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Changing patterns of food consumption in Sri Lanka: 1985-2009

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Abstract

This paper examines the patterns of food consumption in Sri Lanka from 1985 to 2009 using the food disappearance data published by the Food and Agriculture Organization. Trends in per capita daily calorie, protein and fat supply have been examined. The study finds that grain food products are the main source of calories and protein, while fat-calories were mainly sourced from non-grain vegetable products and animal food products. Calories derived from protein were less than the recommended intake for Sri Lankans. During the period studied, there has been a shift away from roots and tubers, fruits and cereals, towards sugars, pulses, oils and animal products. The contributions from animal products were relatively low, being less than 8 per cent.

Key words

Calorie supply, dietary diversity, food balance sheets, food consumption, Sri Lanka

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Changing patterns of food consumption in Sri Lanka 1985-2009

Introduction

Many countries in the world have undergone two types of transitions that have rapidly changed the population—a demographic transition and an epidemiological transition. Historically, these transitions occur when countries are in the process of socioeconomic development and modernisation. The demographic transition describes the shift from high mortality and high fertility rates to a low population growth resulting from low mortality and low fertility. The epidemiologic transition (Omran, 1971) provides a means of understanding the mortality component of the demographic transition process and describes the process of spread of diseases. Omran divides the mortality patterns in present-day developed countries into three broad phases. The first phase is the 'age of pestilence and famine', when death is largely due to malnutrition, periodic famines and poor environment. The second phase of epidemiological transition is the 'age of receding pandemics' when deaths arising from malnutrition are becoming less important in the mortality structure. In this phase starchy staples are gradually displaced by the increased consumption of fruits, vegetables, and animal protein in the diet structure. This phase also has changes in physical activity patterns with more people spending more time at leisure. The third and the last phase of this transition is the 'age of degenerative and man-made diseases'. In this phase, non-communicable diseases begin to rise through risk factors such as obesity. These risk factors generally emerge from dietary change and sedentary life-styles.

Associated with the demographic and epidemiologic transitions is the nutrition transition which describes the process of changes in diseases that occurs when societies move from the age of receding pandemics to an age of degenerative and man-made diseases (Popkin, 1994; Popkin, Horton and Kim, 2001). The large shift in dietary and physical activity patterns, which occurred in developed countries during their development and modernization, are increasingly occurring in many low- to-middle-income countries (Caballero and Popkin, 2002).

Over the past few years the GDP growth in Sri Lanka has been over 4.5 per cent each year, except in 2001 where GDP growth rate was negative value (-1.4 per cent) following a

terrorist attack on the Colombo International airport. Many analysts attribute the improvements in economic growth to the economic policy changes that were introduced in early 1980's. These policy changes included a move away from protectionists and import control policies towards an outward looking liberalized regime (Kelegama,1992). The GDP in 1985 which was Rs 45,300 (at 1975 prices) doubled in 2000 and tripled in 2009when it reached Rs 137,537. Considering the improved economic conditions in Sri Lanka over the years, the International Monetary Fund upgraded the country's level of economic standing from low income to a low-middle income country in 2000.

The increased GDP also improved the average incomes of different socio-economic groups. There has been a reduction in the proportion of the population below the poverty line as shown in the Household Income and Expenditure Survey (HIES) data published by the Department of Census and Statistics (DCS). At the national level the number of people below the poverty line declined steadily from 28.8 per cent in 1995-96, to 22.7 per cent in 2002 and reached 8.9 per cent in 2006/07 (Department of Census and Statistics, 2013). In the initial period of economic growth income inequalities increased. For example, the *Gini* coefficient rose 0.43 in 1995/96 to 0.46in 2000. Following this rise it declined to 0.40 in 2006/07, then to 0.36 in 2009/10, showing reductions in income disparities. Overall, a number of factors have contributed to the rise in GDP and general economic growth. These include investment-friendly policies; pro-poor social and economic interventions of governments over the last few decades; increasing foreign remittances from Sri Lankans working overseas; infrastructure development, improved coverage of communication and accessibility to electricity.

The proportion of children under the age of five years, who are considered underweight, (low-weight-for-age), is the key indicator used by the Millennium Development Goals to monitor poverty reduction. Demographic and Health Surveys (SLDHSs), showed the proportion of children under the age of five years who were stunted declined from 38 per cent in 1993, to 29 per cent in 2000 and to 27 per cent in 2006/07 (Department of Census and Statistics, 2009), in comparison with the National Centre for Health Statistics/WHO growth standards. Despite these improvements, children born with a birth weight lower than 2,500 grams still made up a high proportion with substantial regional variations. This high

prevalence of low birth weight, suggests problems in the nutritional level of mothers during pregnancy (Wijesekere, 2010). Under-five mortality, on the other hand, has declined continuously and has remained below 2 per cent, which is the lowest in South Asia.

The food-based dietary guidelines, revised by the Ministry of Health in Sri Lanka(Ministry of Health, 2011) suggest that people need to diversify their daily diet. Sri Lankans are advised to eat moderately and combine food from different food groups in order to increase their intake of macro- and micro-nutrients for a healthy life. Thus, it is important to understand any changes that may have occurred in the food consumption pattern in Sri Lanka during the period of economic growth, and to observe any nutritional implications of these changes, with particular focus on the supply of minimum calories, protein and fat required for healthy growth and development.

Objectives of the study

The objective of this paper is to assess to what extent the food consumption patterns of the population has changed during the economic and social transformation that has taken place in the period from 1985 to 2009. The identification of the specific changes in the food consumption pattern is vital for the development of food and agricultural policy,as well as health and nutritional education programs. In examining the pattern of change, particular attention is paid to whether the country's food supply adequately met the nutritional requirements of the population, during the period with the emphasis on macronutrient supply such as calories, protein and fat. This study is based on the food disappearance data for the 25-year period from 1985 which was obtained from the Food and Agriculture Organization of the United Nations (FAO)and is available from FAOSTAT.

