

# *Summary & Conclusion*

## Summary & Conclusions

Malnutrition means non optimal status of the individual with reference to one or number of nutrients. It is well established that nutritional status is a major determinant of the health and well being among children. Developing countries like India, accounts for about 40 % of the undernourished children in the world and it is largely due to the result of dietary inadequacy. Nutrient deficiencies vary in their manifestations, some leading to specific clinical signs, many affecting growth at an early stage. Thus assessment of nutritional status plays a vital role.

Iron Folic Acid (IFA) supplementation is a preventive strategy for treating existing anemia. It is effective strategy until the diet of entire population changes significantly or till the time food fortification becomes very common. IFA improves behavioural & cognitive development of the children. It improves overall fitness and work capacity of the children. It also improves child survival where severe anemia is common. Therefore the objective of the study was to assess the nutritional status of underprivileged school children of rural Vadodara and to see the impact of IFA Supplementation and deworming on the nutritional status of children. The study was divided into 3 phases.

### PHASE 1: FORMATIVE RESEARCH

The study was conducted in the rural petrochemical area of Vadodara district, Gujarat. The petrochemical area was divided into six identical zones. All the schools which gave permission to carry out the study were taken. One representative school from each zone was randomly selected. All the children from 1<sup>st</sup> to 7<sup>th</sup> standard of the school were enrolled for the study. The total number of registered children was 3170 out of which data could be collected on 2282 children. Socio economic data of the children was collected using a pre tested semi-structured questionnaire. The anthropometric measurements like weight, height, waist and hip circumference measurements were studied in relation to age and gender. Clinical signs and symptoms, three day dietary pattern were collected using a pretested questionnaire. Biochemical estimation of haemoglobin by cyanmet haemoglobin method was collected on all the children.

**The major findings of this phase of the study are given below:**

### **Socio Economic Status**

- The data revealed that majority (84%) of the subjects were Hindus. Caste bifurcation showed that half of the study population was schedule caste or schedule tribe.
- Gender wise analysis for caste showed that the enrolment for girls was lower in schedule caste and schedule tribe as compared to general category group.
- The economic status revealed that the family income of 2/3 rd (70%) of the subjects was lower than Rs. 6000 per month.

### **Anthropometric Indices and prevalence of malnutrition**

- The mean weight of the girls was slightly lower than boys under 9 years of age. After 9 years reverse trend was seen. Such trend was not seen for height parameter. Height growth was more or less similar for both boys and girls.
- The prevalence of Undernutrition was seen by both CDC 2000 and WHO 2007 classification.
- The prevalence of underweight was 70 % according to CDC 2000 standards and 64 % by WHO 2007 standard.
- Prevalence of stunting was more or less same by both the standards. It was 31 %.
- Thinness in the study population was 60 % using both the classification.
- Prevalence of severe underweight, stunting and thinness was 27.3 %, 8.6 % and 25.2 % respectively by WHO standards.
- Prevalence of undernutrition was lower in children less than 6 years of age but then it peaked up and remained high throughout the childhood.

### **Clinical signs and symptoms**

- Assessment of deficiencies of clinical signs and symptoms of Iron, iodine & vitamin A were elicited from 960 children.

- The symptoms for micronutrients were listed and a government recognised paediatrician was deputed to assess the children.
- Iron deficiency was visible in 35.5 % of the children and vitamin A deficiency in 8.12 % children. Only two children showed mild symptoms of goitre.

### **Dietary Intake**

- Two working days and one Sunday was included for eliciting information on dietary pattern related to morning meals, mid day meal & consumption of vegetables and fruits.
- Morning snacks were consumed by just 22 % of the subjects. About 9 % of the children did not consume the MDM at all.
- It was not made compulsory for the children to have food in the school. The serving size of the Mid Day Meal also varied from child to child.
- The serving size depended on the size of plates or the Tiffin boxes which the children brought from home. If the children had not got any tiffin then he was not given food.
- Mid Day Meal consumption ranged from 52.8 % to 63.6 % in schools.
- The monthly consumption of MDM was maximum in December (66.6 %) and January (61.7%).
- The MDM consumption was highest in standard 3<sup>rd</sup> (62.8 %) and 4<sup>th</sup> (69 %).

