Prevalence of malnutrition among children in an urban squatter settlement in Petaling Jaya

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Summary

In a study of mild to significant malnutrition in an urban squatter settlement, the weights for age of 297 children between birth and ten years, and the heights for age and weights for height of 197 children between two to ten years were analysed. Using NCHS standards, the overall prevalence of underweight was found to be 18.9%, stunting 15.2%, and wasting 11.2%. Age and ethnicity were significantly associated with the prevalence of underweight and stunting. The growth achievement of children below the age of two years were significantly better off than the older children, and Chinese children significantly better off than Malay and Indian children.

Key words: anthropometry, malnutrition, urban squatter settlement, children, growth achievement.

Introduction

Between the mid-1960's and 1980, urban squatters were estimated to constitute between 25% to 30% of the population in Kuala Lumpur[1]. Due to the process of industrialisation and consequent urbanisation in the early 1970's, there was large-scale net in-migration into the Kuala Lumpur area[2]. As many of these immigrants could not afford conventional housing, they continually swelled the ranks of the squatter population.

In recent years, the resettlement of squatters into low-cost high rise flats and wooden longhouses have resulted in bringing the squatter population in Kuala Lumpur down to 16% in 1987, and then 12% in 1990[3]. This is still a substantial proportion of the city population.

Often located adjacent to industrial areas, squatter settlements are exposed to air and noise pollution, and are usually crowded and lacking in adequate sewerage, toilet facilities, garbage disposal, and water supply. Despite a national trend towards a decreasing incidence of infectious diseases, and a concentration of curative and high technology medical care in the urban areas, health problems which are characteristic of underdevelopment, such as anaemia, worm infestation, and low birth weight[4,5,6], have been documented in urban squatter settlements.

Malnutrition of children is a problem which is widespread in both urban and rural areas in Malaysia[7,8]. Studies in the 1970's have documented the prevalence of mild to moderate malnutrition among urban schoolchildren[9,10]. One recent study reports that the prevalence of malnutrition among children attending clinics in two urban squatter settlements is as high as 20–23%[11].

National health indices such as the infant and toddler mortality rates have fallen to relatively low levels compared to other developing countries[12]. Further improvement in the general health status of the population will have to come from uplifting the health status of specific disadvantaged groups. In this context, therefore, the squatter population remains an important target group for nutrition and health intervention programmes.

The research reported in this paper is part of a larger study[13] on the health status, health problems, and health care utilisation of various demographic and social groups in an urban squatter settlement. The results of the anthropometric measurements on children from 0-10 years of age is presented in this paper.

Materials and Methods

The study was carried out in Kampung Baiduri (henceforth, KB), a squatter settlement located next to an industrial area in Petaling Jaya. Data was collected in three months, from September to November 1988.

First, a census of the entire settlement was carried out, and households were stratified according to ethnic groups. For the purpose of the anthropometric study, the households with infants and children were identified. A 15% sample was randomly chosen from the stratified Indian and Malay households. Since the Chinese population was smaller, and the proportion of non-respondents expected to be higher than in the other two ethnic groups, a 20% sample was randomly selected from the list of Chinese households to ensure a comparable sample size.

For every household in the sample, basic demographic, socio-economic and health information was obtained by using a structured, pre-coded, and pre-tested questionnaire. The data collected was analyzed by the Statistical Package for the Social Sciences-X computer programme[14]. The chi-square test was used to investigate levels of significance in association between nominal variables, and Duncan's multi-range test was used to investigate levels of significance in differences between means of groups[15].

The ages of the children were calculated from their birth dates. The weights of children from birth to ten years were measured and recorded: infants and small children were weighed using the Kubota baby scale which has a capacity of 12 kg and measures up to 0.05 kg intervals; older children were weighed on a bathroom scale with a capacity of 150 kg and intervals of 0.5 kg. The heights of children from two to ten years were taken by asking them to stand against a vertical wall. Their heights were marked off on the wall with the aid of a clipboard and measured with a steel tape measure.

Weight for age is used to denote underweight. It is an overall indicator for malnutrition and is also one of the four direct health indicators that has been proposed by the World Health Organisation to be used to monitor its 'Health For All' strategy[16]. Height for age is used as an indicator of stunting, an index of chronic malnutrition; while weight for height is used as an indicator of wasting, an acute condition of current malnutrition.

