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AN ECONOMETRIC ANALYSIS OF HOUSEHOLD FOOD AND NUTRIENT ELASTICITIES IN URBAN, RURAL AND ESTATE SECTORS IN SRI LANKA

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Abstract

Expenditure on food consumption plays an important role in energy and nutrition. The objective of the study is to examine household (HH) food and nutrient elasticities in urban, rural and estate sectors. 10 main food groups including 112 food items applied in the study. HIES data used cover 2016, 2012/13, 2009/10 and 2006/07. Badulla, Kandy, Nuwara-Eliya and Ratnapura districts were chosen as study areas which cover all sectors with at least 5% of HH lived. The sample size was 13,881 HH. MLA AIDS and DMNA models adopted for analysis with Zellner ISUR. Food expenditure elasticities were relatively high and own price elasticity for all food groups are negative. Uncompensated food cross-price elasticities are smaller due to lack of dietary diversity. Nutrient expenditure elasticities for energy, protein and carbohydrate are relatively high. Nutrient price elasticities of food groups are low and price inelastic. The study suggest that income-oriented policies are important to achieve better nutrition.

***Key words**: Food elasticity; Nutrient elasticity; MLA AIDS; DMNA; ISUR*

Introduction

Household food demand has received more attention in the last few decades since food consumption has a fundamental part on human health and labour productivity. That is consumption in terms of nutrient derive from the household plays important role in energy and nutrition. The households living in different sectors spend on different commodities to attain utility and satisfaction. The expenditure on food commodities is most crucial in the household behavior as food is the basic nutritional ingredient for every human being.

A household's nutrient intake depends on food consumption and all food demand patterns which are strongly correlated with change in food prices and/or income. Thus, food price and income elasticities are directly connected with nutrient elasticities which indicate that the changes in food prices and income has impact on the consumption of nutrients. Estimated demand, income/expenditure elasticities are regarded as important tools for the nutritional policy design and planning. These observations however, explain the proliferation of food demand studies using different methodologies and focusing on different food items across the world (Gallet, 2010).

Significance of the study

Food consumption in Sri Lanka has been an important issue, since it is not only related to poverty and food security, but also it is highly correlated with living standards and household resource allocation. Essentially, the demand for food depends on population and the dietary habits, per capita daily calorie intake of the people under consideration. On the other hand, the food requirement of the nation is dependent on an additional factor of food import and export balance (Kormawa, 1999; Obayelu *et al.,* 2009). The literature review of food elasticity studies was oldest and now the consumer behaviour has been totally changed and food intake among the households are also changed. Therefore, it is important to study the current situation of food consumption expenditure and the elasticities of food and nutrients. However, a review of the literature indicated that there have been insufficient studies that focused on nutrient elasticities of food for the last few decades. So, there is a necessity to investigate nutrient elasticity variations among the sectors for identifying nutrient demands in Sri Lanka.

Objective of the study

The objective of this study is to examine household food consumption expenditure in terms of elasticities primarily for main groups of food under urban, rural and estate sectors in Sri Lanka.

Literature review

Analysis of household food and nutrient elasticities became a debatable issue by researchers in all over the world. It is especially meaningful in developing countries where food expenditures account for a relatively large share of household income. Studies of food consumption shed light on food related nutritional policies. It provides estimates of how food consumption is affected by changes in prices, income, and taxation policies (Dunne and Edkins, 2005). There exist some studies which examined the economic impact of different types of food demand elasticities by food consumption pattern. Examples of some remarkable studies available in some countries were, for Greece (Mergos and Donatos, 1989; Fousekis and Lazaridis, 2001), East Africa (Delisle, 1990), Pakistan (Burney *et al.,* 1991; Farooq *et al.,* 1999; Babar and Shahnawaz, 2010a; Manzoor *et al.*, 2011), India (Radhakrishna and Ravi, 1992; Sharma, 2011; Jain *et al.,* 1998), Bangladesh (Samad and Hossain, 1992), United States (Nayga, 1994; Holcomb *et al.*, 1995; Byrne and Capps, 1996), China (Fan and Chern, 1997), Japan (Chern *et al.*, 2002), Canada (Salvanes and Devoretz ,1997), Turkey (Ozer, 2003; Caglayan and Astar, 2012), Tanzania (Weliwita *et al.* ,2003), Russia (Shiptsova *et al.*, 2004), Egypt (Fabiosa and Soliman, 2008; Dawoud, 2014), Ghana (Aidoo *et al.* ,2009), Nigeria (Obayelu *et al.*,2009; Bamidele *et al.*, 2010; Oguoma *et al.*, 2010), Malaysia (Tey *et al*., 2009), Indonesia (Pangaribowo and Tsegai, 2011), Kenya (Ofwona, 2013) etc. These studies illustrate guidelines, policy options, and recommendations etc. to follow up the consumption situations of its country.

Food demand or elasticity studies in the context of Sri Lanka are rather scarce in the published literature. However, there exist some studies investigates about food demand. For example, Jogaratnam and Poleman (1969) estimated food expenditure elasticity using semi-log functional form. To that, they obtained data from Consumer Finance Survey in 1963. It concluded that percentage expenditure on starchy staples has declined while that on animal product has gone up with increases in income. Secondly, Alderman and Timmer (1980) estimated price and expenditure elasticities for eight major food commodities using double log quadratic functional form. Data obtained from Socio Economic Survey 1969/70 and the Consumer Finance Survey 1973. It showed that income elasticities were higher among lower income groups. Then, Bogahawatte and Kailasapathy (1986) analyzed price and expenditure elasticities for protein and calorie sources using a quadratic form. They used time series data on expenditure and consumption from 1965 to 1980. The results indicated that the consumers were more responsive to changes in the price of rice than that of wheat.

Linear Approximation of Almost Ideal Demand System (LA AIDS) model was applied in many studies to estimate price and expenditure or income elasticities. For instance, using Badulla district data Nigel and Bogahawatte (1990) estimated price and income or expenditure elasticities. Pradhun and Tudawe (1997) examined demand for eleven food groups using Household Income and Expenditure Survey (HIES) 1985/86 and 1990/91 data and they found out own price elasticities of demand for most food commodities declined between 1985/86 and 1990/91. Thudawe (2002) estimated food demand parameters of eleven food groups and the study showed that expenditure or income was more important in increasing rural consumption of rice whereas in the urban sector lower prices were more effective in enhancing household rice consumption. Nirmali and Edirisinghe (2012) studied household demand in Western Province using HIES 2006/07 survey data. All food items were found to be price inelastic while they had a positive expenditure elasticity which was less than unity except bread. Lokuge and Edirisinghe (2015) analyzed high prevalence of dietary diseases and malnutrition by using six types of pulses HIES 2006/07. It showed consumption choices of dhal may be severely affected by any action which exporting countries introduce, while rest of the pulses will be affected by both price and income-oriented policies. Moreover, Sivarajasingham and Jogaratnam (1996) estimated expenditure elasticities using by Box-Cox transformation technique.