### **Haemoglobin status and prevalence of anemia**

- Haemoglobin levels could be ascertained from 865 children studying from 4<sup>th</sup> to 7<sup>th</sup> standard.
- The mean haemoglobin levels of the children were almost similar in both the genders being  $11.4 \pm 1.8$  gm/dl and  $11.1 \pm 1.2$  gm/dl in boys and girls respectively.
- It was seen that 72% of the children were anemic of which 57.6 % were in mild category and 14.2 % in moderate category.
- Nearly 75 % of underweight and thin children were anemic. Prevalence of anemia in stunted children was found to be 33 %

- A positive correlation was seen when haemoglobin values were correlated with clinical signs and symptoms of iron deficiency ( $\chi^2$  53.9,  $p < 0.001$ ). The sensitivity for the correlation was 64 % while specificity was 44 %.

## **PHASE 2: LONGITUDINAL STUDY: GROWTH MONITORING FOR 3 YEARS**

The study was conducted in the rural industrial area of Vadodara, Gujarat. Out of the 45 government primary schools in the area, four schools were randomly selected. In the first year, all the children from 1<sup>st</sup> to 7<sup>th</sup> standard were enrolled for the study. Anthropometric measurements i.e. height and weight were recorded for all the children. In the first year data was collected on 2282 children of which 1094 were girls and 1188 were boys. In the second year same children were followed up. Looking at the dropout rate and the passed out children of 7<sup>th</sup> standard on whom the data could not be collected, the sample size became 1555 children. In the third year, keeping the same criteria, anthropometric data could be collected on 465 children of which 227 were boys and 238 were girls.

A total of 465 children had 3 pair of data for consecutive 3 years. Paired data of these children were used for studying dynamics of growth and weight trends in the study population. The reference data used to identify the BMI cutoffs as well as conversion of weight and height to Z score were taken from CDC 2000 data set and WHO 2007 data set for growth parameters in children.

**The major findings of this phase of the study are given below:**

### **Change in mean Height & weight over a period of three years**

- As the age increased the increase in mean height and weight of boys and girls were studied for 3 years. The increase of height per year ranged from 6.1 cm to 5 cm. The mean increase in weight per year for children ranged from 2.8-2.7 kg. The weight increase was almost similar in both girls and boys.

### **Change in prevalence of malnutrition over a period of three years**

- According to WHO 2007 standards, the prevalence of underweight decreased to 30.9 % in the third year from 60 % in the first year.
- The prevalence of stunting remained 32 % in the 3 years at 95 % CI limits of 25 – 40.
- As per WHO 2007 classification, there was a gradual decrease in the prevalence of thinness in consecutive years. In the first year the prevalence was 58 % [52.0-64.0] which decreased to 56 % [50.0-62.2] and further came down to 47 % [40.3-53.7].

### **Growth transition trend analysis**

- Tracking data of children for Undernutrition showed that negative growth was seen in 10.8 % of children which remained constant in the third year.
- As far as stunting was concerned, in the first year positive shift were seen in 22 % of children while negative shifts were evident in 5 % of children. Negative shift in second year increased to 21 % which calls for attention and intervention.
- With regards to thinness, 22 % showed positive trend in the first year while almost similar i.e. 21 % showed negative trend. The negative trend in second year reduced to 12 % while positive trend was evident in 28 % of children.

