

## **CHAPTER 5**

### **SUMMARY AND CONCLUSION**

Adolescence provides the second and the last opportunity to make up for the lost chance of growth and development in childhood (Rhode 1993). This holds true especially for poor segments of the population, who live with many constraints that compromise growth and development. It is only in the last decade or two that the problems of the adolescents have been on the agenda of the health planners and health professionals. According to Coyaji (1993), to improve the quality of life it is imperative to give importance to this crucial period of life, that is, adolescence. This is because during this period, the foundation for future with respect to physical, social, cultural and traditional role that boys and girls are going to perform, is established. As adolescents grow and develop, they become aware of the expectations that their family and society have from them. Socially defined roles often result in discrimination against females in all stages of life cycle including adolescent girls. This contributes to poor nutritional health status with adverse consequences. The impact of this gender discrimination on nutritional health status of women and female child has been studied, but with regard to adolescent boys and girls, gender sensitive data is inadequate. Further, keeping in view individual variations in growth and development during adolescence, there is a need for longitudinal growth data on adolescents; especially comparative data for boys and girls which is scarce. Thus with this background, the present study was undertaken with the following objectives :

- To conduct longitudinal studies on nutritional status of poor adolescents boys and girls
- To undertake gender based analysis of the data to compare nutritional status of the adolescent boys and girls in the different age groups from 10 – 18 years.
- To identify environmental determinants of nutritional status of adolescent boys and girls : proximal and distal factors

## 5.1 Methodology

The study was conducted in one urban slum and two government aided schools catering to low socio – economic group. All the children in the age group of 10 – 18 years from the selected schools and the slums were enrolled for the study. The children who were enrolled and available for the study were covered for socio-economic and anthropometric surveys. Data was collected on random sub-sample for Hb status, morbidity profile, quality and quantity of food intake and perceptions about their own health. As the focus of the study was on longitudinal data, analysis was carried out only for those subjects whose nutritional status data for the beginning and after 12 months were available. Thus, the study sample for socio-economic (SE) profile and anthropometric measurements consisted of 330 boys and 362 girls in the age group of 10 – 18 years. The age-wise and sex-wise distribution of the sample is presented below in Box 5.1.

**Box 5.1 : Age-wise and Sex-wise Distribution of the Study Sample for SE Profile and Anthropometric Measurements**

Age (years)	Boys	Girls	Total
10 - 12	98	98	196
13 - 15	142	173	315
16 - 18	90	91	181
10 - 18	330	362	692

## 5.2 Study Design

This was a longitudinal study comparing nutritional status of adolescent boys and girls in the same environment. Data on socio – economic status, anthropometric measurements, that is, height, weight, mid upper arm circumference and skin fold

thickness, haemoglobin levels were collected at the beginning and after 12 months of the study. In addition, morbidity profile, food frequency, food and nutrient intake and IHFD data were collected for the three seasons, that is, summer, winter and monsoon on random sub-sample shown below.

Indicators	Sample Size		
	Boys	Girls	Total
Hb	90	96	186
Morbidity	118	112	230
Food frequency Summer	93	94	187
Monsoon	110	98	208
Winter	92	90	182
Nutrient intake (summer, monsoon, winter)	91	101	192
Intra-household food distribution (summer, monsoon, winter)	43	44	87

### 5.3 Data Analysis

The data collected were entered in database package (FoxPro 2.5) and the statistical tests, that is, mean, median, ‘t’ test, Chi Square were performed in Epi Info 6 package. Growth in terms of height, weight, mid upper arm circumference and skin fold thickness was compared with NCHS standards and that of wherever appropriate. Nutrient intakes were analyzed as percent of recommended allowance (RDA) met (Gopalan et al 1989). The focus all through was on gender based analysis and longitudinal data : Changes in nutritional status of the adolescent boys compared with the adolescent girls. Age-wise trend were also observed

### 5.4 Salient Findings of the Study and Emerging Conclusions

The major findings of the study are presented below.

#### 5.4.1 Nutritional Health Status

##### H-A

- ✦ Mean H-A was above 90 % of the standards across all the ages among the study boys and girls. About one fifth (20 %) of the adolescents were stunted (H-A < 90 % of the NCHS standards).

- ✦ The distance curves of the study boys and girls showed that the mean height lagged behind NCHS and the other Indian affluent adolescents throughout the adolescent period.
- ✦ Though partial catch up growth was evident during certain periods of adolescence, the overall deficits in height vs. NCHS among the girls remained more or less the same, but increased in the boys.
- ✦ The pubertal growth spurt in terms of PHV lasted for a longer period in boys (from 10 - 14 years) whereas in the girls, it was short lived. The magnitude of annual height gain at the age of PHV was similar both in boys and girls : 6.9 cms.
- ✦ Catch up growth in height among the study girls was better than in the study boys across all the ages.

