Original Article

Socioeconomic profile and nutritional status of children in rubber smallholdings

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This paper will present the socioeconomic profile and nutritional status of children aged 1–6 years in the rubber smallholdings of Peninsula Malaysia. A total of 323 households were involved in this study. The sociodemographic data were obtained through interviews with heads of households using a set of questionnaires. Anthropometric measurements were taken from 506 children aged 1–6 years from these households. The weight and height of the children were compared with the reference values of the National Center for Health Statistics (NCHS) and the nutritional status was classified based on the recommendations of WHO. The average age of the fathers was 39.9 ± 8.6 years and 34.4 ± 7.0 years for the mothers. The mean household size was 6.67 ± 2.27. The majority (49.7%) of the heads of households received 4–6 years of formal education and 7.9% received no formal education. Based on the monthly per capita income, 24.0% were found to be in the hardcore poor category, 38.3% fall into the poor category and 37.7% in the above poverty income group. The prevalence of stunting and underweight among children between the ages of 1–6 years were highest among children from the hardcore poor, followed by the poor category and above the poverty line income group. Wasting was present in all income groups, with a prevalence of 4.2% found among the hardcore poor, 9.4% among the poor group and 8.4% in the above poverty income group. The Pearson Product Moment Correlation showed significant relationships between household total income and height-for-age (r = 0.131, P = 0.05) and weight-for-age (r = 0.127, P = 0.05). There were also significant correlations between monthly per capita income with height-for-age (r = 0.16, $P < 0.01$) and weight-for-age (r = 0.13, $P < 0.05$). The acreage of land utilised was correlated with height-for-age (r = 0.11, $P < 0.05$), weight-for-age (r = 0.17, $P < 0.05$) and weight-for-height (r = 0.16, $P < 0.05$). However, stepwise multiple regression analysis indicated that the predictor of height-for-age was monthly per capita income (R^2 = 0.03, $P < 0.01$) and acreage of land utilised was a predictor for weight-for-age (R^2 = 0.03, $P < 0.01$) and weight-for-height (R^2 = 0.01, $P < 0.01$). Because income and acreage of land utilised have been shown to be associated with nutritional status, it is recommended that intervention programs that focus on generation of income and diversification of land utilisation should be undertaken. A multidiscipline approach involving the family, community and government agencies should be applied to any type of intervention program.

Key words: anthropometry, children, income level, Johor, Kedah, Kelantan, Malaysia, Perak, rubber smallholdings, socioeconomic.

Introduction

The rubber industry remains one of the biggest agricultural sectors in Malaysia with 1.8 million hectares cultivated with rubber trees. Out of this, 85% are smallholdings while the rest belong to big companies or corporations. There are 400 000 rubber smallholders in the country.[1] The low price of this commodity over the years has made rubber smallholders a marginalised group in the country and this economic setback has definitely affected the livelihood and the quality of life of this community.

Communities involved in low-income agriculture, such as rubber smallholdings or related rural industries, are often the most nutritionally vulnerable groups. Nutritional studies of children in rural population in Malaysia showed that malnutrition persists. A recent study by Norhayati *et al.*,[2] conducted on 1–7-year-old children in a village 70 km from the city of Kuala Lumpur, showed that malnutrition is still a problem in rural communities. The prevalence of stunting, underweight and wasting were 18.1, 46.2 and 30%, respectively. In a peninsula-wide study on rural communities comprising of padi farmers, rubber smallholders, coconut

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smallholders, fishermen and rubber estates revealed that 32.6% of boys and 35.9% of girls aged 1–6 years were underweight. Approximately 28% of the children had stunted growth and 10% were wasting. However, the prevalence of malnutrition differed with each community studied.[3] In comparison to a nationwide study on poverty villages conducted more than a decade ago, the recent studies have shown marginal improvement. The earlier study reported a higher prevalence rate of 43% for stunting, 37% for underweight and 5% for wasting among children aged 1–6 years.[4]

Several factors have been shown to contribute to the development of malnutrition. The relationships between sociodemographic variables and the nutritional status of children have been reported in earlier studies.[2,5–7] Factors such as income, parents' age, education, occupation, and household size have been examined with various outcomes.

Poverty, however, is the root cause of undernutrition. Both acute and chronic undernutrition primarily affect young children in poor and marginalised families who cannot produce or procure adequate food, live in unsanitary environments without access to clean water, lack basic services and are poorly educated. Because economic setbacks have affected the rubber smallholders, it is imperative to investigate not only their socioeconomic profile but also its influence on the nutritional status of the children.

