

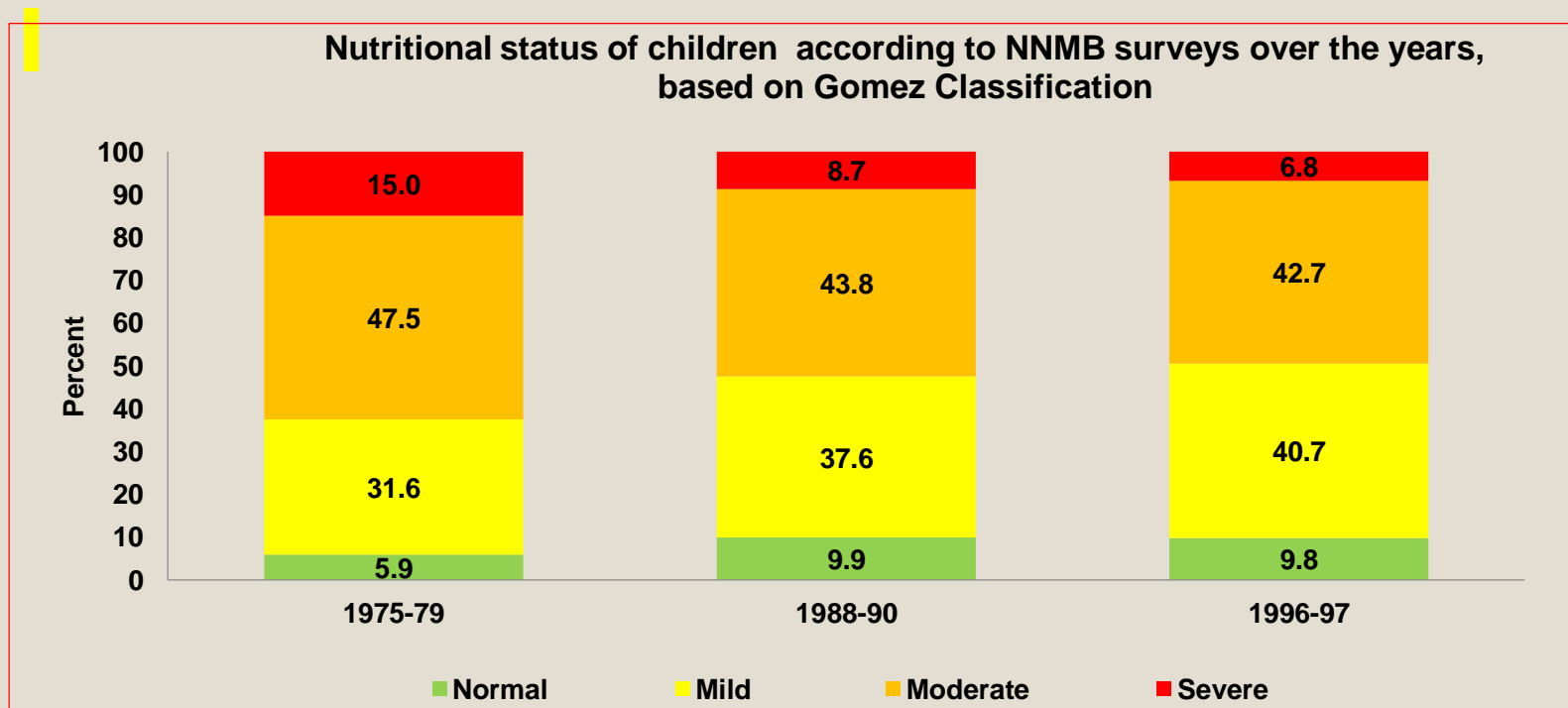
NUTRITIONAL STATUS OF PRESCHOOL CHILDREN FROM LOW INCOME GROUPS

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**NFI-NAMS Dr. C GOPALAN CENTENARY SYMPOSIUM
18.10.2019**

- ✚ Improved nutrition is a key priority in international development, both as an end in itself and as a means to escape income poverty. Sustainable Developmental Goal 2 focuses on ending all forms of malnutrition by 2030.
- ✚ Nutrition of infants and young children is one of the largest concerns since deprivation in early childhood often causes irreversible damage to physical and mental health, reduces learning at school and leads to lower income as an adult.
- ✚ Nutrition problems are often unnoticed until they reach a severe level. But mild and moderate undernutrition are highly prevalent and carry consequences of enormous magnitude: growth impediment, impaired learning ability and, later in life, low work productivity.
- ✚ None of these conditions is as visible as the diseases from which the undernourished child dies. Children may appear to be healthy even when they face grave risks associated with undernutrition (UNICEF, 2009).

- ✚ About 20 % of children under-age five in India are wasted, 36 % underweight and 38 % stunted (NFHS-4, 2015-16). Data from NNMB surveys (1975-2006) over the years has shown a significant reduction in the prevalence of severe grade [-3SD] under nutrition but **mild and moderate undernutrition continues to add to the pool of undernutrition.**
- ✚ It becomes **equally important to track children with mild and moderate undernutrition** as early as possible for timely nutrition and health intervention to prevent further deterioration in nutritional status.



Objectives of the study

The present study was undertaken to explore the appropriateness of anthropometric indicators in assessment of nutritional status and early identification of children in need of immediate intervention and to study the association of morbidity and feeding practices on nutritional status of children.

- ✚ To undertake anthropometric measurements (weight, height, mid-upper arm circumference, waist and hip circumference) of underprivileged children below 6 years at three-month interval.
- ✚ To assess growth pattern of these children.
- ✚ To assess the prevalence of undernutrition and overnutrition in children using weight for age, height for age, weight for height, BMI-for-age and MUAC-for-age.
- ✚ To compare the various anthropometric indices in assessing nutritional status of the children.
- ✚ To study the relation between feeding practices and nutritional status of the children.
- ✚ To study the relation between morbidity and nutritional status of the children.

METHODOLOGY

The present mixed longitudinal study was undertaken on 2305 subjects (boys and girls) aged 0-71 months from 6 AWCs in Haiderpur, New Delhi.

Data was collected from all AWCs in twelve rounds at three monthly intervals (± 15 days) from August 2006 to April 2010.

Locale : Six anganwadis in Haiderpur ICDS block in North West Delhi
Locale was purposively selected on the basis of nearness to the investigators, relatively stable population and cooperative ICDS personnel.

Inclusion criteria

Children between 0-71 months of age,
Currently residing in the selected anganwadis
Willing to participate in the study

Exclusion Criteria

Physical disability of a child preventing him from standing erect
Errors in recalling age of the child by primary caregivers.
Children over 71 months of age
Not willing to participate in the study

Sampling Technique and sample

Selection of subjects

✚ No actual data on prevalence of malnutrition, undernutrition or morbidities or

✚ The prevalence of malnutrition reported by NFHS-3 is further lower (17%)

✚ The prevalence of malnutrition is 19% (NFHS-3). All children of age 25 and above are included. This is a vicious cycle

✚ To assess the prevalence of malnutrition, the sample size was determined for the present study

Calculation of sample size using proportion equation by Magnani (1997)

Basic Equation

$$n = D[(Z_{\alpha} + Z_{\beta})^2 * (P_1(1-P_1) + P_2(1-P_2)) / (P_2 - P_1)^2]$$

where,

n = required sample size for each comparison group

D = design effect, value taken was 2

P₁ = prevalence of morbidity in normal children (20%)

P₂ = prevalence of morbidity in undernourished children (30%)

Z_α = 95% level of statistical significance (1.645)

Z_β = 80 percent power (0.840)

Putting into the above formula,

$$\begin{aligned} n &= 2 [(1.645+0.84)^2 * (0.20 (1-0.20) + 0.30 (1-0.30))] / (0.30-0.20)^2 \\ &= 2 [(6.175 * 0.37) / 0.01] \\ &= 2 [228] \\ &= 456 \end{aligned}$$

Therefore, the sample size required to be included in the undernourished group with morbidity was 456. Prevalence of BMI is 9%, to get 456 undernourished (low BMI) subjects it is required to enroll 5066 children, making total sample size to be **5066**.