The United States National Centre for Health Statistics (NCHS) standards were used as growth standards[17]. The use of minus two standard deviations of the reference median as the cut-off point for the definitions of underweight, stunting, and wasting was proposed by Waterlow[18]. In this study, children whose growth attainment fell at and below minus two standard deviations of the NCHS median were considered significantly malnourished, while children whose growth achievement fell between minus one and minus two standard deviations of the NCHS reference median were considered to be mildly malnourished.

Results

Socio-Economic Background

A total of 861 households were enumerated in the census of KB. Of these, 482 (56.0%) are Malay, 144 (16.7%) Chinese, and 235 (27.3%) Indian. The average household consists of 4.8 persons. The sample selected for the study consists of 168 households, of which 52.4% are Malays, 20.2% Chinese, and 27.4% Indian.

The socio-economic characteristics of the sample are presented in Table I. The majority of household heads are sales and service, and production and general workers in the private sector. A quarter are self-employed; these being primarily hawkers and small traders in the informal sector. If M$140.00 per capita per month is taken as the poverty line income in Kuala Lumpur[19], then 38.7% of the households can be considered poor.

Table I
Socio-economic characteristics of households in study sample, Kampung Baiduri (1988) (n = 168)

	Number	Percent
Ethnic group		
Malay	88	52.4
Chinese	34	20.2
Indian	46	27.4
Occupation of household heads		
Technical and clerical[a]	24	14.3
Self-employed	42	25.0
Sales and service	59	35.1
Production and general	40	23.8
Housewives and unemployed	1	0.6
Occupational status of household heads[b]		
Employer/Self-employed	41	24.4
Employee (government)	11	6.5
Employee (private)	113	67.3
Retired	1	0.6
Unemployed	2	1.2
Monthly household income per capita		
$1 – $140	65	38.7
$141 – $280	71	42.2
More than $280	32	19.1

[a] *This category includes administrative, managerial and professional workers, but the majority in this survey are technical and clerical workers*
[b] *n = 166*

The Prevalence of Underweight

The weight for age of a total of 297 children between birth and the age of nine years from the sample of 168 households were analyzed, and the results presented in Table II. The overall prevalence of significant underweight in the squatter settlement is 18.9%, while another 27.6% are mildly underweight.

Table II
Prevalence of underweight among children aged 0 – 9 years by various groups, Kampung Baiduri (1988)

	Significantly underweight[a] children		Mildly Underweight[b] children		Children who are not underweight		Total	
	n	%	n	%	n	%	n	%
Total in sample	56	18.9	82	27.6	159	53.5	297	100
Age group (months)								
0 – 23.9	15	15.0	18	18.0	67	67.0	100	100.0
24 – 59.9	23	25.6	21	23.3	46	51.1	90	100.0
60 – 119.9	18	16.8	43	40.2	46	43.0	107	100.0
	$x^2 = 18.94$, df = 4, p = .0008							
Ethnic group								
Malay	44	29.3	39	26.0	67	44.7	150	100.0
Chinese	2	3.6	11	20.0	42	76.4	55	100.0
Indian	10	10.9	32	34.8	50	54.3	92	100.0
	$x^2 = 29.18$, df = 4, p = .0000							
Income group[c]								
≤ M$140	35	22.9	46	30.1	72	47.1	153	100.0
> M$140	21	14.6	36	25.0	87	60.4	144	100.0
	$x^2 = 5.87$, df = 2, p = .0532							

[a]*Significantly underweight is defined as weight for age equal or less than minus two standard deviations of NCHS median.*

[b]*Mildly underweight is defined as weight for age between minus one and minus two standard deviations of NCHS median.*

[c]*Income groups are according to monthly household income per capita.*

The prevalence of significant underweight is highest (25.6%) in the two to four year age group. The prevalence of mild underweight increases with age, from 18.0% among the below two year olds, to 23.3% among the two to four year olds, and to 40.2% among the five to nine year olds. The association between age and the prevalence of underweight is statistically significant at the $p < .01$ level.

Among the ethnic groups, the prevalence of significant underweight is found to be highest among Malay children (29.3%) when compared with Chinese (3.6%) and Indian children (10.9%). A larger percentage of Indian children (34.8%), however, experience mild underweight as compared to the Malays (26.0%); while a substantial percentage of Chinese children (20.0%) are also in this marginal situation. The association between ethnicity and the prevalence of underweight is also statistically significant at the $p<.01$ level.

The prevalences of significant as well as mild underweight are higher among the lower income households as compared to the upper income households, but the association between income and the prevalence of underweight is not statistically significant.