Subjects and methods

This study was part of a collaborative research project funded by the Ministry of Science, Technology and Environment to assess the nutritional status of functional groups from rural, urban and affluent urban communities in Peninsula Malaysia. The rural sectors comprised padi farmers, rubber smallholders, coconut growers, fishermen and rubber estate workers.

Each of the five sample populations was independently selected by multistage random sampling, as described by Chee *et al.*[8] in their report on the socioeconomic profile of all households involved in this study. Three groups, the padi farmers, rubber smallholders and coconut smallholders, were selected from the Department of Agriculture's 1990 census. For each crop, 80 districts in the peninsula were arranged in ascending order according to the total cultivated area, and the upper median of 40 districts were taken to be the sampling frame. A 10% sample was then randomly picked from the 300 subdistricts (*mukim*) located in these 40 districts. In the final stage of sampling, the study villages were randomly selected from all of the villages in the 30 selected subdistricts. Based on past reports, it was estimated that approximately 600 households would be the required sample size in order for the prevalence of malnutrition to be detectable. This number was therefore used as a target in determining the number of villages selected for each of the low income groups.

The fishing villages were selected from the 1991 list of Fishermen Associations of the Fishermen's Development Authority. The Fishermen Association areas of the east and west coast of the Peninsula were listed separately, ranging from the area having the highest number of fishing villages to the area with the lowest number. Again, the areas in the upper median of each of the lists (11 areas on the east coast and 14 areas on the west coast) were chosen to be the sampling frames. The study villages were then randomly selected from all of the fishing villages in these areas; the number of villages being determined using the estimate of 300 households required for the east coast and 300 for the west coast.

The estates were selected from a list provided by the National Union of Plantation Workers. All of the estates in this list were first stratified into small-sized estates (less than 500 hectares), medium-sized estates (500–1499 hectares) and large estates (1500 hectares and above). Random sampling was then carried out in each category, with the number of estates determined by an estimate of 200 households required for each category.

This paper will only highlight the socioeconomic profile of rubber smallholders and the nutritional status of children aged 1–6 years. Rubber smallholdings from four states in Peninsula Malaysia, namely Kedah, Kelantan, Johor and Perak, comprising 323 households were involved in this study. The sociodemographic data were obtained from direct interviews with the head of the households using a set of questionnaires. These included questions concerning family background, socioeconomic variables, demographic information and agricultural activities.

A total of 506 children aged 1–6 years (comprising 249 boys and 257 girls) from these households were the study subjects of this report. The anthropometric measurements of the children were assessed in temporary clinics at various community centres in the four states. The weights of the children were obtained by weighing them without shoes using the TANITA (Tanita, Tokyo, Japan) beam balance to the nearest 0.1 kg. Height was measured using the microtoise tape to the nearest 0.1 cm. The children stood erect against a straight wall with a tape suspended 2 m from the floor. The weight and height of the children were compared with the reference values of the National Center for Health Statistics (NCHS) and the nutritional status was classified based on the recommendations of WHO (1983).[9] Children with a height-for-age 2 SD below the NCHS median were considered stunted, those with a weight-for-age 2 SD below the NCHS median were categorized as underweight and wasting was classed as a weight-for-height 2 SD below the reference median.

Data were analysed using the SPSS for Windows version 10.0 (SPSS, Chicago, IL, USA). The Pearson Product Moment Correlation and Stepwise Multiple Regression were used to establish the relationships between the variables.

Results

Demographic characteristics

Nearly all of the households in this study (99.4%) were of the Malay ethnic group. Table 1 presents the sociodemographic characteristics of these households.

The average age of the subjects' fathers was

Table 1. Sociodemographic characteristics of the households

Variable	*n*	%	Mean	Range
Age of father (years)	293		39.9 ± 8.6	21.9–69.4
≤ 30	40	13.7		
> 30–40	119	40.6		
> 40–50	99	33.8		
> 50–60	31	10.6		
> 60–70	4	1.4		
Age of mother (years)	317		34.4 ± 7.0	17.8–58.4
≤ 30	93	29.3		
> 30–40	148	46.7		
> 40–50	75	23.7		
> 50–60	1	0.3		
Education of father (no. years)	290		6.4 ± 3.2	0–17
0	23	7.9		
1–3	28	9.7		
4–6	144	49.7		
7–9	53	18.3		
10–11	36	12.4		
> 11	6	2.1		
Education of mother (no. years)	305		5.5 ± 3.5	0–14
0	50	16.4		
1–3	34	11.1		
4–6	130	42.6		
7–9	53	17.4		
10–11	34	11.1		
> 11	4	1.3		
Household size	323		6.67 ± 2.27	3–16
<4	18	5.6		
4–6	141	49.2		
7–9	134	41.5		
10–12	24	7.4		
> 12	6	1.9		
Monthly household income (RM)	321		530.03 ± 371.67	40–2120
1–250	70	21.8		
> 250–500	134	41.7		
> 500–750	52	16.2		
> 750–1000	30	9.3		
> 1000–1250	15	4.7		
> 1250–1500	9	2.8		
> 1500	11	3.4		
Monthly per capita income (RM)	321		84.27 ± 60.00	7.14–384.00
≤ 42.19	77	24.0		
> 42.19–84.38	123	38.3		
> 84.38	121	37.7		

