

Adolescent Nutrition:

A Review of the Situation in Selected South-East Asian Countries



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Executive Summary

Approximately 20% of the population of the WHO South-East-Asia (SEAR), consists of adolescents. The foundation of adequate growth and development is laid before birth, during childhood, and is followed during adolescence. Adolescents are the future generation of any country and their nutritional needs are critical for the well being of society. In SEAR, a large number of adolescents suffer from chronic malnutrition and anaemia, which adversely impacts their health and development. The high rate of malnutrition in girls not only contributes to increased morbidity and mortality associated with pregnancy and delivery, but also to increased risk of delivering low birth-weight babies. This contributes to the intergenerational cycle of malnutrition.

In most developing countries, nutrition initiatives have been focusing on children and women, thus neglecting adolescents. Addressing the nutrition needs of adolescents could be an important step towards breaking the vicious cycle of intergenerational malnutrition, chronic diseases and poverty. Epidemiological evidence from both the developed and developing countries indicates that there is a link between foetal under-nutrition and increased risk of various chronic diseases during adulthood.

A review of the nutritional status of adolescents in Member Countries of WHO's South-East Asia Region has been undertaken to identify the nutritional problems and to suggest relevant strategic interventions for policy makers. This review can be used to identify research gaps and serve as a guide to researchers for undertaking research in priority areas to generate evidence for strategic interventions.

Very few studies that provided data on nutritional status of adolescents in the Region were available. Available literature on adolescent population

(sex-wise) covering literacy rate; average age at marriage; median age at first pregnancy; pregnancy outcomes; nutrients and micronutrients consumption and deficiency and anthropometric data among numerous other parameters were studied. These were obtained from demographic survey reports, national health surveys, conference proceedings, technical reports and other published and unpublished scientific papers.

Demographic profile: Adolescents constitute about 20% of the total population in countries of the Region with the exception of Sri Lanka and Thailand where they comprise about 17% of the population. In all countries, male adolescents outnumber female adolescents. The illiteracy rate is high among adolescents in Bangladesh, Bhutan, India and Nepal, especially in girls. A majority of older adolescents are not in school. Rural adolescents are more likely to work and less likely to study than their urban counterparts.

Nutritional status: Growth during adolescence is faster than at any other time in an individual's life except the first year. Good nutrition during adolescence is critical to cover the deficits suffered during childhood and should include nutrients required to meet the demands of physical and cognitive growth and development, provide adequate stores of energy for illnesses and pregnancy, and prevent adult onset of nutrition-related diseases.

A large percentage of adolescents in the Region suffer from nutritional deficiencies. Dietary intake with respect to adequate availability of food in terms of quantity and quality (particularly, the mean caloric intake), ability to digest, absorb and utilize food and the social discriminations against girls can greatly affect the adequate nutrition of adolescents. Studies in India and Bangladesh have shown deficiencies in the intake of all nutrients, particularly iron, calcium, vitamin A and vitamin C. The reported reasons are mainly the low educational level of parents and low family income.

Studies conducted in different countries in the Region, reveal that nutritional deprivation affects almost all growth parameters and final adult body size resulting in thinness and stunting. However, nutritional status of both boys and girls improved with age, showing that the effect of malnutrition is more pronounced at the time of peak growth.

Obesity amongst adolescents is responsible for carrying weight-related risks like cardiovascular diseases into adulthood. An Indian study has shown

that obese adolescents are more likely to develop hypertension later in life as compared to their leaner counterparts. According to a Thai study, over-consumption of calories, especially fast food, snacks and soft drinks were contributing factors resulting in obesity and female adolescents were more prone to this as compared to males.

Anaemia has a serious negative impact on growth and development during adolescence. A high rate of iron deficiency anaemia is reported among adolescents in the Region. There is, however, a great disparity within the Region. There are disparities between rural and urban areas as well as in school going and non-school going adolescents. It was also observed that socio-economic status determined the occurrence of anaemia among adolescents. Boys are as much prone to anaemia as girls in some countries. Irrespective of the severity, the prevalence of anaemia ranges between 12-100% in the Region. There is clear evidence of an association between plasma-serum levels of vitamin A and haemoglobin levels. Studies conducted in different settings in Bangladesh showed a high prevalence of sub-clinical vitamin A deficiency among adolescents.

Early pregnancy among adolescents poses major risks, not only for the girl but for the child too. Adolescent mothers bear a double burden: one involving their own growth and development, and another involving the intra-uterine growth and development of their offspring. Greater risk of anaemia and other nutritional deficiencies can have negative effects on the outcome of the pregnancy as well as on the growth and development of adolescents themselves. Poor pregnancy outcomes are more often observed in pregnant adolescents who have poor nutritional and low socio-economic status. Due to the high rate of adolescent marriage in some countries of the Region, pregnancy during adolescence is still common. Adolescent fertility rates were high in Bangladesh, Bhutan, India and Nepal. Not many studies have been done on the nutritional status of pregnant adolescents and its effect on pregnancy outcome. The limited studies carried out in Nepal and India showed a high prevalence of malnutrition among pregnant adolescents.

Programmes addressing adolescent nutrition in this Region are very few and are undertaken on a small and experimental basis. They are mainly aimed at the prevention and control of anaemia among adolescents.

Strategies for improving adolescent nutrition: To respond to the diverse needs of adolescents, different interventions are needed in different



countries. There is an acute scarcity of programmes targeted at adolescents in the Region. The major underlying reason for the widespread lack of policies and programmes for improving health and nutritional status of adolescents in the Region is a lack of age and sex-disaggregated data on health and nutritional status of adolescents at the national level. Scarcity of trained health providers and adolescent-friendly health centres to deal with the special needs of adolescents are important reasons for the neglect of adolescents in public health programmes.

The main strategies suggested for improving adolescent nutrition include: food-based strategies like dietary diversification and food fortification, for ensuring adequate nutrition at household level; addressing behaviour modification to bring about dietary change in adolescents. This can be achieved through school-based nutrition interventions, using a social marketing approach, behaviour change through communication and mobilizing families and communities; control of micronutrient deficiencies; regular nutrition assessment and counselling of adolescents; care of adolescents during pregnancy and postnatal period; intersectoral linkages at community level and building linkages with adolescent friendly health services.

Possible actions at the country level were suggested after the review of nutritional status of adolescents in the Region. Adolescent nutrition can be addressed as part of existing maternal and child nutrition programmes. The health sector should play the major role in integrating adolescent nutrition in other programmes and also mainstream it in other sectors e.g., education, social welfare, food and agriculture, mass media, and the legal sector. The major actions required from the health sector are: developing database regarding health and nutrition of adolescents; designing advocacy material; formulating policy guidelines and strategies to improve adolescent nutrition; developing an integrated and intersectoral approach to address nutritional problems of adolescents; development of adolescent-friendly health centres catering to the holistic needs of adolescents; mainstreaming adolescent nutrition in the health systems and reaching the unreached out-of-school adolescents with nutrition interventions. Need for equipping the service providers with knowledge, skills, particularly counselling and communication skills, and developing appropriate training methodologies and tools for training were also been highlighted.



It is imperative that an adolescent health and development strategy is put in place at the national level with adolescent nutrition as an important component.

Actions at the regional level: The UN and other international and donor agencies working at the regional level should increase commitment and advocacy for improving adolescent nutrition, share knowledge and information with the countries in the Region, build capacity of providers, support and encourage research and provide support to Member Countries for developing locally defined anthropometric cut-offs.

Closing the gaps, both in research and in action, would benefit society as a whole, resulting in improved health and nutrition of adolescents and help in harnessing their full physical and mental potential for overall improvement of the populations and economies.





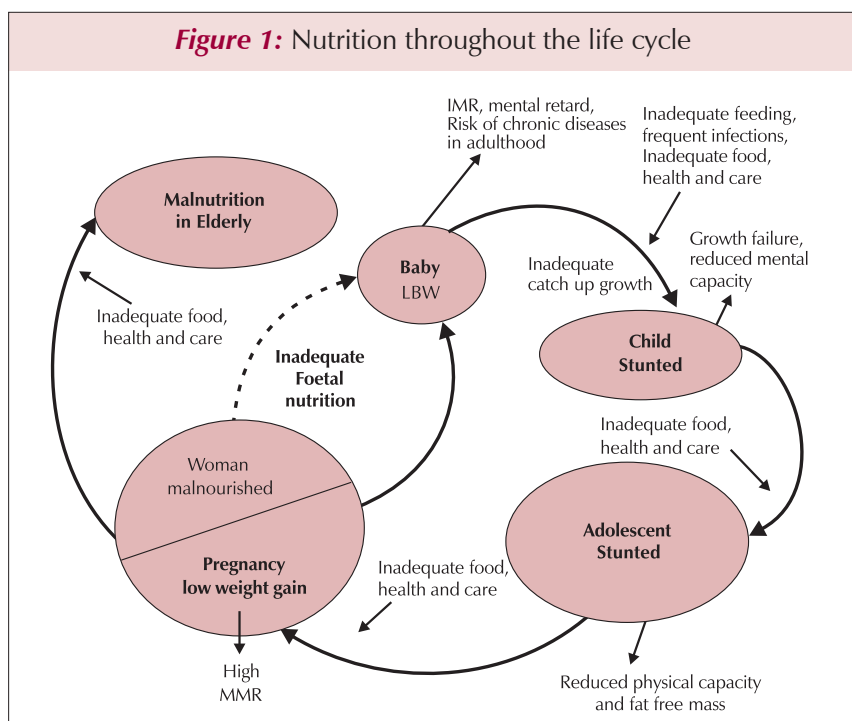
Abbreviations

ACC/SCN	Administrative Committee on Coordination/Sub Committee on Nutrition
CBR	Crude Birth Rate
CDC	Centers for Disease Control and Prevention (USA)
CDR	Crude Death Rate
ICDS	Integrated Child Development Services Scheme
ICMR	Indian Council of Medical Research
IFA	Iron and folic acid
IEC	Information, Education and Communication
NHANES	National Health and Nutrition Examination Survey
NIN	National Institute of Nutrition (Hyderabad, India)
NNMB	National Nutrition Monitoring Bureau
RDA	Recommended Dietary Allowance
SEAR	South-East Asia Region
UNICEF	United Nation's Children Fund
WHO	World Health Organization



Introduction

Poor nutrition starts before birth, and generally continues into adolescence and adult life and can span generations. Chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood, and when pregnant, are more likely to deliver low birth-weight babies. Epidemiological evidence from both developing and industrialized countries now suggests a link between foetal under-nutrition and increased risk of various adult chronic diseases (ACC/SCN, 2000). Nutrition challenges continue throughout the life cycle, particularly for girls and women (Fig. 1).



Source: ACC/SCN, 2000



It is thus imperative to prevent malnutrition at every stage of the life cycle. Investing in nutrition throughout the life cycle will have both short-term and long-term benefits of economic and social significance, including large savings in health care costs, increased educability and intellectual capacity, and increased adult productivity (ACC/SCN, 2000). So far, most of the interventions have either focused on children aged 0-5 years or on pregnant women, and, to some extent on lactating women. However, not much attention has been paid to adolescents by nutrition-related programmes in developing countries. WHO defines adolescence as the segment of life between the ages of 10-19 years. Adolescents are an in-between group, with some nutrition problem commonalities with children and some with adults. In addition, there are adolescent-specific issues that call for specific strategies and interventions.

If adolescents are well nourished, they can make optimal use of their skills, talents and energies today, and be healthy and responsible citizens and parents of healthy babies tomorrow. To accomplish such a task, and in order to break the intergenerational cycle of malnutrition, a special focus for overcoming adolescent malnutrition is needed.

This task can be accomplished if a special focus is given to overcome malnutrition in adolescents and break the intergenerational cycle of malnutrition. As a first step, a review of the nutritional status of adolescents living in the South-East Asia Region has been prepared to:

- Identify the nutrition problems and risks faced by adolescents.
- Highlight the nutrition problems and risks that can be best managed during adolescence, and therefore call for targeted action.
- Identify and suggest strategic approaches to address these nutritional problems.



2 Methodology

The review of the nutritional status of adolescents and related parameters was undertaken in 10 countries of the South-East Asia Region, namely; Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka and Thailand. Efforts were made to collect the demographic and malnutrition data from these 10 countries. Data from Timor-Leste was not available at the time of the review.

The demographic data were:

Sex-wise population of adolescents, literacy rate, average age of marriage of girls, median age at first pregnancy,

The nutrition data comprised:

Average food and nutrient consumption by adolescents, anthropometric measurements, percentage of stunted, thin and obese adolescents, percentage of adolescents having mild, moderate, and severe anaemia, prevalence of IDD, vitamin A and calcium deficiency, and ongoing programmes/interventions for adolescents.

Data was collected through:

- WHO country offices in the countries mentioned above and their nutrition focal points in the MH (Ministry of Health)
- Electronic databases namely,
 - Medline, conference papers index, dissertation abstracts online, and the sites of FAO, UNICEF, WHO, World Bank, UNFPA and UNESCO.
 - A search of on-line, web-based documents using 'Google' and 'Altavista' search engines.

- Demographic survey reports, national health surveys, conference proceedings, technical reports and other unpublished documents.
- Journals that publish papers on nutrition (1983 to 2002).
- Presentations at regional meetings organized by the Regional Office for South-East Asia, on the improvement of nutritional status of adolescents, held from 17-19 September 2002 in India. Information from presentations made by participants from Member Countries of the Region is also included in the review.

Quality assessment of studies

As very few studies are available that provided data on nutritional status of adolescents in countries of the Region, data from all the studies have been included without using strict quality assessment.



General Information About Adolescents in the South-East Asia Region

The WHO South-East Asia Region comprises 11 countries - Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, and Timor-Leste which joined the Region after the review was compiled. The Region is characterized by great diversity, not only in the size and physical features of the countries, but also in their demographic and socioeconomic characteristics.

The adolescent population constitutes about 18-25% of the total population in eight countries of the Region (Table 1). Bhutan and Maldives have the highest proportion of adolescents among all countries. A common feature is that the male adolescents outnumber female adolescents.

Table 1: Adolescent population in countries of the South-East Asia Region

Country	10-14 years				15-19 years				Total (%)
	Male		Female		Male		Female		
	(thousands)	(%)	(thousands)	(%)	(thousands)	(%)	(thousands)	(%)	
Bangladesh	9252	6.0	8785	5.8	8431	5.5	7964	5.2	22.5
Bhutan	149	6.2	143	6.0	136	5.7	131	5.5	23.4
DPRK	N.A.		N.A.		N.A.		N.A.		N.A.
India	59526	5.4	55451	5.1	56672	5.2	52563	4.8	20.5
Indonesia	10965	4.9	10610	4.7	11012	4.9	10697	4.7	19.2
Maldives	21	6.2	20	5.9	20	5.9	19	5.6	23.6
Myanmar	2670	5.3	2620	5.2	2493	4.9	2463	4.9	20.3
Nepal	1629	6.2	1518	5.8	1454	5.5	1347	5.1	22.6
Sri Lanka	819	4.2	795	4.1	852	4.4	825	4.2	17..0
Thailand	2677	4.2	2620	4.1	2745	4.3	2702	4.2	16.8

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2002 Revision and World Urbanization Prospects: The 2001 Revision*

Apparently, this is the natural outcome of the prevalent gender discrimination that starts before birth in these countries, and due to the higher female mortality rates. It is also apparent from the data that there are more younger adolescents except in Indonesia and Thailand than the older ones. This may be attributed to the fact that the crude death rate (CDR) is falling faster than the crude birth rate (CBR) in these countries. More and more young people are being added to the population, making it imperative that the government and other agencies in South-East Asian countries start focusing on the needs of adolescents who are still in an active phase of growth and development and who will soon join the productive work force of their respective countries.

