LAPORAN AKHIR

PROJEK PENYELIDIKAN JANGKA PENDEK
UNIVERSITI SAINS MALAYSIA

"The Effect of Food Supplement Programme on Nutritional Status of Primary School Children In Rural Areas of Tumpat and Bachok Districts"

[304/PPSP/6131226]

Dr Che Asiah Taib,
Prof Madya Dr Zulkifli Ahmad,
Prof Madya Dr Halim Salleh
Dr Mohd Hashim Mohd Hassan

UNIVERSITI SAINS MALAYSIA

2005

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UNIVERSITI SAINS MALAYSIA

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KANDUNGAN

BAHAGIAN PENYELIDIKAN & PEMBANGUNAN
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1) Nama Penyelidik: ..... PROF...MADYA DR ABD HALIM SALLEH .....

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Nama Penyelidik-Penyelidik
Lain (Jika berkaitan) : PROF MADYA DR ZULKIFLI AHMAD .....

DR MOHD HASHIM MOHD HASSAN .....

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2) Pusat Pengajian/Pusat/Unit : PUSAT PENGAJIAN SAINS PERUBATAN .....

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3) Tajuk Projek: .....THE EFFECT OF FOOD SUPPLEMENT PROGRAMME ON NUTRITIONAL STATUS OF PRIMARY SCHOOLCHILDREN IN RURAL AREAS IN KELANTAN

4) (a) Penemuan Projek/Abstrak

(Perlu disediakan makluman di antara 100 – 200 perkataan di dalam Bahasa Malaysia dan Bahasa Inggeris. Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Pembangunan sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti).

Malnutrisi adalah satu masalah yang global terutama dikalangan negara-negara yang sedang membangun. Masalah malnutrisi masih banyak berlaku di kalangan penduduk luar bandar yang miskin di Malaysia. Rancangan Makanan Tambahan Sekolah (RMTS) adalah satu-satu program intervensi untuk meningkatkan tahap kesihatan dan pemakanan kanak kanak di Malaysia. Di antara objektif kajian ini ialah untuk mengenal-pasti kadar prevalen, faktor faktor risiko bagi malnutrisi dan mengkaji tahap keberkesanan RMTS dalam meningkatkan tahap pemakanan kanak-kanak darjah satu sekolah-sekolah luar bandar di daerah Tumpat dan Bachok. Kajian ini mengandungi dua fasa. Fasa 1 ialah kajian hirisan lintang, manakala Fasa 2 ialah kajian kohort. Kajian ini dijalankan di kalangan kanak-kanak darjah satu dari sekolah luar bandar di daerah Tumpat dan Bachok dari bulan Januari 2002 hingga bulan Mac 2003. Seramai 937 kanak-kanak dari 18 buah sekolah rendah telah terlibat dalam kajian ini. Pemilihan kanak-kanak untuk program RMTS dilakukan oleh pihak sekolah. Borang soal-selidik mengenai tahap sosio-ekonomi dan demografi keluarga telah di edarkan dan dijawab oleh ibu-bapa. Ukuran berat dan tinggi kanak-kanak dilakukan sebanyak tiga kali; selum RMTS, 6 bulan selepas RMTS dan 12 bulan selepas RMTS. Nilai WAZ, HAZ dan WHZ dikira dengan menggunakan program Epi-Nut Anthropometry (Epi-Info Versian 6). Prevalen malnutrisi dikira berdasarkan nilai skor z; <-2 adalah kurang zat makanan dan >+2 sebagai terlebih zat makanan. Prevalen 'underweight', 'stunting' dan 'wasting' adalah masing masing 25.2%, 21.1% dan 6.2%. Prevalen 'overweight' pula ialah 1.1%. Seramai 541 orang kanak-kanak terlibat didalam program RMTS. Dengan menggunakan analisa regresi logistik, menunjukkan faktor risiko untuk 'underweight' ialah kanak-kanak lelaki (OR 1.4), daerah Tumpat (OR 1.5) dan pendapatan keluarga sebanayk RM 0-250 dan RM 251-500. (OR 2.2) . Kanak kanak lelaki adalah merupakan satu satunya faktor risiko yang signifikan kepada 'stunting' dan ibu yang bekerja merupakan faktor risiko kepada 'wasting'. Analisa 'repeated measures ANOVA' menunjukan terdapat perbezaan yang signifikan pada pertambahan WHZ (p=0.007) diantara kumpulan RMTS dan bukan RMTS. Sementara itu, WAZ (p=0.126) dan HAZ (p=0.266) menunjukkan tiada perbezaan yang signifikan. Kesimpulannya, kadar prevalen kurang zat makanan di kalangan kanak-kanak masih tinggi di daerah Tumpat dan Bachok. Keadaan ini ada kaitan dengan tahap sosio-ekonomi dan demografi yang rendah dikalangan penduduk di kedua daerah ini. Program RMTS telah berjaya meningkatkan tahap pemakanan kanak-kanak yang 'wasting' secara signifikan. Bagaimanapun , RMTS tidak dapat meningkatkan tahap pemakanan kanak-kanak yang 'underweight' dan 'stunted' secara signifikan.

(b) Senaraikan Kata Kunci yang digunakan di dalam abstrak:

Bahasa Malaysia	Bahasa Inggeris
malnutrisi	malnutrition
bantut	stunting
susut	wasting
kurang berat	underweight
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

5) Output Dan Faedah Projek

(a) Penerbitan (termasuk laporan/kertas seminar)
(Sila nyatakan jenis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).

1. 18th Nutrition Society of Malaysia Scientific Conference
Kuala Lumpur, 22-23.3.2003...

...2. 8th National Conference of Medicak Cciences,
Kota Bharu 8-9 May, 2003

...3. 3rd Kelantan Health Conference
Kota Bharu , 19-20.8.2003

...4. 10th National Colloquium on Public Health
Kuala lumpur 23-24 September, 2003

...5. The Prevalence and Risk factors of Malnutrition Among Primary One Schoolchildren in Kelantan.
Malaysian J Public Health Medicine 2004;1

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.....