In sum, there is no consensus among the researchers regarding the nutrient elasticities in the context of world. For instance, using the LA AIDS model for Nigeria, Akinleye & Rahji (2007) showed that guinea corn was the food that would have the greatest implications for the nutrient status of low-income households. Tey *et al* (2008) examined Malaysian meat consumption behaviors in terms of income, price, and nutrient elasticities by the LA AIDS model. This study concluded that the major meat products are normal goods and own-price elastic.

Methodology

Data and variables

Data for this study is gathered from HIES for the period of 2016, 2012/13, 2009/10 and 2006/07. Badulla, Kandy, Nuwara-Eliya and Ratnapura districts are selected as study area where all three sectors consist with minimum 5% of population in each sector. The sample size of the total survey was 13,881 households that covered urban - 2010; rural – 8508; estate - 3363 based on the two-stage stratified sampling method of Neymann allocation. Table 1 illustrates the distribution of sample by sectors. The survey was conducted over a period of 12 consecutive months recording weekly consumption of 112 food items. All the HIES data were combined separately for the sectoral analysis.

Table 1: Distribution of household samples by Sectors

HIES Reports	Nos of households surveyed			
	Urban	Rural	Estate	Total
2016	323	2883	726	3932
2012/13	615	1830	885	3330
2009/10	509	1849	881	3239
2006/07	563	1946	871	3380

Total Households	2,010	8,508	3,363	13,881

Source: HIES Reports in 2006/07, 2009/10, 2012/13 and 2016

The listed 112 food items in the food category of household expenditure data were aggregated to 10 main food groups to provide monthly food expenditure separately. The main types of food groups were used in this study are (i) rice (ii) wheat flour (iii) bread (iv) pulses (v) vegetables (vi) meat (vii) fish (viii) egg (ix) coconut and (x) milk & milk products. Each food group consists of its food items where it listed in the HIES 2016 survey given below used in this study;

(i) Rice: White Kekulu normal, White Kekulu Samba, Red Kekulu normal, Red Kekulu Samba, Samba, Nadu Red, Nadu White, Basmathi and other rice
(ii) Wheat flour: Wheat flour
(iii) Bread: Normal bread
(iv) Pulses: Gram Dhal, Masoor Dhal, Watana Dhal, Green gram, Gram, Red Cowpea, White Cowpea, Soya, Soya meet, other pulses
(v) Vegetables: Ash Plantain, Brinjal, Ladies fingers, Bitter gourd, Thuba karivila, Long beans, Snake gourd, Ridge gourd, Pumpkin, Beans, Carrot, Beetroot, Cabbage, Cauliflower, Tomatoes, Leeks, Knol khol, Capsicum, Winged bean, Radish, Drumstick, Cucumber, Cooking melon, Ash pumpkin, wild eggplant, Plate brush, Kohila yams, Lotus stem, Plantain flower, Ambarella, Raw mango, Raw cashew nuts, Mushroom, Jack immature, other vegetables, Mukunuwanna, Gotukola, Kankun, Kathurumurunga, Spinach, Thampala, Sarana, Kohila leaves, Onion leaves, Cabbage leaves, Other leaves, Jack & Jack seed, Bread fruit, Potatoes, Sweet potato, Mannioc, Kiriala, Innala, Other yams
(vi) Meat: Chicken, Beef, Mutton, Pork
(vii) Fish: Balaya, Seer, Shark, Paraw, Thalapath, Tuna (Kelawalla), Mullet, Other large fish, Sprats, Hurulla, Karalla / Katuwalla, Kumbala / Angila, Salaya / Sudaya, Other small fish, Lula, Theppli / Telapiya / Korali, Catla/Rohu, Other fresh water fish
(viii) Egg: Hen eggs
(ix) Coconut: Coconuts
(x) Milk & milk products: Cow milk, Goat milk, Sterilized milk, Curd, Yoghurt, Condensed milk, Milk powder, Infant milk powder, Butter, Margarine, Cheese, Milk packets, other liquid milk

Weighted Average Price (WAP) method was applied in this study to estimate average price of each food groups, since HIES was not provide the actual market prices of food commodities. Even though many existing literatures (Eg. Park *et al.*, 1996; Weliwita *et al.*, 2003) used unit value as a proxy for food prices as it is the common practice in literature.

Model Specification

(1) Modified Linear Approximation of Almost Ideal Demand System (MLA AIDS)

In recent decades many economists concern about how to model aggregated demand function. Initially Rotterdam or Translog models were used in aggregated demand applications. However, Deaton and Muellbauer (1980) developed a model called Almost Ideal Demand System (AIDS) that allows for aggregation without the restrictive assumption of parallel Engel curves. The AIDS is a first-order approximation to any demand system, easy to estimate, and consistent with the preference axioms. Then LA AIDS was developed by Blanciforti and Green (1983) which incorporates Stone's Price Index

(SPI) in the model. Formula for the SPI is given by equation (1):

$$\ln(P^*) = \sum_i w_i \; ln(p_i) \qquad (1)$$

Where i = food group i, w_i = budget share of food group i, p_i = price of food group i, P^* = Stone's Price Index (SPI)
Incorporating with SPI, in a short and snappy way the demand function of LA AIDS in budget share form can be expressed as in equation (2):

$$W_i = \alpha_i + \sum_j \gamma_{ij} \ln\left(p_j\right) + \beta_i \ln\left(\frac{x}{P^*}\right) \quad (2)$$

Where i = 1…… 10 which indicate the major food groups, W_i = budget share of food group i, p_j = price of food group j , x = household's monthly total food expenditure, P* = Stone's Price Index (SPI), α_i, β_i and γ_i are estimated parameters.

Green and Alston (1990) concluded that using SPI may not be appropriate, because the index is itself a function of expenditures shares that also appear in the model's dependent variable. Since prices are never perfectly collinear, it is widely cited that applying the Stone index introduces the units of measurement error (Alston, Foster and Green, 1994; Asche and Wessells,1997; Moschini, 1995). Thus, SPI does not satisfy the fundamental property of index numbers because it is variant to changes in the units of measurement for prices. They suggested a modification of the functional form such that the price index is a function of total expenditure and prices (FAO, 2003).

