Original Article

Obesity in Asia: prevalence and issues in assessment methodologies

E-Siong Tee PhD

Nutrition Society of Malaysia, Kuala Lumpur, Malaysia

The dramatic changes in the lifestyle of many Asian communities, and the resultant changes in the food and nutrition issues facing the communities in the region have been documented by various investigators. Health authorities and researchers have given greater attention to the problem of overweight and obesity. Available data are lacking, but various estimates have indicated that the emerging problem of overweight amongst children cannot be ignored. Estimates of overweight by the World Health Organization (WHO) amongst preschool children in Asia in 1995 was around 2.9%. Data extracted from selected studies in individual Asian countries show much higher prevalences, ranging from 5% to 9% amongst several urban cities in Asia. In several other developing countries in the region, the prevalence is probably very low, with prevalences of less than 1%. There is thus considerable variation in this prevalence amongst the various countries. The problem of increasing overweight and obesity amongst adults in Asia has been highlighted for more than a decade. The database on the extent of the problem is far from being comprehensive, but various studies have pointed out the severity of the problem. Various reports in the 1990s have pointed out prevalences of overweight of over 20% and obesity of over 5% amongst urban population groups of the more developed countries in the region. It is also to be noted that there are also reports indicating that the most affluent societies in the region, such as Seoul and Tokyo, did not have the highest prevalence of overweight. There are also data on increasing prevalence of overweight among rural areas in the last 10 years. The situation for children is similar: there is considerable variation in the severity of the problem. In the Philippines National Surveys, for example, slightly lower prevalences have been reported. Countries in the region will continue to progress, accompanied by continued changes in lifestyle of communities. It is therefore of utmost importance to continue to monitor the nutritional status of communities. The lack of nationally representative data which is regularly updated is a major concern. The lack of data for certain age groups such as the adolescents and the elderly need to be addressed. One of the main obstacles in the formulation and effective implementation of intervention programs in developing countries is the lack of comprehensive data on the extent of the problems in many cases and the causes of such problems specific to the communities concerned. In addition to the lack of good data, other concerns too need to be addressed. These include methodological issues such as the need for harmonization of methods in assessment of nutritional status for the various groups, the appropriateness of criteria for cut-offs, growth reference to be used, and association of overweight and obesity with comorbidities.

Key words: adult, Asia, assessment, children, methodology, obesity, overweight.

Introduction

Many countries in the Asian region have witnessed sustained economic growth and increasing political stability, thereby bringing about rapid advances in socioeconomic status for more than three decades. Even the least-developed countries in the region have made significant progress. Some, for example, China, are recognized as economically stable despite current global economic uncertainties.

Such rapid developments have brought about increased nutrient availability in many countries in the region as well as improved health facilities. These improvements have led to improvements in morbidity and mortality and a marked decrease in nutrient deficiencies. Nevertheless, the extent of the undernutrition problem is still large and the magnitude varies markedly among the countries in the region.

In addition to changes in the amounts of available nutrients in Asian countries, there have also been marked changes in the sources of nutrients and the pattern and composition of diets.[1] There have also been increases in the percentage energy from fat, and there has been an increased consumption of added fats in most countries. The most affluent countries show an increase in vegetable and fruit consumption. Meat consumption (and thus the consumption of saturated animal fat) increased markedly in some countries.

There have also been other changes in dietary behaviour. More families eat out, and the consumption of fried foods is increasing. Overeating is a concern among some. Dietary supplement use is also increasing, and some individuals have the mistaken belief that supplements can replace missed

Correspondence address: Dr E-Siong Tee, Nutrition Society of Malaysia, c/- Division of Human Nutrition, Institute of Medical Research, 50588 Kuala Lumpur, Malaysia.
Tel: +603 26986704; Fax: +603 26943575
Email: president@nutriweb.org.my

meals. Other significant lifestyle changes have also taken place, including decreased physical activity, even in rural areas. The high prevalence of smoking in the region, however, remains unchanged.

The combined effect of these lifestyle behaviours is resulting in a significant change in the food and nutrition issues facing Asian countries. Of growing concern are the significant proportions of the population now faced with the other facet of the malnutrition problem: the chronic diseases associated with excessive consumption of various nutrients (e.g., fat), on the one hand, and low intake levels of other nutrients (e.g., complex carbohydrates and fibre), on the other. The increased prominence of these diseases is evident in the mortality and epidemiological data, which vary markedly among countries in the region. These new dimensions in the nutrition situation in developing countries pose great challenges to nutritionists and other health workers. The dramatic increase in overweight and obesity in the region, for example, should be a cause for real concern and for concerted interventions. For countries not yet afflicted with diet-related chronic diseases, it is important to avoid or reduce the onslaught of these diseases. It is hoped that these countries will be able to learn from the mistakes of others, and not follow the same path.