3.1 Education

The World Bank's World Development Report (*Investing in Health*, 1993), emphasized the need to foster an environment that enables individuals and households to improve their health. It suggested expanding investment in education, particularly with regard to access to education by girls. The report provides strong evidence to indicate that capacity of individuals (particularly mothers) to use the information and financial resources to shape their dietary, health care, fertility and other lifestyle choices has a powerful influence on the health of individuals and household members. Achieving literacy is seen as central to achieving economic and social development, as well as improved health and nutrition.

Educated girls are more productive, healthier, have high self-esteem, and have better decision-making and negotiating skills. There is consistent evidence to show that an increase in the number of years of schooling for girls is almost always associated with an increase in the age at marriage (LeVine et al., 1991). The Educated girls also tend to delay their first pregnancy (which usually means they will have a safer pregnancy). Education of girls and women also contributes to child survival (Cochrane et al., 1982). Child mortality has been found to decline with higher levels of maternal education. It is therefore important that greater emphasis be laid on the education of girls for their and their family's well being.

There is lot of considerable disparity in the educational levels of adolescents in countries of the Region (Table 2). The illiteracy rate is high among adolescents in Bangladesh, Bhutan, India and Nepal, especially



Table 2: *Education of adolescents*

Country	Percent of adolescents aged 15-19 who are illiterate		Literacy rate (age 15+) (%)		Primary school enrolment, 2000, % of school-age adolescents enrolled		Secondary school enrolment, 1993-1997, % of school-age adolescents enrolled	
	F	M	F	M	F	M	F	M
Bangladesh	71	58	30	52	NA	NA	13	25
Bhutan	NA	NA	34	61	22	19	NA	NA
DPR Korea	NA	NA	NA	NA	NA	NA	NA	NA
India	44	20	45	68	109	92	39	59
Indonesia	3	2	82	92	110	106	48	55
Maldives			96	96	133	134	71	67
Myanmar	18	12	81	89	91	91	30	29
Nepal	51	26	24	59	140	112	33	51
Sri Lanka	10	9	89	94	—	—	78	72
Thailand	2	1	94	97	96	91	37	38

Source: Population Reference Bureau (2000) *The World Youth 2000*. Washington, DC, Population Reference Bureau, Measure Communication.

among girls. As many as 71% of adolescents girls in Bangladesh, 51% in Nepal and 44% in India are illiterate. However, the percentage of literate boys is also not very high in these countries. The table also shows that enrolment in the secondary schools is low except in Sri Lanka and Maldives. There are also gender differences particularly in Bangladesh, where the secondary enrolment ratio for boys is nearly double those for girls.

A majority of older adolescents in the Region do not attend school, except in Sri Lanka (Table 2). Some are unemployed, while others work for pay or work without remuneration in households, family farms and businesses. Surveys show that labour force participation rates are relatively high, both among older adolescents aged 15-19 and among younger adolescents aged 10-14 (Table 3). Adolescents in rural areas are more likely to work and less likely to study than their urban counterparts. Caution in interpreting sex-specific figures is advised since surveys can underestimate



Table 3: Labour force participation rates of adolescents by sex and age group

Country and year	Females (%)		Males (%)	
	Aged 10-14	Aged 15-19	Aged 10-14	Aged 15-19
Bangladesh (1995-96)*	28.1	47.8	37.8	65.5
India (1991)*	5.1+	26.2	5.7+	43.8
Indonesia (1999)*	NA	90.6	NA	45.5
Nepal (1991)*	28.0	49.0	18.1	49.2
Sri Lanka (1999)**	3.1	21.2	3.3	35.8
Thailand (1999)**	8.3++	29.1	9.0++	37.7

Sources:

* International Labour Organization (1998) *Year Book of Labour Statistics 1998* Geneva, ILO

** International Labour Organization (1999) *Year Book of Labour Statistics 1999* Geneva, ILO

+Aged 5-14, ++Aged 13-14

girls' contributions to household labour and, consequently, their economic activity (Jejeebhoy, 1993).

3.2 Mortality Levels

Adolescence is generally a period of life free from both childhood diseases and the ravages of ageing. Thus, as in other regions, mortality rates among adolescents in this Region are generally lower than those observed at younger and older ages. Data on mortality rates of adolescents by sex and age group was available for five countries, Bangladesh, India, Nepal, Sri Lanka and Thailand. An examination of age-specific mortality rates by sex reveals interesting differences across countries of the Region (Table 4). In Bangladesh and India, mortality rates for females were higher than males in the older age group i.e. in the reproductive years. However, in India the pattern remained the same in the younger age group as well. In Sri Lanka and Thailand, mortality rates for females were less than or equal to that for males in both age groups.



Table 4: Age-specific mortality rates of adolescents by sex and age group

Country and year	Females (%)		Males (%)	
	Aged 10-14	Aged 15-19	Aged 10-14	Aged 15-19
Bangladesh (1986)	1.1	2.3	1.7	2.0
India (1997-98)	1.4	2.5	1.0	1.8
Nepal (1986-87)	6.6+	4.1++	4.3++	N.A.
Sri Lanka (1995)	0.4	0.9	0.5	1.7
Thailand (1997)	0.3	0.6	0.5	2.1

+Aged 5-14, ++ Aged 15-24, further breakdown not available

Sources:

Bangladesh: United Nations (1997) *Demographic Yearbook 1995* New York, United Nations (ST/ESA/STAT/SER. R/26)

Sri Lanka, Thailand: United Nations (2000) *Demographic Yearbook 1998* New York, United Nations (ST/ESA/STAT/SER. R/29)

India: International Institute for Population Sciences (2000) *NFHS-2 1998-99: India*. Mumbai, International Institute of Population Sciences

Nepal: Central Bureau of Statistics, Nepal (1995) *Population Monograph of Nepal*. Kathmandu, Government of Nepal





4

Nutritional Status of the Population in SEAR Countries

The foundation of adequate growth and development is laid before birth and during childhood and may persist in adolescence. The next generation also gets affected when malnourished girls become mothers during adolescence or later in adulthood. Table 5 shows the indicators of major nutritional problems, which are of public health importance in the Region: low birth weight, protein energy malnutrition, chronic energy deficiency in adults and deficiencies of iron and vitamin A.

As evident from the data, a large percentage of the vulnerable population in these countries is affected by these deficiencies. The incidence of *low birth weight (LBW)*, which reflects intrauterine growth retardation, is high among the babies born reportedly to undernourished mothers of this Region. The incidence ranges from 7-50% Surveys carried out in some countries of the Region revealed that 15-47% of women suffer from chronic energy deficiency [Body mass Index (BMI) <18.5].

The prevalence of *protein energy malnutrition (PEM)* is high in most countries of the Region. All countries have a very large number of undernourished (underweight and stunted) preschool children.

Iron deficiency and anaemia have profound negative effects. The condition has a prevalence rate of 74% in Bangladesh to 13% in Thailand among pregnant women. It is the major cause of maternal morbidity and mortality. The prevalence of iron deficiency anaemia is worse in case of children less than five years of age. Given this situation, a large proportion of children, especially girls, entering adolescence may already be highly anaemic and without iron supplementation during childhood and/or adolescence, are at serious risk of morbidity and mortality from pregnancy-related causes.



Table 5: *Nutritional status of the population in SEAR countries*

Country	Year	% of LBW babies	% of children <5 yrs under-weight and stunted (wt/age and ht/age respectively)		% of women with BMI <18.5	Prevalence (%) of anaemia		Vitamin A deficiency in children <5 yrs##
			Wt/age	Ht/age		Pregnant women	Children <5 yrs	
Bangladesh	1993-95	50	47.7**	44.7**	47.0**	74	73	0.78
Bhutan	1995	16	38.0	54.0	13.8	68	58	Not reported
India*	1998-99	23	47.0	45.5	35.8	51.8	74.3 (6-35 m old)	0.70
Indonesia	1995	11	36.0	38.0	35.5	51	40.5	0.3
Maldives	1995	20	38.0	30.1	21	68	81.5	Not reported
Myanmar	1995	23	44.0	42.0	—	52	48	0.38
Nepal	1996	33	47.0	63.0	—	68	79	0.84
Sri Lanka	1995	18	40.0	25.0	—	40	45	0.6
Thailand	1995	7.2	1.8*** 18	Not reported	15-25	13.4	15	Reported none

* NFHS II, India

** BDHS, Bangladesh 1999-2000

Bitot spots > 0.5%, night blindness > 1.0%, corneal xerosis > 0.01%, and corneal scars > 0.05%

*** Using the Thai standard

Source: WHO Global database, 1997 HFA Country reports



5

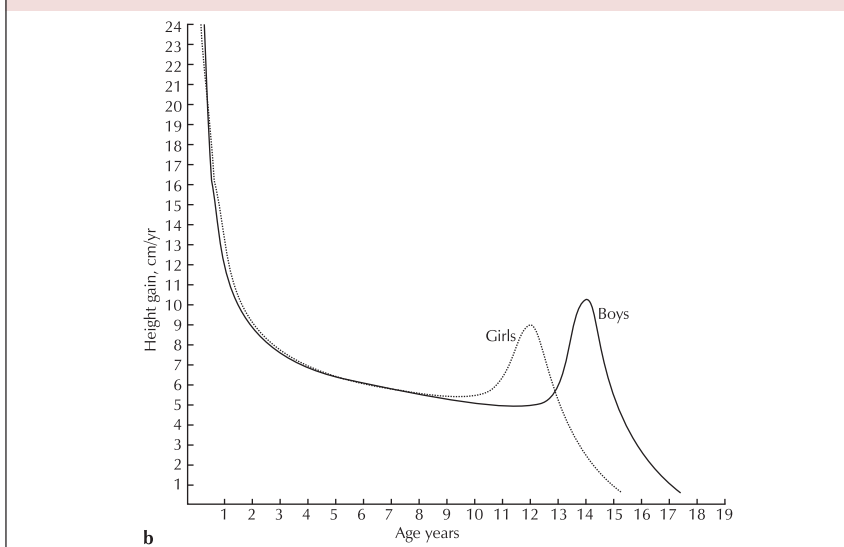
Nutritional Needs During Adolescence

In adolescence, a second period of rapid growth may serve as a window of opportunity for compensating for early childhood growth failure, although the potential for significant catch-up is limited. Adult size, measured by height and weight, also reflects an entire range of physiological measurements that determine work capacity, safety, ease of childbirth and decreased obstetric risk to mother and decreased incidence of low birth weight. Survival itself, for both mother and child is affected by maternal body size. Research evidence suggests that optimal nutrition during the brief period of pre-pubertal growth spurt, some 18 to 24 months immediately preceding menarche, results in catch- up growth from nutritional deficits suffered earlier in life (Spear, 2002).

During adolescence, the relatively uniform growth of childhood is suddenly altered by an increase in the velocity of growth (Fig. 2). The graph shows the height attained and velocity curves of a boy and a girl. Growth is faster than at any other time in the individual's life except the first year (Brasel, 1982). Over 80% of adolescent growth (attained weight and height) is completed in early adolescence (10-15 years), with a marked deceleration in weight and height velocity in the post-pubertal phase (Srikantia, 1989). This adolescent growth spurt is also associated with cognitive, emotional and hormonal changes. An important feature is the great variability that exists in the timing and magnitude of the growth spurt both between genders and among individuals (Tanner and Davis 1985, Tanner 1987). The girl begins her adolescent growth spurt at an average of about 10 years and grows at peak velocity at about 12 years. These ages vary from country to country, being lowest in developed countries and highest in poorest countries. The boy starts his adolescent growth spurt around 12 years of age and in a year or two overtakes the girl. The girl



Figure 2: Velocity curve for height in boys and girls, from birth to 18 years



Source: Tanner, 1962

attains her adult height at about 16 years, the boy at 18 years. Adolescents of a given chronological age usually vary widely in physiological development. Because of this variability among individuals, age is a poor indicator of physiological maturity and nutrition needs (Spear, 2002).

The hormones mediating the pubertal growth spurt are sex steroids and growth hormone, which are modulated to a great extent by nutritional factors. All these changes create special nutrition needs. The requirement of some of the nutrients is as high as, or higher in adolescents than in any other age groups (WHO, 2000), and therefore many micronutrients, including vitamin A, thiamine, riboflavin, niacin, folic acid, vitamin B 12, vitamin C, and iodine, reach levels required by adults (For RDAs see Annex 2).

Adolescence is considered as a nutritionally critical period of life for several reasons.

- Firstly, the dramatic increase in physical growth and development puts greater pressure on the need for nutrients. During this period, adolescents will experience a weight gain equivalent to 65% of their weight at the beginning of the period or 40% of their final weight, and a height gain equivalent to 15% of their adult height (Brasel, 1982).



- Secondly, there may be socio-cultural factors or change of life-style and food habits of adolescents that can affect both nutrient intake and needs (Spear, 2002).
- Thirdly, growing adolescents have increased nutrient requirements during pregnancy and illness (Scholl et al., 1994, Story et al., 1999).
- Fourth, adolescence can be the second opportunity to catch up growth if environmental conditions, especially in terms of nutrient intake are favourable (Gopalan, 1989).
- Finally, psychological changes and development of their own personality can impact on their dietary habits during a phase when they are very influence-able.

The box shows the major changes in height, weight and body composition during adolescence.

Adolescence can be the second opportunity to catch up growth if environmental conditions, especially in terms of nutrient intake, are favourable (Gopalan, 1989).

5.1 Are Nutritional Needs of Boys and Girls the Same?

The nutritional needs of males and females of the same age differ little in childhood but diverge after the onset of the pubertal growth spurt. After puberty, the differences in nutrient needs persist (Table 6). The reason for the sex differences in nutrient recommendations after the age of 10 include earlier maturation of females (protein requirements of 11-14 year old girls are higher than the boys of the same age group but are much less for 15-18 year old girls as compared to their male counterparts), and variations in physiological needs for some nutrients by sex e.g., difference in the requirement of iron. Besides differences in height and weight, boys gain proportionately more muscle mass than fat as compared to girls. They experience increased linear growth to produce a heavier skeleton and develop greater red blood cell mass than girls. Girls on the other hand have more fat than muscle tissues. These differences in body composition have important implications for nutritional needs of male and female adolescents as shown in Table 6.

Changes in height, weight and body composition during adolescence

The time and tempo of changes in height, weight and body composition can vary greatly between and among adolescents.

Changes in height

- 15-20% of adult height is gained during adolescence.
- Growth spurt starts later in boys than girls and has a higher peak velocity than in girls. Linear growth can be slowed or delayed in adolescence if diet is severely restricted in energy or energy expenditure is increased as in highly competitive athletes.

Changes in weight

- 25-50% of final adult ideal weight is gained during adolescence.
- The timing and amount of weight gain can be greatly affected by energy intake and energy expenditure.

Changes in body composition and skeletal mass

- In the pre-pubertal period the proportion of fat and muscle in boys and girls is similar, and lean body mass is equal in both sexes.
- Growing boys gain proportionately more muscle mass than fat, and more lean body mass as compared to girls.
- As adults the normal percentage of body fat is about 23% for women and 15% for men.
- Approximately 45% of skeletal mass is added during adolescence. By the end of the second decade of life, 90% of total bone mass is gained.
- Females with delayed puberty fail to gain bone mass at a normal rate and show lower mineral density as adults. Nutrition is one of the environmental factors that determines onset of puberty.
- The pubertal growth can be monitored by using height-for-age, weight-for-age and body mass index (BMI)-for-age (weight/height²).



