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An Assessment of Intrahousehold Calorie Allocation: A Case Study of Tea Estate Workers

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ABSTRACT

Health condition and nutritional level of the workers affect the worker productivity, worker output, income generating ability and finally the economy of the country. The pattern of intra household food allocation plays a major role in determining the standard of health and nutritional status of individual members.

This study was conducted to examine the pattern and determinants of intra household food allocation among tea estate households. Through a household survey, the individual food intake, the monthly income, non cash benefits and personal and family characteristics were collected. Individual food sufficiency (calorie adequacy ratio) was measured and individual relative calorie allocation was woked out.

ANOVA followed by mean separation was performed to examine whether there is a significant difference between calorie adequacy ratio (CAR) of father's, mother's and children's (family members below 16 years). Calorie adequacy ratio is the dependent variable for the household regression. The dependent variable for the mother and children was relative calorie allocation (RCA). Independent variables were socio-economic factors such as father's income, mother's income, total income, mother's income proportion and father's education, mother's education, father's age, mother's age, children's age, children's birth order, children's gender, mother's pregnancy and lactation, number of adults (family members above 16 years) and number of children.

The results indicate that there is a significant difference in calorie allocation between children and their parents. However, there was no significant difference of calorie allocation between father and mother. Parents were at better nutritional status compared to their children. Also male children were in a better nutritional status than female children. Total income had a significant positive impact on household calorie adequacy ratio. Mother's income proportion had a positive impact on her relative calorie allocation and household calorie adequacy ratio. Employed mother had a negative impact on children's relative calorie allocation. However, children's age had a significant positive impact on his/her relative calorie allocation. It was also found that the nutritionally risk individuals are the children. Therefore, it is important especially to target the children below five years, in planning nutritional intervention programs.

Key words: Calorie adequacy ratio, household calorie adequacy ratio, relative calorie allocation

INTRODUCTION

The pattern of intra household food allocation plays a major role in determining the nutritional status and standard of health of individual members. A well-nourished healthy workforce is a necessary precondition for successful economic and social development. Specially, workers in the plantation sector, play a major role in the economy of Sri Lanka, because a considerable portion of the export earnings (14.2% of the total foreign exchange earnings) is coming from the plantation sector (Anon, 2001). Health condition and nutritional level of the workers affect the work productivity, work output, income generating ability and finally the economy of Sri Lanka.

There are large differences in energy intake among different sectors and income groups. The energy intake is lowest in the urban sector at all levels of income and the highest in the estate sector, mainly due to subsidies provided on certain food and non-food items as part of welfare facilities provided by the estate (Anon, 1999). In the estate sector, the non-food subsidies permit a higher proportion of expenditure on food compared to the rural sector. Average calorie intake of the estate sector in Sri Lanka is 2550 kilo calories/person/day (Anon, 2002), and it is above the FAO standards of 2193 kilo calories /adult person /day. However, 24% of the people in the plantation sector are receiving calories below the required level and it is obvious that malnutrition is one of the problems in the plantation sector (Anon, 2002).

Most of the women do not receive their daily calorie requirement and also other essential micro - nutrients. Accordingly protein and energy malnutrition, anemia and goiter are common problems among them. In the estate sector nearly 59% of mothers are undernourished, based on Body Mass Index (BMI). In urban and rural sector, percentages of undernourished mothers are 21% and 43% respectively. Other acute problem among the plantation workers is anemia. According to the 4th National Nutrition and Health Survey, 30-50% of the plantation workers are suffering from anemia.

Poverty is one of the reasons of inadequate food supply. Disease problems may be due to lack or low utilization of health services, inadequate water supplies and sanitary facilities, poor food hygiene or inadequate child -care. Inadequate or poor education particularly is an underlying cause of malnutrition. Gender discrimination against female children in the intra family food allocation has been reported by a number of studies. A prevalence of severe malnutrition among female children is higher compared to the male counterparts (Carloni, 1981).

Several countries have conducted studies on intra household food allocation for different groups of people. However in Sri Lanka, only a few studies have been conducted on intra household food allocation for rural and urban sector. However, no information is available on intra household food allocation of estate workers in Sri Lanka.

Rathnayake and Weerahewa (2002) conducted a study to identify, whether there is a misallocation of calories among household members in Kandy municipal limit area. From

the study, it was reported that there was a misallocation of calories among family members. Also, mother's income has a positive effect on the mother's calorie allocation and negative effect on children's calorie allocation. According to the study, boys receive comparatively a higher portion of calories than girls. Family size has a negative effect on mother's relative calorie allocation.