Overweight and obesity amongst children

The emerging problem of overweight in children cannot be ignored. Estimates of overweight by WHO amongst preschool children in Asia in 1995 were around 2.9%. There is, of course, considerable variation in this prevalence. The estimate for Asia as a whole was 2.9%, with a higher prevalence of 4.3% in Eastern Asia and 2.4% in Southeast Asia (Table 1).[2] A total of 17.6 million preschool children in all developing countries were considered overweight. Of this total, 61%, or 10.6 million, were in Asia. It is also important to note that the region also has the highest number of stunted preschool children. Tackling this double burden of under- and over-nutrition poses a great challenge to nutrition and health workers in the region.

Data extracted from selected studies in individual Asian countries show much higher prevalences. A 1997 national survey of children under five years of age in Brunei Darussalam showed a high prevalence of overweight ranging from 7.7 to 10.2% in different parts of the country and averaging 9.1% for the whole country (Table 2).[3] In a study of almost 6000 primary school children (7–10 years old) in almost all schools in Kuala Lumpur, the prevalence of overweight was observed to be 8.4%, with the prevalence among boys almost 1.4 times that among the girls (Table 3).[4,5] The prevalence of risk to overweight among this group of urban schoolchildren was about 4 times higher than that reported for rural primary school children (1.9%). (Table 3).[5]

Slightly lower prevalences of overweight have been reported for children in China. In the 1992 national nutrition survey, overweight was observed in 6.5% of urban children under 5 years of age (Table 4).[6] Amongst rural children, a significant prevalence of 4.9% was also observed. In the 1998 nationwide surveillance involving a larger sample size and the same criteria, the prevalence of overweight among urban 6-year-old-children was 5.2%, whereas the prevalence among rural children was 3.5% (Table 5).[7] In an even larger study of 109 701 urban children aged 0–7 years in nine cities in China in 1996, 1.76% of the subjects had over 120% of the reference weight for height. The prevalence rate was lowest

Table 1. Regional and global prevalences and numbers of overweight† preschool children (aged < 5 y) in 1995*

UN regions and subregions	Percentage of population covered %	Percentage overweight %	Number overweight n × 10^3
Africa	70.9	3.9	4471
Eastern	68.0	NA‡	NA
Middle	20.7	NA	NA
Northern	77.2	8.1	1645
Southern	88.2	6.5	375
Western	90.7	2.6	888
Asia	92.4	2.9	10643
Eastern	94.4	4.3	4719
South-central	98.9	2.1	3719
South-eastern	82.5	2.4	1327
Western	54.8	NA	NA
Latin America and Caribbean	94.1	4.4	2429
Caribbean	64.8	NA	NA
Central America	97.9	3.5	564
South America	95.5	4.9	1729
Oceania§	15.5	NA	NA
Developing countries	87.8	3.3	17561

*Source: de Onis and Blossner, 2000.[2]

†Overweight defined as a weight-for-height >2 SDs of the National Center for Health Statistics/World Health Organization (NCHS/WHO) international reference median; ‡Not available; §Excluding New Zealand and Australia.

Table 2. Prevalence of undernutrition and overweight amongst children under 5 years old, Brunei Darussalam, 1997 survey*

District	Number	% of children			
		Underweight†	Stunting‡	Wasting§	Over-weight¶
Brunei-Muasa	822	14.1	13.1	3.9	9.1
Tutong	129	12.4	15.5	3.1	7.8
Beliat	147	10.9	8.8	2.7	10.2
Temburong	39	15.4	15.4	2.6	7.7
Total	1137	13.5	12.9	3.6	9.1

*Source: Ministry of Health Brunei, 1999.[3]

†<–2SD weight-for-age of NCHS reference; ‡<–2SD height-for-age of NCHS reference; §<–2SD weight-for-height of NCHS reference; ¶>+2SD weight-for-height of NCHS reference.