Food balance sheets and disappearance data of the FAO

FAO data are refined estimates of the national Food Balance Sheets (FBS)that are annually compiled by the DCS of Sri Lanka. The data include national-level data that depict the supply and utilization of each food commodity/food group. The supply side of the data includethe quantities of food produced within the country, and those that are imported. The

net supply of a specific food commodity is estimated taking into account the variations in stocks (by balancing stocks at the beginning of the period and end of the period) and subtracting exports. The utilization data include the quantities of the food fed to animals, quantities used as seed, quantities used for food processing, quantities lost during production, transport and storage, and food used for non consumption purposes.

The quantities of each food commodity available for human consumption are estimated by balancing the food supply with non-food use. FAO calculates the total food supply available for human consumption on a per capita basis by dividing the quantity of net food supply by the estimated mid-year population of the country. This represents the number of people actually partaking of the supply. Data on per capita food supplies are then converted to calories, protein and fats by applying relevant food composition factors (FAO, 2001). Calories (kilocalories), protein (grams) and fat (grams) estimated from food commodities are reported for each commodity as per capita per day. Thus, the FAOSTAT data can be used to assess the national supply of food, and to judge any changes to the different types of food commodities that may be occurring. The data can also be used to assess whether the national food supply is adequate in meeting the nutritional needs of the population as a whole.

There are some general issues relating to food balance sheet data that are covered in a review sponsored by the FAO (Jacobs and Sumner, 2002). One issue relates to the inability of individual countries to accurately estimate the stock variations in different food commodities. The FAO, in recognition of this fact, estimates the data as three-year averages in order to minimize the errors. Similarly, food balance sheet data are not accurately estimating wastage, food quantities used for non-food use in manufacturing, and any food used for consumption by non-residents such as tourists. For any specific food commodity, the net food available for human consumption estimated as a residual. The estimation of net food supply may be affected by uncertainty in estimation of any elements in the utilization side of the food balance sheet such as non-food use, wastage and stock changes.

Another issue concerns the calorie supply estimated from food balance sheets. The calorie supply available for human consumption is likely to be overestimated because the amount of calories wasted in cooking and food losses at the household level are not accurately accounted for in the data.On the other hand, the methods used to estimatedifferent food

commodities can understate food quantities. For example, in Sri Lanka rice production is estimated multiplying the total area under paddy cultivation reported at the village level by agriculture officers by the average paddy yield estimated from crop cutting surveys. The accuracy of paddy yield estimates can be affected by several factors, including the paddy variety, fertilizer use, and water use in the paddy plots chosen for the survey. Similarly, meat production data in Sri Lanka are generally lower than the actual supply, as official reporting is based on slaughtering of cattle authorised by the local government authorities (Yogaratnam and de Mel, 1975). Similarly fish production is underreported as the data include those reported by the Fisheries Corporation. There is also a misclassification of some food items. For example, bananas which is a popular fruits in Sri Lankan diet, is currently reported in food balance sheets along with plantains and therefore wrongly classified as a vegetable. Similarly, yams are not reported in food balance sheets. Local production of many other food commodities such as coconuts, fresh milk and poultry are also subject to similar errors which may result in over-or underestimation of supply.

Wastage of food is generally higher in perishable commodities and loses occur in all stages from production to consumption. Supply figures for food commodities such as any fruits, vegetables, fish, poultry, or cow-milk, and other milk products (i.e. curd), which are produced at the household or traded in informal markets are not represented in food balance sheets. Thus, in these circumstances the food supply as well as calories, protein and fats estimated from net supply of foods commodities are likely to be understated in food disappearance data. The other main issue of using food disappearance data to estimate food supply and macronutrients is that the data only provides estimates at the national level and consequently any variations by socio-economic subgroups or subnational areas cannot be estimated.

As the data are compiled for a country on an annual basis, the food disappearance data can be used to identify broad changes in the dietary patterns within a country over time and examine trends in per capita calorie, protein and fat supply. The data can be used to assess whether the per capita food supply per day estimated from food supply is adequately meeting the nutritional needs of the population. More broadly, food balance sheet data are useful in evaluating food, agricultural and nutritional policies of the government.

Per capita daily calorie supply: overall trends

In this paper calories, protein and fat refer to per capita consumption (supply) per day, and unless otherwise stated are expressed in kilocalories (kcal). It should be noted that the per capita values used in this paper are different to those published by FAO. This is because this paper uses revised mid-year population estimates published by the Registrar General's Department (RGD), which for a number of years has given lower population estimates than those previously published by the Department and hence used by FAO.[1]

Table 1: Trends in total per capita calorie supply (kcal) per day by major supply source: Sri Lanka 1985-2009

Year	Total calories	Vegetable products		Animal products	Year	Total calories	Vegetable products		Animal products
		Grain	Non-grain				Grain	Non-grain	
1985	2,366	1353.7	894.3	117.7	1998	2,210	1302.5	793.1	115.3
1986	2,331	1336.4	887.9	107.0	1999	2,343	1365.3	836.0	141.6
1987	2,269	1352.2	801.3	115.1	2000	2,288	1261.0	881.2	146.2
1988	2,284	1345.9	819.5	119.1	2001	2,391	1361.0	876.8	153.0
1989	2,241	1278.2	834.5	128.2	2002	2,377	1360.1	869.7	148.7
1990	2,207	1318.5	772.3	116.2	2003	2,372	**1369.9**	**837.5**	163.7
1991	2,221	1271.0	818.9	131.1	2004	2,345	1370.3	*832.5*	143.3
1992	2,191	1294.0	769.7	127.3	2005	2,402	1420.2	*848.5*	133.3
1993	2,128	1258.7	751.7	117.8	2006	2,436	1377.0	*886.0*	171.7
1994	2,316	1327.6	869.6	118.3	2007	2,427	1384.9	*890.2*	151.7
1995	2,233	1336.8	750.8	145.7	2008	2,476	1405.7	*917.2*	151.7
1996	2,244	1288.4	815.2	140.0	2009	2,452	1464.5	823.7	162.7
1997	2,259	1279.3	833.7	145.9					