Prevalence of malnutrition or prevalence

Prevalence of malnutrition is 19% as reported by NFHS-3. BMI (17%) was

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Flow Chart of Data Collection

Data Collection- Twelve rounds at 3 month (± 15 days interval)

- Rnd 1 (n=621)
- Rnd 2 (n=626)
- Rnd 3 (n=457)
- Rnd 4 (n=541)
- Rnd 5 (n=506)
- Rnd 6 (n=602)
- Rnd 7 (n=564)
- Rnd 8 (n=504)
- Rnd 9 (n=410)
- Rnd 10 (n=510)
- Rnd 11 (n=531)
- Rnd 12 (n=523)

Socioeconomic-demographic profile

- Age and Sex
- Family type and size
- Educational and occupational level of parents
- Standard of Living Index

Utilization of ICDS

- Regularity of attending AWC
- Primary immunization
- Weighing of children
- Supplementary feeding
- Referral services
- Nutrition health education

Anthropometry

- Weight
- Length/Height
- MUAC- WC and HC

Morbidity pattern (on 15 days recall)

Infant and young child feeding practices (Current and Past)

Dietary Intake on a subsample (1-6 year children)

At the time of enrollment

Pretested questionnaire

In each round

Each child was assigned a **Child Card** at the time of enrollment during the study to record data in successive rounds.

Last three rounds (included all three seasons)

Focus Group Discussions with mothers on dietary pattern and IYCF practices

Interactive 24-hr recall from mothers after standardization of utensils and recipes at field level

n given in parentheses against each Round No. is total number of children covered in the round

Anthropometry

The measurements were recorded using standard techniques (WHO, 1995)

Measurement	Technique
Age	<ul style="list-style-type: none">• Immunization cards, if available• Local event calendar• WHO Anthro software for those whom month and year is available
Weight	Seca electronic weighing scale sensitive upto 100 grams
Length (0-24 months)	Infantometer sensitive upto nearest mm
Height (> 24 months)	Microtoise sensitive upto nearest mm
Circumferences (MUAC, WC and HC)	Fibre glass tape with vernier attachment sensitive to nearest mm



Data processing and analysis



- The data collected both quantitative and qualitative were organized and systematically tabulated. Microsoft Excel 2007 and SPSS 16.0 software were used for data analysis.

- The total number of set of observations on these children were 6334 (cross-sectional group) and data on 372 children were collected for more than 5 rounds (longitudinal group).

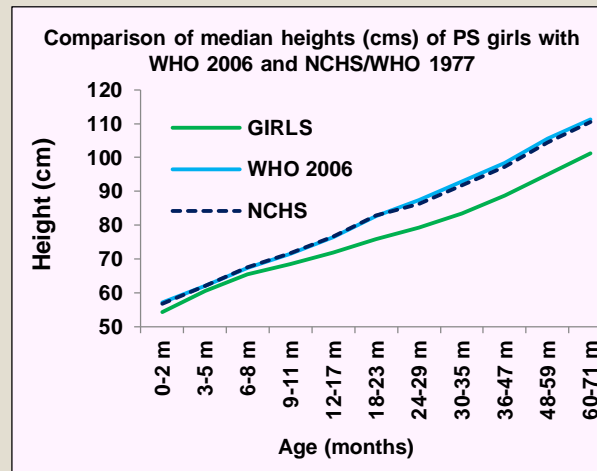
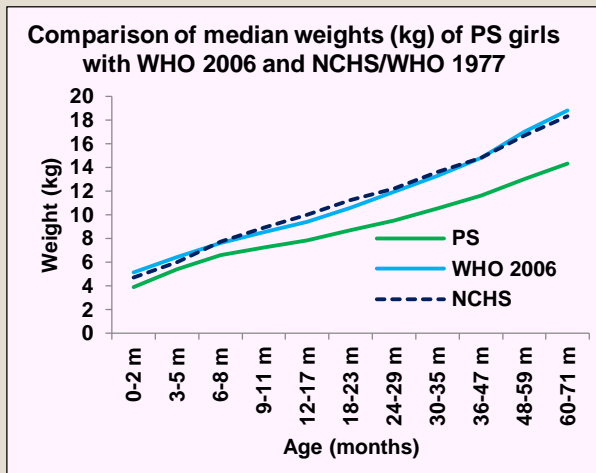
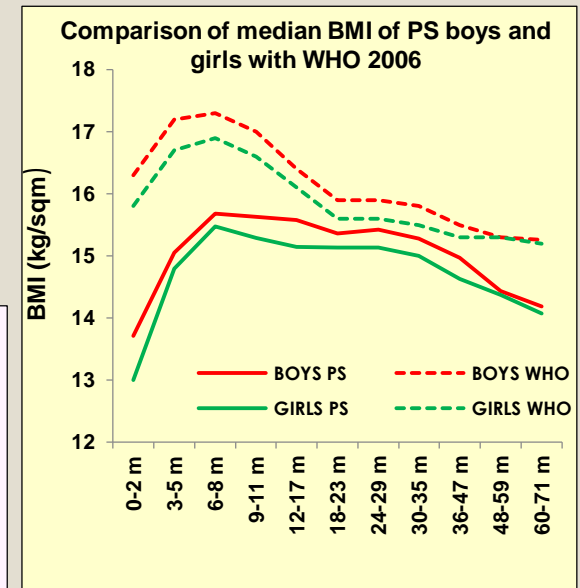
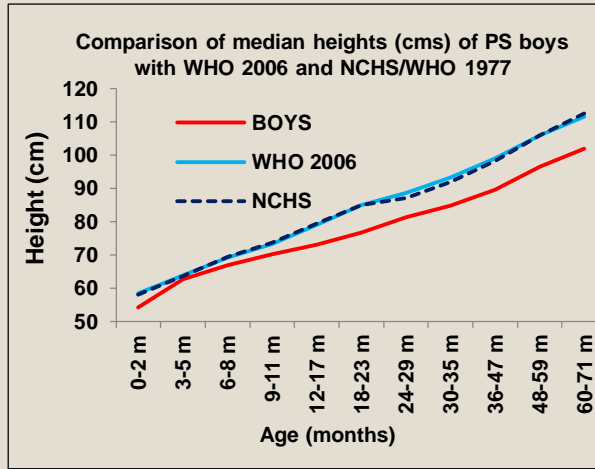
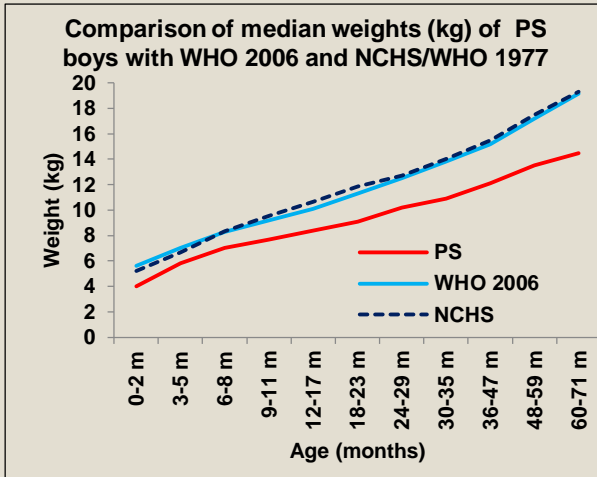
- The mean weight, height and BMI of children at 3, 6, 9, 12, 15 and 18 months interval of longitudinal data (n=372) were compared with that of pure cross-sectional data (n=957) for all the age categories using Student's t-test and Analysis of Variance



MAJOR FINDINGS:

