the recording will be kept confidential. Is it okay with you that we tape this discussion?"

Theme – involvement of grassroot agriculture officers in promoting nutrition among the community, their knowledge on nutrition and their observation on nutritional needs and habits of the local community

1. **Component**: Involvement in promoting nutrition

1a. Question – What are the activities you do in relation to promoting nutrition?

Probe:
What is your main role?
Within your official capacity, do you engage in promoting nutrition?
Does your job role include focus on nutrition?
Is your department involved in providing or helps providing any of nutrition related services?
Are there policies, acts or circulars followed by your institution to promote nutrition?

1b. Question – Do you give nutrition related advices to the community?

Probe:
When it comes to selecting crops for cultivation, do you advise the community what to grow based on the nutritional benefits of various crops?
Do people ask for such advices?

2. **Component:** Multisectoral collaboration in promoting nutrition

2a. Question – Have you worked with other organizations to promote nutrition among the community?

Probe:
Do you or have you ever worked with any other sectors related any activity to promote nutrition among the community?
What are those collaborations and the purpose of those collaborations?
Who are/were the collaborating partners?

Have you been given additional responsibilities within that collaboration that is beyond your job description? How did the collaboration initiate?

2b. Question – What do you think of the effectiveness of those collaborations?

Probe: Have you achieved the objectives of those collaborations? Are/were they temporary collaborations or long-term collaborations? How did/do you contribute do to the collaboration? How did/do other sectors contributed the collaboration? How did you communicate with other sectors? What did you communicate with other sectors? What was the attitude of other sectors towards the collaboration? What was the attitude of the beneficiaries towards such collaborations?

2c. Question – What are the challenges of collaborating with other sectors?

Probe" Were the challenges or difficulties that you encountered related to: personalities and attitudes, Policies and practices of your own institution different priorities of the organizations involved, limitations in policies Limitations in official capacity Communication and infrastructure issues How were these challenges/limitations dealt with?

2d. Question – What should be done to sustain those collaborations?

Probe: How can you make those collaborations more effective?

3. **Component:** Understanding of the nutrition state of the local community

3a. Question – What is your understanding of the consumption habits of people in your area?

Probe: What are the food consumption habits of the people in this area?

Do children have unhealthy eating habits? Do people usually maintain home stead gardens? What types of crops they grow? Do they keep part of their harvest for their household consumption?

3b. Question – Do you have nutrition issues specific to your area?

Probe: Have your recognized nutrition issues specific to your area? Would you like to get help from other sectors to address those issues? What kind of help would you need?

4. **Component:** Current knowledge on nutrition

4a. Question – what knowledge do you have on nutrition dense crops and vegetables grown locally?

Probe: What are the kinds of crops and vegetables grown locally that are considered as nutrition dense? What are the nutrition benefits of those crops and vegetables? What do you consider as a healthy diet?

4b. Question – Do you think you have sufficient knowledge on nutrition?

Probe: Are you confident to give nutrition related advices to the community? Do you know of the nutrition benefits of the crops you recommend for farmers? Have you been given any training to improve your knowledge on nutrition?

5. **Component:** Knowledge on research-based studies related to cultivation, new technology and methods used in cultivation

5a. Question – What kind of research-based data do you have on growing crops and vegetables resilient to local environment?

Probe: Have you tried to get farmers to cultivate diverse crops based on various studies? Have you explored the possibility of enabling farmers grow new varieties of crops suitable to the environment? Give some examples of such instances?

5b. Question – Do you have knowledge on new technologies or methods that enable growing crops under various environmental conditions?

Probe: Have you been informed/ Do you know of new technologies or methods that enable growing crops under various environmental conditions? Give some examples? Where can you get such knowledge? What can you do to get such knowledge?

End of the discussion.

Annexure : literature review (few important studies)

Name of the research article	Reference (IEEE Referencing Style)	Annotation
The role of agriculture in women's nutrition: Empirical evidence from India.	[1]T. Rao and P. Pingali, "The role of agriculture in women's nutrition: Empirical evidence from India", PLOS ONE, vol. 13, no. 8, p. e0201115, 2018. Available: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0201115.	The study evaluates a five-year panel dataset of rural households of 18 villages in India to 'establish a statistically important relationship between household agricultural income and women's BMI'. The research establishes that improvements in own-production and market purchase are associated with improvements of nutrition level of the community. Agricultural income growth has also shown links to the positive growth results in BMI. The market is also said to play a pivotal role in facilitating access to nutrition rich food.

Food and Nutrition Insecurity in Selected Rural Communities of KwaZulu-Natal, South Africa-Linking Human Nutrition and Agriculture.	[2]L. Govender, K. Pillay, M. Siwela, A. Modi and T. Mabhaudhi, "Food and Nutrition Insecurity in Selected Rural Communities of KwaZulu-Natal, South Africa—Linking Human Nutrition and Agriculture", International Journal of Environmental Research and Public Health, vol. 14, no. 1, p. 17, 2016. Available: https://www.mdpi.com/1660-4601/14/1/17.
Key Drivers of State Preemption of Food, Nutrition, and Agriculture Poli cy: A Thematic Content Analysis of Public Testimony.	[3]J. Pomeranz and M. Pertschuk, "Key Drivers of State Preemption of Food, Nutrition, and Agriculture Policy: A Thematic Content Analysis of Public Testimony", American Journal of Health Promotion, p. 089011711882316, 2019. Available: https://journals.sagepub.com/doi/full/10.1177/0890117118823163?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub%3Dpubmed.
Beyond nutrition a nd agriculture polic y: collaborating for a food policy	[4]S. Stewart, A. Kennedy and A. Pavel, "Beyond nutrition and agriculture policy: collaborating for a food policy. - PubMed - NCBI", Ncbi.nlm.nih.gov, 2014. [Online]. Available: https://www.ncbi.nlm.nih.gov/pubmed/25267247.
Agricultural inputs and nutrition in South Asia	[5]B. Shankar, N. Poole and F. Bird, "Agricultural inputs and nutrition in South Asia", ScienceDirect, 2018. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0306919218308297.

