Improving Fruit and Vegetable Intake and Production in Sri Lanka: An Evaluation of the FRESH End-to-End Approach

FRESH Sri Lanka | Research Brief #1

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Introduction

Problem Statement

Inadequate diets are a major contributor to malnutrition and the leading risk factor for morbidity and mortality worldwide. Low fruit and vegetable (F&V) intake contributes significantly to these burdens.

F&Vs are essential sources of micronutrients,[1] and their production has a lower environmental footprint compared to other nutrient-dense foods,[2] making them critical for both health and sustainability. Despite these well-documented benefits, global F&V intake remains below the recommended 400 grams (about 5 servings) per person per day.[3] This is particularly true in low- and middle-income countries (LMICs), where less than 20% of adults meet this target.[4, 5] This is likely due to a complex interplay of factors including availability, affordability, accessibility, and other context-specific barriers.

Narrowing F&V intake gaps requires a nuanced understanding of the interconnected factors influencing their consumption. The approach must be comprehensive and encompass addressing factors across the food system.

Generating high-quality, context-specific evidence on these factors is essential to designing effective strategies that enhance F&V desirability, affordability, accessibility, and availability, ultimately supporting healthier, more sustainable diets.

Sri Lankan Context

Diet and Nutrition

In Sri Lanka, around 15% of children under five are stunted, and 19% are wasted. Anemia affects between 8–19% of children, adolescents, and adults, while deficiencies of vitamin D, vitamin B12, and zinc are prevalent among pregnant women and adolescents.[6] Among adults, over one-third are overweight or obese, with a higher prevalence in women than men. Moreover, nearly 30% of adults are diagnosed with hypertension, and one-quarter suffer from diabetes (read more in the Sri Lanka Nutrition & Diet Profile[6] and the Sri Lanka Urban Nutrition Profile[7]).

Sri Lanka is an island nation that has faced a compounding set of crises in recent years, such as political instability, climate disasters, an economic crisis, COVID-19, fuel shortages, disruptions to agricultural production, and price inflation.

These factors contributed to a high prevalence of severe food insecurity in 2022, with healthy diets being unaffordable for 34% of the population.[8, 9] Additionally, more than 90% of households experienced increased monthly expenditures driven by food price inflation in 2023.[10] Although the economy has been stabilizing, poverty and food prices remain high, in part due to climate-related crises.[11, 12] As such, the challenge of meeting a diet adequate in nutrient-dense foods, such as F&V and animal-source foods, persists among both rural and urban households.[13]

Less than a third of Sri Lankan adults meet the recommended quantity of fruit and vegetable intake, with urban residents consuming more than rural residents.

A nationally representative survey reported that only 32% of Sri Lankan adults consume the recommended number of servings of F&V per day.[14] Household-level consumption data indicate that the per capita availability of fruit (133 g per day) and vegetables (211 g per day) are both below the regional and global averages (Food Systems Dashboard[8]). Urban areas have the highest per capita fruit (188 g per day) and vegetable (181 g per day) consumption, followed by rural areas (152 g per day for fruit and 166 g per day for vegetables).[15] However, at the individual level, scarce data indicate much lower F&V intake at 190 g per adult per day among rural agricultural households in Sri Lanka. [16, 17] Additionally, evidence on what interventions work to increase F&V intake in Sri Lanka is limited.[6]

Agriculture

Sri Lanka's agricultural sector relies heavily on both rice and vegetable cultivation. Approximately 70% of the rural population depends on farming as their primary livelihood, and nearly half of the country's arable land is dedicated to agriculture.[18] With diverse agroecological zones, Sri Lanka supports a diverse array of indigenous F&V that are rich in nutrients,[19] enabling year-round cultivation of fresh produce for the local population.