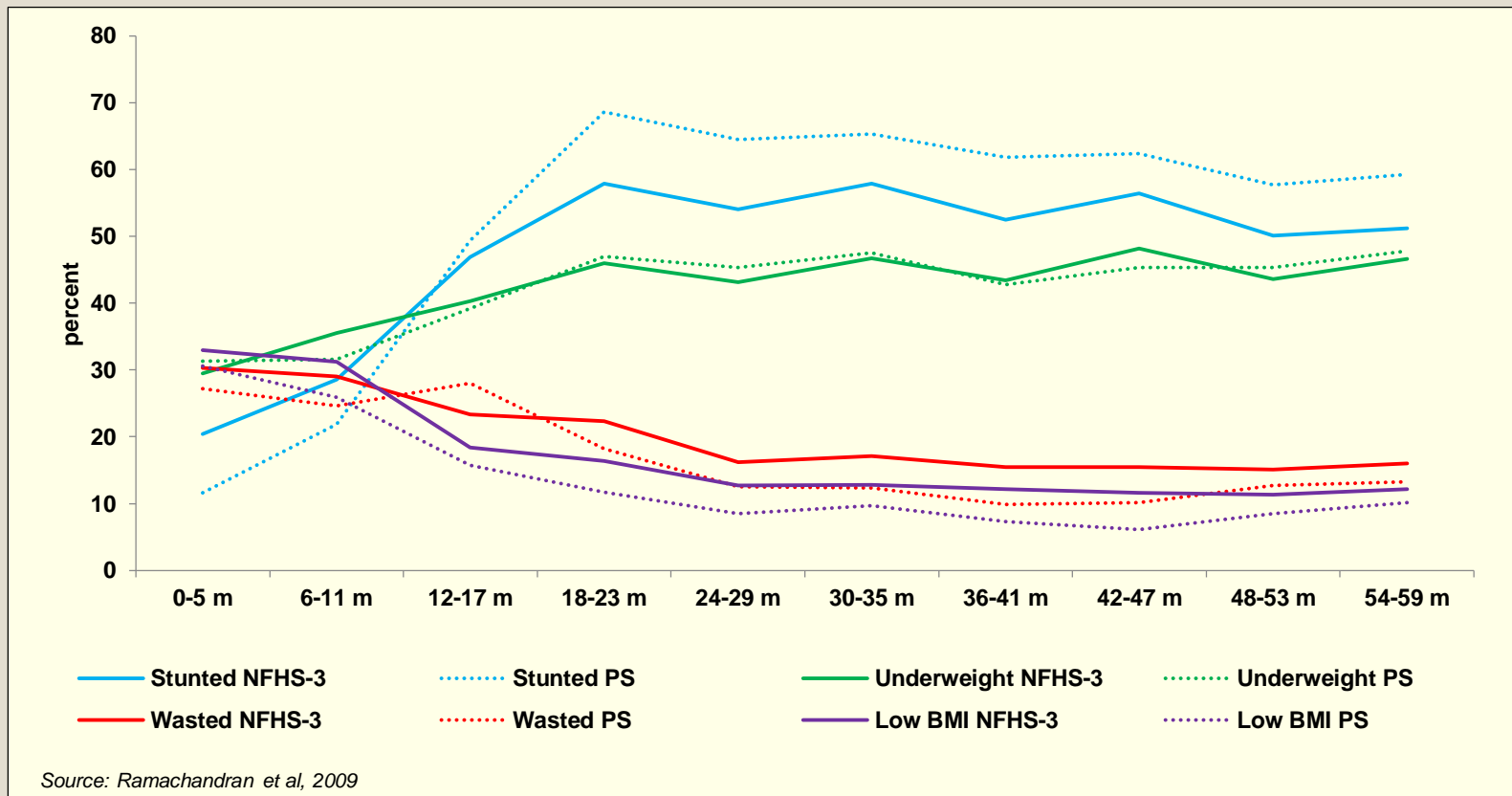
NUTRITIONAL STATUS OF
UNDERPRIVILEGED CHILDREN
BELOW 6 YEARS OF AGE

1. The children living in an urban slum of Delhi had lower mean body weight, height, BMI and MUAC as compared to WHO 2006 standards.



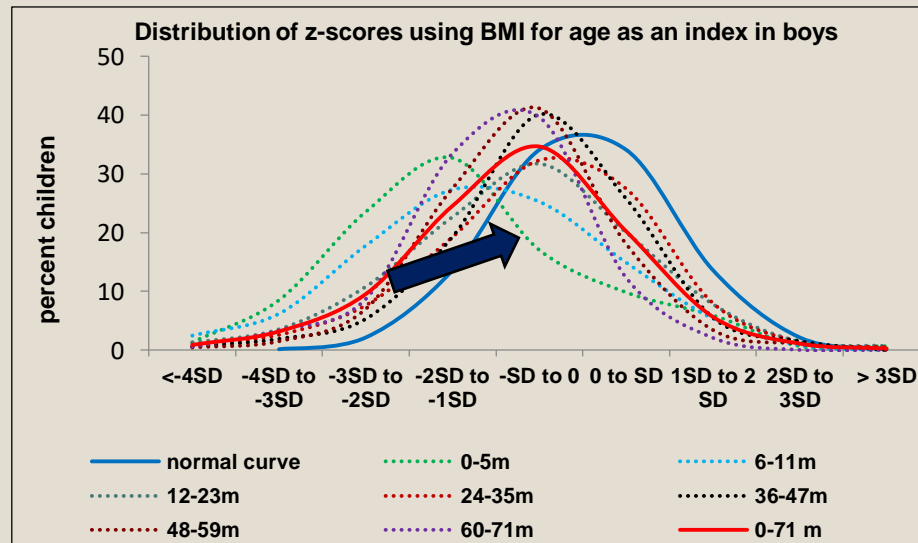
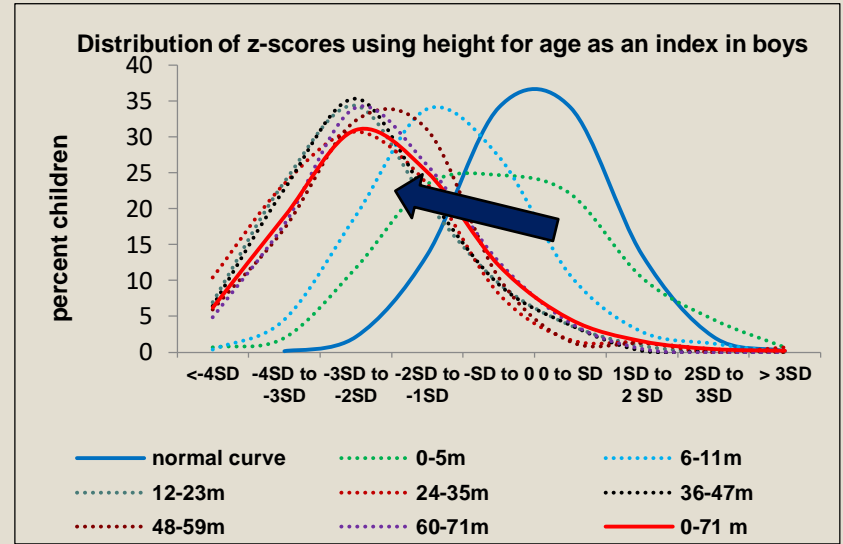
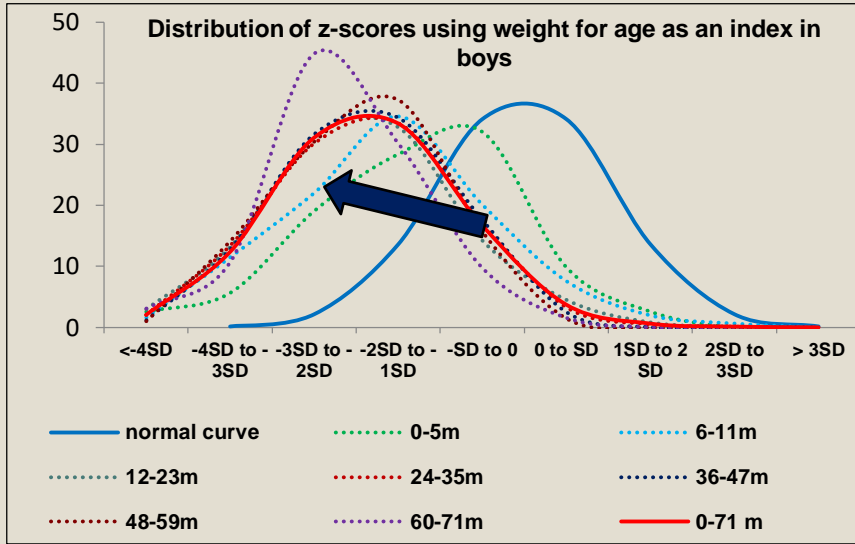
2. Nearly 30 % of the children were underweight, wasted and had low BMI and 10 % of the children were stunted in the age group of 0-5 months reflecting intrauterine undernutrition.