39.9 ± 8.6 years, while the mothers' average age was 34.4 ± 7.0 years. The majority of the parents were in the same age category of 30–40 years. Household sizes ranged from 3 to 16 family members and the mean household size was 6.67 ± 2.27. Almost half of the households (49%) had family sizes ranging between four and six family members, and 42% of the households had seven to nine family members.

The majority of the parents received between 4 and 6 years of formal education, while 7.9% of fathers and 16.4% of mothers had no formal education. The average years of education received were 6.4 ± 3.2 for fathers and 5.5 ± 3.5 for mothers. Only 12–14% had completed their formal education. In general, a high percentage (67.3–70.1%) of the parents received 6 years of education or less.

The total household income was based on all sources of income, such as the main income from major crops grown or main employment, side income from other crops grown or other employment, contributions from children and government aids. The study showed that the mean monthly income was RM 530.03 ± 371.67. The majority of families studied (41.7%) earned between RM 250 and RM 500 each month. The mean monthly per capita income was RM 84.27 ± 60.00, with a range of RM 7.14 to RM 384.00. Based on the Malaysian poverty line income of RM 405.00

for a household size of 4.8, the per capita poverty line income would be RM 84.38 and the hardcore per capita line income would be RM 42.19.[10] In this study, 24.0% were found to be in the hardcore poor category, 38.3% in the poor category and 37.7% above the poverty line income. Therefore, more than 50% of the rubber smallholding households lived in poverty (Fig. 1).

Agricultural activities

The agricultural activities varied between rubber smallholdings. Table 2 showed that 38.8% of the households were involved in rubber growing or tapping as their main employment, followed by fruit growers at 5.2%. The other crop grown was padi. A greater percentage of households (48.3%) were not involved in any type of agricultural activities but worked as teachers, clerks or factory workers. The findings showed that the mean acreage of land utilised was 0.6 acres, and land left to fallow was 84.6 acres.

The distribution of households involved in rearing livestock for their own consumption or for sale is shown in Table 3. Most of the households (68.7%) reared chicken for their own consumption and only about 3.1% reared chicken for sale. Other livestock reared was minimal.

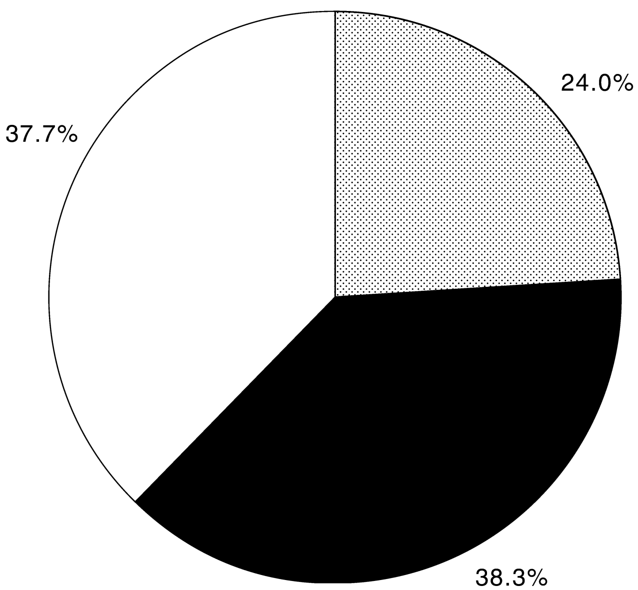

Figure 1. Distribution of monthly per capita income. (□) > RM 84.38; (■) RM 42.19–84.38; (▒) < RM 42.19.

Table 2. Percentage of households according to main agricultural activities

Crop	*n*	%
Rubber	126	38.8
Fruits	17	5.2
Padi	16	4.9
Other	9	2.7
None	157	48.3

Nutritional status of children aged 1–6 years

A total of 506 children between the ages of 12–72 months were assessed anthropometrically. These comprised 249 boys and 257 girls. Table 4 shows the distribution of children by age group.