Kimhi and Senauer (2000) conducted a similar study to find out the pattern of intra household food allocation among rural families in Southern Ethiopia. They used data collected from 583 families, in 1995. They have found out that the economic position of women has a positive effect on the relative nutritional status of their children. Pregnancy and breast-feeding had negative effect on women's food allocation. Also they have found out that, in poor families children tend to be in a better nutritional status relative to their parents and adult female children are in a better nutritional status than their male counterparts. Birth order has a positive effect on nutritional status among the youngest children. The number of children in a family has a negative effect on each child's food allocation.

A household survey was done by Senauer *et al.,* (1988) to find out determinants of the intra household allocation of food in the rural Philippines. This survey had been conducted in three rural provinces using 800 households. According to this study, mother's income has a significant positive impact on the relative calorie allocation of herself and negative effect on father's calorie allocation. Also it has a positive impact on children. An increase in the wage of the father, increases his own and mother's allocation but reduces the children's. Also father's age has a significant positive effect and mother's age has a negative impact on his relative calorie allocation. The number of children in the household has a positive impact on intra household calorie allocation and children's birth order has a significant negative effect.

With this background, it is attempted here to assess the intra household food allocation of the estate sector workers in Sri Lanka.

METHODOLOGY

Study Area and sample

St. Coombs estate was selected for this survey, because of its relative accessibility. Out of 375 families in the estate 107 were randomly selected for the survey. This accounts for 25% of the total number of families in the estate.

Method of data collection

Data was collected through a household survey, commencing in October 2002, in St. Coombs estate. A key element in the survey was the direct measurement of individual food intake of household members. Details on food intake of all household members were collected using a pre- tested questionnaire, on three consecutive days. Personal and family characteristics, individual food intake for 24-hour period were included in the questionnaire.

The method of recording individual food intake was by the recall method. In this survey, all food items consumed by the individuals were taken into account. Monthly income was collected from the estate records. Non cash benefits given by the estate and income earned from vegetable cultivation and rearing animals were also included in calculating the income.

Calorie content of the food items was calculated according to food composition tables available for Sri Lanka. Individual daily calorie intake was calculated by aggregating overall food items consumed by each individual. Considerable variation in daily calorie intake on the three consecutive days could be observed and in order to minimize the influence of this problem, average of the three consecutive days were taken. Extended families were excluded from the sample. Also Children below one year were excluded since they were breast feeding.

Three indicators, nutrient intake, nutrient adequacy ratio and relative nutrient allocation are commonly used to measure the food intake of an individual.

Nutrient intake

The amount of nutrients intake by a person is known as nutrient intake. The amount of food used by a person is converted into amount of nutrient by using the food conversion tables. Nutrient intake is expressed as the amount of nutrient per person per day. This is a good indicator when compared to food intake.

Individual Calorie Adequacy Ratio (ICAR)

The ICAR is defined as the ratio of individual calorie intake to the recommended daily calorie allowance, i.e.

$$\text{ICAR} = \frac{\text{Individual calorie intake}}{\text{Recommended daily calorie allowance for an individual}} \times 100$$

Household Calorie Adequacy Ratio (HCAR)

The HCAR is defined as the ratio of household total calorie intake to the recommended daily allowance for the entire household, i.e.

$$\text{HCAR} = \frac{\text{Calorie intake of all the family members}}{\text{Total recommended daily allowance for the entire household}} \times 100$$

Relative Calorie Allocation or Relative Calorie Adequacy Ratio (RCA)

It is a measure of whether a person is consuming less, at or more than expected amount

if available nutrients were distributed according to relative needs of the household. It can be estimated by using this equation,

$$RCA = \frac{\text{Individual calorie adequacy ratio}}{\text{Household calorie adequacy ratio}} \times 100$$

Analysis of Variance (ANOVA) followed by mean separation was performed to determine the mis – allocation of calories between family members. Multiple regression analysis was performed to identify determinants of intra household food allocation. RCA and HCAR were selected as the dependent variables in the analysis, while socio-economic factors such as father's income (Rs./month), mother's income (Rs./month), father's age (year), mother's age (year), father's education (grade), mother's education (grade), number of adults (family members above 16 years) and number of children in the family (family members below 16 years), each child's age, gender, and birth order, mother's pregnancy and lactation were studied as independent variables. Three functional forms were separately studied for household, mother and children.

Household Model

$Y_1 = f(M, X_1 \ldots\ldots X_n)$

Mother's model

$Y_2 = f(M, X_1 \ldots\ldots X_n)$

Children's model

$Y_3 = f(M, X_1 \ldots\ldots X_n)$

where, Y_1 = Household calorie adequacy ratio

Y_2= Mother's relative calorie allocation

Y_3= Children's relative calorie allocation

M= Vector of total income (family income), proportion of father's income and mother's income.