There is **steep increase in stunting rates after 6 months of age** and plateau after two years of age but wasting and **low BMI rates decreased after 6 months of age**. This should not be interpreted as improvement in nutritional status of children.



Source: Ramachandran et al, 2009

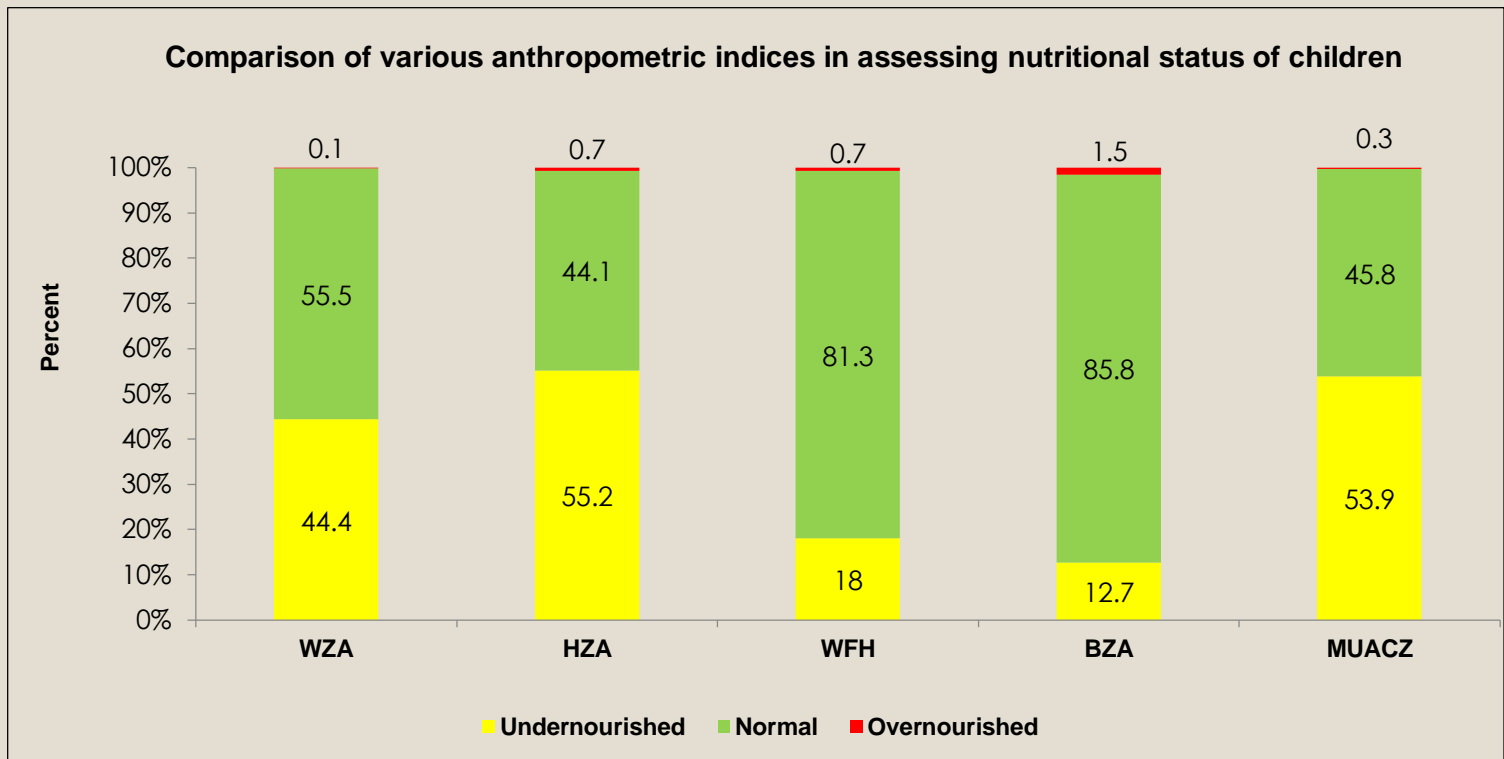
Distribution of z-scores for weight-for-age, height-for-age and BMI-for-age in relation to age, based on WHO 2006 standards



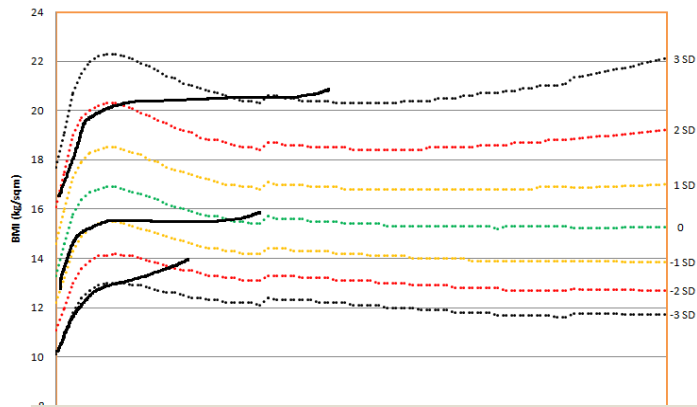
3. Prevalence of stunting was highest in children

60 % of the children with normal BMI were actually stunted revealing that these children had normal weight for their current height and age.

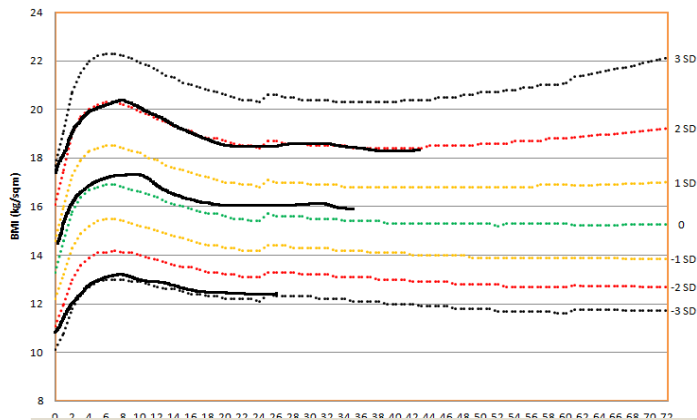
BMI-for-age identified 1.5 % prevalence of overnutrition in children.
About three-fourth of these children were stunted i.e. short and fat.
Weight-for-age failed to make this distinction.



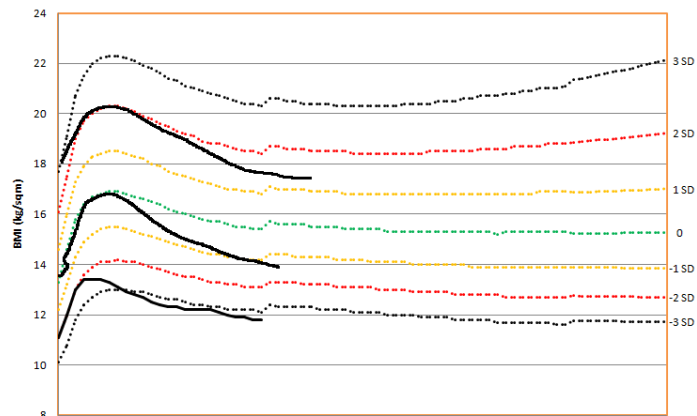
UPWARD DEVIATION



NO DEVIATION



DOWNWARD DEVIATION



4. Longitudinal Analysis : Trends in Growth trajectories

Half of the children were following their own trajectories. Of which nearly 30 % of the children were actually underweight or stunted which would always appear as undernourished in a cross-sectional survey.

Plotting weight-for-age trajectories straightaway identified **28 % children (showing downward deviation) forming the most prior group for targeted nutrition intervention**, which would be much higher (44%) in the cross-sectional survey.

BMI-for-age trajectories further prioritized the target group in need of immediate nutrition and health intervention, with 22 % children showing downward deviation and delay in intervention could make these children further 'stunted and wasted'.

One third of children were showing upward deviation in BMI-for-age trajectories, of which 17 % of the undernourished children were showing upward deviation indicating that these children were becoming 'short and fat'.