Table 3. Prevalence of overweight among urban and rural children in Malaysia*

	Boys	Girls	Both
Urban[4]			
% > 95th percentile	9.7	7.1	8.4
N	3037	2958	5995
Rural[5]			
% > 2SD	2.0	1.9	1.9
N	1731	1544	3275
Urban/rural	4.8	2.7	4.1

*Source: Tee et al, 2000.[4]; Khor & Tee, 1997.[5]

Table 4. Prevalence of under- and overnutrition among children under 5 years in China, 1992 National Nutrition Survey*

Region	Number	% of children			
		Underweight†	Stunting‡	Wasting§	Overweight¶
Urban	1606	10.5	20.3	2.9	6.5
Rural	6789	19.8	35.8	3.7	4.9
Rural low income	2487	24.8	44.4	4.3	4.9
Rural middle income	2221	19.6	35.0	3.9	4.5
Rural high income	2081	14.1	26.1	2.7	5.1
National	8395	18.0	32.8	3.6	5.2

*Source: Ge K et al. 1999.[6]

†<–2SD weight-for-age of NCHS reference; ‡<–2SD height-for-age of NCHS reference; §<–2SD weight-for-height of NCHS reference; ¶>+2SD weight-for-height of NCHS reference.

Table 5. Prevalence of under- and overnutrition among children under 6 years in China, 1998 surveillance data*

Region	Number	% of children			
		Underweight†	Stunting‡	Wasting§	Overweight¶
Urban	5 780	2.70	4.07	2.08	5.22
Rural	10 688	12.59	21.98	2.62	3.46
General rural	6 999	12.59	18.13	2.62	3.46
Less developed rural	3 689	19.46	30.98	3.36	2.58
National	16 468	10.12	17.50	2.49	3.90

*Source: Chen C 2000.[7]

†<–2SD weight-for-age of NCHS reference; ‡<–2SD height-for-age of NCHS reference; §<–2SD weight-for-height of NCHS reference; ¶>+2SD weight-for-height of NCHS reference.

among children below three years of age and increased with age. The highest prevalence was observed for the 6–7 years age group, where 5.4% of boys and 2.8% of girls were found to be overweight.[8]

In the 4th National Nutrition Survey 1995 of Thailand[9] (Table 6), the prevalence of overweight among children 0–5 years of age was reported to be 17.6%, whereas 5.4% of the children were reported to be obese. The prevalence of overweight among urban children was higher, with an urban : rural ratio of 1:1.3. In the 6–14 age group, the prevalences of overweight and obesity were both lower (10.0% and 5.2%, respectively). In this age group, there was a greater prevalence of overweight among the rural children such that the urban:rural ratio was 1:0.7. It is to be noted that direct comparison of these prevalence rates with reports from other countries should be made with caution as this report had used different criteria for classifying overweight and obesity and had also used the Thai growth reference.

In several other developing countries in the region, the prevalence is probably very low. For example in the large national survey of child nutritional status by Vietnam in 1999 of over 90 000 children, the prevalence of overweight was not reported.[10] In a survey of children under five years of age in different parts of Laos, the overwhelming problem was undernutrition, and overweight was not detected.[11] The National Nutrition Surveys of the Philippines reported prevalences of <1% amongst children less than 10 years of age from 1989 to 1998.[12]

There is thus considerable variation in this prevalence amongst the various countries. High prevalences have been reported for urban areas of Brunei and Kuala Lumpur – about 8%, urban areas of China and Thailand are probably experiencing prevalences of about 5%, whereas very low prevalences of less than 1% are encountered in Vietnam, Laos and the Philippines. It should also be pointed out there is a serious lack of data in the region. Large data sets, representative of the country and regularly collected over time, are just too few.

Adult overweight and obesity in Asia

The problem of increasing overweight and obesity in Asian adults has been highlighted for more than a decade. As in the case of children, the database on the extent of the problem is far from comprehensive, but various studies point to the severity of the problem. In the studies cited below, unless otherwise mentioned, overweight refers to a body mass index (BMI) (expressed in kg/m^2) between 25.0 and 29.9, and obesity as BMI ≥ 30.0.