#### W-A

- ✦ Unlike H-A, there was a high prevalence of under-weight both in the study boys and girls (in the beginning and after 12 months) : 82 % - 76 % and 81 % - 76 % respectively.
- ✦ Among both the study boys and girls in each age group, the subjects either maintained or improved their mean weight as % standards over the 12 month period of the study. However, 18 year old boys on an average had less weight (as % standards) than 10 year olds indicating deterioration in weight profile as adolescence progressed. In contrast, on an average 18 year old girls had better weight (as % standards) than 10 year olds exhibiting an improvement in weight profile as adolescence progressed.
- ✦ The total weight increment of the girls was 90 % of the NCHS gain, whereas in the boys it was only 55 % of the total NCHS increments.

- ✦ The pattern of PWV was again markedly different in the boys and girls, that is, weight gain was high during 11 - 14 years in boys whereas in the girls the period of weight gain was short lived (up to the age of 12 years). But compared to the boys, magnitude of weight gain in the girls was high across the age groups
- ✦ According to Waterlow's qualitative classification, only 43 % - 63 % boys and 40 % - 70 % girls had normal nutritional status by both H-A as well as W-H indicating the need to intervene for girls as well as boys.
- ✦ A significantly higher number of the girls than the boys had both H-A and W-H below normal (12 % vs. 4 %). In the older age groups, these gender differences narrowed down, indicating increasing prevalence of under-nutrition with age among the adolescent boys whereas in the older girls it decreased. This trend was seen at the end of the study also. In fact, after 12 months, a significantly higher number of 13 - 15 years old boys had under-nutrition compared to the girls (8 % vs. 2 %).

#### **BMI, Mid Upper Arm Circumference and Skin Fold Thickness**

- ✦ The mean BMI of both the boys and girls had mean values around 80 % of the standards. However, the gender differences existed. Mean BMI as (% standards) declined from 85 % to 83 % in the boys, whereas it improved in the girls 83 % to 87 % during 10 to 18 year period. Overall the girls exhibited a higher BMI (as % standards) than the boys. Considering the proportion with below normal BMI (below 80 % of the standards), 51% - 53 % of the boys and 32 % - 37 % of the girls were undernourished.
- ✦ According to MUAC, the percent standard values decreased in the boys from 10 to 18 years, whereas it increased in the girls. During the 12 month study period, the longitudinal data showed that within each age group the percent standard values of MUAC remained more or less similar.

- ✦ Mean SFT values as % standards over the 12 month period deteriorated in the boys whereas it improved in the girls. This trend is consistent with that observed for BMI and W-A in the boys and girls.

### **Morbidity**

- ✦ With regard to morbidity as measured by 15 days recall period, overall 50 % of the boys and girls suffered from various ailments in the three seasons (summer, monsoon and winter). Fewer adolescent boys and girls in the older age group reported morbidity (one fourth to one third) compared to the younger adolescents. Overall the prevalence of morbidity reported was slightly higher in winter season.

### **Emerging Conclusions**

**Overall, by BMI prevalence of under-nutrition was high : 51 % - 53 % in boys and 32 % - 37% in girls. By both height and weight, less than half of the subjects had normal nutritional status. Gender differences were seen. According to most anthropometric indicators, boys depicted poor growth profile compared to the girls. The prevalence of under-nutrition increased as the boys grew older whereas it decreased as the girls grew older, especially during 10 to 15 years. This could be because the timing of the adolescent growth spurt occurs earlier in the girls and later in the boys. The period of growth spurt coincides with relatively higher prevalence of under-nutrition. This highlights the need to intervene during early adolescence : 10 - 15 years. Thus, interventions during early adolescence are important when the growth spurt is taking place and nutrient requirements are high.**

## Haemoglobin Status

- ✦ Overall as many as 65 % - 100 % of the adolescent boys and 91 % - 96 % of the adolescent girls had Hb values below 12.0 g/dl cut off levels during the study period indicating a high prevalence of anaemia
- ✦ No marked changes occurred in the boys and girls, as regards Hb levels over the study period in different age groups, that is, overall mean Hb values for the boys ranged between 10.22 and 10.73 g/dl and for the girls between 10.22 and 10.09 g/dl.
- ✦ Moderate to severe anaemia (Hb < 10 g/dl) was prevalent in higher percentage of the older boys (above 60 %) both in the beginning and after 12 months, whereas majority of the girls (more than 60 %) had mild anaemia (Hb < 12 g/dl) both at the beginning and after 12 months of the study. Severe anaemia was low both in the boys and the girls.