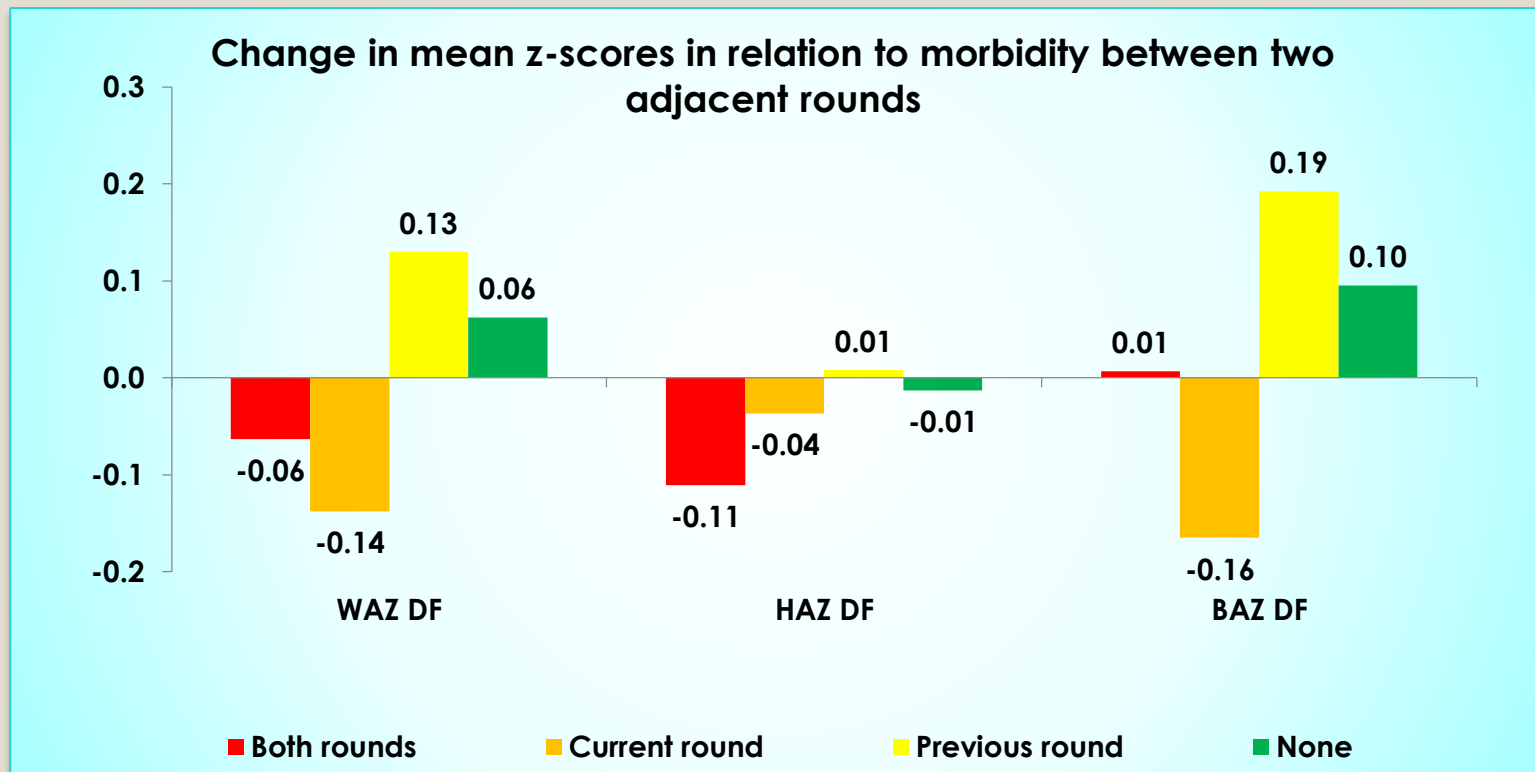
Targeted intervention in terms of additional food supplementation would make these children overweight for their current height and predisposed them to later risks for overnutrition and non-communicable diseases in adult life.

BMI-for-age trajectories would help in tracking early faltering (downward or upward) and help in taking appropriate nutrition and health intervention.

5. The prevalence of morbidity was highest in 6-23 months of age and thereafter decreases. The children who were underweight, wasted and had low BMI had higher risk of infections.

The association between stunting and acute morbidity in the last fortnight was the lowest.

BMI-for-age z-scores reduced faster in case of current morbidity and increased faster in case of convalescence as compared to other indicators.



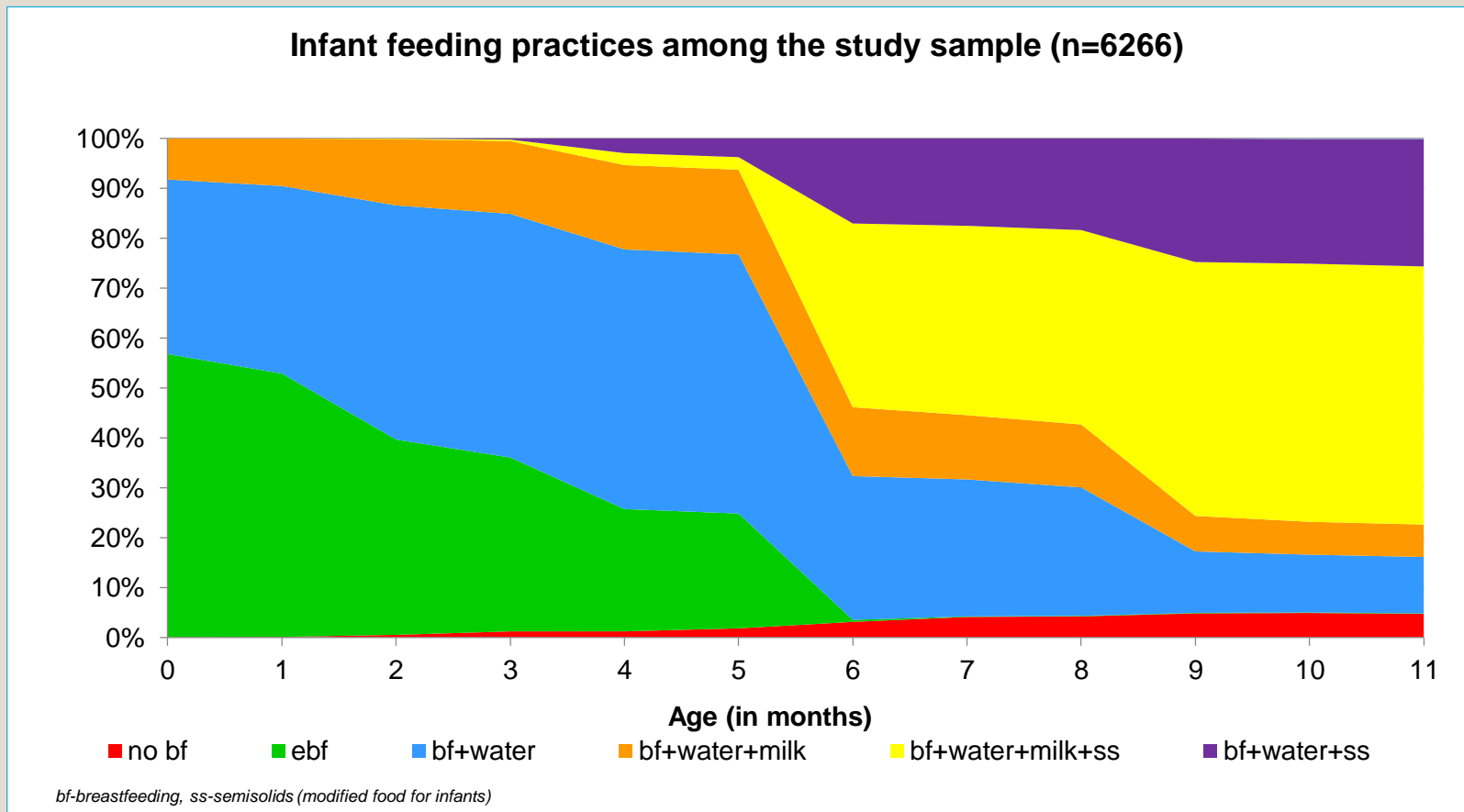
6. **Repeated morbidity led to underweight and stunted children.** The mean z-score for weight-for-height and BMI-for-age didn't show significant difference.