Table 6: Recommended dietary allowances (RDA) for selected nutrients during adolescence

Nutrients	Female		Male	
	11-14 yr	15-18 yr	11-14 yr	15-18 yr
Energy (kcal)	2200	2200	2500	3000
Protein (g)	46	44	45	59
Iron (mg)	15	15	12	12
Calcium (mg)	1200	1200	1200	1200
Zinc(mg)	12	12	15	15
Vitamin A (µg RE)	800	1000	800	1000
Vitamin D (µg)	10	10	10	10
Vitamin C (mg)	50	60	50	60
Folic acid (mcg)	150	180	150	200

Source: Food and Nutrition Board, National Academy of Science National Research Council, Recommended Dietary Allowances, 10th ed, Washington DC (1989)

Nutrition during adolescence should meet the following objectives:

- Provide the necessary nutrients to meet the demands of physical and cognitive growth and development.
- Provide adequate stores for illness or pregnancy.
- Prevent adult onset of diseases related to nutrition e.g., cardiovascular diseases, diabetes, osteoporosis and cancer
- Encourage healthy eating habits and lifestyle.

5.2 Energy and Protein Requirements

Adolescence is an important time for gains in height as well as weight. While both muscle and fat increase, girls gain relatively more fat, and boys gain relatively more muscle. Thus, the requirement of energy as well as proteins increases considerably during this period. Energy and protein needs correlate more closely with the growth pattern than with the chronological age (Spear, 2002). The peak in energy and protein requirements coincides

with the peak in growth of adolescents. Actual needs also vary with physical activity. Therefore, monitoring weight and height and body mass index [BMI (weight/height²)] is essential to determine the adequacy of energy intake for individual adolescents. Generally, the requirement of protein is met even in economically disadvantaged populations if caloric intake is sufficient. However, if energy intake is limited, dietary protein may be used to meet energy needs and be unavailable for synthesis of new tissues or for tissue repair. This may result in reduction of growth rate and muscle mass despite an apparent adequate protein intake (Spear, 2002).

5.3 Mineral and Micronutrient Requirements

Minerals play a crucial role in adolescent nutrition. Adolescents, at the peak of their growth velocity, require large quantities of nutrients. The increment in skeletal mass, body size and body density, associated with pubescence, highlights the role of minerals in the growth process (Daniel, 1977). The role of iron, calcium, iodine and zinc in the growth and nutrition of adolescents is explained briefly below.

Iron requirements

Iron requirements peak during adolescence due to rapid growth with sharp increase in lean body mass, blood volume and red cell mass which increases iron needs for myoglobin in muscles and haemoglobin in blood (Beard, 2000). In boys, there is a sharp increase in the iron requirements from approximately 10 to 15 mg/day. After the growth spurt and sexual maturation, there is a rapid decrease in growth spurt and need for iron (Dallman, 1989). As a result, there is an opportunity to recover from an iron deficiency that might have developed during this peak growth. In girls, however, the growth spurt is not as great, but menstruation typically starts about one year after peak growth and some iron is lost during menstruation. The mean requirement for iron reaches a maximum of approximately 15 mg/day at peak growth but settles to approximately 13 to 15 mg/day because of the need to replace menstrual iron losses (Strasburger and Brown, 1991).

Iron requirements in adolescence are greater in developing countries because of infectious diseases and parasitic infections that can cause iron loss, and because of low bio-availability of iron from diets. (Brabin and Brabin, 1992).



Other benefits of iron for adolescents: Iron helps in improving cognition which leads to better academic performance that may be an incentive for girls to remain in school (Bruner et al., 1996).

Calcium requirements

Dietary calcium has been identified as a nutrient of great potential concern for adolescents (Haddad and Johnston, 1999). The adolescent years are a window of opportunity to influence lifelong bone health. Because of the accelerated muscular, skeletal and endocrine development, calcium needs are greater during puberty and adolescence than in any other population age group except pregnant women (Spear, 2002). At the peak of the growth spurt, the daily deposition of calcium can be twice that of the average between 10 to 20 years. In fact, 45% of the skeletal mass is added during adolescence (Spear 2002, Sentipal et al., 1991). By the end of the second decade of life, 90-95% of the total body peak bone mass is attained (Cadogan et al., 1997). Bone mineral content must be maximized during puberty to prevent osteoporosis (risk of fracture in later life) (Lytle, 2002). Low calcium intake in early life may account for as much as 50% of the difference in hip fracture rates in postmenopausal years (Matkovic et al., 1995). Consumption of calcium rich products with every meal goes a long way towards ensuring that requirements are met for calcium and many other nutrients e.g., phosphorus, magnesium and vitamin D needed for bone health (Weaver et al., 1999, Weaver, 2000).

Zinc requirements

Zinc is known to be essential for growth and sexual maturation during puberty. It enhances bone formation and inhibits bone loss. Limited intake of zinc-containing foods may affect physical growth as well as development of secondary sex characteristics (Thompson, 1986).

Iodine requirements

Iodine is important during adolescence for two reasons. These are the high growth velocity of adolescents, and the increased iodine requirements during pregnancy. As a large percentage of adolescent girls get married early and bear children during adolescence, their requirements for iodine increase to provide for their own growth as well as for the needs of the

foetus. Severe iodine deficiency in children results in learning disability and lowered achievement (Tiwari et al., 1996). In fact, even moderate iodine deficiency can lead to loss of 10-13 IQ points. Iodine deficiency during pregnancy has been associated with increased incidence of miscarriages, still births, birth defects and mental retardation, and if severe, may result in cretinism in the offspring (Levander and Whanger 1996).

Other minerals

Although the roles of other minerals in the nutrition of adolescents have not been studied extensively, the importance of magnesium, phosphorus, copper, chromium, cobalt and fluoride is well recognized. The possibility of interactions among these nutrients cannot be overlooked (Spear, 2002).

5.4 Vitamins

The requirements for vitamins are also increased during adolescence. Because of higher energy demands, more thiamine, riboflavin and niacin are necessary for the release of energy from carbohydrates. The increased rate of growth and sexual maturation increases the demand for folic acid and vitamin B-12 (Spear 2002, Haddad and Johnston, 1999). With increasing evidence of the role of folic acid in the prevention of birth defects, all adolescent girls of childbearing age should be encouraged to consume the recommended amount of folic acid from supplements in addition to intake of food folate from varied diet (Food and Nutrition Board, 1998). The Center for Disease Control and Prevention recommend 400 µg of folate for all females of childbearing age (1992). The rapid rate of skeletal growth demands more vitamin D. Vitamins A, C, and E are needed in increased amount for new cell growth. Adolescents' vitamin needs are also associated with the degree of maturity rather than chronological age because of demands of growth.

5.5 Nutrition and Adolescent Pregnancy: Why are Adolescents at Higher Risk?

Early pregnancy not only focus major health risks for the adolescent girl and her child, but also disrupts the physiological, social and intellectual development of young girls. When the adolescent becomes pregnant, her needs for energy and nutrients may be in direct competition with those of



her foetus (Stang, 1999). The risk of anaemia is greater for girls during pregnancy (Jolly et al., 2000; Konje et al., 1993). Recent research has shown that growth during pregnancy does occur in adolescent females and that it can have negative effects on pregnancy outcome if additional dietary and weight gain allowances are not made (Scholl et al., 1994). The risk of LBW and preterm delivery increases among iron-deficient anaemic adolescents (Scholl et al., 1992; Scholl and Hediger, 1994). As pregnant adolescents often receive inadequate antenatal care, their anaemia during labour and the postpartum period may be worse than in older women (WHO, 2003). Severe anaemia is an important cause of maternal mortality among adolescents (Brabin et al., 2001).



Nutritional Issues Among Adolescents

In this section, the nutritional problems of adolescents in South-East Asia are discussed. There is very limited data available in the Region on the nutritional situation of adolescents in general. This review makes an effort to examine the available data and assess the nutrition situation of adolescents.

Inappropriate dietary intakes during adolescence can have several consequences. For example, it can:

- potentially retard physical growth, reduce intellectual capacity and delay sexual maturation, as rapid physical growth creates an increased demand for energy and nutrients (Story M, 1992).
- affect young people's risk for a number of immediate health problems such as iron deficiency, undernutrition, stunting, bone health, eating disorders and obesity (CDC, 1996). It may also affect concentration, learning and school performance in school-going adolescents.
- also have long-term implications. For example, low calcium intake during adolescence is associated with low bone density and an increased risk for osteoporosis later in life; being overweight as an adolescent is associated higher risk for diabetes as an adult; and high fat intake during adolescence and into adulthood is associated with an increased risk of heart disease (CDC, 1996).

Further, stunting and underweight among girls during adolescence, continuing into adulthood, and early pregnancies, increases the obstetric risk for women. Thus, the compromised nutritional status and poor growth in adolescent years affects the reproductive role (Gopalan, 1989).



6.1 Adolescents' Nutrient and Dietary Intake: The Gap

Adolescent growth and development is closely linked to the diet they receive during childhood and adolescence. Adequate nutrition of any individual is determined by two factors (Chen, 1979). The first is the adequate availability of food in terms of quantity as well as quality, which depends on socioeconomic status, food practices, cultural traditions, and allocation of the food. The second factor is the ability to digest, absorb, and utilize the food. This ability can be hampered by infection and by metabolic disorders. Poverty is considered the prime factor determining food consumption; however, some researchers suggest that cultural factors play a stronger role than socioeconomic conditions in determining allocation of food and nutritional adequacy (Sendrowitz, 1995). Even where food resources are adequate, the mean caloric intake of individual family members can fall below requirements. The most vulnerable are children under two, and adolescents (Hamilton et al., 1984). In some countries of the Region, gender discrimination plays an important role in intra-household food allocation. Because of the preference for sons, girls may receive less food and/or food inferior in quality (Chen et al., 1981). In some parts of India, girls' food consumption is limited for the fear that they will grow too rapidly and will have to be given in marriage soon (CHETNA, 1991). An adolescent girl in India may need to observe a series of fasts once or twice a week for getting a good husband, (CHETNA, 1991). Therefore, girls are probably more exposed than boys to inadequate intakes because of social discrimination, dieting or lower energy intake and pregnancy.

The role of education/literacy of adolescents which empowers them to take care of their nutritional needs has been discussed in the General Information section of this document.

Indian study

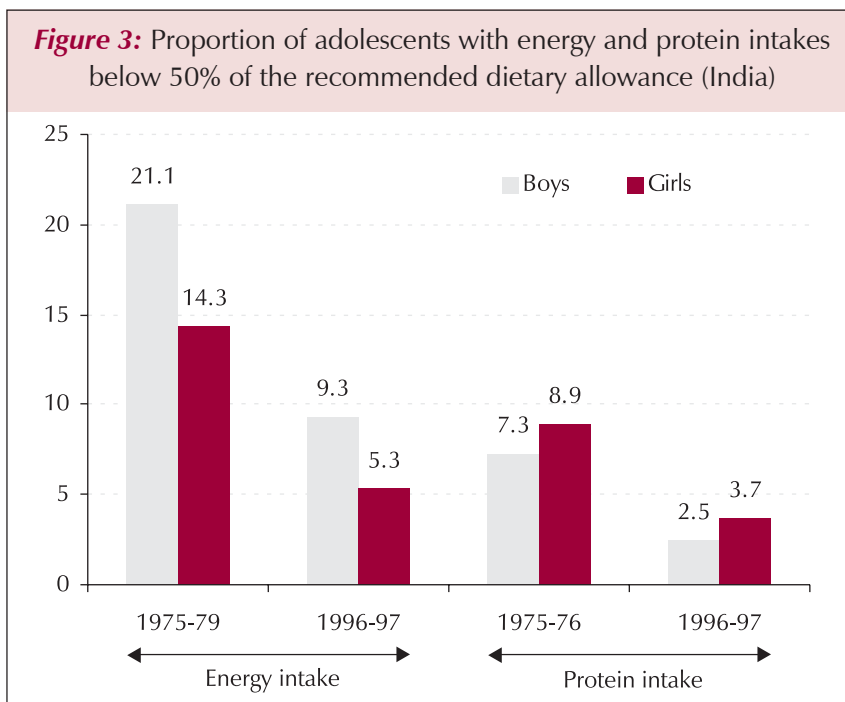
An assessment of the current diet and nutritional status of 12,124 adolescents was carried out in villages of 10 states of India in 1996 by the National Nutrition Monitoring Bureau (NNMB), India, and compared with the data of an earlier survey conducted in 1975-79 in the same villages. The average daily food and nutrient intake of different groups were studied and compared with the recommended dietary intake for Indians (RDI,



1981), whereas the average intake of nutrients was compared with the Recommended Dietary Allowances (RDA) for Indians (1990).

The results revealed that intake of most foods, except cereals, millets, roots and tubers, were below the RDI in all ages of adolescence. Consumption of green leafy vegetables, fruits, pulses and milk was grossly inadequate. The mean nutrient intakes were below the RDA in all adolescent age groups irrespective of sex. In both the sexes, the proportion of adolescents consuming inadequate amounts was higher in case of micronutrients i.e., iron and vitamin A than that of protein, energy and total fat.

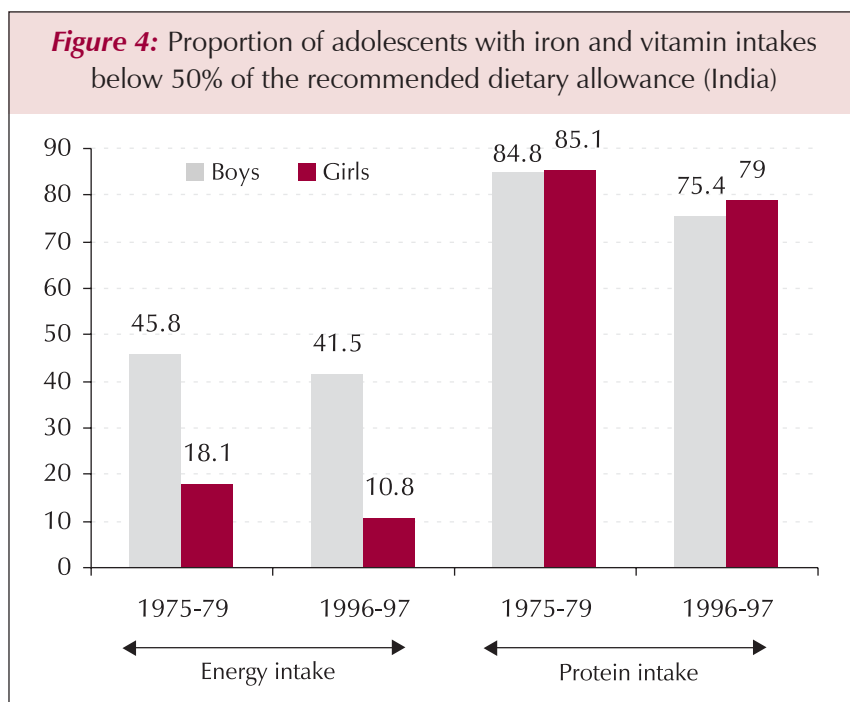
Almost half of the adolescents of both sexes were not getting even 70% of their daily requirements of energy and a quarter of them were getting less than 70% of RDA of proteins. However, the extent of severe deficit with respect to energy intake (<50%) decreased from 21% to 9% in boys and 14% to 5% in girls during 1996-97 as compared to 1975-79 (Fig. 3). Similarly, the deficit in protein intake also decreased. Low energy and protein intake by adolescents in India can explain to some extent the high proportion of undernourished and stunted adolescents and adults.