(b) Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten.
(Jika ada dan jika perlu, sila guna kertas berasingan)

.....TIADA.....

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(c) Latihan Gunatenaga Manusia

i) Pelajar Siswazah: .....

.....DR ASIAH BT TAIB
PELAJAR SARJANA PERUBATAN MASYARAKAT

.....

.....

ii) Pelajar Prasiswazah: .....TIADA

.....

.....

.....

iii) Lain-Lain : .....TIADA

.....

.....

6. Peralatan Yang Telah Dibeli:

.....TIADA.....

UNTUK KEGUNAAN JAWATANKUASA PENYELIDIKAN UNIVERSITI

Laporan telah diteliti dan didapati
melangkaui kegiatan yg dicadang —
Output memuaskan

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PUSAT PENGAJIAN

PROFESSOR ABDUL AZIZ BABA
Chairman of Research & Ethics Committee
School of Medical Sciences
Health Campus
Universiti Sains Malaysia
16150 Kubang Kerian, Kelantan

UNIVERSITI SAINS MALAYSIA
JABATAN BENDAHARI
KUMPULAN WANG PENYELIDIKAN GERAN USM(304)
PENYATA PERBELANJAAN SEHINGGA 30 SEPT 2005

Jumlah Geran:	RM	19,152.00	Ketua Projek:	PROF(M) ABD. HALIM SALLEH
Peruntukan 2002 (Tahun 1)	RM	0.00	Tajuk Projek:	The Effects of Food Supplement Programme on Nutritional Status of Primary School Student at Rural Areas in Kelantan
Peruntukan 2003 (Tahun 2)	RM	0.00		
Peruntukan 2004 (Tahun 3)	RM	0.00	Tempoh:	15 Jun 02- 14 Dis 03
				BEKU 09.05.05
			No.Akaun:	304/PPSP/6131226

Kwg	Akaun	PTJ	Projek	Donor	Peruntukan Projek	Perbelanjaan Tkumpul Hingga Tahun Lalu	Peruntukan Semasa	Tanggungan Semasa	Bayaran Tahun Semasa	Belanja Tahun Semasa
304	11000	PPSP	6131226		3,072.00	3,552.50	(480.50)	-	-	-
304	14000	PPSP	6131226		-	-	-	-	-	-
304	15000	PPSP	6131226		-	-	-	-	-	-
304	21000	PPSP	6131226		3,030.00	2,124.25	905.75	-	-	-
304	22000	PPSP	6131226		-	-	-	-		-
304	23000	PPSP	6131226		300.00	5.00	295.00	-	-	-
304	24000	PPSP	6131226		-	-	-	-	-	-
304	25000	PPSP	6131226		-	-	-	-	-	-
304	26000	PPSP	6131226		-	-	-	-	-	-
304	27000	PPSP	6131226		500.00	691.25	(191.25)	-		-
304	28000	PPSP	6131226		-	-	-	-	-	-

ABSTRAK

Malnutrisi adalah satu masaalah yang global terutamanya dikalangan negara-negara yang sedang membangun. Masaalah malnutrisi masih banyak berlaku di kalangan penduduk luar bandar yang miskin di Malaysia. Rancangan Makanan Tambahan Sekolah (RMTS) adalah salah-satu program intervensi untuk meningkatkan tahap kesihatan dan pemakanan kanak-kanak di Malaysia. Diantara objektif kajian ini ialah untuk mengenal-pasti kadar prevalen, faktor-faktor risiko bagi malnutrisi dan mengkaji tahap keberkesanan RMTS dalam meningkatkan tahap pemakanan kanak-kanak darjah satu sekolah-sekolah luar bandar di daerah Tumpat dan Bachok. Kajian ini mengandungi 2 fasa. Fasa 1 ialah kajian hirisan lintang, manakala fasa 2 ialah kajian "cohort". Kajian ini dijalankan dikalangan kanak-kanak darjah satu dari sekolah luar bandar di daerah Tumpat dan Bachok dari bulan Januari 2002 hingga bulan Mac 2003. Seramai 937 kanak-kanak dari 18 buah sekolah rendah telah terlibat dalam kajian ini. Pemilihan kanak-kanak untuk program RMTS dilakukan oleh pihak sekolah. Borang soal-selidik mengenai tahap sosio-ekonomi dan demografi keluarga telah diedarkan dan dijawab oleh ibubapa. Ukuran berat dan tinggi kanak-kanak dilakukan sebanyak 3 kali; sebelum RMTS, 6 bulan selepas RMTS dan 12 bulan selepas RMTS. Nilai WAZ, HAZ dan WHZ dikira dengan menggunakan Epi-Nut Anthropometry (Epi Info version 6). Prevalen malnutrisi dikira berdasarkan nilai z-score; < -2 adalah kurang zat makanan, dan >+2 sebagai terlebih zat makanan. Prevalen 'underweight', 'stunting' dan 'wasting' adalah masing-masing 25.2%, 21.1% dan 6.2%. Prevalen 'over weight' pula ialah 1.1%. Seramai 541 orang kanak-kanak terlibat di dalam program RMTS. Dengan menggunakan analisa regressi logistik, menunjukkan faktor risiko untuk 'underweight'

ialah kanak-kanak lelaki (OR=1.4, P<0.05), daerah Tumpat (OR=1.5, p<0.05) dan pendapatan bulanan keluarga sebanyak RM 0-250 (OR=2.2, p<0.05) and RM 251-500. Kanak-kanak lelaki adalah merupakan satu-satunya faktor risiko yang signifikan bagi 'stunting' dan ibu yang bekerja merupakan faktor risiko kepada 'wasting'. Analisa 'repeated measures ANOVA' menunjukkan terdapat perbezaan yang signifikan pada pertambahan WHZ (p = 0.007) diantara kumpulan SSFP dan bukan SSFP. Sementara itu, WAZ (p=0.126) dan HAZ (p=0.266) menunjukkan tiada perbezaan yang signifikan. Kesimpulannya, kadar prevalen kurang zat makanan di kalangan kanak-kanak masih tinggi di daerah Tumpat dan Bachok. Keadaan ini ada kaitan dengan tahap sosio-ekonomi dan demografi yang rendah dikalangan penduduk. Program RMTS telah berjaya meningkatkan tahap pemakanan kanak-kanak yang 'wasting' secara signifikan. Bagaimanapun, RMTS tidak dapat meningkatkan tahap pemakanan kanak-kanak yang 'underweight' dan 'stunted' secara signifikan.