The Prevalence of Stunted and Wasted Children

Heights for age and weights for height were analyzed for a total of 197 children between the ages of two and nine years, and the results presented in Tables III and IV. On the whole, the prevalences of significantly stunted (15.2%) and wasted children (11.2%) are both lower than the prevalence of significant underweight. Large proportions of the children, however, experience unsatisfactory growth, as indicated by the 27.4% who are mildly stunted, and the 36.0% who are mildly wasted.

Table III
Prevalence of stunted children aged 2 – 9 years by various groups, Kampung Baiduri (1988)

	Significantly stunted[a] children		Mildly stunted[b] children		Children who are not stunted		Total	
	n	%	n	%	n	%	n	%
Total in sample	30	15.2	54	27.4	113	57.4	197	100.0
Age group (months)								
24 – 59.9	11	12.2	18	20.0	61	67.8	90	100.0
60 – 119.9	19	17.8	36	33.6	52	48.6	107	100.0
	$x^2 = 7.44$, df = 2, p = .0243							
Ethnic group								
Malay	26	26.3	30	30.3	43	43.4	99	100.0
Chinese	2	5.0	4	10.0	34	85.0	40	100.0
Indian	2	3.4	20	34.5	36	62.1	58	100.0
	$x^2 = 30.63$, df = 4, p = .0000							
Income group[c]								
≤ M$140	18	17.6	33	32.4	51	50.0	102	100.0
> M$140	12	12.6	21	22.1	62	65.3	95	100.0
	$x^2 = 4.69$, df = 2, p = .0956							

[a]*Significantly stunted is defined as height for age equal or less than minus two standard deviations of NCHS median.*

[b]*Mildly stunted is defined as height for age between minus one and minus two standard deviations of NCHS median.*

[c]*Income groups are according to monthly household income per capita.*

Table IV
Prevalence of wasted children aged 2 – 9 years by various groups, Kampung Baiduri (1988)

	Significantly wasted[a] children		Mildly wasted[b] children		Children who are not wasted		Total	
	n	%	n	%	n	%	n	%
Total in sample	22	11.2	71	36.0	104	52.8	197	100.0
Age group (months)								
24 – 59.9	12	13.3	36	40.0	42	46.7	90	100.0
60 – 119.9	10	9.3	35	32.7	62	57.9	107	100.0
	$x^2 = 2.59$, df = 2, p = .2733							
Ethnic group								
Malay	16	16.2	32	32.3	51	51.5	99	100.0
Chinese	1	2.5	14	35.0	25	62.5	40	100.0
Indian	5	8.6	25	43.1	28	48.3	58	100.0
	$x^2 = 7.40$, df = 4, p = .1161							
Income group[c]								
≤ M$140	13	12.7	40	39.2	49	48.0	102	100.0
> M$140	9	9.5	31	32.6	55	57.9	95	100.0
	$x^2 = 1.97$, df = 2, p = .3738							

[a]*Significantly wasted is defined as weight for height equal or less than minus two standard deviations of NCHS median.*

[b]*Mildly wasted is defined as weight for height between minus one and minus two standard deviations of NCHS median.*

[c]*Income groups are according to monthly household income per capita.*

The prevalence of significantly stunted children is higher among the older age group (17.8%) compared to the younger (12.2%). There is also a higher percentage of mildly stunted children among the older age group (33.6%) compared to the younger (20.0%). The prevalence of stunting is significantly associated with age at the $p < .05$ level. The prevalence of wasting is, however, not significantly associated with age.

As with underweight, more of the Malay children (26.3%) than the Chinese (5.0%) and Indian children (3.4%) are significantly stunted. However, large proportions of children from all three ethnic groups are mildly stunted. The association between ethnicity and the prevalence of stunting is statistically significant at the $p < .01$ level. The association between ethnicity and the prevalence of wasting, on the other hand, is not statistically significant.

Although the percentages of significantly stunted and wasted children are higher in the lower income group in comparison with the higher income group, the associations between income and the prevalences of wasted and stunted children are not found to be statistically significant.

Mean Growth Achievement

Growth achievement of the KB children relative to the NCHS reference median is shown in Table V. It can be seen that the average weight for age of the youngest age group is 99.2% of the NCHS median, for the two to four year olds it is 88.8% and for the five to nine year olds it is 87.5%. The weight for age achievement of the youngest age group is significantly better than the two older age groups ($p < .01$), but the two older age groups do not differ significantly from each other. The height for age and weight for height achievements of the two to four and the five to nine year age groups also do not differ significantly.