Overview of FRESH in Sri Lanka

The CGIAR Research Initiative on Fruit and Vegetables for Sustainable Healthy Diets (FRESH), now under the CGIAR Science Program on Better Diets and Nutrition (BDN), uses an end-to-end approach to improving dietary intake of fruit and vegetables. The approach integrates interventions across the food system to address barriers to increasing intake, focusing on three key areas in Sri Lanka: consumer demand (increasing desirability), food environment (increasing accessibility and affordability), and supply (increasing availability through genetic innovation, safe and sustainable agricultural production, and reducing food loss and waste). Together with local and international partners, the International Food Policy Research Institute (IFPRI) is leading the evaluation of the FRESH approach in Sri Lanka.

Methodology

FRESH End-to-End Approach

The FRESH end-to-end approach begins by examining diets to understand general patterns of F&V intake and associated nutrient inadequacies. It then identifies barriers and facilitators to intake across the food system, exploring strategies to address these constraints. Key challenges include: 1) motivating increased consumption of F&V; 2) strengthening food environments in which people purchase and consume foods; 3) resolving postharvest issues to reduce food loss and waste; 4) improving food quality; 5) increasing production of safe, sustainable, and diverse vegetables through improved practices; and 6) supporting vegetable biodiversity and genetic innovation

(more information on FRESH activities and publications can be found here[20]).

Program interventions

Supply

The package of supply-side activities developed under the FRESH approach aims to enhance agricultural production practices to support safe, sustainable, and diverse vegetable cultivation throughout the year. These efforts target small-holder farmers, including women and extension workers.

Supply-side interventions have been tailored to the two predominant farming systems in the selected areas in Sri Lanka: 1) ***Continuous vegetable farming system***, where vegetable cultivation is established, and 2) ***Staple farming system***, where rice is the major cultivation. In both systems the focus is on promoting Good Agronomic Practices (GAP) by implementing integrated management of water, nutrients, fertilizers, pests, and diseases to improve resource-use efficiency and ensure food safety and supporting the integration or diversification of vegetables through intercropping, relay cropping, and crop rotation to boost year-round availability.

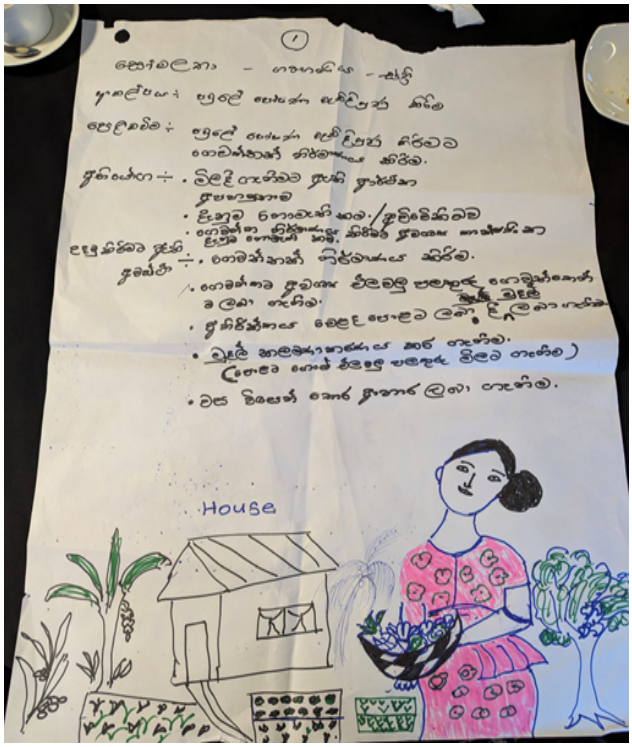
The International Water Management Institute (IWMI), World Vegetable Center (WVC), and Borlaug Institute for South Asia (BISA) in collaboration with the Department of Agriculture (DOA) and Provincial Departments, through a participatory approach established four demonstration plots, two in each Welimada and Balangoda Divisional Secretariats (DS) from Badulla District (predominantly vegetable-intensive farming) and Ratnapura District (predominantly rice-vegetable farming), respectively. These plots, located in separate Grama Niladharis (GNs – the smallest administrative unit in Sri Lanka) are managed jointly with local farmers.