Note: Per capita values used in this and subsequent tables are different from those published in FAOSTAT as these values have been re-calculated using revised mid-year estimates published by the Registrar General's Office Sri Lanka

In Sri Lanka, the overall per capita dietary energy (calorie) supply per day (henceforth calorie supply) increased by 3.6 per cent (linear trends) over the 25-year period from 1985. Between 1985 and 1999 the calorie supply fluctuated between 2,128 (1993) and 2,336 (1985) (Table 1) but remained above per capita minimum calorie norm of 2,100 calories per day. Even though the calorie supply remained above the calorie norm, Sri Lanka had the threat of food insecurity during this period (1985-99). This was because the calorie-supply estimated from food disappearance data is generally lower than the true calorie supply: an unknown

[1]Sri Lanka did not conduct the Census of population which was due in 1991 because of security issues arising from the civil war situation in several parts of the country. The next population census was conducted in 2001 and which also had some undercounts in areas which were subject to political conflicts. After mid 1980's there was a huge flow of undocumented outmigration of people, mostly fleeing the civil war in several part of the country. Until 2001, the existing mid-year population estimates were based on the 1981 census. These estimates based on the 1981 census, recorded natural increases and documented net migration, were found to be overestimation when the 2001data were released. This prompted the Registrar General's Department back-estimate the mid-year estimates from the year 1981.

amount of calories is lost to wastage of food at the household level, and in cooking. These factors are not taken into account in estimating calorie supply.

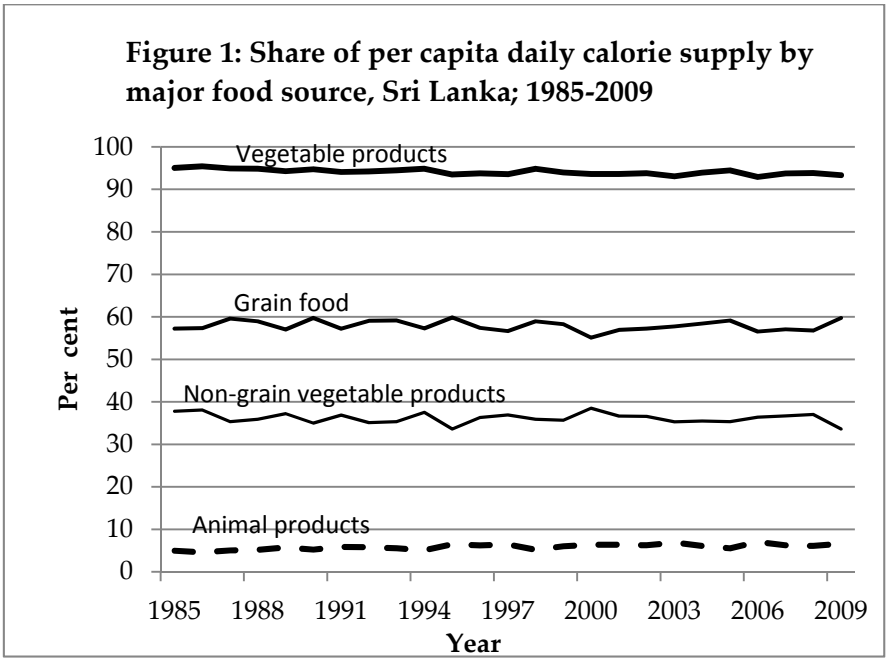


Table 2: Percentage of per capita daily calories derived from vegetable food products and animal food products, Sri Lanka, 1985-2009

	Vegetable products				Vegetable products		
Year	Grain food	Non-Grain	Animal food	Year	Grain food	Non-Grain	Animal food
1985	57.2	37.8	5.0	1998	58.9	35.9	5.2
1986	57.3	38.1	4.6	1999	58.3	35.7	6.0
1987	59.6	35.3	5.1	2000	55.1	38.5	6.4
1988	58.9	35.9	5.2	2001	56.9	36.7	6.4
1989	57.0	37.2	5.7	2002	57.2	36.6	6.3
1990	59.7	35.0	5.3	2003	57.8	35.3	6.9
1991	57.2	36.9	5.9	2004	58.4	35.5	6.1
1992	59.1	35.1	5.8	2005	59.1	35.3	5.6
1993	59.1	35.3	5.5	2006	56.5	36.4	7.1
1994	57.3	37.5	5.1	2007	57.1	36.7	6.3
1995	59.9	33.6	6.5	*2008*	56.8	37.1	6.1
1996	57.4	36.3	6.2	*2009*	59.7	33.6	6.6
1997	56.6	36.9	6.5				

Note: Based on Table 1.

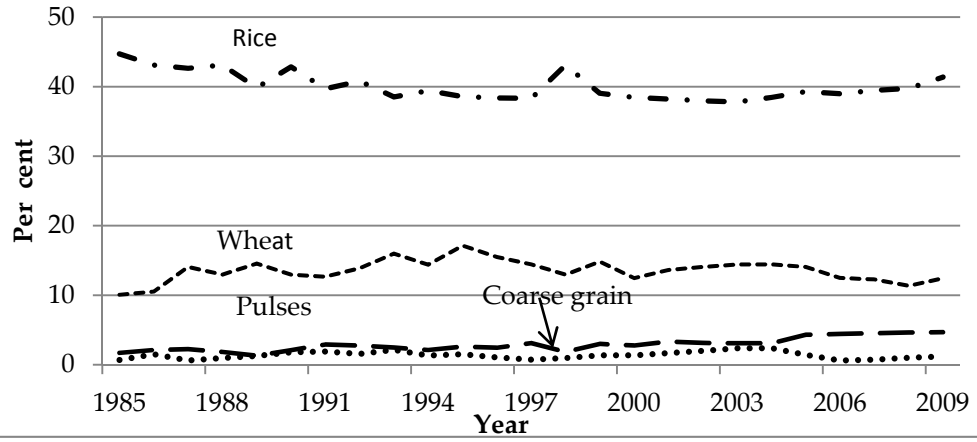
An important feature of calorie supply in Sri Lanka is the dominance of vegetable food products. Approximately 94 per cent of the calorie supply throughout the 25-year period was derived from vegetable products (Table 2). Animal products on the other hand contributed on average 6 per cent of total calorie supply and its relative contribution varied between 4.6 to 7.1 per cent. Grain products (cereals and pulses) provided on average more