This is most likely due to the fact that the children with repeated episodes of morbidity had become stunted and therefore their BMI did not show any significant change.

Number of rounds with morbidity	n	WAZ (mean±SD)	HAZ (mean±SD)	WZH (mean±SD)	BAZ (mean±SD)
1	76	-1.42±1.01	-1.65±1.21	-0.72±1.13	-0.58±1.16
2	102	-1.86±0.98	-2.2±-2.31	-0.86±1.10	-0.63±1.13
3	60	-2.13±1.07	-2.57±1.38	-0.95±1.00	-0.64±1.04
≥4	72	-2.19±1.06	-2.69±1.25	-0.95±1.01	-0.62±1.05
Anova Test (F-value)		8.518*	10.115*	0.746	0.042
*, significant at p-value <0.05					

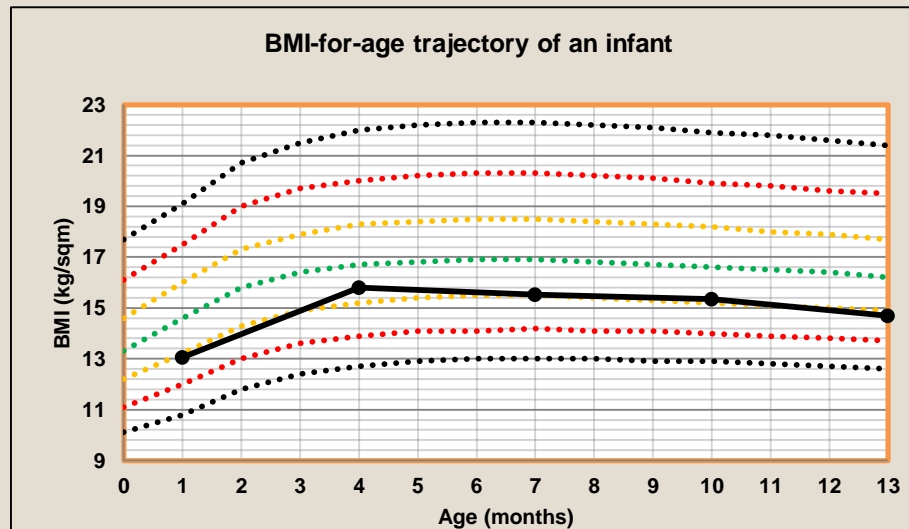
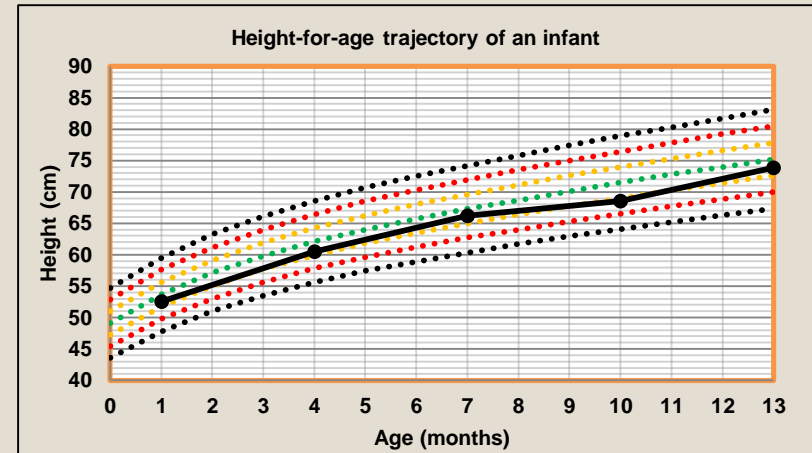
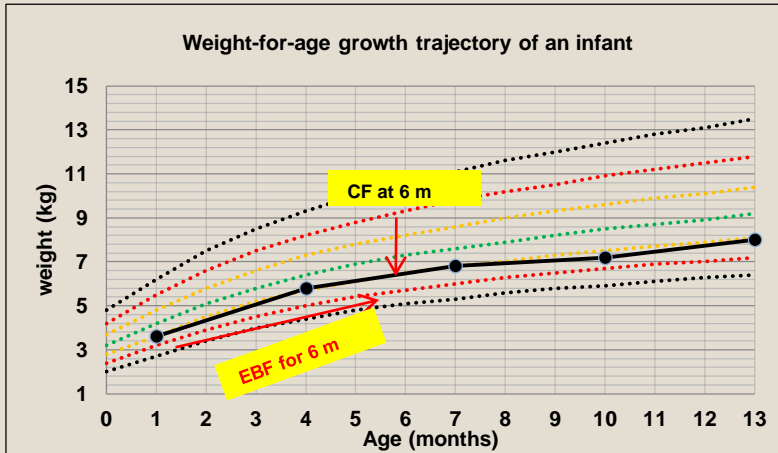
7. Overall, **23 % of the children were exclusively breastfed for six months** and only **54 % of the children had received semisolids at the age of six months**.

The children who were **exclusively breastfed and had timely introduction of semisolids** not only had higher mean body weight, height and BMI, but also had **fewer infections** as compared to those who were not.

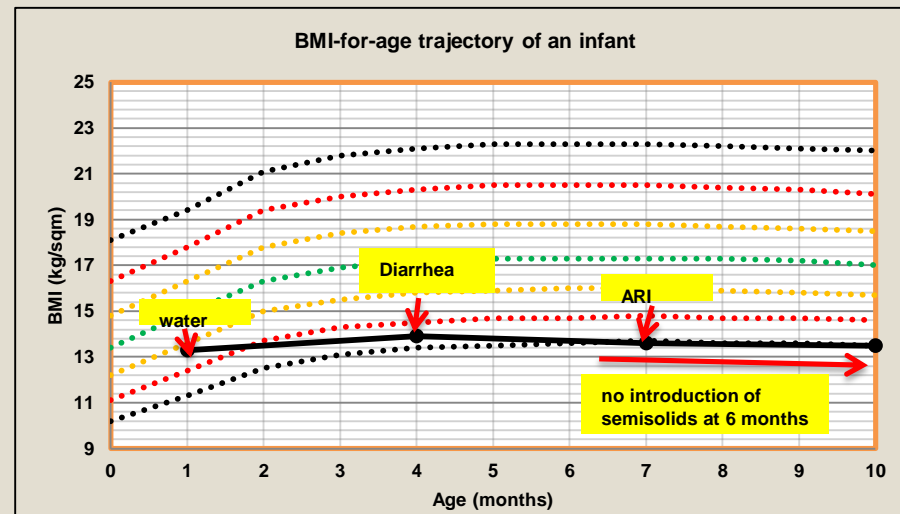
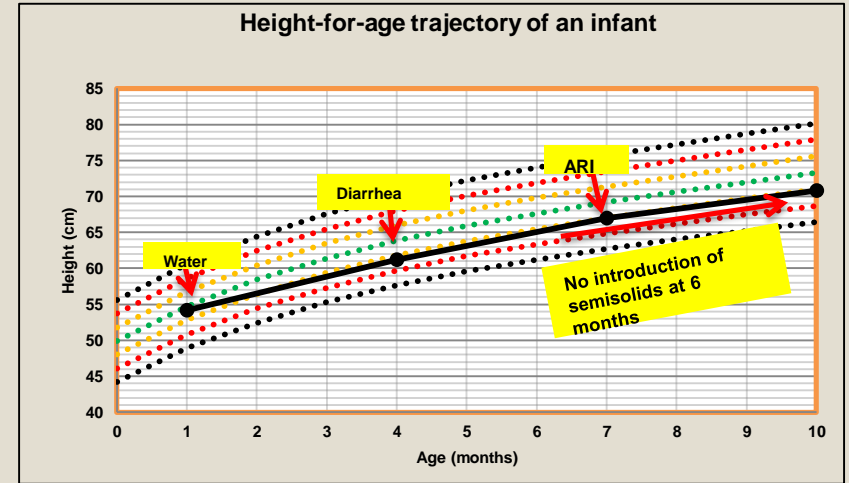
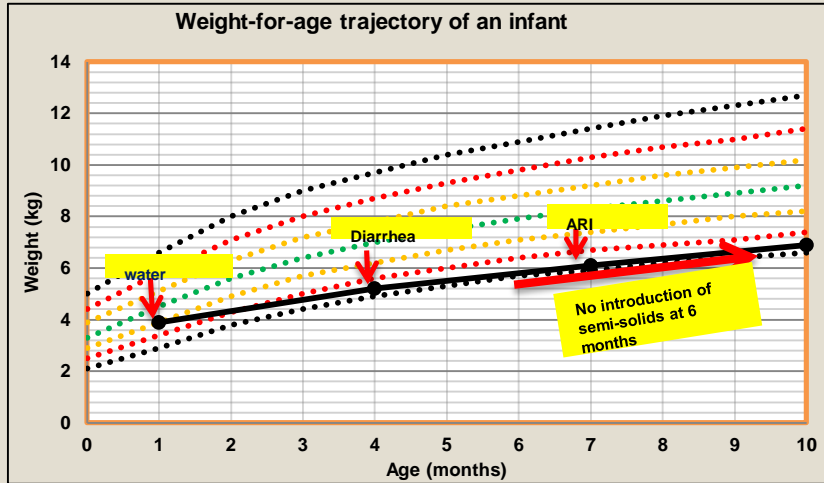