In comparing among the ethnic groups, the Chinese children fare significantly better than the Malay and Indian children in terms of weight for age ($p < .01$). The average weight for age of the Chinese children is in fact 1.8% above the NCHS median; for the Indian children, it is 93.8% of the NCHS median, and for the Malay children, it is 86.9%.

The Chinese and Indian children are significantly taller for their age than the Malay children although they do not differ significantly from each other. In terms of weight for height, the Chinese children are significantly better off than the Indian and Malay children, but the difference between the Malay and Indian children is not significant.

When the two income groups are compared, it can be seen that although the growth achievement of the higher income group children is better in terms of all the three indicators, none of these differences is found to be significantly different.

Discussion

In earlier studies, children whose growth attainment falls below a specified cut-off point are considered malnourished. In the present study, an effort is made to distinguish between these children, who are classified as *significantly* malnourished, and those who are *mildly* malnourished. This is done in order to focus attention on the large proportions of mildly malnourished children whose growth achievements are not satisfactory even though they may not fall below the conventional cut-off point.

In Table VI, an attempt is made to compare the prevalence of malnutrition in KB with other relevant studies. For reasons of comparability, only the significantly malnourished category in KB is used.

Table V
Mean percent of NCHS median for weight for age, height for age, and weight for height by various groups, Kampung Baiduri (1988)

	Mean percent of NCHS median for[a]		
	weight for age (n = 297)	height for age (n = 197)	weight for height (n = 197)
Age groups (months)			
0 – 23.9	99.2*	–	–
24 – 59.9	88.8+#	97.9	92.4
60 – 119.9	87.5#	96.1	94.4
Ethnic groups			
Malay	86.9*	95.0*	92.5*#
Chinese	101.8+	99.5+#	99.6+
Indian	93.8#	98.3#	90.8#
Income groups[b]			
≤ M$140	89.5	96.4	91.9
> M$140	94.3	97.5	95.1

[a]*Values with no common symbol in the same column are significantly different ($p < .01$) by Duncan's multiple-range test. Values with no symbol in the same column are not significantly different.*

[b]*Income groups are according to monthly household income per capita.*

In general, the proportions of children who are underweight and stunted are both lower in KB compared to those found in the study of rural poverty villages[20], although the proportion of wasted children is higher in KB.

However, if one focuses on Malay children only, the prevalence of underweight among the Malay children in KB is found to be within the range of the rural poverty villages. Referring to Table IV: the prevalence of underweight in KB among the below two year and the two to four year age groups are 24% and 40%, compared to a range of 30% to 41%, and a mean of 37% among the below six year age group in the rural villages; in the older age groups, the prevalence of underweight in KB Malay children is 26% compared to a range of 18% to 46%, and means of 38% (boys) and 23% (girls) in the rural villages.

The overall KB prevalences, however, are within the same range as those found among the attendees of two clinics located in urban squatter settlements[11].It is interesting to note that the prevalence of underweight found among primary schoolchildren in Kuala Lumpur and Klang twelve years ago by Rampal[10] is very much higher than the KB prevalence. The prevalence of underweight found in Chen's

Table VI
A comparison of several studies on growth retardation among children in Peninsular Malaysia

Study (Reference)	Year of study	Population studied	Sample (n)	Age group (yrs)	Prevalence of		
					under-weight[a]	stunting[a]	wasting[a]
Chee, 1990	1988	urban squatter community	296	0–10	19	15[b]	11[b]
		Malays only:	51	0–1	24	–	–
			45	2–4	40	20	20
			54	5–9	26	31	13
Chong et al, 1984 (19)	1979 – 1983	rural poor villagers (all Malays)	726	0–5	37 (30–41)	43 (41–47)	5 (4–6)
			460	6–11 (boys)	38 (28–46)	49 (41–57)	2 (0–4)
			501	6–11 (girls)	23 (18–34)	35 (28–42)	2 (1–3)
Mohd Sham Kassim, 1989 (11)	1982 – 1986	two urban squatter clinic attendees	(1)150[c]	0–10	23	19	13
			(2)150[c]	0–10	20	11	8
		Malays only:	(1) 50[c]	0–10	29	26	16
			(1) 50[c]	0–10	12	11	5
Chen, 1977 (9)	1972	Primary school – children, KL-PJ	2,340	6–9	27[d]	25[e]	9[f]
		Malays only:	761	6–9	35[d]	38[e]	7[f]
Rampal, 1977 (10)	1976	Primary school – children, Malays, only:					
		(1) Urban (KL)	915	7–12	49[g]	3[h]	–
		(2) Rural (Klang)	836	7–12	74[g]	11[h]	–