In Malaysia, the National Morbidity Survey of 1996 reported an overall nationwide prevalence of overweight among adults of 20.7% and of obesity of 5.8%. There was a slightly higher prevalence of overweight amongst women (21.4%) compared with men (20.7%) whereas the problem of obesity amongst women (7.2%) was twice that of men (3.8%). The Indian ethnic group had the highest prevalence of overweight (24.9%). Prevalence of obesity was highest among the Malays and Indians (6.6%)[13] (Table 7). Among urban adults, isolated studies have reported higher prevalences of around 29% for overweight and 12% for obesity.[14] High prevalences of 19.8% overweight among men and 28% among women have also been reported for selected rural population groups in a study of the mid-1990 s[15] The prevalences of obesity among men and women were 4.2% and 11.1%, respectively. The combined prevalence of overweight and obesity (body mass index > 25) in Malaysia probably ranged from 26% to 53%, with an overall mean of 39%.[14]

In a study of a small number of urban subjects in 12 Asian cities, the prevalence of overweight and obesity (BMI > 25) was found to be high (more than 23%) in five of them: Beijing, Hong Kong, Kuala Lumpur, Manila, and

Table 6. Prevalence of under- and overweight amongst children 0–14 years in Thailand (4th National Nutrition Survey)

	Male			Female			Whole Kingdom		
	Combined	Urban	Rural	Combined	Urban	Rural	Combined	Urban	Rural
0–5 years									
N	2196	374	1822	2065	374	1690	4261	748	3512
% obese	5.3	8.6	4.6	5.4	9.1	4.6	5.4	8.8	4.6
% preobese	12.2	13.4	12.0	12.3	13.1	12.1	12.3	13.2	12.0
% overweight	17.5	22.1	16.6	12.8	22.2	16.7	17.6	22.0	16.6
Normal weight	74.8	67.9	76.2	71.9	66.8	73.0	73.4	67.4	74.7
Underweight	7.7	10.2	7.1	10.3	11.0	10.3	9.0	10.6	8.7
6–14 years									
N	619	79	540	628	97	531	1247	176	1071
% obese	5.8	1.3	6.5	4.6	4.1	4.7	5.2	2.8	5.6
% preobese	3.4	3.8	3.3	6.2	5.2	6.4	4.8	4.5	4.9
% overweight	9.2	5.1	9.8	10.8	9.3	11.1	10.0	7.3	10.5
Normal weight	70.6	69.6	70.7	61.8	57.7	62.5	66.0	63.1	66.7
Underweight	20.2	25.4	19.4	27.4	33.0	26.3	23.8	29.5	22.9

*Source: Ministry of Public Health Thailand.[8]

Notes: Obese = weight/height ≥120% of standard; Preobese = weight/height ≥110–119.9% standard; Overweight = weight/height ≥110% standard; Normal weight = weight/height ≥ 90–109.9% standard; Underweight = weight/height < 90% standard; The Thai growth reference 1987 was used in the analyses.

Table 7. Prevalence of under- and overweight among Malaysian adults (National Health Morbidity Survey, 1996)*

	Underweight BMI < 18.5	Normal BMI 18.5–24.9	Overweight BMI 25–29.9	Obese BMI ≥ 30.0
All	12.7	60.8	20.7	5.8
Men	11.5	64.5	20.1	4.0
Women	14.1	56.8	21.4	7.6
Malay	13.4	57.5	22.0	7.0
Men	12.2	63.3	20.0	4.5
Women	14.7	51.9	23.9	9.5
Chinese	11.1	62.3	21.6	5.0
Men	9.0	61.8	24.5	4.7
Women	13.3	62.7	18.7	5.3
Indian	11.4	56.8	24.9	6.8
Men	10.4	61.6	24.2	3.8
Women	12.5	52.2	25.6	10.3
Other indigenous	14.0	63.5	17.9	4.5
Men	11.3	69.3	16.7	2.7
Women	16.8	57.7	19.1	6.3

*Source: Lim et al. 2000.[13]

Bangkok. It was also noted that the most affluent societies in the study, for example, Seoul and Tokyo, did not have the highest prevalence of overweight.[16]

The 1998 National Health Survey of Singapore reported similar prevalences of 24.4% for overweight and 6% for obesity, with considerable variation amongst the three major ethnic groups. The prevalence of overweight was higher amongst the men, whereas there was a slightly higher proportion of obese women (Table 8).[17] The report also pointed out that the prevalence of obesity in the Republic in the 1992 survey six years ago was very similar, at 5.1%.