### **PHASE 3: INTERVENTION RESEARCH: A RANDOMIZED CONTROL TRIAL**

The impact of weekly IFA supplementation ( 60 mg elemental Iron + 0.5 mg folic acid) for 30 weeks along with twice a year deworming tablet (Albendazole 400 mg) and only Deworming tablet was seen on growth, physical work capacity and haemoglobin status of school children. Here three schools were randomly selected and the interventions were randomly assigned to them. One was a control group in which standard care condition were maintained, one experimental group which received IFA supplementation for 30 weeks and deworming tablet twice a year. The third group received deworming tablet twice a week. After the intervention of one year, washout effect was seen for 6 months. For six months no intervention was

given and the sustainability of the intervention was looked into. The children from 4th to 7th standard were enrolled for the study.

**The major findings of this phase of the study are given below:**

#### **Anthropometric Indices and prevalence of malnutrition**

- There was a significant increase in the height of the children in all the three groups. The increase was highest in the group supplemented with IFA+ DW. The height gain was highest in the age of 9-11 years.
- Weight gain was more in the control group as compared to the intervention group. In between the two intervention group too, the weight gain was more in the group supplemented with DW as compared to the IFA+DW supplemented group. Thus the supplementation failed to show its impact on the weight parameter of the school children.
- In the IFA+DW supplemented group, there was 5 % increase in the prevalence of underweight while 3 % drop was seen in the DW group. In the control group 16 % reduction in the prevalence of underweight was seen. The rise in prevalence of underweight was more in girls as compared to boys.
- The prevalence of stunting was more or less similar before and after intervention in the IFA+DW group. In the DW group, the prevalence of stunting came down by 7 % while in the control group prevalence dropped by 4.5 %.
- There was increase in the prevalence of thinness in both the experimental groups. In the IFA+DW group, there was 14 % increase in the prevalence of thinness and 4 % in the DW group.
- Thus IFA intervention with deworming did not support growth in rural school children.

#### **Haemoglobin Status and Prevalence of Anemia**

- There was a significant change in the mean haemoglobin levels before and after the intervention.
- In the IFA+ DW supplemented group, there was mean increase of 1.9 gm/dl increase and the difference was statistically significant. The increase was

more in boys as compared to girls. In the deworming group non significant rise in the mean haemoglobin levels were registered.

- It was seen that in IFA supplemented group, the improvement in the Hb levels were more in severe anaemic group as compared to less severe category. The increase in the normal category was only  $0.4 \pm 0.9$  gm/dl as compared to  $0.6 \pm 1.0$  in category of mild category. The highest increase was seen in the moderate anemic group which was  $0.7 \pm 0.6$  gm/dl.
- In the group supplemented with IFA+DW it was seen that as the age increases the difference between the initial and the final Hb level increased. That shows that the utilization of IFA increased in the body as the age increased due to increased demand by the body.
- Before intervention in the IFA+ DW group, 75 % of the children were anemic, which after intervention was only 10 %. The intervention was successful in bringing down the prevalence of mild anemia from 58 % to 8 %.
- There was no major effect of deworming alone on reducing the prevalence of anemia. In both the mild and moderate category the prevalence remained same.
- Positive change in the haemoglobin levels were observed in the experimental group as compared to the control. The IFA+ DW intervention was highly significant  $p < 0.001$  in improving the Hb status of initially anaemic group. There was improvement in the Deworming supplemented group too ( $P < 0.01$ ). Such changes were not seen in control group.

### **Physical work capacity**

- The physical work capacity as judged by the  $SPO_2$  values, was not influenced by any of the intervention strategy.
- In the group supplemented with IFA+DW tablet, there was statistically significant increase ( $p < 0.05$ ) in the number of steps taken by the children. When the gender wise difference was looked into, it was seen that the number of steps were significantly higher for boys than girls. Thus the IFA + DW could increase the physical work capacity of the boys in a more pronounced manner.



- A non significant improvement in the work capacity of the children was also seen as compared to the control group.