Assessing food value chain pathways, linkages and impacts for better nutrition of vulnerable groups	[6]M. Maestre, N. Poole and S. Henson, "Assessing food value chain pathways, linkages and impacts for better nutrition of vulnerable groups", Food Policy, vol. 68, pp. 31-39, 2017. Available: https://www.sciencedirect.com/science/article/pii/S0306919216304821.	The paper evaluates as to what extent the private sector can be expected to get involved in achieving nutrition objectives of the public sector. It studies the role that the food value chain plays on nutrition outcomes. According to the writer, there are certain requirements for the food value chain to operate successfully in oder to help increase the micronutrient intake. During processing, storage, distribution and/or preparation, it is ncessary to ensure that food is safe to eat; food is nutrient-densed at the point of consuption; and food reaches consumers to ensure food is consumed in adequate amounts on a sustained basis to bring about the desired nutritional outcomes. However, the consumer choice of food depends on their nutrition awareness, nutrition information/ singals provided by the suppliers, availability of food in the market or through home production, consumer affordability and accesptability.
Planning an integrated agriculture and health program and designing its evaluation: Experience from Western Kenya	[7]D. Cole et al., "Planning an integrated agriculture and health program and designing its evaluation: Experience from Western Kenya", Evaluation and Program Planning, vol. 56, pp. 11-22, 2016. Available: https://www.sciencedirect.com/science/article/pii/S0149718916300581.	

Principles of innovation to build nutrition-sensitive food systems in South Asia	[8]D. Glover and N. Poole, "Principles of innovation to build nutrition-sensitive food systems in South Asia", Food Policy, 2018. Available: https://www.sciencedirect.com/science/article/pii/S0306919218308492.	
Sustaining healthy diets: The role of capture fisheries and aquaculture for improving nutrition in the post-2015 era	[9]S. Thilsted et al., "Sustaining healthy diets: The role of capture fisheries and aquaculture for improving nutrition in the post-2015 era", Food Policy, vol. 61, pp. 126-131, 2016. Available: https://www.sciencedirect.com/science/article/pii/S030691921630001X.	
Nutrition Sensitive Agriculture: What have we learned so far	[10]M. Ruel, A. Quisumbing and M. Balagamwala, "Nutrition-sensitive agriculture: What have we learned so far?", Global Food Security, vol. 17, pp. 128-153, 2018. Available: https://www.sciencedirect.com/science/article/pii/S221191241730127X.	This paper reviews recent empirical evidence (since 2014), including findings from impact evaluations of a variety of NSA programs using experimental designs as well as observational studies that document linkages between agriculture, women's empowerment, and nutrition linkages. The paper summarizes existing knowledge regarding impacts, but also pathways, mechanisms, and contextual factors that affect where and how agriculture may improve nutrition outcomes. The paper concludes with reflections on implications for agricultural programs, policies, and investments, and highlights future research priorities.

Impact of agricultural interventions on the nutritional status in South Asia: A review	[11]V. Pandey, S. Mahendra Dev and U. Jayachandran, "Impact of agricultural interventions on the nutritional status in South Asia: A review", Food Policy, vol. 62, pp. 28-40, 2016. Available: https://www.sciencedirect.com/science/article/pii/S0306919216300264.	The writers focus on nutrition issues in the South Asian (SA) regions and how agricultural interventions in SA can have positive nutrition outcomes to address such issues. While the writers present several hypotheses as to how development in agriculture or agricultural activities can impact nutrition, they note that in many cases, the outcomes may not be measurable. However in some cases, evidence are more conclusive.

Annexure :

Identified roles and prioritized responsibilities for each sector:

Agriculture sector:

The potential impacts of agriculture on health and nutrition extend across a number of channels. One area of impact is household ability to produce, purchase and consume more, better and cheaper food Another important contribution of agriculture towards nutrition and health is increased rural income, allowing people to improve their diets. The poor are overwhelmingly located in rural areas and derive a significant share of their income from agricultural activities. Given the importance of agriculture for the livelihoods of the rural poor, agricultural growth has the potential to greatly reduce poverty – a key contributor to poor health and undernutrition. Agricultural activities can also generate economy-wide effects such as increasing government revenues to fund health, infrastructure and nutrition intervention programmes

Goals:

Ensure year-round access to adequate, safe, nutrient-rich food within the local community.

Provide adequate income/wealth generation while promoting responsible and healthy crop selection and production

Develop partnerships with other sectors and work along with the health professionals of the locality to integrate health and wellbeing to activities

Activities :

1. Provide training for ground level officers on nutrition, health and impact of their activities on these health and nutrition in the community
2. Provide training for farmers
3. Provide training on nutrition sensitive home gardening
4. Create awareness in other stakeholders involved in the supply chain
5. Empower the producers to develop a distribution plan and create a local market for a reasonable price
6. Protect women, children and famers from exposure to hazardous chemicals through good practice and personal protection

Rural Development sector.