ABSTRACT

Undernutrition is a serious global problem especially among developing countries. Undernutrition is still common among poor rural children in Malaysia. The School Supplementary Feeding Programme (SSFP) is one of the intervention strategies implemented to improve the nutritional status of children in Malaysia. The objectives of the study are to determine the prevalence of malnutrition, associated factors of underweight, stunting and wasting and to evaluate the effect of School Supplementary Feeding Programme on improving nutritional status among primary one children in rural areas of Tumpat and Bachok districts. The study has 2 phases. Phase 1 is a cross-sectional study and the Phase 2 is a cohort study. The study was done among primary one children in rural areas of Tumpat and Bachok districts from February 2002 to March 2003. Nine hundred and thirty seven children from 18 primary schools were selected. Questionnaires eliciting socio-economic and demographic informations were answered by the parents. The weight and height of the children were measured three times; before starting SSFP, after 6 months and after 12 months of SSFP. The WAZ, HAZ and WHZ were calculated using Epi-Nut Anthropometry software (Epi Info version 6). The prevalence of malnutrition were calculated based on cutoff point of z-score < -2 SD as undernutrition and > +2 SD as overnutrition. The school administration chose eligible children to participate in the SSFP. Five hundred and forty one children were enrolled in SSFP and 396 were in non-SSFP group. The prevalence of underweight, stunting and wasting at baseline were 25.2%, 21.1% and 6.2% respectively. Only 1.1% of children were overweight. In multiple logistic regression

analysis, the significant risk factors of underweight were being male children (OR=1.4, P<0.05), Tumpat district (OR=1.5, p<0.05) and monthly family income of RM 0-250 (OR=2.2, p<0.05) and RM 251-500 (OR=2.3, p<0.05). Being a male children (OR=1.6, p<0.05) was the only significant factor for stunting and working mother (OR=2.1, p<0.05) was the only significant factor of wasting. Repeated measures ANOVA showed there was significant different of increment of WHZ (p = 0.007) between SSFP and non SSFP group with regard to time and adjusted for gender, district, family income group and baseline nutritional status. However, no significant different of WAZ (p=0.126) and HAZ (p=0.266) with regard to time and group was found. In conclusion, there is still a high prevalence of undernutrition among children in rural areas of Tumpat and Bachok. The condition was associated with low socio-economic and demographic status of the population. The SSFP has significantly improved the nutritional status of children with wasting. Also, the increment of WAZ, HAZ and WHZ was better among undernourished children compared to normal children.

CHAPTER 1

INTRODUCTION

1.1 Nutritional Status

Nutritional status refers to types and amounts of nutrients available in the body and how the body utilized them (Suitor and Hunter, 1980). The nutritional status of children is determined by their diet, health status, availability of food, condition of environment and characteristics of childcare. Nutritional status in children is an indicator of their health and well-being (Zemel *et a*l, 1997). It affects every aspect of a child's health, physical activity and response to illness. A good nutritional status is essential for good health (Suitor and Hunter, 1980). It affects every aspect of a child's health, physical activity and response to illness. A good nutritional status is essential for good health (Suitor and Hunter, 1980).

Nutritional status of children is related with the overall standard of living and ability of population to meet their basic needs such as food, housing and healthcare. However, according to de Onis *et al,* (1995) the major factors affecting a child's physical growth and mental development are infections and unsatisfactory feeding practices.

1.1.1 Nutritional status assessment

Nutritional status assessment evaluates a person's health from a nutritional perspective. Nutritional status can be assessed by medical history, clinical examination, biochemical analyses (laboratory tests), dietary and anthropometric measurements. An accurate and complete medical history can reveal conditions that place a child at risk for malnutrition. Physical examination can be used to detect signs of nutrient deficiency or toxicity. Many physical signs are nonspecific. For this reason, physical findings by themselves are unreliable for diagnosis of a nutrition problem. Whereas, biochemical analyses can help determine what is happening internally. Most tests are based on analysis of blood and urine samples, which contain nutrients, enzymes, and metabolites that reflect nutritional status.

Growth assessment is the single measurement that best defines the health and nutritional status of children because disturbances in health and nutrition, regardless of their etiology, invariably affect child growth (de Onis and Habicht, 1996). Growth in infancy, childhood and adolescence is a consequence of increasing cell size and cell number and this is most commonly assessed by the measurement of stature and weight (Zemel *et al*, 1997).

Anthropometry is physical measurements that reflect body composition and development or growth. Anthropometric indexes provide an approximate reflection of nutritional status (FAO and WHO, 1992). It has been widely accepted that for practical purposes, anthropometry is the most useful tool for assessing growth and nutritional status of children. Anthropometric indexes provide an approximate reflection of nutritional status. The basic objective of

anthropometric assessment at the community level is to provide an estimate of the prevalence and severity of malnutrition. Its also has other public health uses such as for individual and population assessment, identification of target groups or areas for intervention, selecting persons in need of immediate attention in emergency situation and studying the effects of seasonal changes in food supply or prevalence of disease. Anthropometry is also used for continuous nutritional surveillance in development planning. However, the other important use of anthropometry is to determine trends of nutritional status and to evaluate the impact of nutritional programs. As a conclusion, all the nutritional status information is important in the formulation of health and development policies of countries (WHO, 1986).

There are many advantages of anthropometric measurements such as being simple, non-invasive, socially acceptable, convenient, reliable with proper equipment and training and permit large-scale operation of determining short and long-term nutritional status (Siti Norazah, 1992/93). However, they require precision instruments that should be checked regularly for accuracy. Numerous anthropometric measures are used in nutritional assessment, because no single measure can fully characterize nutritional status (Zemel *et al*, 1997).