than half the calorie supply during the period and non-grain vegetable products provided close to a third of total calories.

Trends in calorie supply from grain food

Total calories from grain food on average increased by 4.2 per cent during the period (linear trend) and its share in providing the total calories fluctuated between 55.1 in 2000 to 59.9 in 1995 (Table 2). Rice and wheat flour products accounted for on average 73 per cent and 24 per cent of the calorie supply from vegetable food respectively. The calorie contributions from 'other grain food products' (coarse grains) such as sorghum and maize were of little significance, but these food products did show an increasing trend during the period (Figure 2).The share of calories contributed by rice declined modestly (0.3 per cent)over the 25-year period, while the share of wheat flour products and 'course grain food' products increased (Figure 2). The calorie supply from pulses increased at a rate of 3 per cent. Between 1985-87 and 2007-09,the calorie supply from pulses more than doubled. It increased from 47 (kcal) to 114 (kcal) and its share in the total calories increased from 2 to 5 percent.

Figure 2: Share of per capita daily calories (Kcal) derived from grain food products, by food source Sri Lanka; 1985-2009



Trends in calorie supply from non-grain vegetable food products

Non-grain vegetable products, as a whole, accounted for between 34 to 39 per cent of total calorie supply during the 25-year period. There were substantial changes in the calorie composition of different food groups in this category. The calorie supply from starchy roots

and tubers has declined on average by 2.5 per cent, and consequently its share in the total calories declined (Table 3).Starchy roots provided on average 116 (kcal) calories per person per day in 1985-87 which declined by more than half to 59 per capita calories per day during 2007-09. Cassava (manioc) and sweet potatoes were the main contributors to the decline while the calorie derived from potatoes increased. The calorie supply from potatoes has fluctuated over the period, but the per capita calorie supply of 9 (kcal) recorded in 1985-87 has more than doubled in 2007-09 (19 Kcal).

Table 3: Share of per-capita daily calorie supply derived from non-grain food products: Sri Lanka 1995-2009

	Non-grain vegetable food products					Non-grain vegetable food products			
Year	Roots/tubers	Sugars	Oils	Fruits	Year	Roots/tubers	Sugars	Oils	Fruits
1985	5.8	11.2	14.6	3.4	1998	4.9	9.6	15.2	3.5
1986	4.9	11.0	15.3	4.0	1999	2.8	12.2	14.5	3.3
1987	4.4	10.4	14.5	3.5	2000	2.8	14.4	14.9	3.2
1988	4.9	9.6	15.2	3.5	2001	2.4	14.1	13.7	3.5
1989	4.3	11.1	15.7	3.8	2002	2.3	14.6	13.7	2.8
1990	3.9	9.4	15.9	3.3	2003	2.3	13.3	13.9	2.7
1991	3.6	11.9	15.5	3.0	2004	2.2	12.9	14.5	2.7
1992	3.1	11.8	14.1	3.1	2005	2.2	12.1	15.2	2.7
1993	3.2	9.5	16.7	3.4	2006	2.2	13.7	14.6	2.4
1994	2.9	13.0	16.1	3.3	2007	2.3	11.9	16.0	2.5
1995	3.0	9.8	14.9	3.4	2008	2.4	13.9	14.5	2.5
1996	3.0	12.3	14.8	3.4	2009	2.5	11.5	13.3	2.4
1997	3.0	14.1	13.8	3.0					

Source: FAOSTAT

Note: Percentage share of vegetables and other miscellaneous non-grain vegetable products is not shown.

The other non-grain vegetable food product, which showed a decline in calorie-supply during the 25-year period, was fruit. Per capita daily fruit supply declined by almost 1 per cent over the period. Although, the calorie supply from vegetables showed an increase by the same rate, its contribution to total calories remained low (data not shown). For example, the share of vegetables in the total calorie supply stood at less than 2 per cent during the period 2007-09. Contrary to expectations the consumption (based on calorie supply) of fruits and vegetables did not increase, despite rise in national income. Low consumption of fruits and vegetables by the Sri Lankan adults was also observed in a national dietary survey conducted in Sri Lanka. The survey results revealed that daily consumption of fruits and vegetables were well below the national recommendations and only a small proportion (3.5

per cent) of adults consumed recommended 5 portions of fruits and vegetables per day (Jayawardena *et al.* (2012).

The overall calorie supply from edible oils, of which the main source is coconut,and its share in the total calorie supply remained the same during the period. However, when the calorie supply between 1985-87 and 2007-09 (343 to 358 (kcal), is compared it showed an increase of 3.4 per cent, while the calorie share remained stable at 15 per cent. Large gains in total calorie supply were recorded in the sugar food group, which rose by 4.0 per cent during the period. Calorie supply from sugars was 202 (kcal) in the beginning of the 25 year period (1985-87),and it rose to 348 (kcal) in the 2007-09 period. Calories from 'other non-grain vegetable product' (i.e. spices, tree-nuts and alcoholic beverages combined) also rose by approximately 3 per cent, but their share in the total calorie supply remained low at less than 2 per cent.