Source: Vijayraghavan et al., NNMB.2000



During the periods 1975-79 and 1996-97, the intake of micronutrients, namely iron and vitamin A was very low. More than 75% of adolescents were consuming <50% of RDA of vitamin A, and 41% of boys and 11% girls were getting <50% of RDA of iron (Fig. 4). The extent of decline in case of iron and vitamin A was lower compared to other nutrients. Although the nutrient intakes have improved, the extent of deficit even now is very high and needs intervention.



Source: Vijayraghavan et al., NNMB.2000

In 2000-2001 another survey was conducted by NNMB, India in the rural populations of nine states of India. The results of the survey are shown in Table 7.

In general, the median intake of all the nutrients was less than the RDA for all age groups and in both the sexes. The diets were grossly deficient in micronutrients such as iron and vitamin A. More than 80% of adolescents are getting less than 50% of their daily dietary requirements of vitamin A. Similarly, more than 70% had their iron-deficient diet by more than 50% of RDA and more than 50% of boys and girls get less than 50% of required calcium.

Table 7: Distribution of adolescents according to intake of nutrients as proportion of recommended dietary allowance (India)

Age yrs/ sex	% of RDA	Energy	Fats	Protein	Calcium	Iron	Vitamin A	Vitamin C	Free Folic acid
10-12									
Girls	<50	8.5	30.5	23.8	63.2	77.5	87.8	51.9	42.0
	50-70	34.9	18.2	35.1	14.8	11.2	3.0	13.1	29.1
	>=70	56.6	51.3	41.1	22.0	11.2	9.2	35.0	29.0
Boys	<50	16.8	27.5	19.2	60.2	80.7	87.8	48.1	42.3
	50-70	39.0	18.4	31.4	15.6	10.2	3.0	13.3	27.5
	>=70	44.3	54.0	49.4	24.2	9.1	9.2	38.6	30.2
13-15									
Girls	<50	5.8	23.9	24.9	56.1	68.0	87.7	44.4	64.9
	50-70	24.7	17.9	36.5	18.5	16.7	2.9	14.9	23.3
	>=70	70.2	58.2	38.7	25.4	15.3	9.3	40.7	11.7
Boys	<50	10.3	18.8	24.4	50.1	79.6	86.3	41.7	53.9
	50-70	34.0	15.6	35.4	17.0	10.1	2.9	11.7	26.9
	>=70	55.7	65.6	40.2	32.9	10.3	10.7	46.6	19.2
16-17									
Girls	<50	5.9	29.6	22.7	48.3	71.2	87.8	42.9	58.2
	50-70	23.9	16.6	34.5	16.9	14.9	2.6	13.7	24.3
	>=70	70.2	61.8	42.8	34.8	13.9	9.6	43.4	17.5
Boys	<50	6.6	21.8	24.7	50.0	73.3	87.8	43.6	59.2
	50-70	25.9	17.3	36.0	17.4	14.3	2.9	13.7	23.9
	>=70	67.5	60.9	39.3	32.6	12.5	9.3	42.8	16.9

Source: NNMB, 2002

Figures in bold indicates consumption less than 50% RDA in girls

Shaded figures indicates consumption less than 50% RDA in boys

Table 7 also shows that the nutrient deficits are at a higher level than the total energy deficit, suggesting that the qualitative aspect of the diet is more of a problem than the quantity.

The National Family Health Survey 1998-99 (NFHS-2), India also showed that 50% of households were not consuming adequately iodized salt; this means that adolescents living in 50% of households too are not consuming adequately iodized salt, hence are at risk of learning disability.

Although other studies had suggested gender discrimination in the intra household food allocation, data on food consumption by male and



female adolescents in India does not show such a pattern. Girls are consuming a similar quality and quantity of foods as boys.

Bangladesh study

A cross-sectional survey was conducted to investigate the dietary pattern and nutritional status of adolescent girls attending schools in Dhaka city (Ahmed et al 1998). The intake of nutrients was much below the RDA (Table 8). Animal sources supplied 50% of dietary protein. Milk was the major contributor for riboflavin and preformed vitamin A (retinol). Leafy vegetables and fruits were the main sources of carotene.

Table 8: *Nutrient intake by school going adolescents in Bangladesh*

Nutrient	Percentage of RDA			
	<50%	50-74%	75-99%	100%
Energy	10	56	25	9
Fat	12	33	32	23
Protein	17	46	20	17
Calcium	48	17	14	21
Iron	31	35	11	23
Vitamin A	44	10	8	38
Vitamin C	37	18	12	33

Source: Ahmed et al., 1998

The food consumption pattern in India and Bangladesh shows that the diet of adolescents is deficient in all the nutrients, more so iron, calcium, vitamin A and vitamin C. The lower deficits shown in the Bangladesh study can be attributed to the type of sample, i.e. school going adolescent girls from urban areas. In addition to the impact on growth and development, eating practices affect adolescents' risk for a number of immediate health problems, such as iron deficiency, under-nutrition, obesity and bone health. Dietary practices during adolescence may also have long-term implications. The reported reasons for deficient consumption of nutrients were:

- low educational level of parents;
- low family income;

Data on food and nutrient consumption by adolescents in other countries of the Region was not available.

Dietary behaviour and discriminatory practices in the household: Another reason for dietary inadequacies

Factors influencing food choices of adolescents:

Appeal of food; craze for trendy foods; mood; body image; habit; media and association of food with famous people; convenience foods; food from outside home; peer influence; benefits of food (including health); vegetarian beliefs; parental influence on eating behaviours (including the culture and religion of the family).

Findings from Group Discussion with adolescents at WHO Regional Meeting on “Improvement of Nutritional Status of Adolescents”, Chandigarh, India, 16-17 September, 2002

Eating

Adolescent eating is conceptualized as a function of individual and environmental influences. Four levels of influence are described: Individual or intrapersonal [psychosocial, biological]; social environmental or interpersonal [e.g., family and peer]; physical environmental or community settings [e.g., schools, fast food outlets] and macro system or societal [e.g., mass media, marketing and advertising, social and cultural norms] (Story, 2002). The search for identity, the struggle for independence and acceptance, and concern about appearance, tend to have a great impact on lifestyle, eating patterns and food intake among adolescents (Spear, 2002). The meal pattern of adolescents becomes more disorganized, and they tend to miss their meals at home as they get older, often skipping breakfast. Some dietary patterns like snacking, usually on energy dense foods, wide use of fast foods that are low in iron, calcium, riboflavin, vitamin A, folic acid and fibres, low consumption of fruits and vegetables and faulty dieting are more common among the adolescents of industrialized countries (Dennison et al., 1995, Spear, 2000). In developing countries also, particularly in cities, some of these patterns are also common, and yet very little has been documented. A study in Nepalese schoolchildren showed that fast foods (ready to eat snacks, chips etc) were preferred by more than two-third of adolescents. Advertising, probably TV and magazines, influenced preferences in 80% of these Nepalese adolescents (Sharma, 1998).



Myanmar study

A food study (Table 9) carried out in schools of Myanmar (Phyu Phyu Aung, unpublished, 2002) showed that approximately half of the students buy snacks as they consider them good for health and 30-50% of students consume snacks that are advertised. They were curious to try the new products or liked the taste. It can also be inferred that preferences can be guided by peer influence, which is very strong in this age group. However the encouraging finding was that, preference for Myanmar snacks was more than for western snacks (74.5% vs 25.5%).

Table 9: Results of food study in Myanmar

Variables	Thah ton School (%)	Tadau School (%)	Sanch-aung School (%)	South Dagon School (%)	Dagon S.H.S.(1) School (%)
Factors considered for buying snacks					
Price	4.2	2.7	4.6	8.9	6.8
Preference	44.4	42.2	50.2	37.7	45.9
Advertisements	–	1.4	3.1	5.7	6.6
Benefits of health and nutrition	51.4	53.4	42.2	47.8	40.7
Practice on consumption of advertised foods	30.8	42.9	37.9	51.2	32.0
Reasons for buying advertised snacks					
Nutritious	5.9	25.0	2.9	4.8	–
Taste/preference	64.7	37.5	61.2	48.3	67.6
Curiosity	29.4	37.5	35.8	40.8	32.4
Winning the lucky draw	–	–	–	6.1	–

Source: Phyu Phyu Aung, Unpublished, 2002

Indonesia study

A food consumption survey among adolescents (Sunarno and Untoro, unpublished, 2002) found that energy intake was between 1104–1238 Kcal, far below the recommended allowance. Low energy intake was associated with food habits of not having breakfast among adolescent and school-age children due to factors such as workload of parents and availability of street food near school. The studies recommended the importance of nutrition education to school children and street food vendors on hygienic food preparation and nutrition.



Intra-household distribution of food is another reason for girls not getting adequate food in terms of both quality and quantity. Culturally, it is expected that the girls should eat after serving all family members (Akhtar et al., 1998). They eat with their mothers after the family has eaten. Families are generally less aware of high adolescent requirements for food and often believe that boys should get a bigger share.

From intra-household food distribution data in two poor communities of Vadodara, India, it was observed that compared to other family members, both adolescent boys and girls met relatively less of their nutrient requirements (calorie, proteins, iron and beta-carotene). Adolescent girls showed the greatest deficit in terms of percent RDA met for iron (Samrani et al., 1996).

In another study in Bangladesh (Akhtar et al., 1998), intake of fish, meat, eggs, milk, legumes and fruits and vegetables were highest in case of boys and main earning members as compared to female adolescents. Although foods like fish, meat, eggs, milk and some fruits and vegetables were said to be restricted for girls, it was reported by only 5% of the girls.

6.2 Prevalence of Thinness (low BMI) and Stunting

The pubertal growth spurt involves gain in weight as well as height. A pre-pregnancy weight of about 45 kg and height of 145 cm has been agreed upon as the minimum standard. Research has shown that better-nourished girls have higher pre-menarcheal growth velocities and reach menarche earlier than undernourished girls, who grow more slowly but for a longer, as menarche is delayed (Kulin et al., 1982). Because underweight girls are growing for longer duration, they may not finish growing before their first pregnancy. In India, for example, up to 67% of girls were classified to be at obstetric risk (by weight and height criteria) in their 15th year as compared with about 20% in their 19th year (Gopalan, 1987).

The rate of weight gain during adolescence corresponds to the height spurt. In boys, the peak height velocity coincides with the peak weight velocity. In contrast, peak weight velocity occurs 6 to 9 months before height rate changes in girls (Gong and Heald, 1998). Weight gain during this period accounts for approximately 50% of the ideal adult weight. Because peak weight occurs before the peak height in girls, many parents and teens become concerned about teenage girl's weight. Some girls may try losing weight. Any weight loss during this period may affect ultimate adult height (Spear, 2002). This fact needs to be publicized and girls need counselling to discourage this practice.



Can undernourished children catch up on incomplete childhood growth during adolescence? There is little evidence to suggest that growth retardation suffered in early childhood can be significantly compensated for in adolescence. Some spontaneous catch-up growth in adolescence may be possible in chronically malnourished children since the growing period is thereby extended (Golden, 1994). Studies on effects of adoption show that some catch-up growth may be possible, but is not complete for those who remain in the same adverse environment (Martorell et al., 1994). As good diet forms part of an individual's improved environment, care should be taken to focus attention on improvement of their diet. The gained height is beneficial in reduction of obstetric risks in girls, and in improving physical work capacity in adolescent boys.

Stunting: In children and young adolescents, chronic undernutrition leads to stunting. Stunting is defined as height-for-age <3rd percentile of the National Centre for Health Statistics (NCHS) – Annexure 6. In adolescents, chronic undernutrition also delays normal maturation and is an important and widespread problem with multiple adverse health outcomes. Stunting among adolescents is of interest for several reasons. First, a short woman tends to have a small pelvis and, therefore, is more likely to have obstructed labour during childbirth. Second, 25% of an individual's attained height is achieved during adolescence, which marks the end of growth in height and the attainment of adult height (Kurz, 1996).

Thinness: Thinness is of particular interest because it results in poor pregnancy outcomes, in particular low birth weight (Kramer, 1987). Thinness may also limit school achievement and work productivity. Thinness is defined as Body Mass Index (BMI) less than 5th percentile of the NCHS (Must et al., 1991) and World Health Organization (1995) reference data (annexure-6). BMI (weight/height^2) for age was recommended as the best indicator for use in adolescence. It has been validated as an indicator of total body fat at the upper percentiles. However, BMI has not been fully validated as an indicator of thinness or undernutrition in adolescents. Nonetheless, it provides a single index of body mass, applicable at both extremes (Himes and Bouchard, 1989). The relationship between BMI and body fatness is dependent on maturation state, race and gender in children and adolescents (Daniels et al., 1997). Can NCHS BMI reference data (from adolescents in USA) be used internationally? WHO (1995) recommends that in the absence of other data specifying optimum cut-

off values of BMI in adolescence, BMI-for-age data for US children may be used until country-specific reference data are available.

Surveys done in rural and urban areas and in schools and communities in the Region show high prevalence of stunting and thinness.

Among four countries of the Region (Table 10), rural Bangladesh has the highest prevalence of thinness and stunting (67% and 48% respectively) among adolescents. At the same time, the lowest prevalence was observed in school-going girls of urban Bangladesh (16% and 10%). Although stunting was similar in boys and girls, the prevalence of thin boys was more than the girls (75% vs 59%) in rural Bangladesh.

Table 10: Summary of the results of surveys in SEAR countries to assess adolescent nutritional status

Country	Period of survey	Age of survey subjects	Number	Socio-economic status	Prevalence of low BMI <5 th per centile (thinness)	Prevalence low height for age (stunting) <5 th per centile
School girls in Dhaka, Bangladesh (1)	1995	10-16	384 females	Literacy: 98% fathers 95% mothers	16%	10%
School boys in Calcutta, India (2)	1982-83	10-16	570 males	> 10 yrs of schooling 82% fathers 64% mothers	52%	12%
School students in Mumbai, India (3)	1992-93	10-19	69 males 69 females	Residents of urban slums	53%	32%
Residents of 3 rural villages in Nepal (3)	1992-93	12-18	179 males 148 females	Lower income areas	36%	47%
Residents of 4 rural villages of Bangladesh (4)	2000	10-17	906 47% male 53% females	Lower income group	67%	48%
Myanmar (5)	2002	10-18	2400 Boys and girls		32%	39%

Source:

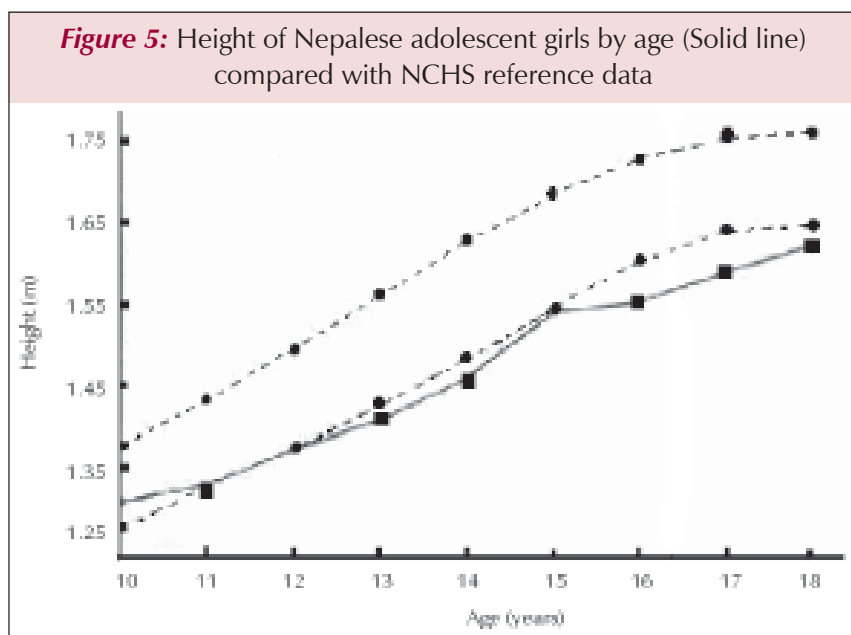
1. Ahmed et al., 1998
2. de Onis et al, 2001
3. Kurz, 1996
4. Shahabuddin et al., 2000
5. National Haemoglobin and Nutritional Status survey among adolescents, National Nutrition Centre, Myanmar, 2002



The prevalence of thinness was 32% and stunting was 39% in Myanmar. Both stunting and thinness were more prevalent in the 16-18 years age group (40.6% and 44.1% respectively) as compared to the younger adolescents and were more common in rural areas and among adolescent boys.