The indicators used most often are body weight and height, in relation to a subject's age and sex. Others include arm, head and thigh circumferences and skin-fold thickness (FAO and WHO, 1992).

1.1.2 Nutritional indices

The most commonly used anthropometric indices for assessing child growth are weight-for-age (WA), height-for-age (HA), weight-for-height (WH) and midupper arm circumference (MUAC) (de Onis and Habicht, 1996). There are three different systems to compare a child or children with the reference population which are percentiles, percent of median and z-scores (SD scores).

a) Percentile rank system

The percentile rank system consist of smoothed observed percentiles from the 5^{th} to 95^{th} percentiles for weight-for-age, height-for-age and weight-for-height (Dibley *et al*, 1987). This system showed the position of an individual weight of a particular height in the reference values in terms of the percentage of values exceed or equaled (Matthews *et al*, 1991). It is suitable for monitoring growth of individual children in a clinical setting. However, it cannot monitor the growth of the individual child who is above or below the outer percentiles (5^{th} and 95^{th} percentiles) of reference (Dibley *et al*, 1987; WHO, 1986). For the children below the 3^{rd} percentile, this system cannot classify the children further into either moderate or severe malnutrition (Matthews *et al*, 1991).

b) Percent-of-median

The percent-of-median indicate the ratio of a child's weight to the median weight of a reference child with the same height in the reference data. It is expressed as a percentage (Matthews *et al*, 1991). There are various

classification schemes to describe abnormal nutritional status such as Gomez criteria, Jelliffe criteria, Waterlow criteria and Wellcome Trust criteria. All of these classification classified protein-energy malnutrition using various cutoff points. Advantages of this method are that it is easy to use and understand and more influential. Its can also distinguish between severe and moderate malnutrition (Matthews *et al*, 1991). However, the percent-of-median method has limitations of its own. A given percent of median for an indicator is not constant across ages and does not have the same meaning for different indicators (Dibley *et al* 1987). The percentage of median is also less accurate. The method cannot take into account the fact that the variation in weight found in normal children at one height will be different to the variation found at a different height (Matthews *et al*, 1991).

c) Z-scores or standard deviation scores

To overcome the problems associated with the two previous methods, a new method was proposed. This method measures the deviation of the anthropometric measurement from the reference median in terms of standard deviations or z-scores (Dibley *et al*, 1987). To use the z-score method, the NCHS/CDC growth reference curves had to be transformed into a z-score representation with approximately normal distribution.

The z-scores are widely recognized as the best system for analysis and presentation of anthropometric data in population-based assessment including nutritional survey and surveillance. This is because it can be applied to the individual or population, can pinpoint any given weight and height, can note any improvement or deterioration of weight or height in relation to the reference

values and lastly it's can classify children of all ages and sizes equally (Matthews *et al*, 1991). A study done by Matthews *et al* (1991) in Angola showed 1.6 times greater chance of selecting undernourished children compared to using other methods.

The z-score is the number of standard deviation the child is away from the median of the reference population. It is applied to z-score of weight-for-age (WAZ), z-score of height-for-age (HAZ) and z-score of weight-for-height (WHZ) (http://wbln0018.worldbank). This method allows anthropometric cutoff points to be defined by extrapolation beyond the observed outer percentiles of the original reference data. When it is expressed as a standard deviation or z-scores, it will reflect the reference distribution and are comparable across ages and across indicators (Dibley *et a*l, 1987).

The formula for calculating the z-score is:

$$\text{z-score (SD-score)} = \frac{\text{Observed value} - \text{median value of the reference population}}{\text{Standard deviation of reference population}}$$

The WHO global database on child growth and malnutrition has classify weight-for-age, height-for-age and weight-for-height as moderate malnutrition when the z-score is < -2 standard deviation (SD). When the z-score is < -3 SD, it's defined as severe malnutrition. The cutoff point of z-score > +2 classifies as high weight-for-height or overweight in children. (WHO., 1986 and Zemel *et al.*, 1997). However, these indicators are only used for children less than 10 years old and it not recommended beyond this age (WHO, 1995).

1.1.3 Reference population

A reference is defined as a tool for grouping and analyzing data and provides a common basis for comparing populations (Mei *et al*, 1998). The reference data usually used is large enough to contain adequate statistical information. The population used should be healthy and well-nourished (WHO, 1986). The reference data generally used is the National Center for Health Statistics (NCHS) / Centers for Disease Control (CDC) Growth data (http://wbln0018.worldbank). This data was based on a population of normal North America children and was accepted as international reference standard (Kibel and Wagstaff, 1996). The international growth reference has provided a single set of growth references that permit comparison of growth data from different populations. The effect of genetics on physical growth was small compare to effect of nutrition. However, the NCHS/WHO curves are inappropriate for healthy, breast-fed infants who live under favorable environmental conditions in different parts of the world. Infants fed according to WHO recommendations and living under conditions that favor the achievement of genetic growth potential, grew less rapidly and deviated significantly from the international reference (de Onis and Habicht, 1996). In some cases, local reference data may be required or other local factors must be considered. The NCHS/WHO values are available only up to 18 years of age in each sex. The Expert Committee did not recommended any reference data for height in adulthood because of the wide international variation, the lack of understanding of genetic and environmental determinants, and the inability to intervene (de Onis and Habicht, 1996).