X_1= Father's age (years)

X_2=Mother's age (years)

X_3=Father's education

X_4=Mother's education

X_5=Number of adults in the family (Family members above 16 years)

X_6=Number of children in the family (Family members below 16 years)

X_7=Children's age (Years)

X_8=Children's birth order

Dummy variables

X_9=Children's gender male=1 Female=0

X_{10}=Mother's pregnancy If pregnant=1 Not pregnant=0

X_{11}=Mother's lactation If lactation=1 Not lactation=0

X_{12}=Employed mother If employed=1 Not employed=0

Four functional forms were analyzed separately using log-log, lin-log, log-lin, lin-lin models for the above models.

Log-log model- $\log Y = C + \sum_{i=1}^{n} \log X_i$

where, $i = 1.....n$

Lin – log model- $Y = C + \sum_{i=1}^{n} \log X_i$

Log – lin model- $\log Y = C + \sum_{i=1}^{n} X_i$

Lin-lin model- $Y = C + \sum_{i=1}^{n} X_i$

Based on the value of the coefficient of determination (adjusted R^2), the best functional forms were selected.

RESULTS AND DISCUSSION

Characteristics of the sample

An average household contained approximately 3 adults and 2 children. The average monthly income of a father was Rs.3400/= and income of a mother was Rs.3500/=. Mother's contribution to the total household income was relatively greater than that of father's. The average age of the father and the mother were 39 years and 35 years respectively. Both father and mother had equal opportunity for education and the average education level was up to year 6.

Table 1: Description of household, father, mother and children of the sample

Group	Total no.	HCAR>1		HCAR<1	
Households	107	82		25	
		ICAR>1	ICAR<1	ICAR>1	ICAR<1
Father	91	64	5	11	11
Mother	93	69	3	17	4
Children	211	61	104	0	56

Out of 107 households HCAR of 82 households were above 1 and it was below 1 for the rest of 25 households. This indicated that, 76.6% total households of the sample were receiving recommended daily calorie requirement and only 23.36% were not receiving their recommended daily calorie requirement. In the estate sector, 24% are undernourished (Anon, 2002). However, father, mother and children of category HCAR>1 did not receive their recommended calorie requirement. Some fathers, mothers and children of category HCAR<1 received their recommended calorie requirement. According to these results, 82.4% of the mothers received their recommended calorie requirement. However, 92.4% of the fathers received their calorie requirement and only 7.6% were under-nourished. This result shows that fathers were at better position in terms of energy intake than that of mothers. Most vulnerable group to malnutrition was the children. According to the results, 75.8% of the children were under-nourished.

Table 2: Mean values of calorie intake, RDA's and CAR

Group	Mean of the recommended daily allowance (kcal)	Mean value of calorie intake (kcal)	Mean Calorie Adequacy Ratio (MCAR)
Father	2459.10	3239.38	1.31
Mother	2012.32	2606.38	1.30
Children	1919.47	1791.49	0.92
Male children	1904.60	1833.86	0.95
1-5 years	1362.33	1184.81	0.87
Above 5 years	2196.59	2183.36	0.99
Female children	1932.47	1753.55	0.89
1-5 years	1386.54	1077.84	0.79
Above5 years	2064.29	1916.22	0.92
Average	2324.33	2069.54	1.11

The national average calorie requirement of an individual is 2193 kilo calories per person per day (Anon, 1999), but the average calorie intake for Sri Lanka is 2078 kilo calories per person per day (Anon, 1999). Therefore, national average CAR is below 1. It indicates that an individual in Sri Lanka receives only 95% of their recommended calorie level. Per capita calorie intake of an individual in the estate sector is 2550 kilo calories per day. Therefore overall average calorie adequacy ratio for the estate sector is greater than 1. It indicates that individuals in the sample receive their recommended or more than calorie requirement.

According to the table 02, the MCAR of father and mother were 1.31 and 1.30 respectively. These values indicate 30% higher than the recommended levels. However MCAR of children was 0.92. This indicates that even though there was no malnutrition as a whole, the average calorie intake of the children was far below when compared to their recommended daily calorie requirement. They seem to obtain only 92% of their calorie requirement. Mean calorie adequacy ratio was higher for boys compared to girls. Among the boys and girls, children above five years received energy relatively better than those who were below five years (excluding the children those who are breast fed).

Analysis of CAR

Analysis of Variance revealed that ICAR was different between father, mother and children (P=0.0001). The mean separation revealed that ICAR of children was significantly different from ICAR of fathers and mothers. However, there was no significant difference between ICAR with respect to father, mother. Also, mean RCA of father and mother and children were significantly different from one.

Determinants of CAR

Regression analyses were done to identify the determinants of the households CAR and RCA of different members of household in the estate sector.

i) Determinants of household CAR

The summary output of the regression analysis is presented in table 03.