The nutritional data is presented according to the different age groups. Table 5 presents the mean *z*-scores according to age group. The results show that the mean *z*-scores for height-for-age, weight-for-age and weight-for-height for children aged 12–72 months were below the NCHS reference median, with means of –1.63 ± 0.97, –1.63 ± 0.92 and –0.83 ± 0.90, respectively.

Height-for-age. Severe stunting, as indicated by height-for-age values more than 3 SD below the NCHS median, was found in all age groups with a prevalence rate of 10.4% in the youngest group of children, 7.1% among children aged > 24–48 months and 9.5% among older children. Overall, the prevalence of stunting among children between the ages of 12–72 months was 33.1%. Of this, 8.7% were severely stunted. The highest prevalence of stunting (41.7%) was among children aged 12–24 months, followed by 34.3% among children older than 48–72 months and 28.5% in children in the > 24–48 months category.

Table 3. Percentage of households according to type of livestock reared

Type of livestock	Consumed	Sold	None
Chicken	68.7	3.1	28.2
Ducks	10.4	0.6	89.0
Goats	8.0	3.1	89.0
Cattle	7.1	4.3	88.7
Rabbits	2.1	0.3	97.5
Buffalo	1.2	1.5	97.2
Fish	0.6	0.3	99.1

Table 4. Distribution of children in the study group

Age group	Boys		Girls	
(months)	No.	%	No.	%
12.0–24.0	32	12.9	47	18.3
> 24.0–48.0	113	45.4	106	41.2
> 48.0–72.0	104	41.8	104	40.5
Total	249	100	257	100

None of the children were above 2 SD from the NCHS reference median for height-for-age, indicating that none of these children were overweight (Table 6).

Weight-for-age. The weight-for-age measurement is used to indicate the current and past nutritional status. Similar to stunting, there were also cases where children were found to be severely underweight in all age groups, as indicated by weight-for-age values of greater than 3 SD below the NCHS median. Overall, the prevalence of underweight among children 12–72 months of age was 34.7%. Children over 24–48 months accounted for the highest prevalence of underweight (39.6%). The group with the next highest prevalence of underweight was children between 12 and 24 months (36.5%). A period of adjusting to either new foods or to adult foods might explain the high percentage when compared with children of over 48–72 months (Table 6).

Weight-for-height. The prevalence of wasting ranged from 4.2 to 8.9%. The almost equal prevalence of stunting and underweight may account for this low prevalence of wasting. There was no severe wasting found in any of the age groups.

A higher prevalence of wasting was seen among children in the > 24–48 months age group compared with the other age groups. In general, the prevalence of normal weight-for-height (91.9%), which is between –2 SD and 2 SD of the NCHS median, were higher than the prevalence of normal height-for-age (66.9%) and normal weight-for-age (65%; Table 6).

The prevalence of malnutrition according to age group is presented in Figure 2. Undernutrition, whether it be stunting, underweight or wasting, was found in all age groups. The effects of long-term deprivation of energy and protein were seen in all age groups, as indicated by the prevalence of stunting. However, it is also possible that the stunting observed in this study could be the outcome of several frequent episodes of inadequate food intake. The prevalence of underweight was lower among 48–72-month-olds compared to the younger age groups. The supplementary feedings provided by government and non-government preschools in rural areas may have contributed to the lower prevalence of underweight.

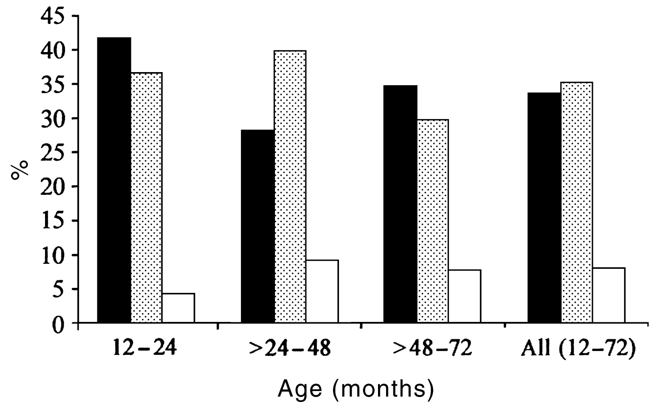

Figure 2. Prevalence of malnutrition among children aged 12–72 months. (■) stunting; (▩) underweight; (□) wasting.