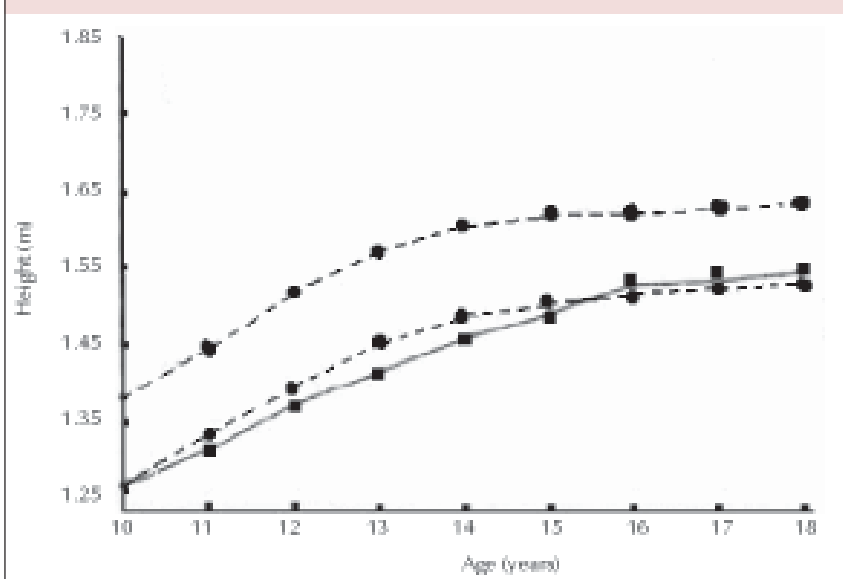
The implications of nutritional disadvantage for boys are unclear. Some authors have suggested that the issue is related to the boys' delayed and longer growth spurt. In terms of stunting, boys may later catch up with girls. Caution is also needed with regard to anthropometric measures underlying stunting and wasting in adolescents (WHO 2000a). Recent work in this area by WHO shows that both the indicators to identify wasting and stunting in adolescents, as well as the cut-off points for different degrees of these conditions need more research. It has not been established whether sex differences play any role in the anthropometry of nutritional status in adolescents.

In rural Nepal, the mean height did not improve over the 8 years of adolescence for which data was collected. The mean height of girls was near the 5th percentile of NCHS reference (Fig. 5) and dipped slightly at the middle of the age range. A boy's height was slightly above the 5th percentile at the age of 10 years, after that it remained below the 5th percentile until 18 years (Fig. 6).



Source: Kurz, 1997

Figure 6: Height of Nepalese boys by age (Solid line) compared with NCHS



Source: Kurz, 1997

The mean BMI increased substantially relative to the reference data across 8 years. At 10 years, girls started near the 5th percentile and by the age of 18 years, were near the 50th percentile. This is in contrast to the lack of increase observed in height relative to the reference data. The study showed that prevalence of under-nutrition was high when all the ages were combined.

Another recent study by the National Nutrition Monitoring Bureau, India, compared the BMI values of adolescents with those reported for NHANES of USA. The proportion of adolescents below the 5th percentile of NHANES ranged from 77.6% at 11 years compared to 44% at 17 years age among boys, and from 62.7% at 10 years to 16.4 % at 17 years among girls.

The overall prevalence of stunting was similar in both the sexes (boys-39.5% and girls-39.1%). However, it increased in boys as age advanced from 34.7% at 10 years to 59.7% at 17 years, but in girls, stunting increased with age up to 13 years (37.4% to 46.7%) after which it decreased to 37.2% at the age of 17 years (Table 11).



Table 11: *Distribution of adolescents according to stunting and underweight in India*

Age (Yrs)	Percent of Stunted boys (-2SD)	Percent of Stunted girls (-2SD)
10+	34.7	32.5
11+	31.3	37.4
12+	32.8	44.7
13+	32.1	46.7
14+	36.3	41.2
15+	48.9	37.5
16+	51.8	34.1
17+	59.7	37.2

Source: Vijayaraghavan et al., NNMB, 2000

Data from the above surveys in four countries shows that:

- thinness ranges from 16% to 67% and prevalence of stunting from 10% to 48% among adolescents in different settings
- estimated prevalence of thinness exceeds that of stunting in all the studies except in the Nepal where stunting was more prevalent
- prevalence of thinness and stunting is more in rural areas as compared to urban areas
- in spite of parents being educated (in two studies), substantial chronic under-nutrition was seen among the adolescents
- the mean height of girls and boys did not improve during the 8-year period of review in the Nepal study. However, BMI, especially in case of girls, increased substantially with age.
- both thinness and stunting were more prevalent in the 16-18 years age group in Myanmar (40.6% and 44.1% respectively).
- although a large percentage of adolescents are undernourished, the nutritional status of both boys and girls in India improved with age, showing that the effect of malnutrition is more pronounced at the time of peak growth.

Comparison of body mass index of urban and rural Indian girls with NHANES

India is a large country and there are wide disparities with respect to socio-economic status, living conditions, and diets between different sections of



the country's population, with the urban rich and rural poor representing two ends of the socio-economic spectrum. The growth performance of the two groups is, in a broad sense, an indication of prevailing socio-economic disparities in the country (Gopalan 1989). While the BMI of affluent adolescent girls is comparable (after 13 years of age) with adolescent girls of USA, the margin of difference between rich and poor girls within the country is apparently high. The growth of these rich girls, who are not subject to dietary and environmental constraints fully reflects their genetic potential (Table 12).

Table 12: Comparison of Body Mass Index of Urban and Rural Indian Girls with NHANES

Age (years)	Body Mass Index		
	Rural Adolescent girls*	Urban Affluent Adolescent girls**	NHANES (USA)
10+	13.9	16.4	17.0
11+	14.2	16.9	17.7
12+	14.7	17.6	18.4
13+	15.5	18.6	18.9
14+	16.5	19.1	19.3
15+	17.3	19.6	19.7
16+	17.9	20.0	20.1
17+	18.5	20.1	20.4

Source:

* NNMB, India: Report on Diet and Nutritional Status of Adolescent Girls: 2000

** Gopalan, C: Growth of Affluent Indian Girls during Adolescence, NFI, India: 1989

Though the data on thinness and stunting discussed here do not cover all countries in the Region, it shows that nutritional deprivation seems to affect almost all growth parameters and final adult body size. However, in the absence of an appropriate reference data set at international level to assess the nutritional status of adolescents, it is difficult to assess whether under-nutrition or obesity is a prevailing concern. Anthropometric assessment is more complex in adolescence, than in childhood, because of changes in body composition and the variable timing of the growth spurt.

6.3 Prevalence of Obesity in Adolescence

Adolescents with a BMI above the 85th percentile (Annexure 6) are at risk for overweight. Weight gain is the result of a positive energy balance



(consuming more energy than is expended). Energy expenditure, as assessed through levels of physical activity, declines in children as they reach adolescence, particularly in adolescent girls. There is evidence (Wang et al., 2002) that children and adolescents of urban families are more overweight than in the past, possibly because of decreased physical activities, sedentary lifestyle, altered eating patterns and increased fat content of the diet. Increase in sedentary activities, such as television viewing and computer games, is suspected to be responsible for the decline in physical activity levels. Overweight and obesity during adolescence has some immediate consequences, particularly as they relate to body image and self-esteem, and becomes a risk factor for overweight and obesity as an adult. One quarter to one-half of the individuals who are obese in adolescence remain obese in adulthood (Charney et al., 1976, Must, 1999, Whitaker et al., 1997). However, many factors come into play while predicting adult obesity from adolescent obesity, which includes age of onset, degree of overweight and how long overweight persists in adolescence.

There is very little data on obesity in adolescence, particularly in this Region. In the absence of consistent cut-off points and reference values comparisons are also not easy.

Longitudinal tracking studies show that adolescent weight-related risk carries into adult cardiovascular risk (Lytle, 2002). Data from Bogalusa (USA) show that adolescents with a BMI >75th percentile were more than eight times as likely to have hypertension in adulthood as compared with leaner adolescents (Srinivasan et al., 1996). Similarly, overweight adolescents, particularly boys, are more likely to have high serum cholesterol and abnormal lipoproteins levels in adulthood (Lauer et al., 1990). In the Bogalusa Heart Study, 2.4% of the overweight adolescents developed type 2 diabetes by the age of 30 years, whereas none of the normal weight adolescents developed the disease.

A study conducted in India (Kapil et al., 2002) showed the prevalence of obesity in affluent adolescent schoolchildren was 7.4%, and higher in males than in females. The maximum prevalence of obesity was found during the pubertal period (between 10 to 12 years).

Thailand study

In 1992, the Nutrition Division conducted surveys in 10 high schools (N=7,437). The findings (Table 13) showed that except for certain grades

Table 13: *Prevalence of overweight in high school children in Bangkok, based on Thai Growth Standards*

Sex	School Ages 11-17 years in Grade...					
	7	8	9	10	11	12
Male	10.1	13.0	12.7	15.3	12.3	17.3
Female	18.5	17.6	14.6	16.8	24.5	24.9
Both sexes	14.4	15.4	13.2	15.9	17.9	20.5

Source: Nutrition Division, DOH, Thailand

(highlighted in the Table) overweight tended to increase in the higher grades. Females were more prone to this problem as compared to males. Overconsumption of calories, especially fast food, snacks and soft drinks, were common among these adolescents. In addition, they rarely exercised (Nutrition Division, Department of Health, Thailand).

These surveys in India and Thailand highlight that obesity needs to be addressed in this Region as well.

6.4 Iron Deficiency and Iron Deficiency Anaemia in Adolescents

Adolescents, particularly girls, are especially vulnerable to iron deficiency due to low intake and absorption of iron, and increased iron requirements for growth and replacement of menstrual blood losses (Brabin and Brabin, 1992). Anaemia can be associated with other nutrient deficiencies (folic acid, vitamin A, B 12), as well as with infectious diseases like malaria, intestinal parasitic infestations, and chronic infections such as HIV (Dreyfuss et al., 2000).

Mild to moderate iron deficiency, even without anaemia, has adverse functional consequences, although the effects are less obvious. Anaemia has a serious negative impact on growth and development during adolescence, and decreases the ability to concentrate and learn. Iron deficiency was shown to be associated with impaired cognitive processes in adolescents, as suggested by improved performance following supplementation in South-East Asia (Nelson, 1996). Similarly, anaemia was independently associated with lower school achievements in adolescent girls (Walker et al., 1996). Iron deficiency decreases energy and physical



strength resulting in reduced physical capacity and work performance, both in men and women (Behrman, 1992, Li R et al., 1994). Physical performance may be compromised even at mild levels of anaemia (Nelson et al., 1994). In addition, anaemia in adolescence may also impair the immune response thus making them more prone to infections. A study of Indian children aged 1-14 years indicated that the immune response was significantly depressed in those with haemoglobin concentrations below 10g/dl (Dallmon, 1989).

As physical growth slows down in late adolescence, the iron status of boys improves (Dallmon, 1989). Adult men are therefore less at risk of anaemia than women, who lose blood (and as a result, iron) through menstruation.

During adolescence, women's bodies develop and prepare for future childbearing. Low iron stores in young women of reproductive age makes them susceptible to iron deficiency anaemia because dietary intake alone is insufficient in most cases to meet the iron requirements of pregnancy (Beard, 2000). Anaemia in adolescence puts a young woman and her future child at risk of premature birth, low birth weight, and increased peri-natal mortality (Scholl et al., 1994). Infants born to iron-deficient mothers also have higher prevalence of anaemia in the first six months of life (Perziosi et al., 1997). Maternal mortality is increased in women whose haemoglobin levels fall below 6-7 g/dl (Brothwell et al., 1979).

A summary of anaemia prevalence in some countries of the South-East Asia Region is shown in Tables 14 and 15. There is a great disparity within the Region. Inequalities are in rural and urban areas as well as in schoolgoing and non-schoolgoing adolescents. Irrespective of severity, the anaemia prevalence ranges between 12-100% within the Region. Within India and Bangladesh also there is a wide disparity in anaemia prevalence. For example, incidence of anaemia is as high as 100% in girls and 99% in boys in rural Bangladesh whereas only 22% girls were anaemic in the urban areas. Similarly, 90% prevalence of anaemia was reported by studies done by ICMR and Survival for Women and Children (SWACH) Foundation as compared to 37% in another study in India. It was also observed in an Indonesian study that socio-economic status also determined the occurrence of anaemia among adolescents. Boys experience as much anaemia as girls in some of the countries, but the incidence was comparatively low in Myanmar and Indonesia. Nevertheless, even these



levels of anaemia, which affect one-fourth of the adolescent population, need attention.

Table 14: *Prevalence of anaemia in adolescents in selected countries*

Study	Country	No of subjects/setting	Prevalence (%)
Soekarjo DD et al., 2001	Indonesia (East Java)	M/F age 12-15 y/Schools in urban & rural Java	Girls-25.8 Boys-12.1 Pre-pubertal boys-28.5
Nagi M et al., 1995	India (Punjab)	13-15 years old girls/city school	77
Vasanthi et al., 1994	India	551, 11-16 y old girls/urban slums and rural area schools	37.5
Ahmed F (Review of national data)-2000	Bangladesh	Adolescents/rural	43
Ahmed F et al., 2000	Bangladesh (Peri-urban Dhaka)	548, 11-16 yrs old girls/schools in peri urban area	27 (girls with lower serum retinal had lower Hb)
Shahabuddin et al., 2000	Bangladesh	906, 10-17 yrs old / rural area	Range: Boys : at 10 yr-98.9 to 80.8 at 17 yr Girls: 98.8 at 10 yr to 100 at 17 yr
Ahmed et al., 1996	Bangladesh	225 12-15 yr old girls/urban schools	22 (11% had low levels of serum retinol)
ICRW review (Kurz KM) 1996	India	● 69 boys, 69 girls 10-19 y/ school based Urban slum	55
Potdar-India		● 179 boys, 148 girls 10-18 y/	
Regmi and Adhikari – Nepal	Nepal	● Rural community	42
National Survey 2002	Myanmar	1200 10-18 yr Adol./rural and urban	26.4
Family Health Bureau 2000	Sri Lanka	11-19 years, boys and girls	Girls: 40% Boys: 31.6%



Table 15: *Prevalence of anaemia among adolescents in India according to severity*

Study	Country	No of subjects/setting	Year	Anaemia prevalence (%)			
				Mild	Moderate	Severe	Total
SWACH Foundation	India (Haryana)	218/206 SGAG/NSGAG rural	2001	SGAG*- 21.9 NSGAG- 17.0	SGAG- 56.1 NSGAG- 61.6	SGAG- 7.3 NSGAG- 11.7	SGAG- 85.3 NSGAG- 90.3
ICMR (Toteja et al)	India	4337 Girls/16 districts	2001	32.1	50.9	7.1	90.1
Rajaratnam et al	India (Tamil Nadu)	316, 13-19 yrs old girls/rural	2000	36.5	6.3	2.1	44.8
Kotecha et al Baseline survey; adolescent girls	India (Vadodara district)	2,860, 12-19 yrs old girls in tribal, rural and urban areas	2000	58.0	15.1	1.6	74.7

*SGAG: Schoolgoing adolescent girls,
NSGAG: Non-schoolgoing adolescent girl

Table 15 shows the occurrence of anaemia according to severity in India. The extraordinary high prevalence of severe anaemia (11.7 and 7.1) has been reported by SWACH and ICMR. However, severe anaemia ranges from 1.6%-11.7% in different studies conducted in different settings. Prevalence of severe anaemia was higher (11.7%) among non-schoolgoing girls. These adolescents are at serious risk of morbidity and mortality from pregnancy-related causes besides other health consequences.