One of the solutions to correct the units of measurement error is that prices are scaled by their sample mean. Following Moschini's suggestion (1995), a Laspeyres price index (LPI) can be used to overcome the measurement error as it renders parameter estimates insensitive to units of measurement. Specifically, the log-linear analogue of the LPI is obtained by replacing w_i in equation (1) with $\overline{w_i}$, which is a mean budget share. Hence, the LPI becomes a geometrically weighted average of prices. Moschini (1995) showed that a Laspeyres modification of SPI as below;

$$\ln(P^L) = \sum_i \overline{w_i} \; ln(p_i) \qquad (3)$$

Substitution of equation (3) into equation (2) yields the MLA AIDS model with the LPI is as follows:

$$W_i = \alpha_i + \sum_j \gamma_{ij} \ln\left(p_j\right) + \beta_i \ln\left(\frac{x}{P^L}\right) \quad (4)$$

Where P^L = Laspeyres Price Index (LPI), other variables and parameters denoted are as same as in equation (2). Therefore, the above-mentioned model is used in this study, where the budget shares of various commodities are linearly related to logarithms of real food expenditure and relative food prices. And the model was selected as the basic model for the aggregated complete demand system estimation in the study due to its flexible functional form and nimbleness in estimation.

The form of the price change measurement is based on Green and Alston (1990). The modification allows for the price to change as the units of measurement for prices change. To be theoretically consistent, the estimated model needs to satisfy the following standard demand theory restrictions:

$$\sum_i \alpha_i = 1, \;\; \sum_i \beta_i = 0, \;\; \sum_q \gamma_{qj} = 0, \quad (5)$$

$$\sum_q \gamma_{jq} = 0 \, , \qquad (6)$$

$$\gamma_{ij} = \gamma_{ji} \qquad (7)$$

The first 3 restrictions in equation (5) are the adding-up requirements for a demand system, where α is the coefficient for the intercept, β_i are the price index coefficients and γ_{qj} are the price coefficients (q stands for the equation number and i stands for the food item category within the k^{th} equation). The fourth restriction in equation (6) corresponds to the homogeneity conditions and the fifth one in equation (7) imposes the symmetry conditions.

The expenditure and price elasticity derived from the Equation (4) are as follows:

$\eta_i = 1 + \left(\frac{\beta_i}{w_i}\right)$ Expenditure elasticity (8)

$\varepsilon_{ij} = -\delta_{ij} + \left(\frac{\gamma_{ij} - \beta_i \bar{w}_j}{\bar{w_i}}\right)$ Uncompensated price elasticity (9)

Where δ_{ij} is the Kronecker delta that is equal to one if $i = j$ (own price), and zero for $i \neq j$ (cross price). In this study, the sample mean is used for the point of normalization.

Using the MLA AIDS model to estimate the two-stage budgeting demand function presents several advantages. Probably the most important is that a flexible functional form. The MLA AIDS substitution pattern implies an unconstrained pattern of conditional cross-price across products within sub-segments. This is an advantage, because competition is probably higher among differentiated products within sub-groups. Another important advantage of the MLA AIDS model is the perfect aggregation over consumers, without requiring linear Engle curves. This is very important in studies of aggregate data. Finally, the demand function derived from this model crosses the price axis, avoiding the presence of virtual prices.

(2) Demand Model for Nutrient Availability (DMNA)

A model of household demand for the different food items which compete for the household budget allocation requires a complete demand system framework. Arising from its theoretical consistency which postulate that households maximize utility in their consumption decision making process, and its flexibility to encompass broad ranges of behaviour, the MLA AIDS was selected for modeling household behavior in equation (4). From the equation (4) expenditure elasticity (equation 8) and uncompensated price elasticity (equation 9) were derived.

A system of share equations based on equation (4) and subject to the restrictions (adding-up, homogeneity, and symmetry) is estimated using Iterative Seemingly Unrelated Regression (ISUR) method of Zellner. It assumes that budget shares of various commodities are linearly related to logarithms of real food expenditure and relative food prices. This method is equivalent to Full Information Maximum Likelihood (FIML) estimation. ISUR ensures consistent and asymptotically efficiently estimates. Therefore, it used to estimate the MLA AIDS model with correlated random errors when the share equations are not simultaneous. The adding-up property of demand causes the error covariance matrix of system to be singular, so one of the expenditure share equations is dropped from the system to avoid singularity problems. The estimates are invariant of which equation is deleted from the system. Homogeneity is maintained by normalizing all of the prices (proxies by the aggregate cost figures) by the price of other food item. The coefficients pertaining to the expenditure share equation of other food item's aggregate, which is dropped from the system in the estimation stage, are obtained by using the adding-up property. Symmetry is imposed during the estimation of the system of equations. So, both MLA AIDS and DMNA models are employed in ISUR.

Expenditure and uncompensated own price elasticities are estimated in the first stage, while we explore the use of demand model for nutrient availability in the second stage as developed by Huang (1996). To do this, information about the nutrient values of each food that we considered here is needed. Let a_{ki} be the amount of the k^{th}

nutrient obtained from a unit of the ith food. The total amount of that nutrient obtained from various foods, say Φ_k may be expressed as below;

$$\Phi_k = \sum_i a_{ki} q_i \quad (10)$$

This is referred by Huang (1996) as the values of a_{ki}'s for non-foods will be assigned zero, thus the terms associated with non-foods will disappear. This equation, including all foods consumed, plays a central role in the transformation of food demands into nutrient availability. By substituting a demand equation for the quantity variable of equation (2), changes in consumer nutrient availability become as below:

$$d\Phi_k = \sum_i a_{ki} \left[\sum_j (\delta q_i/\delta p_i) dp_i + (\delta q_i/\delta m) dm\right] \quad (11)$$

Furthermore, the relative changes of consumer nutrient availability can be expressed as functions of the relative changes in food prices and per capita expenditure as follows:

$$\frac{d\Phi_k}{d\Phi} = \sum_j \left(\sum_i e_{ij} a_{ji}\, q_i / \Phi k\right) dp_j p_j + \left(\frac{\sum_i \eta_i a_{ki} q_i}{\Phi k}\right) dm/m = \sum_j \Pi_{kj}\, dp_j/p_j + p_k dm/m \quad (12)$$

Where $\Pi_{kj} = \frac{\sum_i e_{ij} a_{ki} q_i}{\Phi_k}$ is a price elasticity measure relating the effect of the jth food price on the availability of the kth nutrient, and p_k represents the effect of expenditure on the availability of that nutrient.