Similar figures were reported for the National Nutrition Survey 2000 in Japan: men's overweight 24.5% and obesity 2.3%; and women's overweight 17.8% and obesity 3.4%. There appears to be an increase in the prevalence of overweight and obesity among male Japanese. The overall prevalence of overweight men increased by two times over the last 20 years, while the most evident increase was amongst younger men and in rural areas. On the other hand, the overall prevalence of overweight among women has not changed over the same time period, while the prevalence among younger women decreased, being more prominent in metropolitan areas.[18]

Prevalence of overweight ranged from 12.1% amongst elderly subjects to 40.2% among adults 40–49 years of age, according to the 1995 national survey of Thailand (Table 9).[9] The mean national average was 26.1%. It is to be noted that these prevalences are for BMI > 25.0, and prevalence of obesity was not separately reported. Prevalences of overweight for women of all age groups were all higher than that for the men. Prevalences among urban dwellers were generally higher than those for the rural subjects, but the problem was also rather high among the latter group, with a national average of 25.1%.

Table 8. Weight status of Singapore residents aged 18–69 years, by gender, 1998*

	Male	Female	Combined
Underweight	6.9	11.5	9.2
Normal	59.2	61.5	60.4
Overweight†	28.6	20.3	24.4
Obese‡	5.3	6.7	6.0

*Source: Ministry of Health Singapore 1998.[17]
†BMI = 25.0–29.9. ‡BMI = ≥30.0.

In China, the prevalence of overweight is slightly lower than the Asian countries mentioned above. The national nutrition surveys conducted in 1982 and 1992 showed that the prevalence of overweight and obesity in young adults increased from 9.7% to 14.9% in urban areas and 6.2% to 8.4% in rural areas during the 10-year period. The increased rate was 53.6% for urban residents and 36.6% for rural residents.[8]

The severity of the problem appears to be lesser in the Philippines. Results from the 5th Philippines National Survey of 1998 showed that the prevalence of overweight was 16.9% and that for obesity, 3.3%. Both overweight and obesity were higher amongst women (Table 10).[19] The combined prevalence of BMI > 25 of 20.2% for the 1998 survey was observed to be 3.6% higher than that of the 4th National Survey (1993) of 16.6%.

The high prevalence of overweight and obesity are associated with increases in a whole host of diet-related chronic diseases in many communities in the Asian region. Coronary heart disease has been reported to be a main cause of death in many countries, and the prevalence of hypertension and diabetes has reached worrying proportions.

Table 9. Nutritional status of subjects 20 years and above, by sex and residence (4th National Nutrition Survey)*

	Male			Female			Whole Kingdom		
	Combined	Urban	Rural	Combined	Urban	Rural	Combined	Urban	Rural
20+ yrs									
N	1764	254	1510	4027	659	3367	5791	913	4877
% underweight	30.6	31.9	30.3	22.5	18.4	23.3	25.0	22.1	25.5
% overweight	16.7	18.5	16.4	30.2	36.3	29.0	26.1	31.3	25.1
20–29 yrs									
N	394	65	329	1660	251	1409	2054	316	1738
% underweight	28.4	40.0	26.1	25.2	23.5	25.6	25.8	26.9	25.7
% overweight	13.5	10.8	14.0	22.1	28.3	20.9	20.4	24.7	19.6
30–39 yrs									
N	546	86	460	993	794	199	1539	285	1254
% underweight	21.2	25.6	20.4	16.1	15.1	16.4	17.9	18.2	17.9
% overweight	20.0	26.7	18.7	35.1	35.7	35.0	29.8	33.0	29.0
40–49 yrs									
N	209	28	181	493	66	427	702	94	608
% underweight	21.1	25.0	20.4	10.3	4.5	11.7	13.8	10.6	14.3
% overweight	24.4	21.4	24.9	46.9	45.5	47.1	40.2	38.3	40.5
50–59 yrs									
N	256	25	231	485	82	403	741	107	634
% underweight	29.7	20.0	30.7	17.1	9.8	18.6	21.4	12.1	23.0
% overweight	21.5	24.0	21.2	42.0	58.5	38.7	34.9	50.5	32.3
60+ yrs									
N	359	50	309	395	61	334	755	111	643
% underweight	53.2	42.0	56.0	48.6	34.4	51.2	50.7	37.8	53.0
% overweight	7.5	10.0	7.1	16.2	31.1	13.5	12.1	21.6	10.4
All ages									
N	3528	508	3020	8053	1913	6139	11582	1826	9754
% underweight	30.6	31.9	30.4	22.5	17.4	24.0	25.0	22.1	25.5
% overweight	16.7	18.5	16.4	30.2	36.1	28.4	26.1	31.3	25.1

*Source: Ministry of Public Health Thailand.[8]

Underweight: BMI < 20.0; overweight: BMI ≥ 25.0.