Selected Growth Trajectories-Impact of feeding practices and morbidity

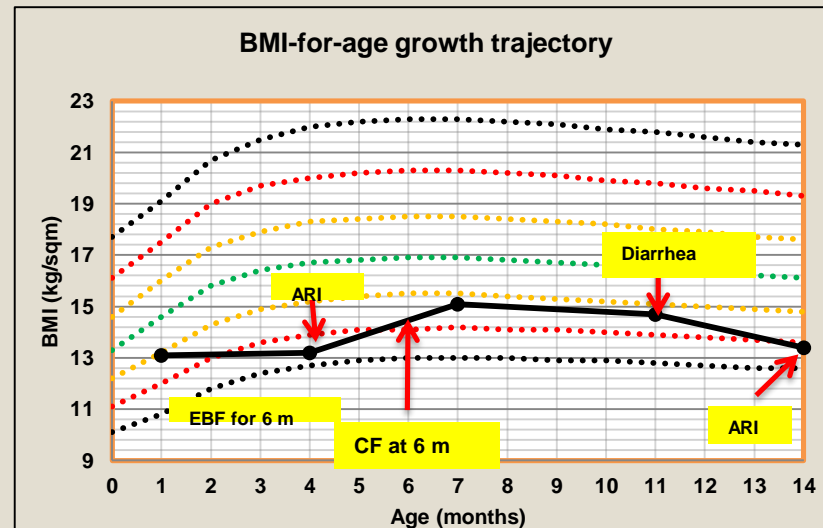
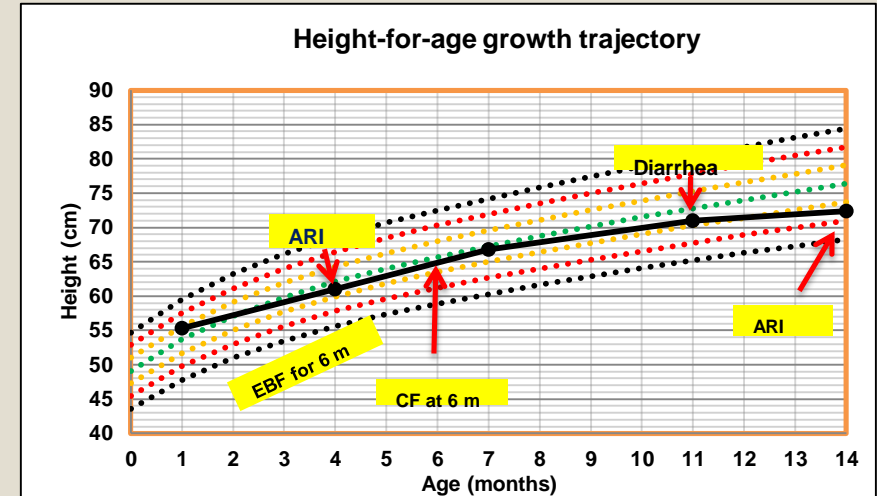
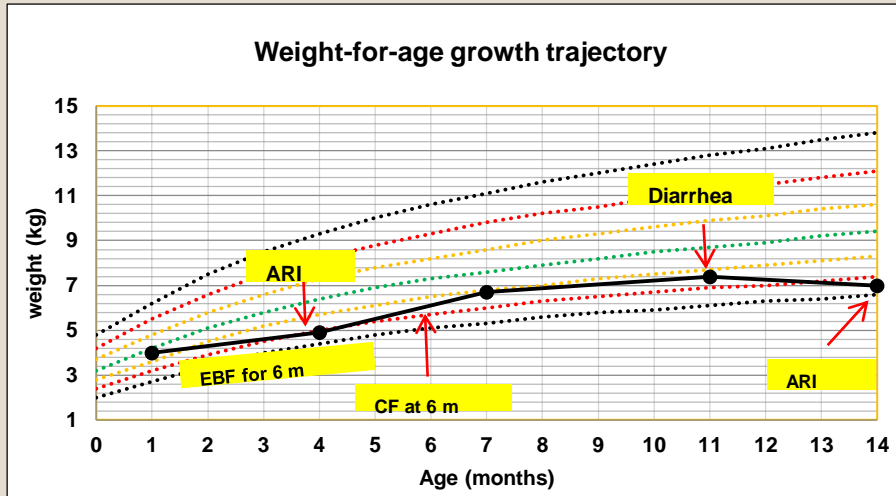
1. Infants who were exclusively breastfed for 6 months and were given complementary foods from the age of 6 months grew in their own trajectories for weight-for-age, height-for-age and BMI-for-age.



2. Non-exclusive breastfeeding and delay in introduction of complementary foods had resulted in deterioration in nutritional status of the child.

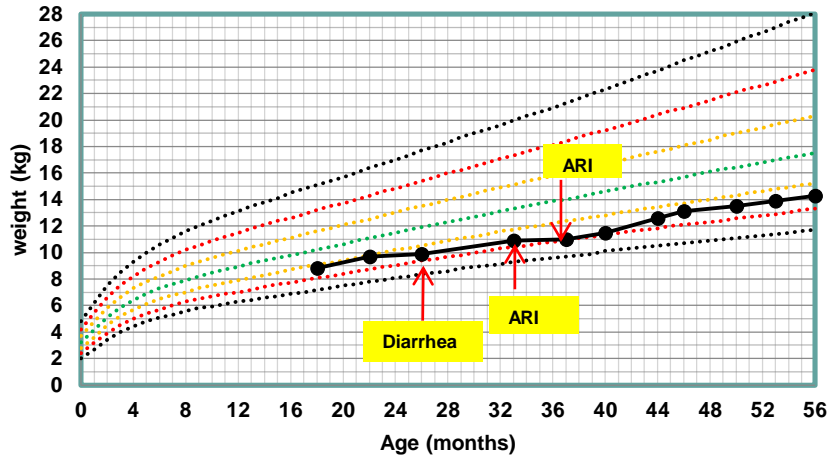


3. Repeated episodes of morbidity resulted in growth faltering even in children who were exclusively breastfed for 6 months and were given complementary feeding from 6 months.