Trends in calorie supply from animal food

In Sri Lanka animal food products provided, on average, 5 to 7 per cent of the total calories during the period. The total calories supplied by animal food products fluctuated and ranged between 107 (kcal) in 1986 and 163 (kcal) in 2009 (Table 4). In terms of calorie supply, milk food products (including fresh milk, powdered milk, yoghurt, curd) were the main component of animal food, and accounted for approximately two-fifths of the animal food group. This was followed by fish products, which contributed slightly less than a third. The relative contribution of meat products in the total calories supplied by animal products accounted for over 15 per cent. All food commodities in the animal food group, except animal fats and eggs, increased their contribution to total calorie supply.

However, this increase occurred slowly, at less than 1 per cent. Although calorie supply from milk products increased, their share in the total calories declined slightly during the period. Fish food products and meat products, on the other hand, increased both in their contribution to calorie supply and the share in the total calorie supply.

Among meat products bovine meat was the main component and accounted for over half of the calories from meat during 1985 -1987. The calories supplied by pork and mutton products were low. The calorie supply from bovine meat began to decline after 1987. By 1994, poultry food products

surpassed bovine meat and became the largest contributor of calories in the meat food group. In 2007-09, poultry provided 65 per cent of calories supplied by meat food products, whereas bovine meat provided 22 per cent. In recent years inland fishing has also been popularised. Calorie supply from fish products (mainly ocean fish) was low in 2005 and 2006 due to effect of Tsunami which hit the island in December 2004.

Table 4: Trends in per capita calorie (kcal) supply per day derived from animal food products by major food commodity: Sri Lanka, 1985-2009

	Calories (kcal) from animal food					Calories (kcal) from animal food			
Year	All	Meat	Milk	Fish	Year	All	Meat	Milk	Fish
1985	118	12.5	46.1	28.7	1998	115	11.1	45.3	29.1
1986	107	13.3	37.1	30.5	1999	142	13.8	37.9	35.9
1987	115	12.4	43.4	29.2	2000	146	15.4	37.6	35.6
1988	119	11.1	45.3	29.1	2001	153	16.4	34.9	32.2
1989	128	10.3	49.2	24.6	2002	149	17.7	39.5	33.3
1990	116	11.4	45.6	29.8	2003	164	16.7	36.4	31.5
1991	131	12.4	45.7	29.5	2004	143	19.0	36.6	35.2
1992	127	13.6	42.4	30.4	2005	133	21.2	42.4	27.3
1993	118	15.5	42.2	29.3	2006	172	14.1	39.4	26.5
1994	118	17.9	40.2	29.9	2007	152	17.3	40.7	32.7
1995	146	15.2	38.6	27.6	2008	152	17.3	40.7	32.7
1996	140	15.0	42.1	31.4	2009	163	15.5	39.1	29.8
1997	146	15.0	41.5	33.3					

Source: FAOSTAT (Per capita values are based on revised mid-year population. Eggs and animal fat food groups are not shown in the table

Relatively low apparent consumption of meat, particularly beef, and high apparent consumption of fish products observed during the period was also found in other developing countries. Traditionally, the consumption of meat is low in countries in South Asia, especially where there is a substantial proportion of Buddhists or Hindus or Moslems. Muslims do not consume pork due to religious beliefs, and people of other faith (i.e. Buddhists) also avoid pork for health concerns. Hindus do not eat beef. In these countries, fish consumption is found to be higher than that of meat.A study conducted in the Southern province in Sri Lanka reported that persons who did not purchase or consume meat in general did so due to religious concerns (stated by 34 per cent) and antipathy for killing animals (stated by 82 per cent), (De Silva, Atapattu, and Sandika**,** 2010).As Sri Lanka is an island, fish production is generally higher than that of other animal products.

Trends in protein and fat supply

The FAO provides data on the availability of per capita daily protein and fat supply in grams. By converting grams into calorie (kcal) equivalents —where 1 gram of protein equals

4 calories and 1 gram of fat equals 9 calories—it is possible to assess trends in calorie supply from protein and fat. The results are presented in Table 5along with the data on fat/protein-calorie ratios for each year from 1985-2009.

Table 5: Distribution of total calories (kcal) derived from protein and fat: Sri Lanka 1985-2009

	Calories (kcal)		% calories from			Calories (kcal)		% calories from	
Year	Protein	Fat	Protein	Fat	Year	Protein	Fat	Protein	Fat
1985	192	396	8.1	16.7	1998	190	380	8.6	17.2
1986	191	404	8.2	17.3	1999	215	399	9.2	17.0
1987	196	373	8.6	16.4	2000	206	397	9.0	17.3
1988	196	392	8.6	17.2	2001	217	400	9.1	16.7
1989	188	401	8.4	17.9	2002	218	389	9.2	16.4
1990	190	392	8.6	17.8	2003	221	406	9.3	17.1
1991	196	395	8.8	17.8	2004	218	397	9.3	16.9
1992	196	362	8.9	16.5	2005	221	417	9.2	17.4
1993	191	395	9.0	18.6	2006	230	432	9.4	17.7
1994	197	412	8.5	17.8	2007	236	444	9.7	18.3
1995	206	397	9.2	17.8	2008	231	420	9.3	17.0
1996	204	386	9.1	17.2	2009	236	403	9.6	16.4
1997	207	370	9.2	16.4					

Source: FAOSTAT (Per capita values for protein and fat availability were re-calculated using revised mid-year estimates).