### **Washout effect**

- After the washout period, a significant fall in the overall Hb levels was seen in both the intervention group.
- Sustainability was seen in only 31 % of the children. The prevalence of IDA increased after the washout period and was found to be 90.6%, 69.1%, 91.4% in control, IFA+DW and only DW supplemented group.

### **Conclusion**

We can conclude that nutritional status of rural school children is compromised which is evident by the high prevalence of malnutrition. This condition is prevalent even though the Mid Day Meal (MDM) program is being run by government of India. The main reason behind this is that the consumption of MDM is a big question mark in this region. Children are not consuming the MDM regularly.

A healthy MDM can help to protect children from hunger, and to provide supplementary nutrition. MDM is not enough to guarantee the right to food, but they are an important step towards it. Similarly, cooked midday meals contribute to the right to education by facilitating regular school attendance and enhancing children's learning abilities.

There are serious problem relating to the infrastructure and logistics of mid day meals. Shortage of utensils is a common problem. There is similar issue with the lunch plates. Children are expected to bring plates or bowls from home. Some parents however are reluctant to let children take plates or bowls away from home, for fear of losing them.

The morning breakfast of the children is being compromised as parents feel that MDM is available in the school. Even in the rural area, the consumption of cheap fried snacks is very high. The consumption of fruits and vegetables at home is very

low. Even in the MDM, vegetables are not added and the meal does not provide adequate micronutrients to the children.

From the intervention study we can conclude that the weekly supplementation of 60 mg elemental iron along with 0.5 mg of folic acid was beneficial to reduce the prevalence of anemia and improve the mean haemoglobin status of the children. The supplementation was more beneficial to severely anemic and children in the moderate category of anemia. The rise in haemoglobin status was more in them as compared to children in the mild and normal category of anemia. The sustainable effect of the supplementation was again a big question mark. The intervention could not sustain its effect when the supplements were not provided for 6 months. This proves that the supplements should be provided at a regular interval to the school children and should not be stopped. The intervention was not much effective in improving the malnutrition scenario for which inputs of macronutrients are also very vital. This can be done through regular consumption of MDM in the school premises and increasing the food intake at home too.

The growth monitoring phase emphasise the importance of routine growth monitoring in the school set up too. This will help us to detect the children who are experiencing constant growth faltering and necessary steps can be taken there and then. The study also focuses on importance of routine medical checkups for school children even in rural setup. Further referral could be advised if the need be.

**Based on our study, we propose the following recommendations. The components which need to be addressed are:**

Component	Recommendation
Behaviour Change Communication (BCC)	Simple BCC messages can be designed and should be imparted to the school children to bring about long term changes.
Medical Checkups	Quality medical checkups should be made regular in the rural schools
MDM	<ul style="list-style-type: none"> <li>The recipes which provide adequate micronutrients</li> </ul>

	<p>should be incorporated in the menu.</p> <ul style="list-style-type: none"> <li>• Children's likes and dislikes should be taken into consideration.</li> <li>• Plates and bowls should be provided by the school authorities itself.</li> <li>• MDM should be made compulsory for all the school children and the school authorities should be strict about it.</li> <li>• Monitoring system needs to be overhauled. Close supervision and regular inspections are essential to achieve higher quality standards</li> </ul>
Iron Folic Acid (IFA) Supplementation	<ul style="list-style-type: none"> <li>• Weekly IFA supplementation along with deworming can be given to the school children of 4<sup>th</sup> to 7<sup>th</sup> class in the rural setup.</li> <li>• Macronutrient intake of the children should also be increased along with micronutrient supplements for the improvement in the growth status of the children.</li> </ul>
Growth Monitoring	<ul style="list-style-type: none"> <li>• It should be a regular practice in the school and the growth should be plotted on the chart as done in the anganwadis to reflect the trend in the growth.</li> </ul>

Overall parents and teachers should be made aware of the grave situation of malnutrition. We feel once weekly IFA tablet supplementation along with deworming and regular MDM consumption may go a long way to arrest the growing trend of malnutrition among rural school children.