Food and Agriculture Organization of the United Nations

MAINSTREAMING NUTRITION IN THE AGRICULTURE SECTOR IN SRI LANKA

TECHNICAL BRIEF

VEGETABLES AND FRUITS

INTRODUCTION & BACKGROUND

Vegetables and fruits are essential components of the daily diet of humans. They provide macro-nutrients such as carbohydrates, as well as micronutrients such as vitamins A, B complex and C and minerals such as calcium, magnesium, phosphorous, potassium and selenium among others. Furthermore, they are rich sources of dietary fibre and phytochemicals carrying bioactivity including antioxidant, anti-carcinogenic, hypoglycemic, hypocholesterolemic, hepatoprotective and prebiotic effects etc. Therefore, vegetables especially green leafy vegetables and fruits, have been identified as a major food group in the dietary guidelines of many countries. Vegetable and fruit intake is an important indicator of the quality of diet and protection against certain chronic diseases such as cardiovascular disease, cancer, diabetes mellitus, Alzheimer's disease, cataract and age-related functional decline. A substantial proportion of the Sri Lankan population consume meals that include very little or no servings of vegetables, though Sri Lanka records a high production of vegetables and fruits (Jayawardena et al., 2012). The current daily intake of vegetable portions, which stands at 1.73 portions was notably below the national and international recommendations of 5 portions. The per capita availability of fruits and vegetables is estimated to be 466 g/day in Sri Lanka, while the recommended daily intake of fruits and vegetables is 400 g (Food Balance Sheets, FAO). However, the average consumption of vegetables and fruits in Sri Lanka stands far below the recommendation. A part of the population still suffers from one or more micronutrient deficiencies, as a result of diets that are deficient in staple and micronutrient-rich foods.

Due to wide variations in temperature, rainfall, topography and soils, Sri Lanka has been blessed with a rich diversity of plant species. As a result, the country has been identified as one of the 25 biodiversity hot spots in the world. It is estimated that there are more than 230 fruit species belonging to 57 plant families in Sri Lanka (Piyathunga et al., 2016). However, only about 80 vegetables and fruits are commercially available (Export Development Board, 2013). Sri Lanka produces nearly 710,000 MT of vegetables and 540,000 MT of fruits annually. The majority of the produce comes from small producers or home-garden growers whose individual extent of land does not exceed a hectare (Export Development Board, 2013).

Apart from the commonly consumed fruit crops such as banana, pineapple, papaya, mango, avocado and rambutan, there is a large number of underutilised fruit species such as Nelli (Phyllanthus embilica), Lovi (Flacouria inermis), Rata Nelli (Phyllanthus acidus), Ugurassa (Flacouria indica), Delum (Punica granatum), Veralu (Elaeocarpus serratus), Bilin (Averrhoa bilimbi), Diwul (Limonia acidissima) and Beli (Aegle marmelos) which grow naturally in various parts of Sri Lanka. They are found in the wild or in home-gardens which vary from 100 m2 to 1000 m2 in extent. They are commonly found in many rural areas of Sri Lanka (Rajapaksha, 2007) and contribute to the traditional dishes of rural people. The villagers often collect the produce and sell in village fairs or supply to collectors. Therefore, these fruit crops are essential for thousands of resource-poor people in regions where food and nutrition security is a significant problem.

Table 1. Some of the bioactive compounds in vegetables and fruits and their health effects.

Compound Group	Example of Bioactive compounds	Health Effects
Carotenoids	α-carotene	Antioxidant, inhibits cell proliferation
	β-carotene	Antioxidant, inhibits cell proliferation
	Lutein	Antioxidant, reduces cataract and macular degeneration
	Lycopene	Antioxidant
Vitamin C	Ascorbates	Antioxidant, reduces formation of nitrosamines
Vitamin E	Tocopherols	Protects oxidation of polyunsaturated fatty acids in cell membranes and synergistic effects with selenium
Sulfides	Diallyl sulfides	Stimulates anti-cancer enzymes, reduces generation of nitrosamines, antibacterial
	Allyl methyl trisulfide	Stimulates anti-cancer enzymes, reduces generation of nitrosamines, antibacterial
Phyto estrogens	Genistein	Antioxidants, inhibition of cancer cell proliferation
	Biochanin A	Antioxidants, inhibition of cancer cell proliferation
Lignans	Secoisolariciresinol	Antioxidant
Glycosylates	Indoles	Protects against estrogen-induced cancer
	Isothiocyanates	Protects against estrogen-induced cancer
Phytosterols	B-sitosterol	Strong protection against hormone-induced cancer
Saponins		Reduce tumor cell division and elicit anti-cancer activity, binds with cholesterol and promote excretion
Phenolic acids	Chlorogenic acid	Antioxidant, reduces formation of nitrosamines
	Ellagic acid	Antioxidant, protects DNA
	Caffeic acid	Antioxidant, prevents formation of carcinogens
	Vanillic acid	Antioxidant
Anthocyanins	Cyanidin	Antioxidant
Tannins		Prevents binding of carcinogens to target cells
Stilbenes	Resveratrol	Antioxidant, cardioprotective action
Minerals	Selenium	Cofactor for glutathione peroxidase system that protects body from reactive oxygen species