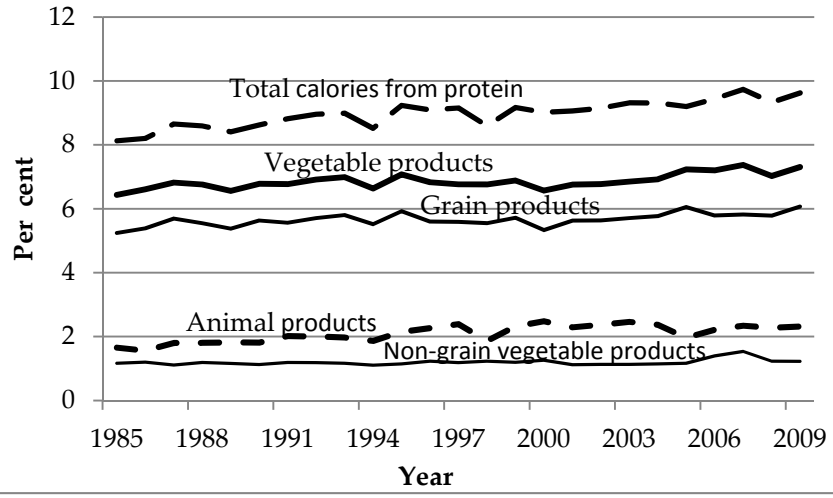
Protein-calories

Per capita calories derived from protein per day (henceforth protein-calories) in Sri Lanka ranged from 191 (kcal) in 1991 to 236 (kcal) in 2009. Trends in protein-calories during the 25 year period correspond with the total calorie supply. When the total calorie supply remained low, just above the minimum calorie norm, as observed in the 15 years from 1985-1999, protein-calorie supply also remained low. When total calories exceeded 2,300 calories per person per day after 1999, protein-calories supply also increased (see Figure 3). The correlation between the total calorie supply and total protein-calories was high (Pearson's correlation coefficient was 0.89 and significant at .01 level).

Food-based dietary guidelines developed for Sri Lanka suggests that per capita daily protein intake should be a minimum of 10-15 per cent of the per capita daily calories (MOH, 2011:19). By applying these proportions to the minimum calorie target of 2,100 calories per

capita per day,[2] the minimum protein requirement of per capita protein-calories per day for healthy living would range between 212 (kcal) and 315 (kcal) (or between 53 and 79 grams). Using this threshold, it is possible to judge whether the food available for human consumption in Sri Lanka, during the 25 year period from 1985, was indeed adequate in meeting at least the per capita minimum daily protein and fat requirements.

Figure 3: Share of per capita daily calories (Kcal) derived from protein, by main food source, Sri Lanka; 1985-2009



In 2000, Sri Lanka recovered from the protein-calorie shortfall experienced in the earlier period. Since 2001 the per capita daily protein-calorie supply has surpassed the minimum protein-calorie threshold of 210 kcal per person per day. However, dietary guidelines require that a minimum of 10 per cent of calories should come from protein. Thus, if protein-calorie requirements were estimated based on total calories instead of a fixed 2,100 calorie norm, then the amount of calories derived from protein was too low. This gap was observed in the entire 25-year period: the 10 per cent of the total calories required from protein ranged from 213 (kcal) in 1993 to 248 in 2008 (Table 5). This was a matter of concern as the actual protein-calorie supply is generally lower than that estimated from food disappearance data.

It is also concerning that the variations in access to and utilization of protein-rich food by population-groups has resulted in a high prevalence of protein-calorie malnutrition in the

[2]The minimum per capita daily calorie requirements depend on many factors including age, sex, activity level, body weight and the life-style stage, it is considered that an average person needs a minimum of 2,100 calories per day.

country for a number of years. Inadequacy in protein intake and its relationship to the prevalence of malnutrition was also found in the food consumption patterns observed between 1965 and 1985 (Bogahawatte and Kailasapathy, 1986).Protein-calories can be obtained from both plant-based and animal-based food, but those derived from animal food products are considered as of good quality and provide different types of amino acids required for healthy growth, mainly muscle growth. However, the vast majority of protein supply in Sri Lanka comes from vegetable food products. For example, vegetable food products (grain food and non-grain vegetable products) provided between 147 (kcal) to 179 (kcal) (Table 6) protein-calories. Among the vegetable food products grain food (cereals and pulses) accounted for on average little over 60 per cent of total protein-calories during the period, and cereals alone contributed over half of the total protein-calories. Rice is low in protein and can vary by type and quantity.

Table 6: Calories derived from protein (kcal) by major food source, Sri Lanka 1985-2009

		From vegetable products (%)					From vegetable products (%)		
Year	Protein (kcal)	Grain	Non-grain	Animal food (%)	Year	Protein (kcal)	Grain	Non-grain	Animal food (%)
1985	188.0	64.5	14.7	20.9	1998	205.6	60.7	13.2	26.1
1986	187.6	65.7	14.9	19.4	1999	220.0	62.4	12.7	24.7
1987	192.8	65.8	13.1	21.2	2000	210.4	59.1	13.7	27.0
1988	192.8	64.5	14.1	21.4	2001	215.2	62.1	12.5	25.5
1989	185.2	63.9	14.0	22.0	2002	215.2	61.5	12.5	26.2
1990	186.8	65.3	13.3	21.4	2003	218.8	61.2	12.2	26.7
1991	192.8	63.1	13.7	23.2	2004	216.4	61.9	12.4	25.7
1992	192.8	63.7	13.5	22.8	2005	218.8	65.8	12.8	21.6
1993	188.4	64.5	13.2	22.3	2006	227.6	61.3	14.9	23.7
1994	195.2	64.8	13.1	22.1	2007	233.6	59.8	15.9	24.3
1995	205.2	64.1	12.5	23.4	2008	228.4	62.0	13.3	24.7
1996	204.0	61.6	13.5	24.9	2009	233.6	63.0	12.8	24.3
1997	208.4	61.0	12.9	25.9					

Source: FAOSTAT (Per capita values have been estimated using revised mid-year population).

It has been estimated that on average rice provides between 6 and 12 per cent protein-calories (Ministry of Health, 2011). Hence to ensure the minimum protein-calorie norm is met the consumption of a large amount of rice per person per day is required. During the period of 25 year periods, the share of protein-calories from rice declined modestly, while protein-calories derived from wheat flour and pulses increased.