1.2 Malnutrition

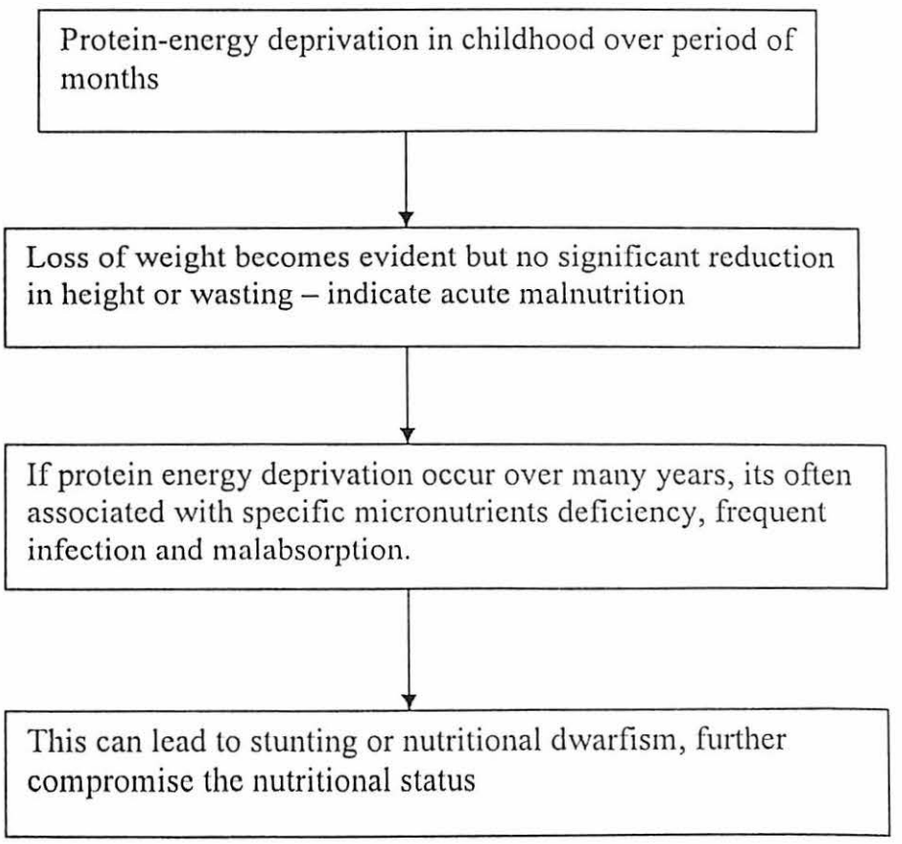
Malnutrition is defined as a number of conditions characterized by an excess or deficit of nutrients and /or calories. Malnutrition can be divided into two types either undernutrition or overnutrition. Undernutrition applies to an individual who doesn't ingest an adequate amount of nutrients. Babasaheb *et al* (2000) defined malnutrition as a clinical condition that includes several overlapping syndromes, such as growth failure in children and wasting in adults. Whereas, overnutrition occur when the individual eats more food than he need (Suitor and Hunter, 1980). Undernutrition among children usually results from a combination of inadequate dietary intake (quality or quantity/calories) and infections. It can be due to an inadequate intake of protein energy or micronutrients or a combination of these. Childhood undernutrition can threaten life, stunts growth and may thwart the realization of growth potential of children. Kibel and Wagstaff (1996) stated that children are vulnerable to nutritional inadequacies because of rapid growth, their dependence on others and their increasing exposure to various environmental hazards.

The most important types of malnutrition are protein-energy malnutrition, iron deficiency anaemia, iodine deficiency and vitamin A deficiency.

1.2.1 Protein-energy malnutrition (PEM)

Protein-energy malnutrition is due to lack of essential protein and energy from carbohydrate. This is the most common form of malnutrition in childhood. It may be hidden or obvious. The earliest effects of prolonged protein-energy deprivation in childhood is a deceleration of growth rate (Robinson and Lam,1994). PEM has been used to describe a range of disorders primarily

characterized by growth failure or retardation in children. It's also has been called as failure to thrive and infant multideficiency syndromes. This is the result of an adaptation phenomenon which allows the child to survive optimally on a restricted diet. The pathophysiology of protein-energy malnutrition is described in Figure 1.1.



(Anderson, 1982)

Figure 1.1. Pathophysiology of protein-energy malnutrition

1.2.2 Underweight

A child with a low weight-for-age is defined to be underweight. Underweight is an indication of general undernutrition. Weight-for-age has been used most widely for many years as an indicator of nutritional status and its measurement is the easiest for field personnel. The sequential weighing of children over time allows for a direct observation of the pattern of growth and enables health and others workers to detect growth faltering before it becomes severe. However, it cannot distinguish between children who are short and fat from children who are tall and skinny (WHO, 1986). Underweight children may either be chronically or acutely malnourished (de Onis *et al*, 2000).

1.2.3 Stunting

The measurement of height relative to age (height-for-age) has been promoted as a means of assessing overall and cumulative physical development (WHO, 1989). When z-score of height-for-age (HAZ) is < -2, the child is deemed stunted. Stunting reflects a deficit in height relative to age (Isabel *et al*, 2002). It's signifies a slowing in skeletal growth and acts as a main indicator of long term growth impairment. It is frequently found to be associated with poor overall economic conditions especially mild to moderate, chronic or repeated infections, as well as inadequate nutrient intake. A significant degree of stunting takes a longer time to be established and also for catch-up growth after a food intervention programme (WHO,1986).

1.2.4 Wasting

A low z-score of weight-for-height is called wasting. Wasting reflects a deficit in weight relative to height due to a deficit in tissue and fat mass compared with the amount expected in a child with the same height or length (WHO, 1986; Isabel *et al*, 2002). It may result either from failure to gain weight or from actual weight loss (WHO, 1986). There are seasonal episodes of wasting, related to variations either in food supply or in disease prevalence. Wasting can develop very rapidly and under favorable conditions, it can be restored rapidly. Because of this, wasting can be used as an index of current health status (WHO, 1986). It is also used to discriminate between children who are stunted and (at present) malnourished from those who are stunted but not (at present) at risk of undernutrition (Mora, 1989). Wasting is the index most used in nutritional emergencies as well as in long-term situations of undernutrition, such as famine. In children, weight-for-height ratio can be used without knowing the individual's age (FAO and WHO, 1992).

In children, the use of two indices (height-for-age and weight-for-height) was recommended for most of nutritional assessment. However, in certain instances, weight-for-age may be more practical for giving an overview of the distribution of nutritional problems in a country (WHO, 1986).