## Emerging Conclusions

Contrary to the widely held belief that girls are more vulnerable than boys, in the present study Hb levels were unsatisfactory both in the boys and the girls. Overall the prevalence of anaemic boys and girls was high. Further, over the study period longitudinal data did not show any marked improvement in Hb levels over the 12 month study period both in the boys and girls. Iron interventions during adolescent growth are required for both boys and girls.

## 5.4.2 Proximal and Distal Determinants of Nutritional Status

### 5.4.2.1 Proximal Determinants

#### *Food Intake*

- ✦ In the three seasons, no noticeable gender differences between the boys and girls were found. A majority of boys and girls (60 % - 68%) consumed pulses two to three times in week in all the age groups. Legumes, sprouts and fruits were eaten by majority only once a week. In monsoon consumption of legumes increased among the study boys and girls across the age groups.
- ✦ Overall, across the seasons, the frequency of GLVs consumption by majority was very less : once in a week/fortnight/month. Even when seasonal availability increased as in winter, the adolescents did not consume them more frequently. In general, among both the study boys and girls, frequency of intake of roots and tubers (mostly potatoes and onions) and other vegetables was higher compared to GLVs, that is, above 50 % consumed at least 2 to 3 times a week. There were no marked gender differences. Owing to cost factor, most of the vegetables were cooked with potatoes and onions.
- ✦ Milk was consumed in the form of tea by most of the study boys and girls. Buttermilk and curd were generally consumed in the form of '*kadhi*'. Non vegetarian foods were consumed only occasionally and tended to be consumed more by the study boys than the study girls. Thus, among adolescents, intake of protective foods was highly unsatisfactory.
- ✦ Mean calorie intake (as % RDA) ranged from 62 % - 70 % in the boys and 51 % - 64 % in the girls across the seasons. As for the seasonal trend, calorie intake improved in monsoon and winter as compared to summer for both the boys and girls. Relatively, the boys consumed more calories (as % RDA) than the girl across the seasons.



- ✦ In the adolescent group, iron intake was the highest in the monsoon season and was better in the girls than in the boys (69 % vs. 60 % respectively). In the winter, it was higher in the boys than in the girls (65 % - 59 %). No gender difference was observed in the summer and also iron intake was the lowest among the three seasons. Although iron intake was somewhat better in the girls than in the boys, the prevalence of anaemia was equally high in the study boys and girls which could be due to low bio-availability of iron, and menstrual losses in the girls.
- ✦  $\beta$  - carotene intake was extremely inadequate across the three seasons among both the study boys and girls, meeting only one fourth of RDA. The intake of vitamin C was similar in monsoon and summer in the boys and girls: 52 % and 47 % respectively. In winter, the adolescent boys had higher vitamin C intake compared with the adolescent girls (57 % vs. 40 %).

### ***Intra-household Food Distribution***

- ✦ The calorie intake of the adult male remained the highest across the three seasons, followed by the adult female : 68 % - 80 % RDA and 58 % - 77 % RDA respectively.
- ✦ The adult female received a higher share of the nutrients compared with the adolescent and the children.
- ✦ Overall, between the adolescents and children, the adolescents obtained higher share of calorie from the family pool across the three seasons : 62 % - 70 % RDA in the adolescent boys, 51 % - 64 % RDA in the adolescent girls, 58 % - 65 % RDA in the male child and 52 % - 60 % in the female child. However, compared to the adolescent boy, the adolescent female had less share of nutrients. Similarly the male child was better off than the female child as regards meeting his RDA.

### ***Comparing BMI and Nutrient Intake***

- ✦ The group with the lower most tertile of BMI values as % standards (under-nourished) and the group with the upper most tertile of BMI as % standards (well-nourished) was compared for its Hb status and nutrient intake.

The under-nourished girls had lower mean Hb values compared with undernourished boys. However, the difference was not significant.

- ✦ The nutrient intake of well nourished boys by BMI was either similar to or better than the undernourished group. In the girls, the well nourished group also had higher intake of nutrients, but the difference was not significant.
- ✦ Both well nourished and undernourished boys by BMI showed higher intake of nutrients compared with their female counterparts,

### **Emerging Conclusions**

**Overall, all the family members had deficient nutrient intake and the adolescents were even more disadvantaged especially the adolescent girls. The nutrient intake of the adolescent boys and girls were much below the RDA. The adolescents received proportionately less share of nutrients from the family pot. The adolescent female and the female child receive the least amount of food. The undernourished group of the adolescents defined as the lowest tertile of BMI (as % standards) exhibited lower intake of nutrients than those in the upper most tertile.**

#### **5.4.2.2 Distal Factors**

##### ***Socio-economic status***

The association of socio-economic variables (caste, family size, per capita income per month, education and occupation of the parents, type of family, other indirect economic

indicators such as availability of house hold appliances, radio, TV) with nutritional status of the adolescents was studied.