Serving as production hubs, these sites are piloting technologies for integrated pest management, improved irrigation, conservation agriculture, soil fertility enhancement, and post-harvest handling. At each hub, groups of farmers are being trained in these technologies and will serve as peer trainers for other farmers in each cropping season. Farmer field days are also organized to disseminate knowledge on GAP, strengthen market linkages by connecting farmers with vendors, and engaging private sector stakeholders such as seed companies, traders, and processors. Nearly 300 farmers and 50 extension workers have already benefited directly from these trainings and 600 may have benefitted indirectly. These activities are being scaled-up to reach a total of 14 GNs within the study areas, targetting another 200 direct beneficiary farmers.

Consumer demand and food environment

The interventions involved with creating consumer demand for F&V and fostering a supportive food environment for the sale and purchase of F&V are currently under development. A Human-Centered Design (HCD) approach, using GAIN's toolkit[21], is being used to co-create interventions with relevant local stakeholders in Sri Lanka. This participatory, iterative process ensures that interventions are relevant, feasible, and aligned with the needs and preferences of the communities.

Two stakeholder workshops were conducted in December 2024 using the HCD approach, bringing together community members, local leaders, vendors, farmers, and other key actors in Haputale (Badulla District) and Balangoda (Ratnapura District). Building on the insights generated in this exercise, an additional workshop was conducted in July 2025 with government officials and potential implementation partners at the national level to explore opportunities for scaling and sustaining the interventions beyond the intervention lifespan. Shortlisted intervention ideas and feedback from both workshops were then brought back to the community for review and acceptance estimation among potential beneficiaries.



The demand-side interventions are expected to focus on shifting behavior towards increased F&V intake and overall healthier diets. Potential interventions here may include income support mechanisms to increase purchasing power (e.g. cash transfers, food vouchers) and behavioral interventions to enhance knowledge and attitudes towards F&V. Approaches integrating the Food-Based Dietary Guidelines for Sri Lankans via social behavior change communication (SBCC), community-based or individual home-based nutrition education, and digital tools will be considered. Digital and other types of messaging may strengthen market linkages by providing real-time information on seasonal F&V availability, pricing, and vendor locations, connecting nutrition knowledge with practical market access information.

The food environment intervention will focus on improving accessibility of F&Vs in open-air markets and/or retail outlets and addressing barriers to consumer purchases of F&V. Selected interventions may include supporting vendors in using GAPs and promoting increased demand for sustainably grown fresh produce through labeling or signage. Vendors may also implement price promotions or adjust product displays to encourage healthier purchases.

Study description

Study design

The end-to-end approach and its interventions will be evaluated through a longitudinal cluster-matched and partially randomized controlled trial with five study arms: three in rural areas and two in urban areas **(Figure 1)**. Clustering took place at the village/ town level as defined by government officials based on administrative boundaries. The first study arm includes villages where the supply-side, demand-side and food environment interventions will be implemented. The second study arm consists of villages where demand-side and food environment interventions will be implemented, and the third rural arm will receive none of the three interventions. The urban areas include two study arms: one that will receive the demand-side and food environment interventions and a second arm that will receive none of the interventions.

The study protocol was reviewed and approved by the Wayamba University of Sri Lanka Ethics Review Committee (No.: 202404H1) and the IFPRI Institutional Review Board (No.: NDH-24-0419MP).