1.3 Associated factors for undernutrition

The factors most directly influencing nutrition can be grouped under the broad categories of food, health and care. These groupings encompass a number of issues including the availability of and access to food; individual health status,, lifestyles and utilization of health care services; and ability of household and community to care for, or provide the time, attention, support and skills to meet the needs of vulnerable individuals (FAO and WHO, 1992). Socio-economic circumstances, particularly poverty are fundamental determinants of malnutrition. Poverty and inadequate child care and attention, inappropriate feeding practices, poor sanitation and water supply and poor living condition lead to inadequate diet and infection, and these forces are responsible for growth failure in early childhood (Martorell, 1996). However, according to de Onis *et al* (1993) the major factors affecting a child's physical growth and mental development are infections and unsatisfactory feeding practices.

The prevalence of malnutrition in a population is determined by immediate, underlying and basic causes. Immediate causes are inadequate dietary intake and disease. Underlying causes mainly concern the unmet basic needs of children and women. There are three main groups of underlying causes; inadequate health services and an unhealthy environment; inadequate household food security; and inadequate mother-and-child caring practices, which can lead to inadequate dietary intake and infection. While, basic causes include political, legal, and cultural factors. Most of underlying causes are the result of basic causes related to the unequal distribution of resources in a society, the historical background and external factors as explained in Figure 1.2

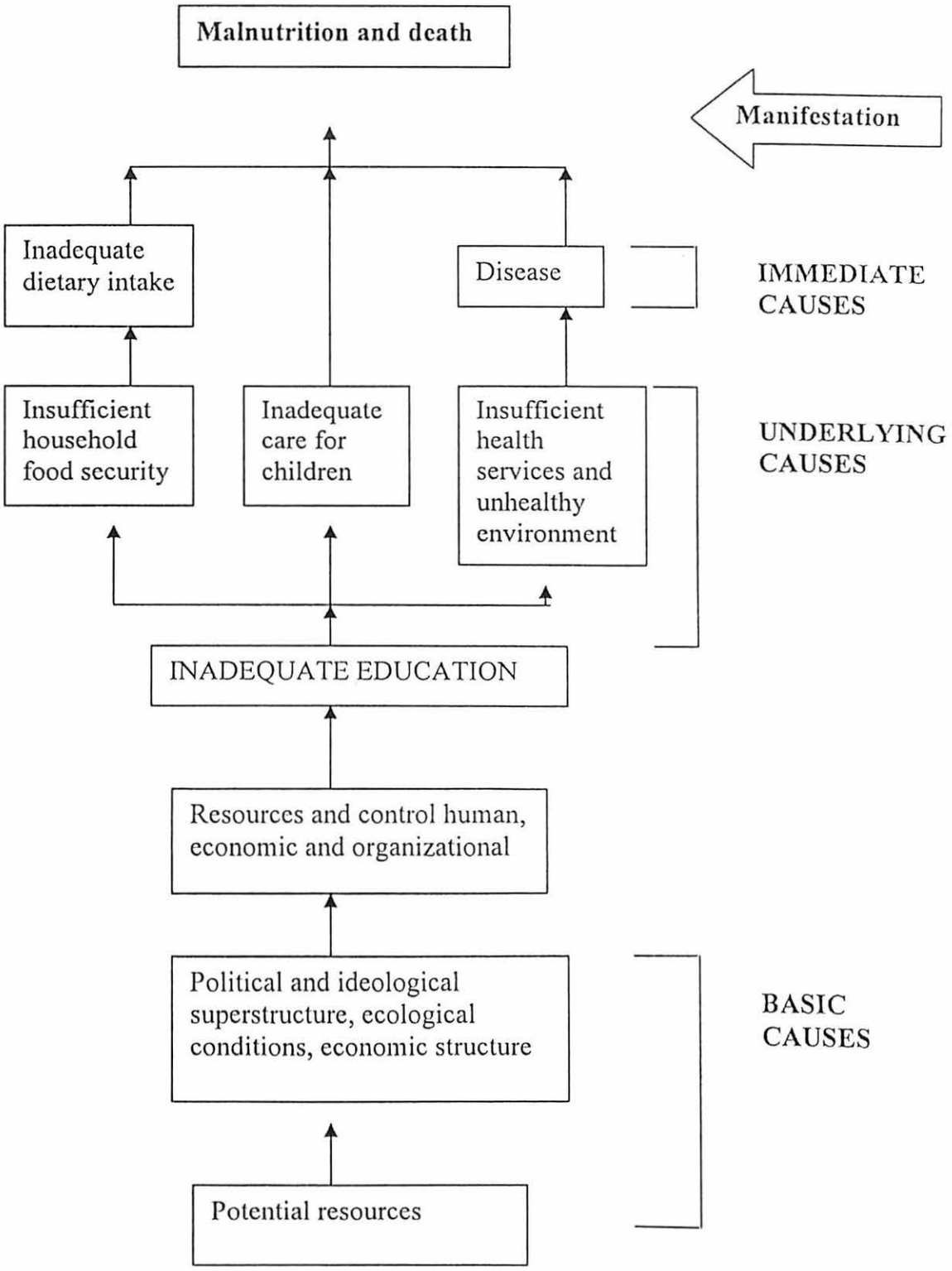


Figure 1.2 Conceptual framework (UNICEF) for determining the causes of malnutrition in a population

1.4 Consequences of undernutrition

In early childhood, growth failure will cause short stature, reduction of cellular and non specific immunity, thus increasing morbidity and mortality by making children more susceptible to infection. In women, short stature is often used as an indicator of obstetric risk. Further more, small stature result in diminished lean body mass, strength and work capacity. Massive growth failure in early childhood has an impact on long term learning and intellectual performance. These factors can leads to less desirable occupations and reduce productivity and income. It will impact on economic growth of the countries (de Onis *et al*, 1993, Martorell, 1996,).

Although the prevalence of childhood malnutrition in Malaysia is decreasing, it is still an important health problem especially in rural areas. Pre-school and school-aged children commonly suffer from malnutrition. The most important type of malnutrition is protein-energy malnutrition (PEM), which is manifested by failure to grow causing stunting, wasting or underweight.