Obviously, the measurement represents the weighted average of all own and cross price elasticities (e_{ij}'s) in response to the jth price with each weight expressed as the share of each food's contribution to the kth nutrient $\left(\frac{a_{ki} q_i}{\Phi k}\right)$. Similarly, measurement of ρ_k represents the weighted average of all expenditure elasticities (η_i's) with each weight again expressed as the share of each food's contribution to the kth nutrient. Thus, the general calculation of nutrient elasticity matrix, say N, for the case of ℓ nutrients and n foods can be obtained as a product of multiplying matrix S by matrix D as follows:

$$N = S \times D \quad (13)$$

where N is the $\ell \times (n+1)$ matrix of nutrient elasticities in response to changes of food prices and expenditure, S is the $\ell \times n$ matrix with entries of each row indicating a food's share of a particular nutrient, and D is the $n \times (n + 1)$ matrix of demand elasticities. From these nutrient elasticity measurements, a change in a particular food price or per capita expenditure will affect all food quantities demanded through the interdependent demand relationships and thus cause the levels of consumer nutrient availability to change simultaneously.

Results and Discussions

The equation (4) was initially employed to examine appropriateness of demand models of every food groups for each sector by using Zellner's ISUR method. Table 2 below shows the results of Zellner's ISUR model.

Table 2: Results of Zellner's ISUR model

Demand model	Chi square value		
	Urban	Rural	Estate
Rice	43.53***	44.16***	24.36*
Wheat flour (WF)	15.22	19.98*	8.91
Bread	29.20**	27.79**	29.33**
Pulse	33.81***	61.55***	15.52
Vegetable	51.24***	51.13***	26.73**
Meat	16.08*	41.37***	25.80**
Fish	55.95***	66.81***	27.47**
Egg	26.81**	41.58***	12.01*
Coconut	66.56***	34.51***	13.40*

Milk	35.16***	27.60**	32.36***

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Significance of demand models of every food groups in each sector were checked by Zellner's ISUR method. Above results disclose that almost all food group's demand models are significance in all three sectors except wheat flour demand model in urban sector, and wheat flour and pulses demand models in estate sector are not significant. The equation for milk group was excluded to avoid singularity, but its coefficients were later recovered with the use of the homogeneity property. The estimated parameter (γ) satisfy the adding-up restriction. The empirical results for the specified model for demand functions (MLA AIDS) illustrate that all estimated coefficients agree with a priori theoretical expectations. Overall, it can also be seen from the estimated results that a majority (27 out of 30 variables) of coefficients of the explanatory variables are significant in all three sectors under ISUR method. So applied MLA AIDS model is goodness to fit for aggregate food consumption analysis in this study as given some of the existing studies Ahmad *et al.* 2015; Aziz *et al*. 2011 & Agbola *et al.* 2002.

Now equation (4) was estimated separately for urban, rural and estate sector's samples of households, regardless of their respective consumption. Later, households were split according to their consumption patterns, and the food demand models were estimated for each food group. Following Green and Alston (1990, 1991), preference structure is assumed as follows: the first stage, consumers choose how to spend their income among food consumption and in the second stage, the level of expenditure in each food group, as determined in the first stage, is allocated to the commodities in that group.

Using MLA AIDS model, the result of 2nd stage of the two-stage budgeting process estimates of the structural parameters (γ) for food groups for urban, rural and estate sectors are shown in Table 3, 4 & 5 respectively.

Table 3: Parameter estimates of MLA AIDS for Urban sector

Prices of Variables	Rice	WF	Bread	Pulse	Veg	Meat	Fish	Egg	Coconut	Milk
Rice	0.03**	0.01**	0.02**	-0.01	-0.01**	-0.01	0.01	0.01	-0.01*	-0.01
WF	0.01**	0.02*	-0.02	-0.01	-0.01*	-0.01	0.01	-0.01*	0.01	-0.02
Bread	0.02**	-0.02	-0.01	0.01	0.01	-0.01	-0.01	0.01**	-0.01	-0.03
Pulse	-0.01	-0.01	0.01	0.02***	-0.01	-0.01	-0.01	0.01	-0.01	-0.01
Veg	-0.01**	-0.01*	0.01	-0.01	0.03***	-0.01	0.01	-0.01	0.01**	-0.01
Meat	-0.01	-0.01	-0.01	-0.01	-0.01	0.05***	-0.01	-0.01	-0.01*	0.01
Fish	0.01	0.01	-0.01	-0.01	0.01	-0.01	0.04***	0.01	-0.01**	0.01
Egg	0.01	-0.01	0.01**	0.01	-0.01	-0.01	0.01	0.01***	-0.01	0.01
Coconut	-0.01*	0.01*	-0.01	-0.01	0.01**	-0.01*	-0.01**	-0.01*	0.03***	-0.01
Milk	-0.03***	0.01	0.01	-0.01	-0.01	0.01	-0.04***	-0.01**	-0.01	0.06
Food Exp	-0.02***	-0.01	-0.02***	-0.01	-0.02***	0.01	-0.02*	-0.01	-0.01***	-0.01***

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Table 4: Parameter estimates of MLA AIDS for Rural sector

Prices of Variables	Rice	WF	Bread	Pulse	Veg	Meat	Fish	Egg	Coconut	Milk
Rice	0.02*	0.01	-0.01*	0.01	-0.01	-0.02**	-0.01**	0.01	0.01	-0.01
WF	0.01	0.01	0.01	-0.01	-0.01*	-0.01	-0.01*	-0.01	-0.01	0.01
Bread	-0.01*	0.01	0.01	-0.01	0.01**	0.01	-0.01	-0.01	0.01	-0.01
Pulse	0.01	-0.01	-0.01	0.06***	0.01	-0.01***	0.01	0.01	-0.01	0.01
Veg	-0.01	-0.01*	0.01**	0.01	0.02***	-0.01**	-0.01	-0.01	0.01	-0.01
Meat	-0.02**	-0.01	0.01	-0.01***	-0.01**	0.06***	0.01	-0.01	0.01	-0.01
Fish	-0.01**	-0.01*	-0.01	0.01	-0.01	0.01	0.04***	-0.01	-0.01	0.01