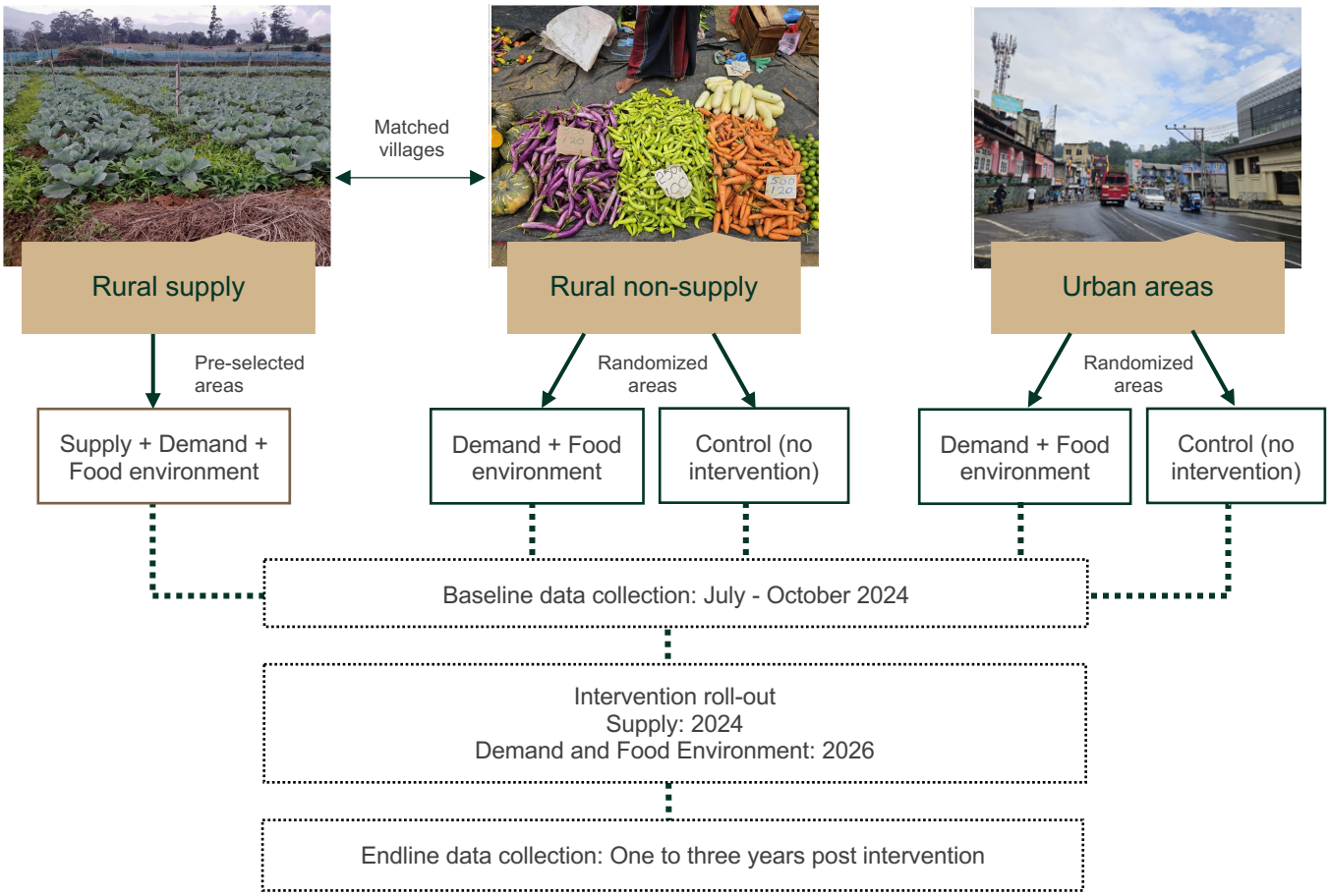
Study locations

The study is being conducted in two districts: Badulla (Uva Province) and Ratnapura (Sabaragamuwa Province); selected based on the locations where FRESH supply-side activities have already been initiated through the establishment of agriculture demonstration plots for production activities in Welimada (Badulla District) and Balangoda (Ratnapura District). Non-supply rural study areas and urban study areas were matched and randomized from the same two districts.

Target population

The primary target population of the study in Sri Lanka is women of reproductive age (WRA) aged 20 to 49 years. WRA play a key role in household food purchasing, preparation, and decision-making. Thus, targeting WRA may lead to improved diets not only of the women themselves, but also their families. The sample size for the study includes 2875 households that include a WRA. Secondary target populations include men aged 20-49 years for dietary intake assessment and children and adolescents between 10-19 years of age for anthropometric measurements, all from the same households.

Figure 1: FRESH Sri Lanka study design



Study objectives

To evaluate the impact of the package of interventions on household vegetable production and dietary intake of F&V among WRA and men within beneficiary households **(Figure 2).**

Data collection

The study in Sri Lanka employs a comprehensive data collection strategy across multiple levels.