Table 5. Mean of anthropometric measurements according to age group

Anthropometric measurements	12–24 months	> 24–48 months	> 48–72 months	All (12–72 months)
Height-for-age	–1.84 ± 0.97	–1.47 ± 0.98	–1.7 ± 0.94	–1.63 ± 0.97
Weight-for-age	–1.59 ± 0.88	–1.72 ± 0.96	–1.56 ± 0.90	–1.63 ± 0.92
Weight-for-height	–0.74 ± 0.93	–0.98 ± 0.86	–0.73 ± 0.92	–0.83 ± 0.90

Table 6. Percent distribution of anthropometric *z*-scores of children according to age group

Anthropometric measurements	< –3.0 SD	–3.0 to –2.01 SD	–2.0 SD to median	> median to 2.0 SD	> 2.0–3.0 SD
Age 12.0–24.0 months					
Height-for-age (*n* = 48)	10.4	31.3	56.3	2.1	0
Weight-for-age (*n* = 52)	3.8	32.7	57.7	5.8	0
Weight-for-height (*n* = 48)	0	4.2	77.1	16.7	2.1
Age > 24.0–48.0 months					
Height-for-age (*n* = 126)	7.1	21.4	66.7	4.8	0
Weight-for-age (*n* = 129)	10.1	29.5	56.6	3.9	0
Weight-for-height (*n* = 124)	0	8.9	80.6	10.5	0
Age > 48.0–72.0 months					
Height-for-age (*n* = 137)	9.5	24.8	62.0	3.6	0
Weight-for-age (*n* = 136)	5.9	23.5	65.4	4.4	0.7
Weight-for-height (*n* = 135)	0	7.4	71.1	20.7	0.7
All (age 12.0–72.0 months)					
Height-for-age (*n* = 311)	8.7	24.4	63.0	3.9	0
Weight-for-age (*n* = 317)	7.3	27.4	60.6	4.4	0.3
Weight-for-height (*n* = 307)	0	7.5	75.9	16.0	0.7

Socioeconomic determinants for nutritional status

Height-for-age. Comparison of the anthropometric measurements of the subjects according to income level was carried out. Prevalence of severe stunting, as indicated by height-for-age values greater than 3 SD below the NCHS reference median, were found in all income groups, with 13.4% in the hardcore poor group, 7.6% in the poor category and a smaller percentage (5.2%) in the above poverty line income group.

The overall prevalence of stunting, including severe stunting, was 38.1% among children in the hardcore group and this prevalence is lower in the poor category (33.0%) and the above poverty line income group (28.1%). Figure 3 illustrates the prevalence of malnutrition according to income groups.

Weight-for-age. A similar trend as for height-for-age was observed for weight-for-age values, whereby a higher prevalence of underweight children were noted in the hardcore poor group (41.4%). In the poor category, the prevalence of underweight was 34.1% and 28.5% of the above poverty line income group were underweight (Fig. 3).

Weight-for-height. While severe wasting (< –3 SD from NCHS reference median) was not observed in all of the income groups, the prevalence of wasting was found to be 4.2% of children in the hardcore poor group, 9.4% in the poor group and 8.4% in the above poverty income group (Fig. 3).

Relationship between variables

Table 7 shows the relationship between some of the socioeconomic variables, namely, age and education of parents, household size, income from main occupation and secondary income, and various land utilisation methods with monthly per capita income. Monthly per capita income was positively correlated with most variables with *r*-values ranging from 0.13 to 0.68, but it was negatively correlated with age of fathers ($r = -0.138$, $P < 0.05$), age of mothers ($r = -0.176$, $P < 0.01$) and household size ($r = -0.24$, $P < 0.01$). With the exception of income from main occupation, all of the correlations were weak.

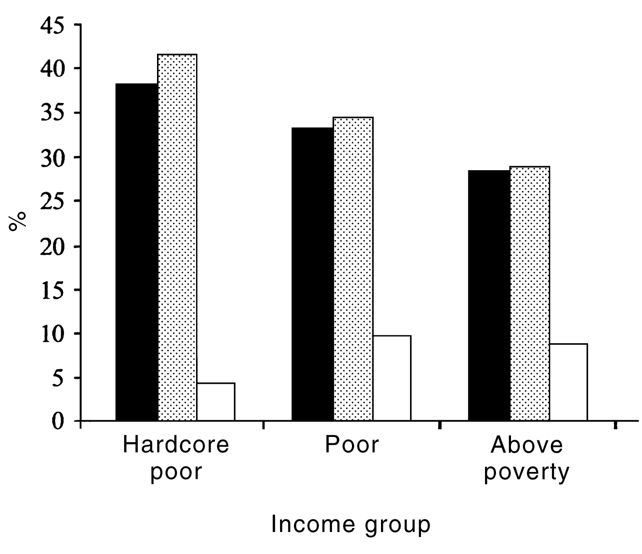

Figure 3. Prevalence of malnutrition according to income group. (■) hardcore poor; (▩) poor; (□) above poverty line.