Lack of comprehensive data

The lack of comprehensive data on the prevalence of overweight and obesity in many countries in Asia has been highlighted above. Only a few national authorities set aside funding for regular national surveys. Japan seems to have the most comprehensive and systematic data on community nutritional status and food consumption patterns. Economic progress in the countries of the region will continue to be accompanied by lifestyle changes. It is therefore of the utmost importance to continue to monitor nutritional status of communities. Systems to periodically collect data on nutritional status and dietary intakes should be in place in all countries.

Indeed, comprehensive data specific to the communities concerned should be made available through systematic research programs to permit the formulation and effective implementation of intervention programs in developing countries. The lack of data for certain age groups such as adolescents and the elderly need to be addressed.

Methodology issues

In addition to the lack of good data, other concerns too need to be addressed. These include methodological issues such as the need for harmonization of methods in assessment of nutritional status for the various groups, the appropriateness of criteria for cut-offs, growth reference to be used and association of overweight and obesity with comorbidities.

It has been previously suggested that the use of cutoff points of less than the 5th percentile and equal to or greater than the 85th percentile for determining prevalence of thinness and overweight, respectively, as recommended by WHO (1995) may not be appropriate.[4] The latter cutoff appeared to have overestimated the prevalences by a magnitude of about 2–3 times. It was suggested that the use of a cutoff of at or above the 95th percentile would give a more accurate prevalence of overweight amongst adolescents. There are already several reports in the literature using the WHO recommendations. To further complicate the situation, some investigators use > 85th percentile for overweight and

Table 10. Prevalence of under- and overweight among adults over 20 years, 5th National Nutrition Survey of the Philippines, 1998*

Age groups (years)	N	Underweight %	Desirable weight %	Overweight %	Obese %
Male:					
20–39	1556	8.7	74.6	15.1	1.5
40–59	1547	10.7	68.5	17.1	3.6
60 & up	1539	24.5	66.1	8.2	1.2
All	4652	11.1	71.9	14.9	2.1
Female					
20–39	1557	13.9	65.4	16.7	4.0
40–59	1559	13.3	56.7	24.5	5.4
60 & up	1531	26.2	54.5	15.4	3.9
All	4647	15.4	61.3	18.9	4.4
Both					
20–39	3123	11.2	70.2	15.8	2.7
40–59	3106	12.0	62.6	20.8	4.5
60 & up	3030	25.4	60.0	12.0	2.6
All	9299	13.2	66.7	16.9	3.3

*Source: Villavieja *et al.* 2001.[19]

95th percentile for obesity amongst adolescents. It is hoped that there would be greater uniformity in the use of terminologies and cutoffs for defining the problem amongst this group of the population.

The appropriateness of using BMI > 25 for defining overweight and BMI > 30 for obesity for the Asian population has been questioned by certain quarters in recent years. The Japan Association for the Study of Obesity (JASSO) has been reported to be considering lowering the cutoff for obesity as BMI > 25.[20] In the meantime, China has recently completed an extensive analysis of large data sets from cross-sectional and longitudinal studies. It has been decided that the cutoff for defining overweight is to be lowered to 24.0–27.9 and that for obesity to > 28.[21] Other countries in the region have not taken firm action on this as it is felt that there has to be sufficient scientific evidence for the downward adjustment of the cutoff.

The appropriate growth reference to be used for the analysis of survey data has long been discussed. Whether a national growth reference is preferred over the National Center for Health Statistics (NCHS), which has been recommended for international use by WHO, will continue to be a matter for discussion. Whatever the outcome, it is important that researchers from countries in the region continue to use the WHO recommended reference so as to allow for international comparison of growth achievement of communities. For countries with national growth references, these data can also be analysed using these references in addition to using the international references.