- Support families to better manage the increased income from agriculture-related activities (including processing and sale of agricultural products or wages earned) which can be used to access health services or purchase higher-quality,
- Empower females through micro-finance facilities and capacity building. Initiatives that both educate women and enhance their involvement in agriculture-based activities and small businesses.
- Create support groups and discuss time allocation patterns during agriculture seasons and activities, to give more care for children, changes in household decision-making, impacts on nutrient requirement
- Support livelihoods, not only for farmers but also for other local services to create sustainable and healthy communities.
- Create environmental change through their activities that promote healthy and safe lifestyles
- Provide a platform to deliver health awareness and health conscious interventions, especially on younger and healthier populations who are not accessible to health care professionals
- Develop partnerships with other sectors and work along with health professionals of the locality to integrate health and wellbeing to activities
- Nutrition and health conscious decision taking to avoid development processes at micro and macro levels that encourage behaviors/habits/practices that are detrimental to health

Health sector

- Given that health sector cannot reach every household, use Agriculture sector, farmers associations as a mechanism to reach communities and families for health and nutrition promotion activities. Work in collaboration with agriculture sector to co-design these interventions.
- Create the awareness among agricultural communities to discourage farmers to sell more expensive, more nutritious produce on the market, retaining less nutritious foods for self-consumption
- Address other behaviorul risk factors such as alcohol and tobacco among famers and their families.
- Encourage interactions with other sectors at ground level and local directorate levels
- Develop partnerships with other sectors and work along the health professionals of the locality to integrate health and wellbeing to activities

Education Sector

- Work with agriculture officers to promote school gardens and education children and to increase physical activity through working in the garden
- Work with local framers' associations and establish supply chains to use local produce for school meals and canteens
- Ensure availability of nutritious and attractive school meals
- Train schoolteachers to work in collaboration with local agriculture officers and primary healthcare officers to mobilize local resources and improve school nutrition
- Provide a platform for behavior and attitude change within communities on encouraging healthy behaviors and discouraging unhealthy practices.

Evaluation strategy

Inputs and activities	Outputs	Outcomes and impact
Workshops and training programs	Improvements in knoweldge and awareness	translation of this knowledge to community level activities in CSIAP
Numers of training Participation Completion numbers	pre and post questionnaires and knowledge assessment skills assessment	health interventions changes in nutritional and health practices

Tools for evaluation for IMNAS

Learning objectives for non-healthcare stakeholders

(Agriculture officers, development sector workers at grassroot level and media personnel)

1. Recognize and critically evaluate the nutrition related implications of agriculture development in promoting the nutrition of the individual and the community
2. Analyze positive and negative nutrition implications of various agriculture based interventions – with a special emphasize on targeted activities of CSIAP program
3. Analyze issues related to malnutrition (under nutrition and over nutrition)
4. Identify issues related to deficiencies of micronutrients
5. Identify each stakeholder's role in addressing nutritional needs of special groups
6. Understand issues related to food availability and affordability
7. Analyze other health issues due to inappropriate nutrition
8. Identify common misconceptions regarding nutrition.
9. Create conducive home environment in order to improve nutrition of the family
10. Mitigate the negative nutritional impact of alcohol, tobacco and other additive substances in the individual and the family

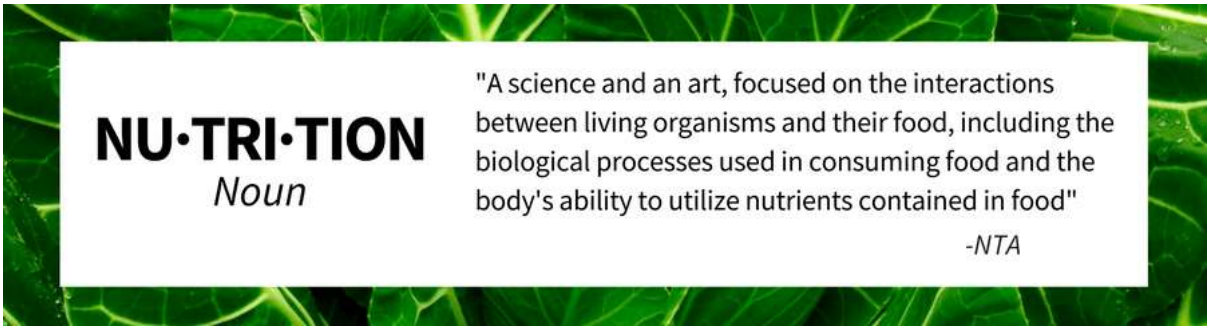
Training manual for non health professionals

IMNAS project

This study material is targeted for

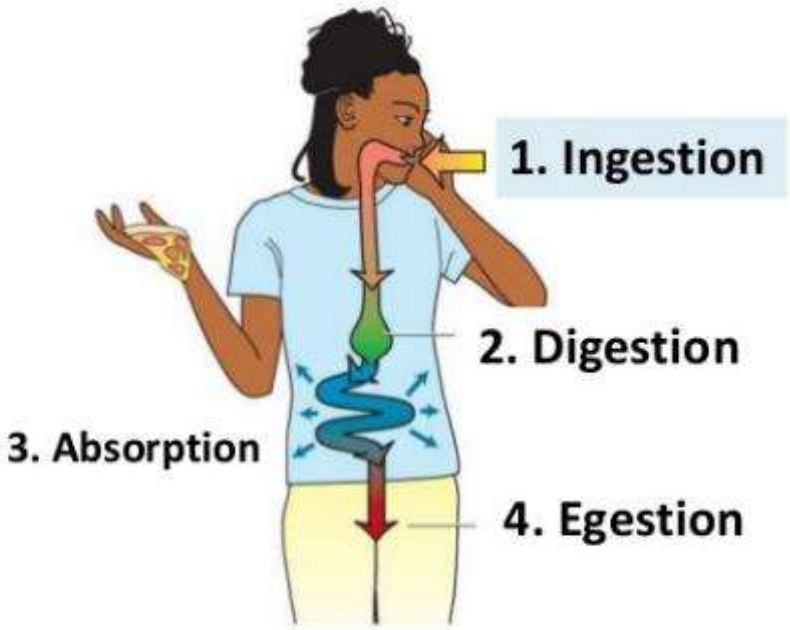
- Agriculture officers
- Development officers at grassroot level
- Media personnel

Introduction



What is Nutrition….?