At the community level, **village surveys** will be used to gather information from key informants such as village leaders, Grama Niladhari officials, public health midwives, and extension officers, about the village infrastructure, services, and health and agricultural support systems.

The **household survey** consists of two complementary sections: one for household heads focusing on socioeconomic status, assets, agricultural production, and expenditures; and another for the WRA (if different from household head) covering food security, water security, food choice, and women's empowerment, among others.

Additional individual-level data collection includes a phone-based **diet survey**, using 24-hour dietary recalls administered to the WRA and men, with 20% receiving a repeat recall to account for day-to-day variation; and a context- specific F&V food frequency questionnaire (FFQ) for the WRA. **Anthropometric measurements** such as weight, height, hip circumference, and waist circumference are also included for the WRA and all eligible adolescents in the households.

The **food environment assessment** incorporates a baseline **census of all retail outlets**, followed by year-long monthly detailed **market surveys and vendor surveys** to track food availability, cost, quality, and safety throughout the study period.

Figure 2: Study objectives in Sri Lanka

Rural areas

Primary objectives

- To evaluate the impact of supply + demand + food environment interventions on household vegetable production and F&V intake among WRA.
- To evaluate the added benefit of a demand + food environment intervention added to a supply intervention on household vegetable production and F&V intake among WRA.
- To evaluate the impact of a demand + food environment intervention on vegetable production and F&V intake among WRA.

Secondary objectives

- To assess the changes over time in vegetable production and F&V intake among WRA.
- To evaluate the cost effectiveness of the FRESH approach on vegetable production and F&V intake among WRA.

Urban areas

Primary objective

- To evaluate the impact of the demand + food environment intervention on F&V intake among WRA

Secondary objectives

- To assess changes over time on F&V intake among WRA.
- To evaluate the cost effectiveness of the demand + food environment intervention on F&V intake among WRA.

Comparative analysis

- To compare the impact of the demand + food environment intervention on F&V intake among WRA between rural and urban areas.

Policy relevance

This study's holistic end-to-end approach aligns well with Sri Lanka's National Nutrition Policy (NNP) 2021-2030. The NNP outlines strategies to ensure food and nutrition security through nutrition-sensitive food value chains, financial strategies to improve affordability, and community empowerment to promote healthy eating habits. These activities aim to support the NNP's target of increasing the proportion of adults meeting WHO fruit and vegetable intake guidelines to 40% by 2030.

In line with the NNP strategy, the study will generate valuable data on agricultural production, dietary intake among WRA and men, and the nutritional status of WRA, children, and adolescents across rural and urban settings in the study areas. By evaluating the impact of the interventions, this research will address critical knowledge gaps regarding the effectiveness of interventions on household vegetable production and F&V intake at the individual level. These findings can be used to inform future programs and policies related to diets, nutrition, food environments, food systems, and public health and agriculture strategies throughout Sri Lanka.