1.5 Nutrition intervention programmes

In Malaysia, nutrition intervention programmes such as School Supplementary Feeding Programme and School Milk Programme are implemented by the Ministry of Education. The Ministry of Health has implemented a National Nutrition Rehabilitation Programme for malnourished children from poor families, iodine salt to all pregnant mothers and full cream milk to anemic mothers and malnourished children. The Rehabilitation Programme for Malnourished Children was in the form of a monthly supply of a basic food items for malnourished children. Another important nutrition intervention programme under Ministry of Health is the Baby Friendly Hospital Initiative (BFHI) that gives the best possible support for mother to breast feed. These

nutrition intervention programmes should be assessed and monitored regularly, especially on their effectiveness in improving the nutritional status of the target groups.

1.5.1 School Supplementary Feeding Programme

School Supplementary Feeding Programme (SSFP) is one of nutritional intervention programmes in Malaysia. The School Supplementary Programme is a programme under Ministry of Education. This programme was carried out in primary school children. In 1974, SSFP was initiated as a pilot project, by Selangor State Government under the Applied Food and Nutrition Programme (AFNP) in Hulu Langat district and later, this programme was extended to other districts. In 1976, the National AFNP was expands the SSFP to 12 districts in 6 states. By 1979, the programme was extended to all districts in every state in Malaysia under Ministry of Education. At that time, only schools with a population of 200 or less were entitled for SSFP. In 1989, the programme was extended to all schools irrespective of the number of students. Currently, about 532,500 of primary school children from poor family involved in SSFP every year. They received food from this programme for 190 days per year in 2002, comparable with schools days (Ministry of Education, 2002). The selected children are served breakfast every morning before beginning class. The meals for this programme were prepared by the school canteen operators. In rural schools, where the number of children was less than 200 and which does not have a canteen, meals preparation are contracted out to local community members while some are prepared voluntarily by the school teachers (Shahril *et al*, 2000). The objectives of School Supplementary Feeding Programme are:-

1) To improve the health and nutritional status of children, especially those from the rural areas, through the provision of a wholesome and balanced meal.

2) To improve health and food habits and to prevent the occurrence of malnutrition among school children.

3) To educate children on food selection

4) To encourage the participation of parents, teachers and public in the welfare of the school

5) To strengthen health and nutrition programme in schools

The budget costs for SSFP have changed many times due to increased cost of ingredients. Initially, the budget allocation per child was RM 0.20 per day. After that, this was increased to RM 0.45 per child in Peninsular Malaysia and RM 0.50 in Sabah and Sarawak. In 1995, this budget allocation increase again to RM 0.80 in Peninsular Malaysia and RM 0.85 in Sabah and Sarawak. The menus for the meals also increased from 10 to 20 for all participating schools. They were given the option to use all the 20 menus or select menus that were acceptable to the students (Jabatan Pendidikan Negeri Kelantan, 1995). In 2002, the budget was increased to RM 1.20 per child in Peninsular Malaysia and RM 1.35 per child in Sabah and Sarawak. According to the current rate and total number of students involved, the program costs about RM 123,647,250.00 per year (Jabatan Pendidikan Negeri Kelantan, 2002).

The criteria use for selection of students into SSFP are:

1) Family income less than RM400.00 or a per capita less than RM80.00

2) Students who were diagnosed as malnourished by doctors or school health personnel.

3) A student who stays far away from school and has transport problems.

Once selected, the students will get food supplements for 6 years, from Standard One up to Standard Six. The weight and height of students involved will be taken at the start of programme in Standard One and at the end of programme in Standard six (Jabatan Pendidikan Negeri Kelantan 1996, 2000, 2002).

Beside the guideline selection by Jabatan Pendidikan Negeri Kelantan criteria, others criteria were also considered by individual schools such as children with excellent academic performance, orphans, children whose academic performance was poor and children with a family problem (Shahril *et al,* 2000). In cases where more than one child from the family are attending school, preference will be given either to the youngest child or the child who appeared 'weak', while the other child will be placed in the reserve list. The school administration can decide whether to select all siblings or not based on the financial resources available (Shahril *et al,* 2000).

Others programme which have similar objectives is the School Milk Programme. This project has two component schemes, voluntary paying scheme and free scheme. In voluntary paying scheme, the students can buy milk twice a week at a

discounted price. In free scheme milk program, milk is given free twice a week to SSFP students (Chen, 1989).

1.6 The importance of the study

Although the prevalence of malnutrition among Malaysian children is decreasing, there is still a high prevalence of persistent acute and chronic malnutrition in agricultural and fishing villages, estate and urban slums areas (Khor and Tee., 1997, Nor hayati *et al.*, 1997 and Marjan *et al.*, 1998). In spite of implementation of nutrition intervention programmes among poor pre-school and primary school children, the prevalence did not decrease as expected by the Ministry of Health. The target set by the National Plan of Action for Nutrition of Malaysia (NPANM) for year 2000 was to reduce the prevalence of underweight to 12.5% (Ministry of Health Malaysia, 2001). However, a study done by the Ministry of Health among 5108 children under five years old from urban and rural areas showed prevalence of underweight, stunting and wasting far higher than the target set. The prevalence of underweight, stunting and wasting found were 21.7%, 20.9% and 16.6% respectively (Ministry of Health Malaysia, 2001). Kelantan is among the poorer states in Peninsular Malaysia, and it is expected that the problem of undernutrition to be more serious, especially in agricultural and fishing areas. The study will explore the extent of nutritional problems among the children. If the prevalence found is high, we have to give more attention and create new strategies on prevention of undernutrition especially among pre school children because undernutrition among infants and young children are associated with reduced physical activity, lowered resistance to infection, impaired intellectual development and cognitive abilities and increased morbidity and mortality (FAO and WHO, 1992). We like to explore associated factors of undernutrition especially the preventable factors

such as socio-economic status, immunization status and parasitic infections. There are many strategies which can be implemented to overcome the risk factors.