Egg	0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	0.01***	-0.01	-0.01
Coconut	0.01	-0.01	0.01	-0.01	0.01	0.01	-0.01	-0.01	0.01***	0.01
Milk	0.01	0.01	-0.01	-0.01	-0.01	-0.02	-0.02***	-0.01	-0.01**	0.05
Food Exp	-0.03***	-0.01**	-0.01***	-0.01***	-0.02***	0.01	-0.01	-0.01***	-0.01***	-0.01***

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Table 5: Parameter estimates of MLA AIDS for Estate sector

Prices of Variables	Rice	WF	Bread	Pulse	Veg	Meat	Fish	Egg	Coconut	Milk
Rice	0.04**	0.01	0.01	0.01	0.01	0.01	-0.04***	-0.01	-0.01	-0.01
WF	0.01	-0.06*	0.03*	0.01	-0.02	0.01	0.01	-0.01	-0.01	-0.02
Bread	0.01	0.03*	-0.01	-0.01	-0.01	-0.02**	-0.01	0.01	0.01	-0.01
Pulse	0.01	0.01	-0.01	0.02**	-0.01	-0.01*	-0.01	0.01	0.01	0.03**
Veg	0.01	-0.02	-0.01	-0.01	0.03***	-0.01	0.01	0.01	0.01	0.07***
Meat	0.01	0.01	-0.02**	-0.01*	-0.01	0.06***	-0.01	-0.01*	-0.02**	0.01
Fish	-0.04***	0.01	-0.01	-0.01	0.01	-0.01	0.04***	-0.01	-0.01	0.01
Egg	-0.01*	-0.01	0.01	0.01	0.01	-0.01*	-0.01	0.01*	0.01	-0.05*
Coconut	-0.01	-0.01	0.01	0.01	0.01	-0.02**	-0.01	0.01	0.01	-0.01
Milk	-0.03*	0.02	-0.02***	-0.01	0.01	-0.01	0.01	0.01	-0.01	0.01
Food Exp	0.01	-0.01	-0.01	0.01	-0.02***	0.02	0.01	0.01	-0.01**	-0.05***

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

38, 33 and 28 estimated parameters out of 110 are statistically significant in urban, rural and estate sectors respectively. Some similar studies (E.g. Agbola *et al.* 2002, Ahmad *et al.* 2015 and Aziz *et al*. 2011) suggest that although only around 1/3 of the estimated coefficients are statistically significant in each sector which number is reasonable for calculated elasticity coefficients become a significant in their respective models.

Estimation of food elasticities

Table 6 below shows the expenditure elasticity of each food groups for each sector separately.

Own price elasticity of each food groups is discussed for each sector which is estimated using uncompensated method and the results are given in Table 7 below. Cross price elasticity of each food group under uncompensated method in order to compare among sectors show in Tables 8, 9 and 10.

Estimation of food expenditure elasticities

Table 6: Expenditure elasticity of food groups (2006 - 2016)

Sector	Rice	WF	Bread	Pulse	Vegetable	Meat	Fish	Egg	Coconut	Milk
Urban	0.87***	0.85*	0.20**	0.96***	0.82***	1.10**	0.48***	0.56**	0.78***	0.81***
Rural	0.82***	0.72*	0.46**	0.82***	0.79***	1.15***	0.87***	0.39***	0.81***	0.86**
Estate	1.06*	0.77**	0.71**	1.11*	0.79**	1.56**	1.00**	0.96**	0.76**	0.41***

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Results (Table 6) reveal that expenditure elasticity for selected main food groups are relatively high in all three sectors as expected to theory and some of the existing empirical studies such as Aziz *et al.,* 2011; Mafuru *et al.,* 2003; Fayyad *et al.,*1995. As households face tight budgetary constraints and selected all food items are considered as very important in the food basket, so it fulfills fundamental requirements of households. Since it can be explained by the economic situation in Sri Lanka.

Expenditure elasticity for wheat flour, bread, vegetables, egg, coconut and milk food items are positive and less than one, indicating that food items are normal and necessary goods in all sectors. But there are no inferior goods in the food items in all three sectors. Since the co-efficient of meat is positive and more than one which is categorized under non normal food item in all sectors. However, rice, pulses and fish food items are also categorized under non normal foods in estate sector while these food items are categorized under normal good in urban and rural sectors. So, estate households spent relatively more money to consume above goods. Bread in urban sector has the lowest expenditure elasticity of demand.

It is expected that these food items will experience an increase in demand when consumers' income increases with the overall economic growth of the country. However, if expenditure of households further decreases, in relative terms, less expenditures will be allocated to these food commodities. This result indicates that as households' expenditures increase and households diversify their diets, they tend to increase their consumption of non-staple foods rather than staple foods.

Estimation of food own price elasticities under uncompensated method

Table 7: Uncompensated Own price elasticity of food groups (2006 - 2016)

Sector	Rice	WF	Bread	Pulse	Vegetable	Meat	Fish	Egg	Coconut	Milk
Urban	-0.81***	-0.27**	-1.07***	-0.53**	-0.73**	-0.68***	-0.51**	-0.40**	-0.48**	-0.16**
Rural	-0.84***	-0.89**	-0.84*	-0.44***	-0.77***	-1.06*	-0.37**	-0.29**	-0.76***	-0.33***
Estate	-0.75**	-2.98***	-1.07*	-0.64*	-0.70**	-1.30**	-0.52**	-0.20***	-0.79*	-0.84**

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Results in Table 7 reveal that uncompensated own price elasticity of demand for all food groups are negative and consistent with the a priori expectation in all three sectors as expected to theory and some of the existing empirical studies (eg. Chikobola *et al*., 2016; Ahmad *et al*., 2015; Ogundari, 2012; Aziz *et al.*, 2011). The absolute value of own price elasticities for almost all food groups in all three sectors (except wheat flour in estate sector; bread in urban and estate sectors; meat in rural and estate sectors) are lower than unity. Thus, these food groups are classified as inelastic which indicates that the consumers are insensitive to own price changes i.e. if the price increases, the decrease in the quantity demanded is expected to be relatively small. Where elasticity amounts to bread (-1.070) in urban sector; meat (-1.058) in rural sector; wheat flour (-2.977) meat (-1.303) and bread (-1.068) in estate sector are classified as elastic demand thus price changes affect the demand for these food items in a greater extent as compared to the other food groups in other sectors.