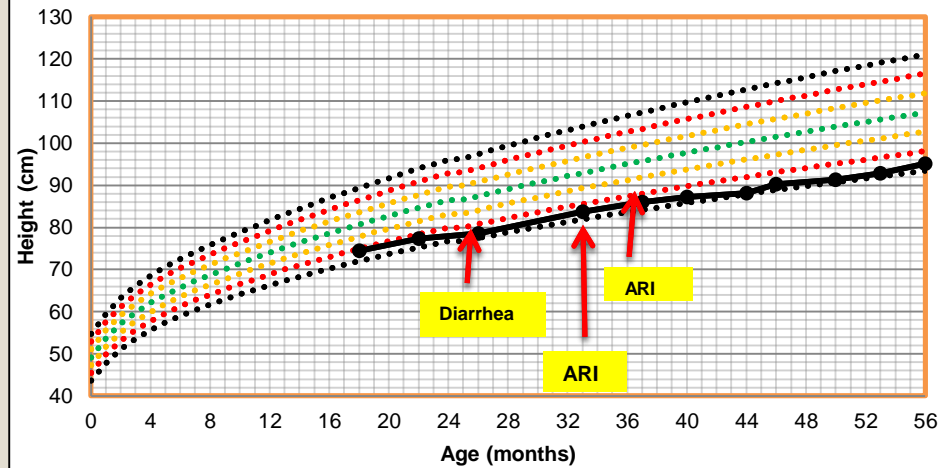


4. Repeated morbidities in children resulted in severe stunting. Some of the stunted children showed upward deviation in BMI-for-age in this case should not be considered as improvement in nutritional status. Children during illness showed a dip in their BMI-for-age growth and there was a compensatory upward trend during convalescence.

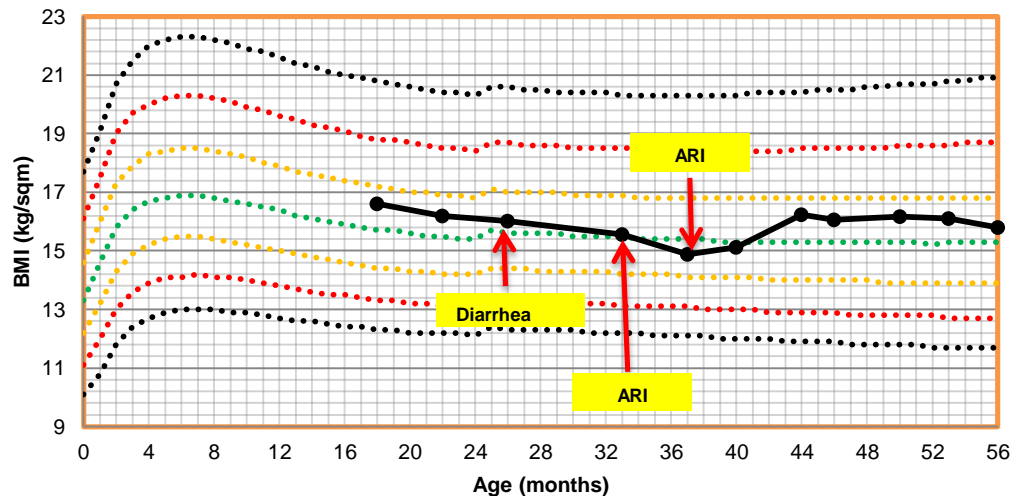
Weight-for-age growth trajectory



Height-for-age growth trajectory



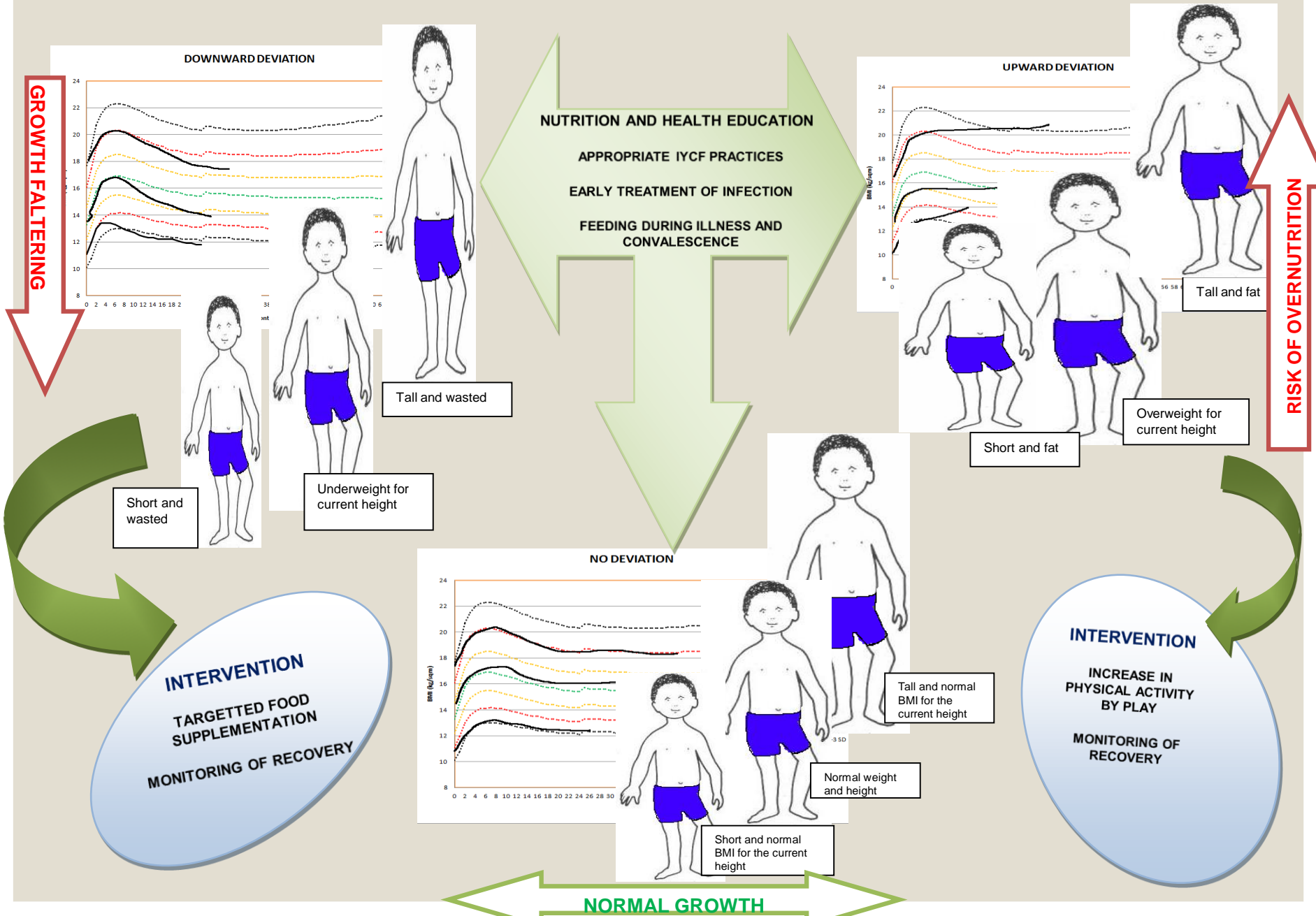
BMI-for-age growth trajectory



Limitations of study

- ✚ Limited longitudinal data was available owing to losses due to high migration rate in the slum area.
- ✚ A relationship with birth weight could not be ascertained due to non-availability of birth weight data as nearly 70 % of the children were delivered at home. Even those who were delivered at hospital, didn't have records for birth weight, recall from mothers could have created errors in results.
- ✚ Investigator was not able to collect dietary data for all the children in each round because of paucity of time and operational feasibility.

TYPE OF INTERVENTIONS BASED ON TRENDS IN BMI-FOR-AGE GROWTH TRAJECTORIES



RECOMMENDATIONS

1. Focus on use of growth monitoring as a tool for identifying target group for appropriate nutrition intervention in terms of food supplementation and health intervention in terms of access to health care. This would ensure optimal usage of resources available.
2. Tracking growth faltering (both upward and downward) would help in prioritizing action for appropriate nutrition and health intervention
3. Use of BMI-for-age growth charts, wherever possible, for identification of children with both undernutrition and overnutrition as BMI is reversible and responds faster in case of both morbidity and convalescence.
4. Plotting serial measurements on weight-for-age growth charts (mother and child protection card) by AWW to identify growth faltering would help in prioritizing the targeted nutrition and health intervention.
5. In the present study stunting rates were less and wasting rates were highest in first year of the life which can be improved by adequate dietary intake and would prevent deterioration in nutritional status therefore, it is required to monitor growth of children as early as possible preferably from birth itself.
6. Universalizing Mother and child protection card and linking it to other social and health care benefits would create awareness among the population.

THANK YOU