The Pearson Product Moment Correlation showed relationships between anthropometric measurements and selected socioeconomic variables (Table 8). It was found that there were correlations between height-for-age and total household income ($r = 0.131$, $P < 0.05$), monthly per capita income ($r = 0.157$, $P < 0.01$), income from main occupation ($r = 0.124$, $P < 0.05$) and acreage of land utilised ($r = 0.112$, $P < 0.05$). However, the correlations between height-for-age and the other variables were weak and not significant.

Simple linear regression between selected variables and height-for-age are presented in Table 9. The variables that were significant predictors for height-for-age were total household income, monthly per capita income, income from main occupation and acreage of land utilised. From the stepwise regression analysis (Table 10), it was found that only the monthly per capita income was a significant predictor of height-for-age, which accounted for 3.0% of the variance in height-for-age ($R^2 = 0.025$, $P < 0.01$).

The same variables that were correlated with height-for-age were also correlated with weight-for-age (Table 8). They are total household income ($r = 0.127$, $P < 0.05$), monthly per capita income (0.125, $P < 0.05$), income from main occupation ($r = 0.134$, $P < 0.05$) and acreage of land utilised ($r = 0.172$, $P < 0.05$). Simple linear regression analysis also indicated that the same variables that predicted height-for-age also predicted weight-for-age (Table 11). However, from the stepwise regression analysis, shown in Table 12, it was revealed that only acreage of land utilised was a significant predictor of weight-for-age, with $R^2 = 0.030$ and $P < 0.01$. Thus, 3.0% of the variance in weight-for-age was contributed by acreage of land utilised. Although the other variables, namely total household income, income from main occupation and acreage of land

Table 7. Pearson Product Moment Correlation between monthly per capita income and selected variables

Variable	Monthly per capita income	
	r	*P*
Age of father	–0.138	0.018*
Mother's age	–0.176	0.002**
Father's education	0.239	0.000***
Mother's education	0.211	0.000***
Household size	–0.240	0.000***
Income from main occupation	0.680	0.000***
Secondary income	0.336	0.000***
Acreage of rubber	0.131	0.018*
Land utilised (acres)	0.13	0.020**
Fallow land (acres)	–1.066	0.238
Land rented out (acres)	0.188	0.001**

$^*P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.00$.

Table 8. Pearson Product Moment Correlation between nutritional status and selected socioeconomic variables

Variable	Height-for-age	Weight-for-age	Weight-for-height
Father's age	0.07	–0.15	–0.08
Mother's age	0.07	0.01	–0.07
Father's education	0.01	–0.28	–0.66
Mother's education	0.09	0.04	–0.66
Age of child	–0.05	0.05	0.059
Household size	–0.87	–0.067	–0.03
Household total income	0.131*	0.127*	0.077
Monthly per capita income	0.157**	0.125*	0.06
Total income from main occupation	0.124*	0.134*	0.1
Total secondary income	–0.10	–0.002	–0.00
Acreage of land utilised	0.112*	0.172*	0.164*
Acreage of idle land	0.017	–0.03	–0.048
Acreage of land rented	–0.03	0.047	0.08

$^*P < 0.05$; $^{**}P < 0.01$.

Table 9. Simple linear regression between selected variables and height-for-age

Variable	R^2	β	P-value
Father's age	0.005	0.074	0.216
Mother's age	0.004	0.066	0.255
Father's education	0.000	0.007	0.907
Mother's education	0.008	0.087	0.137
Age of child	0.002	–0.046	0.442
Household size	0.008	–0.087	0.127
Household total income	0.017	0.131	0.021*
Monthly per capita income	0.025	0.157	0.006**
Total income from main occupation	0.015	0.124	0.029*
Total secondary income	0.000	–0.010	0.860
Acreage of land utilised	0.013	0.112	0.048*
Acreage of idle land	0.000	0.017	0.760
Acreage of land rented	0.001	0.572	0.572

$^*P < 0.05$; $^{**}P < 0.01$.

Table 10. Stepwise regression analysis for selected variables predicting height-for-age

Variable	Standardized β	P-value
Monthly per capita income	0.157	0.006**
Total household income	0.004	0.970
Income from main occupation	0.030	0.704
Acreage of land utilised	0.089	0.118

$^*P < 0.05$; $^{**}P < 0.01$. Stepwise regression analysis included four variables: monthly per capita income, total household income, income from main occupation and acreage of land utilised. Adjusted $R = 0.021$; Multiple $R = 0.157$; $R^2 = 0.025$.

utilised, were significant predictors in the simple regression analysis, they were excluded from the final prediction model.