Estimation of food cross price elasticities under uncompensated method

Table 8: Uncompensated cross price elasticity in urban sector (2006-2016)

	Rice	WF	Bread	Pulse	Vegetable	Meat	Fish	Egg	Coconut	Milk
Rice		0.49*	1.01*	-0.13**	-0.09***	-0.34***	0.26***	0.03*	-0.11**	-0.01*
WF	0.08**		-0.62*	-0.11*	-0.08**	-0.05**	0.01*	-0.82**	0.03**	-0.27*
Bread	0.12*	-0.52**		0.02*	0.03**	-0.48*	-0.23*	1.13***	-0.11***	-0.41*
Pulse	-0.03*	-0.17	0.07		-0.02*	-0.03	-0.03*	0.08*	-0.01*	-0.06**
Vegetable	-0.06***	-0.31*	0.21**	-0.07*		-0.26*	0.16*	-0.05	0.15	-0.02*
Meat	-0.05***	-0.04***	-0.54**	-0.02*	-0.06*		-0.05*	-0.57*	-0.15*	0.18**
Fish	0.03***	-0.01**	-0.27**	-0.04*	0.03**	-0.07**		0.06*	-0.09	0.08**
Egg	-0.01**	-0.29***	0.49***	0.02*	-0.01*	-0.22*	0.02*		-0.08*	0.06*
Coconut	-0.04*	0.06*	-0.22***	-0.02	0.08	-0.33*	-0.16*	-0.43**		-0.04
Milk	-0.17	0.14*	0.41*	-0.09*	-0.05*	0.06*	-1.18	-0.57*	-0.05*	

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

The above results (Table 8) demonstrate that with respect to rice group wheat flour, bread and fish food items are showed as substitutes, whereas pulses, vegetable, meat, egg, coconut and milk are showed as complements in urban sector. For wheat flour group rice, coconut and milk food items are showed as substitutes, while bread, pulses, vegetable, meat, fish and egg food items are showed as complements. For bread group rice, pulses, vegetable, egg and milk food items are showed as substitutes, but wheat flour, meat, fish and coconut food items are showed as complements. Likewise, for pulses group only bread and egg are showed as substitutes, but other food groups are showed as complements. For vegetable group bread, fish and coconut food items are showed as substitutes but other food items are showed as complements. For meat group only milk item is showed as substitute; and other food items are showed as complements. For fish group bread, pulses, meat, coconut and milk food items are showed as complements while other food groups are showed as showed as substitutes. For egg group rice, bread, pulses and fish food items are showed as substitutes but other food items are showed as complements. For coconut group only wheat flour and vegetable food items are showed as substitutes. And finally, for milk group meat, fish and egg food items are showed as substitutes, but other food items are showed as complements in urban sector. And also, the results indicate that bread-rice and egg-bread cross-price elasticity depict the substitute effects which are very high, while fish-milk shows the complement effects which is also very high in urban sector.

Table 9: Uncompensated cross price elasticity in rural sector (2006 -2016)

	Rice	WF	Bread	Pulse	Vegetable	Meat	Fish	Egg	Coconut	Milk
Rice		0.40*	-0.36*	0.13**	-0.02***	-0.74**	-0.40**	0.13*	0.06**	-0.03*
WF	0.07*		0.27*	-0.04*	-0.05**	-0.21*	-0.19	-0.25**	-0.03**	0.14**
Bread	-0.06*	0.21*		-0.10*	0.08*	0.18**	-0.05*	-0.36**	0.04***	-0.13**
Pulse	0.04**	-0.05**	-0.18**		0.01	-0.50**	-0.01*	0.04*	-0.03*	0.01*
Vegetable	-0.01***	-0.21***	0.42**	0.01**		-0.47***	-0.05***	-0.07**	0.04**	-0.02**
Meat	-0.11**	-0.19**	0.22**	-0.30**	-0.10**		0.21*	-0.29*	0.03*	-0.09*
Fish	-0.07**	-0.19*	-0.05**	-0.01*	-0.01**	0.22*		-0.05**	-0.05*	0.14*
Egg	0.01**	-0.09*	-0.16**	0.01*	-0.01**	-0.11*	-0.02*		-0.01	-0.23*
Coconut	0.02**	-0.054**	0.12*	-0.04	0.02***	0.04*	-0.09**	-0.02**		0.04
Milk	0.08*	0.213**	-0.15	-0.13*	-0.02	-0.55*	-0.69*	-0.06*	-0.18*	

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

The above results (Table 9) illustrate that rice group has a substitute effect with wheat flour, pulses, egg, coconut and milk food items whereas bread, vegetable, meat and fish food items show complements effects in rural sector. Wheat flour group has a substitute effect with rice, bread and milk food items whereas other balanced food items show complements effects. For bread group wheat flour, vegetable, meat and coconut food items are substitutes and rice, pulse, fish egg and milk food items are complements. Likewise, for pulse food group only rice, vegetable and egg are substitutes but other food items are complements. Vegetable food group has a substitute effect with bread, pulse and coconut food items whereas other food items show complements effect. Meat food group has substitute effect with bread, fish and coconut food items while rice, wheat flour, pulse, vegetable, egg and milk food items show complements effects. For fish group only meat food item is substitute but others are complements. In egg food group rice and pulse food items are only substitutes while other food items are complements. For coconut food group rice, bread, vegetable and meat food items show substitute effects but wheat flour, pulse, fish, egg and milk food items show complement effects. And finally, for milk group wheat flour, pulse, fish and coconut food items are substitutes while rice, bread,

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vegetable, meat and egg food items are complements in rural sector.

Table 10: Uncompensated cross price elasticity in estate sector (2006-2016)

	Rice	WF	Bread	Pulse	Vegetable	Meat	Fish	Egg	Coconut	Milk
Rice		0.23*	0.58*	0.08*	0.05**	0.24*	-1.20**	-1.03*	-0.05*	0.08*
WF	0.03*		1.41*	0.23*	-0.13**	0.20**	0.35*	-0.79***	-0.01***	-0.25*
Bread	0.07*	1.14*		-0.10*	-0.04*	-0.68**	-0.28*	0.50**	0.18*	-0.01**
Pulse	0.02**	0.38**	-0.17**		-0.02*	-0.55*	-0.28**	0.15*	0.06*	0.43*
Vegetable	0.01**	-0.52**	-0.19**	-0.08*		-0.55**	0.01*	0.47*	0.03	0.97
Meat	0.05***	0.21***	-0.77*	-0.32*	-0.11*		-0.04**	-1.06*	-0.32*	0.09*
Fish	-0.21*	0.36**	-0.34*	-0.19**	0.01*	-0.05		-0.26*	-0.05*	0.19*
Egg	-0.06***	-0.27***	0.22***	0.03**	0.04*	-0.40**	-0.09		0.09*	-0.69*
Coconut	-0.04*	-0.02***	0.45*	0.06	0.01*	-0.72*	-0.12**	0.51*		-0.01*
Milk	-0.16**	0.59*	-0.95	-0.14*	0.01*	-0.12*	0.13*	0.33*	0.01	