The following steps take place in obtaining nutrition …..



1. Ingestion
2. Digestion
3. Absorption
4. Utilization of nutrients.

- Why is nutrition important?

- Good nutrition is an important part of leading a healthy lifestyle
- Proper nutrition increases immunity and fight against diseases.
- Several chronic diseases can be prevented by proper nutrition.
- Quality of life and life expectancy can be improved by proper nutrition
- Proper nutrition will increase working capacity and generate better income
- Unhealthy eating will contribute to illnesses and premature death.
- Malnutrition in early childhood impairs all aspects of development including cognitive functions.
- Malnutrition in early childhood leads to short stature.
- Malnutrition in pregnancy and early childhood can lead to chronic diseases in adult life.

Few facts– Nutrition recommendations and consequences of an unhealthy diet

- Breast feeding should be initiated within one hour of birth.
- Exclusive breast feeding should be maintained for the first 6 months of life
- Brest feeding should be continued till 2 years and beyond.
- Complementary feeding –
    - start complementary food on completion of 6 months with well mashed rice
    - Introduce foods of animal origin by about one week of introducing complementary food
    - Ensure variety in every meal
    - increase the frequency of meals , amount of food at each meal and consistency as the child grows older
    - Include locally available fruits and vegetables daily
    - Add oil , thick coconut milk to increase energy density of food
- Pregnant and lactating women need more nutritious food

- Children and adolescents should take an adequate and nutritious diet.
- Females need more iron in their food.
- Physical exercises are important to stay healthy.
- Limiting salt and salt containing food are important for prevention of hypertension and control hypertension.
- Fish provide healthy oils, iron and proteins
- Animal proteins have a higher biological value than plant proteins.
- The elderly should eat foods with high nutritional value.
- Five fruit and vegetables per day will reduce several chronic diseases such as cancers, IHD, DM.
- Having central obesity will lead to heart diseases, DM, stroke . (The simplest and most often used measure of **abdominal obesity** is waist size. According to Asian guidelines, central obesity is defined as waist size of 80 cm or higher in women, and a waist size of 90cm or higher in men).
- If you are inactive, eating large starchy meals may lead to diabetes
- If you are overweight, weight reduction is very important for control diabetes, hypertension, and IHD.
- Obese and overweight children very likely to be obese adults and have a higher risk of getting NCDs.
- The epidemic of the diabetes, obesity, hypertension, and heart diseases are associated with recent changes in the lifestyle.
- Coconut oil does not contain cholesterol.
- All type of starch (red rice, kurakkan, wheat) will convert to glucose in our body. However most important factor is the portion size of starchy food.

(Source- Food based dietary guidelines for Sri Lankans- Nutrition Division- Ministry of Health)

A balanced diet should contain all of these nutrients.

Name of the Nutrient	Sources	Function	
Carbohydrates (energy giving food)	Rice, potato, wheat, sugar	Provides energy	
Fats (energy giving food)	Butter, ghee, milk, cheese	Gives more energy compared to carbohydrates	
Vitamins and minerals (protective food)	Fruits and vegetables	Required for normal growth and development	
Proteins (body building food)	Milk, eggs, meat, fish, soybean	Helps in building and repair of body	

Do you know which food contain which nutrient?

1. Carbohydrates- rice, bread, pittu, hoppers, rotti, manioc, sweet potatoes, yam, bread fruit, Jack
2. Protein- fish, meat, dried fish, egg (white), milk, dairy products. TVP, pulses(beans, green gram, cowpea or lentils) ,
3. Fats- coconut oil, coconut milk, butter, margarine, vegetable oil
4. Vit C- fruits(nelli, guava, orange, lemon) dark green leafy vegetables
5. Vit A – liver, egg yolk, milk, milk products, meat, fish, spinach (nivithi), kathurumurunga, thampala, carrot and beet leaves, carrot, tomato, yellow pumpkin, mango, papaya,
6. Iron- red meat, liver, fish , (balaya, kelawalla, sawelaya,dried fish) chicken, egg yolk, , gotukola ,thampala, sarana, mukunuwanna, nelumala, mung, kadala, dhal (meat , liver, fish contain well absorbed heam type of iron - and egg yolk, green leaves and pulses contain non heam iron which is not that well absorbed)

7. Folate - thampala, karapincha (curry leaves), spinach, plantain, pineapple, lime, beans, soya bean, mung (green grams).
8. Fiber- brown rice, kurakkan, corn, green leaves, fruits, vegetables, unrefined cereals,
9. Sugar- sweets, hakuru (jaggery) treacle, soft drinks, sugary biscuits, , sweet fruits (eg. Banana), ice cream, chocolate
10. Salt – table salt, dry fish, processed food items
11. Cholesterol- egg yolk, red meat , milk , butter, cheese, full cream milk and milk products.

1.**Analyzing positive and negative nutrition implications of developing agriculture in the community**

(Group discussion – Explore positive and negative nutritional implications of agriculture in small and large scale in your area with the help of your instructor)

1.1 Direct effects : food availability, income generation

Discuss how these will change dietary habits and behaviors that could result in positive and negative outcomes for health and nutrition

1.2 Methods of utilizing excess food production effectively.

- Food preperation
- Food preservation
- What food items are being preserved in your area?
- (Demonstration)

……

……..

……

……

Small group discussion.

Critically analyze their impact on nutrition.

(Ex. Crop modification and introduction of a different crop such as maize in your area)

1.2 Make a list of health/nutrition/behavioral impacts when farmers in your area secure a higher income from one of your interventions

Positive :

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.....
.....
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.....

Negative:

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Small group discussion

Now , discuss among yourselves how to encourage a positive impact on nutrition and how to modify these interventions from the time of planning and implementation

Malnutrition.