It may be inferred from the above studies that:

- A higher rate of anaemia was observed among the lower socio-economic population. This reflects a lower intake of iron-rich foods, especially from animal sources, and higher infection rates.
- Boys are equally prone to iron deficiency before they attain puberty. Iron status improves among adult men once they have finished growing (Kurz, 1996). It is not known whether there are functional consequences of transient anaemia among boys during adolescence (Kurz, 1996). A higher rate of anaemia is observed in girls, than in boys, after they attain puberty. After menarche, girls show an increase in prevalence of anaemia.



Indonesia study:

(Sunarno RW and Rachmi Untoro, Paper presented at WHO Regional Meeting on Adolescent Nutrition in Chandigarh, India, 16-17 September, 2002)

Iron deficiency anaemia is a public health nutrition problem. A national household health survey in 1995 found that the prevalence of anaemia among schoolboys and girls was 46.4% and 48.0% respectively. Among 10-14 year age-group the prevalence was 45.8% in boys and 57.1% in girls. A baseline study among adolescent girls in 10 districts in East and Central Java provinces showed the prevalence to be 80.2% and 57.4% respectively. The study also showed a limited awareness of anaemia due to scanty information provided in the school curriculum by family, and mass media.

Nepal study:

(Pandey S, Paper presented at WHO Regional Meeting on Adolescent Nutrition in Chandigarh, India, 16-17 September, 2002).

The Nutrition Section, Ministry of Health, measured haemoglobin levels of 410 school-going adolescent girls in Kathmandu valley. The result showed that 72.5% of these girls had mild, moderate or severe anaemia. The study looked at parents' education, girls' menstruation pattern, distance from home, helminthiasis and malaria and showed that there were not significant statistical differences in these areas between the normal and anaemic group. However, a significant difference was found in relation to food consumption in these two groups. Approximately 16% of non-anaemic girls took soybean in comparison to 6% of anaemic group. Similarly, 36% of non-anaemic girls took daytime snack in comparison to 24% of anaemic girls.

- A significant association was found between haemoglobin concentration and the educational level of the girls and her mothers. The SWACH Foundation study demonstrated that prevalence of anaemia is higher in non-school going girls as compared to school going girls. This may be due to ignorance



about the nutritional needs, as well as the socio-economic background of non-school going girls.

- A higher rate of anaemia was observed in rural girls as compared to the urban poor irrespective of the age and menarche status. Higher prevalence of worm infestation due to poor hygiene, inadequate environmental sanitation and disposal of waste could be one of the influencing factors. However, rates in urban population were high enough to pose a considerable problem.
- There is clear evidence of an association between plasma serum levels of vitamin A and haemoglobin levels. Girls with lower serum retinol level were found to have lower haemoglobin. Mejia (1992) has reviewed the importance of adequate vitamin A status for effective utilization of iron and for maintaining normal haemoglobin. Vitamin A deficient girls did not respond to iron supplementation. A study done in Bangladesh (Ahmed et al., 2001) showed a significant increase in haemoglobin level of anaemic girls when vitamin A supplements were added to iron and folic acid supplements.

6.5 Vitamin A Deficiency

Vitamin A deficiency affects millions of children in developing countries around the world. The major cause of this deficiency is inadequate dietary intake of vitamin A. Though the risk of severe deficiency declines with age, vitamin A deficiency frequently extends into adolescence and further into early adulthood (Upadhyay et al., 1985 and Henning et al., 1991). Reports have shown that vitamin A deficiency is also prevalent among adults, especially in women of reproductive age (Bloem et al., 1994 and Katz et al., 1995). Studies conducted in different settings in Bangladesh (Ahmed et al., 1996, 1997, 2001) showed that there is a high prevalence of sub-clinical vitamin A deficiency among adolescents.

6.6 Adolescent Pregnancy

Teenage mothers bear a double (physiological) burden: one involving their own growth and development, and another involving the intra-uterine growth and development of their offspring. Teenage mothers in India, on the other hand, carry a triple burden – the added (pathological) burden of

their under-nutrition and underdevelopment with its inevitable mutually aggravating effect on the other two burdens (Gopalan, 1989). This is probably true in many countries in the Region.

Adolescent females who are considered biologically immature (less than 2 years past menarche) or who are less than 16 years old, may continue to experience linear growth and changes in weight and body composition (Stang, 1999). They show gains in linear height during pregnancy and accrue additional body fat, almost exclusively during the third trimester, which is the period of most rapid growth by the foetus (Scholl et al., 1994). These pregnant adolescents deliver infants of lower birth weight than the comparable non-growing adolescents, suggesting that the mother and foetus may compete for energy and nutrients (Scholl et al., 1990). Calcium status is a particular concern, as the bones of adolescents still require calcium for growth at a time when foetal needs for bone growth are also high (ACC/SCN, 2000). The overlap of the increase in iron requirement due to growth, onset of menses and costs of pregnancy suggests that there is a limited opportunity to acquire sufficient iron before pregnancy to acquire a storage iron pool of sufficient size to meet the demands of pregnancy (Beard, 2000). Controlled studies in several sites have shown that adolescent mothers have higher incidence of prematurity, low birth weight and complicated labour (Kurz, 1997, Scholl et al., 1992, Scholl and Hediger, 1994). Poor pregnancy outcomes are more often observed in pregnant adolescents who have poor nutritional and low socio-economic status. Maternal mortality ratios for 15-19 years-olds in Bangladesh are twice as high as those for 20 to 24-years-olds (WHO, 1989). These grave risks are further heightened by the fact that pregnant adolescents are less likely to use antenatal and obstetric services (Scholl et al., 1994). Pregnant adolescents from poor families are at exceptionally higher risk. The growth pattern of rural and poor girls continues for a longer time than in the well-to-do, and it is the poor rural girls that are married off at a much younger age and have to start their reproductive role much earlier than the well-to-do ones. Furthermore, since menarche is delayed in the poor girls and they grow for a longer time, it is more important that conception is delayed till about the 18th year (Gopalan, 1989).

The average age of marriage for women has a significant effect on the teenage birth rate. In rural areas of some countries of this Region, tradition is strongly in favour of early marriage for females. Often, the stress is on



Table 16: *Percentage of women aged 20-24 married by age 15 and 18 in selected countries of South-East Asia Region*

Country and year	By age 15 (%)	By age 18 (%)
Bangladesh (1993-94)	47	73
India (1998-99)	24	50
Indonesia (1994)	9	31
Nepal (1996)	19	60
Sri Lanka (1993)	1	12
Thailand (1987)	2	20

Sources: National Demographic and Health Surveys from various years as noted. Figures cited in Bott S and Jejeebhoy J(2003)

marriage soon after the onset of menstruation. About 60% of marriages in Nepal involve adolescent brides (UNFPA, 1998). Table 16 shows that the majority of women marry as adolescents in Bangladesh, India and Nepal. Large surveys have found that almost half of all women aged 20-24 are married by the age of 15 in Bangladesh, as are nearly one-fourth in India (24%) and one-fifth (19%) in Nepal.

In Nepal, the median age at first marriage amongst girls is 16.4 years (Nepal Family Health Survey, 1996). In India, 24% of girls below 18 years are married. Here, among the married adolescent girls, the proportion of girls considered 'at risk' due to short stature (<145 cm) was 24.1% and due to underweight (<38 kg) was 18.6% (NNMB, 2000).

Over the past decade, adolescent fertility has dropped in nearly all South Asian countries (Bott S and Jejeebhoy J, 2003). However, due to the high rate of adolescent marriages in some countries, pregnancy during adolescence is still common (Table 17). The 1996-97 Bangladesh Demographic and Health Survey found that 14% of 15-year-old girls were either already mothers or pregnant with their first child (Mitra et al., 1997). Adolescent fertility rates were also high in Bhutan, India and Nepal, which is again associated with the lower mean age of marriage for women. Myanmar and Sri Lanka have a much lower adolescent fertility rate because most women marry in their mid-twenties. Fig. 7 shows that one out of three (30%) girls in Bangladesh and one out of ten in Nepal begin child bearing by 16 years of age when they are not biologically ready to bear a child.

Table 17: *Adolescent child-bearing in countries of the South-East Asia Region*

Country	Year	Live births/1000 women aged 15-19 years
Bangladesh (1)	1996-97	147
Bhutan (2)	1994	120.2
DPR Korea (3)	1990-1995	26
India (4)	1990-92	116
Indonesia (5)	1995-97	62
Maldives (6)	1990-95	71
Myanmar (7)	1996-97	24.6
Nepal (8)	1996-97	132
Sri Lanka (9)	1990-95	33
Thailand (10)	1995-96	53.8

Source:

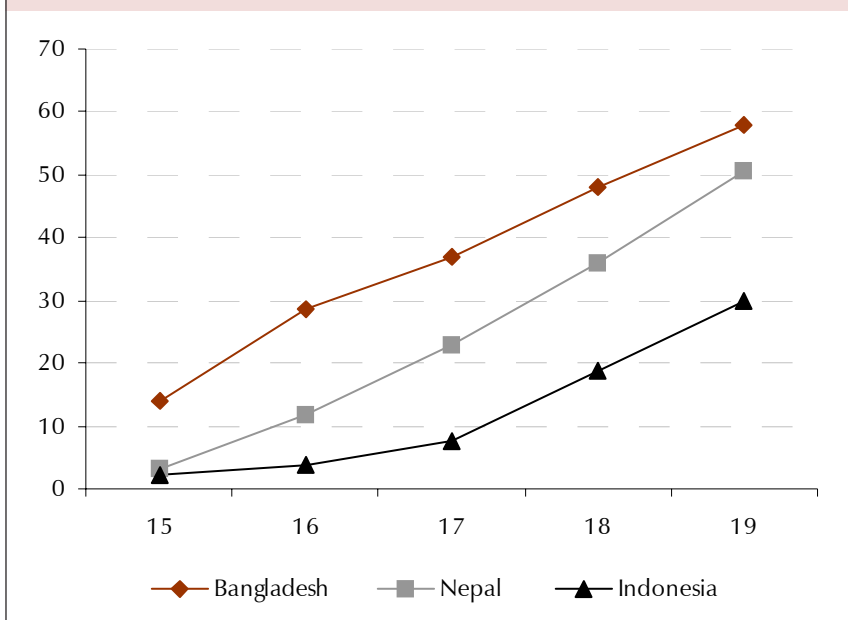
1. Mitra et al., 1997. Ministry of Health and Education Report on National Health Survey, 1996
2. United Nations. The World's women, 1995
3. NFHS, 92-93
4. Central Bureau of Statistics, 1998
5. United Nations Department of Economic and Social Affairs, 1998.
6. Ministry of Immigration and Population, 1998.
7. Pradhan et al., 1997.
8. Family Health Bureau Sri Lanka, Family Health Bureau 2000 (Unpublished document)
9. National Statistics Office. The 1996 Survey of Fertility in Thailand Bangkok

A few studies have reported the nutritional status of pregnant adolescents. In a study done in Nepal on risks and outcomes of adolescent pregnancy, 48% of girls suffered from anaemia (Sharma et al., 2001). A similar situation was observed in another study done on pregnant adolescents among selected tribal population in India where all of them were suffering from moderate to severe anaemia and one-third had vitamin A deficiency (Sharma and Sharma, 1992). It is thus not surprising that adult pregnant women of the same population are anaemic, because their nutritional needs were not addressed during their adolescence.

The nutritional needs of pregnant adolescents are the greatest at the time when these are most difficult to be met. If the adolescent is still growing, steps must be taken to assure adequate weight gain and nutrient intake to prevent poor pregnancy outcomes, including low birth weight. Adequate intake of other nutrients that are essential for growth, such as



Figure 7: Percentage of women 15-19 years who have begun child bearing in selected countries of SEA Region



Source:

1. Mitra et al., 1997.
2. Indonesia Demographic and Health Survey, 1997
3. Pradhan et al., 1997.

iron, vitamin A, zinc, folic acid and vitamin D, need to be assured through dietary means or supplements.

As it may not be possible to ensure the above, postponing the first pregnancy is an excellent way to improve the nutritional status of the adolescent girl and to ensure that she enters pregnancy later in life in better health and nutritional condition. This would contribute in breaking the intergenerational cycle of malnutrition, poverty and disease (WHO, 1997).

Review of Nutrition Interventions for Adolescents in Selected Countries of the South-East Asia Region

As adolescents apparently have a low prevalence of infections and disease compared to children under five and the elderly, they receive little health and nutrition attention (Senderowitz, 1995). Programmes addressing adolescent nutrition in this Region are very few, small and experimental. They are mainly aimed at the prevention and control of anaemia among adolescents.

Some of the programmes targeted at adolescents in some countries of the Region include:

7.1 India

Adolescent girl's scheme

The Adolescent Girls Scheme (AGS) or “Kishori Shakti Yojana” is part of the Integrated Child Development Services Scheme (ICDS), devised during 1991-92, for adolescent girls in the age group of 11-18 years.

The scheme fills the gap in services for adolescents including school dropouts, as government schemes previously covered children (0-6 years), mothers and schoolgoing children.

The main objectives of the scheme are:

- To improve the nutrition and health status of girls in the age group of 11-18 years;
- To provide literacy and numeracy skills through non-formal education;



- To train and equip adolescent girls to improve or upgrade home-based skills and to enable them to run child care centres at a later stage;
- To promote awareness of health, hygiene, nutrition and family welfare issues and to encourage girls to marry after 18 years.

The scheme provides ‘hands-on’ learning at the Anganwadi centre, education, health check-ups and supplementary nutrition. A major thrust of the programme is to prevent teenage pregnancies.

UNICEF adolescent anaemia project

UNICEF has initiated a project in 11 Indian states to provide iron and folic acid tablets to adolescent girls in order to reduce levels of anaemia prior to their initiating childbearing. This strategy has operated through schools with the support of the health centres in some states, and in others, has operated as part of *Kishori Shakti Yojna*, the ICDS adolescent girls’ scheme (under the Department of Education and DHFW in Gujarat). Iron and folic acid tablets are provided under supervision of teachers on a weekly basis. Evaluations have shown high rates of compliance and significant improvements in haemoglobin levels (Kotecha et al., 2002). This model of distributing IFA to adolescent girls is now being adopted in the national ICDS programme.

Adolescent Girls’ Anaemia Reduction Programme, Vadodra district, Gujarat state

The programme is aimed to:

- institute school-based, supervised weekly IFA supplementation for all enrolled girls, with built-in compliance monitoring by the school system, reported to the local medical college for tabulation;
- provide nutrition education to the girls and teachers, in order to induce changes in dietary habits; and
- explore the possibility of reaching out to non-school going adolescent girls.

The project was established in 405 schools, with a total female enrolment of roughly 65,000 girls aged 12-19 years. A baseline study found that 74.7% of girls were anaemic, and that 97% of the girls were willing to

consume IFA tablets on a weekly basis. The schools ensured the IFA supplementation and nutrition education sessions on a fixed-day, weekly basis. The health system received and distributed the IFA tablets to schools, and served as a referral service if the girls reported side effects. The education sessions drew on an array of multimedia IEC materials specially prepared for the project. Compliance with weekly supplementation was above 90%, based on regular reporting from nearly three-quarters of the schools, and only transient side effects were reported.