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Above results (Table 10) demonstrate that rice group has substitution relationships with wheat flour, bread, pulse, vegetable and meat food items at the same time complementary relationships with fish, egg, coconut and milk food items. Likewise, wheat flour group has substitution relationships with rice, bread, pulse, meat, fish and milk while complementary relationships with vegetable, egg and coconut food items. Bread group has substitution relationships with rice, wheat flour, egg and coconut food items only whereas other food items have complementary relationship. Pulses group has substitution relationship with rice, wheat flour, egg and coconut while it has complementary relationship with bread, vegetable, meat, fish and milk foods. Vegetable group has substitution relationships with rice, fish, egg, coconut and milk food items though it has complementary relationships with wheat flour, bread, pulse and meat food items. Meat group has substitution relationships with rice and wheat flour food items only. Rest of other food items has complementary relationships. Fish group has substitution relationships with wheat flour, milk and vegetable food items only. Other balanced food items have complementary relationships. Egg food group has complementary relationships with rice, wheat flour, meat and fish food items while substitution relationships with the other food items. Coconut food group has substitution relationships with bread, pulse, vegetable, egg and milk food items however complementary relationship with rice, wheat flour, meat and fish food items. Finally, milk food group has substitution relationships with rice, pulse, vegetable, meat and fish food items whereas complementary relationship with wheat flour, bread, egg and coconut food items. Wheat flour-bread and bread-wheat flour substitution effects are very high but fish-rice, egg-rice and egg-meat complementary effects are also high in estate sector.

Estimation of food nutrient elasticities

Table 11 illustrates that food share of nutrients and Table 12 shows the nutrient expenditure elasticity for each sector and Table 13 shows that nutrient price elasticities for main food groups in all three sectors.

Table 11: Food Share of nutrients based on food consumption (2006 - 2016)

Food	Energy			Protein			Carbohydrate			Fat		
Groups	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate
Rice	0.53	0.63	0.55	0.48	0.59	0.51	0.64	0.73	0.62	0.13	0.17	0.19
WF	0.05	0.03	0.18	0.05	0.03	0.18	0.06	0.04	0.20	0.02	0.01	0.07
Bread	0.09	0.05	0.04	0.07	0.04	0.03	0.10	0.05	0.04	0.06	0.03	0.03
Pulse	0.06	0.05	0.05	0.12	0.11	0.11	0.06	0.05	0.05	0.01	0.01	0.02

Vegetable	0.06	0.07	0.05	0.08	0.10	0.06	0.08	0.08	0.06	0.04	0.04	0.04
Meat	0.01	0.00	0.00	0.04	0.02	0.02	0.00	0.00	0.00	0.01	0.01	0.00
Fish	0.01	0.01	0.00	0.04	0.02	0.01	0.00	0.00	0.00	0.06	0.04	0.02
Egg	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.03	0.02	0.03
Coconut	0.11	0.12	0.08	0.03	0.03	0.02	0.03	0.03	0.02	0.47	0.55	0.48
Milk	0.06	0.04	0.03	0.08	0.05	0.04	0.03	0.02	0.02	0.17	0.11	0.12

Source: Author's calculations

The results of the Table 11 indicate that food share of nutrients in average food group's consumption per household for each sector. Results disclose that among the ten food groups, rice is the main stable food in urban, rural and estate sectors as a result it has highest content of energy, protein and carbohydrate. Coconut is the most main food in all three sectors to contribute fat. It is observed that the major sources of energy, protein, carbohydrates and fat in Sri Lanka are derived from plant products with very small amounts from animal products. Among these three sectors, rural sector has the highest food share value in the above nutrients. So, they consume more nutrients comparably other sectors for healthy life and labour productivity.

Estimation of nutrient expenditure elasticities

Table 12: Nutrient expenditure elasticities (2006 - 2016)

Nutrients	Urban	Rural	Estate
Energy	0.794***	0.798**	0.941***
Protein	0.808***	0.805***	0.961**
Carbohydrate	0.798**	0.796***	0.960***
Fat	0.749***	0.800**	0.794**

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Above results reveal that nutrient expenditure elasticities for energy, protein and carbohydrate are relatively high in estate sector according to consistent with those for food demand. So, estate sector households are spent more money comparably with other sectors for getting nutrients from food groups. At the same time lowest energy and fat nutrient elasticities found in urban sector as well as lowest protein and carbohydrate nutrient elasticities found in rural sector. As a result, these sector's households involve less expenditure to get these nutrients. And among the nutrients, protein is the highest nutrient elasticity in all sectors. As a result, protein type of foods items are relatively high prices in markets.

Estimation of nutrient price elasticities

Table 13: Nutrient price elasticities of main food groups (2006 - 2016)

Food Groups	Energy			Protein			Carbohydrate			Fat		
	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate
Rice	-0.44***	-0.52***	-0.41**	-0.40**	-0.49***	-0.38**	-0.51**	-0.61**	-0.46**	-0.14*	-0.13**	-0.17*
WF	0.18**	0.21*	-0.36***	0.14**	0.19**	-0.33**	0.21**	0.25**	-0.42***	0.05*	0.04*	-0.09**
Bread	0.42***	-0.23*	0.52*	0.40**	-0.22*	0.43*	0.52***	-0.27*	0.58*	0.02**	-0.02*	0.27*
Pulse	-0.12**	0.04**	0.04**	-0.14*	0.01**	-0.01*	-0.13*	0.06**	0.06*	-0.05*	-0.02*	0.02*
Vegetable	-0.09**	-0.06***	-0.03*	-0.11**	-0.08**	-0.05*	-0.11*	-0.07**	-0.04*	-0.01*	-0.03**	-0.02*
Meat	-0.27***	-0.53***	0.02**	-0.21***	-0.53***	0.04**	-0.30*	-0.61*	0.09**	-0.23***	-0.18***	-0.36***
Fish	0.04**	-0.30***	-0.63*	0.04**	-0.27***	-0.59**	0.11*	-0.32**	-0.69*	-0.21**	-0.19**	-0.24*
Egg	-0.01**	0.05**	-0.62***	-0.01**	0.04**	-0.60***	0.05*	0.06*	-0.73**	-0.23*	-0.01**	0.06**
Coconut	-0.11**	-0.06***	-0.08*	-0.07**	0.01**	-0.04*	-0.08*	0.02**	-0.03*	-0.25**	-0.42***	-0.38**
Milk	-0.07*	-0.03**	0.04*	-0.06*	-0.03**	0.07*	-0.07**	-0.03*	0.06*	-0.06***	-0.02**	-0.07*