The Pearson Product Moment Correlation in Table 8 showed a significant but weak correlation between acreage of land utilised and weight-for-height ($r = 0.164$, $P < 0.05$). The simple linear regression (Table 13) and stepwise regression analysis (Table 14) both showed that the significant predictor of weight-for-height was acreage of land utilised ($R^2 = 0.01$, $P < 0.01$).

Discussion

Findings from this study show that protein-energy malnutrition persists among children aged 1–6 years. The prevalence of stunting, underweight and wasting were 33.1, 34.7 and 7.5%, respectively. Severe malnutrition was also observed among these children and the majority of children in the normal category fell below the NCHS median. Compared to the study carried out in poor villages almost two decades ago,[4] which revealed a high prevalence of stunting (43%), underweight (37%) and wasting (5%), the 10% reduction in the prevalence of stunting and the 2.3% reduction in the prevalence of underweight in the present study are considered to be marginal.

Another study among 1–7-year-old children from rural communities located near Kuala Lumpur reported a higher prevalence of stunting (46.2%) and wasting (30.3%) and lower prevalence of underweight (18.1%).[2] As this study is part of a larger research project to determine the nutritional status of families in rural communities, it is pertinent to compare the nutritional status of children in the rubber smallholdings with the children from other agricultural sectors in the same study.[3] It was revealed that the overall mean prevalence

Table 11. Simple linear regression between selected variables and weight-for-age

Variable	R^2	β	*P*-value
Father's age	0.000	0.015	0.797
Mother's age	0.000	0.009	0.872
Father's education	0.001	–0.028	0.634
Mother's education	0.002	0.042	0.467
Age of child	0.002	0.048	0.399
Household size	0.004	–0.067	0.238
Household total income	0.016	0.127	0.024*
Monthly per capita income	0.016	0.125	0.026*
Total income from main occupation	0.018	0.134	0.017*
Total secondary income	0.000	–0.002	0.971
Acreage of land utilised	0.030	0.172	0.002**
Acreage of idle land	0.001	–0.030	0.600
Acreage of land rented	0.002	0.047	0.406

*$P < 0.05$; **$P < 0.01$.

Table 12. Stepwise regression analysis for selected variables predicting weight-for-age

Variable	Standardized β	*P*-value
Acreage of land utilised	0.172	0.002**
Total household income	0.087	0.133
Income from main occupation	0.101	0.077
Monthly per capita income	0.101	0.073

**$P < 0.01$. Stepwise regression analysis included four variables: monthly per capita income, total household income, income from main occupation and acreage of land utilised. Adjusted $R = 0.026$; Multiple $R = 0.172$; $R^2 = 0.030$.

Table 13. Simple linear regression between selected variables and weight-for-height

Variable	R^2	β	*P*-value
Father's age	0.007	–0.083	0.067
Mother's age	0.005	–0.072	0.211
Father's education	0.004	–0.066	0.270
Mother's education	0.000	0.006	0.924
Age of child	0.004	–0.059	0.299
Household size	0.001	–0.029	0.611
Household total income	0.006	0.077	0.177
Monthly per capita income	0.003	0.057	0.317
Total income from main occupation	0.009	0.096	0.091
Total secondary income	0.000	–0.002	0.977
Acreage of land utilised	0.027	0.164	0.004**
Acreage of idle land	0.002	–0.048	0.405
Acreage of land rented	0.007	0.082	0.153

**$P < 0.01$.

Table 14. Stepwise regression analysis for selected variable predicting weight-for-height

Variable	Standardized β	*P*-value
Acreage of land utilised	0.096	0.01**

**$P < 0.01$. Adjusted $R = 0.008$; Multiple $R = 0.096$; $R^2 = 0.009$.

of stunting among children in the rubber smallholdings was higher (33.1%) than in the fishing villages (30.7%), coconut growing areas (17.1%) and rubber estates (15.1%), but lower than the prevalence of stunting among children in the padi farming areas (34.5%). For underweight children, the prevalence in this study was 34.7% compared with 38.1% in fishing villages, 36.7% in padi farms, 25.1% in coconut growing areas and 31.4% in rubber estates. The prevalence of wasting among children in this report was lower than prevalence in other agricultural sectors. In general, the nutritional status of children in all of the agriculture sectors were similar, except for coconut growing areas and rubber estates. The difference in the nutritional status of the children in the rubber smallholdings and the other agricultural sector when compared with coconut and rubber estates could be attributed to a higher household income from these two sectors. The prevalence of stunting and underweight in this study was very much lower than the prevalence of stunting and underweight among the Orang Asli or aborigines from various settlements in Malaysia, which ranged from 18.8 to 66.7% and 25.9–61.8%, respectively.[11]

As previously reported, socioeconomic variables such as income and family size did influence the nutritional status of the children in this study.[2,5–7] The current findings showed a higher prevalence of malnutrition among children from the hardcore poor in comparison to the poor, and with those living above poverty line income. Norhayati *et al.*[2] also identified household income as a significant risk factor of stunting and wasting.