A mid-term impact assessment showed that the prevalence of anaemia (Hb<12.0 g/dl) declined from 74.7% at baseline to 54.2%. There were improvements in all categories of anaemia.

7.2 Indonesia

Programme for iron deficiency anaemia in women of reproductive age

The programme is integrated in Healthy Reproductive Initiatives for Adolescents. The activities include nutrition education and counselling during intra and extra-curricular activities such as School Health Programme, School Children Association, Youth Red Cross, health consultation, anaemia detection, iron supplementation etc.

General nutrition education through school media

The Directorate of Community Nutrition has published a Manual of Balanced Diets for Adolescents and a Manual of Nutrition Education for Schoolchildren to be implemented by community health centre personnel.

Distribution of iron supplementation tablets

Ministry of Health is also urging schools to improve distribution of iron supplementation tablets for schoolgirls by using a self-supporting fund.

Reaching young Indonesian women through marriage registries: An innovative approach for anaemia control

Although this programme was not targeted at adolescents, the innovative strategy of the programme would also be useful for adolescents.



In an effort to build up iron stores before pregnancy and reduce the high prevalence of anaemia, the Ministry of Health/Indonesia and the Mother Care project implemented an anaemia control programme for newly-wed women (Jus'at et al., 2000). As part of an existing programme to counsel couples about marriage and to expert them to obtain tetanus toxoid immunization before obtaining a marriage certificate, women were also counselled to buy and consume 30-60 iron and folic acid tablets. Results showed that there was a decrease in the prevalence of anaemia from 23.8% to 14% over a period of 3-4 months.



Strategies for Improving Adolescent Nutrition

Adolescence represents a window of opportunity to prepare for healthy adulthood. During adolescence, some nutritional deficiencies originating during childhood can potentially be corrected, in addition to addressing their current needs. Healthy eating and lifestyle behaviours should be promoted and practiced, thereby preventing or postponing the onset of nutrition-related chronic diseases in adulthood. Undernourished adolescents would require further nutrition interventions, besides proper health care, to improve their health and nutrition status. While it is important to improve nutrition of both girls and boys, girls demand more attention because of their reproductive role.

To respond to the diverse needs of adolescents, different interventions are needed in different countries. Lack of visibility of adolescents in existing policies and strategies at national level compromises the health sector response to their special needs. There are many factors contributing to the neglect of adolescents in public health programmes. Some of these include the following:

- Lack of age and sex disaggregated data on health and nutritional status of adolescents at the national level is the major underlying reason for widespread lack of policies and programmes for improving the health and nutritional status of adolescents.
- Adolescents are considered healthy and have been accorded a low priority within existing public health programmes and health services.
- Adolescents have inadequate knowledge about their own health, development and nutritional needs.



- Adolescents who are informed about their own needs, may not have the skills needed to address those needs, nor sufficient information about where to seek services, or whom to contact when help is needed.
- Lack of involvement of young people in preventive and promotive health programmes.
- Health providers are often not skilled or trained to deal with the special needs of adolescents in a friendly manner. Adolescents are treated as children or mothers.
- Adolescents are a diverse group. There is enormous variability in the timing of their growth. Because of this variability, age is a poor indicator of physiological maturity and nutritional needs, thus interventions need to vary according to differing needs.
- Barriers relating to availability, accessibility and acceptability of services influence the health care seeking behaviour of adolescents.
- Socio-cultural factors, especially gender discrimination – the tradition of favouring sons and neglect of girls – adversely affect their health and nutrition.

8.1 The Guiding Principles

- Adolescents should be recognized as a priority target group and their needs should be adequately addressed in national programmes.
- Adolescents should be considered separately as two groups for programmatic purpose: the younger ones (10-14 years), when 80% of the growth takes place and need for nutrients is very high; and the older ones (15-19 years), whose rate of growth has slowed down but for whom micronutrient deficiency control, especially IDA control, is important. Health providers should also be aware that adolescents are at risk of health problems prevalent among adults, such as anaemia.
- Multisectoral collaboration for adolescent health and nutrition should be led by the health sector.



- Adolescent nutrition should be mainstreamed and integrated in existing public health programmes that have an adolescent component e.g., RCH in India and other health and nutrition programmes of the countries (Annexure 4, List of adolescent programmes supported by UN agencies).
- It is important to include adolescent nutrition as an integral component in National Adolescent Health Strategies that are being formulated.
- There should be clear-cut policy and strategies for reaching adolescents in different settings; school going, out-of-school, in urban slums, rural areas etc.
- Gender issues, behaviour/life-style modification using multi-sectoral approach should be addressed.
- Involving adolescents and young people in the design, planning, implementation and evaluation of measures to improve their health and nutritional status will increase their ownership.

8.2 Strategies for Addressing Adolescent Nutrition in the South-East Asia Region

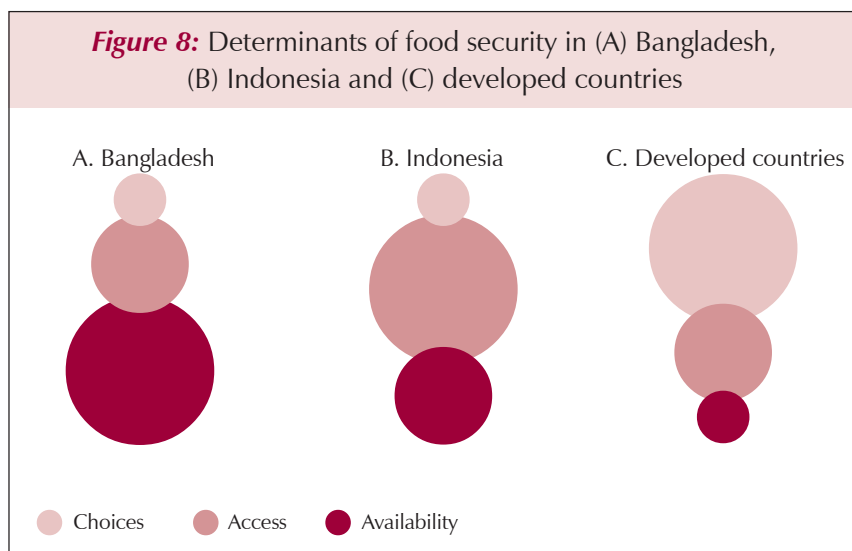
Food-based strategies

An intervention strategy that is sustainable without external support and can combat multiple micronutrient deficiencies simultaneously is a food-based strategy. Change in dietary pattern e.g., increase in consumption of vegetables and fruits, dairy products and animal foods, and modification in food processing methods help in improving diet and micronutrient status. Asian diets are mainly cereal-based and bioavailability of certain nutrients from such diets is limited. Iron from animal sources is more available, but consumption of such foods is restricted due to poverty. Means of improving bioavailability from vegetarian foods such as consumption of vitamin C rich foods, avoidance of iron absorption inhibitors and fermentation of cereals and legumes should be encouraged.

Intervention strategies to improve inter and intra-household food security are also important.



Figure 8 (Kiess et al., 2001) represents schematically the determinants of food security among poor households in a country such as Bangladesh. In rural areas of such countries adequate food availability, especially of foods such as dairy and animal-origin foods, fruits and vegetables remains below what is required. In addition, with a large population below the poverty line, food accessibility is also a problem. In this situation, food choice is a much less important determinant of food security. The problem is still worse in case of adolescent girls for whom intra-household food security is also a constraint because of gender bias. This suggests that behavioural change programmes should be coupled with programmes to improve food availability and access to improve food security (Kiess et al., 2001).



Source: Kiess et al., 2001

Addressing modification

Nutrition interventions, especially those that are behaviour-based have been effective in producing dietary change in adolescents (Lyte, 1995) rather than knowledge-based strategies (Hoelscher, 2002). Factors influencing eating behaviours of adolescents need to be better understood to develop effective nutrition interventions to change behaviour (Lenfant, 1995). Programmes that extend the interventions to the family may be more effective than those which reach only adolescents (Baranowaki, 1997, Feunekes et al., 1998, Parcel et al., 1988).

Public health interventions in particular have the potential to affect adolescents and children, especially when disseminated through channels that reach a majority of adolescents, such as:

- School-based nutrition interventions
- Social marketing approach
- Behaviour change through communication
- Mobilizing the family and communities

School-based nutrition interventions

Schools provide the most effective and efficient way to reach adolescents because:

- Students can be reached at an influential stage in their lives, during childhood and adolescence (WHO, 1996, MMWR, 1996) when lifelong nutrition patterns are formed.
- Schools provide a setting to introduce nutrition information and technologies to the community (WHO, 1996).
- Schoolgoing adolescents can reach out-of-school adolescents and can also become the role models for them (Bhatia, 2001).
- Compared with various public health approaches, school-based nutrition interventions such as regular nutritional screening, providing micronutrient supplements, ensuring consumption and nutrition behaviour development are the most cost-effective (WHO, 1998, Muro et al., 1999).

Social marketing is effective in behaviour change

An intensive social marketing strategy is essential for behaviour change. Social marketing has been shown to be effective in promoting consumption of carotene-rich foods and significantly reducing vitamin A deficiency (Smitasiri et al., 1993, 1999).

Social marketing may also be particularly effective with adolescents, considering their liking (and being a preferred target) for commercial marketing (Delisle, 2001)



Behaviour change through communication (BCC)

BCC is a multi-level tool for promoting and sustaining the desired behaviour in individuals and communities by using a variety of communication channels and creating demand for information and service.

The media can influence through food advertisements. Mass media can encourage new behaviours. Multimedia approaches that combine face-to-face and mass media are appropriate for nutrition education (Zeiltin and Formacion, 1981).

Food advertising is also a pervasive and influential aspect of media. Advertisements for so called 'junk foods' and non-nutritious fast foods should be regulated. Children have to be taught to recognize the purpose of advertising strategies such as those providing important information and those solely promoting a particular brand (WHO, 1998). Children also need to learn to recognize that some advertising may not be supportive of good nutrition.

In addition to government agencies, other sectors such as industry and trade, consumer organizations, insurance companies, sports organizations etc., can utilise the mass media (WHO, 1998).

Mobilizing family and community

Mobilizing family and community through local NGOs and adolescent clubs. This approach is also useful to reach adolescents who are hard-to-reach, such as out-of-school adolescents, street children etc. This not only helps in reaching the intended audience but does so cost-effectively.

Control of micronutrient deficiencies

Targeting adolescent girls for reduction of micronutrient deficiencies, especially iron deficiency anaemia before childbearing, serves, to complement (not substitute) ongoing efforts to address the problem during pregnancy and infancy. The rationale for considering pre-childbearing adolescent years as a time to reduce iron deficiency anaemia is based on three considerations (Kurz and Galloway, 2000). First, many girls are often already anaemic by the time they become pregnant. Second, pregnancy is too short a period in which to reduce pre-existing anaemia, particularly when many women do not seek prenatal care until their second or third

trimester. Third, intervention channels already exist through which adolescents can be targeted for iron intake.

The following interventions can be useful to address IDA and other micronutrient deficiencies in adolescents:

- Promotion of consumption of micronutrient-rich foods through home gardening (Smitasiri et al., 1999) or provision of food through community kitchens (Creed-Kanashiro et al., 2000) or poultry farming.
- Providing iron and folic acid supplements to adolescent girls through schools or through the community outreach programme (Kanani and Poojara, 2000).

Large-scale programmes to combat IDA among adolescents have seldom been attempted because of the cost of daily supplements and the extra managerial burden for the health sector (ACC/SCN, 1991). There is a need for an alternative approach, which is less costly. Supplementation, using a weekly schedule may offer such an alternative for a large-scale programme targeted at adolescent girls. Studies on adolescents in Indonesia, Sri Lanka and Nepal (Angeles et al., 1997, Jayatissa and Piyasena, 1999, Shah and Gupta, 2002) showed that a weekly iron supplement was as effective in improving iron status as a daily supplement.

- Building demand for iron supplementation and promoting the purchase of iron supplementation through the private sector and local stores has proved to be a sustainable strategy (Jus'at et al., 2000, Smitisari et al., 1999, Bhatia, 2001). The complinace rate is better when iron supplements are purchased than when distributed free.
- Addressing non-food factors: Good hygiene and sanitation and control of intestinal parasites should go hand-in-hand with supplementation and dietary improvement.
- Food fortification and promotion of fortified foods through media.

Nutrition assessment of adolescents

Regular nutrition assessment should be inbuilt in all nutritional interventions for adolescents. This includes anthropometry (weight and height) for assessing under- nutrition and stunting on one hand and obesity on the



other and screening for the indicators of malnutrition (e.g., pallor for anaemia). Adolescents undergoing pubertal growth spurt should be given preferential attention. The results of the assessments should be used for counselling the adolescents and their families for taking corrective action. Schools and Adolescent Friendly Health centres would be the suitable settings for regular assessment.

Care of adolescents during pregnancy and postnatal period

Intervention programmes should focus on nutrition of pregnant adolescents and reduce the risks of pregnancy during adolescence (Long, 2002).

Although pregnant adolescents are beneficiaries of services offered to pregnant women, they face more risks and therefore need closer monitoring and care.

- Early identification of pregnant adolescents is essential for providing required services as early as possible.
- Nutritional counselling should be compulsory in antenatal care of pregnant adolescents, and also include adequate rest during pregnancy.
- Pregnant adolescents require closer monitoring for adequate weight gain than adult women (Rees et al., 1992).
- Calcium supplementation may reduce the risk of premature delivery (but not intra- uterine growth retardation), pre-eclampsia and pregnancy-induced hypertension, (Gulmezoglu et al., 1997).
- Teenage mothers also need extra care during the postpartum period (Gillespie, 1997). In addition, support for breastfeeding is even more critical than in adult mothers in view of poor lactation performance and of higher nutritional risks in offspring (Delisle et al., 2001, Buvinic, 1998).

Intersectoral linkages at the community level

The role of other sectors, in addition to the health sector, in improving the nutritional status of adolescents is critical. There are different sectors involved directly or indirectly with programmes addressing the needs of adolescents. Some of these include education, sports, youth welfare, social

welfare, employment, social justice, agriculture and horticulture etc. For school going adolescents, involvement of the education sector is important since life skills education and nutrition related activities are primarily addressed by this sector in most Member Countries of the Region. Similarly for out-of-school adolescents, non-formal education and employment opportunities are addressed by other relevant sectors. Inter-sectoral coordination to focus on adolescent nutrition can have a multiplier impact on changing behaviours related to nutrition, improving access as well as availability of foods. The health sector has an important role in sensitization and in building advocacy with different sectors on adolescent nutrition. Different strategic approaches can be adopted towards enhancement of inter-sectoral linkages at the national level.

Linkages to adolescent friendly health services (AFHS)

Adolescent Friendly Health Services are the ones which are accessible, acceptable and appropriate for adolescents. They are in the right place, at the right time, at the right price (free where necessary) and delivered in the right style to be acceptable to young people (WHO, 2003). AFHS would be able to cover the most vulnerable sections and are comprehensive in nature providing a clutch of services to the entire target group. The gold standard for AFHS is that they are effective and meet individual needs of young people who return when they need to and recommend these services to friends (WHO, 2003). There is no need to constitute separate dedicated services for adolescents; the existing services in local communities can be improved by enhancing the competencies of health care providers to deal effectively with adolescents and removing the existing barriers-like judgmental attitude of health workers, inconvenient location and timing, unfriendly policies etc.