[a]*Unless otherwise stated, the cut-off point is minus two standard deviations of NCHS median.*

[b]*n = 197, age groups 2–4 years and 5–9 years only*

[c]*Approximate figures*

[d]*Underweight is defined as less than 70% of Harvard standard; this cut-off point is lower than minus two standard deviations of NCHS median.*

[e]*Stunting is defined as less than 90% of Harvard standard; this cut-off point is lower than minus two standard deviations of NCHS median.*

[f]*Wasting is defined as less than 80% of Harvard standard; this cut-off point is equal to minus two standard deviations of NCHS median.*

[g]*Underweight is defined as between 80%–60% of Harvard standard, while marasmus is defined as less than 60% of Harvard` standard. The figure here includes the few cases of marasmus. The cut-off point of 80% Harvard standard is equivalent to minus two standard deviations of NCHS median.*

[h]*Stunting is defined as less than 85% Harvard standard; this cut-off point is lower than minus three standard deviations of NCHS median.*

1972 study of primary schoolchildren in Kuala Lumpur and Petaling Jaya[9] is also higher than the KB rates even though a lower cut-off point was used.

Comparing across ethnic groups, the problem of malnutrition is much more widespread among the Malay children in KB. However, the Indian children in KB are only slightly better off than the Malay children. A similar inter-ethnic pattern has also been found in other studies[10,21].

In KB, the Chinese are generally more well-off and urbanised compared with the Malays and Indians. It can be seen from TableVII that a significantly larger proportion of the Chinese children (70.9%) belong to the higher income group. The mean per capita household income of the Chinese children ($177) is also higher than those of the Malay ($150) and Indian ($124) children. A 1986 survey of KB had found that 79% of the Chinese were originally urban dwellers; while 73% of the Malays were originally from rural villages; and among the Indians, 48% were from rural estates and 44% were from urban areas[13].

From the perspective of income groups, the extent of malnutrition among the lower income children is, on the whole, greater than the higher income children. The differences between the two income groups in KB are, however, not significant. This is possibly because the range of incomes found in KB is not that wide.

The finding in KB of a higher prevalence of underweight toddlers compared to the other age groups is similar to those of other studies[20,22,23]. This has been attributed to the weaning age being a vulnerable phase.

The higher proportions of stunted children found among the older age groups may also be explained with reference to the chronic nature of stunting. Since the process of stunting takes place over a period of time and different children have different rates of deficit growth, therefore, the prevalence of stunted

Table VII
Household Income by Ethnicity
KB (1988) (n = 297)

Household per capita monthly income	Malay		Chinese		Indian	
	n	%	n	%	n	%
≤ $140	78	52.0	16	29.1	59	64.1
> $140	72	48.0	39	70.9	33	35.9
Total	150	100.0	55	100.0	92	100.0

$x^2 = 16.95$, $df = 2$, $p = 0.0002$

children will increase with the passage of time even if the prevalence of stunting only remains constant[24].

The better growth achievement of the below two year olds compared to the older children in KB is also similar to the results of the rural poverty villages study[20] where median weight for age was found to sharply decline from 92% of NCHS median at infancy to 79% at five to six years, and to further decline for the primary school children.

Conclusion

Mild to significant malnutrition is found to be widely prevalent in KB, an urban poor community. The findings of this study supports the findings of previous studies which document the problem of malnutrition among the rural and urban poor, and target urban squatters as a nutritionally disadvantaged community.

The mild to significant malnutrition found in KB and widely documented in this country indicates the current nature of the problem which has to be addressed by national health policies. As mortality rates dip to increasingly low levels, and clinical levels of undernutrition become increasingly rare, efforts to improve the health status of the population should increasingly focus on problems such as unsatisfactory growth achievement among children. The dip in growth achievement among toddlers should be a particular cause for concern, and they should be a primary target group for nutrition intervention programmes.

This study also focuses attention on children who, though not conventionally classified as malnourished, have unsatisfactory growth achievements. The problem of malnutrition exists on a continuum, and this group of mildly malnourished children should also be considered an important target group in health policies and programmes.

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References

1. Azizah Kassim. The genesis of squatting in West Malaysia with special reference to the Malays in the Federal Territory. *Malaysia in History* 1983; 26 : 60–83.

2. Department of Statistics. *Population and housing census of Malaysia 1980: general report of the population census, volume I.* Kuala Lumpur: Department of Statistics, 1983.