Table 3: Regression results for household CAR

Dependent variable = CAR			
Independent variable	**Estimated Coefficient**	**t-statistics**	**P-value**
Intercept	1.02	5.42	0.00
Mother income proportion	-0.78	-0.72	0.48
Total income	0.003	1.77	0.09
Number of children	-0.03	-1.07	0.292
Mother's pregnancy	-0.37	-2.64	0.01
Mother's education	0.92	0.91	0.37
Mother's age	-0.04	0.79	0.43
Number of adults	0.05	0.40	0.24

The adjusted R^2 (0.19) and R^2(0.24) were very low and only 24% of the household CAR explained by this model. This means that there are other explanatory variables which were not studied in this survey to determine the household CAR. Standard deviation and mean of the dependent variable were 0.194 and 1.144 respectively.

According to table 03, total income has a positive impact on household CAR. Mother's pregnancy has a strong impact on CAR.

ii) Determinants of mother's RCA

The summary output of the regression analysis is presented in table 04.

Table 4: Regression results for mother RCA.

Dependent variable = Log RCA			
Independent variable	**Estimated Coefficient**	**t-statistics**	**P-value**
Intercept	-2.55	-2.95	0.01
Log of mother income proportion	0.26	2.70	0.01
Log of total income	0.28	2.92	0.01
Log of father's age	0.20	0.01	0.99
Log of mother's education	0.07	0.99	0.33
Log of number of adults	0.32	3.78	0.001

Based on adjusted R^2 (0.47) and R^2(0.58) best fit was given by log-log model. This means that 58% of the mother's RCA explained by the selected explanatory variables. Standard deviation and mean of the dependent variable were 0.137 and 0.187 respectively.

According to table 04, the total income has a significant positive impact on mother's RCA. Also mother's income proportion has a significant positive impact on her RCA. Number of adults in a household has a positive impact on mother's calorie allocation.

iii) Determinants of children's RCA

The summary output of the regression analysis is presented in table 05.

Table 5: Regression results for children's RCA

Dependent variable = RCA			
Independent variable	**Estimated Coefficient**	**t-statistics**	**P-value**
Intercept	0.89	9.49	0.00
Total income	0.00006	0.74	0.46
Employed mother	-0.09	-2.21	0.03
Mother's age	-0.01	0.35	0.73
Father's education	-0.08	-1.95	0.05
Children's birth order	-0.04	-0.27	0.79
Children's age	0.01	3.36	0.001
Mother's lactation	-0.02	-0.54	0.59
Number of adults	-0.03	-2.33	0.02

The adjusted R^2 (0.22) and R^2 (0.27) were very low and only 27% of the children's RCA is explained by this model. The standard deviation and mean of dependent variable were 0.148 and 0.81 respectively

According to table 5, employed mother has a significant negative impact on children's RCA. In the estate sector, most of mothers are working for about 8 hours in the field. Therefore, they have limited time for child care and preparation of food. Children are fed with same meal prepared for adults. Because of the lack of preference to this meal, children's food intake is less than expected. Kennedy and Bouis (1992) have found out that women's participation in work activities, in and outside home, have overall adverse consequences for their children's well being.

Father's education also found to be affecting negatively on children's RCA. Children's age has a significant positive impact on his or her RCA. This result indicates that older children are treated better than younger ones. There is a significant negative effect of number of adults in the household on children's RCA.

CONCLUSION AND POLICY IMPLICATIONS

According to the results of this study, CAR varies between family members. The CAR and RCA of father, mother, and children were significantly different from one. Therefore, energy malnutrition is not a severe problem among the fathers and mothers. Children have the lowest calorie adequacy ratio compared to parents.

The average daily calorie intake in the study area is 2324 kilo calories/person/day and 23.36% in the area were undernourished. Findings imply that in the estate sector households, parents tend to be in a better nutritional status relative to their children. Also male children are in a better nutritional status than their female counterpart. Among children the elderly male and female children are in a better nutritional status than younger ones.

Total household income has a significant positive impact on the entire household's calorie adequacy ratio and mother's income has a significant positive effect on her relative calorie allocation. However, employed mother is a significant negative factor of children's calorie allocation.

Number of adults in the household has a negative effect on mother's and children's calorie allocation. Family size has a significant positive impact on mother's RCA. However, children's age has a significant positive impact on his or her calorie allocation. Father's education has a significant negative impact on children's calorie allocation.

Policy Implications

In the study area, the nutritionally risk individuals are the children. Energy malnutrition is not a severe problem for the parents. Among the children, older children are in a better nutritional status compared to younger children. Therefore, it is important to target both male and female children below five years, in planning nutrition intervention programs.

Economic position of women has a positive influence on her relative nutritional status. However mother's employment is a negative factor for children's calorie allocation. Therefore, women's time allocation is an important and frequently overlooked determinant of her and her children's nutritional status.

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