Source: Various references cited by Ann et al. (2000)

MAIN REASONS FOR LOW CONSUMPTION OF VEGETABLES AND FRUITS

- High market prices of vegetables and fruits. Prices of vegetables fluctuates very much during the year with prices going up to SLR 300-400/kg during some months. Moreover, there is a considerable gap between the farm gate and retail prices. This is mainly attributable to the involvement of intermediary groups. Many fruits are seasonal with one major season and one minor season. During the season prices slide down, while during off season the availability goes down; hence prices shoot up.

- Variations in availability. Many fruits are seasonal; thus they plentifully available only in some months and are less available during other months.

- Heavy use of agro-chemicals. The haphazard use of agro-chemicals mainly insecticides for vegetables is common in Sri Lanka. The use of non-recommended mixtures, overdosing and non-compliance with the pre-harvest interval are also common. As a result, there is a high proportion of agro-chemical residues present at the time of consumption, exceeding the Maximum Residue Levels (MRL). Therefore, many consumers are highly concerned about the safety of vegetables and fruits. This has affected the consumption of agricultural produce.

- There are nearly 200 different types of green leaves consumed by Sri Lankans. The consumption patterns vary depending on the area. However, only 10-15 green leaf types are commercially available. Many consumers are worried over the heavy use of pesticides on commercially cultivated green leaves.

- Artificial ripening of fruits. Many consumers are concerned over the use of chemical ripening agents on fruits. The improper use of ripening agents and the use of carbide which is currently banned in the country, have become concerns for safety and the taste of fruits. If properly practiced, artificial ripening does not pose serious safety issues. However, there is a misconception that artificial ripening introduces harmful chemical agents into fruits.

- Some consumers are concerned about the use of hybrid seeds in the cultivation of fruits and vegetables such as bitter gourd, snake gourd and papaya. Some have the misconception that these vegetables and fruits are genetically modified.

- Inconvenience in preparation. Most of the local fruits such as mangoes, papaya, durian, jackfruit, mangosteen and Annona have to be peeled off and prepared before they can be consumed, while most of the exotic fruits such as apples, pears, peaches, nectarines and grapes are ready to eat. Therefore, many are reluctant to spend time cleaning and preparing fruits. This has reduced the consumption of local fruits which are nutritionally important.

- Less availability of vegetable salads and cut fruits in ready-to-eat form in the market. Fruits and vegetables are not commonly available in a convenient form and this has contributed to the low consumption of them in Sri Lanka.

REASONS FOR LOW AVAILABILITY AND POOR QUALITY PRODUCE

- Heavy losses of vegetables and fruits in the field due to wild animals such as wild boars, porcupines, monkeys, giant squirrels, bats and birds. Furthermore, vegetables and fruits are heavily damaged in the field due to insects and pests such as the fruit fly, and fungal and bacterial diseases such as blight.

- Heavy post-harvest losses of vegetables and fruits due to poor handling. The use of improper harvesting methods leads to the loss of fleshy fruits such as mangoes. During transport of vegetables and fruits, plastic or wooden crates are used only for extremely sensitive produce such as tomatoes, while the others are still transported in gunny bags. Refrigerated trucks are not in common use. During loading, unloading and storage, produce is not properly handled and as a result produce is damaged, leading to a shortened storage life.

- Lack of coordination in crop planning is one of the key issues that leads to the loss of produce. A large number of farmers cultivate the same crop; thus, a clear excess of the product comes to the market at the same time, leading to a price drop and high post-harvest losses. Therefore, it is essential to develop a crop plan and inform the farmers in each season well in advance, based on the need of the country.