References

1. World Cancer Research Fund/American Institute for Cancer Research. Patterns of diet and cancer. In: Food, Nutrition and the Prevention of Cancer: a Global Perspective. Menasha, WI: Banta Book Group, WCRF/AICR, 1997; 20–52.
2. de Onis M, Blossner M. Prevalence and trends of overweight among preschool children in developing countries. Am J Clin Nutr 2000; 72: 1032–1039.
3. Ministry of Health. Nutritional status of children under five years old and pregnant women in Brunei Darussalam. Report of the Ministry of Health. Brunei, Darussalam: Ministry of Health, 1999.
4. Tee ES, Khor SC, Ooi HE, Young SI, Zakiyah O, Zulkafli H. Regional study of nutritional status of urban primary school children. Fd Nutr Bull 2002; 33: 41–47.
5. Khor GL, Tee ES. Nutritional assessment of rural villages and estates in Peninsular Malaysia. II. Nutritional status of children aged 18 years and below. Mal J Nutr 1997; 3: 21–47.
6. Ge KY, Zhai FY, Du SF, Chang SY, He YN, Hao HF. The Dietary and Nutritional Status of Chinese Population – Children and Adolescents, Vol. 2. Beijing, China: People's Medical Publishing House, 1999.
7. Chen CM. Executive summary of food and nutrition surveillance in 1998 and policy recommendation. J Hygiene Res 2000; 29: 308–347.
8. Ge KY, Fu DW. The magnitude and trends of under- and over-nutrition in Asian countries. Biomed Environ Sci 2001; 14: 53–60.
9. Department of Health. The Fourth National Nutrition Survey of Thailand, 1995. Bangkok: Ministry of Public Health, 1995.
10. Ha HK, Nguyen CK, Le DT, Tu N, Tran TX. 1999 Vietnam Child Nutrition Situation. Hanoi: Medical Publishing House, 2000.
11. Phimmasone K, Akkhavong S, Oudom M, Fauveau V, Depaepe A, Pholsena P. Women and children in the Lao DPR: Results from the Lao Social Indicator Survey. Lao: Mother and Child Health Institute, Ministry of Public Health, 1994.
12. Barba CVC. Compilation of national nutrition surveys in the Philippines: comprising data from the 1989–90 update, 1992 update, 4th national survey in 1993, 1996 update and the 1998 update. Manila, Philippines: Food and Nutrition. Research Institute, 2002.
13. Lim TO, Goh BL, Zaki M, Suleiman AB, Fatimah S, Siti S, Tahir A, Maimunah AH. Distribution of body weight, height and body mass index in a national sample of Malaysian adults. Med J Mal 2000; 55: 108–128.
14. Tee ES. Nutrition of Malaysians: where are we heading? Malays J Nutr 1999; 5: 87–109.

15. Khor GL, Azmi MY, Tee ES, Kandiah M, Huang MSL. Prevalence of overweight among Malaysian adults from rural communities. Asia Pac J Clin Nutr 1999; 8: 272–279.
16. Sakamoto M, Ishii S, Kashiwazaki H, Chiu PC, Chen CM, Chang NS, Leung SF, Rabuco LB, Tee ES, Winarno FG, Tontisirin K, Howden J, Saldanha LG. A collaborative study of nutritional knowledge, attitude and food practices among urban adults in the Asian region. In: 2nd International Workshop on Nutritional Problems and Strategies in the Asian Region. 29–30 September 1997, Kuala Lumpur.
17. Epidemiology and Disease Control Department. National Health Survey 1998. Singapore: Ministry of Health Singapore. 1999.
18. Yoshiike N, Kaneda F. What are reasonable and effective population approaches to combat an increasing trend of overweight in Japan ? ILSI Symposium and Workshop on Forging Effective Strategies for Prevention and Management of Overweight and Obesity in Asia. Singapore, 22–24 April 2002.
19. Villavieja GM, Constantino AS, Laña RD, Nones CA, España N, Pine CR. Anthropometric assessment of adolescents, adults, pregnant and lactating women: Philippines, 1998: Reports of the Fifth National Nutrition Survey 1998 (Part 1). Food and Nutrition Research Institute, Department of Science and Technology. Philippines J of Nutr 2001; 48: 15–27.
20. Inue S. Criteria for obesity in Japan and Asia-Oceania and causes of obesity in Japan. ILSI Symposium and Workshop on Forging Effective Strategies for Prevention and Management of Overweight and Obesity in Asia. Singapore: 22–24 April 2002.
21. Wu YF. The appropriate cutoff points of BMI and waist circumference for identifying obesity and overweight in Chinese adults: a pooling analysis of a cross-sectional sample of 240,000 adults and a follow-up cohort of 76,227 adults. ILSI Symposium and Workshop on Forging Effective Strategies for Prevention and Management of Overweight and Obesity in Asia. Singapore: 22–24 April 2002.