- ✦ Compared to the under-nourished boys (as defined by BMI) the well nourished boys had smaller family size (5 or less), their parents had better education (secondary level or above) or had higher PCI per month. A larger number of such boys lived in the *pucca* house, possessed at least one two wheeler and TV compared to the under-nourished boys.
- ✦ A significantly higher number of the well nourished girls belonged to higher caste had a self employed father with a better paying occupation. A higher proportion of well nourished group had a working mother but the difference was not statistically significant. No significant association between indirect economic indicators and their nutritional status was seen among the girls.

#### ***Perceptions about Their Own Health, Nutrition and Gender***

- ✦ As many as 82 % of the adolescents believed themselves to be healthy and yet above 80 % desired to improve their health.
- ✦ About 66 % and 79 % respectively perceived their H-A and W-A appropriate. More boys than girls desired to increase their height and weight.
- ✓ ✦ Most of the adolescents considered 10 - 18 years of their life as important for future health.
- ✦ Only 17 % could correctly state what is a nutritious diet and only 42 % of them expressed that their food intake influences their growth and development. But almost all felt that their activities influenced their food intake. Girls perceived that their activities had a deleterious impact on their food intake while boys believed otherwise.

- \* More girls than the boys reported that the activities of boys and girls should not be different and that girls have more responsibilities than boys.
- \* Nearly three fourths believed that nutritious diet for boys and girls should not be different and that both need to develop and have similar needs.

### ***Knowledge about Pregnancy, Lactation and Child Care in the Adolescent Girls***

- ✓ \* Two thirds of the girls stated that weight should be increased during pregnancy. However, 79 % did not know about anaemia in pregnancy.
- \* About one fifth or less believed that breast feeding should be initiated within 24 hours after delivery and colostrum should be given to the child. About 41 % felt that exclusive breast feeding should be continued till child is 4 to 6 months old.
- ✓ \* More than three fourths girls expressed that lactating mother should eat more.

### **Emerging Conclusions**

**Overall, though nutritional status of boys and girls was associated with selected socio-economic indicators, more boys than girls appeared to show this association, indicating that improved socio-economic conditions benefit boys more than the girls.**

**Perceptions of the adolescent boys and girls revealed that this group requires nutrition education. Not only adolescents but their families also should be given nutrition education to increase their awareness regarding the nutritional needs of both adolescent boys and girls; in particular about the increased needs of the adolescent for nutrients in view of their future reproductive role.**

**Parents in particular need to realize that next to infancy, the adolescents show a rapid growth spurt which markedly increase their requirements for various nutrients. They also need to be aware that food insufficiency in adolescence leads to growth retardation which has adverse implications on their future health and productivity. Such efforts will be more effective when supply of food is not a limiting factor.**

## **Future Directions for Research and Program Strategies for Adolescents**

### *Under- Nutrition*

Using most anthropological indicators including BMI, it was consistently seen in this study that under-nutrition was more prevalent in the boys than girls and that catch up growth was also less satisfactory in boys. Nevertheless, both boys and girls showed a high prevalence of under-nutrition. Thus, improvement in nutritional status of both adolescent boys and girls becomes critically important. It is already established that for adolescent girl, compromised growth results in under-nutrition and stunting which are known obstetric risk factors and lead to poor pregnancy outcomes like low birth weight baby.

Under-nutrition in adolescent boys may lead to limited work capacity and has impact on economic development. Impact on future productivity and reproductive health arising out of adolescent under-nutrition should be studied.

### *Anaemia*

It was highly prevalent in boys and girls. Future research should investigate the long term effect of anaemia in adolescents. It is believed that girls will benefit more from interventions to reduce anaemia than boys, because girls continue to have anaemia during adulthood and also face pregnancy demands for iron, whereas in boys anaemia is transient and prevalence diminishes once boys have completed their adolescent growth. Future research should focus on the differential impact of anaemia control interventions in boys and girls and consequences of anaemia on growth, cognitive functions, physical work capacity.

### *Nutrient Intake and Intra-house hold Food Distribution*

Nutrient intake and intra-household food distribution favoured boys rather than the girls, yet under-nutrition and anaemia were wide spread both in boys and girls. The role of various proximal and distal factors on nutritional status of adolescents need to be further understood. Poor awareness regarding nutrition and health issues among adolescents needs to be addressed through relevant nutrition education program which are integrated into health services.

Thus, it has become imperative to give more attention on research and program strategies on adolescents and to integrate this group in health services.