Fat-calories

Calories from fat, on the other hand, contributed more than twice the protein, although one gram of fat provides more than 2.5 times the calories than protein. Per capita daily calories derived from fat, in the total calorie supply, ranged between 16.4 per cent and 18.3 per cent during the 25-year period and showed an increasing trend, overall. As with protein-calories, vegetable food products dominated (over four-fifths) the supply of calories, but the major contribution (around 78 per cent) came from non-grain vegetable products (Table 7 and Figure 4).

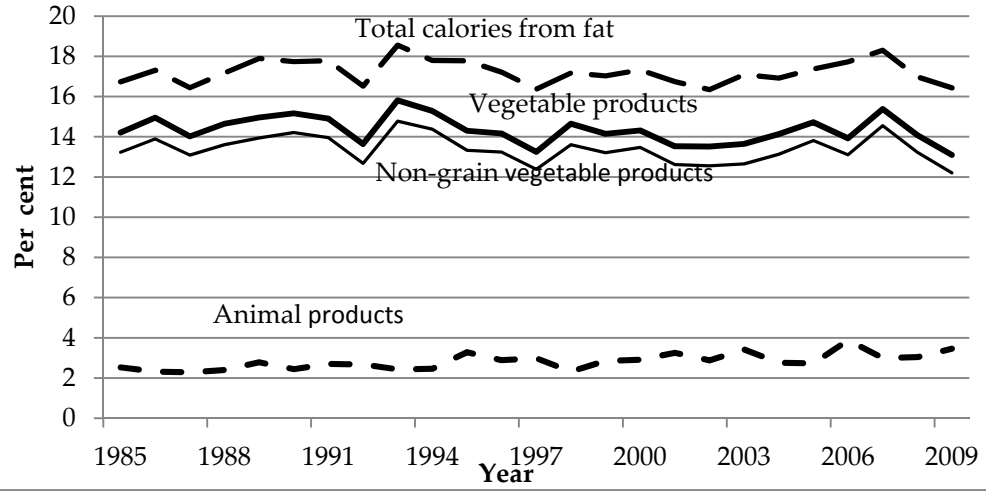
Table 7: Total calories (kcal) derived from fat by major food source: Sri Lanka, 1985-2009

		Fat-calories (kcal) from					Fat-calories (kcal) from		
Year	All food	Vegetable food	Animal food	Non-grain*	Year	All food	Vegetable food	Animal food	Non-grain*
1985	396.0	336.1	59.9	313.1	1998	379.5	323.7	55.0	300.6
1986	403.7	348.6	55.0	323.8	1999	399.0	331.4	67.7	309.4
1987	373.0	318.0	54.1	296.9	2000	396.5	327.7	68.9	308.2
1988	392.2	334.4	56.8	310.6	2001	400.4	323.4	77.0	301.7
1989	401.2	335.2	65.9	312.3	2002	388.6	321.3	68.3	298.5
1990	391.6	334.7	57.8	313.6	2003	405.5	323.7	80.9	300.1
1991	395.0	331.0	64.0	310.0	2004	396.9	331.5	65.4	307.9
1992	361.9	298.7	63.2	277.6	2005	417.3	353.6	64.5	331.8
1993	395.0	336.5	57.6	314.5	2006	431.9	339.1	91.8	319.1
1994	412.2	354.0	58.2	333.1	2007	444.3	373.3	71.0	353.3
1995	397.1	319.3	77.8	297.6	2008	420.5	348.6	71.9	327.6
1996	386.2	317.8	68.4	297.1	2009	403.0	321.1	81.9	299.3
1997	369.8	299.2	70.6	279.6					

Source: FAOSTAT (Per capita values have been estimated using revised mid-year population).*non-grain vegetable food products

Animal food products provided approximately 17 per cent of the supply of calories during the 25-year period. Among non-grain food products, protein supply per capita per day was mainly gained through edible oils, of which coconuts were the main commodity. Coconuts accounted for three-fifths of fat-calorie supply. Major food commodities that contributed to fat-calories during the period were milk, fish and meat, in that order.

Figure 4: Share of per capita daily calories (Kcal) derived from fat, by main food source, Sri Lanka; 1985-2009



The revised dietary guidelines for Sri Lanka specify that 15-30 per cent of calories per person per day should come from fat (Ministry of Health, 2011:31). This translates to a per capita calorie-intakeof between 315 and 630 kilo calories (or 35 to 70 grams) per day, if the minimum calorie requirement of 2,100 calories per capita per day is to be maintained.Sri Lanka achieved this minimum fat-calorie norm even during the years before 2000, when the total per capita daily calorie supply remained below 2,300.The per capita daily calories derived from fat during the period was higher than the fat-calorie norm, even if the minimum threshold was compared using the total calories.

Dietary diversity

In general, food insecurity at the household level is a result of the lack of diversity in diets which eventually leads to undernutrition. Food-based dietary guidelines prepared for Sri Lanka recognises this fact. Dietary diversity has an impact on diet quality, which includes the number of different foods within or across food groups, consumed in a particular time period. The consumption of a variety of foods in adequate quantities is expected to provide the intake of essential macro-and micro-nutrients, promoting good health (Ruel, 2002).

Per capita daily calorie supply trends in Sri Lanka during the 25-year period showed a slight decline in the share of cereals as well as in fruit and roots and tubers. By contrast, there was a trend towards an increased supply of calories per person per day from food groups such

as pulses, and variety of non-grain vegetable products, mainly sugars, oils, vegetables and other food products (i.e. spices, tree nuts and alcoholic beverages). The other food group which showed an increasing trend was animal food products which increased by 2 per cent over the period. Calorie supply from animal food products mainly increased through fish and milk products, rather than meat or eggs. These trends in calorie supply suggest that diversity in diets had occurred in Sri Lanka over the 25-year period, but diversity occurred mainly within the vegetable food group. Calorie supply from animal foods increased, but their contribution to total calories was low.