In the present study, multiple regression analysis indicated that the major predictor of height-for-age was monthly per capita income, and for both weight-for-age and weight-for-height, the main predictor was acreage of land utilised. This implied that the monthly per capita income did influence the long-term nutritional status of children and the current nutritional status is affected by the acreage of land utilised. The higher the acreage of land utilised, the better the nutritional status of the children would be.

The low price of rubber and the dependency of rubber tapping on weather conditions, as well as the low acreage of land utilisation, have been shown to contribute to the poor nutritional status of these children. All of these factors lead to low food-purchasing power resulting in diet inadequacy, which has a bearing on the nutritional status of families, particularly among the children.

Conclusion

The present study showed the significant contribution of income and acreage utilisation of land on the nutritional status of children. The majority of households studied fell below the poverty line. It is therefore pertinent to suggest that intervention programmes should focus on generation of income. Other researchers have used alternative agricultural projects or food production activities with some success in generating income. Diversified farming should be encouraged, and government agencies like the Ministry of Agriculture and Federal Agricultural Marketing Authorities, providing agricultural expertise and marketing strategies, respectively, may help to pave the way for combating malnutrition in young children. Initial financial support is much needed for farmers to carry out any projects because the majority are already in the poor category group. If for some reason a large-scale project was not possible, food crops cultivated on a subsistence basis together with livestock rearing could at least ensure the adequacy of food intake in the farming families.

Despite the many efforts made through intervention programmes and availability of health services to improve nutritional status in Malaysia,[12] pockets of malnutrition still exist in this country, as indicated in this study. This may be partly due to the inaccessibility of these programmes to certain population groups. Effective approaches to consolidate existing programmes and efforts should be examined to ensure that all of the poor and the marginalised groups, like rubber smallholders, can be reached. Integrated efforts between agencies, communities and families will be necessary to further improve the delivery services of existing programmes.

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References

1. Department of Statistics. Landuse Report. Kuala Lumpur: National Printing Department, 1991.
2. Norhayati M, Noor Hayati MI, Mohammod CG, Oothuman P, Azizi O, Fatimah A, Fatmah MS. Malnutrition and its risk factors among children 1–7 years old in rural Malaysian communities. Asia Pacific J Clin Nutr 1997; 6: 260–264.
3. Khor GL, Tee ES. Nutritional assessment of rural villages and estates in Peninsula Malaysia: II. Nutritional status of children aged 18 years and below. Mal J Nutr 1997; 3: 21–48.
4. Chong YH, Tee ES, Ng TKW, Kandiah M, Hanis Hussein R, Teo PH, Siti Shahid S. Status of Community Nutrition in Poverty Kampung. Bulletin no. 22. Kuala Lumpur: Institute for Medical Research 1984.
5. Soon SD, Khor GL. Nutritional status of children aged 1–6 years in FELDA Sungai Koyan, Pahang. Mal J Nutr 1995; 1: 115–128 (in Malay).
6. Marjan ZM, Taib MNM, Khor GL, Tee ES. Socioeconomic determinants of nutritional status of children in rural Peninsula Malaysia. Asia Pacific J Clin Nutr 1998; 7: 307–310.
7. Xilin Y, Bridget H, Huiguang T, Gang H, Qina D, Junhua W, Wahlqvist ML. The role of income and education in food consumption and nutrient intake in a Chinese population. Asia Pacific J Clin Nutr 1998; 7: 217–222.
8. Chee HL, Khor GL, Tee ES. Nutritional Assessment of Rural Villages and Estates in Peninsular Malaysia: I. Socioeconomic Profile Households. Mal J Nutr 1997; 3: 1–19.
9. World Health Organization. Measuring Change in Nutritional Status. Geneva: World Health Organization, 1983.
10. Percetakan Nasional Malaysia Berhad. Mid-Term Review of the Sixth Malaysia Plan 1991–1995. Kuala Lumpur: Percetakan Nasional Malaysia Berhad, 1993.
11. Osman A, Zaleha MI. Nutritional status of women and children in Malaysian rural populations. Asia Pacific J Clin Nutr 1995; 4: 319–324.
12. Tee ES. Nutrition of Malaysia: where are we heading? Mal J Nutr 1999; 5: 115–128.