Interpreting growth charts. (for case studies refer the appendix 2)

Common causes of malnutrition

Small group discussion. : discuss common causes of malnutrition in your area (remember, malnutrition can be under or over-nutrition)

Now list down five causes of malnutrition that you discussed and mention your suggestions to overcome those problems.

1. ……..
2. ……..
3. ……..
4. ……..
5. ……..

Assessment of nutrition

By the end of this session you will be able to calculate your own BMI and the category you belong to for your knowledge.

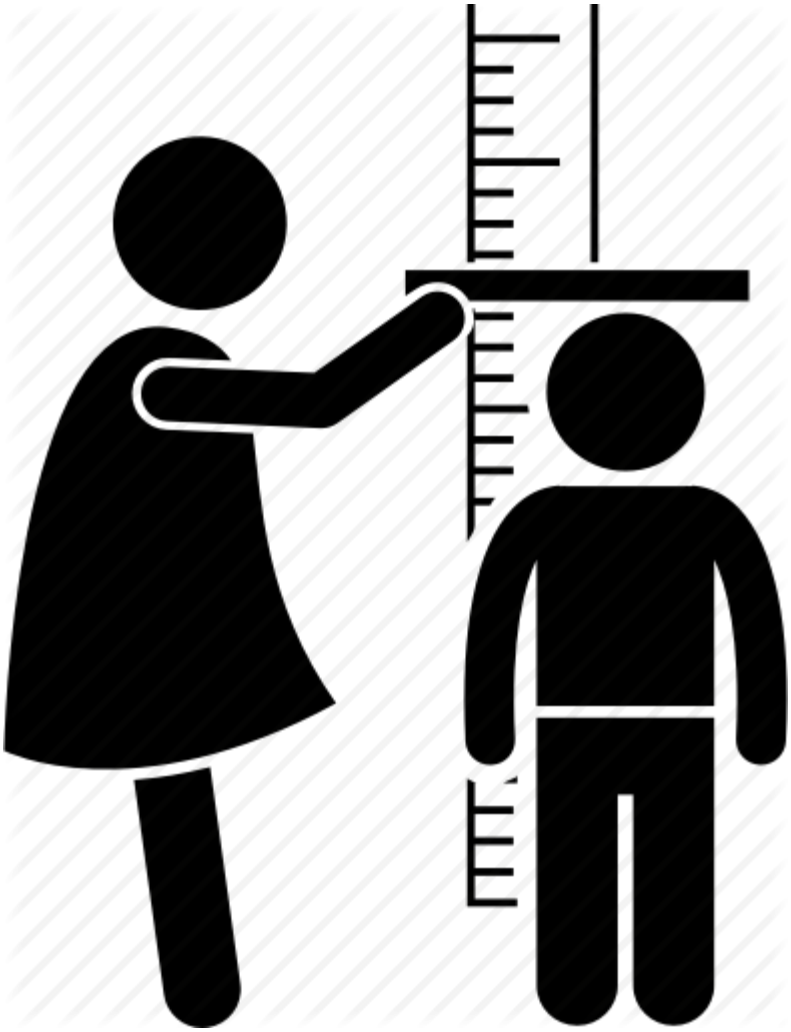
- Anthropometric measurements –

  How to measure height, weight and calculate BMI
  (You will be guided on the technique of taking anthropometric measurements in a demonstration)

  Measuring weight

  Measuring height

When measuring height;



Look straight ahead with straight shoulders and keep arms at sides.
Your shoulders (scapulae), back of the head, buttocks and heels should touch the measuring board.
Keep your legs straight, heels and knees together, and stand on flat feet.

Always need two persons to measure the heights. One is a helper who looks after the positioning of waist downwards. Measurer has to adjust the head and take the measurement.

From the measurements of height and weight we can calculate Body Mass Index (BMI).

$$BMI(\ Kgm^{-2}) = \frac{Weight\ (\ Kg)}{Height\ x\ Height\ (\ m^2)}$$

According to BMI values level of nutrition can be classified as (ESSL, 2014) :-

BMI	Interpretation
< 18.5	underweight
18.5- 22.9	normal
>23	Overweight
>25	obesity

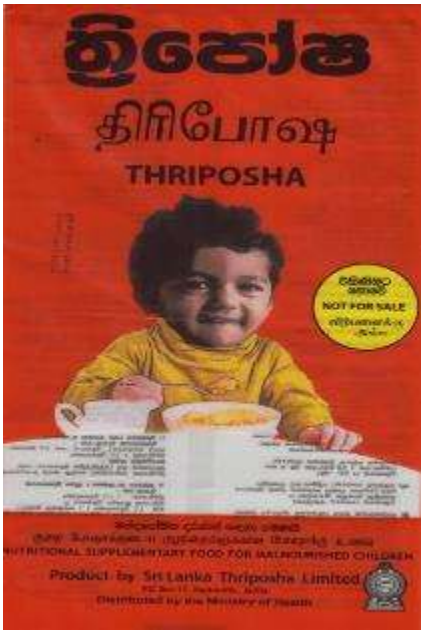
Food supplementation

What is a food supplement?

Food supplements are concentrated sources of nutrients or other substances with a nutritional or physiological effect and their purpose is to supplement the normal diet.

Thriposha

(Triposha is an example of a supplementary food. A supplementary food is given to provide extra energy, nutrients required by the under nourished and certain physiological state like pregnancy and lactation. Additional information on supplementary food items will be provided by your instructor.)



Small group discussion

- What are the other food supplements you know of ?
- Are Marmite, Sustegen useful?