REFERENCES

1. FAO and WHO, *Sustainable healthy diets – Guiding principles.* 2019: Rome.
2. Clark, M.A., et al., *Multiple health and environmental impacts of foods.* Proc Natl Acad Sci U S A, 2019. **116**(46): p. 23357-23362.
3. Afshin, A., et al., *Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017.* The Lancet, 2019. **393**(10184): p. 1958-1972.
4. Global Nutrition Report, *The state of global nutrition* 2021.
5. Frank, S.M., et al., *Consumption of Fruits and Vegetables Among Individuals 15 Years and Older in 28 Low- and Middle-Income Countries.* The Journal of Nutrition, 2019. **149**(7): p. 1252-1259.
6. Koyratty, N., et al., *Nutrition & diet profile: Sri Lanka. FRESH Country Profile* 2024, International Food Policy Research Institute: Washington, DC.
7. Margolies, A., et al., *Resilient Cities urban nutrition profile: Sri Lanka. Resilient Cities Country Profile.* . 2024, International Food Policy Research Institute: Washington, DC.
8. Food Systems Dashboard. *Sri Lanka*. n.d. 17 June 2025]; Available from: https://www.foodsystemsdashboard.org/countries/lka/fsci.
9. WFP, *Sri Lanka Food Security Monitoring*. 2022, World Food Programme.
10. Department of Census and Statistics, *Household Survey on Impact of Economic Crisis*. 2023, Ministry of Finance, Economics Stabilization and National Policies Sri Lanka.
11. World Bank Group, *Sri Lanka Development Update: Bridge to Recovery*. 2024.
12. Institute fof Policy Studies of Sri Lanka, *Sri Lanka's Food Security after Cyclone Ditwah: Risk, Recovery, and Resilience*. 2025, Talking Economics.
13. IPS, *Sri Lanka: State of the Economy 2024*, in *Economic Scars of Multiple Crises: From Data to Policy*. 2024, Institute of Policy Studies of Sri Lanka: Colombo, Sri Lanka.
14. WHO, *STEPS Country Report Sri Lanka*. 2021.
15. Udari, U.D.R., et al., *Do We Know What We Should Be Eating? Consumption Patterns of Fruit and Vegetables*. 2021, Hector Kobbekaduwa Agrarian Research and Training Institute.
16. Silva, R., et al., *Consumption and dietary intake of fruits and vegetables in Sri Lanka with a focus on traditional and indigenous fruits and vegetables*. 2023, Bioversity International and International Center for Tropical Agriculture (CIAT): Rome, Italy.
17. Joyce, C.A., et al., *Dietary intake and micronutrient adequacy among adults engaged in agriculture in rural Sri Lanka: findings from a cross-sectional baseline survey.* Public Health Nutr, 2025. **28**(1): p. e35.
18. Gregrowski, S., *Sustainable vegetable cultivation. Research-based agronomic practices promise safer, more efficient crop production.* 2024, International Water Management Institute.
19. Aheeyar, M., et al., *Opportunities for and constraints to safe and sustainable vegetable production in Sri Lanka*. 2023, International Water Management Institute: Colombo, Sri Lanka.
20. IFPRI. *Fruit and Vegetables for Sustainable Healthy Diets (FRESH)*. 2025; Available from: https://www.cgiar.org/initiative/fruit-and-vegetables-for-sustainable-healthy-diets-fresh/#:~:text=This%20initiative%20aims%20to%20use,and%20mitigating%20negative%20environmental%20impacts.
21. GAIN. *Human-Centered Design (HCD) Toolkit. Boosting the Nutrition Impacts of Social Protection*. n.d. 10 July 2025]; Available from: https://www.gainhealth.org/human-centered-design-hcd-toolkit.

ACKNOWLEDGEMENT

From 2022 to 2024, the CGIAR Research Initiative on Fruit and Vegetables for Sustainable Healthy Diets (FRESH) was implemented by CGIAR researchers from IFPRI, CIMMYT, the Alliance of Bioversity International and CIAT, IWMI, and CIP, in close partnership with the World Vegetable Center, Applied Horticultural Research, the University of Sydney, the Institute of Development Studies, Wageningen University & Research, the University of California, Davis, Sokoine University of Agriculture, Wayamba University of Sri Lanka, the Philippines Department of Science and Technology–Food and Nutrition Research Institute, and others. FRESH's work is now part of CGIAR Science Program on Better Diets and Nutrition (BDN), which aims to ensure sustainable healthy diets for all.

We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund: www.cgiar.org/funders.

PHOTO CREDIT

Page 2: Alliance of Bioversity International & CIAT

Page 3: Artwork by workshop participants photographed by Global Alliance for Improved Nutrition / J. Rajendran

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About BDN

The CGIAR Science Program on Better Diets and Nutrition (BDN) identifies, co-designs and tests consumer-oriented solutions to ensure sustainable healthy diets for all while enhancing livelihoods, social equity, and environmental sustainability. Through evidence-based research and collaboration, BDN supports country-led food system transformation in low- and middle-income countries. To learn more about BDN, please visit https://www.cgiar.org/cgiar-research-porfolio-2025-2030/better-diets-and-nutrition/.

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We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund: www.cgiar.org/funders.