- Lack of planting materials of underutilised fruits. It is very difficult to find planting materials of Annona, Lovi, Lavulu, Dam and Ma Dam, among others

STRATEGIES SUGGESTED

- Establishment of orchards in different parts of the country as public-private partnerships or assisting the private sector to establish orchards. The fruit village programme (2016) has already been started with the aim of raising the daily fruit consumption up to 200 g. The success of this programme should be well monitored and accelerated to achieve results in the near future.

- Development of good quality planting materials of underutilised fruits rich in health benefits and making them available to the general public. Further development of fruit cultivars which can be cultivated as orchard crops. When the fruit trees are cultivated as orchard crops, maintenance and harvesting is convenient. Therefore, the crop can be easily managed. Fruits can be easily harvested with minimum damage to them.

- Giving priority to nutritional quality in selection and breeding programmes. Currently, the selection and breeding programmes are mainly based on the yield and pest resistance. It is now high time to consider the nutritional value, giving special emphasis to micronutrients and bioactives. Fruit and vegetable species biofortified with iron, zinc, calcium and vitamin A are some priority areas.

- Promotion of home-gardening as an eco-friendly nutrition sensitive agriculture system. The promotion of home-gardens has been already implemented under several programmes such as the Home-gardening Promotion Programme (2016) targeting the establishment of 500,000 home-gardens in 25,000 villages to ensure food and nutrition security. This also aligns well with the National Biodiversity Strategic Action Plan 2016-2022.

- Continuation of the fertiliser subsidy programme for vegetable crops.

- Incorporation of underutilised fruits into existing food products. Fruit processing is mainly handled by the private sector. Thus, the Department of Agriculture can promote the use of fruits into their line of products and in the development of novel products, using underutilised fruits.

- Increased utilisation of fruits, especially underutilised fruits, through public awareness programmes. The health benefits of consumption of vegetables and fruits can be conveyed through media, exhibitions, school programmes and community programmes.

- Reduction of post-harvest losses of fruits and vegetables by processing and preservation. The use of frozen storage for vegetables is a direct solution for minimising post-harvest losses of vegetables. Public-private partnerships can be set up in establishing cold room facilities. Many vegetables such as bitter melon, beans, carrots, leeks, cabbage and okra can be kept under frozen conditions for nearly 1 year.

- Development of technology for the processing of fruits and vegetables. There is a need for novel, energy efficient technologies for the processing of agricultural produce. Sorters and graders, colour sorters, peelers and energy efficient dryers are some examples. The non-adoption of modern technology has led to poor quality products. A large quantity of tomato paste is imported into the country for manufacturing sauces and ketchup while a significant quantity of tomato is wasted during the season. Therefore, an energy efficient method to concentrate tomato juice needs to be introduced. The use of conventional methods for concentrating tomato juice is not viable.

- Increasing the availability of ready-to-eat consumer sized vegetable and fruit packages. These can be made available for sale in popular places such as restaurant chains such as Hela Bojun. It is important to promote vegetable salads and fresh cut fruit packs in offices, colleges, schools and university cafeterias. Different underutilised fruits can be incorporated into these ready to serve food packs.

- The use of dehydrated fruit pieces, especially nutrient dense underutilised fruits such as berries in baked goods such as cupcakes, muffins, cakes and buns. Promotion of dehydrated and osmotically dehydrated fruits such as fruit pieces, fruit leather and fruit bars.

- Harnessing the safety of agricultural produce especially the safety of green leaves. The safety can be assured by expanding the SL-GAP certification programme which has already been initiated by the Department of Agriculture. Pesticide residues should be monitored on a regular basis. The effectiveness of the programme should be strengthened by strictly enforcing the MRLs.

SUMMARY

Sri Lanka produces a large quantity of vegetables and fruits, however, nearly 40% of them is wasted on a daily basis. Moreover, the country is blessed with a large number of fruit, vegetable and green leafy getable species throughout the year, however, only a limited number of produce is commercially available. Furthermore, the average vegetable and fruit consumption of Sri Lankans is far below the recommendations. A number of factors are attributable to low consumption of vegetables and fruits. It is an urgent need to make behavioural changes among Sri Lankans to improve the level of consumption of wide variety of vegetables and fruits daily to maintain good health and wellbeing. This is achievable through a multi-sectoral engagement led by the Department of Agriculture, Sri Lanka.

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