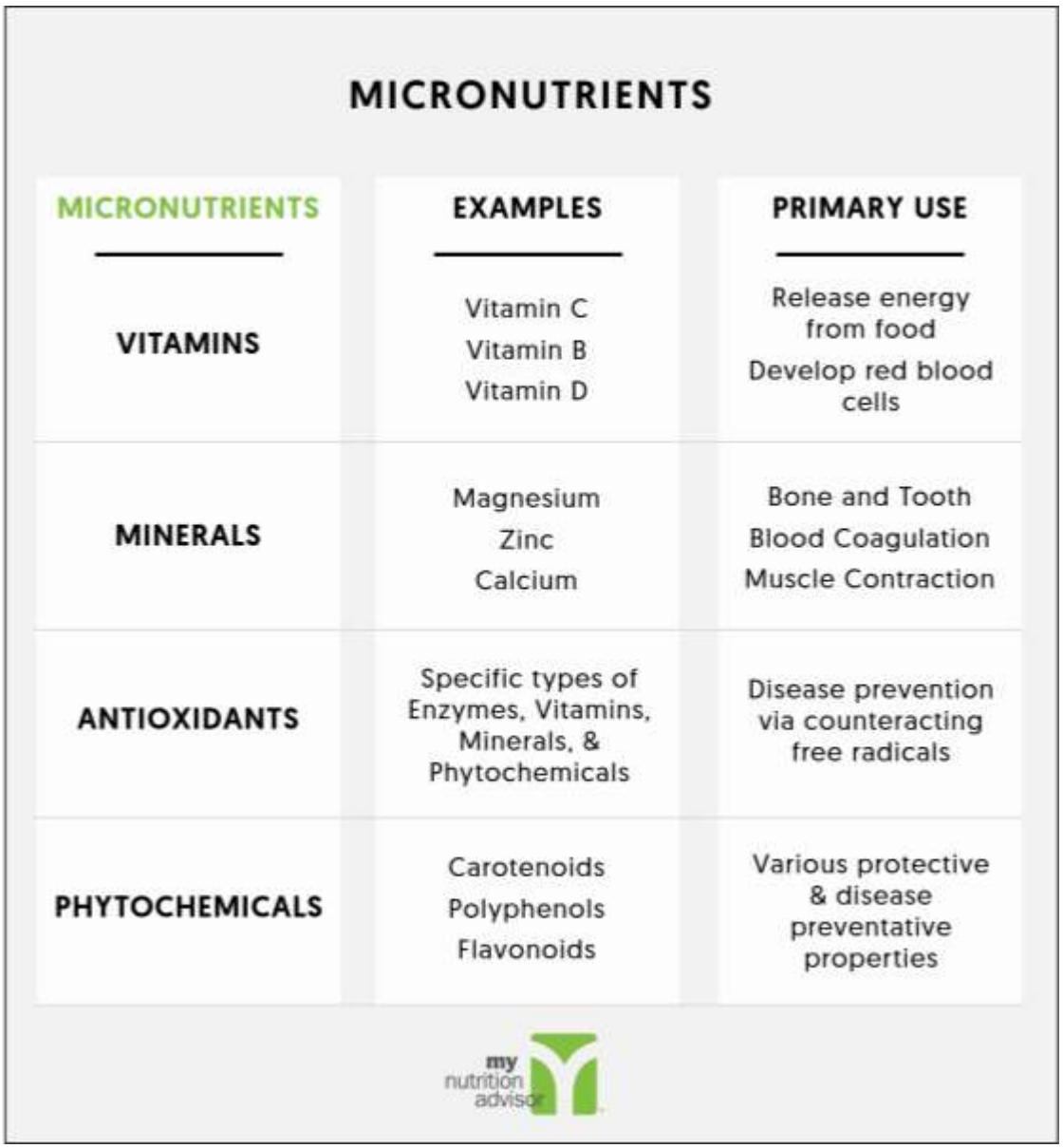
Micronutrient deficiencies

Micronutrients

- What is a Micronutrient

A chemical element/ substance required **in trace amounts** for the normal growth, metabolism and development of human beings.

Eg. Iron, zinc, vit.A



Question : What are common micronutrient deficiencies in Sri Lanka?

……

……

……

……

……

Food rich in micronutrients.

- Iron - ……
- Zinc -……
- Calcium -……
- Vit A - ……
- Vit B complex - ……
- Vit C -……

Small group discussion

Ask PHM which micronutrient deficiencies are more prevalent in your area.

Discuss among yourselves which food items can be grown best in your area that could tackle these problems – they can be large farmland crops as well as things that can be grown in home gardens

How can you help to improve availability and accessibility of these food items?

Nutritional needs of special groups

Among the elderly population in Sri Lanka….

- Consumption of foods of animal origin is poor
- Carbohydrates are the main energy contributor
- Dietary diversity is not up to optimal level

❖

❖ What are the other nutritional issues that the elderly have?

……
…….

……
……

❖ How can their nutritional status be improved?

What do you know about nutritional needs of pregnant mothers and children?

Dietary diversity

(source-Food Based Dietary Guidelines for Sri Lankans published by Ministry of Health)

Meals that include no servings or very few servings of different food groups such as fruits and vegetables, dairy products, fish and meat and pulses, lack both balance and variety. It is evident that a substantial proportion of the Sri Lankan population does not consume a varied and balanced diet, which is suggestive of a close association between the nutrition-related NCD in the country and these unhealthy eating habits. (Jayawardananaet al, 2012)

There are six food groups that provide you energy and nutrients to keep you healthy. Each food group gives you different nutrients needed by your body. You need to eat a **variety** of food every day, in **recommended quantities** to form a **healthy diet.**

The food groups are:

1.Grains (cereals) and tubers (yams)

Rice, wheat, *kurakkan*, maize (corn), rice & wheat flour preparations (bread, string hoppers etc.)
Tubers (yams)- manioc, potato and sweet potato, *innala, kiriala*
Starchy fruits- jak, breadfruit

- Provides energy for your daily activities

2.Fruits

Plantain, mango, papaya, pineapple,oranges, guava, avocado etc.