The fat-calorie ratio in Sri Lanka remained below 18 per cent throughout the period. However, dietsthat include the consumption of energy-dense food, such as refined grains, added sugars and fats, are low in nutrition and essential micronutrients (Andrieu, Darmon, and Drewnowski, 2006) and are responsible for the rise in overweight and obesity. The National dietary survey conducted in Sri Lanka found evidence to confirm this. The survey analysis showed that the diversity in diet among upper socioeconomic groups had positive influence on the prevalence of overweight and obese in adults (Jayawaradena, *et al.*,2010)

Concluding observations

Dietary changes exhibited in food disappearance data for Sri Lanka parallel what has occurred in other countries undergoing economic transition, although in Sri Lanka it has occurred at a slower rate. The movement from traditional diets, that were dominated by grain food products, towards non-grain vegetable products, such as sugars and sweeteners, oil-crops and vegetables, and animal and livestock food products, was observed in food disappearance data for Sri Lanka in the 25-year period examined in the report. While these changes have occurred in Sri Lanka's food consumption, even in the late 2000s about half of calories came from cereals. Calories from animal food products have risen but they still contribute a small proportion of total calories, protein and fat supply in the country. Among animal-based food products, milk and fish food products contributed to total calories more than meat. The majority of calories derived from meat came from poultry products.

Although vegetable diets include most of the nutrients needed for a healthy diet, they cannot provide all the required nutrients healthy growth and development. This is particularly true for protein-calorie supply. Small increases observed in calories derived

from animal products are important as these food products generally provide a number of macro- and micro-nutrients needed to improve nutritional status of the population. It is also of concern that fruit consumption, based on calorie supply, has declined over the period. Ifcalorie supply from fruit and vegetables were combined they provided as little as 5 to 6 per cent of calories in Sri Lanka. The consumption of these food items are below the recommended levels, if this continues over time it could increase the risk of micronutrient deficiencies in the population and many nutritional related diseases.

Rising incomes in Sri Lanka appear to have led to improved food security, and improved nutrition. Although, the two cannot be linked with the available data examined, the increase in per capita food supply, and resulting increases in calories, protein and fats, appeared to have played a role in the improvement of nutritional status of children. Although Sri Lanka's total calorie supply has increased substantially since 2000, the protein-calorie supply increased above the minimum norm. In the early period between 1985 and 1999, the protein-calorie supply was not meeting even the protein-calorie norm based on 2,100 calories per capita per day. Since 2000 when protein-calories exceeded this norm, protein-calorie supply per capita per day remained below the required 15 per cent of the total calories. The intake of protein-calories, if lower than the desired level, should be a concern as a deficiency in protein has adverse nutritional outcomes, especially for young children in their growing years. In Sri Lanka, a part of the problem is that cereals are still the major source of protein-calories which are low in protein-content.

The continued growth in incomes in Sri Lanka will eventually move more people out-of-poverty, which, in turn, will lead to increasing demand for high-calorie animal and dairy products. If this increased demand is to be met by increasing production, there will be implications for biodiversity. Also, the consumption of animal products is important as a means of improving macro- and micronutrients, and to mitigate protein-calorie malnutrition. The over-consumption of animal products will also have adverse effects on health, such as obesity and associated NCDs. The challenge facing Sri Lankan policy makers is to design strategies to maintain both the momentum of economic growth and improved diversity in food. This needs to be done while safe-guarding the health of the population from vagaries of obesity and diet-related diseases.

The development and publicizing of dietary guidelines for Sri Lanka is important in promoting healthy diets among the population. To be successful, the guidelines need to be understood and adopted by the majority of people in the country. The guidelines need to be supplemented with well-designed nutritional education programs targeting different population groups such as the urban, rural and estate populations. Households should also be educated on how the food should be prepared to retain maximum nutritional value and how to minimize wastage at the household level. It is also important that mothers have information on what to feed a sick child, what foods they should eat when they are pregnant or lactating, and appropriate methods and duration of breastfeeding and food supplementation, and how to prepare healthy lunches for school-children.

Sri Lankans consume a diverse diet but quantities of different food items consumed are low, excepting rice. Many food items they consume are below the recommended quantities as was revealed in the dietary study conducted in Sri Lanka among adults using a 24-hour recall method. This study reported that Sri Lankan adults consumed a variety of food products but the quantities of food consumed were low, except for rice (Jayawardena *et al*, 2010). Similar findings were reported in a study conducted in a rural area of Sri Lanka by Ratnayake, Madushani, and Silva (2012).

The information in the food balance sheets for Sri Lanka reveals broad trends in food consumption at the national level. However further analysis of food consumption patterns should be studied using household surveys according to income class and major socioeconomic groups. This will provide valuable additional information for monitoring and developing food policies in Sri Lanka. It is important to investigate the extent of the hunger problem, and look for solutions, in the context of growing national wealth in the country. This investigation is also vital as the poor tend to be more vulnerable to any decline in real incomes and rising food prices than any other groups in the society. If the decisions on the type of food to be eaten are dictated by cost concerns, promoting dietary diversity involving high-cost food among low income groups will become a problem. In fact, economic worry was stated by 82 per cent of the respondents who did not buy or consume meat reported in the Southern Province study reported earlier (De Silva, Atapattu and Sandika, 2010).

The study found a number of issues with the inconsistent reporting and classification of some fruits and vegetable food products in national food balance sheets. It may be necessary for the Department of Census and Statistics, who is responsible for compiling national food balance sheets, to re-examine the reporting of different food commodities and their categorizations in to appropriate food groups. In order to enhance the value of the food balance sheet data for food and nutritional policies it may be necessary to improve and streamline the reporting system on local production of different food commodities. This is particularly important for estimating the local production of rice, fish, meat and dairy products.

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