These services can be delivered through the hospitals, health centres, in schools and colleges or in the community. An overall strategy spelling out the kind of health services to be delivered, and to which group of people, needs to be developed.

AFHS also require inputs from the community and from adolescents. Communities need to be well informed about and supportive of the work. At the same time, adolescents must be well informed about available services and must be able to participate actively in the design of appropriate services.



Making adolescent friendly health services available will go a long way in developing healthy behaviours with respect to nutrition from the early years. An effective health service will have linkages with different sectors such as education and social welfare. The health system should be organized to ensure that adolescents have access to appropriate quality of services that have a bearing on adolescent nutrition as well. These can include growth-monitoring, diagnosis, treatment, and care of problems related to nutrition in addition to other problems. Supply of IFA tablets, deworming, nutrition education and nutrition counselling and referral services are integral part of AFHS.

Many countries in the Region notably India, Indonesia, Nepal and Thailand, have encouraged the establishment of AFHS centres. These centres operate from a variety of settings hospitals, shopping malls, NGOs and community settings that are more accessible to the adolescents and young people. Many of these centres are extensively networked with schools, colleges, government bodies and institutions that have a stake in adolescents. Tools, guidelines and materials to plan and implement AFHS have been developed by WHO.



Possible Actions at the Country Level

Adolescent nutrition can be addressed as part of existing programmes on maternal and child nutrition. The health sector should play a major role in integrating adolescent nutrition in other programmes and also in mainstreaming it in other sectors.

The major actions required from the health sector include:

- Developing a database regarding health and nutrition status of adolescents, taking into consideration rural-urban differentials and socio-economic disparity. Collection and analysis of age and sex disaggregated data can be included in the national surveys. The reliable disaggregated database should be utilized for:
 - designing advocacy material for stronger political commitment and social mobilization;
 - formulating policy guidelines and strategies to improve adolescent nutrition; and
 - developing and implementing feasible ameliorative measures through various sectors.
- Developing an integrated approach to address nutritional problems of adolescents, both boys and girls (especially in early adolescence). School-based, community based and health facility-based interventions have their own advantages and drawbacks if implemented as stand-alone programmes. However, if interventions can be carried out at all these places in a coordinated manner, it can help in improving the nutritional status of non-pregnant as well as pregnant adolescents.



- Meeting the challenges of addressing adolescent nutrition, necessitating development of adolescent friendly health centres catering to the holistic needs of adolescents including uninterrupted supplies of supplements; mainstreaming adolescent nutrition in the health systems; reaching the unreached-out of school adolescents with nutrition interventions.
- Building interventions on the successful models in the Region; however operational research may be needed to test the ways of scaling up the interventions. For instance, what inputs would be needed, what needs to be modified; and what are the costs and benefits of scaling up?
- Recognizing intersectoral collaboration as one of the strategies to address problems of adolescent nutrition. Appropriate methodology and tools should be prepared to further sensitize community health workers, education, women's welfare, child development, social empowerment and other sectors to effectively incorporate and address relevant issues. Partnership with the private and voluntary sectors should be strengthened for delivery of services.
- The health sector should coordinate with the school system and provide counselling services along with other outreach services related to nutrition and health. Integration of nutrition and gender issues into existing Life Skills Education Programmes can further strengthen these efforts.
- Equipping health service providers with knowledge and skills, particularly in counselling and communication, to implement adolescent nutrition as a part of provision of Adolescent Friendly Health Services. The available tools, guidelines and materials developed by WHO can be adapted at the national level.
- Adolescent health and development policy/strategy should be in place in the Member Countries of the Region. Interventions to address adolescent undernutrition should be incorporated as part of the overall adolescent strategy.
- Sensitization of media persons should be carried out.
- Targeting adolescents for prevention of obesity in urban areas where changing lifestyles and eating patterns contribute to obesity.



In countries undergoing rapid urbanization and economic growth, nutrition transition is observed with the rise in obesity and other nutrition-related chronic diseases.

- Introducing measures to control micronutrient deficiencies and understanding the effect of multiple micronutrient supplementation or food supplementation on maternal nutrition and foetal outcomes in pregnant adolescents.
- Giving emphasis to conducting operational research and behavioural studies for finding new and innovative ways with which to approach the nutrition problems during adolescence.
- The health sector should strongly advocate coherent policies supportive of health and nutrition of adolescents and undertake research on the status and impact of such policies and legislations.

9.1 Role of other Sectors

The following sectors can make a positive contribution to the health and nutrition status of the adolescent populations:

Education sector

Ensure retention of girls in schools; organize school health programme; impart nutrition education; provide nutrition-counselling services; distribute nutrition supplements; address gender discrimination; link nutrition with Life Skills Education in schools.

Social welfare sector

Ensure training of staff to deal with problems of adolescents; especially out of school adolescents; collaboration with the health sector to provide services to unreached adolescents; changing the existing socio-cultural milieu that adversely affects adolescent nutrition; creating awareness to improve health care seeking behaviour of adolescents.

Food and agriculture sector

Fortification of food with micronutrients, which is a cost effective approach in overcoming micronutrient deficiencies, especially among the economically deprived population.



Mass media

Mass awareness campaigns should be developed in collaboration with the health sector to create awareness among the masses regarding nutritional needs of adolescents, especially girls.

Legal sector

Ban on sale of non-iodized salt (the ban has been re-imposed recently in India); strict implementation of the law on age at marriage of girls; rights-based approach to provision of health services to adolescents.

Community

Advocate and create awareness on equal rights and needs of girls and boys; promote safe and supportive environment for growth and development of adolescents.

9.2 At the Regional Level

The UN and other international and donor agencies working at the regional level should take the following actions to support and reinforce country efforts:

- Increase commitment and advocacy for improving adolescent nutrition.
- Share knowledge and information with member countries in the region.
- Build capacity of providers.
- Support and encourage research.
- Provide technical assistance to Member Countries for developing locally-defined anthropometric cut offs.

9.3 Research Priorities

Research may be conducted to find new and innovative ways with which to approach the nutritional problems of adolescents. The research must be broad and encompass a complex range of factors. Research priorities are:

- Development of a database on the nutritional status of adolescents and development of national standards (cut off points for indicators, including BMI based on functional and health-related outcomes)
- Review of existing policies and programmes addressing adolescent nutrition.
- Qualitative studies on adolescents' diets and eating behaviours
- Beneficial effects of calcium supplementation during adolescence.
- Effect of multiple micronutrient and/or food supplementation on maternal nutrition and foetal outcomes in pregnant adolescents.
- Research on emerging micronutrient deficiencies-folate, zinc and calcium.
- Studies on cost-effectiveness of selected nutrition interventions.
- Interventions and approaches to identify and address obesity in adolescence.
- Role of gender issues in adolescent health and nutrition.
- Strategies for community mobilization/establishing family support for adolescent nutrition.



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Annex 1-A

Recommended Dietary Allowances- NCHS, Revised 1989

Category	Age (Yrs)	Protein (g)	Iron (mg)	Calcium	Vitamin A (mcg RE)	Vitamin C (mg)	Folate (mcg)
Infants	0-1/2	13	6	400	375	30	25
Infants	1/2-1	14	10	600	375	35	35
Children	1-3	16	10	800	400	40	50
Children	4-6	24	10	800	500	45	75
Children	7-10	28	10	800	700	45	100
Males	11-14	45	12	1200	1000	50	150
Males	15-18	59	12	1200	1000	60	200
Males	19-24	58	10	1200	1000	60	200
Males	25-50	63	10	800	1000	60	200
Males	51+	63	10	800	1000	60	200
Females	11-14	46	15	1200	800	50	150
Females	15-18	44	15	1200	800	60	180
Females	19-24	46	15	1200	800	60	180
Females	25-50	50	15	800	800	60	180
Females	51+	50	10	800	800	60	180
Pregnant		60	30	1200	800	70	400
Lactating	1-6 months	65	15	1200	1300	95	280
Lactating	7+ months	62	15	1200	1200	90	280



Annex 1-B

Summary of RDA for Indians (1989)

Group	Particulars	Body wt. kg	Net energy kcal/d	Protein g/d	Fat g/d	Calcium mg/d	Iron* mg/d	Retinol mcg/d
Man	Sedentary work		2425					
	Moderate work	60	2875	60	20	400	28	600
	Heavy work		3800					
Woman	Sedentary work		1875					
	Moderate work	50	2225	50	20	400	30	600
	Heavy work		2925					
	Pregnant woman	50	+300	+15	30	1000	38	600
	Lactation 0-6 months	50	+550	+25	45	1000	30	950
	6-12 months		+400	+18				
Infants	0-6 months	5.4	108/kg	2.05 kg		500	350	
	6-12 months	8.6	98 kg	1.65 kg				
Children	1-3 years	12.2	1240	22			12	400
	4-6	19.0	1690	30	25	400	18	400
	7-9	26.9	1950	41			26	600
Boys	10-12	35.4	2190	54	22	600	34	600
	10-12	31.5	1970	57			19	
Boys	13-15	47.8	2450	70	22	600	41	600
	13-15	46.7	2060	65			28	
Boys	16-18	57.1	2640	78	22	500	50	600
	16-18	49.9	2060	63			30	

Source: ICMR, India

* RDA for iron is higher than NCHS probably because of low bio availability from vegetarian diets in India

Annex 2

Interventions for Improvement of Nutritional Status in Adolescents and their Impact

S. No	Source	Interventions	Country	Impact
1	Bhatia, 2001	<ul style="list-style-type: none"> • Active participation of youth and children • Child-to-child & Girl-to-girl approach for behaviour change • School as entry point, reached community through schoolchildren • Provided iron supplements at subsidized rate by creating demand (used social marketing) but not free • Provided vegetables at cost price to families from community garden • Promotion of use of footwear. • Cost shared by community 	India	<ul style="list-style-type: none"> • Reduced prevalence of anaemia in adolescent girls by 50% • Improved compliance for supplement intake • Improvement in diet and hygiene practices • Reduced parasitic infestation
2	SWACH Foundation	<ul style="list-style-type: none"> • Social marketing to promote iron supplements and good dietary practices • Provided IFA tablets free but capsules and syrups of IFA at a price • Involved adolescent girls, school teachers and community health workers and private health practitioners • Girl-to-girl approach to increase outreach 	India	<ul style="list-style-type: none"> • Reduction in severe anaemia (3.2% to 0.9% in schoolgirls and 11.7% to 3.2% in non-school going girls) • Improved KAP • Improvement in dietary practices



S. No	Source	Interventions	Country	Impact
3	Kanani and Poojara, 2000	<ul style="list-style-type: none"> Daily supplementation of IFA (60 mg Fe and 0.5 mg folic acid) to adolescent girls in urban slums Weekly supplementation of IFA (100mg Fe and 0.5 mg folic acid) to school girls 	India	<ul style="list-style-type: none"> Mean change in Hb Level was +1.73g/dl after 3 months Significant weight gain Non-significant improvement in Hb level after 6 months
4	Jus'at et al., 2000	<ul style="list-style-type: none"> Iron and folic acid tablets to women through marriage registries (women purchased the tablets) IEC activities to educate people 	Indonesia	<ul style="list-style-type: none"> Decrease in prevalence of anaemia from 23% to 14% in 3-4 months
5	Angeles et al., 1997	<ul style="list-style-type: none"> Weekly supplementation of 60 mg iron, 6000 microgram retinol, 0.5 g folic acid 	Indonesia	<ul style="list-style-type: none"> Improved Hb level from 20% to 5.7% after 3 months
6	Shah and Gupta, 2002	<ul style="list-style-type: none"> Weekly IFA Daily supplementation with IFA 	Nepal	<ul style="list-style-type: none"> Improved Hb from 70.1% to 13.4% after 14 weeks Improved Hb levels from 68.6% to 20%
7	Smitasiri et al., 1999	<ul style="list-style-type: none"> Built on behaviour change Involvement of women Social marketing approach for information to community School based nutrition education campaigns Improved nutrient content of school lunch Iron supplements purchased by girls for weekly consumption (monthly supply cost only 3 US cents) Promotion of poultry raising, fish ponds and vegetable gardens Salt iodization by women 	Thailand	<ul style="list-style-type: none"> Change in KAP Prevalence of anaemia decreased from 25% to 16% after one year Serum retinol level showed consistent improvement



Annex 3

Body Mass Index (BMI)

Body Mass Index (BMI) is an anthropometric index of weight and height that is defined as body weight in kilograms divided by height in meters squared

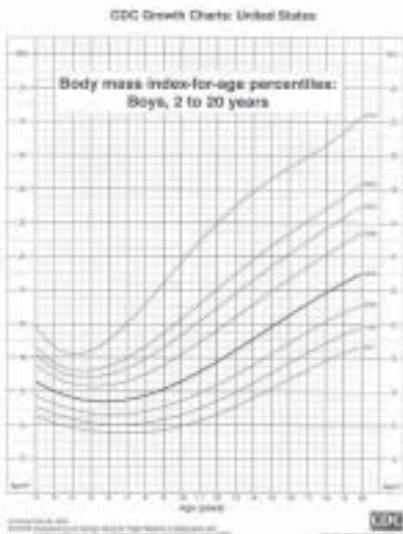
$$\text{BMI} = \text{weight (kg)} / \text{height (m}^2\text{)}$$

BMI is the commonly accepted index for classifying adiposity in adults and it is recommended for use with children and adolescents.

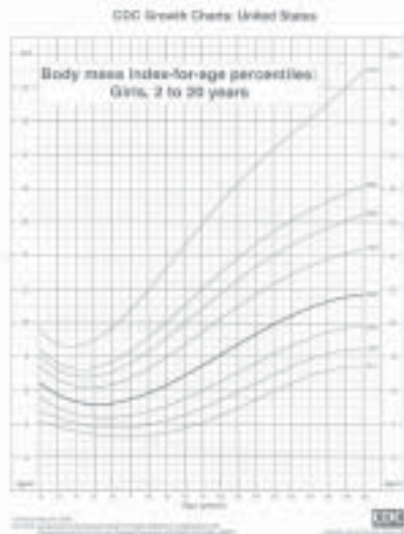
BMI is used differently for children than it is for adults

In children and teens, body mass index is used to assess underweight, overweight, and risk for overweight. Children's body fatness changes over the years as they grow. Also, girls and boys differ in their body fatness as they mature. This is why BMI for children, also referred to as BMI-for-age, is gender and age specific. BMI-for-age is plotted on gender-specific growth charts. These charts are used for children and teens 2 – 20 years of age.

Body mass index-for-age percentiles: boys, 2-20 years



Body mass index-for-age percentiles: girls, 2-20 years



Annex 4

Recommended Cut-off Values

Indicator	Anthropometric variable	Cut-off values	Original References
Stunting or low height for age	Height-for-age	< 3 rd percentile or < -2 Z score	Hamill et al 1979
Thinness or low BMI-for-age	BMI-for-age	< 5 th percentile	Must et al 1991
At risk of overweight	BMI-for-age	≥ 85 th percentile	Must et al 1991
Obese	BMI-for-age	≥ 95 th percentile	Must et al 1991

Source: WHO technical report series No. 854

WHO Criteria for diagnosis of Anaemia

Age/sex Groups	Hb (g/dl)
Children 6 m to 59 m	< 11
Children 5-11 yrs	< 11.5
Children 12-14 yrs	< 12
Adult males (above 15yrs)	< 13
Non pregnant women (above 15 yrs)	< 12
Adult females (pregnant)	< 11

Source: WHO, 2001

The table above shows how anaemia is diagnosed in different age groups in children, and in adult men, non-pregnant and pregnant women.



**World Health
Organization**

Regional Office for South-East Asia
New Delhi