- protects you from diseases

3. Vegetables

Leafy vegetables - *kankun*, spinach, *gotukola*, *mukunuwenna*, *sarana*, *katuru-murunga*, *drumstick ,murunga*leaves etc.

Root and fruit vegetables - gourds, brinjals,ash plantains, ladies fingers, tomato, carrot, beet etc.

- protects you from diseases

4.Fish, pulses, meat and eggs

Fish - fresh water fish & sea fish, sprats, dried fish, shell fish(prawns, cuttle fish)
Pulses - Chick pea *(kadala*), green gram, cowpea, soy bean, *ulundu*, lentil (dhal),other beans
Meats - chicken, beef, pork, mutton, Offal- liver
Eggs - hen's, duck, quail (*vatu*)

- helps in growth and maintenance of your body

5.Milk and/or milk products

Milk, curd, yoghurt, cheese

- Helps in growth and maintenance of your bones and teeth

6.Nuts and oil seeds

coconut, pea nuts, kottang, cashew nuts,pumpkin seeds, coconut milk, coconut oil,gingelly and palm oils,other vegetable oils,butter, margarine, ghee

- Provides energy and helps in bodily functions

❖ The Golden rule: Be sure to eat some **food from each of these groups daily**. It is important to include some item (s) from each group rather than a large quantity of one or two groups. This will ensure variety in your diet and thereby give you the nutrients required by your body every day.

How much of each food group should be consumed?

The number of servings needed daily from each of the six food groups depends on the age, sex, body size, level of activity, and the stage of the lifecycle. Illnesses impose additional considerations.
Eat more of some food (grains, fruits and vegetables) and less of others (fats and oil).

What are serving sizes?
It helps you understand how much food is recommended every day from each of the six food groups. It is assessed using household measures.

Portion size estimations

Estimation of vegetable portions

- Three heaped table spoons or ½ cup or 80 grams of cooked vegetable is defined as one vegetable serving.

- If there is a vegetable curry with half amount gravy six table spoons are defined as one vegetable portion.

- one medium size coconut spoon is considered as three table spoons or one serving

Estimation of fruit portions

- Fruit juice- Even if more than one glass per day was reported, it would only count as one portion of fruit per day
- Fruit juices (fresh) count as up to a maximum of two portions per day

One portion of fruit, (average weight is 80 grams)

- Small sized fruits– Ten fruits considered as one portion, example: grapes, veralu, nelli, lovi, rose apple (jamboo)
- Small–medium size fruits – number may vary (2-6): ambarella, banana (small), naminan, rambutan, passion fruit, mangosteen, jack fruit ripen (waraka)
- Medium-sized - one medium fruit, such as one apple, banana, pear, orange, guava, woodapple, belli, manderin
- Large-sized - one slice of papaya, one slice of melon (two-inch slice), one large slice of pineapple, two slices of mango (two-inch slices), pomegranate (1/2 medium), durian (2 pieces),

- Dried fruit: One tablespoon of raisins, currants, sultanas, one tablespoon of mixed fruit, two figs, three prunes, one handful of banana chips.
- Juice: One medium glass (150ml) of fruit juice.
- A-half cup of chopped fruits

- Pineapple portion is defined as one large slice or two round shapes slices.

- Two bananas were defined as one portion.

Estimation of pulse portions

- Cooked pulses ½ tea cup or three full table spoons or 1 coconut spoon is defined as one pulse portion.

Estimation of dairy products

- One glass of milk (250 ml) of fresh milk is defined as one portion.
- As milk powder is used commonly in Sri Lanka as main dairy food source three table spoonfuls is defined as one serving equivalent to fresh milk.

- Two small cups of yoghurt (80grms each) and one tea cup or eight table spoons of curd is considered as one serving.
- Two slice or two wedges of cheese or 1/8 from 250 g of cheddar cheese are defined as one portion.

Estimation of cereal or equivalent portions

- One portion of cereal or equivalent is defined as the amount of starchy food in which 15 g of carbohydrate is contained.
- 1/3 tea cup of rice, milk rice and noodles, one slice of bread, ¼ of 10cm diameter and 0.5 cm thickness coconut roti, 2 string hoppers and ½ hopper is considered as one serving of each food.
- 1/3 tea cup of boiled bread fruit, jak and sweet potato, ½ tea cup of ash plantain and yam is defined as one portion.
- Serving of cooked starch vegetables is decided by comparing the amount of curry which contains 15 g of carbohydrate.
- Then portion size is calculated as how many household measures with the above weight of curry. This is used for both cooked and raw foods. As an example, one portion of manioc curry is 90 g and it holds in three table spoons. Ash plantain curry 90 g is defined as one serving and six table spoons of it is taken as one portion.
- Biscuits, cake, short eats (roll, cutlet), vegetable roti and papadam are also included in starch portions .
- One piece of 4 cm slice cake and one short eat is calculated for one portion cereal or equivalent.