*Note: ***, **, * indicates that variables are significant at 1%, 5% and 10% level of significance respectively*
Source: Author's calculations

Nutrient price elasticities for main food groups are low for almost all food items, which indicate that nutrient consumption is price inelastic in general. Hence, households are mostly able to adjust their consumption patterns through substitution of high-priced foods, so that the effects of moderate short-term food price variations on nutritional status are relatively small. Rice and vegetable are price inelastic food for all nutrients in all sectors. Likewise, wheat flour in estate sector; bread in rural sector; pulses in urban sector; meat and milk in urban and rural sectors; fish in rural and estate sectors; coconut in urban and estate sectors are price inelastic foods for the all nutrients. Pulses for protein in estate sector and fat for rural sector; meat and fish for fat in estate sector; egg for energy and protein in urban and estate sectors, fat for urban and rural sectors, carbohydrate for estate sector; coconut for energy and fat in rural sector; milk for fat in estate sector are also price inelastic. So, for the price inelastic food groups in the above sectors, decreasing prices are associated with increases in the consumption of nutrients.
At the same time wheat flour in urban and rural sectors; bread in urban and estate sectors shows price elastic food groups for all nutrients. Likewise pulses elastic food for energy and carbohydrate in rural and estate sectors, protein for rural sector, fat for estate sector; meat and milk for energy, protein and carbohydrate for estate sector; fish for energy, protein, carbohydrate in urban sector; egg for energy, protein, carbohydrate in rural sector, carbohydrate in urban sector, fat for estate sector; coconut for protein and carbohydrate in rural sector are fell in price elastic foods. So, for these elastic food groups, where consumption is decreasing the above nutrients hardly any effect occurs.

Conclusions

The food problem and inadequate nutrition in terms of consumption are regarded as major issues that attract intensive attention in socio economic dimensions. A Sri Lankan household is suffering from malnutrition and unbalanced essential nutrients. It is observed that the major sources of nutrients are plant products with small amounts of nutrients from animal products. As a result, lack of dietary diversity is a particular problem among households in Sri Lanka. So, food consumption expenditure pattern of households is extremely involved as main influences. So, this study is attempted to examine household food consumption expenditure patterns in terms of food and nutrient elasticities for major food groups in urban, rural and estate sectors. For the purposes MLA AIDS and DMNA econometric models are used to apply food items in sectoral households.

Expenditure elasticities for all nutrients are relatively high in this study. Proteins record the highest expenditure elasticity in the households especially in estate sector. These results imply that households may shift towards other affordable food choices such as cereals and vegetables, in order to obtain adequate energy. This again represents the usual dietary pattern of Sri Lankans, where the majority of households are devoted to have rice at least for one meal. Rice, being the staple food in Sri Lanka and a rich carbohydrate source, compensates the energy intake and consume together with several curries in which coconut milk serves as one of the major ingredients which become the major source of fat in Sri Lanka.

Uncompensated cross price elasticities are smaller in absolute terms than those of the expenditure or own-price elasticities in urban, rural and estate sectors generally. The cross-price elasticities characterize pairs of food commodity groups as substitution relationship or complementary relationship. Many food items are based on a single food with small amounts from plant or animal products. Food groups showed a substitution relation may be a reason in explaining the lack of dietary diversity. It is important that a number of different healthy food sources consume and encourage a wide variety of healthy foods to improve the nutritional quality. Dietary diversity is one of a way to ensure a balance of nutrients for all ages of households. This might result from aggregation decisions of the composite commodities.

Nutrient elasticities with respect to price changes of most of the food groups are negative and statistically significant. As quantity demanded for all food groups is found to be inversely related with corresponding price changes. If the food price increases it may diminish nutrient intakes of households. However, consumption of all nutrients appears to be very less responsive to the price changes in most of the food groups. So, household food consumption heavily depends on substitutes, therefore they alter food choices as prices vary. Because of the ability to endure these price changes through substitution, households are more likely to gain necessary nutrients by any means.

Policy Recommendations

The findings of the empirical analysis of price or demand and expenditure elasticities for the selected food groups could be used in the projections for future food consumption. Production in Sri Lanka is expected to be getting farther away from being self-sufficient in its food. This holds true particularly for food items exhibiting high expenditure elasticities such as meat and pulses food groups. The high price elasticities of demand for many food items stress the importance of food price changes for households especially in estate sector. So, their results are taken in the development of agricultural and food policies.

Rice is a stable food for Sri Lankans meals daily. So, Sri Lankan diets are found high consumption of rice and comparatively low consumption of other healthy foods. It is important that efforts undertaken to encourage consumption of a wide variety of foods to improve the nutritional quality of the diet and health. Considering the relatively high expenditure elasticities of demand for meat, pulses and vegetables of all households, income increases would exert a positive influence on the intake of micronutrients that are given by meat, pulses and vegetable products. The results of this study suggest that income-oriented policies are important to achieve better nutrition and reduce the problem of unbalanced diets. In addition, complementing policies are necessary.

Increase in meat food production must be focused, particularly chicken, beef, mutton and pork, aiming at increasing the per capita consumption of animal protein in its various forms by means of raising productivity of domestic poultry, cow, goat and swine using improved varieties to increase milking rate, meats and eggs production. Increasing the quantities of animal products is expected to have an effect on the prices and benefit to households.

Expenditure effects greatly influence on household consumption of nutrients. Hence, policies target on improving income and living standards rather than controlling prices of food commodities. However, income growth and price moderations may not ensure balanced nutrient consumption of households. Because of the devoted dietary patterns of Sri Lankans, such policies that are favorable for households more nutritionally risk in some instances.

Consequently, all income and price regulations carry out concurrently with campaigns that educate people about nutritional dietary patterns especially in estate and rural sectors

Considering food insecurity and malnutrition remain huge problems in the developing world, it is surprising that economists have made little recent effort to understand and quantify nutritional impacts of policies and exogenous shocks. Further it is noted that energy effects are relatively documented while aspects of micronutrient consumption have been less analyzed. So, an approach is developed that is suitable for empirical analysis, but certainly the research direction would benefit from additional work. Apart from further improvements in terms of methodology and data, a useful extension would drive beyond consumption and quantify health outcomes associated with nutritional deficiencies.

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