There were several studies done in Malaysia to evaluate the School Supplementary Feeding Programme. The study done by Kandiah and Tee (1989) in Selangor and Pahang showed significant reduction of prevalence all types of undernutrition. However, multivariate analysis was not applied in that study to control for all the confounding effects. The study also didn't look at the changes of z-scores of nutritional indicators itself. There was no previous study done in Kelantan to explore the effectiveness of SSFP in improving nutritional status of primary school children in rural areas. This study will be evaluated the effect of SSFP on change of individual z-scores in rural areas of Kelantan (Bachok and Tumpat).

CHAPTER 2

LITERATURE REVIEW

2.1 Epidemiology of undernutrition

2.1.1 Worldwide

Undernutrition is a serious global issue especially in developing countries. It is estimated that 32.5% of children aged less than 5 years in developing countries was stunted in 2000. However, by year 2005 the prevalence for all developing countries estimate will be about 29%.

About 20% of the developing world's population (>780 million) suffers from insufficient food intake. Although severe undernutrition is rarely encountered, but mild-to-moderate undernutrition affects a significant proportion of the world's population especially in developing countries. More than 192 million children are suffering from protein-energy malnutrition. The global prevalence of underweight preschool-aged children in developing countries is 35.8%. It was estimated that prevalence of underweight, stunting and wasting in Asia to be 42.0%, 47.1% and 10.8% respectively (de Onis *et al*, 1993).

Most countries in Asia have high or very high prevalence of underweight children, while most developing countries in Latin America have low or

moderate prevalence. In Africa, however, both moderate and high prevalence were found (de Onis *et al*, 1993).

The prevalence of underweight, stunted and wasted children are far higher in Southern Asia (i.e India, Bangladesh and Pakistan) than in any other region. South-Eastern Asia (i.e Philipines, Thailand and Myanmar) ranks second in the descending order of prevalence of underweight and third for wasting and stunting. Western Africa (i.e Senegal, Sierra Leone and Ghana) ranks second for wasting, third for underweight, and fifth for stunting. Whereas, Eastern Africa (Malawi, Zimbabwe, Uganda and Kenya) rank second for stunting and fourth for wasting and underweight (de Onis *et al*, 1993).The detail about prevalence of underweight, stunting and wasting in different regions are stated in the Table 2.1.

Table 2.1. Regional estimates for prevalence of underweight, stunted and wasted children in developing countries, ranked in descending order

Underweight	(%)	Stunted	(%)	wasted	(%)
Southern Asia	60.5	Southern Asia	60.3	Southern Asia	17.3
South-eastern Asia	37.8	Eastern Africa	47.0	Western Africa	9.5
Western Africa	32.8	South-eastern Asia	43.2	South-eastern Asia	7.6
Eastern Africa	31.0	Melanesia	42.2	Eastern Africa	6.0
Melanesia	29.5	Western Africa	37.9	Northern Africa	5.8
Eastern Asia	21.3	Eastern Asia	32.1	Melanesia	5.5
Caribbean	19.4	Central America	29.8	Central America	4.6
Central America	17.7	Caribbean	25.9	Eastern Asia	3.6
Northern Africa	11.3	Northern Africa	25.4	Caribbean	2.2
Southern America	8.4	Southern America	18.1	Southern America	1.9

According to de Onis *et al* (2000), the overall prevalence of undernutrition in developing countries as measured by stunting has fallen progressively from 47% in 1980 to 32.5% in 2000. Prevalence of stunting in all developing countries is expected to further reduce to 29.0% in year 2005. Globally, 1/3 of all children aged below 5 years in developing countries are stunted. About 70% of stunted children live in Asia, 26% live in Africa and 4% live in Latin America and Caribbean (de Onis *et al*, 2000).

However, Eastern Africa showed an increase in the average prevalence of stunting (0.08% points per year). Other sub-regions have shown decreasing prevalence, ranging from 0.06% to 0.98% per year. The most important factors contributing to reduce trend in prevalence of stunting are the increase availability of high energy foods, increase in female literacy and increase of gross national product (GNP) of the country (de Onis *et al*, 2000).

Monteiro *et al*, (1992) found there was a reduction of nearly 60% in the prevalence of childhood malnutrition in Brazil over a 15-year period (1975 – 1989). It also showed that the prevalence of malnutrition in childhood was higher in rural areas compared to urban in 1975 and 1989.

A study done by Stoltzfus *et al*, 1997 in rural area of Tanzania showed prevalence of stunting was higher (83%) among 13 year old children compared to 7 year old children (14%). This was contrast with the previous statement where de Onis *et al* (1993) believed that linear growth retardation occur mainly in early childhood.

Ying *et al* (1994) stated that prevalence of stunted, wasted, and underweight of pre-school children in poor rural areas in China in 1989 was 56.0%, 2.7% and 28.2% respectively. In a post war country like Democratic People's Republic of North Korea (DPRNK); prevalence of wasting (16.5%) and stunting (38.2%) was high compared to others countries (Apte and Mokdad, 1998). Wasting is most important indicator in emergency situations. This is because it results from recent inadequacies of dietary intake or infection or both (WHO, 1995). Chronic and cumulative shortage of food, shortage of basic medicine and fuel and damage to the infrastructure from flood may be the cause of the problem in this country (Apte and Mokdad, 1998).

Most of primary school children in urban slum areas in Indonesia were found to be underweight and stunted. The percentage of children who were underweight or stunted was significantly greater in boys (underweight=65%, stunted=65%) than in girls (underweight; 50%, stunted; 50%) (Hadju *et al*, 1995).

2.1.2 Malaysia

The major nutritional deficiencies in Malaysia are protein-energy malnutrition amongst children, chronic energy deficiency in adults, and deficiencies of micro-nutrients such as iron and iodine deficiency. Moderate undernutrition is widespread especially among rural underserved communities, and affects mainly young children and pregnant women (Tee, 1999).

In Malaysia, Khor and Tee (1997) show the persistence of chronic, current and acute forms of undernutrition among children from the agricultural villages and the estates. Several factors may contribute to this situation. These