3. Dewan Bandaraya Kuala Lumpur. Census on squatters 1991. Unpublished report of the Enforcement Directorate of Kuala Lumpur City Hall.

4. Khor GL, George J. Incidence of low birth weight in an urban squatter community. In: Mohd Ismail Noor, Ng TKW, Zanariah Jiman, Tan DTS, Siti Mizura Shahid, (eds). *Proceedings of the third scientific conference of the Nutrition Society of Malaysia.* Kuala Lumpur: Nutrition Society of Malaysia, 1988: 54–62.

5. Kan SP. Soil-transmitted Helminths in Selangor, Malaysia. *Med. J. Malaysia* 1982; 37 : 180–190.

6. Che Ghani Mohammod, Noor Hayati Mohd Isa, Osman Ali, Mohd Hashim Baharam. Effect of rehousing and improved sanitation on the prevalence and intensity of soil-transmitted helminthiases in an urban slum in Kuala Lumpur. Paper presented at the symposium on role of voluntary organisations in improving the health status of children in developing countries. Faculty of Medicine, National University of Malaysia, Kuala Lumpur, 11th – 13th August, 1989.

7. Tee ES, Khor GL. Overview of country nutritional status. In: Chong YH, Mohd Ismail Noor (eds). *Proceedings of the first scientific conference.* Kuala Lumpur: Nutrition Society of Malaysia, 1986: 7–24.

8. Wong ML, Arokiasamy JT. *Review of studies on child health in Malaysia.* Kuala Lumpur: Department of Social and Preventive Medicine, Faculty of Medicine, University Malaya, 1988.

9. Chen ST. Prevalence of protein-calorie malnutrition in a group of Malaysian school children. *Med. J. Malaysia* 1977; 31 : 266–9.

10. Rampal L. Nutritional status of primary school children: a comparative rural and urban study 1976. *Med. J. Malaysia* 1977; 32 : 6–16.

11. Mohd Sham Kassim. Health status of children attending clinics in Sentul and Selayang. Paper presented at the symposium on role of voluntary organisation in improving the health status of children in developing countries, Kuala Lumpur: Faculty of Medicine, National University of Malaysia, 11th – 13th August, 1989.

12. Chee HL. *Health and health care in Malaysia: present trends and implications for the future.* Kuala Lumpur: Institute for Advanced Studies, University of Malaya, 1990. (IPT Monograph Series: SM No. 3).

13. Chee HL. Health and health care among the poor: a case study of an urban squatter settlement in Peninsular Malaysia. PhD Thesis. *University of Malaya,* 1990.

14. Nie NH, Hull CH, Jenkins JG, *et al. Statistical package for the Social Sciences* (2nd ed). New York: McGraw-Hill, 1975.

15. Steel RG and Torrie JH. *Principles and procedures of statistics.* Toronto, Ontario: McGraw-Hill, 1960.

16. World Health Organization. *Development of indicators for monitoring progress toward health for all by the year 2000.* Geneva: World Health Organisation, 1981.

17. World Health Organisation. *Measuring change in nutritional status: guidelines for assessing the nutritional impact of supplementary feeding programmes for vulnerable groups.* Geneva: World Health Organisation, 1983: 1–101.

18. Waterlow JC. Classification and definition of protein-calorie malnutrition. *British Medical Journal* 1972; 3 : 566–9.

19. Khairuddin Yusof, Wong YL, Patrick W. *Sang Kancil Program (Evaluation).* Kuala Lumpur: Faculty of Medicine, University of Malaya, 1988.

20. Chong YH, Tee ES, Ng TKW, *et al. Status of community nutrition in poverty kampungs* Kuala Lumpur: Institute for Medical Research, 1984. (IMR Bull. No. 22).

21. Chen ST. Comparative growth of Malay, Chinese and Indian school children in Malaysia. *Southeast Asian J. Trop. Med. Publ. Hlth.* 1976; 7 : 443–51.

22. Chen PCY, Chan MKC, Teoh ST, *et al. A nutrition study of the Interior, West Coast and Kudat Divisions of Sabah.* Kuala Lumpur: Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya; Kota Kinabalu: Office of Medical Services, Sabah, 1991.

23. Khor GL. Malnutrition among Semai Children. *Med. J. Malaysia* 1988; 43 : 318–26.

24. Waterlow JC. Observations on the natural history of stunting. In: Waterlow JC (ed). *Linear growth retardation in less developed countries.* New York: Raven Press, 1988. (Nestle Nutrition Workshop Series Volume 14).