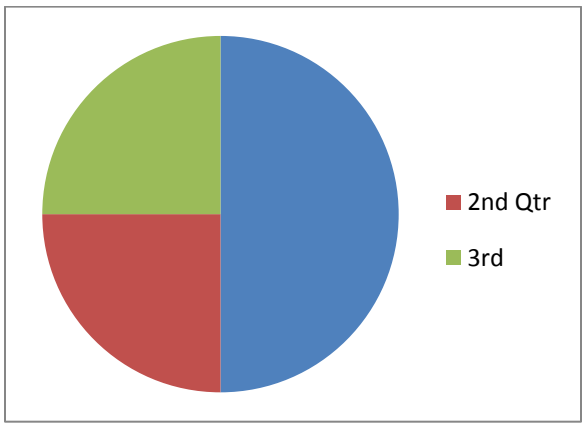
Estimation of meat portions

- The serving size was defined considering 7 grams of protein in the food portion.
- One egg, 30 gram weight of meat, fish, and 30 g weight of prawns and meat balls is defined as one meat portion.
- Since dry fish contain more protein, 15 g is defined as one portion. But one portion of dry fish curry is considered as 30 g since it contains gravy.
- Commonly sprats are served using table spoons. As one table spoon holds 7-8 sprats weight of one table spoon is considered as 7.5-8 g. Thus 2 table spoons of sprats are defined as one portion.
- In Sri Lanka 1 kg of chicken is cut into 13-15 pieces and one piece of chicken is considered as two portions.
- Since non- vegetarian fried rice contains more than 2.6g protein than normal cooked rice, it is considered as 1/3 of meat portion included in fried rice.

Estimation of sugar portion sizes

- Five grams of sugar is defined as a portion.
- One portion of honey, treacle and jaggery was calculated estimating the weight or volume which contains 5grms of sugar.

My plate



- **Half the plate should be filled with rice.- (approx. 2 cups)**
- **Quarter of the plate should be filled with protein. It should include pulses i.e., dhal and fish. Ex. Sprats (one serving of fish/eggs/meat and 2 table spoons of pulses)**
- **The balance quarter should contain vegetables and fruits (3 servings of vegetables and one serving of fruit)**

Prepare menu of healthy diet including commonly available food items in
your area.
(3 weekdays and one weekend day)

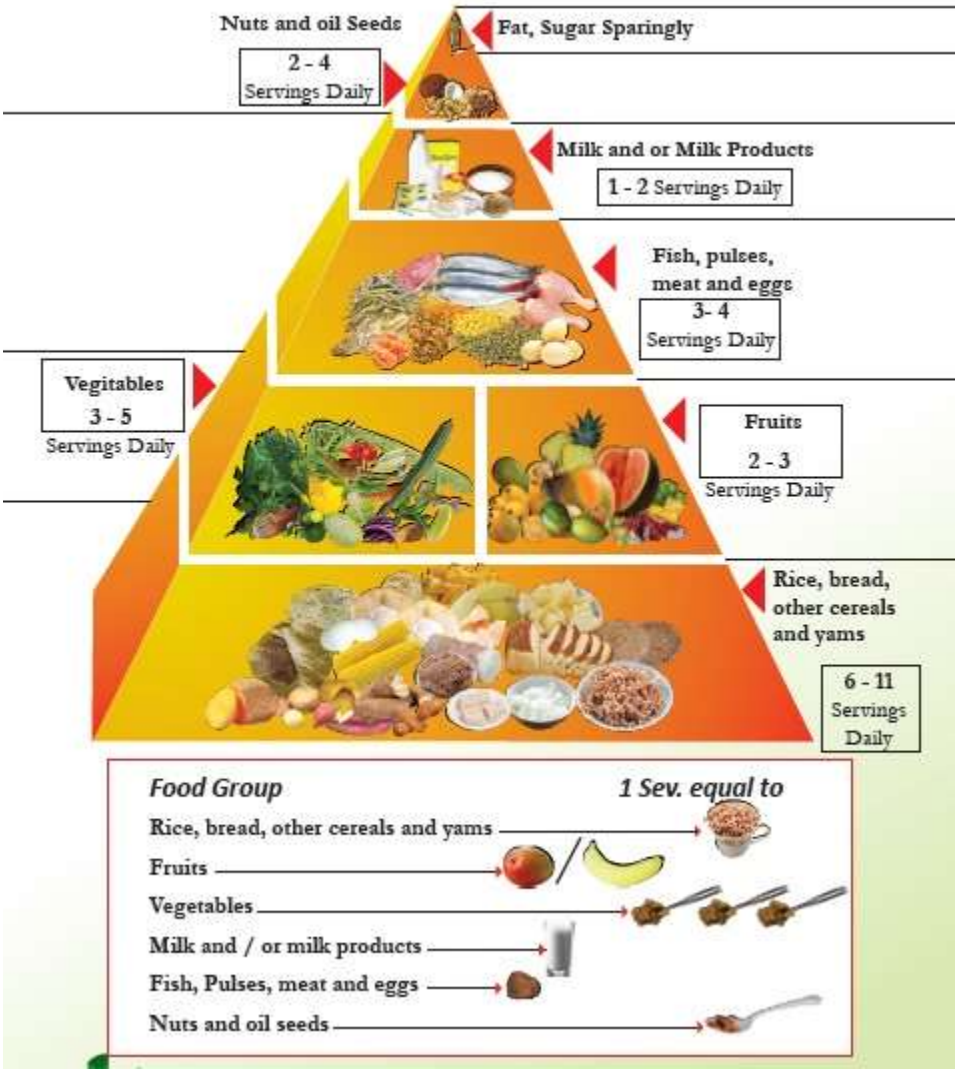
Breakfast -…….

Lunch -…….

Dinner -…….

Food pyramid

(Source- Nutrition division- Ministry of health)



Healthy snacks.

Some healthy snacks

Any fruit/ fresh fruit juice
Yoghurt/ curd
A hand full of cashew nuts, peanuts or any other healthy nut
Helapa, ,mungguli

(Source- food based dietary guidelines for Sri Lankans- a publication by Nutrition Division – Ministry of Health)

Food hygiene

Hand washing is important for food hygiene.

The five key principles of food hygiene, according to WHO are:

1. Prevent contaminating food with pathogens spreading from people, pets, and pests
2. Separate raw and cooked foods to prevent contaminating the cooked foods.
3. Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens.
4. Store food at the proper temperature.
5. Do use safe water and cooked materials.

What are the ways that you can improve food hygiene?

1……

2……

3……